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Department of
Agriculture**

Forest Service

Pacific
Northwest
Region



D-Bug

Hazard Reduction

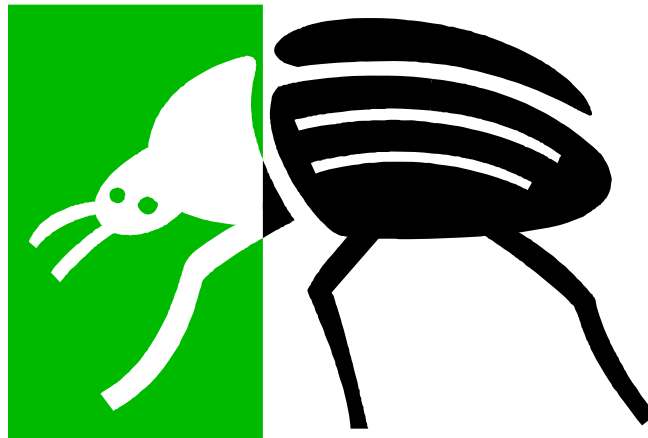
Timber Sale Project

Draft Environmental Impact Statement

Umpqua National Forest

Diamond Lake Ranger District

March 2009



D-BUG HAZARD REDUCTION TIMBER SALE PROJECT

DRAFT ENVIRONMENTAL IMPACT STATEMENT

Douglas County, Oregon

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This DEIS is being prepared under the authority of the Healthy Forest Restoration Act and is subject to the objection process under 36 CFR 218.3. Only those who have submitted specific written comments related to the proposed project during the comment period may file an objection (36 CFR 218.6). Comments must be submitted within 45 days from the date the Notice of Availability appears in the Federal Register.

Comments are due by no later than: **April 27th, 2009.**

Electronic comments can be mailed to: comments-pacificnorthwest-umpqua@fs.fed.us

Abstract:

This Draft Environmental Impact Statement documents three action alternatives and the no action alternative considered for commercially harvesting timber, treating activity generated fuels, reducing hazardous fuels, conducting road improvement, temporary road construction and road maintenance, and implementing connected actions within the following land allocations: riparian reserve, matrix, Oregon Cascades Recreation Area, and Inventoried Roadless Areas within the Lemolo and Diamond Lake watersheds of the Umpqua National Forest. This project is being conducted under the authority of the Healthy Forest Restoration Act. Alternative 4 has been identified as the preferred alternative.

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SUMMARY

Chapter 1—Purpose and Need for Action

ENVIRONMENTAL SETTING

The D-Bug planning area is located near the crest of Cascades Mountains in Southern Oregon, on the Diamond Lake Ranger District of the Umpqua National Forest. The planning area is within a high-use recreation destination, centrally located roughly 90 miles from the cities of Bend, Klamath Falls, Roseburg, and Medford Oregon. Primary access corridors to this recreation area are the Rogue-Umpqua Scenic Byway which includes State Highways 138 and 230. The 42,000 acre planning area is bordered on the south by Crater Lake National Park, Lemolo Lake Recreation Area to the north, Mount Thielsen Wilderness and Oregon Cascades Recreation Area to the east, and the Mount Bailey Inventoried Roadless Area to the west.

Dominant landscape features of the area are the broad pumice flats covered in ash from the volcanic eruption that formed Crater Lake over 7,000 years ago. Cold air settling onto these flats creates large frost pockets favoring lodgepole pine. Other conifers in the planning area represent a unique blend of tree species from both the east and west sides of the Cascade Mountains.

Most of the lodgepole pine forests in the area are now mature stands ranging from 80 to 150 years old; the result of large fires in the late 19th and early 20th centuries. The high incidence of fire during this period may be partly the result of stockmen setting fires intended to create open conditions for livestock. The pioneering lodgepole that reseeded into the burned areas resulted in the vast acreage of stands that are mature today. Since the mid-1900s, Forest Service policies to suppress fire have resulted in artificially small fires that have done little to break up the homogeneous stands in the area (USDA, Umpqua National Forest, 1998). This historic increase in large-scale burning followed by a dramatic cessation of fire has set the stage for a landscape-scale mountain pine beetle outbreak and/or large wildfire events.

Both low intensity and stand replacement fire were historically common in pure lodgepole stands in the planning area. In the past, these fires burned in a mosaic creating patches of different age classes over the landscape (Arno 2000, Agee 1993) with different degrees of susceptibility to future insects and stand replacing wildfire. The fire return interval for lodgepole pine in this area is thought to be about 60 to 80 years (Agee 1993; USDA, Umpqua National Forest, 2008). Low intensity fires also likely occurred in lodgepole pine forests of the Pacific Northwest; often spreading slowly from log-to-log. Prior to fire exclusion, these low intensity fires reduced surface fuel loads, which minimized fire severity to soil during the larger stand replacement events. The dramatic difference in fuel conditions is assessed in the 1998 Diamond Lake/Lemolo Lake Watershed Analysis (Appendix B) (USDA, Umpqua NF 1998); prior to fire exclusion, most fuel conditions consisted of light fuels in low quantities while the vast majority of current conditions consist of heavy fuels in higher concentrations.

Dense stands of lodgepole pine (either in pure lodgepole stands or in mixed conifer stands) that are at least 80 years of age with trees at least 8 inches in diameter are highly susceptible to mountain pine beetle attack. Mountain pine beetle attacks seldom occur in younger stands, particularly those stands with trees less than 4 inches in

diameter. Because of the very large amount of the landscape having mature, older pine in and around the planning area, the risk of a landscape-scale outbreak is considered high (Goheen and Bridgewater 2007).

A mountain pine beetle outbreak along the east shore of Diamond Lake and in Crater Lake National Park was noted in 2004. This is now recognized as an infestation which extends in and beyond the D-Bug planning area. It is very probable that this infestation will continue to spread through a high proportion of these lodgepole pine stands within the next few years (Goheen 2008). As much as 90 percent mortality of the lodgepole pine overstory in the affected stands will likely occur and much of the ponderosa and western white pine may be adversely affected.

The mixed conifer stands in the planning area avoided the large stand-replacement fires of the late 19th and early 20th centuries that resulted in lodgepole pine dominance elsewhere. Now due to fire exclusion, these stands are exhibiting a change from their historic composition and structure. Many of the mixed conifer stands currently consist primarily of large mountain hemlock, ponderosa pine, Shasta red fir and Douglas-fir with substantial in-growth of white fir developing underneath. Under reference conditions, these areas typically experienced fire more frequently, so fire exclusion has had a greater ecological impact here than in other planning area stands. Ponderosa pine is not able to withstand very much vegetative competition from understory species, so it eventually will die out in the absence of fire. Stand replacement fire in mixed conifer stands is now more likely due to the uncharacteristic buildup of live and dead vegetation (due to a lack of frequent fire) in most mixed conifer forest types in the planning area.

DESIRED CONDITION

The D-Bug project was initiated to move current conditions in pine dominated landscapes in the general vicinity of high-use recreation areas, toward landscape and stand conditions more resilient to infestation from pine beetle, with reduced hazardous fuel conditions, and more open stand conditions representative of the natural fire regime both inside and outside areas designated as Wildland-Urban Interface areas (WUIs). Commercial timber harvest can be used to remove the larger host lodgepole pine trees before the beetles infest an area (Fettig et al. 2007). This reduction in the number of potential host trees and creation of a sunny micro-climate can reduce beetle-caused tree mortality, thus decreasing the future accumulation of fuel and hazard trees. Similarly, commercial and non-commercial tree removal can open up uncharacteristically dense stands in order to modify fire behavior, lower the risk of stand replacement fire, improve stand vigor and resistance to insects, and allow fire-fighting crews safe access for fire control and potential fire use in the future.

The Healthy Forest Restoration Act and Community Wildfire Protection Plans

The Healthy Forest Restoration Act (HFRA) of 2003 was designed to expedite hazardous fuels reduction and forest restoration projects on specific types of Federal lands that are at risk of wildland fire or insect epidemics. This law encourages the development of Community Wildfire Protection Plans under which communities designate their Wildland-Urban Interface (WUI) areas where expedited projects under HFRA may take place. In 2006, the Umpqua National Forest collaborated with Douglas County and other entities to finalize the Douglas County Community Wildfire Protection Plans. These Plans include the designation of the Diamond Lake and Lemolo Lake

WUIs. The Protection Plans for Diamond and Lemolo Lake list hazardous fuel reduction treatments and methods to protect these at-risk communities.

The Healthy Forest Restoration Act also includes ways to streamline the planning process for projects such as D-Bug that qualify as authorized hazardous-fuels reduction projects. D-Bug is an Authorized Hazardous Fuels Reduction Project under section 102 of this law because:

- The project includes the Lemolo Lake and Diamond Lake WUIs and surrounding high-use recreation areas in an area with presently high fuel loads and an insect epidemic that is adding to the fuel loads.
- Based on an assessment of the mountain pine beetle epidemic by a Forest Service entomologist, the Forest Supervisor of the Umpqua National Forest has made a determination that the mountain pine beetle epidemic in the planning area and surrounding areas poses a significant threat to recreation resources and wildland-urban interface values.
- The methods proposed to implement this project include harvesting, thinning, and fuel treatments to suppress the further spread of mountain pine beetle in areas already affected and to help prevent the further spread of infestations by changing the conditions that presently render the forest susceptible to epidemics. Methods also are included to restore ecological integrity to uncharacteristically dense stands so that ecosystem components are functioning and more capable of self-renewal in the event of a wildfire.

PURPOSE AND NEED FOR ACTION

The purpose of this project is to lessen the fuel and safety hazards associated with the on-going outbreak of mountain pine beetles and the on-going impacts from fire exclusion by the timely implementation of commercial harvest and non-commercial treatments in strategic locations. The difference between the existing condition and the desired condition defines the need for action. The four elements of the D-Bug purpose and need are:

Element 1: The need for modifying pine beetle habitat conditions in stands containing lodgepole to reduce potential infestation by mountain pine beetles.

Element 2: The need to reduce existing and predicted fuel loads in areas identified as high fire hazard within the Diamond and Lemolo Lake WUI and their evacuation routes identified in the 2006 Douglas County Wildfire Protection Plans for Lemolo and Diamond Lake WUIs.

Element 3: The need for removing existing dead and imminently dying pine and other hazard trees where human use is high in order to protect the recreating public.

Element 4: The need for increasing stand vigor in densely-stocked mixed conifer stands containing older, large ponderosa pine, western white pine, Shasta red fir, and Pacific silver fir in order to improve stand resiliency.

PROPOSED ACTION

The proposed action was developed to meet the purpose and need. It includes the following:

- Variable density commercial thinning of 3,165 acres in lodgepole pine stands (leaving 20-70 TPA), thinning 1,145 acres of lodgepole-mixed conifer (leaving 50-200 TPA), and thinning of 2,247 acres in mixed conifer stands (leaving 50-90 TPA). The lodgepole variable density thinning would not generate any openings greater than 40 acres in size. These commercial thinnings include 620 acres within outer edges of the Mt. Bailey and Thirsty Creek Appendage Inventoried Roadless Areas (IRA's), and 318 acres along the edge of the Oregon Cascades Recreation Area (OCRA).
- Overstory removal (leaving 20 overstory TPA) in two lodgepole pine stands on 59 acres. These overstory removals would not generate any openings greater than 40 acres.
- Salvage of 375 acres of dead and dying lodgepole.
- The commercial harvest would use ground-based and skyline logging systems in both the matrix and riparian reserve land allocations to generate an estimated 44.8 million board feet of timber.
- Non-commercial removal of fuels on about 2,026 acres by pre-commercial thinning, mastication, whip felling, chipping, and piling and burning of slash. This includes treatment on about 344 acres of stands along the edges of the Mt. Bailey and Thirsty Creek Appendage Inventoried Roadless Areas and 15 acres in the OCRA.
- Re-using about 25.6 miles of existing spur roads to access thinning areas then obliterating about 11.1 miles after use.
- Building a total of about 15.4 miles of new temporary spur roads to provide access for logging machinery and for accessing stands for non-commercial treatments, then obliterating them after use.
- Amending the 1990 Umpqua National Forest Land and Resource Management Plan (LRMP) in terms of: scenery standards; timber harvest in MA 1; opening size limitations in MA 2; and timber harvest in the lodgepole pine ecosystem.

DECISION TO BE MADE

Based on the analysis documented in this Environmental Impact Statement, the Forest Supervisor of the Umpqua National Forest will decide the following:

- To implement the project as proposed; to implement a modified version of the project (an alternative) that addresses unresolved issues; or to not implement the project at this time (no action).
- If the project is implemented, which mitigation measures, project design features, monitoring, and water quality best management practices are necessary to achieve resource goals, objectives, and the desired future condition,
- If the project is implemented, whether to amend the Forest Plan as proposed.

SCOPING

Under the direction of the Healthy Forest Restoration Act (HFRA), a collaborative process was used during the development of the proposed action which included several newspaper articles and announcements, mailings to over 350 potentially interested

people and groups, a public meeting in Roseburg on September 27, 2007, a public field trip to the project area on November 3, 2007, and various one-on-one discussions with groups and individuals from September 2007 through December 2007.

Formal scoping (a process used to surface issues) began when the proposed action was published in the federal register on January 22, 2008. A scoping notice was sent to the public on January 10, 2008 detailing the proposed action and soliciting comments. On February 8, 2008, The Roseburg News-Review published a front-page article describing the D-Bug proposed action and announcing the opportunity to submit scoping comments to the Forest Service.

Thirty-seven scoping comments were received, including letters, e-mails, face-to-face conversations and meetings, and phone conversations. The D-Bug project record contains a scoping summary that details the scoping comments received for the project.

ISSUES

The scoping process generated a number of issues related to the proposed action. An issue is a point of disagreement, debate, or dispute about the proposed action based on effects identified through scoping. The following significant issues were used to develop alternatives to the proposed action:

Issue 1--Amendments to the Forest Plan

The proposed Forest Plan Amendments that would amend scenery standards and that would include the harvest of lodgepole pine which is normally excluded from the timber harvest base would be harmful to the ecosystem and scenic quality of the area.

Issue 2--Treatments in Inventoried Roadless Areas/Oregon Cascades Recreation Area, and other Potential Wilderness Areas

Conservation groups state that scheduled timber harvest activities on a programmed basis are not permitted in the OCRA; creating fuelbreaks (which require periodic maintenance) along the Thirsty Creek Road and Kelsey Point Road along the edge of the Thirsty Creek Appendage IRA's violates the 2001 Roadless Area Conservation rule, which states that any cutting of timber in IRA must be infrequent; and harvest activities in potential wilderness areas could severely degrade the rare features and the potential wilderness characteristics of these important areas.

Issue 3--New road building

Several conservation groups are concerned that the proposed 15.5 miles of temporary road building and subsequent obliteration would cause ecological damage.

Issue 4--Trails

Some conservation groups are concerned that log haul on top of existing trails and thinning next to existing trails will negatively affect the trails and the recreation experience due to the impacts from logging and other fuel reduction treatments.

Issue 5--Fuelbreaks

Multiple commenters expressed various concerns over the location, width, and thinning techniques proposed on some of the fuelbreaks, questioning their effectiveness and the possible impacts of such fuelbreaks. In particular, the fuelbreaks along Thirsty Creek and Kelsey Point roads were thought to be redundant because the proposal also includes a fuelbreak on the Windigo Pass road, located directly to the northwest. Moreover, these fuelbreaks enter the Thirsty Creek IRA and are outside the WUIs.

Issue 6--Extent and Intensity of Treatments in Lodgepole Pine and Project Economics

Several conservation groups are concerned that the proposed action includes too much harvest, resulting in impacts in the lodgepole pine ecosystem.

Several other commenters stated that the proposed action is not doing enough removal to achieve project needs in terms of treatment intensity, treatment extent, and economic returns.

Chapter 2 –Alternatives Including the Proposed Action

ALTERNATIVE 1 – NO ACTION

Under Alternative 1, no thinning, fuel treatment, biomass utilization, temporary road construction, road reconstruction and maintenance, or other similar or connected activities such as pre-commercial thinning, subsoiling, weed control, or road decommissioning would occur. No ground-disturbing activities would take place and no timber would be offered for sale. On-going activities, including road maintenance, recreation use, and noxious weed control would continue to occur (Table 13, Chapter 3). Future activities, such as those described in Table 14 also would occur.

ALTERNATIVE 2 - PROPOSED ACTION

This alternative is the proposed action used in the scoping process. The proposed action was developed to meet the purpose and need. It includes the following:

- Variable density commercial thinning of 3,165 acres in lodgepole pine stands (leaving 20-70 TPA), thinning 1,145 acres of lodgepole-mixed conifer (leaving 50-200 TPA), and thinning of 2,247 acres in mixed conifer stands (leaving 50-90 TPA). The lodgepole variable density thinning would not generate any openings greater than 40 acres in size. These commercial thinnings include 620 acres within outer edges of the Mt. Bailey and Thirsty Creek Appendage Inventoried Roadless Areas (IRA's), and 318 acres along the edge of the Oregon Cascades Recreation Area (OCRA).
- Overstory removal (leaving 20 overstory TPA) in two lodgepole pine stands on 59 acres. These overstory removals would not generate any openings greater than 40 acres.
- Salvage of 375 acres of dead and dying lodgepole.
- The commercial harvest would use ground-based and skyline logging systems in both the matrix and riparian reserve land allocations to generate an estimated 44.8 million board feet of timber.
- Non-commercial removal of fuels on about 2,026 acres by pre-commercial thinning, mastication, whip felling, chipping, and piling and burning of slash. This includes treatment on about 344 acres of stands along the edges of the Mt. Bailey and Thirsty Creek Appendage Inventoried Roadless Areas and 15 acres in the OCRA.
- Re-using about 25.6 miles of existing spur roads to access thinning areas then obliterating about 11.1 miles after use.

- Building a total of about 15.4 miles of new temporary spur roads to provide access for logging machinery and for accessing stands for non-commercial treatments, then obliterating them after use.
- Reconstructing portions of 11 sections of existing system roads (work would occur along 4.7 miles of road) including road re-alignment, intersection improvement, widening, continuous placement or replacement of surface rock and rock armoring, reshaping road beds, replacing culverts, adding culverts, and hazard tree felling.
- Maintaining about 67 miles of existing system roads (approximately 9 miles are currently closed), including the grading and shaping of existing road surfaces, dust abatement, blading road beds and ditches, hazard tree felling, cleaning/maintaining ditches and culverts as needed, isolated placement or replacement of surface rock and rock armoring, opening and re-closing existing closed roads, removing debris from the roadway, and the cutting of intruding vegetation along roadsides.
- Utilizing the existing Lemolo Dam rock pit and the Boundary rock pit as rock sources for the road work.
- Amending the 1990 Umpqua National Forest Land and Resource Management Plan (LRMP) in terms of: scenery standards; timber harvest in MA 1; opening size limitations and firewood cutting in MA 2; and timber harvest in the climax lodgepole pine ecoclasses.

ALTERNATIVE 3

Alternative 3 was developed to address Issues 2-6. Under Alternative 3, commercial harvest in the IRAs, the OCRA, and in potential wilderness areas is lowered by 65%, 64% and 52%, respectively, compared to Alternative 2. The construction of new temporary roads under Alternative 3 is lowered by 35% compared to Alternative 2. The use of existing trails for timber haul is lowered from 8.2 miles (in Alternative 2) down to 4.8 miles in Alternative 3. The Thirsty Creek and Kelsey Point fuelbreaks are dropped in this alternative where they overlap the Thirsty Creek IRA, equating to a reduction of 420 acres of commercial harvest and 109 acres of non-commercial fuel treatments. Also, under Alternative 3, the amount of commercial harvest in lodgepole pine is decreased by 26% (1,145 acres) relative to Alternative 2. The same plan amendments would apply to this alternative. Alternative 3 would generate an estimated 33.8 million board feet of timber.

ALTERNATIVE 4

Alternative 4 was developed to respond to Issue 6. Several commenters responded to the proposed action stating that not enough lodgepole pine would be treated in terms of total area treated or intensity of treatments.

Under Alternative 4, both the amount and intensity of lodgepole pine treatment is increased over that of Alternative 2. Alternative 4 includes nearly a 50% increase in the amount of lodgepole pine stands proposed for commercial treatment, equating to 2,219 more live lodgepole acres commercially harvested than Alternative 2. Similar to Alternative 2, most of the lodgepole acres would receive a variable density thinning (leaving 20-70 TPA interspersed with 10% of the area with no treatment). Alternative 4 also increases the amount of lodgepole pine regeneration harvest by applying the overstory removal prescription to an additional 182 acres over that of Alternative 2. The

overstory removal harvest would meet Forest Plan green tree retention standards and guidelines by leaving 15% on the area in uncut aggregates and scattered retention of 20 overstory trees per acre. None of the lodgepole openings would be larger than 40 acres in size. The increased acres of commercial lodgepole treatment would require the building of an additional 9.7 miles of temporary road over that of Alternative 2. As with Alternative 2, all these new temporary roads would be obliterated following use.

All of the mixed conifer stands in Alternative 2 would also be included, unchanged, in Alternative 4. Alternative 4 also includes an additional 187 acres of non-commercial fuel treatment over that of Alternative 2. Most of the additional non-commercial fuel treatments in this alternative are located west of the Lemolo Lake Resort. The same plan amendments apply to this alternative. Alternative 4 would generate an estimated 55.3 million board feet of timber.

Chapter 3—Affected Environment and Environmental Effects

Affected environments and environmental effects discussed in the EIS include Forest Vegetation, Fire and Fuels, Coarse Woody Debris, Wildlife, Unique Habitats, Noxious Weeds, Botany, Soils and Site Productivity, Air Quality, Economics, Recreation, OCRA, IRA, Potential Wilderness and Potential wilderness areas, Wilderness, Water Quality, Stream Flows, Erosion and Sedimentation, Riparian Reserves, Stream Channels, Fish, and numerous Specifically Required Disclosures.

The alternatives vary in some aspects, in terms of the degree to which they meet the various elements of the purpose and need (Table S-1).

Table S-1. Alternative comparison for the elements of the Purpose and Need.

Purpose and Need	Alt. 1	Alternative 2	Alternative 3	Alternative 4
Element 1 – Pine Beetle Habitat Modification Acres of susceptible lodgepole treated.	0	4,743	3,506	6,962
Element 2 – Fuel loading in WUIs and along WUI Evacuation Routes. - Acres treated within the WUIs. - Acres of treatment along designated evacuation routes. - Acres of fuelbreak protecting Lemolo WUI from wilderness/roadless area fires.	0 0 0	3,781 4,242 970	3,112 3,796 391	4,557 4,428 995
Element 3 – Hazard Tree Reduction Acres of commercial harvest within developed recreation sites and by private dwellings/businesses.	0	199	199	199
Element 4 – Improved Fire Resiliency & Stand Vigor Acres of mixed conifer stands thinned.	0	2,247	1,790	2,247

The alternatives also differ in terms of how they respond to the issues raised during scoping (Table S-2).

Table S-2. Response to Significant Issues by Alternative.

Significant Issues	Alt. 1	Alternative 2	Alternative 3	Alternative 4
Issue 1 – Plan Amendments				
• Acres of lodgepole harvested.	0	4,743	3,506	6,962
• Acres of Retention VQO along Highways 138 and 230 moved to:				
o Partial Retention	0	220	220	220
o Modification		265	265	265
• Acres of Partial Retention VQO along Highways 138 and 230 moved to:				
o Modification	0	164	164	164
Issue 2 – IRA/OCRA/Potential Wilderness Areas				
• Acres of commercial thinning in the OCRA.	0	318	115	318
• Acres of forest treated in the IRA's.				
o Commercial treatment	0	620	221	620
o Non-Commercial treatment	0	345	163	345
• Acres of treatment Potential Wilderness Areas (excluding overlap with IRA and OCRA acres)	0	1,515	768	3,069
Issue 3 – Road Building				
• Miles of temporary roads constructed and subsequently obliterated.	0	15.4	10.0	25.1
Issue 4 –Impacts of Thinning/Haul on Trails				
• Miles of existing trail used for logging access.	0	8.2	4.8	8.2
• Acres of commercial & non-commercial treatment within 200 feet of trails.	0	1,345	992	1,345
Issue 5 – Fuelbreaks – Effectiveness, Redundancy and Extent.				
• Acres of commercial/non-commercial treatments along Thirsty Creek and Kelsay Point fuelbreaks.	0	970	391	995
• Total acres in roadside fuelbreaks	0	5,212	4,187	5,423
• Acres of improved resiliency to stand replacement fire within and adjacent to fuelbreaks	0	4,508	3,364	5,757
Issue 6 – Lodgepole Pine Prescriptions, Extent of Lodgepole Treatment and Project Economics				
• Acres of lodgepole pine regenerated	0	59	0	241
• Acres of lodgepole pine and lodgepole-mixed conifer commercially thinned	0	4,310	3,224	6,345
Extent of Lodgepole Pine Treatment				

Significant Issues	Alt. 1	Alternative 2	Alternative 3	Alternative 4
Acres harvested south of Hwy. 230 toward Crater Lake National Park.	0	1,660	928	3,267
Economic Efficiency				
Net Present Value	0	\$137,901	-\$173,665	\$98,657
Least Cost to Government (Total Cost/Total Acres Treated)	0	\$1,443	\$1,485	\$1,365

Chapter 4—List of Preparers

This chapter lists the members of the interdisciplinary team (IDT) who contributed to the preparation of the EIS.

Chapter 5—List of Participants and Public Involvement.

Chapter 5 documents the public involvement process and who participated. Initial contacts with the public for the D-Bug project began in August of 2007, when the IDT started field reconnaissance to develop a proposed action. At that time, the need to collaborate was identified. Numerous contacts were made with interested individuals, homeowners, special use permittees, conservation groups, industry representatives, and other agencies over a 6 month period of time, with the goal of collaborating on the development of the proposed action. This collaboration also included newspaper articles, an advertised public meeting at the Douglas County library and a follow-up field trip. The feedback received during the development of the proposed action is summarized in notes, conversation records, and in a 'pre-scoping summary' document. The project was also listed in the October 2007 Schedule of Proposed Actions (SOPA), which let interested people know the project was in development.

Formal scoping began in January of 2008, when a scoping packet was sent to over 350 individuals and groups, including maps and details of the proposed action. People were invited to document their concerns regarding the proposal. In addition, a Notice of Intent to prepare an Environmental Impact Statement was published in the January 22, 2008 Federal Register, and a front-page story describing the details of the proposed action was published on February 8, 2008 in The Roseburg News-Review newspaper.

The regulatory agency (US Fish and Wildlife Service) charged with overseeing the Endangered Species Act, was consulted extensively throughout the planning process. Consultation with this agency will be finalized before the Record of Decision is signed.

The Tribal governments (Cow Creek Band of Umpqua Indians, Confederated Tribe of the Grand Ronde Indians, and the Confederated Tribe of the Siletz Indians) have been sent a letter describing the project, with a request to contact the Forest for further information. To date, no responses have been received. The Tribes were also consulted under the National Historic Preservation Act.

During the scoping period, letters, face-to-face discussions, e-mails, and phone calls regarding the D-bug Hazard Reduction Timber Sale Project Proposed Action were received from 37 individuals or groups. The D-Bug analysis file contains a detailed scoping summary of all scoping comments. An extensive mail list was developed for the D-Bug project used to inform the public of the opportunity for early involvement, public meetings, and field trips and the start of the formal scoping process.

CHAPTER 1

PURPOSE AND NEED FOR ACTION

INTRODUCTION AND ENVIRONMENTAL SETTING

Chapter 1 describes the purpose and need for action and the proposed action for the D-Bug Hazard Reduction Timber Sale Project (D-Bug Project). The chapter also briefly characterizes the project area and its setting, outlines applicable management direction, addresses the scope of the decision, summarizes the scoping process, and lists the issues identified during scoping.

The 42,000-acre planning area is located within the Diamond Lake, Lemolo Lake, and Clearwater 5th field watersheds on the Diamond Lake Ranger District of the Umpqua National Forest (UNF). The planning area contains areas of concentrated human use centered around Diamond Lake and Lemolo Lake. Crater Lake National Park is located just south of the planning area. These high use recreation lakes are approximately 90 miles from the cities of Bend and Klamath Falls, Oregon to the east and Medford and Roseburg, Oregon to the west (Figure 1).

The planning area includes all or portions of T26S, R5E, Sections 10, 11, 13-15, 23-26, 34-36; T26S, R6E, Sections 16-21, 28-33; T27S, R5E, Sections 1-5, 25, 36; T27S, R6E, Sections 5-8, 17, 20, 29-32; T28S, R5.5E, Sections 4, 9, 16, 18-21, 28-30, 33-35; T28S, R6E, Sections 1, 12, 13, 22-26, 35; and T29S, R5.5E, Sections 2-4.

Recreational Use

Diamond Lake has about 700,000 recreational visitor days annually with the major summer activities of camping, boating, fishing, biking, ATV use, swimming, and sightseeing. The main winter activities are cross-country skiing and snowmobiling. Hunting in the fall is also a major use.

The Diamond Lake vicinity has about 450 campsites, numerous picnic sites, several boat ramps and docks, a visitor information center, and many miles of trails for hiking, equestrian, bicycle, all terrain vehicle and winter snow use. The Diamond Lake Improvement Company runs a resort, lodge, horse rental corral, two grocery stores, a gas station and a pizza parlor on Forest Service land under special use permit, including multiple permanent residences associated with this development. Also under Forest Service special use permit are 102 privately owned recreation residents, an RV Park, and a State-owned cabin for water-level and fishery management.

Lemolo Lake averages 70,000 recreation visitor days annually with the same year-round uses as Diamond Lake. Developments include 95 campsites, boat ramps, and many miles of both summer and winter trails. The Lemolo Lake Resort runs a year-round lodge and restaurant, a seasonal boat dock, and an RV park on Forest Service land under special use permit, including permanent residences associated with the development.

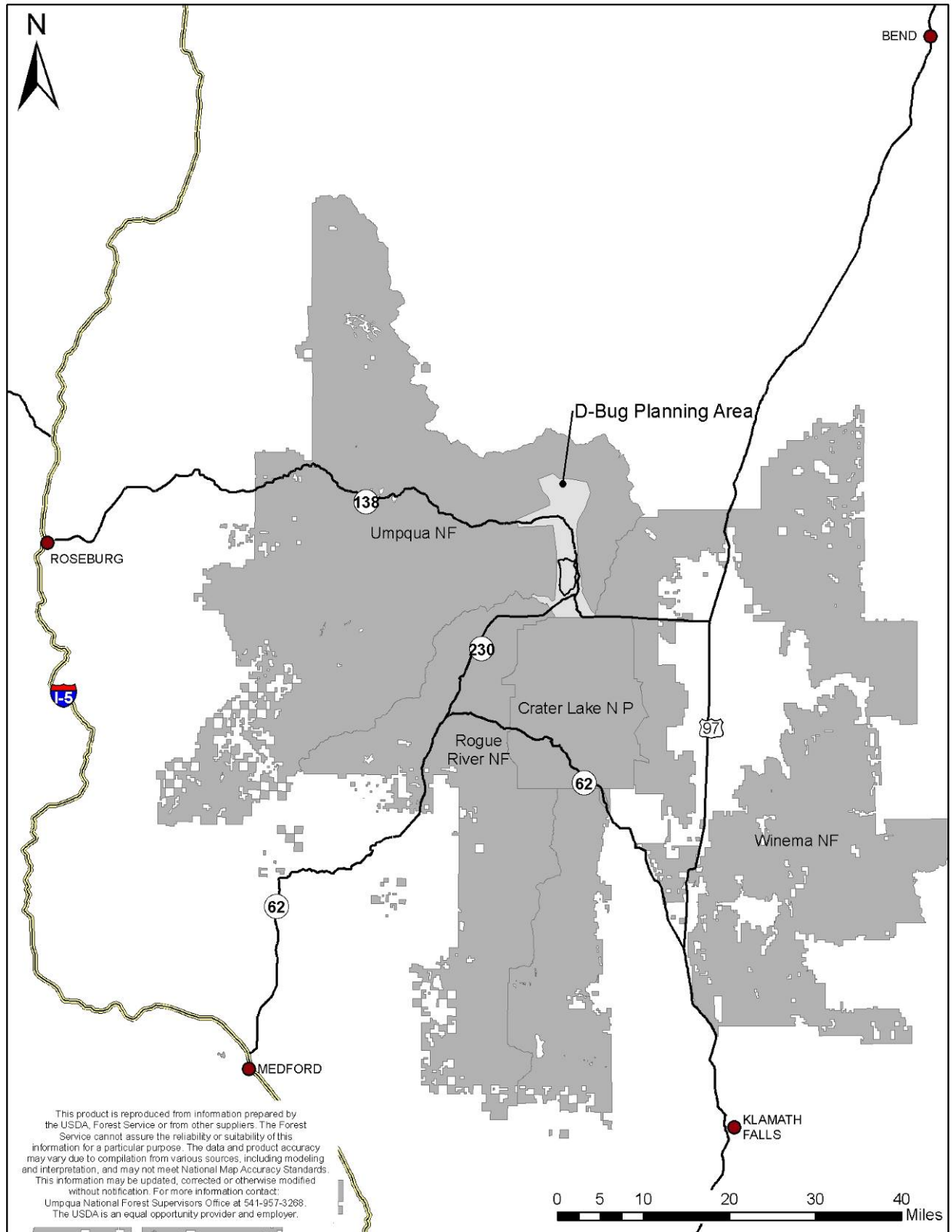


Figure 1. Vicinity of the D-Bug Hazard Reduction Timber Sale Project.

Forest Condition

The D-Bug planning area is near the crest of the Cascade Mountains where both eastside and Westside forest types are represented. As such, the D-Bug planning area contains a very diverse array of tree species. The dominant feature of the Diamond Lake/Lemolo Lake area is the vast, contiguous stands of lodgepole pine, 80 to 150 years of age. These stands carpet the pumice flat area by Lemolo Lake, sweep up the flanks of Mt. Thielsen, and extend seamlessly south into Crater Lake National Park.

In much of the planning area, lodgepole pine is the “pioneer” that establishes following disturbance such as fire or clearcut harvest. This is particularly true in flat terrain with pumice soils, where cold air drainage forms frost-pockets. In such cold, unproductive environments, lodgepole pine dominates both the overstory and understory in pure stands. In less harsh locations, the pioneering lodgepole is succeeded by other conifers that eventually come in under the lodgepole canopy, which provides frost protection. These stands eventually succeed to mixed conifer stands that can include Shasta red fir, Pacific silver fir, white fir, Douglas-fir, mountain hemlock, Engelmann spruce, and western white pine. Ponderosa pine is present in some of these mixed conifer stands on southerly aspects.

Mature natural lodgepole pine stands on the landscape today are the result of the large fires in the late 19th and early 20th century. At least three different large conflagrations can be documented between 1880 and 1910 in the Diamond Lake and Lemolo Lake watersheds. One historic account described a number of fires spreading over the area started by an electrical storm on July 5, 1910; most were not extinguished until fall rains in September (Perkins 1938). Diary accounts during the late 1800s included many references to fire and thick smoky conditions that often obscured views of Mt. Thielsen from Diamond Lake (Waldo 1880). As a result, large areas of the landscape in the vicinity of the D-Bug planning area are now covered by mature lodgepole pine stands. The high incidence of fire during this period may be partly the result of stockmen setting fires intended to create open conditions for livestock. The pioneering lodgepole that reseeded into the burned areas resulted in the vast acreage of stands that are mature today. Forest Service policies to suppress fire have resulted in artificially small fires that have done little to break up the homogeneous stands in the area (USDA, Umpqua National Forest 1998), setting the stage for a landscape-scale mountain pine beetle outbreak and/or large wildfire events.

Lodgepole Pine, Mountain Pine Beetle, and Fire Hazard

Dense stands of lodgepole pine (either in pure lodgepole stands or in mixed conifer stands) that are at least 80 years of age with trees at least 8 inches in diameter are highly susceptible to mountain pine beetle (*Dendroctonus ponderosae*) attack. The life history of lodgepole pine lends itself particularly well to mountain pine beetle attack but all pines including ponderosa pine, western white pine, and whitebark pine are susceptible to attack during an outbreak. Younger stands, particularly of trees less than 4 inches in diameter, are seldom attacked. The risk of a landscape scale outbreak in the planning area is considered high because of the very large amount of area covered by mature pine (Goheen and Bridgewater 2007).

A mountain pine beetle outbreak has been on-going since 2004 (Figure 2). Focal points for the outbreak include the east shore of Diamond Lake and areas just north of the lake.

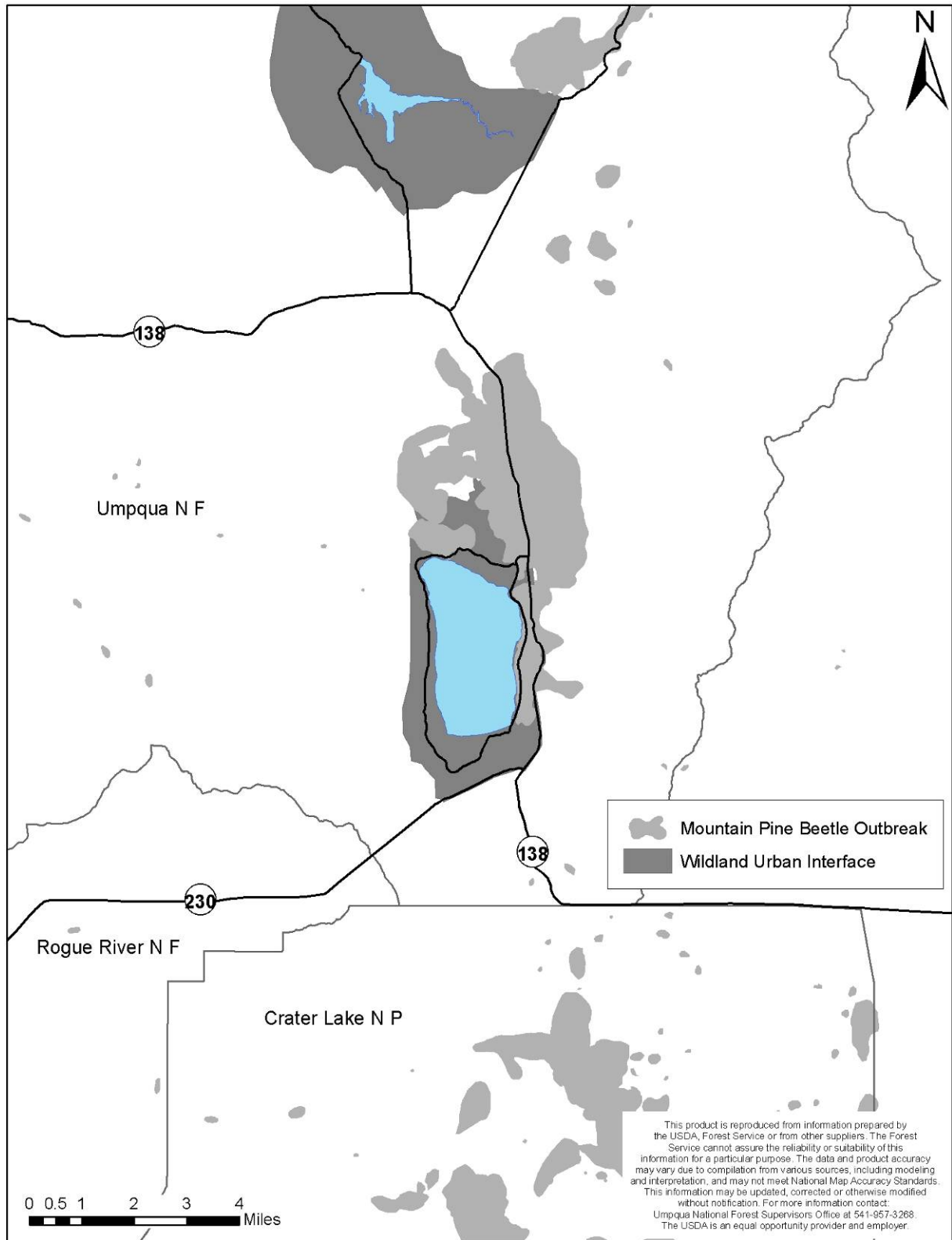


Figure 2. Mountain Pine Beetle Outbreak Areas (mapped from aerial surveys 2002-2006) and Wildland Urban Interfaces Areas.

Since then, beetles have begun killing lodgepole near the south shore and all along the west shore of Diamond Lake. Forest Service entomologists predict that the present infestation on the north and west shores of Diamond Lake will spread to other areas, and that this could happen quickly. Their assessment is based on how rapidly mountain pine beetle populations build and spread when epidemics occur, on historic mountain pine beetle outbreaks in Oregon (especially the outbreak in the area during the 1920s), and the level of landscape risk due to the presence of continuous mature lodgepole pine that exists in the area today. According to entomologist, Don Goheen, “It is very probable that a high proportion of the lodgepole pine stands in the area will be infested within the next few years” (Goheen 2008). Infested stands will likely suffer as much as 90 percent mortality of the overstory lodgepole pines and may also lose large proportions of any ponderosa, western white, or white bark pines that they contain” (Goheen and Bridgewater 2007). Prior to the on-going epidemic, a pine beetle outbreak occurred at the south end of Diamond Lake during the late 1970’s and early 1980’s.

Mountain pine beetle outbreaks can create landscape level mortality that increases the fire hazard (Parker et. al 2006, Lynch et al. 2006). In pure lodgepole stands, fire hazard is typically high during the first few years following an outbreak before dead needles fall. During this period, fire can spread through the abundant aerial fine fuels (Stuart et al. 1998). In pure stands, the hazard typically subsides a few years after the outbreak in the period after the red needles have fallen and before snags begin to fall. During this period, the threat of crown fire is often very low because there are fewer fine fuels in the canopy. Fire hazard again begins to increase as snags fall and branchwood accumulates on the forest floor. This increase can be rapid and drastic when blowdown results in “jack-strawed” conditions in which dead and downed trees loosely pile atop one another, forming a continuous jumble of logs several feet high. Jack-strawed conditions can create very high intensity and high severity fires (Page and Jenkins 2007) that are very difficult and dangerous for firefighters to suppress and can damage natural resources.

Fire hazard also increases in stands where lodgepole and other pines are killed amongst live hemlock, true firs, and Douglas-fir. The threat of crown fire continues in these stands even after needles have fallen from the beetle-killed trees because a live overstory remains. The beetle-killed trees contribute to surface fuel loadings and ladder fuels, increasing the intensity and severity of fire when it occurs.

Both low intensity and stand replacement fires were historically common in pure lodgepole stands in the planning area. In the past, these fires burned in a patchy mosaic creating patches of different age classes over the landscape (Arno 2000, Agee 1993) with different degrees of susceptibility to future insects and stand replacing wildfire. The fire return interval for lodgepole pine stands in this area is thought to be about 60 to 80 years (Agee 1993; USDA, Umpqua National Forest 2008). Low intensity fires were also thought to occur in lodgepole pine forests of the Pacific Northwest; these fires often spread slowly from log to log in what is often referred to as “cigarette burns.” Prior to fire exclusion, these low intensity fires effectively reduced surface fuel loads between stand replacement fire events and consequently minimized fire severity to soil. The dramatic difference in fuels conditions is assessed in the 1998 Diamond Lake/Lemolo Lake Watershed Analysis (Appendix B) (USDA, Umpqua NF 1998) and shows that prior to fire exclusion, most fuel conditions consisted of light fuels in low quantities while the vast majority of current conditions consist of heavy fuels in higher concentrations.

The mountain pine beetle–wildfire cycle in lodgepole pine forests is a natural process that has undoubtedly been repeated continuously for centuries. However, decades of

fire suppression following what appears to be an unnaturally high occurrence of fire in the late 19th and early 20th centuries has resulted in unusually homogenous tracts of mature lodgepole forest. This condition leaves the landscape with a high fire hazard in a location where summer lightning is common and where high human use and occupancy adds to the risk of fire starts. This could lead to an extensive wildfire that could be difficult and dangerous to manage in the heavily-used recreation sites around Diamond and Lemolo Lakes.

Mixed Conifer and Fire Exclusion

The mixed conifer stands in the planning area have avoided the large stand-replacement fires of the late 19th and early 20th centuries that resulted in lodgepole pine dominance elsewhere. Now due to fire exclusion, the stands in the white fir series, in particular, are exhibiting a change from their historic composition and structure. These stands currently consist primarily of an overstory of very large Douglas-fir and ponderosa pine with substantial in-growth of white fir developing underneath. Much of the white fir is already mature and forms a subcanopy below the Douglas-fir and ponderosa pine and occupies gaps generated by the dying overstory trees. Under reference conditions, these areas typically experienced fire more frequently, so fire exclusion has had a greater ecological impact here than in other planning area stands. Ponderosa pine is able to withstand less vegetative competition than white fir and will eventually be replaced in the absence of disturbance. Stand replacement fire in mixed conifer stands is now more probable due to the uncharacteristic buildup of live and dead vegetation in most mixed conifer forest types.

The effects of fire exclusion are less pronounced in the mountain hemlock and Shasta red fir stands that are less prone to regular fire. However even these vegetation types are likely comprised of reduced age and structural diversity at the landscape scale.

Desired Condition

The D-Bug project was initiated to move current conditions in pine dominated landscapes in the general vicinity of high-use recreation areas, toward landscape and stand conditions more resilient to infestation from pine beetle, with lower fuel profiles, and more open stand conditions representative of the natural fire regime both inside and outside WUIs. Commercial timber harvest can be used to remove the larger host lodgepole pine trees before the beetles infest an area (Fettig et al. 2007). With fewer host trees, and sunny microclimate, beetle-caused mortality can be decreased, thus decreasing the future accumulation of fuel and hazard trees. Similarly, commercial and non-commercial tree removal can open up uncharacteristically dense stands in order to modify fire behavior, lower the risk of stand replacement fire, improve stand vigor and resistance to insects, and allow fire-fighting crews safe access for fire control and potential fire use in the future.

RELEVANT LAWS, OTHER PLANNING DOCUMENTS AND OTHER ANALYSES

The 1990 Umpqua National Forest Land and Resource Management Plan (LRMP) plus its amendments established Management Areas (MAs) to emphasize different land uses. Laws and administrative rules also have been promulgated that affect land use in the vicinity of the planning area (Table 1, Figures 3 and 4).

Table 1. Summary of Land Use Allocations in the D-Bug Vicinity.

Designation	Focus	Requirements
Management Area 1	Unroaded recreation primarily in a semi-primitive environment.	Insect control practices as approved in a vegetative management plan, otherwise no programmed timber harvest*.
Management Area 2	Concentrated Developed Recreation immediately around Diamond and Lemolo Lakes.	Timber management designed to complement the recreation resource. Harvest is limited to ½ acre in size*. Insect control practices allowed, as approved in a vegetative management plan.
Management Area 5	Congressionally designated Oregon Cascades Recreation Area with a focus on dispersed recreation opportunities in predominately natural settings.	Timber harvest is allowed to prevent and control insects, disease, and other damaging agents and to prevent catastrophic mortality from these agents, or when the overall protection of the forest inside or outside the recreation area might be adversely affected by failure to remove dead or damaged timber. No new permanent road construction.
Management Area 10	Produce timber in a cost-effective sustainable basis consistent with other resource objectives.	Road construction/reconstruction is necessary to access land for timber harvest. A variety of silvicultural practices can be used.
Management Area 11	Provide big-game winter range habitat production consistent with other resource objectives.	Road construction/reconstruction is necessary to access land for timber harvest. A variety of silvicultural practices can be used.
Matrix and Riparian Reserve (Northwest Forest Plan)	MA 10 and 11 were revised with additional standards and guidelines in 1994 emphasizing more retention of green tree, dead, and down wood habitat and emphasizing riparian dependant resources along streams and other water bodies.	Timber harvest and road construction is allowed following standards and guidelines.
Inventoried Roadless Areas	Overlaps both the matrix and riparian reserve land allocations in certain places in the planning area	Timber may be cut, sold, or removed in the inventoried roadless area if it is generally small diameter timber and is done to maintain or restore the characteristics of ecosystem composition or structure, such as to reduce the risk of uncharacteristic wildfire effects that would be expected to occur under natural disturbance regimes (2001 Rule); Recent ruling by Judge Brimmer enjoins 2001 Rule.

*a site-specific Forest Plan amendment is proposed to address this requirement.

This analysis tiers to the Final Environmental Impact Statement (FEIS) of the 1990 Umpqua National Forest LRMP, as amended and the 2005 Final Environmental Impact

Statement for the Pacific Northwest Region Invasive Plant Program. It also incorporates by reference the recommendations and analysis in the 1998 Diamond Lake/Lemolo Lake Watershed Analysis (WA), the 2003 Community Wildfire Protection Plans, the 2008 Vegetation Management Plan and Watershed Analysis Iteration, and the 2003 Umpqua National Forest Roads Analysis.

Roadless Area Conservation Rule (RACR) Status

The legal status of the 2001 Roadless Area Conservation Rule (RACR) continues to be unstable. Throughout D-Bug project scoping, public involvement, and project design and analysis the RACR was in force. This regulation prohibited the construction or reconstruction of roads and prohibited the cutting, sale, or removal of timber in inventoried roadless areas (IRAs) identified in the map set for the FEIS for that rule dated November 2000. The prohibitions on road construction and timber harvest also included a limited set of exception situations that would allow these otherwise prohibited activities to take place.

Soon after its issuance in January 2001, the Roadless Area Conservation Rule triggered a round of litigation that led to a complex and continuing legal history of injunctions, reinstatements, replacement regulations, state specific rulemaking, and Forest Service interim directives; this DEIS will not trace that legal history. However, two of the court decisions weigh heavily on this project NEPA document:

1. In February 2007 in the Federal District Court for the Northern District of California, Judge Laporte struck down the 2005 State Petitions Roadless Rule as unlawful, reinstated the 2001 Roadless Area Conservation Rule, and enjoined the Forest Service from taking any further actions contrary to the 2001 rule (Roadless rule must be implemented).
2. On August 8, 2008 in the Federal District Court for the District of Wyoming, Judge Brimmer (for the second time) found the 2001 Roadless Area Conservation Rule to be unlawfully promulgated and ordered that the 2001 rule be permanently enjoined (Roadless rule must NOT be implemented).

These two contradictory rulings from two different courts create a situation where the Forest could potentially be in conflict with either one order or the other, regardless of what the D-Bug Project proposes to do. Nationally, the USDA has filed motions with both courts seeking relief; Judge Laporte has since further clarified her ruling to apply to the 9th District Court and New Mexico. No clarifications or orders have been issued by Judge Brimmer. At this time, the Forest is moving ahead with release of the DEIS. However, when the Record of Decision for this project is signed, the project will comply with whatever court orders apply.

Rationale for compliance with the 2001 Roadless Rule and Judge Brimmer's Ruling

The D-Bug project is an activity that implements the Umpqua National Forest Land and Resource Management Plan. It was developed while the 2001 Roadless Area Conservation Rule was in force and it is also consistent with the requirements of that rule. As outlined in the Purpose and Need section of this document (DEIS pages 16-18) this project responds to a critical need to reduce hazardous wildland fuels in a wildland urban interface. The fuels situation is compounded by an ongoing insect epidemic that continues to kill trees and create more hazardous fuels (DEIS pages 3-6). This situation prompted the need to proceed with this project in full recognition of the special values of roadless areas and the requirements of the RACR. The proposed action includes timber

harvest and non-commercial tree cutting on about 600 acres along the edges of the 18,627 ac. Mt. Bailey IRA and about 365 acres along the edges of the 2,257 acre Thirsty Creek Appendage IRA, for a total of about 620 acres of commercial harvest within the two IRA's and 345 acres of non-commercial treatment within the two IRA's.

The D-Bug proposed action is consistent with the 2001 Roadless Area Conservation Rule as documented in Chapter 3 of the DEIS. There is no road construction or reconstruction in IRAs. The timber harvest and other tree cutting in IRAs is allowed under one of the exception situations to the general prohibition to timber harvest: 1) the trees to be cut are generally small diameter; 2) the cutting is done to maintain or restore characteristics of ecosystem composition and structure within the range of variability that would occur under natural disturbance regimes; 3) the cutting will maintain one or more of the roadless area characteristics as defined in §294.11 of the RACR. Thus, the timber harvest is consistent with §294.13(b)(1)(ii). See pages 259-269 of this DEIS for more discussion of roadless rule considerations.

Because the proposed action involves no road construction or road reconstruction in IRAs and the limited timber harvest is consistent with an RACR exception situation, the proposed action is consistent with the 2001 Roadless Area Conservation Rule and in compliance with Judge Laporte's order.

Because the D-Bug project was designed prior to the Judge Brimmer order enjoining the roadless rule, the DEIS and project record include analyses of project consistency with that rule. However, regardless of which ruling ultimately is in effect when the decision is signed, the project still complies with the spirit of Judge Brimmer's ruling in the following ways:

1. Project design features that make the proposed action consistent with the RACR are equally appropriate in the absence of that rule.

The lack of road construction or reconstruction in IRAs is also influenced by:

- These Roadless Area Conservation Rule IRAs are also designated Appendix C IRAs in the 1990 Umpqua Forest Plan. Forest plan direction (LRMP IV-107 for the Mt. Bailey IRA) prohibits road construction in eastern portion of the Mt. Bailey IRA. Forest plan direction is not changed by Judge Brimmer's injunction.
- Treatment areas sufficient to meet the project purpose and need can be adequately accessed from existing roads, thus for this project road construction in IRAs would not be needed even if the RACR or the forest plan allowed for it.
- Low product values of trees needed to be harvested require that road construction costs be held to a minimum in order for this project to be economically viable.

The silvicultural prescription for the treatment areas would be appropriate in the presence or absence of the RACR. The removal of generally small diameter trees is the best way to shift the fuels profile to reduce potential for catastrophic wildfire in the wildland urban interface, to slow the future tree mortality due to insect attack, and to restore desirable ecosystem characteristics (see discussion of silvicultural prescription pgs 92-94). That these silvicultural treatments are appropriate even in the absence of the RACR is reinforced by the fact that silvicultural prescriptions outside of IRAs are the same as prescriptions inside of IRAs (DEIS pages 90-91).

2. Although designed to be consistent with the 2001 Roadless Area Conservation Rule, the D-Bug project is also consistent with the spirit of Judge Brimmer's injunction of that rule. The project includes timber harvest in two IRAs. It does not treat these areas as de-facto wilderness areas as discussed in Judge Brimmer's order. It enters these IRAs for the purpose of ecosystem restoration and reduction of hazardous fuels in a wildland-urban interface, the prohibition of which was one of the 'injuries in fact' discussed in his order. Release of the DEIS at this time facilitates the public's ability to be informed of and to influence agency decisions, and continues with collaboration as required by the HFRA.

The FEIS and ROD will address the appropriate court rulings as they evolve.

The Healthy Forest Restoration Act and Community Wildfire Protection Plans

The Healthy Forest Restoration Act (HFRA) of 2003 was designed to expedite hazardous fuels reduction and forest restoration projects on specific types of Federal lands that are at risk of wildland fire or insect epidemics. This law encourages the development of Community Wildfire Protection Plans under which communities designate their Wildland-Urban Interface (WUI) areas where expedited projects under HFRA may take place. In 2006, the Umpqua National Forest collaborated with Douglas County and other entities to finalize the Douglas County Community Wildfire Protection Plans. These Plans include the designation of the Diamond Lake and Lemolo Lake WUIs. The Protection Plans for Diamond Lake and Lemolo Lake list hazardous fuel reduction treatments and methods to protect these at-risk communities:

- Thin 300 feet around structures and critical infrastructure;
- Clear and thin evacuation routes for homes and areas of recreation;
- Fuel reduction treatments include mechanical clearing and thinning in the WUIs including harvesting, thinning, mowing, chipping, cutting, and piling;
- Prescribed burning shall be pursued as a method of fuels reduction, where appropriate.

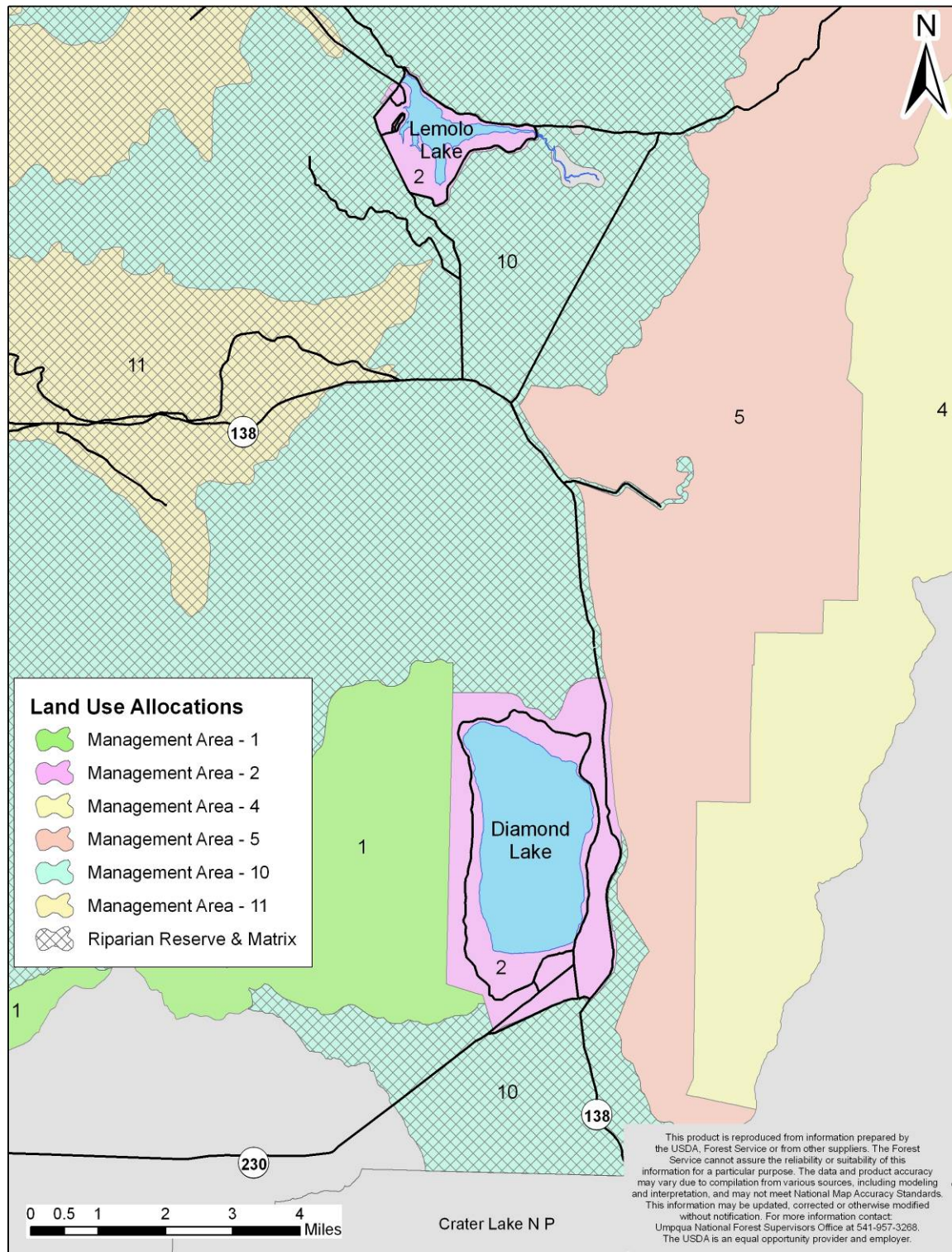


Figure 3. Management Areas designated by the Umpqua NF Land and Resource Management Plan and as Established by Law.

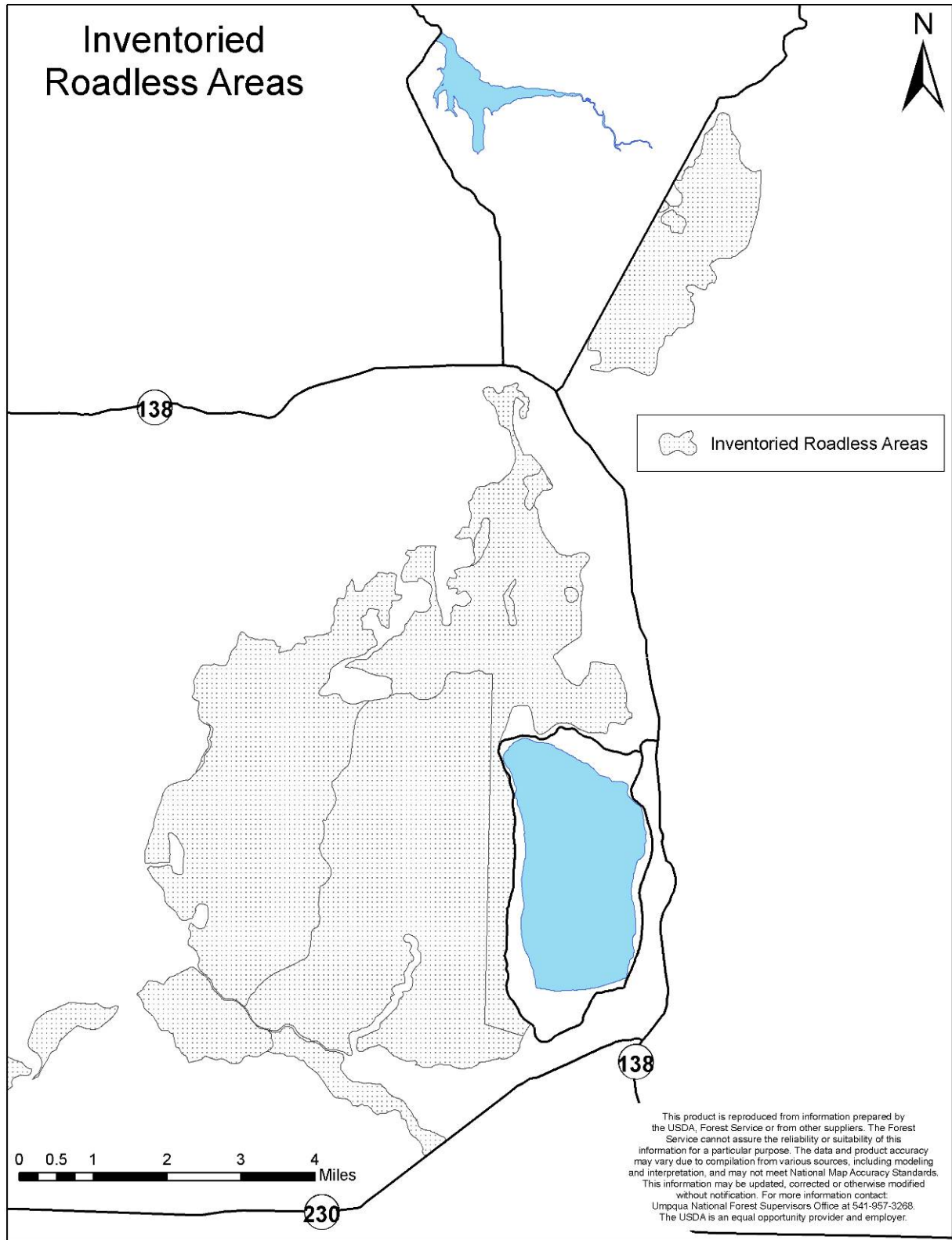


Figure 4. Inventoried Roadless Areas in the Vicinity of the D-Bug Project.

The Healthy Forest Restoration Act also includes ways to streamline the planning process for projects such as D-Bug that qualify as authorized hazardous-fuels reduction projects. D-Bug is an authorized Hazardous Fuels Reduction Project under section 102 this law because:

- The project includes the Lemolo and Diamond Lake WUIs and surrounding high-use recreation areas in an area with presently high fuel loads and an insect epidemic that is adding to the fuel loads.
- Based on an assessment of the mountain pine beetle epidemic by a Forest Service entomologist, the Forest Supervisor of the Umpqua National Forest has made a determination that the mountain pine beetle epidemic in the planning area and surrounding areas poses a significant threat to recreation resources and wildland-urban interface values.
- The methods used to implement this project include harvesting, thinning, and fuel treatments to suppress the further spread of mountain pine beetle in areas already affected and to help prevent the further spread of infestations by changing the conditions that presently render the forest susceptible to epidemics. Methods also are included to restore ecological integrity to uncharacteristically dense stands so that ecosystem components are functional and more capable of self-renewal in the event of a wildfire.

The 1998 Diamond Lake-Lemolo Lake Watershed Analysis (WA)

Watershed Analysis is a compilation of information used to understand ecological processes and trends operating over large landscapes. Watershed analyses help to set the context for appropriate management actions. Several overarching WA recommendations are relevant to the D-Bug project. Other more specific WA recommendations are discussed in Chapter 3.

Mountain Pine Beetle:

- Lodgepole pine stands older than 70 years should be targeted for harvest to reduce the potential for mountain pine beetle epidemics. Treatments to remove large trees and regenerate lodgepole pine that are done in the near future will capture mortality, reduce fire risk, and create a mosaic of lodgepole pine stands of various ages that will respond differently to future mountain pine beetle outbreaks. Young lodgepole pine stands should be thinned to increase vigor in order to suppress future mortality caused by mountain pine beetles.

Restoring the Fire Regime:

- In order to maintain the older scattered ponderosa pine and western white pine, thin or clear around these trees to simulate the natural fire regime (that has been excluded).
- Use prescribed fire as a tool to return the area to a moderate severity fire regime.

Riparian Reserves

- An accepted approach to minimizing wildfire size and the impacts of fire suppression is reducing the amount or continuity of ground and ladder fuels prior to the start of a wildfire in riparian reserves (pg. 219).

- Active silvicultural programs will be necessary to restore large conifers in riparian reserves.
- Prescribed fire for ecosystem maintenance and restoration should be allowed to burn within riparian reserves as fire did historically. These fires will be utilized to restore function and diversity to the system (pg. 220).
- Hazard reduction is recommended along the north shore of Diamond Lake due to high fuel loading, heavy public use, and the existing fire hazard. Hazard reduction treatments also should include the riparian reserve.
- The fire hazard around existing buildings in the Diamond Lake composite cannot be alleviated without treatment occurring within riparian reserves due to the proximity of the buildings to the reserve or the buildings actually being in the reserve. Areas of riparian reserve with high fuel loading on the west (near the summer homes) and south sides of Diamond Lake (around Teal Lake) should be treated. These areas have high public use and due to improvements (summer homes and other developments/facilities), values at risk are high.

The 2008 Vegetation Management Plan and Watershed Analysis Iteration

In 2008, a vegetation management plan and WA iteration was completed to further compile and refine information in the vicinity of the D-Bug project. The following recommendations are applicable:

Pure Lodgepole Pine

- In mature stands (80 years old or older) that are susceptible to infestation from mountain pine beetle (dense stands with lodgepole 8 inches and greater), commercial timber harvest should be employed to remove host trees before the beetles infest an area. Where healthy lodgepole exist with adequate crowns, either heavy thinning (with trees spaced 25-30 feet apart ranging from 50-70 leave trees/ac) or an overstory removal (with sufficient numbers of leave trees to meet standards and guidelines), or a mosaic of these prescriptions resulting in variable density thinning is recommended. These prescriptions would meet Forest Plan tree retention standards. With fewer host trees, and increased sunny microclimate, beetle-caused mortality of host trees can be decreased (Fettig et al. 2007). Where healthy lodgepole are not present, the overstory removal prescription is recommended since unhealthy, failing lodgepole leave trees would eventually add to the fuel accumulation.
- The LRMP excluded most of the lodgepole pine ecosystem from the timber harvest base because of poor site conditions and low growing capacity. Recent analyses of stand conditions shows that these sites are growing at a rate that exceeds plan expectations (Blackburn 2007 and 2008); however, the 1990 LRMP should be amended during site-specific National Environmental Policy Act (NEPA) analysis to allow for timber harvest in the lodgepole pine ecosystem.
- In younger stem exclusion lodgepole pine, apply cost-effective density management techniques such as mastication¹ in order to accomplish a maximum amount of acreage in a cost-effective manner to lower the potential fire intensity in the WUIs.

¹ Mastication is the grinding of woody vegetation using equipment.

Mixed Conifer and Lodgepole/Mixed Conifer

- In stands where the older, larger lodgepole pine have mostly all died, remove some of the dead and dying trees as economically feasible during the thinning operation. Seek funding sources to burn or otherwise dispose of excessive fuel loads determined to be sub-merchantable. Biomass utilization should be explored.
- In older mixed conifer timber stands, thinning from below would reduce stand density to the approximate conditions that would occur under the natural fire regime. The objective is to improve the resiliency of stands to withstand the effects of fire, insect outbreaks and other uncharacteristic conditions that occur under excessive tree densities. In the older lodgepole/mixed conifer stands not yet affected by the beetle infestation, thinning should remove or lower the density of susceptible pines from the overstory and release understories.
- Stands containing ponderosa and western white pine would particularly benefit from reduction in competition through thinning of subordinate trees. These pines are also susceptible to mortality from mountain pine beetle especially under dense conditions created by fire exclusion. Western white pine is more susceptible to white pine blister rust under unnaturally dense conditions. Ponderosa pine also is weakened by other diseases under excessively dense conditions increasing the likelihood of beetle mortality. Underburning is recommended where feasible in the stands containing ponderosa pine as long as duff mounds are pulled away from the base of the legacy pines two years in advance of the underburn. Underburning is not recommended in the stands containing western white pine.

Management Areas 1 and 2

- The LRMP places a size limitation on timber harvest openings (units) that can be created within Management Area 2, the Lemolo Lake and Diamond Lake Recreation Composites. In order to allow for removal of beetle killed trees and to allow for the lodgepole pine to be removed, the LRMP should be amended during site-specific NEPA to allow for timber harvest units greater than ½ acre in size.
- The LRMP does not permit timber harvest in Management Areas 1, except in the event of catastrophic damage. In order to lower the effects of the on-going mountain pine beetle outbreak and reduce fuels in the vicinity of the Wildland Urban Interface Area, the LRMP should be amended during site-specific NEPA to allow timber harvest to help reduce the fire risk within and adjacent to MA 1 west of Diamond Lake.

Scenery Management

- Site-specific forest plan amendments should be pursued where necessary to achieve a desired scenic character that is compatible with desired conditions for vegetation and fuel management in order to lower the fire hazard in the WUIs and along evacuation routes.
- The LRMP suggests opening sizes of 0.25 acre to 1.5 acres in the foreground areas of retention and 0.5 acre to 1.5 acres in the foreground areas of partial retention. Larger openings are suggested in middle ground areas of retention and partial retention areas. Where lodgepole stands are susceptible to beetle mortality, the opening size limitations should be amended during site-specific NEPA analysis to meet the overarching objectives of hazard management in high use recreation areas and WUIs.

Roads Analyses

An Umpqua Forest-Scale Roads Analysis (USDA, Forest Service 2003) evaluated access issues for key road systems across the forest and recommended further evaluations at the watershed and project scale, as needed. Roads Analysis below the Forest scale is not automatically required, but may be undertaken at the discretion of the Responsible Official (FSM 7710).

Former District Ranger John Ouimet, determined that a Roads Analysis below the Forest scale was not needed to support the D-Bug project. This is because no road management activities (road construction, reconstruction, and decommissioning) under the D-Bug project would result in any changes to access, changes to current use, or changes in traffic patterns or road standards. All new road building proposed under the project would be temporary roads that would be obliterated and blocked following use. The road reconstruction on existing roads and existing snow trails would not change any road management levels or standards nor affect any traffic patterns. The small segment of road proposed for decommissioning with D-Bug involves an abandoned segment of road that has not been open or used for years. Because the new road construction is temporary, followed by obliteration, impacts to soils and ecological processes are minimized.

PROJECT RECORD

This Environmental Impact Statement incorporates by reference, the Project Record (40 CFR 1502.21). Chapter 3 provides a summary of the specialists input in adequate detail to support the rationale for the decisions and the Project Record provides supporting documentation. The Project Record contains supplemental information and other technical documentation used to support the analysis and conclusions in this EIS. This information includes summaries or reports for Silviculture, Hydrology, Fish, Wildlife, Botany, Scenery Management, Logging Systems, Economics, Soils, and Cultural Resources. Incorporating this information helps implement the CEQ Regulations provision that agencies should reduce NEPA paperwork (40 CFR 1500.4), that environmental documents shall be “analytic rather than encyclopedic, and shall be kept concise and no longer than absolutely necessary” (40 CFR 1502.2). The objective is to furnish adequate site-specific information to demonstrate a reasoned consideration of the environmental impacts of the alternatives and how these impacts can be mitigated, without repeating detailed analysis and background information available elsewhere. The Project Record is available for review at Umpqua National Forest Headquarters, 2900 NW Stewart Parkway, Roseburg, OR 97471.

PURPOSE AND NEED FOR ACTION

The purpose of this project is to lessen the fuel and safety hazards associated with the on-going outbreak of mountain pine beetles and the on-going impacts from fire exclusion by timely implementation of commercial harvest and non-commercial treatments in strategic locations. The difference between the existing condition and the desired condition defines the need for action in terms of elements that can be measured. The four elements of the D-Bug purpose and need are:

Element 1: The need for modifying pine beetle habitat conditions in stands containing lodgepole pine to reduce potential infestation by mountain pine beetles.

Existing dense timber stands containing mature lodgepole pines have an abundance of host trees that allow the spread of mountain pine beetles resulting in overstory tree mortality and fuel accumulations over landscape areas.

In pure stands of lodgepole pine, the removal of all overstory host trees or the heavy thinning of such host trees (20 feet to 50 feet spacing between host leave trees) would remove the host trees needed for beetle population expansion. This also would increase the vigor of the residual trees, increasing the likelihood they would survive an attack. This desired type of habitat modification also would alter the microclimate by removing the shady conditions preferred by beetles and interrupt the beetles' tree-to-tree population expansion process. A literature review that examined the effectiveness of such beetle prevention treatments, Fettig et al. (2007) concluded that the various treatments studied were effective tools for suppressing mountain pine beetle infestations.

In mixed conifer stands containing mature lodgepole in the overstory, harvest of the lodgepole overstory and retention of the other non-host conifers can prevent stand infestation. The remaining mixed conifer understory can be cultured once the larger host lodgepoles are removed.

Although no treatment can guarantee complete protection of mature residual pine species, the expansion of beetles into pure blocks of mature contiguous lodgepole pine may be interrupted by harvest treatments that result in the desired condition of breaking up the existing homogenous landscape pattern (Fettig et al. 2007; Goheen and Bridgewater 2007).

Element 1 is measured by:

- Acres of susceptible lodgepole pine treated.

Element 2:

The need to reduce existing and predicted fuel loads in areas identified as high fire hazard within the Diamond and Lemolo Lake WUI and their evacuation routes.

The 2006 Douglas County Wildfire Protection Plans for Lemolo and Diamond Lake WUIs identified the need for fuel reduction treatments around homes and recreation areas in these “at-risk” communities such as “mechanical clearing and thinning, including harvesting, thinning, mowing, chipping, cutting, and piling... and prescribed burning where appropriate”. Such treatments would reduce wildland fire hazard and improve the ability to suppress fires and protect both public lands and developments and homes on leased public land. Beetle-caused mortality within these WUI areas has created and will continue to create additional fuel loadings. Proactive commercial and non-commercial thinning in stands within the WUI that are susceptible to bark beetle attack would result in the desired condition of removing fuels that would otherwise accumulate following an attack and reduce fuel loads to desired levels. Treatments within the WUIs also would treat existing fuel loads, independent of mountain pine beetle activity.

Element 2 is measured by:

- Acres treated within the WUIs.
- Acres treated along designated evacuation routes.
- Acres of fuelbreak protecting Lemolo WUI from wilderness/roadless area wildfires.

Element 3:

The need for removing existing dead and imminently dying pine and other hazard trees in areas already infested where human use is high in order to protect the recreating public.

Bark beetle hot spots now exist on the east and north sides of Diamond Lake. Since 2004, these areas have experienced increasing annual mortality. In some stands within campgrounds and other concentrated use areas such as trails, snow parks, and developed facilities and homes, most of the lodgepole host trees are now snags that are hazard trees. Portions of the Diamond Lake campground were not safe enough to open in 2007 because hazard tree felling could not keep up with the rapid and progressive mortality. Removing imminently dying trees and salvaging dead trees would result in the desired condition of reducing human exposure to these hazard trees.

Element 3 is measured by:

- Acres of commercial harvest within developed recreation sites and by private dwellings/businesses.

Element 4:

The need for increasing stand vigor in densely-stocked mixed conifer stands containing older, large ponderosa pine, western white pine, Shasta red fir, and Pacific silver fir in order to improve stand resiliency.

Competition from excessive vegetation in older mixed conifer stands containing ponderosa pine, western white pine, and Shasta red fir has reduced existing stand vigor. This condition has developed in the absence of natural surface fires over many years. In the stands containing ponderosa and western white pine, the dense stocking has increased the pine's susceptibility to mortality from mountain pine beetle and other pathogens and has increased the risk of stand replacement fire. Reducing stand density by thinning would result in the desired condition of improving the resiliency of older mixed conifer timber stands to withstand the effects of fire and potential insects and disease outbreaks.

Element 4 is measured by:

- Acres of mixed conifer stands thinned.

PROPOSED ACTION

The proposed action was developed to address the elements of the purpose and need. In stands containing pine, timely thinning in advance of beetle outbreaks would lessen the fuel accumulation that naturally follows behind pine beetle outbreaks. In stands already infested by mountain pine beetles and located near high use recreation areas, the dead trees would be salvaged to lower safety hazards and fuel accumulations. Fuel treatments inside the WUIs and the installation of fuelbreaks along evacuation routes (Highway 138, Highway 230, and roads leading away from both the WUIs) would implement recommendations of the Douglas County Community Wildfire Protection Plans. Additional fuelbreaks also are included in the proposed action to help slow down a wildfire between the Thielsen wilderness and the Lemolo Lake WUI. Finally, reducing

stand density would approximate more natural stand conditions and potentially increasing the survival of older fire-tolerant trees following future fires.

The proposed action includes:

- Variable density commercial thinning of 3,165 acres in lodgepole pine stands leaving 20-70 TPA interspersed with 10% of the area with no treatment, commercial thinning 1,145 acres of lodgepole-mixed conifer from below (leaving 50-200 TPA), and commercial thinning of 2,247 acres in mixed conifer stands (leaving 50-200 TPA). The lodgepole variable density thinning would not generate any openings greater than 40 acres in size. These commercial thinnings include 620 acres within outer edges of the Mt. Bailey and Thirsty Creek Appendage Inventoried Roadless Areas (IRA's), and 318 acres along the edge of the Oregon Cascades Recreation Area (OCRA).
- Overstory removal (leaving 20 overstory TPA) in two lodgepole pine stands on 59 acres. These overstory removals would not generate any openings greater than 40 acres.
- The commercial harvest would use ground-based and skyline logging systems in both the matrix and riparian reserve land allocations to generate an estimated 44.8 million board feet of timber.
- Non-commercial removal of fuels on about 2,026 acres by pre-commercial thinning, mastication, whip felling, chipping, and piling and burning of slash. This includes treatment on about 344 acres of stands along the edges of the Mt. Bailey and Thirsty Creek Appendage Inventoried Roadless Areas and 15 acres in the OCRA.
- Biomass utilization could occur on about 2,003 acres, depending on the market at the time operations occur. Twenty-one 1-acre landings would be created to process the biomass material.
- Treating activity-created fuels (slash) on all acres commercially thinned by underburning (195 acres), handpile burning along roads in combination with crushing slash on skid roads (1,009 acres), machine piling (964 acres), masticating (1,162 acres), or yarding tops attached (3,224 acres).
- Re-using about 25.6 miles of existing spur roads to access thinning areas, then obliterating about 11.1 miles after use.
- Building a total of about 15.4 miles of new temporary spur roads to provide access for logging machinery and for accessing stands for non-commercial treatments, then obliterating them after use.
- Reconstructing portions of 11 sections of existing system roads (work would occur along 4.7 miles of road) including road re-alignment, intersection improvement, widening, continuous placement or replacement of surface rock and rock armoring, reshaping road beds, replacing culverts, adding culverts, and hazard tree felling.
- Maintaining about 67 miles of existing system roads (approximately 9 miles are currently closed), including the grading and shaping of existing road surfaces, dust abatement, blading road beds and ditches, hazard tree felling, cleaning/maintaining ditches and culverts as needed, isolated placement or replacement of surface rock and rock armoring, opening and re-closing existing

closed roads, removing debris from the roadway, and the cutting of intruding vegetation along roadsides.

- Amending the 1990 Umpqua National Forest Land and Resource Management Plan (LRMP) in terms of: scenery standards; timber harvest in MA 1; opening size limitations in MA 2; and timber harvest in the climax lodgepole pine ecoclasses.

DECISION TO BE MADE

Based on the analysis documented in this Environmental Impact Statement, the Forest Supervisor of the Umpqua National Forest will decide the following:

- To implement the project as proposed; to implement a modified version of the project (an alternative) that addresses unresolved issues; or to not implement the project at this time (no action).
- If the project is implemented, which mitigation measures, project design features, monitoring, and water quality best management practices are necessary to achieve resource goals, objectives, and the desired future condition.
- If the project is implemented, whether to amend the Forest Plan as proposed.

SCOPING

Under the direction of the Healthy Forest Restoration Act (HFRA), a collaborative process was used during the development of the proposed action which included several newspaper articles and announcements, mailings to over 350 potentially interested people and groups, a public meeting in Roseburg on September 27, 2007, a public field trip to the project area on November 3, 2007, and various one-on-one discussions with groups and individuals from September 2007 through December 2007.

Formal scoping (a process used to surface issues) began when the proposed action was published in the federal register on January 22, 2008. A scoping notice was sent to the public on January 10, 2008 detailing the proposed action and soliciting comments. On February 8, 2008, The Roseburg News-Review published a front-page article describing the D-Bug proposed action and announced the opportunity to submit scoping comments to the Forest Service.

Thirty-seven scoping comments were received which included letters, e-mails, face-to-face conversations and meetings, and phone conversations. The D-Bug project record contains a scoping summary that details the scoping comments received for the project.

ISSUES

The scoping process generated a number of issues related to the proposed action. Significant issues associated with a proposed action are the focus of an environmental impact statement because they provide the basis for formulating and comparing alternatives to the proposed action (40 CFR 1502.14). Significant issues also may be used to prescribe mitigation and monitoring measures, or they may be used for analyzing environmental effects. Significant issues are based on unresolved conflicts concerning alternative uses of available resources. An issue is a point of disagreement, debate, or dispute about the proposed action based on effects identified through scoping. The following issues were used to develop alternatives to the proposed action:

Issue 1--Amendments to the Forest Plan

Umpqua Watersheds and Klamath-Siskiyou Wildlands Center are concerned that two of the proposed Forest Plan amendments would be harmful to the ecosystem and scenic quality of the area:

a) They state that based on data from past lodgepole clearcuts in the planning area the proposed D-Bug harvest in the lodgepole pine ecosystem does not conform with long-term sustained yield capacity or the sustained logging assumptions of the 1990 Land and Resource Management Plan.

The following indicator quantifies and tracks this issue:

- Acres of lodgepole pine harvested.

b) These conservation groups also state that the proposed activities along Highways 138 and 230 would degrade the scenic drives, and that the visual quality objectives of retention and partial retention should be retained instead of amending the visual quality objectives along those routes.

The following indicator quantifies and tracks this issue:

- Acres treated along Highway 138 and 230 that currently have retention or partial retention visual standards that would be moved into a lower visual level.

Issue 2--Treatments in Inventoried Roadless Areas/Oregon Cascades Recreation Area, and other Areas Without Roads (Potential Wilderness Areas)

Umpqua Watersheds, Klamath-Siskiyou Wildlands Center, Oregon Wild, and Cascadia Wildlands Project are concerned that the proposed thinning in Inventoried Roadless Area (IRA), Oregon Cascades Recreation Area (OCRA), and other areas without roads (Potential Wilderness Areas) would impact the ecological importance and roadless characteristics of these areas.

a) Cascadia Wildland Project states that in the OCRA, scheduled timber harvest activities on a programmed basis are not permitted. They state that the fuelbreaks located in the OCRA will require additional maintenance treatments that represent programmed harvest, which is in violation of the OCRA direction in the 1984 Act that created the OCRA.

The following indicator quantifies and tracks this issue:

- Acres of commercial thinning in the OCRA.

b) Cascadia Wildlands Project, Umpqua Watersheds, and Klamath-Siskiyou Wildlands Center state that putting fuelbreaks (which require periodic maintenance) along the Thirsty Creek Road and Kelsey Point Road along the edge of the IRA's violates the 2001 Roadless Area Conservation Rule, which states that any cutting of timber in IRA must be infrequent. Tim Ballard, Kim Treadwell, Randall Ballard, and Linda Quintero are concerned over the precedent that would be established in active management of inventoried roadless areas.

The following indicator quantifies and tracks this issue:

- Acres of forest treated within Inventoried Roadless Areas.

c) Umpqua Watersheds and Klamath-Siskiyou Wildlands Center also state that thinning units 72, 73, and 115 are in potential wilderness areas, and that the proposed treatments could severely degrade the rare features and the potential wilderness characteristics of these areas.

The following indicator quantifies and tracks this issue:

- Acres of treatment in potential wilderness areas (excluding overlap with IRAs and the OCRA).

Issue 3--New Road Building

Several conservation groups are concerned that the proposed 15.5 miles of temporary road building/and subsequent obliteration would cause ecological damage.

Cascadia Wildlands stated that fewer miles of road could be built and that other logging systems could be used, resulting in less temporary road building. Umpqua Watersheds and Klamath-Siskiyou Wildlands Center requested that the EIS consider an alternative to the 15.5 miles of temporary road building. Oregon Wild also requested that new temporary road segments be ranked according to their impacts relative to the benefits of access, dropping the roads with the lowest ratio of benefits to costs.

The following indicator quantifies and tracks this issue:

- Miles of temporary road constructed and subsequently obliterated.

Issue 4--Trails

Some conservation groups are concerned that log haul on top of existing trails and thinning next to existing trails will negatively affect the trails and the recreation experience due to the impacts from logging and other fuel reduction treatments.

Umpqua Watersheds and Klamath-Siskiyou Wildlands Center state that log haul on snowmobile trail #1457 (a segment of the Crater Trail) and thinning in the vicinity of cross country ski trail #1410 (a segment of the North Crater Trail) would affect the recreation users and that off-road vehicle use would increase as a result of the thinning and the log haul. Further, Oregon Wild states that use of trail #1457 as a haul road would degrade the roadless characteristics in the vicinity.

The following indicators quantify and track this issue:

- Miles of trail used for logging access.
- Acres of commercial and non-commercial treatment within 200 feet of affected trails.

Issue 5--Fuelbreaks

Multiple commenters expressed various concerns over the location, width, and thinning technique proposed on some of the fuelbreaks, questioning their effectiveness and the possible impacts of such fuelbreaks.

Conservationists state that the fuelbreaks along the Thirsty Creek and Kelsey Point roads are redundant because the proposal also includes a fuelbreak on the Windigo

Pass road, which is located directly to the northwest. Oregon Wild states that there are much higher priorities for modifying fuel structure, such as in dense plantations. Cascadia Wildlands Project states that these fuelbreaks are outside the WUI and that it is not clear how they would meet the stated purpose. Tim Ballard, Kim Treadwell, Randall Ballard, and Linda Quintero also question the effectiveness of these fuelbreaks and suggest that non-commercial removal of fuels is preferred. Oregon Wild also questioned the general effectiveness of the fuelbreaks, citing studies that cast doubt on their effectiveness. On the other hand, other members of the public question whether the fuelbreaks are large enough to be effective.

The following indicator will quantify and track this issue:

- Acres of commercial and non-commercial treatments along the Thirsty Creek and Kelsey Point fuelbreaks.
- Acres of improved resiliency to stand replacement fire within and adjacent to fuelbreaks.
- Total acres in roadside fuelbreaks (measured as 400 meters in total width).

Issue 6—Extent and Intensity of Treatments in Lodgepole Pine and Project Economics

Several conservation groups are concerned that the proposed action includes too much harvest, resulting in impacts in the lodgepole pine ecosystem.

a) Umpqua Watersheds, Klamath-Siskiyou Wildlands Center, and Oregon Wild state that the areas receiving only 20 trees per acre of retention, up to 40 acres in size represents too much regeneration harvest that promotes the spread of wildfire due to dense understory regeneration. They also state that such a heavy harvest in lodgepole pine would result in impacts to habitat quality. Umpqua Watersheds and Klamath-Siskiyou Wildlands Center asked that an alternative be considered that makes smaller openings and includes no regeneration harvest.

The following indicators will quantify and track this issue:

- Acres of lodgepole pine regenerated.
- Acreage of lodgepole pine and lodgepole/mixed conifer commercially thinned.

b) Several other commenters state that the proposed action is not doing enough removal to achieve project needs in terms of treatment intensity, treatment extent, and economic returns. Douglas Timber Operators, Swanson Group, Don Wilson, Communities for Healthy Forests, Monett Logging Inc., and Rick Abbott are concerned that thinning lodgepole pine from below, leaving 20-70 trees per acre may not meet the project's purpose because the leave trees may die anyway, adding to fuel loads, and result in lost economic opportunities. American Forest Resource Council and Larry and Roberta Hall asked for economically viable timber sales with increased revenues to the government.

The following indicators quantify and track this issue:

- Net Present Value
- Least Cost to Government (total cost per acre treated)

c) Mark Boyer stated that more areas need to be treated to more aggressively stem the spread of the mountain pine beetle and lower the associated fire hazard that would threaten improvements.

The following indicator will quantify and track this issue:

- Total acres of commercial lodgepole pine treated south of Hwy. 230

ISSUES THAT DID NOT DRIVE ALTERNATIVES

Several other issues or concerns raised by the public were resolved by clarifying the existing details of the proposed action. Other issues raised were resolved by describing mitigation measures to address them. Other points of debate raised by the public requested full disclosure of the effects of the actions described under the alternatives so that they could fully understand the impacts of the proposal; these points are fully disclosed in Chapter 3. As such, these issues did not drive the development of an alternative to the proposed action. These are discussed below by category:

Issue resolved through the development of mitigation measures or project design features:

Site Disturbance

Numerous commenters including some Diamond Lake cabin owners, US Environmental Protection Agency, and conservationists are concerned that commercial logging and associated road building and slash disposal would result in soil disturbance, loss of ground cover, and canopy reductions. Commenters are concerned that these activities could ultimately lead to weed infestations, loss of soil productivity, and impacts to the aquatic environment, including the aquifer, and increased susceptibility of stands to insect attack.

These concerns are addressed, in part, by a variety of mitigation measures (detailed at the end of Chapter 2) such as: use of native seed to revegetate areas of bare soil; minimizing and/or avoiding any operations in areas of existing weed infestation; installation of waterbars on roads/skid trails in sloping terrain; subsoiling some of the skid trails and temporary roads following logging, as appropriate; retaining green trees and snags in the overstory of all stands to help reduce microclimate changes; and restricting the timing of logging operations during relatively dry soil and weather conditions.

Impacts to Scenery and Land Usability after Harvest

Conservation groups, the Diamond Lake Homeowners Association, and some individual Diamond Lake cabin owners are concerned about the impacts of fuel mastication and the impacts of thinning and associated skid trails, slash piles, and log landings on the usability of the treated areas, and overall visual quality, including the loss of screening vegetation that provides privacy for cabin owners.

These concerns are addressed, in part, by a suite of mitigation measures such as: thorough and timely slash disposal, as feasible; removal of mastication slash from cabin driveways; revegetation of certain disturbed areas with native shrubs; subsoiling certain disturbed areas to speed revegetation; a no-cut buffer along the shoreline of Diamond Lake; returning any cabin driveways used for the timber sale operations to pre-logging conditions; and various project design features to lower visual impacts, as economically feasible.

Impacts to Customers of Private Businesses.

Steve Koch, owner of the Diamond Lake Improvement Company, is concerned that noisy logging operations will disturb his customers and cause a loss of customer enjoyment and loss of business during operations.

This concern is addressed by limiting the logging operations in the near vicinity of private businesses (in special use permit areas) to before Memorial Day and after Labor Day and prior to the winter sports season.

Impacts to Bald Eagles and Ospreys

Oregon Department of Fish and Wildlife is concerned that logging operations and burning would impact raptors through disturbance and habitat changes. They advise seasonal restrictions around nests and avoidance of clearcutting or overstory harvest prescriptions within 330 feet of nests.

This concern is address by limiting operations in the near vicinity of raptor nests so that nesting and fledging is not disturbed. The silvicultural prescription involves a light non-commercial thinning within the 330 foot nest buffer.

Impacts to Private-Use Roads

The Diamond Lake Homeowners Association and some individual cabin owners are concerned about logging impacts to their cabin access roads where they bear the cost of road maintenance under the terms of their special use permit.

This concern is addressed by mitigation measures detailed in Chapter 2 which requires that any cabin access roads used during project operations be returned to pre-logging conditions.

Impact to Streams and Lakes

The US Environmental Protection Agency (EPA), the Steamboaters, and some private cabin owners at Diamond Lake are concerned that thinning operations and associated slash burning and road building could impact riparian areas, that streams such as Lava Creek and the Clearwater River could be affected, and that water quality in Diamond Lake and Lemolo Lake could be impacted. EPA states that methods should be used around Lemolo and Diamond Lakes that reduce the likelihood of nutrient input.

These concerns are addressed in the proposed action by applying appropriate no-cut stream buffers on all perennial streams; applying a no-cut buffer along both lakeshores; avoiding perennial streams during ground-based logging operations; and the use of best management practices (design criteria) for the two new intermittent stream crossings by new temporary roads and road reconstruction and maintenance.

Issues resolved through disclosure of effects:

Impacts to Certain Wildlife

Conservation groups are concerned about important habitat for wolverines, fishers, and at one time, for lynx, stating that the EIS should consider the impacts on these species, and other remote and rare wildlife that depend on large expanses of roadless areas or areas without roads. They state that logging and the associated increase in snowmobile and OHV use will increase hunting, noise, and exhaust pollution, negatively impacting wildlife.

These comments are addressed by fully disclosing the impacts to wildlife that are potentially present in the planning area. Lynx are not on the Regional Forester's special status species list (1/31/08) for the Umpqua National Forest, nor are they a Management Indicator Species on the Umpqua National Forest. Only species on the list determined by the Regional Forester for each individual Forest, or identified within land and resource management plans as management indicator species are required to be analyzed in a biological evaluation. Therefore lynx were not considered in the biological evaluation for the D-Bug Project.

Impacts of Roadside Thinning to Deer and Elk Cover

Oregon Department of Fish and Wildlife is concerned about the thinning of fuelbreaks along roads where deer and elk become too vulnerable to roadside shooting. They suggest reduced thinning intensity to provide visual screens (cover) for these animals.

These comments are addressed by fully disclosing the impacts to deer and elk hiding cover.

Increased Off-Highway Vehicle Use

The Diamond Lake Homeowners Association and Oregon Wild expressed concerns about off-highway vehicle use of new skidtrails and roads, suggesting that all such roads be properly blocked. Oregon Department of Fish and Wildlife is concerned that new logging roads would impact elk calving grounds, wintering areas, or other sites where elk normally congregate and requested that roads be closed following use and that off-road vehicles be prohibited. Umpqua Watersheds and Klamath Siskiyou Wild state that any alternative that logs and builds roads in roadless areas must consider the increased use of off road vehicles, including snowmobiles and the decreased quality of non-motorized recreation, such as equestrian or hiking use. Oregon Wild is concerned about immediate obliteration of such roads in order to prevent OHV trespass.

This concern is addressed in the proposed action where all new road building would consist of temporary roads, obliterated following use and would include the installation of effective barriers at the road initiation points if needed. The impacts to non-motorized recreation and to wildlife from increased snowmobile use (where road obliteration and road blocks do not prevent use) are addressed by full disclosure.

Smoke Management

Oregon DEQ requested that the EIS provide an overview of the smoke management program that will be followed to avoid public health impacts and potential ambient air quality exceedances.

These comments are addressed by the inclusion of mitigation measures to protect air quality and by fully disclosing the impacts to air quality.

Impacts of Rock Pit Use/Development

Conservation groups request that the EIS clearly describe the location of the rock pits that will be used to build new roads, and the impacts to wildlife and recreation in the rock pit areas.

These comments are addressed by fully disclosing the impacts from rock pit use to recreationists and wildlife.

Legality of treatments in the OCRA and Inventoried Roadless Areas

Several conservation groups question the legality of entry into the OCRA and IRAs. Cascadia Wildlands requests that the EIS disclose how the 2001 Roadless Area Conservation Rule is not violated and how the proposed OCRA entry does not violate the regulation of no programmed harvest.

These comments are addressed by disclosing the aspects of the 1984 law that created the OCRA and regulations associated with the Roadless Rule in the context of what is proposed in D-Bug.

Rationale behind Non-significant Forest Plan Amendments

Cascadia Wildlands Project requested that the EIS disclose the criteria and analyses used to reach a non-significant conclusion on the various proposed Forest Plan amendments.

This comment is addressed by disclosing the four criteria described in Forest Service Handbook 1909.12 Section 5.32 needed to make a determination of significance of change to the Forest Plan.

Scientific Controversy

Cascadia Wildlands Project states that there is scientific controversy surrounding the use of logging to prevent future outbreaks of mountain pine beetle, and they requested consideration and disclosure of this controversy.

This comment is addressed in Chapters 1 and 3 of the EIS.

Impacts to the Aquifer

Conservation groups are concerned about impacts to the aquifer under the fragile pumice soils in the planning area.

This comment is addressed by disclosing the impacts of soil compaction from ground based logging on the underground aquifer.

Non-significant issues

Three issues raised during scoping were dismissed as non-significant. Non-significant issues include those that are outside the scope of the proposed action, are already decided by law, regulation, Forest Plan, or other higher level decision, or by previous decision.

Road Decommissioning

Some Diamond Lake cabin owners are concerned about the decommissioning of the existing system road that parallels the lakeshore (4795-400) near their homes, stating that it will be important for fire suppression activities. The American Forest Resource Council is not in favor of system road decommissioning, in general, stating that road decommissioning is careless in a landscape prone to catastrophic wildfires.

This issue was determined to be non-significant (outside the scope of the project) because the decommissioning of a portion of existing system road 4795-400 was covered under a separate decision made by former District Ranger, John Ouimet, in 2006. The actual decommissioning included under this EIS only includes an abandoned section of old Highway 230 that has been closed for many years and is not presently functioning as a system road.

Forage Creation

Oregon Department of Fish and Wildlife suggests that efforts be made to reclaim meadows and openings that have been encroached upon by trees in order to improve forage opportunities for elk.

This issue was determined to be non-significant (outside the scope of the project) because creating forage is not part of the stated purpose and need.

Staged Timber Harvest over Multiple Years

Don Wilson suggested NEPA planning to allow two to three harvest entries over 15 to 20 years that would stage the removal of lodgepole along with associated precommercial thinning in order to help manage the overstocked and stagnated understories that he predicts will gradually develop after lodgepole thinning overstory treatments.

Under NEPA, discrete projects need to be implemented within reasonably definable timeframes. Typically, a NEPA analysis would be required for each timber sale entry over the course of 20 years time. Because future harvest over time is outside the scope of the project, this issue was determined to be non-significant.

PROJECT IMPLEMENTATION

Should an action alternative be selected as a result of this NEPA process, the Forest Service would implement most of the timber harvest, road construction, and road reconstruction through timber sale contracts. All action alternatives would likely result in multiple separate timber sale contracts.

The Forest Service may also choose to use a contracting tool called stewardship contracting, authorized by Congress and described under the January 28, 2004 Forest Service Washington Office Interim Directive (FSH 2409.19, Chapter 60). Stewardship contracting is a tool used to accomplish resource management projects, in collaboration with interested publics, where goods are exchanged for services. Service contracts or construction contracts also can be used to accomplish some of the connected actions or similar actions, which can be funded by other sources.

In the course of implementing complex projects with many acres of harvest, fuel treatment, and several connected actions, minor changes may be needed during implementation to better meet on-site resource management and protection objectives. For example, fuels prescriptions may be modified if site conditions dictate and if other resource objectives can be met. Minor adjustments to unit boundaries may be needed during final layout for resource protection, to improve logging system efficiency, or to better meet the intent of the resource prescriptions. Changes in aspects of logging systems, including locations of temporary spur roads, may be required to better facilitate logging systems and provide for resource protection. Many of these minor changes would not present sufficient potential impacts to require any specific documentation or action to comply with applicable laws.

In determining whether and what kind of further NEPA action is required to document any changes, the criteria for whether to supplement an existing Environmental Impact Statement (FSH 1909.15, sec. 18) would be followed.

CHAPTER 2

ALTERNATIVES, INCLUDING THE PROPOSED ACTION

INTRODUCTION

The National Environmental Policy Act (NEPA) requires analysis of a proposed action and other reasonable alternatives, including no action. The no action alternative provides a baseline for estimating environmental effects. Four alternatives, including no action, for the D-Bug Project are considered in detail. The proposed action was developed to meet the purpose and need established by the District Ranger and Alternatives 3 and 4 were developed in response to significant issues identified during scoping. In addition, two other alternatives were considered, but eliminated from detailed study.

ALTERNATIVES CONSIDERED, BUT ELIMINATED FROM DETAILED STUDY

Based on scoping comments, two alternatives were considered but eliminated from detailed study as described below.

An alternative was suggested that would use helicopter logging to lower the amount of ground disturbance associated with ground-based logging in areas of pumice soil. Helicopter logging is prohibitively expensive because the predicted revenue generated by the various timber sales located in the lodgepole areas would be less than the cost to log them using helicopters. The Contracting Officer states that no bids would be received if helicopter logging was included. If no bids are received, the project cannot be implemented, thus the purpose and need would not be met. Therefore, this alternative was eliminated from detailed study.

Another alternative was suggested that would manage lodgepole pine stands more extensively and intensively by increasing the amount of treatment acres in lodgepole pine and by using regeneration harvest instead of the variable density thinning prescribed under Alternative 2.

This alternative, as considered, included a 36% increase in the amount of lodgepole pine stands proposed for commercial treatment, equating to an additional 2,072 acres over that of Alternative 2. The majority of the commercial lodgepole stands under this alternative (76%) would have received an overstory removal (leaving 20 of the largest overstory lodgepole pine per acre), while only applying variable density thinning of lodgepole (leaving 20-70 overstory trees per acre intermixed with no-cut leave areas) on 23% of the area, where scenic sensitive is high. This alternative, which also included all of the same mixed conifer harvest as Alternative 2, would have generated 67.7 million board feet of timber and generated an estimated 1.2 million dollars of revenue to the national treasury.

Due to available revenue associated with the higher harvest levels, this alternative also included a 17% increase in non-commercial fuel treatments, equating to an additional 305 acres over that of Alternative 2. Most of the additional non-commercial fuel treatments in this alternative would have been located west of the Lemolo Lake Resort which also would have boosted the amount of woody biomass available to that market.

The alternative included the following activities:

- Overstory removal of 4,048 acres in lodgepole pine stands leaving 20 large overstory trees per acre; variable density thinning of 1,248 acres of lodgepole pine leaving 20-70 TPA interspersed with 10% of the area with no treatment; and commercial thinning of 2,247 acres in mixed conifer stands (leaving 50-200 overstory trees per acre). The various harvest treatments would use ground-based and skyline logging systems in both the matrix and riparian reserve land allocations to generate an estimated 67.7 million board feet of timber. These commercial treatments include 620 acres along the outer edges of the Mt. Bailey and Thirsty Creek Appendage Inventoried Roadless Areas (IRA's), and 318 acres along the edge of the Oregon Cascades Recreation Area (OCRA).
- Non-commercial removal of fuels on about 2,318 acres by pre-commercial thinning, mastication, whip felling², chipping, and piling and burning of slash. This includes treatment on about 345 acres of stands along the edges of the Mt. Bailey and Thirsty Creek Appendage Inventoried Roadless Areas (IRA's), and 15 acres along the edge of the Oregon Cascades Recreation Area (OCRA).
- Treating activity-created fuels (slash) on all acres commercially thinned using a variety of methods including by underburning, crushing, machine piling, handpile burning along roads, whole tree yarding, or mastication.
- Re-using about 25.6 miles of existing, spur roads to access thinning areas, then obliterating about 3.8 miles after use.
- Building a total of about 25.4 miles of new temporary spur roads to provide access for logging machinery and for accessing stands for non-commercial treatments, then obliterating them after use.
- Forest Plan Amendments as described under Alternative 2, and conducting road maintenance and road reconstruction similar to that in Alternative 2.

An assessment was done on this alternative's ability to meet the requirements of the National Forest Management Act (NFMA). This law requires that openings created as individual cut blocks have a maximum size limit of 40 acres in lodgepole pine forest types (CFR 219.27(d)(2)). The alternative's emphasis on regeneration harvest rather than variable density thinning caused it to deviate substantially from the size limitation under this law. The law permits exceptions, based on specific rationales, after a 60-day public notice and review by the Regional Forester.

Based on the collaborative process used to develop Alternative 2 and comments received during scoping, a NFMA exemption process would generate much opposition. Conservation groups and other members of the public, including some of the local residents who reside in the planning area, have already expressed concerns over the impacts of thinning to scenery, spread of noxious weeds, effects to certain wildlife species, and increased off-road vehicle access. The extensive amount of regeneration harvest in this alternative would heighten concerns and likely stall the exemption process, thus delaying project implementation. Any delays in implementation likely would result in not meeting the purpose and need as the mountain pine beetle epidemic would continue to expand.

Moreover, the use of variable density thinning has been shown in the scientific literature to achieve the various objectives outlined in the purpose and need while treating broad landscape areas while not creating openings that would deviate from this law. Also,

² Whip felling is the hand cutting of small understory trees.

similar thinning prescriptions have been successfully used and found to be economically viable on the nearby Chemult and Crescent Ranger Districts. As such, compelling reasons to pursue an exception to NFMA do not exist. For the above reasons, this alternative was eliminated from detailed study.

ALTERNATIVES CONSIDERED IN DETAIL

ALTERNATIVE 1 – NO ACTION

Under Alternative 1, no thinning, fuel treatment, biomass utilization, temporary road construction, road reconstruction and maintenance, or other similar or connected activities such as pre-commercial thinning, subsoiling, weed control, or road decommissioning would occur. No ground-disturbing activities would take place and no timber would be offered for sale. On-going activities, including road maintenance, recreation use, and noxious weed control would continue to occur (Table 13, Chapter 3). Future activities, such as those described in Table 14, also would occur.

ALTERNATIVE 2 - PROPOSED ACTION (TABLE 2, FIGURES 5 & 6)

This alternative is the proposed action used in the scoping process. The proposed action was developed to meet the purpose and need. It includes the following:

- Variable density commercial thinning of 3,165 acres in lodgepole pine stands leaving 20-70 TPA interspersed with 10% of the area with no treatment, commercial thinning 1,145 acres of lodgepole-mixed conifer (leaving 50-200 TPA), and commercial thinning of 2,247 acres in mixed conifer stands (leaving 50-200 TPA). The lodgepole variable density thinning would not generate any openings greater than 40 acres in size. These commercial thinnings include 620 acres along the outer edges of the Mt. Bailey and Thirsty Creek Appendage Inventoried Roadless Areas (IRA's), and 318 acres along the edge of the Oregon Cascades Recreation Area (OCRA).
- Overstory removal (leaving 20 overstory TPA) in two lodgepole pine stands on 59 acres. These overstory removals would not generate any openings greater than 40 acres.
- Salvage of 375 acres of dead and dying lodgepole.
- The commercial harvest would use ground-based and skyline logging systems in both the matrix and riparian reserve land allocations to generate an estimated 44.8 million board feet of timber.
- Non-commercial removal of fuels on about 2,026 acres by pre-commercial thinning, mastication, whip felling, chipping, and piling and burning of slash. This includes treatment on about 344 acres of stands along the edges of the Mt. Bailey and Thirsty Creek Appendage Inventoried Roadless Areas and 15 acres in the OCRA.
- Biomass utilization could occur on as much as 2,003 acres, depending on the market at the time operations occur. Twenty 1-acre landings would be created to process the biomass.
- Treating activity-created fuels (slash) on all acres commercially thinned by underburning, handpile burning along roads in combination with crushing slash on skid roads, machine piling, masticating, or yarding tops attached.

- Re-using about 25.6 miles of existing spur roads to access thinning areas then obliterating about 11.1 miles after use.
- Building about 15.4 miles of new temporary spur roads to provide access for logging machinery and for accessing stands for non-commercial treatments, then obliterating them after use.
- Reconstructing portions of 11 sections of existing system roads (work would occur along 4.7 miles of road), including road re-alignment, intersection improvement, widening, continuous placement or replacement of surface rock and rock armoring, reshaping road beds, replacing culverts, adding culverts, and hazard tree felling.
- Maintaining about 67 miles of existing system roads (approximately 9 miles are currently closed), including the grading and shaping of existing road surfaces, dust abatement, blading road beds and ditches, hazard tree felling, cleaning/maintaining ditches and culverts as needed, isolated placement or replacement of surface rock and rock armoring, opening and re-closing existing closed roads, removing debris from the roadway, and the cutting of intruding vegetation along roadsides.
- Utilizing the existing Lemolo Dam rock pit and the Boundary rock pit as rock sources for the road work.
- Amend the 1990 Umpqua National Forest Land and Resource Management Plan (LRMP) in the following areas:
 1. The LRMP assigned Visual Quality Objectives of Retention and Partial Retention along Highway 138 and Highway 230, and areas surrounding Diamond Lake and Lemolo Lakes. The LRMP would be amended to modify these objectives in the short term in order to meet the purpose and need.
 2. The LRMP does not permit timber harvest in Management Area 1, except in the event of catastrophic damage, and as approved in a vegetation management plan. The Forest Plan would be amended to include commercial timber harvest in MA 1 in order to lower the effects of the ongoing mountain pine beetle outbreak and reduce fuels in the vicinity of the Wildland Urban Interface Area, as recommended in the 2008 Vegetation Management Plan (USDA, Umpqua NF 2008).
 3. The LRMP places a size limitation on timber harvest openings (units) that can be created within Management Area 2 surrounding Diamond and Lemolo Lakes. In addition, prescription A4-I for this Management Area, does not allow for commercial or personal use firewood cutting. In order to accomplish effective treatments of adequate size, the LRMP would be amended to allow for timber harvest units greater than ½ acre in size. Also, to allow for the economic removal of dead and dying lodgepole pine, the LRMP would be amended to allow for commercial and personal use firewood cutting.
 4. The LRMP excluded the land in the lodgepole pine climax ecoclasses from the suitable timber base due to low productivity and low economic value of the species. Subsequently, the climax lodgepole pine ecoclasses have been determined to have a site potential that would

produce 50 cubic feet/ac/year or more which would qualify as suitable commercial forest land under the National Forest management Act (Blackburn 2007 and 2008). Furthermore, the LRMP includes a Standard and Guideline that allows for the removal of timber killed by catastrophic events on unsuitable lands considering economic, social, and environmental consequences. The mountain pine beetle infestation qualifies as a catastrophic event in terms of social considerations in an area of high human use. Regardless of the post-LRMP findings of suitability and the applicability of the above Standard and Guideline, the 1990 LRMP would be amended in order to harvest in the climax lodgepole pine ecoclasses for this project.

Thirteen different silvicultural prescriptions are included in Alternative 2. Prescriptions 1-4 and 9-13 include removal of a commercial product, while prescriptions 5-8 include non-commercial treatments (Table 2):

Table 2. Alternative 2 silvicultural prescriptions by individual treatment unit.

Prescription # ³	Units assigned to prescription	Com-mercially treated acres	Non-comm. treatment acres	Volume Removed (thousand board feet)
1 – Overstory removal of lodgepole forests using mechanical harvest, retaining about 20 TPA, 5" and greater; yard tops attached.	29, 30	59	0	472
2 – Variable density thinning of lodgepole pine stands leaving 20-70 TP, 5" and greater, interspersed with 10% of the area with no treatment, using mechanical harvest, yard tops attached, and masticate fuels.	18, 22, 32, 42, 44, 46, 60, 61, 62, 63, 64, 65, 66, 67, 68, 72, 73, 106, 108, 121, 133, 135, 136, 139, 140, 141, 147, 149, 152, 156, 164, 180, 181, 182, 184	3,165	0	15,823
3 – Thinning in stands of lodgepole overstory and mixed conifer understory leaving 50-200 TPA, 5" and greater; yard tops attached and masticate fuels. This prescription includes post and pole size stands to produce biomass.	4, 5, 9, 10, 11, 12, 19, 23, 24, 28, 34, 36, 37, 39, 41, 48, 76, 77, 84, 85, 94, 116, 120, 134, 137, 138, 143, 146, 151, 155, 171, 177, 185, 189, 195, 200, 201, 203	1,145	0	2,290
4 – Salvage of dead/dying lodgepole pine, retaining 50-200 TPA of the residual green trees; yard tops attached and masticate fuels.	1, 56, 59, 75, 79, 80, 93, 95, 97, 112, 130, 204	375	0	1,875
5 – Understory thinning with fuel mastication or handpiling along roadway.	55, 109, 163, 198, 199	0	347	0
6 – Understory precommercial thinning and masticating fuels along	13, 14, 16, 17, 20, 21, 25, 26, 27, 31, 33, 40, 74, 125, 127, 128, 131, 142,	0	622	0

³ Firewood sales would be considered in prescriptions 1, 2, 3, and 4 depending on the amount of mortality that develops as the mountain pine beetle infestation progresses.

Prescription # ³	Units assigned to prescription	Com- mercially treated acres	Non- comm. treatment acres	Volume Removed (thousand board feet)
roadways.	148, 150, 153, 154, 165, 166, 167, 168, 169, 172, 173, 175, 179, 186, 187, 188, 190, 191, 192, 196, 197			
7 – Understory treatment along highways and escape routes, masticating fuels or handpiling along roadway.	35, 45, 47, 49, 50, 51, 52, 57, 58, 69, 71, 78, 92, 99, 101, 103, 110, 111, 119, 170, 174, 178, 205	0	1,043	0
8 – Understory thinning of small trees (whips), pulling slash from around residual ponderosa pine, and underburning.	53	0	14	0
9 – Thin from below in small diameter mixed conifer stands using a mechanical harvester, retaining 50-90 TPA, and grapple piling/burning slash.	2, 7, 8, 15, 86, 89, 113, 118, 144, 160	546	0	5,456
10 – Thin from below in mixed conifer stands dominated by small diameter red and white fir, using cut-to-length harvester retaining 50-90 TPA; masticating or handpiling slash along roadway.	3, 6, 38, 54, 81, 90, 91, 96, 98, 100, 102, 104, 105, 107, 114, 115, 117, 157, 176, 202	1,011	0	10,112
11 – Thin from below in mixed conifer stands with a Douglas-fir and ponderosa pine component using a mechanical harvester retaining 50-90 TPA, and grapple piling/burning slash.	83, 122, 123, 126, 129, 132, 162	418	0	5,440
12 – Thin from below in mixed conifer stands with a ponderosa pine component using skyline yarding retaining 50-90 TPA, and handpiling/burning along roadways at a depth of 2 chains.	158, 161, 193	77	0	771
13 – Thin from below in mixed conifer stands with a ponderosa pine component, using skyline yarding and a mechanical harvester, retaining 50-90 TPA and underburning.	82, 124, 145, 194	195	0	2,529
Totals		6,990	2,026	44,771

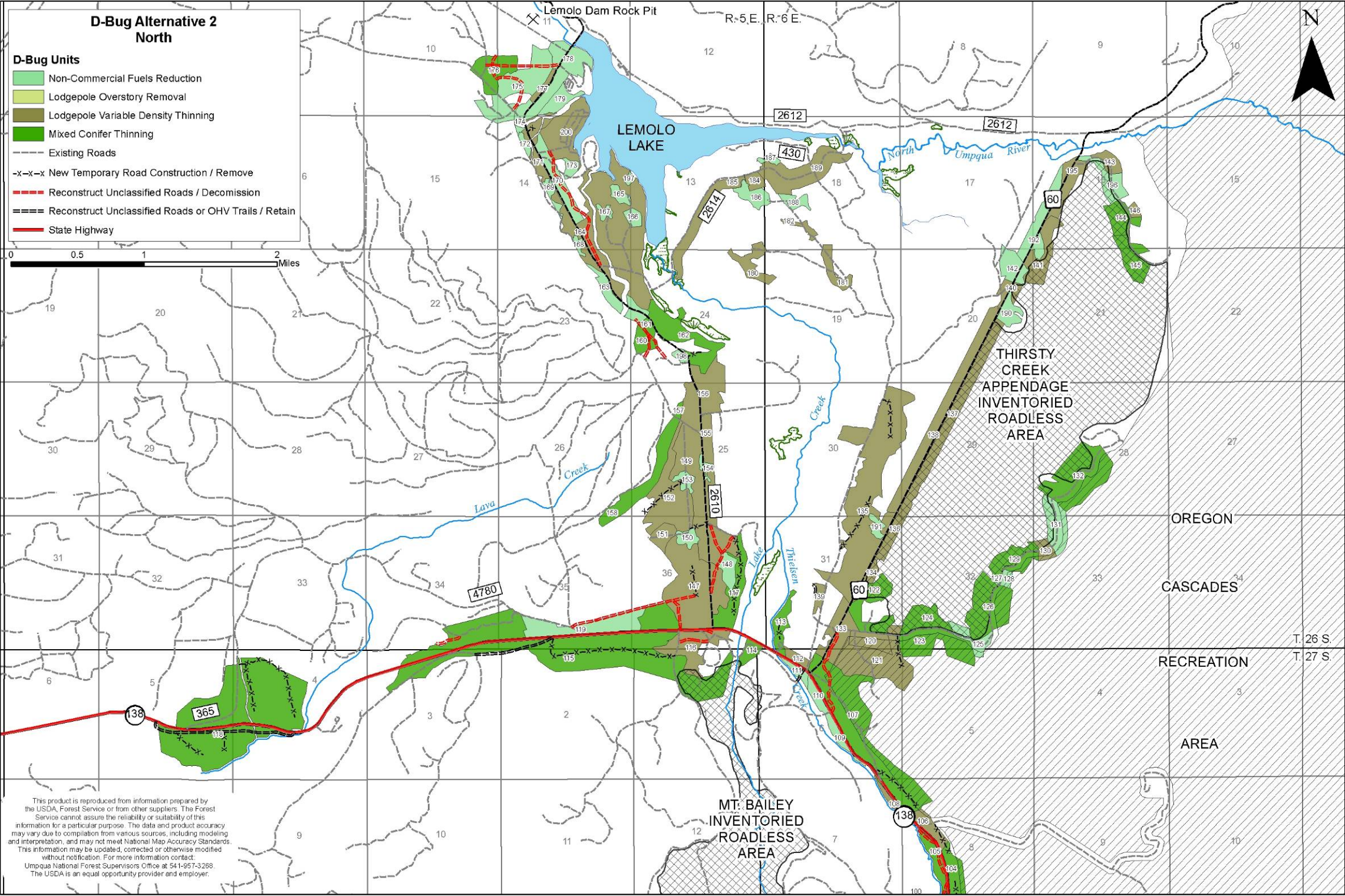


Figure 5. Alternative 2 – Proposed Action North Half.

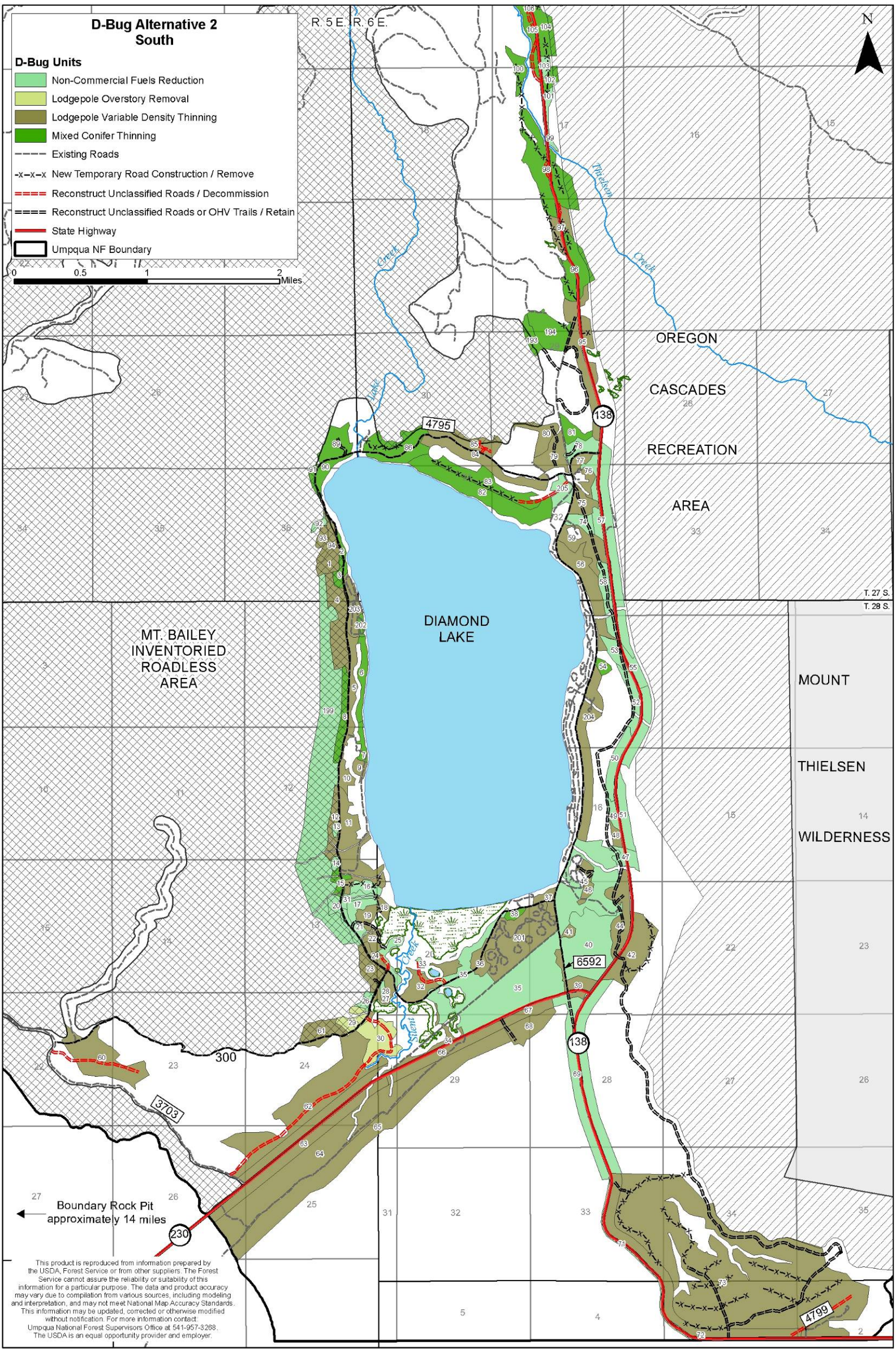


Figure 6. Alternative 2 – Proposed Action South Half.

New Temporary Road Construction/Obliteration

The 15.4 miles of new temporary road to be constructed under Alternative 2 would be native surface roads, with rock added at limited locations where soil moisture requires the use of rock to effectively pass log trucks. Temporary roads are typically constructed with a tractor. After logging they would be obliterated with an excavator or bulldozer appropriately equipped to decompact soil, as needed. Any excavated material, including soil and woody material, would be pulled back over the road to re-establish the original contour, as much as feasible.

Re-Use of Existing Unclassified Roads and Trails

The 25.6 miles of unclassified roads and trails found in and adjacent to the treatment units were initially built for access into the area or are used as winter snow trails today. Some of these old roads were rocked when they were originally built and are in good condition today with little to no erosion potential or rutting. Most are native (dirt) surface that can become rutted if driven on during wet conditions. These existing roads would be re-used because they would provide cost-effective logging access and because the impacts to the site from road building have already occurred. An estimated 11.1 miles of these existing roads would be obliterated following the stand treatments. In all cases, these roads slated for obliteration are not presently open roads. An excavator would be used to modify the existing road beds to remove any potential erosion problems and in some cases to decompact soil in the road beds.

The remaining 14.6 miles of existing roads used for this project are designated either for winter snow-trail use, are a part of the old North Umpqua Highway, or are used for access to other sites. These roads would not be obliterated after use in order to maintain the existing use or the historical values.

System Road Reconstruction

Alternative 2 would include the reconstruction of about 4.7 miles of existing system roads to meet standards and guidelines of the Northwest Forest Plan in order to minimize the disruption of natural water flow pathways, and lessen risk of erosion, (ROD C 32-33), while providing for safe, cost-effective timber haul. The reconstruction would be done using heavy equipment such as an excavator, bulldozer, backhoe, road grader, dump truck, and a water truck. Reconstruction would include the following work listed by road number and mile post (MP):

- 2610-571 (MP 0.0): 0.1 mile, improve intersection with Poole Creek Campground road 2610-570;
- 2614-410 (various locations along route): 0.7 miles, improve alignment;
- 2614-411 (various locations along route): 0.5 miles, improve alignment;
- 4791 - Thielsen Creek Campground (various locations along route): 0.1 miles, fell trees for alignment;
- 4795-300 (various locations along route): 1.4 miles, improve drainage, add/replace culverts;
- 4795-400 – Summer Home Road (various locations along route): 1.2 miles, widen traveled way, place pit run rock at MP 0.35;
- 6000-430 (MP 0.54): 0.1 miles, widen;
- 6000-455 (various locations along route): 0.3 miles, improve alignment;
- 6530-100 (various locations along route): 0.3 miles, improve alignment.

Rock for these reconstruction activities would be generated from the existing Boundary and Lemolo Dam rock quarries. Work at these existing quarries would include drilling, blasting, rock crushing, and hauling of materials. Existing stockpiled material within the pits also would be used.

Excess excavated materials generated by reconstruction would be hauled and dumped at the Oregon Department of Transportation (ODOT) Sand Shed site on road 4700-700.

System Road Maintenance

Alternative 2 would include road maintenance on about 67 miles of existing system roads where timber haul would occur. Maintenance differs from reconstruction in that it consists of more routine work with less site-specific contract requirements. It would be accomplished using a variety of equipment such as a road grader, small bulldozer, dump truck, backhoe, water truck, and a tractor-mounted brusher. The road maintenance under Alternative 2 would include:

- Re-opening and closing (upon completion of haul) currently closed system roads;
- Logging out (removing downed trees, large rocks, slides, etc.) such roads;
- Brushing roads and roadsides;
- Blading road beds, including ditches where needed;
- Cleaning existing culverts at ditch relief and stream crossing locations as needed for proper drainage;
- Hazard tree felling to meet OSHA requirements;
- Applying dust abatement materials to road surfaces.

Connected Actions

Connected actions are those actions that depend on the proposed action to be implemented, are mitigation or management requirements that may be required to implement the proposed action, and/or are located within the sale area boundary. The connected actions, and how they contribute to meeting the purpose and need, would include:

Table 3. Connected Actions Under Alternative 2.

Type of Action	Element of Purpose and Need Met
Reforestation: Includes 200 acres of planting sugar/white pine for stand diversity.	Element 1 – Modifying beetle habitat.
Precommercial thinning: Includes pre-commercial thinning 300 acres in the sale area boundaries.	Element 1 – Modifying future mountain pine beetle habitat; Element 2 – Reduce fuel loads
Visual Management: Seeding, planting shrubs and stump flush cutting where needed.	Lowers the short-term impacts to high profile recreation areas.
Noxious Weed Treatment: Includes seeding along roadsides (49 acres), seeding temporary roads and landings (119.7 acres), and managing weeds on acres after project implementation.	Required to meet Standards and Guidelines.
Education: Install 3 interpretive panels to inform forest visitors about the fire risk and bark beetle outbreak in the area.	Located in geographic area.

Similar Actions

Similar actions are located in the general vicinity of the timber sale area (Table 4). These actions may or may not contribute to meeting the overall purpose and need, but are actions that are located in the sale area boundary or are in a geographically similar area. Under Alternative 2, the first two similar actions involving road decommissioning have decisions previously made under NEPA in 2006; the D-Bug project may potentially fund these two actions. The third decommissioning project is fully incorporated into this D-Bug NEPA analysis since it is not previously covered under NEPA.

Table 4. Similar Actions Under Alternative 2.

Type of Action	Rationale
Road Decommissioning: Includes decommissioning about 1 mile of road 4795-400 in the summer home tract, south of the Noble Fir picnic area.	Located in geographic area.
Road Decommissioning: Includes decommissioning a stream crossing in the summer home area.	Located in geographic area.
Road Decommissioning: Includes decommissioning 0.8 miles of road 6592-100 (the abandoned segment of the old Highway 230). The crushed aggregate and asphalt would be salvaged and stored in an existing stockpile location south of this road segment for use in future projects.	Located in geographic area.

ALTERNATIVE 3 (TABLE 5, FIGURES 7 & 8)

Alternative 3 was developed to respond to issues brought forward by conservation groups, while still meeting the purpose and need. The issues that drove the development of Alternative 3 include:

- Issue 2—Treatments in Inventoried Roadless Areas, the Oregon Cascades Recreation Area, and Potential Wilderness Areas;
- Issue 3—Amount of new temporary road building;
- Issue 4—Use of existing snow-trails as timber haul routes;
- Issue 5—Redundant fuelbreaks along the Thirsty Creek and Kelsey Point Road;
- Issue 6—Amount and intensity of harvest in lodgepole pine.

Under Alternative 3, commercial harvest in the IRAs, the OCRA, and in Potential Wilderness Areas is lowered by 65%, 64%, and 52%, respectively, compared to Alternative 2. The construction of new temporary roads under Alternative 3 is lowered by 35%, and the use of existing snow-trail #1457 is eliminated as a timber haul route. In this alternative, the Thirsty Creek and Kelsey Point fuelbreaks are dropped where they overlap the Thirsty Creek IRA, equating to a reduction of 420 acres of commercial harvest and 109 acres of non-commercial fuel treatments. Also, under Alternative 3, the amount of commercial harvest in lodgepole pine is decreased by 26% (1,145 acres) relative to Alternative 2.

Specifically, Alternative 3 differs from Alternative 2 by changing the lodgepole pine overstory removal prescriptions to variable density thinning in units 29 and 30 and modifying the size of lodgepole pine thinning units 72 and 73 (leaving only a roadside

treatment along Highway 138). Scaling back these commercial treatments reduces the amount and intensity of harvest in lodgepole pine stands, reduces temporary road building, reduces the use of existing snow-trails for timber haul, and reduces impacts to potential wilderness areas. Alternative 3 also decreases the size of unit 115 to avoid thinning a mixed conifer area within a narrow, northern finger of the Mt. Bailey IRA near Highway 138. These changes, coupled with the dropped fuelbreaks, result in 1,670 fewer acres of commercial harvest compared with Alternative 2. The lower revenue generated necessitates a 605-acre reduction of non-commercial fuel treatments in Alternative 3. Some of the most expensive fuel treatments were dropped, while other fuel treatments were scaled back, such as along the Windigo Pass fuelbreak and the area west of the Diamond Lake recreation cabins. Alternative 3 would generate an estimated 33.8 million board feet of timber.

Alternative 3 includes the following activities:

- Variable density commercial thinning of 2,359 acres in lodgepole pine stands leaving 20-70 TPA interspersed with 10% of the area with no treatment, commercial thinning of 865 acres of lodgepole-mixed conifer (leaving 50-200 TPA), and commercial thinning of 1,815 acres in mixed conifer stands (leaving 50-200 TPA). These commercial thinnings include 221 acres along the outer edges of the Mt. Bailey Inventoried Roadless Areas (IRA's), and 115 acres along the edge of the Oregon Cascades Recreation Area (OCRA) next to Highway 138. The lodgepole variable density thinning would not generate any openings greater than 40 acres in size.
- Salvage of 282 acres of dead and dying lodgepole.
- The thinnings would use ground-based and skyline logging systems in both the matrix and riparian reserve land allocations to generate about 33.8 million board feet of timber.
- Non-commercial removal of fuels on about 1,408 acres by pre-commercial thinning, mastication, whip felling, chipping, and piling and burning of slash. This includes treatment on about 163 acres of stands along the edges of the Mt. Bailey Inventoried Roadless Area.
- Biomass utilization could occur on as much as 1,192 acres, depending on the market at the time operations occur. Twenty-one 1-acre landings would be created to process the biomass, if needed.
- Treating activity-created fuels (slash) on all acres commercially thinned by underburning, crushing, machine piling, masticating, or yarding tops attached.
- Re-using about 20.1 miles of existing, spur roads to access thinning areas, then obliterating about 10.5 miles after use.
- Building about 10 miles of new temporary spur roads to provide access for logging machinery and for accessing stands for non-commercial treatments, then obliterating them after use.
- Reconstructing portions of 11 sections of existing system roads (work would occur along 4.7 miles of road), including road re-alignment, intersection improvement, widening, continuous placement or replacement of surface rock and rock armoring, reshaping road beds, replacing culverts, adding culverts, and hazard tree felling.

- Maintaining about 62 miles of existing system roads (approximately 9 miles are currently closed), including the grading and shaping of existing road surfaces, dust abatement, blading road beds and ditches, hazard tree felling, cleaning/maintaining ditches and culverts as needed, isolated placement or replacement of surface rock and rock armoring, opening and re-closing existing closed roads, removing debris from the roadway, and the cutting of intruding vegetation along roadsides.
- Utilizing the existing Lemolo Dam rock pit and the Boundary pit as the rock sources for the road work.
- Amend the 1990 Umpqua National Forest Land and Resource Management Plan (LRMP) in the following areas:
 1. The LRMP assigned Visual Quality Objectives of Retention and Partial Retention along Highway 138 and Highway 230, and areas surrounding Diamond Lake and Lemolo Lakes. The LRMP would be amended to modify these objectives in the short term in order to meet the purpose and need.
 2. The LRMP does not permit timber harvest in Management Area 1, except in the event of catastrophic damage, and as approved in a vegetation management plan. The Forest Plan would be amended to include commercial timber harvest in MA 1 in order to lower the effects of the ongoing mountain pine beetle outbreak and reduce fuels in the vicinity of the Wildland Urban Interface Area, as recommended in the 2008 Vegetation Management Plan (USDA, Umpqua NF 2008).
 3. The LRMP places a size limitation on timber harvest openings (units) that can be created within Management Area 2 around Diamond and Lemolo Lakes. In addition, prescription A4-I for this Management Area does not allow for commercial or personal use firewood cutting. In order to accomplish effective treatments of adequate size, the LRMP would be amended to allow for timber harvest units greater than ½ acre in size. Also, in order to allow for the economic removal of dead and dying lodgepole pine, the LRMP would be amended to allow for commercial and personal use firewood cutting.
 4. The LRMP excluded the land in the lodgepole pine climax ecoclasses from the suitable timber base due to low productivity and low economic value of the species. Subsequently, the climax lodgepole pine ecoclasses have been determined to have a site potential that would produce 50 cubic feet/ac/year or more which would qualify as suitable commercial forest land under the National Forest management Act (Blackburn 2007 and 2008). Furthermore, the LRMP includes a Standard and Guideline that allows for the removal of timber killed by catastrophic events on unsuitable lands considering economic, social, and environmental consequences. The mountain pine beetle infestation qualifies as a catastrophic event in terms of social considerations in an area of high human use. Regardless of the post-LRMP findings of lodgepole pine suitability and the applicability of the above Standard and Guideline, the 1990 LRMP would be amended in order to harvest in the climax lodgepole pine ecoclasses for this project.

Twelve different silvicultural prescriptions are proposed for Alternative 3. Prescriptions 2-4 and 9-13 include removal of a commercial product, while prescriptions 5-8 include non-commercial treatments. Specific prescriptions, along with the unit numbers and total acreage assigned to those prescriptions are as follows (Table 5):

Table 5. Alternative 3 silvicultural prescriptions by individual treatment unit.

Prescription #⁴	Units assigned to prescription	Commercially treated acres	Non-commercially treated acres	Volume Removed (thousand board feet)
2 – Variable density thinning in pure lodgepole pine stands leaving 20-70 TPA, 5" and greater, interspersed with 10% of the area with no treatment using mechanical harvest, yard tops attached and masticate fuels.	18, 22, 29, 30, 32, 42, 44, 46, 60, 61, 62, 63, 64, 65, 66, 67, 68, 72, 106, 108, 133, 135, 136, 139, 140, 141, 147, 149, 152, 156, 164, 180, 181, 182, and 184.	2,359	0	10,785
3 – Thin from below, retaining 50-200 TPA in forests with a lodgepole overstory and mixed conifer understory; yard tops attached and masticate fuels. This prescription includes post and pole size stands to produce biomass.	4, 5, 9, 10, 11, 12, 19, 23, 24, 28, 34, 36, 37, 39, 41, 48, 76, 77, 84, 85, 94, 116, 138, 143, 153, 155, 171, 177, 192, 200, 201, and 203.	865	0	1,835
4 – Salvage of dead/dying lodgepole pine, retaining 50-200 TPA of the residual green trees; yard tops attached, and masticate fuels.	1, 56, 59, 75, 79, 80, 93, 95, 97, 112, and 204.	282	0	1,837
5 – Understory thinning with fuel mastication or handpiling along roadways.	55, 109, 163, 198, and 199.	0	180	0
6 – Understory precommercial thinning and masticating fuels along roadways.	13, 14, 16, 17, 20, 21, 25, 26, 27, 31, 33, 40, 74, 142, 153, 154, 168, 169, 173, 175, 179, 190, 191, 195, and 196.	0	357	0
7 – Understory treatment along highways and escape routes, masticating fuels and handpiling along roadways.	35, 45, 47, 49, 50, 51, 52, 57, 58, 69, 71, 78, 92, 99, 101, 103, 110, 111, 119, 170, 174, 178, and 205.	0	856	0
8 – Understory thinning of small trees (whips), pulling slash from around residual ponderosa pine, and underburning.	53	0	14	0

⁴ Firewood sales would be considered in prescriptions 2, 3, and 4 depending on the amount of mortality that develops as the infestation progresses.

Prescription #⁴	Units assigned to prescription	Commercially treated acres	Non-commercially treated acres	Volume Removed (thousand board feet)
9 – Thin from below in small diameter mixed conifer stands using a mechanical harvester, retaining 50-90 TPA, and grapple piling/burning slash.	2, 7, 8, 15, 86, 89, 113, 118, 144, and 160.	523	0	5,596
10 – Thin from below in mixed conifer stands dominated by small diameter red and white fir, using cut-to-length harvester retaining 50-90 TPA; mastication of fuels or handpiling along roadways.	3, 6, 38, 54, 81, 90, 91, 96, 98, 100, 102, 104, 105, 107, 114, 115, 117, 157, 176, and 202.	966	0	9,622
11 – Thin from below in mixed conifer stands with Douglas-fir and ponderosa pine components using a mechanical harvester retaining 50-90 TPA, and grapple piling/burning slash.	83, 122, and 162.	122	0	1,587
12 – Thin from below in mixed conifer stands with a ponderosa pine component using skyline yarding retaining 50-90 TPA, and handpiling/burning along roadways at a depth of 2 chains.	158, 161, and 193.	73	0	727
13 – Thin from below in mixed conifer stands with a ponderosa pine component, using skyline yarding and a mechanical harvester, retaining 50-90 TPA and underburning.	82, 145, and 194.	131	0	1,699
Totals		5,321	1,408	33,839

New Temporary Road Construction/Obliteration

The 10 miles of new temporary road to be constructed under Alternative 3 would be native surface roads, with rock added at limited locations where soil moisture requires the use of rock to effectively pass log trucks. Temporary roads are typically constructed with a tractor. After logging they would be obliterated with an excavator or bulldozer appropriately equipped to decompact soil, as needed. Any excavated material, including soil and woody material, would be pulled back over the road to re-establish the original contour, as much as feasible.

Re-use of Existing Unclassified Roads and Trails

The 20.1 miles of unclassified roads and trails found in and adjacent to the treatment units were initially built for access into the area or are used as winter snow trails today.

Some of these old roads were rocked when they were originally built and are in good condition today with little to no erosion potential or rutting. Most are native (dirt) surface that can become rutted if driven on during wet conditions. These existing roads and snowmobile routes would be re-used because they would provide cost-effective logging access and because the impacts to the site from road building have already occurred. An estimated 10.5 miles of these existing roads would be obliterated following the stand treatments. In all cases, these roads slated for obliteration are presently closed. An excavator would be used to modify the existing road beds to remove any potential erosion problems and, in some cases, to decompact soil in the road beds.

The remaining 9.6 miles of existing roads used for this project are designated either for winter snow-trail use, are a part of the old North Umpqua Highway, or are used for access for other sites. These roads would not be obliterated after use in order to maintain the existing uses or the historical values.

System Road Reconstruction

Alternative 3 would include the reconstruction of about 4.7 miles of existing system roads to meet standards and guidelines of the Northwest Forest Plan in order to accommodate flood flows, minimize the disruption of natural water flow pathways, and lessen risk of erosion, (ROD C-32 & 33), while providing for safe, cost-effective timber haul. The reconstruction would be done using heavy equipment such as an excavator, bulldozer, backhoe, road grader, dump truck, and a water truck. Reconstruction would include the following work listed by road number and mile post (MP):

- 2610-571 (MP 0.0): 0.1 mile, improve intersection with Poole Creek Campground road 2610-570;
- 2614-410 (various locations along route): 0.7 miles, improve alignment;
- 2614-411 (various locations along route): 0.5 miles, improve alignment;
- 4791- Thielsen Creek Campground (various locations along route): 0.1 miles, fell trees for alignment;
- 4795-300 (various locations along route): 1.4 miles, improve drainage, add/replace culverts;
- 4795-400 – Summer Home Road (various locations along route): 1.2 miles, widen traveled way, place pit run rock at MP 0.35;
- 6000-430 (MP 0.54): 0.1 miles, widen;
- 6000-455 (various locations along route): 0.3 miles, improve alignment;
- 6530-100 (various locations along route): 0.3 miles, improve alignment.

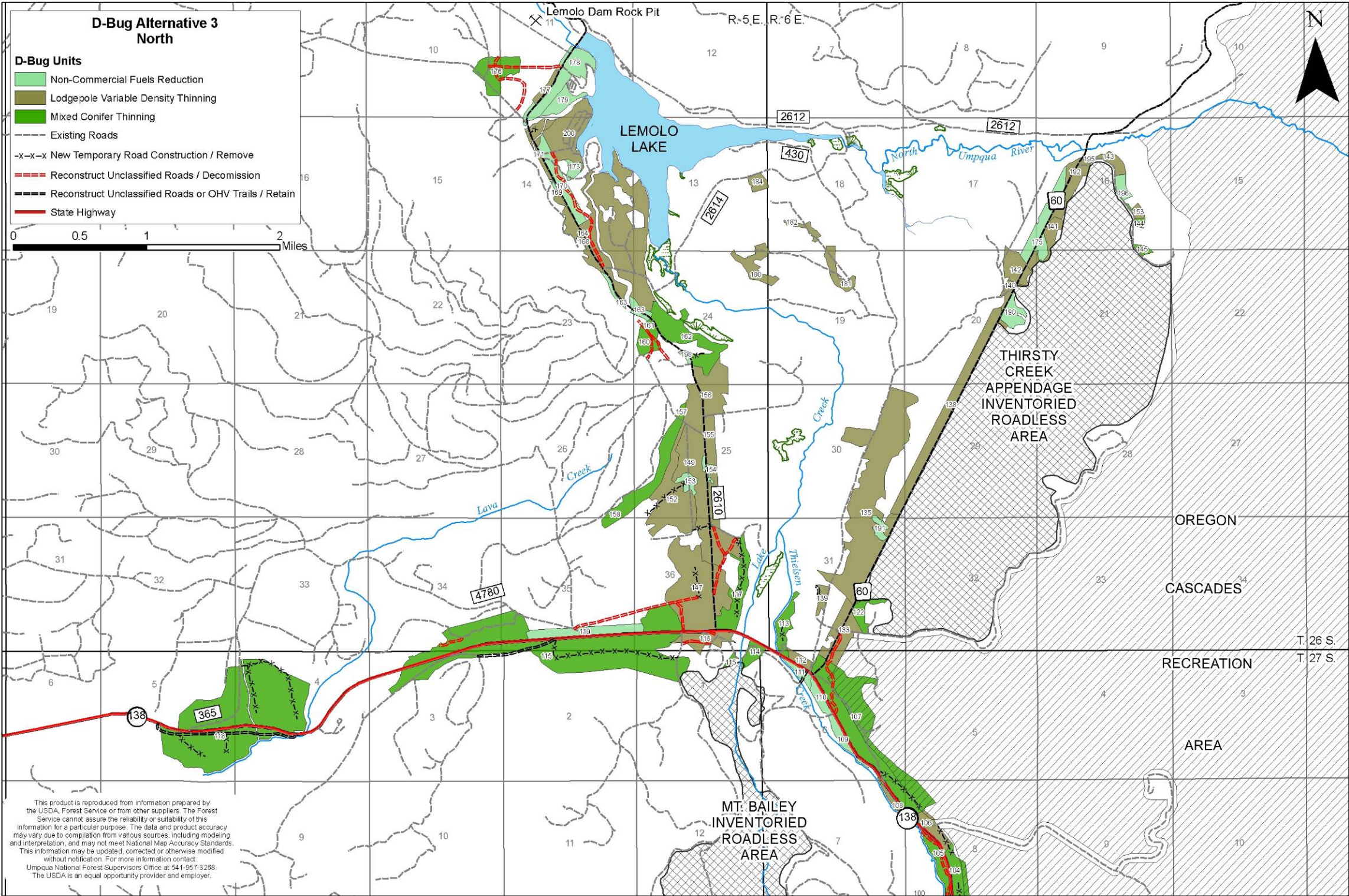


Figure 7. Alternative 3 – North Half.

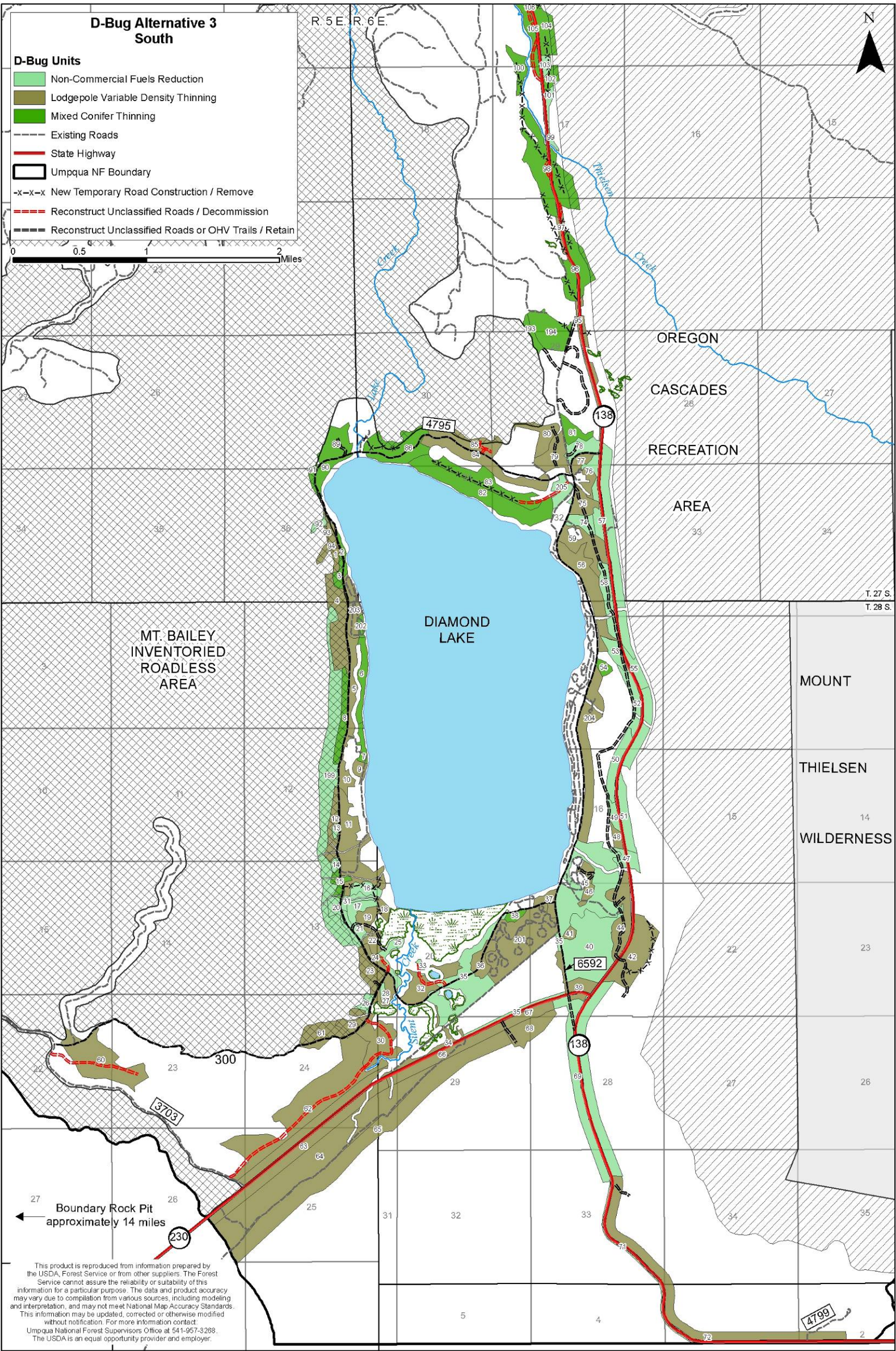


Figure 8. Alternative 3 – South Half.

Rock for these reconstruction activities would be generated from the existing Boundary and Lemolo Dam rock quarries. Work at the Lemolo quarry would include drilling, blasting, rock crushing, and hauling of materials, while only hauling would occur out of the Boundary quarry.

Excess excavated materials generated by reconstruction and any slide material removed as part of maintenance would be hauled and dumped at the Oregon Department of Transportation (ODOT) Sand Shed site on road 4700-700.

System Road Maintenance

Alternative 3 would include road maintenance on about 62 miles of existing system roads where timber haul would occur. Maintenance differs from reconstruction in that it consists of more routine work with less site-specific contract requirements. It would be accomplished using a variety of equipment, such as a road grader, small bulldozer, dump truck, backhoe, water truck, and a tractor mounted brusher. The road maintenance under Alternative 3 would include:

- Re-opening and closing (upon completion of haul) currently closed roads;
- Logging out (removing downed trees, large rocks, slides, etc.) roads;
- Brushing roads and roadsides;
- Blading road beds, including ditches where needed;
- Cleaning existing culverts at ditch relief and stream crossing locations as needed for proper drainage;
- Hazard tree felling to meet OSHA requirements;
- Applying dust abatement materials to road surfaces.

Connected Actions

Connected actions are those actions that depend on the proposed action to be implemented, are mitigation or management requirements that may be required to implement the proposed action, and/or are located within the sale area boundary. The connected actions, and how they contribute to meeting the purpose and need, would include:

Table 6. Connected Actions Under Alternative 3.

Type of Action	Element of Purpose and Need Met
Precommercial thinning: Includes pre-commercial thinning 300 acres in the sale area boundaries.	Element 1 – Modifying future mountain pine beetle habitat; Element 2 – Reduce fuel loads.
Noxious Weed Treatment: Includes seeding along roadsides (49 acres), seeding temporary roads and landings (105.7 acres) and managing weeds on acres after project implementation.	Required to meet Standards and Guidelines.
Visual Management: Seeding, planting shrubs and stump flush cutting where needed.	Lowers the short-term impacts to high profile recreation areas.
Education: Install 3 interpretive panels to inform forest visitors about the fire risk and bark beetle outbreak in the area.	Located in geographic area.

Similar Actions

Similar actions are located in the general vicinity of the timber sale area (Table 7). These actions may or may not contribute to meeting the overall purpose and need, but are actions that are located in the sale area boundary or are in a geographically similar area. Under Alternative 3, the first two similar actions involving road decommissioning have decisions previously made under NEPA in 2006; the D-Bug project may potentially fund these two actions. The third decommissioning project is fully incorporated into this D-Bug NEPA analysis since it is not previously covered under NEPA.

Table 7. Similar Actions Under Alternative 3.

Type of Action	Rationale
Road Decommissioning: Includes decommissioning about 1 mile of road 4795-400 in the summer home tract, south of the Noble Fir picnic area.	Located in geographic area.
Road Decommissioning: Includes decommissioning a stream crossing in the summer home area.	Located in geographic area.
Road Decommissioning: Includes decommissioning 0.8 miles of road 6592-100 (the abandoned segment of the old Highway 230). The crushed aggregate and asphalt would be salvaged and stored in an existing stockpile location south of this road segment.	Located in geographic area.

ALTERNATIVE 4 (TABLE 8, FIGURES 9 & 10)

Alternative 4 was developed to respond to Issue 6. Several commenters responded to the proposed action stating that not enough lodgepole pine would be treated in terms of total area treated or intensity of treatments.

Under Alternative 4, both the amount and intensity of lodgepole pine treatment is increased over that of Alternative 2. Alternative 4 includes nearly a 50% increase in the amount of lodgepole pine stands proposed for commercial treatment, equating to 2,219 more live lodgepole acres commercially harvested than Alternative 2. Similar to Alternative 2, most of the lodgepole acres would receive a variable density thinning (leaving 20-70 TPA interspersed with 10% of the area with no treatment). Alternative 4 also increases the amount of lodgepole pine regeneration harvest by applying the overstory removal prescription to an additional 182 acres over that of Alternative 2. The overstory removal harvest would meet Forest Plan green tree retention standards and guidelines by leaving 15% of the area in uncut aggregates and scattered retention of 20 overstory trees per acre. None of the lodgepole openings would be larger than 40 acres in size. The increased acres of commercial lodgepole treatment would require the building of an additional 9.7 miles of more temporary road over that of Alternative 2. As with Alternative 2, all these new temporary roads would be decommissioned following use.

All of the mixed conifer stands in Alternative 2 also would be included, unchanged, in Alternative 4. Alternative 4 includes a 17% increase in non-commercial fuel treatments, equating to an additional 305 acres over that of Alternative 2. Most of the additional non-commercial fuel treatments in this alternative are located west of the Lemolo Lake Resort. Alternative 4 would generate an estimated 55.3 million board feet of timber.

Alternative 4 includes the following activities:

- Variable density commercial thinning of 4,888 acres in lodgepole pine stands leaving 20-70 TPA interspersed with 10% of the area with no treatment, thin from below 1,232 acres of lodgepole-mixed conifer, and thin 2,247 acres of mixed conifer stands (leaving 50-200 TPA). The lodgepole variable density thinning would not generate any openings greater than 40 acres in size. These commercial thinnings include 620 acres along outer edges of the Mt. Bailey and Thirsty Creek Appendage Inventoried Roadless Areas (IRA's), and 318 acres along the edge of the Oregon Cascades Recreation Area (OCRA).
- Overstory removal of 241 acres in lodgepole pine stands leaving 20 overstory trees per acre with aggregated leave areas covering 15% of the area. Neither the lodgepole variable density thinning or the overstory removal prescriptions would create any openings greater than 40 acres in size.
- Salvage of 375 acres of dead and dying lodgepole.
- The various commercial treatments would use ground-based and skyline logging systems in both the matrix and riparian reserve land allocations to generate an estimated 55.4 million board feet of timber.
- Non-commercial removal of fuels on about 2,318 acres by pre-commercial thinning, mastication⁵, whip felling⁶, chipping, and piling and burning of slash. This includes treatment on about 345 acres of stands along the edges of the Mt. Bailey and Thirsty Creek Appendage Inventoried Roadless Areas (IRA's), and 15 acres along the edge of the Oregon Cascades Recreation Area (OCRA).
- Biomass utilization could occur on about 2,307 acres, depending on the market at the time operations occur. Twenty-one 1-acre landing would be developed to process the biomass, assuming market conditions are favorable.
- Re-using about 25.8 miles of existing, spur roads to access thinning areas then obliterating about 11.1 miles after use.
- Building about 25.1 miles of new temporary spur roads to provide access for logging machinery and for accessing stands for non-commercial treatments, then obliterating them after use.
- Reconstructing portions of 11 sections of existing system roads (work would occur along 4.7 miles of road) including road re-alignment, intersection improvement, widening, continuous placement or replacement of surface rock and rock armoring, reshaping road beds, replacing culverts, adding culverts, and hazard tree felling.
- Maintaining about 70 miles of existing system roads (approximately 10 miles are currently closed), including the grading and shaping of existing road surfaces, dust abatement, blading road beds and ditches, hazard tree felling, cleaning/maintaining ditches and culverts as needed, isolated placement or replacement of surface rock and rock armoring, opening and re-closing existing closed roads, removing debris from the roadway, and the cutting of intruding vegetation along roadsides.
- Utilizing the existing Lemolo Dam rock pit and Boundary rock pit as rock sources for the road work.

⁵ Mastication is the grinding of woody vegetation using equipment.

⁶ Whip felling is the hand cutting of small understory trees.

- Amend the 1990 Umpqua National Forest Land and Resource Management Plan (LRMP) in the following areas:
 1. The LRMP assigned Visual Quality Objectives of Retention and Partial Retention along Highway 138 and Highway 230, and areas surrounding Diamond Lake and Lemolo Lakes. The LRMP would be amended to modify these objectives in the short term in order to meet the purpose and need.
 2. The LRMP does not permit timber harvest in Management Area 1, except in the event of catastrophic damage, and as approved in a vegetation management plan. The Forest Plan would be amended to include commercial timber harvest in MA 1 in order to lower the effects of the on-going mountain pine beetle outbreak and reduce fuels in the vicinity of the Wildland Urban Interface Area, as recommended in the 2008 Vegetation Management Plan (USDA, Umpqua NF 2008).
 3. The LRMP places a size limitation on timber harvest openings (units) that can be created within Management Area 2, the Recreation Composites around Diamond and Lemolo Lakes. In addition the LRMP, under prescription A4-I for this Management Area, does not allow for commercial or personal use firewood cutting. In order to accomplish effective treatments of adequate size, the LRMP would be amended to allow for timber harvest units greater than ½ acre in size. Also, in order to allow for the economic removal of dead and dying lodgepole pine, the LRMP would be amended to allow for commercial and personal use firewood cutting.
 4. The LRMP excluded the land in the lodgepole pine climax ecoclasses from the suitable timber base due to low productivity and low economic value of the species. Subsequently, the climax lodgepole pine ecoclasses have been measured in plot data and determined to have a site potential that would produce 50 cubic feet/ac/year or more which would qualify as suitable forest land under the National Forest management Act (Blackburn 2007 and 2008). Furthermore, the LRMP includes a Standard and Guideline that allows for the removal of timber killed by catastrophic events on unsuitable lands considering economic, social, and environmental consequences. The mountain pine beetle infestation qualifies as a catastrophic event in terms of social considerations in an area of high human use. Regardless, of the post-LRMP findings of lodgepole pine suitability and the applicability of the above Standard and Guideline, the 1990 LRMP would be amended in order to harvest in the climax lodgepole pine ecoclasses for this project.

Thirteen different silvicultural prescriptions are proposed for Alternative 4. Prescriptions 1-4 and 9-13 include removal of a commercial product, while prescriptions 5-8 include non-commercial treatments. Specific prescriptions, along with the unit numbers and total acreage assigned to those prescriptions are as follows (Table 8):

Table 8. Alternative 4 silvicultural prescriptions by individual unit.

Prescription #⁷	Units assigned to prescription	Commercially treated acres	Non-commercially treated acres	Volume Removed (thousand board feet)
1 -- Overstory removal of lodgepole forests using mechanical harvest, retaining about 20 TPA, 5" and greater; yard tops attached.	29, 30, 238, 239, 240, 241, 242, 243, 244, 245, and 246.	241	0	1,814
2 – Variable density thinning of lodgepole pine stands leaving 20-70 TP, 5" and greater, interspersed with 10% of the area with no treatment, using mechanical harvest, yard tops attached, and masticate fuels.	18, 22, 32, 42, 44, 46, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 72, 73, 106, 108, 121, 133, 135, 136, 139, 140, 141, 147, 149, 152, 156, 164, 184, 210, 212, 312, and 214.	4,888	0	24,443
3 – Thinning in stands of lodgepole overstory and mixed conifer understory leaving 50-200 TPA, 5" and greater; yard tops attached and masticate fuels. This prescription includes post and pole size stands to produce biomass.	4, 5, 9, 10, 11, 12, 19, 23, 24, 28, 34, 36, 37, 39, 41, 48, 76, 77, 84, 85, 94, 116, 120, 134, 137, 138, 143, 146, 151, 155, 171, 177, 185, 189, 195, 200, 201, 203, and 216	1,232	0	2,917
4 – Salvage of dead/dying lodgepole pine, retaining 50-200 TPA of the residual green trees; yard tops attached and masticate fuels.	1, 56, 59, 75, 79, 80, 93, 95, 97, 112, 130, and 204	375	0	1,874
5 – Understory thinning with mastication or handpiling of fuels along roadways.	55, 109, 163, 198, 199, and 215	0	492	0
6 – Understory precommercial thinning and masticating fuels along the roadway.	13, 14, 16, 17, 20, 21, 25, 26, 27, 31, 33, 40, 43, 70, 74, 87, 88, 125, 127, 128, 131, 142, 148, 150, 153, 154, 159, 165, 166, 167, 168, 169, 172, 173, 175, 179, 186, 187, 188, 190, 191 and 192.	0	816	0
7 – Understory treatment along highways and escape routes, masticating fuels or handpiling along roadways.	35, 45, 47, 49, 50, 51, 52, 57, 58, 71, 78, 92, 99, 101, 103, 110, 111, 119, 170, 174, 178, and 205.	0	891	0
8 – Understory thinning of small trees (whips), pulling slash from around residual ponderosa	53	0	14	0

⁷ Firewood sales would be considered in prescriptions 1, 2, 3, and 4 depending on the amount of mortality that develops as the infestation progresses.

Prescription #⁷	Units assigned to prescription	Commercially treated acres	Non-commercially treated acres	Volume Removed (thousand board feet)
pine, and underburning.				
9 – Thin from below in small diameter mixed conifer stands using a mechanical harvester, retaining 50-90 TPA, and grapple piling/burning slash.	2, 7, 8, 15, 86, 89, 113, 118, 144, and 160.	546	0	5,456
10 – Thin from below in mixed conifer stands dominated by small diameter red and white fir, using cut-to-length harvester retaining 50-90 TPA; mastication or handpiling slash along roadways.	3, 6, 38, 54, 81, 90, 91, 96, 98, 100, 102, 104, 105, 107, 114, 115, 117, 157, 176, and 202.	1,011	0	10,112
11 – Thin from below in mixed conifer stands (with a Douglas-fir and Ponderosa pine component) using a mechanical harvester retaining 50-90 TPA, and grapple piling/burning slash.	83, 122, 123, 126, 129, 132, and 162.	418	0	5,440
12 – Thin from below in mixed conifer stands with a ponderosa pine component using skyline yarding retaining 50-90 TPA, and handpiling/burning along roadways at a depth of 2 chains.	158, 161, and 193.	77	0	771
13 – Thin from below in mixed conifer stands with a ponderosa pine component, using skyline yarding and a mechanical harvester, retaining 50-90 TPA and underburning.	82, 124, 145, and 194	195	0	2,529
Totals		8,983	2,213	55,356

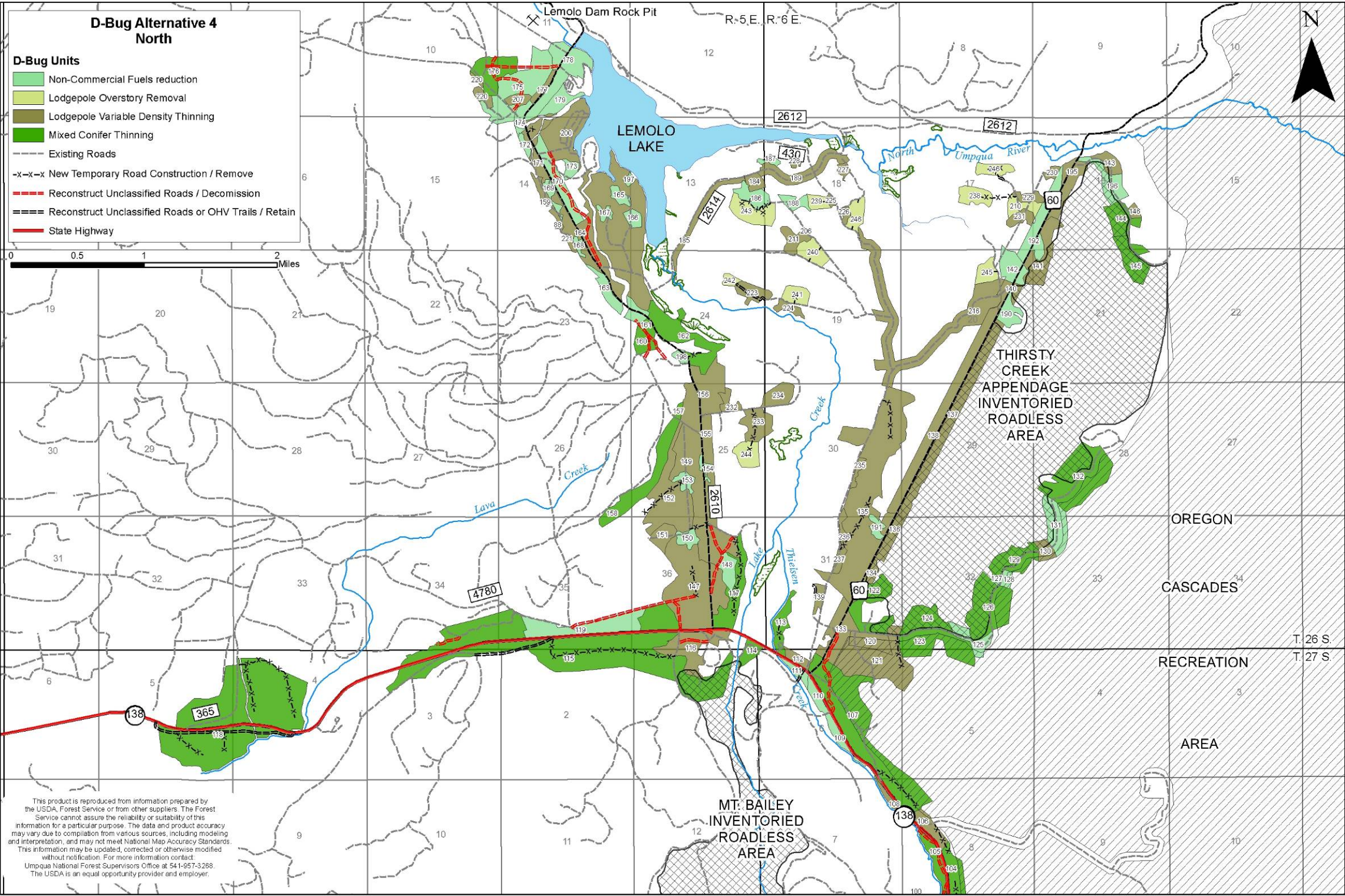


Figure 9. Alternative 4 – North Half.

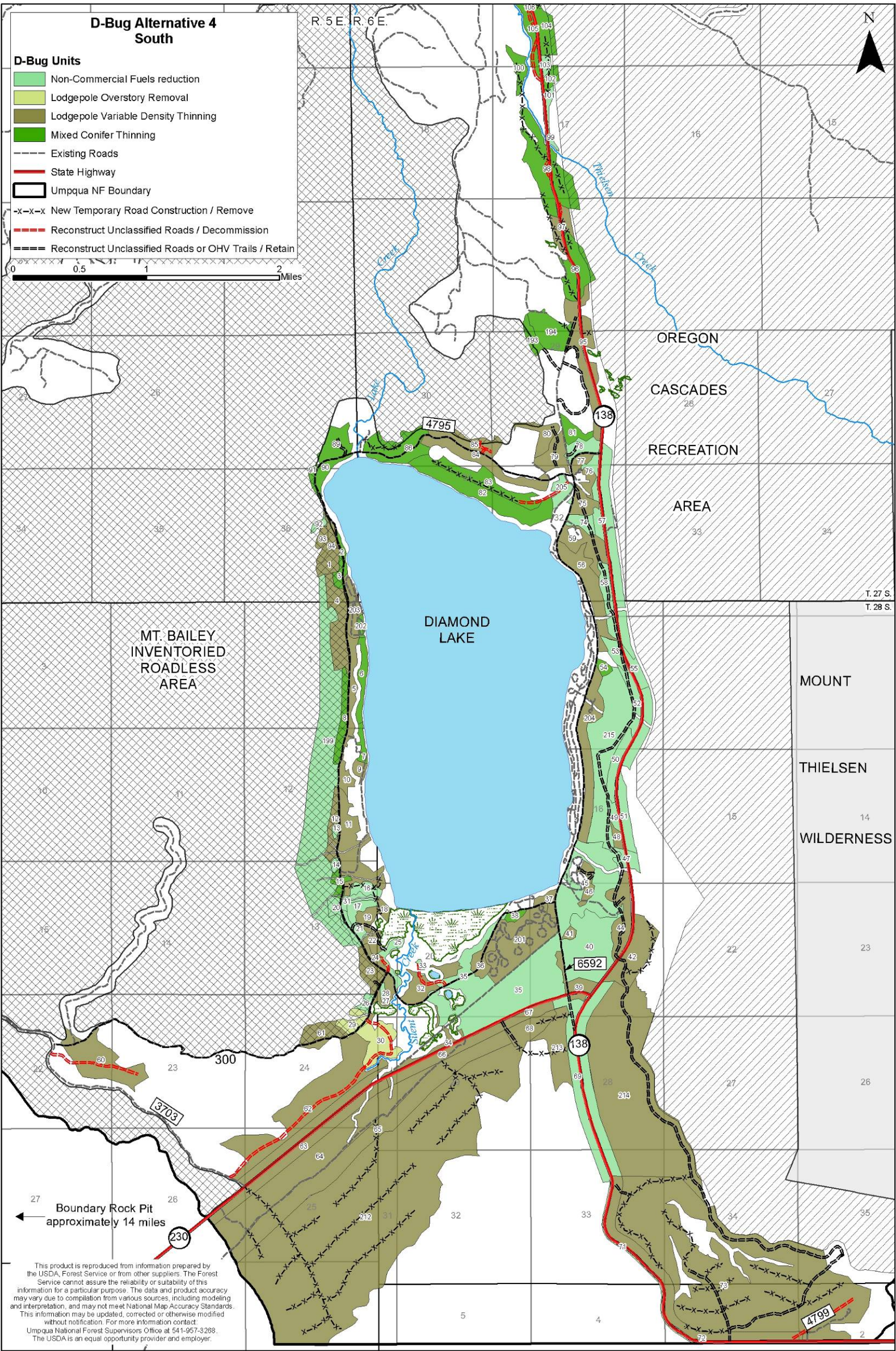


Figure 10. Alternative 4 – South Half.

New Temporary Road Construction/Obliteration

The 25.8 miles of new temporary road to be constructed under Alternative 4 would be native surface roads, with rock added at limited locations where soil moisture requires the use of rock to effectively pass log trucks. Temporary roads are typically constructed with a tractor. After logging they would be obliterated with an excavator or bulldozer appropriately equipped to decompact soil as needed. Any excavated material, including soil and woody material, would be pulled back over the road to re-establish the original contour as much as feasible.

Re-Use of Existing Unclassified Roads and Trails

The 25.8 miles of unclassified roads and trails found in and adjacent to the treatment units initially were built for access into the area or are used as winter snow trails today. Some of these old roads were rocked when they were originally built and are in good condition today with little to no erosion potential or rutting. Most are native (dirt) surface that can become rutted if driven on during wet conditions. These existing roads and snowmobile routes would be re-used because they would provide cost-effective logging access and because the impacts to the site from road building have already occurred. An estimated 11.1 miles of these existing roads would be obliterated following the stand treatments. In all cases, these roads slated for obliteration are presently closed. An excavator would be used to modify the existing road beds to remove any potential erosion problems and in some cases to decompact soil in the road beds.

The remaining 14.7 miles of existing roads used for this project are designated either for winter snow-trail use, are a part of the old North Umpqua Highway, or are used for access to other sites. These roads would not be obliterated after use in order to maintain the existing uses or the historical values.

System Road Reconstruction

Alternative 4 would include the reconstruction of about 4.7 miles of existing system roads to meet standards and guidelines of the Northwest Forest Plan in order to accommodate flood flows, minimize the disruption of natural water flow pathways, and lessen risk of erosion, (ROD C 32-33), while providing for safe, cost-effective timber haul. The reconstruction would be done using heavy equipment such as an excavator, bulldozer, backhoe, road grader, dump truck, and a water truck. Reconstruction would include the following work listed by road number and mile post (MP):

- 2610-571 (MP 0.0): 0.1 mile, improve intersection with Poole Creek Campground road 2610-570;
- 2614-410 (various locations along route): 0.7 miles, improve alignment;
- 2614-411 (various locations along route): 0.5 miles, improve alignment;
- 4791- Thielsen Creek Campground (various locations along route): 0.1 miles, fell trees for alignment;
- 4795-300 (various locations along route): 1.4 miles, improve drainage, add/replace culverts;
- 4795-400 – Summer Home Road (various locations along route): 1.2 miles, widen traveled way, place pit run rock at MP 0.35;
- 6000-430 (MP 0.54): 0.1 miles, widen;
- 6000-455 (various locations along route): 0.3 miles, improve alignment;
- 6530-100 (various locations along route): 0.3 miles, improve alignment.

Rock for these reconstruction activities would be generated from the existing Lemolo Dam rock quarry (including drilling, blasting, rock crushing, and hauling of materials), and the Boundary quarry (hauling existing stockpiled material only).

Excess excavated materials generated by reconstruction and any slide material removed as part of maintenance would be hauled and dumped at the Oregon Department of Transportation (ODOT) Sand Shed site on road 4700-700.

System Road Maintenance

Alternative 4 would include road maintenance on about 70 miles of existing system roads where timber haul would occur. Maintenance differs from reconstruction in that it consists of more routine work with less site-specific contract requirements. It would be accomplished using a variety of equipment such as a road grader, small bulldozer, dump truck, backhoe, water truck, and a tractor-mounted brusher. The road maintenance under Alternative 4 would include:

- Re-opening and closing (upon completion of haul) currently closed roads;
- Logging out (removing downed trees, large rocks, slides, etc.) roads;
- Brushing roads and road sides;
- Blading road beds, including ditches where needed;
- Cleaning existing culverts at ditch relief and stream crossing locations as needed for proper drainage;
- Hazard tree felling to meet OSHA requirements;
- Applying dust abatement materials to road surfaces.

Connected Actions

Connected actions are those actions that depend on the proposed action to be implemented, are mitigation or management requirements that may be required to implement the proposed action, and/or are located within the sale area boundary. The connected actions, and how they contribute to meeting the purpose and need, would include:

Table 9. Connected Actions Under Alternative 4.

Type of Action	Element of Purpose and Need Met
Reforestation: Includes 241 acres of planting sugar/white pine for stand diversity.	Element 1 – Modifying beetle habitat.
Precommercial thinning: Includes pre-commercial thinning 300 acres in the sale area boundaries.	Element 1 – Modifying future mountain pine beetle habitat; Element 2 – Reduce fuel loads.
Noxious Weed Treatment: Includes seeding along roadsides (49 acres), seeding temporary roads and landings (151.1 acres) and managing weeds on acres after project implementation.	Required to meet Standards and Guidelines.
Visual Management: Seeding, planting shrubs, and stump flush cutting where needed.	Lowers the short-term visual impacts to high profile recreation areas.
Education: Install 3 interpretive panels to inform forest visitors about the fire risk and bark beetle outbreak in the area.	Located in geographic area

Similar Actions

Similar actions are located in the general vicinity of the timber sale area (Table 10). These actions may or may not contribute to meeting the overall purpose and need, but are actions that are located in the sale area boundary or are in a geographically similar area. Under Alternative 4, the first two similar actions involving road decommissioning have decisions previously made under NEPA in 2006; the D-Bug project may potentially fund these two actions. The third decommissioning project is fully incorporated into this D-Bug NEPA analysis since it is not previously covered under NEPA.

Table 10. Similar Actions Under Alternative 4.

Type of Action	Rationale
Road Decommissioning: Includes decommissioning about 1 mile of road 4795-400 in the summer home tract, south of the Noble Fir picnic area.	Located in geographic area.
Stream-crossing removal: Includes decommissioning a stream crossing in an unclassified road in the summer home area.	Located in geographic area.
Road Decommissioning: Includes decommissioning 0.8 miles of road 6592-100 (the abandoned segment of the old Highway 230). The crushed aggregate and asphalt would be salvaged and stored in an existing stockpile location south of this road segment.	Located in geographic area.

COMPARISON OF ALTERNATIVES

Table 11 compares the alternatives by the elements of the purpose and need, the issue indicators, and summarizes other activities and actions that would occur.

Table 11. Comparison of Alternatives.

	Alt. 1	Alternative 2	Alternative 3	Alternative 4
Element 1 – Pine Beetle Habitat Modification Acres of susceptible lodgepole treated.	0	4,743	3,506	6,962
Element 2 – Fuel loading in WUI's and along WUI Evacuation Routes. - Acres treated within the WUIs. - Acres of treatment along designated evacuation routes. - Acres of fuelbreak protecting Lemolo WUI from wilderness/roadless area fires.	0 0 0	3,781 4,242 970	3,112 3,796 391	4,557 4,428 995
Element 3 – Hazard Tree Reduction Acres of commercial harvest within developed recreation sites and by private dwellings/businesses.	0	199	199	199
Element 4 – Improved Fire Resiliency & Stand Vigor Acres of mixed conifer stands thinned.	0	2,247	1,790	2,247

	Alt. 1	Alternative 2	Alternative 3	Alternative 4
Issue 1 – Plan Amendments				
• Acres of lodgepole harvested.	0	4,743	3,506	6,962
• Acres of Retention VQO along Highways 138 and 230 moved to:				
o Partial Retention	0	220	220	220
o Modification		265	265	265
• Acres of Partial Retention VQO along Highways 138 and 230 moved to:	0	163.9	163.9	163.9
o Modification				
Issue 2 – IRA/OCRA/Potential Wilderness Areas				
• Acres of commercial thinning in the OCRA.	0	318	115	318
• Acres of forest treated in the IRA's.				
o Commercial treatment	0	620	221	620
o Non-Commercial treatment	0	345	163	345
• Acres of treatment in Potential Wilderness Areas (excluding overlap with IRA and OCRA acres)	0	1,515	768	3,069
Issue 3 – Road Building				
• Miles of temporary roads constructed and subsequently obliterated.	0	15.4	10.0	25.1
Issue 4 – Impacts of Thinning/Haul on Trails				
• Miles of existing trail used for logging access.	0	8.2	4.8	8.2
• Acres of commercial & non-commercial treatment within 200 feet of trails.	0	1,345	992	1,345
Issue 5 – Fuelbreaks – Effectiveness, Redundancy and Extent				
• Acres of commercial/non-commercial treatments along Thirsty Creek and Kelsay Point fuelbreaks.	0	970	391	995
• Total acres in roadside fuelbreaks	0	5,212	4,187	5,423
• Acres of improved resiliency to stand replacement fire within and adjacent to fuelbreaks	0	4,508	3,364	5,757
Issue 6 – Lodgepole Pine Prescriptions, Extent of Lodgepole Treatment and Project Economics				
• Acres of lodgepole pine w/20 lg.trees per acre retained	0	59	0	241
• Acres of lodgepole pine w/40 lg. trees per acre retained	0	4,685	3,506	6,495
Extent of Lodgepole Pine Treatment				
• Acres harvested south of Hwy. 230 toward Crater Lake Park	0	1,660	928	3,267

	Alt. 1	Alternative 2	Alternative 3	Alternative 4
Economic Efficiency				
• Net Present Value	0	\$137,901	-\$173,665	\$98,657
• Least Cost to Government (Total Cost/Total Acres Treated)	0	\$1,443	\$1,485	\$1,365
Comparison of Activities				
Treatment Types				
• Total Acres Commercially Harvested	0	6,991	5,321	9,195
• Total acres non-commercial treatment	0	2,026	1,408	2,318
• Acres potentially available for biomass utilization	0	2,201	1,192	2,307
Estimated Timber Volume Removed (Million Board Feet)	0	44.8	33.8	55.3

BEST MANAGEMENT PRACTICES, MITIGATION MEASURES, PROJECT DESIGN FEATURES, AND MONITORING

The following measures apply to all action alternatives or as otherwise stated. These requirements will be implemented in order to meet laws, regulations, and policies. In most cases these requirements have been designed to reduce potential environmental effects.

Mitigation measures are defined as actions that:

- Avoid the impact all together (such as avoiding harvest on unstable land);
- Minimize impacts by limiting the degree or magnitude of the action;
- Rectify the impact by repairing, rehabilitating, or restoring;
- Reduce the impact over time by applying maintenance operations (such as road maintenance).

General Water Quality Best Management Practices (BMPs), symbolized by a checkmark (✓), are mitigation measures prescribed to protect the beneficial uses of water and to address water quality objectives as required by the Federal Clean Water Act and the 1990 Umpqua National Forest LRMP, as amended. Each BMP is listed by the code used in the Pacific Northwest Regional Guide called General Best Management Practices (USDA, Forest Service 1988). A complete BMP checklist is included in the Project Record.

Other mitigation not related to compliance with the Clean Water Act, but required by the Forest Plan or to further reduce impacts, is indicated by a round bullet (•). Items included in order to track project design features or prescriptive details are noted with the symbol (Rx). Monitoring is delineated by a lightning bolt (⚡).

Contract provisions are noted in parentheses where they apply and Standards and Guidelines (S&Gs) from the Umpqua National Forest LRMP and Northwest Forest Plan are also listed.

CONTROL OF PURCHASER OPERATIONS

BMPs T-5, T-10, T-13, T-14, T-15, T-18, T-19, T-21, T-22, R-3, R-9, R-19, R-20, W-4, VM-2, Forest Plan S&Gs IV-83-3, IV-82-5, IV-61-9.

OBJECTIVE: Enable the Forest Service to exercise control of operations to prevent impacts which could have detrimental results to water quality.

ACTIONS:

- ✓ Contract preparation and administration will include operating periods, modification language, and control and acceptance of purchaser work (BT6.1 and BT6.35).
- ✓ The Normal Operating Season (May 1 to October 31) for the sale area will be identified and applied, unless otherwise agreed to by the Forest Service. To prevent damage to water quality during the operating period, restriction of equipment shall be enforced through the use of appropriate Timber Sale Contract (TSC) provisions when conditions for timber harvest, road construction, or road use are such that excessive damage will result. The Umpqua Road Rules, which calls for suspending work when either road or environmental damage such as stream turbidity is predicted, will be enforced. The kind and intensity of erosion control work done by the purchaser shall be adjusted to ground and weather conditions and the need for controlling runoff and soil compaction.
- ✓ Purchaser erosion control structures and maintenance work must be inspected prior to acceptance by the Forest Service (CT6.6#).
- ✓ Pollutants from logging or road reconstruction equipment will be kept from entering waterways during servicing or refueling by selecting areas at least 100 feet away from wet areas and surface water, and by using a berm around sites to contain spills. If the volume of fuel exceeds 660 gallons in a single container or a total on site storage of 1320 gallons, a Spill Prevention Control and Countermeasures (SPCC) Plan (BT6.341) is required and the necessary equipment will be on site during operations (BT6.34). The purchaser shall take appropriate preventative measures to ensure that any spill does not enter any stream. Any spill that occurs must be reported to the Contracting Officer.
- ✓ Roadwork contractors will have spill prevention and recovery equipment on site during all road construction operations as agreed to by the Forest Service.
- ✓ All landing locations will be approved by the Forest Service prior to landing construction and agreed upon plans for the landing shall insure water quality protection (BT6.422).
- ✓ Road construction operations and road reconstruction will occur during drier periods.
- ✓ Timely erosion control measures will be applied to incomplete road and stream crossing projects before the rainy season.
- ✓ Ground based operation will be excluded from wetlands and meadows in or near units 18, 19, 22, 28, 32, 34, 95, 97, 162, 164, 185, and 189.

LOGGING PRACTICES

BMPs T-1, T-11, T-12, T-16; Forest Plan S&Gs IV-60-2, IV-60-5, IV-67-1, IV-68-2, IV-176, IV-188, IV-190.

OBJECTIVE: Minimize impacts to water quality and soil productivity from timber harvest to the extent practical through logging practices.

ACTIONS:

- ✓ To minimize the number of skyline corridors, skyline roads will be about 150 feet apart for the unit interior with the capability to lateral yard 75 feet, or as required in order to protect green trees prior to felling.
- ✓ Location of all skid trails will be agreed to prior to felling, unless otherwise agreed to in writing (BT6.422) at an average of 100 feet apart.
- ✓ Locate landings so that timber can be yarded with minimal disturbance to riparian reserves.
- ✓ Landing size should be no larger than needed for a safe, efficient yarding and loading operation (BT6.422).
- Units 82 and 86 require a 50-foot no cut buffer uphill from the Dellenback trail to reduce the visual impact from the skyline corridors.

LOGGING EROSION CONTROL MEASURES

BMPs T-3, T-8, T-13, T-14, T-16; Forest Plan S&Gs IV-60-5; IV-65-3, IV-71-13, IV-72-16.

OBJECTIVE: Ensure that any increase in sedimentation is minimized during and after logging or associated activities. Logging methods are described in the Project File.

ACTIONS:

- ✓ Stream course protection will be used on all stream classes (BT6.5).
- ✓ Erosion control measures will be identified where project areas have the potential to produce erosion/sedimentation that may affect water quality and beneficial uses in surface waters (CT6.6#). The installation/application of appropriate erosion control measures will be applied on designated soil gouges in skyline corridors and on ground based equipment skid trails that may reroute or concentrate runoff in order to spread water and allow for infiltration into the soil.

WATERSHED PLANNING AND MONITORING

BMP W-7.

OBJECTIVE: To monitor the long-term stream temperature trends in the Clearwater River and Diamond Lake watersheds and compare with State Water Quality Standards.

ACTIONS:

- ✓ Forest long-term stream temperature monitoring sites include Mowich Creek and Lake Creek which are applicable to the D-Bug Planning Area. The on-going stream temperature monitoring at these sites is evaluated each year.

TEMPORARY ROAD CONSTRUCTION/OBLITERATION, SYSTEM ROAD RECONSTRUCTION, AND SYSTEM ROAD MAINTENANCE

BMPs R-2, R-3, R4, R5, R-6, R-7, R-9, R-15, R-23; Forest Plan S&G IV-83-6.

OBJECTIVE: To minimize sedimentation, the effects of water concentration on roadbeds, cut slopes or fill slopes, and subsequent production of sediment associated with temporary road construction and road reconstruction/maintenance.

ACTIONS:

- ✓ All work at stream crossings (on 4 intermittent channels) will be done during the dry season only.
- ✓ All new temporary roads will be obliterated following use. This will include subsoiling and woody debris placement as feasible.
- ✓ All new temporary road construction on slopes will be done using outslope designs, with drain dips and grade sags as needed, so that no new ditchlines will be built.
- New temporary roads will be blocked immediately after completion of logging operations, or at the end of the logging season to prevent off highway vehicle use.
- ✓ Level 1 aggregate-surfaced system roads to be closed following use will be barricaded and treated with water bars if needed to prevent drainage problems. Water bars and barricades will be in place annually prior to onset of the wet season, typically at the end of the Normal Operating Season.
- ✓ Avoid blading ditches that are functioning and effectively draining.
- ✓ Waste material generated by road reconstruction and road maintenance activities shall be placed in areas agreed to by the Forest Service. These areas shall generally avoid riparian reserves, and avoid affecting fish, wildlife, cultural, and botanical resources.
- ✓ Aggregate will be placed on access roads into water sources to reduce sedimentation to streams, as needed.
- ✓ Surface rock placement may be done outside the normal operating season as weather and road conditions permit, but no surface rock can be added to extend the season of haul on any of the unclassified roads that are to be obliterated after use.
- ✓ During road reconstruction, relief culvert locations will be located, flagged, and approved by the Forest Service before installation to ensure that water is routed only onto stable soil/vegetation.
- ✓ Cut-and-fill slopes will have required erosion control treatments completed the same year they are reconstructed, even if they are not completed to final acceptance specifications. If the same area requires further disturbance to complete the road reconstruction, it will be re-vegetated as needed to ensure surface soil protection.

RIPARIAN AREAS AND WETLANDS WITHIN OR ADJACENT TO CUTTING UNITS

BMPs T-4, T-7, T-8; Forest Plan S&Gs IV-60-1, IV-60-4, 5, 6; IV-61-11, IV-33-5.

OBJECTIVE: Establish riparian area protection zones to minimize stream temperature increases, protect channel bank structure, and provide a debris filter for sediment and debris which could enter the channels, and maintain a source of large woody debris for continued stream channel stability and structural diversity.

ACTIONS:

- ✓ Stream courses and wetlands will be identified on sale area maps.

- ✓ Wetlands will be protected from microclimate change or ground disturbance by applying no-cut buffers for commercial operations. No logging corridors will be put through wetlands.
- ✓ During the decommissioning of the abandoned portion of old Highway 230, the fill that occurs in the wetland bisected by this road will be completely removed so that hydrologic exchange between the two portions of this wetland will be restored.
- ✓ During ground-based logging, restrict equipment entry within 40 feet of streams and wet areas.
- ✓ Apply no-cut buffers around all identified water pipes and water lines in order to protect domestic water sources.
- ✓ Apply no-cut buffers to all perennial streams and lakes as described below:

Perennial Stream	No-cut buffer	Units	Description
Silent Creek	60 ft or slope-break greatest distance	30, 62	Initiation point downstream to tributary confluence
Silent Creek	80 ft or slope-break greatest distance	30	Tributary confluence downstream
Silent Creek	80 ft	25, 28, 32	Lower Silent Creek
Silent Creek Tributary	80 ft	62, 63	Hwy 230 downstream to Tributary confluence
Silent Creek Tributary, east	50 ft	64, 66	Perennial flow initiation to Hwy 230
Silent Creek Tributary, south	50 ft	63, 64	Perennial flow initiation to Hwy 230
Short Creek	60 ft or slope-break greatest distance	45	Initiation point downstream to Forest Rd 4795
Camp Creek	60 ft	44, 45, 47	Perennial flow initiation to Forest Rd 4795
Porcupine Creek	50 ft	51, 52, 204	Hwy 138 above & below; extent of unit 204 to Forest Rd 4795
Spruce Creek	60 ft	56, 57, 58	Extent of these units to Forest Rd 4795
Two Bear Creek	50 ft or to the parallel road; whichever is closest	75, 76, 205	Developed springs downstream to extent of unit 205
Thielsen Creek	60 ft or second slope-break; greatest distance	98, 99, 100, 105, 108, 109, 111, 113	Extent of these units
Lake Creek	60 ft or at slope-break; greatest distance	114	Near Forest Rd 4700-710 crossing
Lake Creek	100 ft above stream to include buffering ash	185	Upstream Forest Rd 2614 crossing

Perennial Stream	No-cut buffer	Units	Description
	bank		
Battery Creek	100 ft	163, 164	Spring initiation to Forest Rd 2614
Battery Creek	50 ft	164	Forest Rd 2614 to channel widens
Battery Creek	60 ft	164	Wider channel segment
Battery Creek	50 ft	164	Narrower channel to Lemolo Lake
Pool Creek	60 ft or slope-break greatest distance	171, 174, 179, 200	Unit 174 extent to Lemolo Lake
North Umpqua River	300 ft (full Riparian Reserve)	143, 195, 196	Near Forest Rd 6000 crossing
North Umpqua River	300 ft (full Riparian Reserve)	189	Near Forest Rd 2614 crossing
Clearwater River	150 ft (full Riparian Reserve)	115	Spring initiation area
Clearwater River	300 ft (full Riparian Reserve)	115	Near Hwy 138
Clearwater River	75 ft or slope-break greatest distance	118	Extent of unit (north side)
Lava Creek	75 ft or slope-break greatest distance	118	Extent of unit (north side)
Lake	No-cut Buffer	Units	Description
Diamond Lake	50 ft from lake bank or high water	2, 6, 7, 9, 11, 202, 203	Western lake shoreline
Lemolo Lake	50 ft from lake bank	164	Along southwestern shoreline; west of Lake Creek inflow
Horse and Teal lakes	150 ft from lake bank	34	Applies to commercial harvest prescriptions only

✓ Select intermittent streams will also receive no-cut buffers. No-cut buffers are designed for some intermittent channels where streambanks are susceptible to surface erosion or where commercial thinning is not necessary to meet riparian reserve objectives. Thinning will occur along intermittent channels where the benefits of thinning outweigh the long-term impacts of stand replacement fire. The individual buffer prescriptions for the intermittent channels are stored in the GIS files.

✓ Underburning of unit 82 within the riparian reserve of Diamond Lake to reduce fuel hazard will be carefully managed to minimize fire intensity and mortality of low fire-resistant species such as hemlock and the younger true fir species. This needs to be balanced with wildlife protection measures in the vicinity of this same unit.

WILDLIFE

- To protect nesting Northern Spotted Owls, prohibit timber harvesting and road construction operations from March 1 to July 15 in mixed conifer stands that contain portions of nesting, roosting or foraging (NRF) habitat (See analysis file for map and GIS file of exact areas).
- Within the mixed conifer stands proposed for treatment, the portions of stands mapped as NRF habitat will retain a canopy closure of 60% post treatment (Units 115, 118, 144, 145, 146, 152, 158, 176, and 194. See analysis file for map and GIS file of exact areas).
- To protect nesting Bald Eagles, the National Bald Eagle Management Guidelines (USDI 2007a) will be followed in units 20, 82, 83, 84, 86, and 199. They include:
 - Avoid timber harvesting operations, including road construction and chain saw and yarding operations, during the breeding season (January through August 31st) within 660 feet of the nest.
 - No prescribed fire activities shall occur during the breeding season (Unit 82) without consulting the planning wildlife biologist to check nesting status of eagles prior to treatment.
- To protect nesting Osprey, active nest sites will have a 600-foot operating restriction from timber sale activities from March 1st through August 31st. This will affect units 50, 51, 89, 91, 156, 160, 161, 162, 163, 164, 198, 204, and 215 (only in Alternative 4; see analysis file for map and GIS file).
- In the stands mapped as nesting/roosting/foraging (NRF) habitat for spotted owls, retain existing coarse woody debris (>10 inch diameter) and snags to the extent practical and safe.
- Where feasible, avoid mechanical impacts and movement of large down wood and leave felled snags on site. In particular retain the largest lodgepole snags in units harvesting lodgepole, where feasible.
- In the portions of units designated as NRF habitat for spotted owls (Units 115, 118, 144, 145, 146, 152, 158, 176, and 194. See analysis file for map and GIS file of exact areas), apply contract provision C(T)2.35, leaving a total of 280 linear feet of down logs per acre for mitigation. Logs to be left will be at least 10 inches in diameter at the large end and 20 feet in length.

Rx If feasible, in skyline units, retain all trees used as anchors in the skyline operation as long as they do not pose a hazard.

Rx Incorporate existing snag patches (e.g., pine beetle mortality, root-rot pockets, etc.) in the no harvest areas with prescriptions 1 (Alternatives 2 and 4 only) and 2 in all alternatives to be utilized as hiding cover and sources of cavities. When feasible retain large diameter lodgepole trees with mistletoe in the crown for use by wildlife in these no harvest areas.

Rx Retain clumps and individual snags as available. Retain all hollow snags and logs, and snags with existing cavities as much as practical.

Rx OSHA requires that hazardous trees/snags be felled to protect workers on the ground during forest operations. Snags that must be felled for safety reasons should be retained on the forest floor to help attain down wood requirements.

Rx Where feasible in areas treated with mechanical harvest, cut hazard trees as high as possible to be retained for wildlife use, except within 50' of Highways 138, State Route 230 or road 4795.

ROCK SOURCE DEVELOPMENT

BMPs R-22, R-17

ACTIONS:

- ✓ Use of the Boundary rock pit will be limited to loading and removal of crushed aggregate from existing stockpiles designated in the timber sale contracts. Disturbance of areas outside the existing pit boundaries will be avoided.
- ✓ Use of the Lemolo Dam rock pit will be limited to loading and removal of riprap and other pit-run materials from locations designated in the timber sale contracts. Pit area surfaces disturbed by the rock removal activities will be sloped to disperse water and minimize erosion following use. Disturbance of areas outside the existing pit boundaries will be avoided.

SOIL AND SITE PRODUCTIVITY

BMPs T-9, T-12; Forest Plan S&Gs IV-67-1, 2, 3, IV-71-12

ACTIONS:

- ✓ All new landings and temporary roads used by the purchaser will be subsoiled to increase water infiltration and reduce surface water runoff to streams. Subsoiling will occur to a depth of 20 inches. An exception may be given to areas where the sale administrator determines slash concentrations are too high to allow subsoiling.
- ✓ Under the timber sale contract, the purchaser will be required to subsoil a maximum total of 640 acres under Alternative 2, 460 acres under Alternative 3, and 870 acres under Alternative 4, including all temporary roads, skid trails (to 100 feet of each landing), and all landings used by the purchaser in mechanical harvest to meet soil standards and guidelines.
- ✓ During the rainy season (November 1 - April 30), no more than ½ acre of exposed soil (S&G#13, LRMP pp. IV-71), including landings, skid trails, and temporary roads, would exist at any time without erosion control that is effective in preventing sediment from reaching streams or any concentrated surface flow in excess of 1.0 cfs. Note: silt fencing is not effective at flows in excess of 1.0 cfs (Brown et al. 1986).
- ✓ Designate and locate skid trails to minimize the area affected by logging operations; use pre-existing skid trails at the discretion of the sale administrator and to the extent feasible.
- ✓ Maintain at least 65% effective ground cover in order to maintain soil productivity and prevent soil erosion.
- ✎ The levels of effective ground cover will be monitored, as funding allows. If monitoring determines that effective ground cover goals are not met, then site specific recommendations will be developed by a soil scientist and the timber sale administrator. Units around summer homes and lodgepole pine stands shall be given priority for monitoring.

Rx In order to minimize effects to soils slash piles will be placed on new and existing skid trails and away from waterways and ditches, where practical.

RECREATION, SCENERY AND CULTURAL RESOURCES

Forest Plan S&Gs IV-12-5 (Developed Recreation); IV-14-3, 4 (Dispersed and Unroaded Recreation); IV-17-2 (Trails); IV-29-5 (Cultural Resources); IV-19-1, 2, 4, 5, 6, 8, 10, 12 (Visual Resource).

- Safety signs will be maintained on the main travel routes during logging operations, including Highways 138 and 230, and Roads 4795, 60, 2610, and 2614. Flaggers will be required when falling trees that may potentially reach any main travel route.
- Trees deemed as a hazard to structures (such as recreation facilities, recreation residences, lodges and associated employee housing/out-buildings) will be identified and may be felled prior to commercial logging operations.
- Effort was made to GPS all known utility lines, water lines, sewer lines, and other infrastructures. Pre-sale and sale administration will consult the GIS shapefile regarding the location of these lines and will work with the purchaser to avoid damaging utility lines.
- Any access road used by special use permittees to access their cabin or developed facility that is used under a timber sale will be returned to pre-logging conditions, at minimum.
- Equipment used for logging and yarding will be restricted to main roads within recreation sites, so as to not damage pavement, unless low PSI equipment can be utilized without damaging pavement. Equipment needing to utilize hydraulic stabilizers must use matting or plywood as a 'cushion' between the pavement and equipment base.
- In order to provide visitors a positive recreation experience, no operations will be conducted between Memorial Day and Labor Day at the following sites: Summer Homes/Recreation Residences, west side of Diamond Lake; South Shore Picnic Site; Broken Arrow Campground; Thielsen View Campground, Poole Creek Campground; and within all special use permit areas (Diamond Lake Resort, Diamond Lake RV Park, and Lemolo Resort).
- For operations near the Dellenback trail, limit hours of operations to 8:00 am to 6:00 pm, Monday through Friday.
- To accommodate use, detour bicyclists and hikers from the Dellenback Trail onto Forest Road 4795 during times equipment will be operating near the trail. Post safety signs and closures when needed.
- In order to maintain visual quality along the Dellenback Trail in Units 82 and 86 where skyline corridors will be apparent, a 50' no cut buffer will be applied north of the bike trail into the units. Hazard trees may be felled and yarded uphill, but not across the bike trail.
- For Trails 1410, 1446, 1448, 1451, 1457, 1460, 1460H, 1460J, 1460K, 1460L, 1476, 1481, 1589, 1589L, and 1591, post signs indicating trail closures when operating near (within 200 feet) the trail.
- All trail treads on existing hiking, biking and OHV trails will be rehabilitated to their pre-logging condition by the operator/purchaser.

- To the extent practical, avoid felling trees that have signs or symbols posted on them, such as signs marking cross country ski or snowmobile routes. In the event a tree with a symbol or sign needs to be felled, contact the sale administrator prior to felling the tree. The sale administrator will work with the District recreation staff to re-post the symbol or sign.
- Post closures as needed at all dispersed recreation sites when equipment will be working in the area.
- In the event that an unknown historic or prehistoric site is discovered in the course of the project, the activity will be stopped and the appropriate measures will be taken to stop any adverse effects to the site resulting from the activity (BT6.24). Any adverse effects, should they occur, shall be mitigated.
- Cultural resource personnel shall be consulted prior to conducting sale layout, sale implementation, and post-sale activities in order to inform other personnel of known cultural resource locations or other areas of concern.
- At several sites within the D-Bug planning area, mitigation measures will be applied and monitoring will be conducted in order to protect known cultural resources. Prior to project implementation, including burning, data will be collected at some sites to monitor the site before activities begin. Sale administrators and layout personnel will be advised of locations of known cultural resources by cultural resource personnel; areas of concern will be flagged prior to activity and/or marking in order to avoid known sites. Operators in specified units will be cautioned by Sale Administrators to stay out of specified area. Monitoring of these sites will occur as needed.
- Mitigation for known cultural resources includes directional felling, avoidance, fall burning, smoothing tread, and use of low impact techniques.
- Known survey benchmarks and corners will be protected during project implementation.

Rx During pre-work meetings with contractors, the sale administrator will emphasize the need to minimize damage to green trees along Highways 138 and 230, and Roads 4795, 2610, and 60.

Rx Slash treatment in the following units in VQO areas of retention will be prioritized for disposal as soon as feasible to minimize visual impacts. Avoid concentrating piles near or adjacent to high use areas. Units in all action alternatives that this prescription applies to include: 1, 2, 3, 5, 6, 7, 8, 15, 35, 45, 54, 76, 77, 78, 81, 86, 89, 90, 178, 199, 202, 203, 205.

- Apply marking paint on the side of marked trees that face away from major roads and trails.
- Where needed and where a stump greater than 6" in height remains, flush-cut stumps for a distance of 50-feet from the cut or fill slope edge along Highways 138 and 230 as funding allows. Areas that cannot be seen from the Highways do not require this mitigation. This mitigation applies to the following units, if the ground can be visually seen after treatment and if mechanical harvesting or mastication leaves stumps over 6" in height: 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 20, 21, 22, 23, 24, 25, 28, 31, 32, 35, 36, 37, 38, 42, 45, 47, 51, 54, 55, 56, 57, 59, 63, 66, 75, 76, 77, 78, 81, 84, 85, 86, 89, 90, 91, 95, 104, 105, 106, 107, 108, 109, 110, 111, 112, 114, 115, 116, 117, 118, 178, 199, 201, 202, 203, 204, 205.

- Where temporary roads are constructed to enter Highways 138 and 230, orient the road at a 90 degree angle from these highways to reduce views into treatment units.

FUEL MANAGEMENT AND AIR QUALITY

General Water Quality BMP's F-1, F-2, F-3; UNF LRMP S&G's IV-68-2, 3 & 4; IV-92-4, 7, 8; NWFP S&G's C-35 & 36, FM-1, FM-4.

OBJECTIVE: Meet air quality regulations and reduce water quality degradation and soil erosion caused by prescribed fire and other types of fuel treatments. Minimize soil compaction, soil displacement and damage to trees remaining after harvest.

ACTIONS:

✓ Hand and grapple piles will be burned under moisture conditions that minimize impacts to soils.

✓ Burn plans would include water quality objectives when appropriate.

✓ Burn plans will be prepared in advance of ignition and approved by the appropriate line officer for each prescribed fire.

✓ Where fireline would be needed on slopes exceeding 30%, water bars would be installed. Fireline water bars would deflect surface run-off from the trail down slope onto stable material such as rock surface cover. Fireline construction would generally avoid sensitive areas like unique habitats.

✓ Post harvest fuels monitoring will take place at a scale deemed appropriate by district fire managers to ensure activity created fuel loads do not generally exceed those predicted or otherwise present hazardous conditions.

Rx Grapple piles would be constructed to the following specifications: All slash from 2 inches in diameter up to 6 inches in diameter and exceeding 3 feet in length shall be piled. Exclude/remove from pile any piece greater than 9 inches in diameter on the small end and greater than 6 feet in length. Piles would be constructed compactly with minimal soil in the piles and covered to shed water so they remain dry for burning during the fall or winter; height would be at least 6 feet and no greater than 12 feet; width would be at least 6 feet and no greater than 10 feet. Piles would be evenly spaced between trees and snags left after harvest. Piles would be placed on temporary roads or designated equipment trails when possible. Piles would be placed at least 50 feet away from live streams and at least 100 feet from the edge of paved roads.

Rx Hand piles would generally be no smaller than 4 feet in height and no wider than they are tall. Handpiles would be partially covered to create a dry pocket of fuel so that piles would burn in the fall or early winter.

Rx Every effort should be made to encourage biomass removal and use whenever economically feasible, particularly when costs of removal would approximate costs to handpile and burn, or otherwise dispose of, the material.

Rx In treatment units cut via CTL system, about 80 – 90% of the activity fuels would be placed on the skid trail and well compacted. In visually sensitive areas, the first 50' of the slash mat on skid trails would be removed or masticated as seen from the road.

Rx Special emphasis and expense would be placed on reducing activity created fuel loads within 150 feet of structures or improvements.

- Air quality would be emphasized during prescribed fire planning. Mitigating measures would be considered including extending the burning season to spread emissions throughout the year. All burning would be planned and conducted to comply with applicable air quality laws and regulations and coordinated with appropriate air quality regulatory agencies.

BOTANY

R-6 Invasive Plan FEIS (USDA Forest Service, 2005a) S&Gs 2, 3, 7, & 13; Forest Plan S&G's IV-200 (C5-I); Contract Provision B/BT6 35.

ACTIONS:

- Establish a 75-foot no-entry buffer around the *Buxbaumia aphylla* location that occurs between units 130 and 131.
- Establish a 150-foot no-harvest buffer (Forest Plan S&G's IV-200 [C5-I]) around unique habitats to minimize potential impacts. Unique habitats are located adjacent to units 18, 19, 22, 28, 32, 34, 95, 97, 162, 164, 185, and 189.
- Treat known sites of spotted, diffuse and meadow knapweed (*Centaurea stoebe* ssp. *micranthos*, *C. diffusa*, and *C. nigrescens*), as necessary and funded, on haul roads, landings, and skid roads prior to logging activities. Higher priority would be given to sites where there is a threat of moving seed from contaminated to uncontaminated areas. Treatments would be based on the Forest Integrated Weed Management Decision Notice and Finding of No Significant Impact signed in June 2003. The Forest Service will flag noxious weed sites to be avoided in the higher priority sites, prior to work commencing. Infested sites to be avoided will be marked with florescent orange flagging and labeled "NOXIOUS WEEDS" with black lettering. Forest Service will provide the contractor with a map indicating where the known infestations of Forest Rated "A" noxious weeds and other invasive weeds of concern are located. Contractor will avoid ground-disturbing activities in the flagged and/or staked areas unless otherwise directed by the Forest Service.
- Actions conducted or authorized by written permit by the Forest Service that will operate outside the limits of the road prism (including public works and service contracts), require the cleaning of all heavy equipment (bulldozers, skidders, graders, backhoes, dump trucks, etc.) prior to entering National Forest System Lands (Prevention Standard 2—Regional Invasive Plants FEIS and B/BT6.35).
- A District or Forest weed specialist will inspect active gravel, fill, sand stockpiles, quarry sites and borrow material for invasive plants before use and transport. Use only gravel, fill, sand, and rock that is judged to be weed free by District or Forest weed specialists (including material from commercial sites) (Prevention Standard 7 - Regional Invasive Plants FEIS).
- Treat or require treatment of infested sources before any use of pit material (Prevention Standard 7 - Regional Invasive Plants FEIS). Starting with the highest slopes that have invasive vegetation growing in previously disturbed areas, scrape off the top several inches of soil and rock to remove the entire seed bank. Stockpile this material in a location at the quarry where it would not be disturbed, i.e. no machinery should drive over the pile. This contaminated material would be monitored and covered as necessary to ensure it does not become a future source of weeds at the quarry.

- All personnel, contractors, etc. working on the project will be made aware of the high priority “A” weeds (specifically spotted knapweed) that could be found during activities; any high priority noxious weeds found should be reported to the Forest Service.
- Use signs such as “logging use only” to discourage public access to active temporary road construction sites by establishing road closures. Allowing only vehicles involved with the construction on the site will help limit introduction of noxious weed seed.
- After harvest, treat remaining or new infestations of noxious weeds for up to three years following sale closure.
- Use native revegetation techniques to reestablish native plants on sites where weeds are removed as well as in areas where exposed mineral soil provides optimal conditions for weeds to colonize. Native plant materials are the first choice in revegetation for restoration and rehabilitation where timely natural regeneration of the native plant community is not likely to occur (Prevention Standard 13 - Regional Invasive Plants FEIS).
- Seed or plant appropriate native vegetation within all units where there is insufficient ground cover (approximately $\geq 15\%$ bare ground) immediately adjacent to the edge of the road shoulder of Hwy 138 (north of the Hwy 230 jct.), FS roads 60 and 2610 to discourage weed movement from the road shoulder. Revegetation should extend at least ten feet and up to 25 feet into the stand as conditions warrant.
- Seed all temporary roads and landings north of Hwy 230 with native vegetation, as appropriate, within the first season subsequent to completion of activities that require the roads or landings. Stands south of Hwy 230 are naturally depauperate of understory vegetation.
- Maintain desirable roadside native vegetation where feasible. If desirable vegetation is removed to bare mineral soil during blading or other ground disturbing activities, that area must be revegetated where appropriate and practicable.
- Conduct road blading, brushing and ditch cleaning in areas with high concentrations of invasive plants in consultation with District or Forest-level invasive plant specialists; incorporate invasive plant prevention practices as appropriate (Prevention Standard 8 - Regional Invasive Plants FEIS). High-priority weed infested sites will be marked with fluorescent orange flagging and labeled “NOXIOUS WEEDS” with black lettering. Forest Service will provide the contractor with a map indicating where the known infestations of Forest Rated “A” noxious weeds and other invasive weeds of concern are located. Contractor will avoid ground-disturbing activities in the flagged and/or staked areas unless otherwise directed by the COR/FSR. Whenever possible, roadside brushing will be accomplished prior to seed setting of noxious weed species (approximately late June) in noxious weed flagged areas. The intent of this is to stop and/or prevent noxious weed spread and establishment.
- If needed, use weed-free straw and mulch for all projects, conducted or authorized by the Forest Service, on National Forest System Lands. If State certified straw and/or mulch are not available, then it must be certified, all states, noxious weed-free (Prevention Standard 3 - Regional Invasive Plants FEIS). Note: because of the aquatic nature of rice, the harvested straw is already considered weed-seed free. The District or Forest weed specialist may approve the use of rice straw for some applications.

SILVICULTURE AND VEGETATION MANAGEMENT

BMP T-20

OBJECTIVE: To manage and protect desired vegetation and to reforest all suitable land within five years after regeneration harvest harvesting.

ACTIONS:

✓ Implementation monitoring will occur concurrently during lodgepole pine harvest in variable density thinning (Rx 2) areas to determine if specifications for live crown ratio, average tree retention numbers, aggregated no-treatment areas, and 40-acre size limit on areas with 20 trees/ac are met. If the number of leave trees per acre exceeds plus or minus 10% percent of the target, remarking or amending the silvicultural prescription will be necessary. No one contiguous area of 20 leave trees per acre can be greater than 40 acres.

Rx Western white pine reforestation activities may occur on approximately 20% of overstory removal acreage within lodgepole pine thinning units, if funding is available on 200 acres in Alternative 2 and 241 acres in Alternative 4.

Rx Bare root stock will be inoculated with mycorrhizal fungi spores mixed with water and a material such as Terrasorb right before outplanting.

Rx Tree handling will meet Regional standards.

Rx The timber sale contract will require purchasers to apply sporax to the cut stumps of all true firs when more than 25% for the leave trees are true fir that are greater than 12" in diameter in order to control the spread of *Fomes annosus*

- Mortality of merchantable leave trees from slash burning operations should not exceed 5% in pile burn areas and 10% in underburn areas.
- Sale Administrators will stress the need to protect residual trees during logging. This measure is especially important when logging the mechanized units during times when leave trees are susceptible to bark slippage.

CHAPTER 3

AFFECTED ENVIRONMENT AND ENVIRONMENTAL EFFECTS

INTRODUCTION

This chapter describes the components and scope of the human environment that may be affected by implementation of the alternatives outlined in Chapter 2. It discloses the potential consequences of implementing each alternative including the mitigation measures, watershed best management practices and management requirements associated with each alternative. A complete description of each alternative is found in Chapter 2.

This chapter presents the scientific and analytic basis for the comparison of alternatives. The effects are discussed in terms of social and environmental changes from the current condition and include quantitative assessments where possible as well as qualitative assessments. All discussions are tiered to the 1990 Umpqua National Forest Final Environmental Impact Statement, as amended. In addition, many of the discussions in this chapter utilize the information found in supporting documents such as the 1996 Upper Clearwater and 1998 Lemolo Lake/Diamond Lake Watershed Analyses and the 2008 Vegetation Management Plan/Watershed Analysis (WA) iteration. This chapter also incorporates by reference all reports and analysis prepared by resource specialists, which are summarized in this chapter.

ACTIVITIES THAT MAY CONTRIBUTE TO CUMULATIVE EFFECTS

Tables 12-14 document the relevant past, present, and reasonably foreseeable activities that may contribute to cumulative effects for the D-Bug project. The Council on Environmental Quality issued a memo stating that agencies are not required to “catalogue or exhaustively list and analyze all individual past actions” (CEQ memo, June 24, 2005). Instead, agencies should use scoping to focus on relevant past actions and discuss their relevance in terms of the cause and effect they had on a resource. This direction is followed in the D-Bug project; the following tables are displayed to summarize information known about the area. Discussion of these activities occurs throughout this chapter, where relevant. Potential cumulative effects are analyzed by considering the proposed activities in the context of past, present, and reasonably foreseeable actions.

For this project activities are considered in the entire Diamond Lake and Lemolo Lake Fifth Field Watersheds⁸ and in the Clearwater River Headwaters and Stump Lake Sixth

⁸ A watershed refers to a land and water area that has all the surface drainage within its boundary converging to a single point. A fifth field watershed refers to a large area ranging in size from 40,000 to 250,000 acres that encompasses multiple smaller subwatersheds; i.e. the Diamond Lake Fifth field watershed encompasses 3 subwatersheds.

Field Subwatersheds⁹ of the Clearwater River Fifth Field Watershed. These are the areas where cumulative effects may occur as a result of this project.

The following relevant¹⁰ past management activities have occurred in the cumulative effects analysis area (Table 12).

Table 12. Past Management Activities in the Cumulative Effects Analysis Area.

Activity	Time Period	Location (5 th , 6 th Field)	Description and Extent of Activity
Recreational Use	1910 – Present	Diamond Lake Lemolo Lake Clearwater River	Recreational fishing began at Diamond Lake in 1910 when the Oregon Fish Commission began stocking with hatchery trout. The first roads were constructed in the area in the early 1920's and campgrounds were established; boat ramps were constructed and boat use occurred. Camping, hunting, hiking, and horseback riding were among the other early recreation uses at the lake. A history of recreation use over time is included in the Diamond Lake/Lemolo Lake Watershed Analysis (1998).
USFS Camps	1920 – 1965	Diamond Lake, Diamond Lake	Campgrounds were established and in use by 1920. Facilities eventually included developed campsites, pit/vault toilets, and potable water from springs.
Diamond Lake Shoreline Road	1922	Diamond Lake, Diamond Lake	A road was constructed around the north, west, and south shores of Diamond Lake. The road was completed in 1922 and graveled in 1928.
Diamond Lake Improvement Company	1922 – 1965	Diamond Lake, Diamond Lake	Special use permit issued to Diamond Lake Improvement Company to build a resort at the North end of Diamond Lake. The improvements consisted of a lodge, a store, and several tents.
Diamond Lake Recreation Cabins	1924 – present	Diamond Lake, Diamond Lake	Permits were issued between 1924 – mid-1950s for a total of 102 cabin sites and associated improvements.
North Umpqua Road Construction and Reconstruction	1939, 1964, 1977-1978	Diamond Lake, Lemolo Lake,	The original road connecting Roseburg and Diamond Lake was completed in 1939, based on an old Indian trail. The

⁹ Sixth field subwatersheds are subdivisions within large watersheds that generally range in size from 10,000 to 40,000 acres; i.e. Lake Creek is one subwatershed within the larger Diamond Lake watershed. Cumulative effects are analyzed at scales most appropriate for individual resources.

¹⁰ The Diamond Lake Restoration FEIS (USDA, Umpqua National Forest, 2004) contains a very thorough list of all past actions in the Diamond Lake and most of Lemolo Lake Watershed and is incorporated by reference; activities such as Federal Land Designation are included in that table, but are not referenced here.

Activity	Time Period	Location (5 th , 6 th Field)	Description and Extent of Activity
		Clearwater River	surface was originally dirt and rock.
Mechanical and Chemical Control of Tui Chub; Rotenone Treatment of Diamond Lake	1946 – 1955	Diamond Lake,	Seining and spot rotenone treatments of shallow water areas were implemented to reduce the chub population. Control activities were carried out annually and resulted in the removal of millions of tui chub. Physical improvements constructed in 1953 included a canal and a flow control structure. The rotenone treatment occurred in September 1954 and involved 100 tons of powder rotenone and 275 gallons of liquid rotenone. An estimated 32 million chub that totaled 400 tons were killed.
Fish Stocking, Diamond and Lemolo Lake	1910 – 2002 2007 to present	Diamond Lake, Lemolo Lake	Fish stocking occurred throughout the lakes with various species.
Road Construction (System Roads – all Maintenance Levels included in totals) ¹¹	1950 – 1959	Diamond Lake, Lemolo Lake, Clearwater River, Clearwater Headwaters Stump Lake	Road construction of system roads occurred as follows: Diamond Lake (entire 5 th field) – 9.7 miles; Lemolo Lake (entire 5 th field) – 6.15 miles; Clearwater River – 14.5 miles.
	1960 – 1969	Diamond Lake, Lemolo Lake, Clearwater River, Clearwater Headwaters Stump Lake	Road construction of system roads occurred as follows: Diamond Lake (entire 5 th field) – 21.6 miles; Lemolo Lake (entire 5 th field) – 53.3 miles; Clearwater River – 18.3 miles.
	1970 – 1979	Diamond Lake, Lemolo Lake, Clearwater River,	Road construction of system roads occurred as follows: Diamond Lake (entire 5 th field) – 6.1 miles; Lemolo Lake (entire 5 th field) – 22.3 miles; Clearwater River – 61.0 miles.

¹¹ Miles of system roads by maintenance level (ML) by watershed include: Diamond Lake – ML 1 – 2.3; ML 2 – 9.6; ML 3 – 8.3; ML 4 – 8.9; ML 5 – 21.1. Lemolo Lake – ML 1 – 42.8; ML 2 – 40.5; ML 3 – 9.9; ML 4 – 0.4; ML 5 – 20.8. Clearwater (only Clearwater Headwaters and Stump Lake) – ML 1 – 60.4; ML 2 – 39.4; ML 3 – 7.8; ML 4 – 0.2; ML 5 – 8.9. Maintenance level (ML) 1 roads are closed roads that are used intermittently and that may require basic custodial maintenance focused on the maintenance of drainage facilities and runoff patterns; ML 2 roads are open roads that are maintained to only accommodate high clearance vehicles; ML 3 roads are open roads that are maintained for travel by a standard passenger cars; and ML 4 roads are maintained to provide a moderate degree of user comfort and convenience at moderate travel speeds; ML 5 roads maintained for a high degree of user comfort and are designed for higher travel speeds, such as Highway 138.

Activity	Time Period	Location (5 th , 6 th Field)	Description and Extent of Activity
		Stump Lake	
	1980 – 1989	Diamond Lake, Lemolo Lake, Clearwater River, Clearwater Headwaters Stump Lake	Road construction of system roads occurred as follows: Diamond Lake (entire 5 th field) – 0.3 miles; Lemolo Lake (entire 5 th field) – 29.9 miles; Clearwater River – 8.5 miles
	1990 – 1999	Lemolo Lake, Clearwater River, Clearwater Headwaters Stump Lake	Road construction of system roads occurred as follows: Lemolo Lake (entire 5 th field) – 0.66 miles; Clearwater River – 4.0 miles
	2000 – 2004	Lemolo Lake, Clearwater River, Clearwater Headwaters Stump Lake	Road construction of system roads occurred as follows: Lemolo Lake (entire 5 th field) – 0.67 miles; Clearwater River – 0.90 miles
Timber Harvest (regeneration harvest, shelterwood, final removal and commercial thin)	1950 – 1959	Lemolo Lake, Clearwater River	A total of 119 acres of regeneration harvest were completed in Lemolo Lake and 566 acres in Clearwater River. Associated activities included road building and slash treatment.
	1960 – 1969	Diamond Lake, Lemolo Lake Clearwater River	A total of 35 acres of regeneration harvest were completed in Diamond Lake; 896 acres in Lemolo Lake, and 1007 acres in Clearwater River. Associated activities included road building and slash treatment.
	1970 – 1979	Diamond Lake, Lemolo Lake, Clearwater River	A total of 35 acres of regeneration harvest were completed in Diamond Lake; 852 acres in Lemolo Lake, and 1378 acres in Clearwater River. Associated activities included road building and slash treatment.
	1980 – 1989	Diamond Lake, Lemolo Lake, Clearwater River	A total of 130 acres of regeneration harvest were completed in Diamond Lake; 1144 acres in Lemolo Lake, and 2501 acres in Clearwater River. Associated activities included road building and slash treatment.
	1990 – 1999	Lemolo Lake, Clearwater River	A total of 1623 acres of regeneration harvest were completed in Lemolo Lake, and 652 acres in Clearwater River. Associated activities included road building and slash treatment.

Activity	Time Period	Location (5 th , 6 th Field)	Description and Extent of Activity
	2000 – 2008	Clearwater River	A total of 432 acres of regeneration harvest were completed in Clearwater River. Associated activities included road building and slash treatment.
Special Use Permits and Water Rights	1922 – present	Diamond Lake, Lemolo Lake	Special use permits issued by the USFS for Diamond Lake Resort, Lemolo Lake Resort, and the Diamond Lake RV Park. Water rights also obtained.
Burning	1950's to present	Lemolo Lake, Clearwater River	Burning occurred throughout the Lemolo and Clearwater Watersheds as follows: 1950's – 444 acres; 1960's – 904 acres; 1970's – 946 acres; 1980's – 725 acres; 1990's – 453 acres; 2000's – 647 acres.
Pre-commercial Thinning	1960's to present	Lemolo Lake, Clearwater River	Pre-commercial thinning occurred throughout the Lemolo and Clearwater Watersheds as follows: 1960's – 21 acres; 1970's – 13 acres; 1980's – 1,628 acres; 1990's – 259 acres; 2000's – 42 acres.
Animal Damage Control	1960's to present	Lemolo Lake, Clearwater River	Animal Damage Control occurred throughout the Lemolo and Clearwater Watersheds as follows: 1960's – 637 acres; 1970's – 9 acres; 1980's – 696 acres; 1990's – 1,060 acres; 2000's – 526 acres.
Pesticide Use for Mosquito Abatement	Mid-1960s – 1982	Diamond Lake 5 th Field in its entirety	Douglas County officials, permittees, and later the USFS used malathion and MLO-FLIT for mosquito abatement in the Diamond Lake area. Chemicals were applied to South Shore Marsh and to areas around the lakeshore.
Diamond Lake Area Improvements	1968 – 1972 Mid 1980's to early 1990's	Diamond Lake	Major water and sewer facilities were constructed to reduce water quality impacts to Diamond Lake in the late 1960's. In the 1980's, other improvements were made including construction of the paved Dellenback Bike Trail.
Hazard Tree Falling	1970's – Present	Diamond Lake, Lemolo Lake, Clearwater River	Hazard tree falling around roads and campgrounds has occurred over the past 30+ years.
Herbicide Use for Road Maintenance	1980 – 1983	Diamond Lake,	Herbicides were used by Douglas County officials along Highway 138 to

Activity	Time Period	Location (5th, 6th Field)	Description and Extent of Activity
Purposes		Diamond Lake East Diamond Lake South	clear vegetation from road shoulders. Chemicals used included Cimizine, 2, 4 Dichlorophenol, and Trichlopyr.
Snowcat Skiing	1981 – present	Diamond Lake, Diamond Lake West Silent Creek	A snowcat skiing operation was created to offer expert skiers a backcountry skiing experience.
Lemolo Fuels Reduction Project	1998 – 2002	Lemolo Lake, Calamut Lake Lake Creek Poole Creek	A fuels reduction project was completed by the Diamond Lake RD Fire Staff. A total of 1,432 acres were treated on Bunker Hill and along roads #2610, 2614, 2612, and 60.
Diamond Lake Fuels Reduction Project (Phase I and II)	1998 – 2002	Diamond Lake, Diamond Lake	Fuels reduction projects completed by the Diamond Lake RD Fire Staff. A total of 876 acres were treated in the vicinity of Diamond Lake, mostly focusing around the campgrounds, the Lodge, the RV Park, and Summer Homes.
Fire Camp Improvements	2002-2003	Diamond Lake, Diamond Lake South	Improvements were made to the Broken Arrow Campground Overflow Area to provide a site for expanded fire camps. Improvements included rocking existing roads, spreading woodchips on high use areas, and clearing areas for parking. The fire camp area was used for the Kelsay Fire in 2003.
Diamond Lake drawdown, fish netting, and rotenone treatment; fish restocking	2005 – 2006 2007 - 2008	Diamond Lake, Diamond Lake	Drawdown of the lake by about 8 feet to prepare for rotenone treatment to remove tui chub from the lake. Other connected actions included removing debris from the boat docks, temporary boat dock construction and other activities as described in the Diamond Lake FEIS. In July of 2006, contract netters removed thousands of fish from Diamond Lake. In the fall of 2006, Diamond Lake was treated with rotenone to kill all fish. The lake was then refilled that winter and fish were restocked in 2007/2008
Lemolo Watersheds Project	2006 – Present	Lemolo Lake, Lake Creek, Calamut Creek	The Lemolo Watershed Projects involved several timber sales and associated road building and restoration.
Diamond Lake	2005 - 2007	Diamond Lake,	A Scenic Byway Enhancement Project was constructed to give visitors a place

Activity	Time Period	Location (5 th , 6 th Field)	Description and Extent of Activity
Viewpoint		Diamond Lake East	to enjoy the scenery and rest, picnic, etc.

There are multiple ongoing activities that may contribute to cumulative effects for the D-Bug Hazardous Fuels Reduction Timber Sale Project. Table 13 displays relevant present activities within the cumulative effects analysis area.

Table 13. Present Management Activities in the Cumulative Effects Analysis Area.

Activity	Location (5 th , 6 th Field)	Description and Extent of Activity
Diamond Lake Fuels Reduction Project (Phase II)	Diamond Lake, Diamond Lake	An ongoing fuels reduction project is being completed by the Diamond Lake RD Fire Staff. The project will total 876 acres of treatment in the vicinity of Diamond Lake, mostly focusing around the campgrounds, the Lodge, the RV Park, and Summer Homes. Some of this planned work will be replaced with treatments under the D-Bug project.
Diamond Lake Paving Project (Phase II)	Diamond Lake, Diamond Lake South Silent Creek Lemolo Lake, Lake Creek	A paving overlay is planned for the south end of the Diamond Lake Loop Road and at the Lake Creek crossing.
Fish Stocking, Diamond and Lemolo Lake	Diamond Lake Lemolo Lake	Done annually by ODFW
Hydrologic and Fishery Monitoring	Diamond Lake, Diamond Lake Lemolo Lake, Lake Creek	ODF&W is monitoring the Diamond Lake fishery; water quality monitoring continues throughout the watersheds.
Hazard Tree Removal	Diamond Lake and Lemolo Lake 5 th Field Watersheds in their entirety	A Title II (PAYCO) funded project is being implemented. This project removes approximately 2,000 trees in the Diamond Lake area. Hazard trees will continue to be removed from areas of high recreational use and when localized events (blowdown, bug kill, fire, etc.) require tree removal for safety and/or structure protection purposes.
Herbicide Use for Noxious Weeds	Diamond Lake, Diamond Lake East Diamond Lake South Lemolo Lake,	The herbicide Picloram is being used by the Oregon Department of Agriculture along roadsides to control spotted and diffuse knapweed populations. Picloram is spot-sprayed on individual plants or groups of plants.

Activity	Location (5 th , 6 th Field)	Description and Extent of Activity
	Lake Creek Poole Creek	
Lemolo Lake Fuels Reduction Project	Lemolo Lake, Calamut Lake, Lake Creek, Poole Creek	An ongoing fuels reduction project is being completed by the Diamond Lake RD Fire Staff. The project totals 1,432 acres of treatment on Bunker Hill and along roads #2610, 2614, 2612, and 60.
Maintenance Activities	Diamond Lake, Lemolo Lake, and Clearwater River 5 th Field Watersheds in their entirety	Maintenance activities are ongoing. Maintenance is required for trails, roads, culverts, buildings, water and sewer systems, campground facilities, and signs.
PacifiCorp Operations	Lemolo Lake, Poole Creek	Lemolo 1 project is a portion of the North Umpqua Hydroelectric Project. Physical project structures include Lemolo Dam, Lemolo Reservoir (454 acres), 16,705 feet of waterways (canals), 7328 feet of penstock, a power plant, and a substation. Associated improvements include maintenance/access roads and transmission/distribution lines.
Recreational Use and Continuance of Special Use Permits	Diamond Lake, Lemolo Lake, and Clearwater River 5 th Field Watersheds in their entirety	Recreational use in the area is down from historic levels, but is the highest on the Umpqua National Forest and is improving since the 2006 rotenone treatment. USFS campgrounds, Diamond Lake Resort, Diamond Lake RV Park, and the Summer Homes have a total capacity of 780 available units. The most common recreational activities include sightseeing, hiking, camping, fishing, bicycling, boating, swimming, hunting, backcountry skiing, and snowmobiling. Snowcat skiing continues.

Reasonably foreseeable actions in the analysis area can also contribute to cumulative effects (Table 14). No private land is located in the Diamond Lake, Lemolo Lake or Clearwater Watersheds. For the Umpqua National Forest, the following activities are likely to occur over the next five years.

Table 14. Reasonably Foreseeable Management Activities in the Cumulative Effects Analysis Area.

Activity	Time Period	Location (5 th , 6 th Field)	Description and Extent of Activity
Campground Improvements	2008 on	Diamond Lake and Lemolo Lake 5 th Field Watersheds in their entirety	Campground improvements will be made as funding from PAYCO, Fee Demo, PacifiCorp, and other sources becomes available. The area occupied by the current facilities will not increase as a result of improvements.

Activity	Time Period	Location (5 th , 6 th Field)	Description and Extent of Activity
Diamond Lake Fuels Reduction Project (Phase II)	2008 – 2010	Diamond Lake, Diamond Lake	Completion of the Diamond Lake Fuels Reduction Project (Phase II).
Fire Camp	2008 on	Diamond Lake, Diamond Lake South	The recently improved South Diamond Firecamp (located south of Broken Arrow Campground) will be used if large fires occur in the area and extensive suppression efforts are applied.
Fishery and Water Quality Monitoring	2008 on	Diamond Lake, Diamond Lake Lemolo Lake, Lake Creek	ODF&W will continue to monitor the Diamond Lake fishery; water quality will continue to be monitored.
Fish Stocking, Diamond Lake	2008 on	Diamond Lake, Diamond Lake	Fish stocking activities will continue at Diamond Lake.
Fish Stocking, Lemolo Lake	2008 on	Lemolo Lake, Calamut Lake Lake Creek Poole Creek	Fish stocking will continue with rainbow trout hatchery catchables, as needed, to provide a recreational fishery during the mid-summer months when brown trout are hard to catch.
Hazard Tree Removal	2008 on	Diamond Lake and Lemolo Lake 5 th Field Watersheds in their entirety	Hazard trees will continue to be removed in the future from areas of high recreational use and when localized events (blowdown, bug kill, fire, etc.) require tree removal for safety and/or structure protection purposes.
Herbicide Use for Noxious Weeds	2008 on	Diamond Lake, Diamond Lake East Diamond Lake South Lemolo Lake, Lake Creek Poole Creek	Herbicides will continue to be used by the Oregon Department of Agriculture along roadsides to control spotted and diffuse knapweed populations. The chemical used in the past has been Picloram and has been spot-sprayed on individual plants or groups of plants.
Lemolo Watershed Project Activities	2008 – 2010	Lemolo Lake, Calamut Lake Lake Creek Poole Creek	The Lemolo Watershed Projects involved several timber sales and associated road building and restoration. This project will continue to be implemented.
Maintenance Activities	2008 on	Diamond Lake and Lemolo Lake 5 th Field Watersheds in their	Maintenance activities will continue at current levels. Maintenance activities include trails, roads, culverts,

Activity	Time Period	Location (5 th , 6 th Field)	Description and Extent of Activity
		entirety	buildings, water & sewer systems, campground facilities, and signs.
PacifiCorp Operations	2008 on	Lemolo Lake; Other watersheds throughout the district	Lemolo 1 project is a portion of the North Umpqua Hydroelectric Project. Physical project structures include Lemolo Dam, Lemolo Reservoir (454 acres), 16,705 feet of waterways (canals), 7328 feet of penstock, a power plant, and a substation. Associated improvements include maintenance/access roads and transmission/ distribution lines. Hazard tree falling will continue. In addition, mitigation fund projects will continue to be planned and implemented.
Recreational Use and SUP Continuance	2008 on	Diamond Lake and Lemolo Lake 5 th Field Watersheds in their entirety	Recreational use in the area is likely to continue at or above current levels, which is the highest on the Umpqua National Forest. The most common recreational activities include sightseeing, hiking, camping, fishing, bicycling, boating, swimming, hunting, backcountry skiing, and snowmobiling. Snowcat skiing continues.
Water Rights	2008 on	Diamond Lake, Diamond Lake Lemolo Lake, Lake Creek Unnamed springs	Water rights issued in the past will continue to be utilized.
Diamond Lake Restoration Project Specific Monitoring Activities	Till 2011	Diamond Lake and Lemolo Lake 5 th Field Watersheds	Appendix BB of the Diamond Lake Restoration Project FEIS provides a detailed description of monitoring activities that would occur in association with Alternative 5 of the FEIS.
Winter Snowparks	2008 - 2010	Diamond Lake	Two Snowparks will be improved – Cinnamon Butte (located immediately off of Highway 138 at the junction of Road 4793) and Three Lakes (located off of Highway 230 off of the 3703 road).
North Umpqua Highway Reconstruction	2009-2010 (+)	Clearwater River	ODOT and Federal Highways are reconstructing Hwy 138 from milepost 52.8 to milepost 67.2.

Terrestrial Environment

A detailed description of the terrestrial environment can be found in the 2008 Vegetation Management Plan and Watershed Analysis Iteration for Diamond and Lemolo Lakes (USDA, Umpqua National Forest, 2008). Site-specific field work and analysis for this project produced additional information, which is provided in the following sections.

Two spatial scales are used in many of the following discussions: (1) the landscape-scale; and, (2) the stand-scale. The landscape-scale focuses on larger-scale conditions such as forest vegetation patterns as seen from an airplane over 1000's of acres. Satellite imagery and landtype maps were used to characterize vegetation and landforms at the landscape scale. The stand-scale refers to areas of from 20 to 100's of acres in size. Stand exams and other field data were used to characterize stand-scale vegetation conditions. Existing and future conditions were quantified and modeled using this stand exam data and the Forest Vegetation Simulator Model (Dixon 2003) and Fire and Fuels Extension to the Forest Vegetation Simulator Model (Reinhardt and Crookston 2003).

FOREST VEGETATION - TRACKED AS A SIGNIFICANT ISSUE

During scoping, issues were raised about the extent and intensity of treatments in mature lodgepole pine stands. Several conservation groups expressed concern over the size of the harvest units and the intensity of the heavy thinning, which they state would result in impacts to habitat for wildlife species. This significant issue was addressed with the development of Alternative 3. It is tracked by acres of lodgepole pine harvested with 20 large¹² trees per acre (TPA) retained and acres of lodgepole thinning with an average of 40 large TPA retained (Table 11).

On the other hand, several members of the public believe the proposed action would not do enough to reduce the bark beetle infestation because not enough acres are proposed for treatment, and they believe that leaving too many trees that may eventually die would contribute to fuel loads and reduce the economic efficiency of the project. This significant issue, Issue 6 in Chapter 2, was addressed with the development of Alternative 4, and is tracked by total acres of lodgepole pine commercially thinned south of Highway 230 (Table 11). The effects of the extent and intensity of thinning for all action alternatives are disclosed in this section. The scientific controversy surrounding the use of thinning to prevent and suppress a mountain pine beetle epidemic is also discussed in this section.

The stands proposed for treatment occupy four distinct forest types (Figure 11 and Table 15):

- 1) Lodgepole pine, a cool/dry forest with both an overstory and understory that is dominated by lodgepole pine.
- 2) High-elevation mixed conifer, a cool/dry forest dominated by mountain hemlock and Shasta red fir.
- 3) Low-elevation mixed conifer, a warm/dry forest dominated by white fir and Douglas-fir.

¹² Large trees are defined here as those 5 inches or larger.

- 4) Lodgepole / mixed conifer, low and high elevation sites that are pine-dominated today and have a mixed conifer understory.

The proposed commercial thinning units are mostly stem exclusion/mature stands of lodgepole pine and mixed conifer. There are scattered western white pine, Pacific silver fir and, to a lesser extent, sub-alpine fir at higher elevations and Douglas-fir, white fir and western hemlock at elevations below 4,500 feet. Englemann spruce is present in riparian areas. Ponderosa pine is present in a few low-elevation, dry sites on south-facing slopes. The shrub layer in low-elevation, mixed conifer stands, where present, is dominated by Pacific rhododendron and vine maple.

Forest age-classes that develop following wildfire or clearcutting are used to characterize forest conditions (Figures 12 and 13)¹³:

- 1) Early seral - New stand with an open canopy. Stand age is generally less than 30 years, but can be older, especially in the high-elevation, cold/dry sites where canopy closure is delayed 10 to 20 years on the average.
- 2) Stem exclusion - Stand where new species do not appear and some present species are dying from competition. Stand age is generally from 40 to over 100 years, the average tree diameter is about 10" diameter at breast height (DBH¹⁴) and canopy closure is ≥53%.
- 3) Mature - Stand where trees reach their maximum height potential. Stand age is generally from 80 to 150 years, the average tree diameter is 10 to 19" DBH and canopy closure is ≥53%. It includes the "understory re-initiation stage" where the understory develops in response to small openings in the canopy (Oliver and Larson, 1990) and the "transition stage" defined in the Northwest Forest Plan as transitioning toward late seral.
- 4) Late seral - Stand with overstory trees dying in an irregular fashion and understory trees are filling the gaps. Stand age is generally greater than 150 years, the average tree diameter is ≥20" DBH in low-elevation, mixed conifer stands and conifer canopy closure is ≥70%. Late seral includes the "shifting gap" stage as defined in the NWFP (USDA/USDI 1994).

2008 Diamond Lake/Lemolo Lake Vegetation Management Plan and Watershed Analysis Iteration – Recommendations

Several desired conditions and recommendations helped craft the D-Bug proposal (USDA, Umpqua National Forest, 2008):

- Community Wildfire Protection – implement fuel reduction treatments in Wildland Urban Interface areas. Thin overly dense stands near special use sites in collaboration with permittee holders.
- Desired stand structure in mature lodgepole pine – where lodgepole pines exist with live crowns sufficient to respond to thinning, use thinning and overstory

¹³ These forest age-classes were developed to model an even-age succession stage in mixed conifer forests. Applying this classification to the lodgepole forest in the high Cascades is problematic for the following three reasons: 1) the stem exclusion stage is often very long and dominance is not well expressed: 2) mature stage is often shortened because lodgepole is not long-lived: 3) the mature stage often has a mean diameter less than 10" and many mature stands are thus classified by satellite imagery as the stem exclusion stage in the current age class distribution for the D-Bug Planning Area (Figure 12).

¹⁴ Diameter at Breast Height (DBH) – tree diameter at 4½ feet above ground level.

removal to create a mosaic of variable density tree retention to reduce susceptibility to mountain pine beetle attacks.

- Desired stand structure in 30 to 80 year-old lodgepole pine (stem exclusion) – reduce density in a cost-effective manner to increase individual tree growth and lower fire hazard.
- Desired stand structure in mixed conifer and lodgepole pine/mixed conifer types – use density and fuel reduction treatments to improve resiliency to stand replacement fire effects. Release mature ponderosa pines and western white pines from competition with subordinate trees.
- Vegetation management in high use areas – remove existing and future hazard trees around high use developments. Some hazard trees would be left and/or aggregated in suitable locations around recreation sites to enable watchable wildlife for visitors.
- Bald Eagle habitat - use uneven-age management with preference for ponderosa pine, Douglas-fir and Shasta red fir to perpetuate nesting and foraging habitat in old growth mixed conifer stands that currently provide these habitats.

Existing and Desired Landscape Conditions

From a landscape-scale perspective, the current age-class distribution varies by forest type (Figures 12 and 13). In mixed conifer, the mature and late-seral age classes occupy approximately 70% of D-Bug Planning Area landscape based upon 1998 satellite imagery. Over 60% of lodgepole forest is stem exclusion and mature stands that are mostly 80 to 120 year-old, even-age stands. The early-seral lodgepole forest represents 30-40 year-old clear-cuts and patches of unmanaged lodgepole stands that regenerated after a mountain pine beetle epidemic in the 1970's. The abundance of the stem exclusion and mature lodgepole reflects the pattern established by 19th and early 20th century, stand-replacement fires. The action alternatives propose commercial thinning in the stem exclusion, mature and late-seral stages and non-commercial thinning in the early seral and stem exclusion stages.

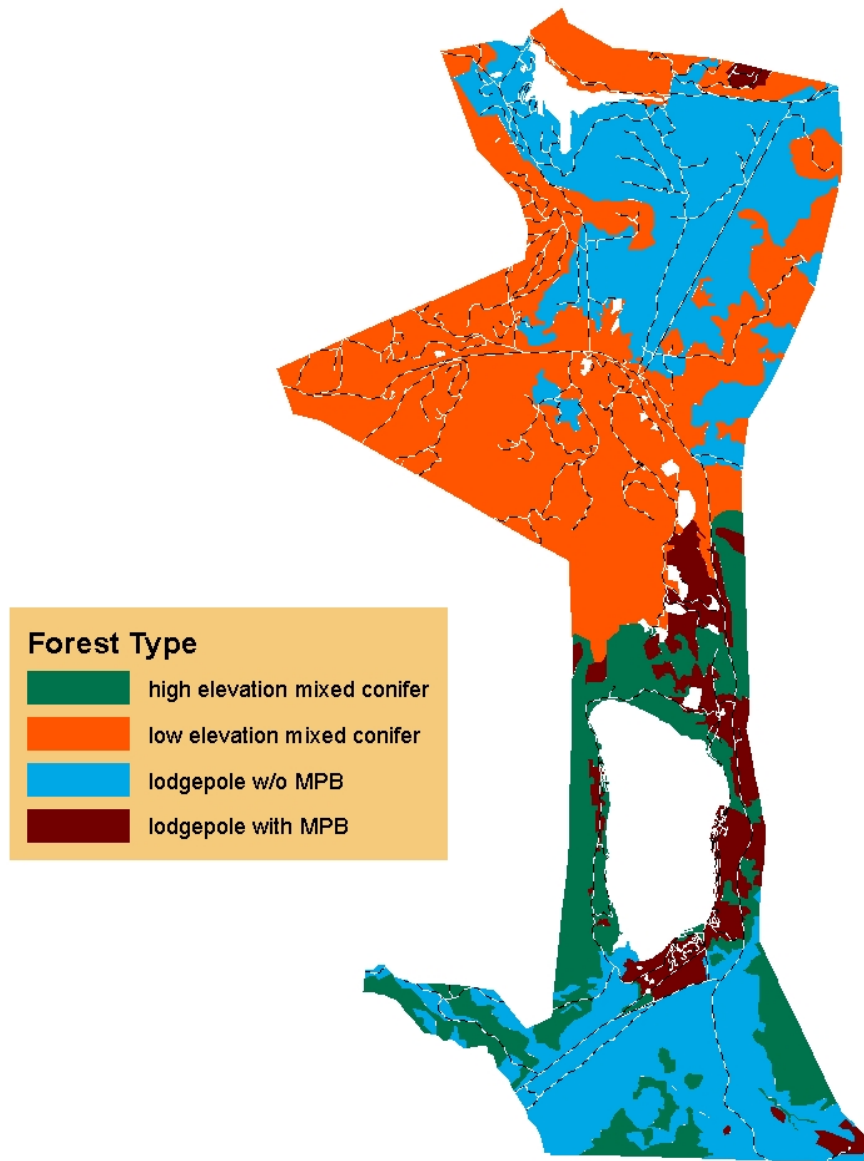


Figure 11. Forest type map for the D-Bug Planning Area. The lodgepole pine type is split into stands where recent mountain pine beetle activity has been observed (lodgepole with MPB) and those stands without recent MPB activity (lodgepole w/o MPB).

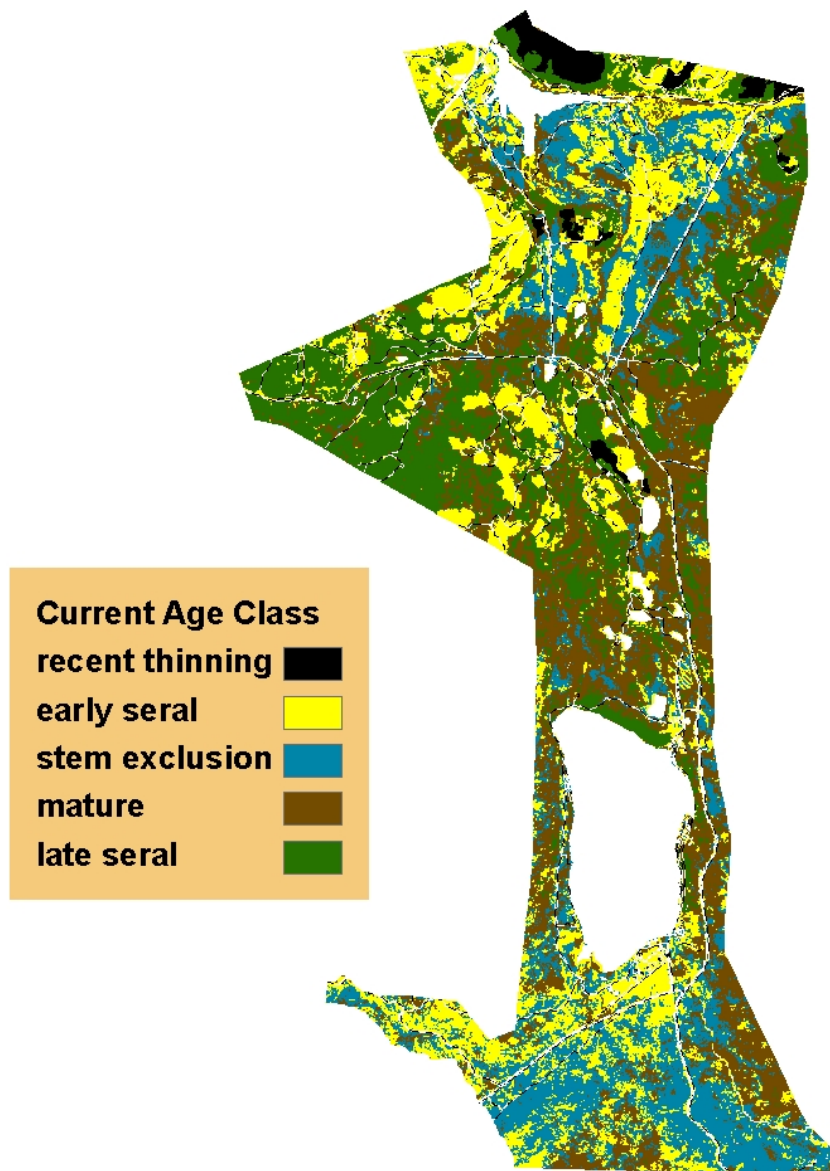


Figure 12. Current age class distribution for the D-Bug Planning Area. Most mature lodgepole stands are classified as the stem exclusion stage because of the small average diameter of lodgepole at maturity.

Today's landscape vegetation patterns reflect the following forest structure characteristics and related disturbance processes:

- 1) The full range of fire severity regimes exist within the 42,000 acre planning area:

- a. low severity - low elevation mixed conifer type with ponderosa pine present and a 10 to 40-year average fire return interval.
 - b. moderate severity - low elevation mixed conifer and high elevation Shasta red fir types with 40-70 year average fire return intervals.
 - c. high severity - high elevation lodgepole and mountain hemlock types with 60-80+ year average fire return interval.
- 2) The occurrence of even-age lodgepole pine stands represent past high severity fires that typically occurs on an interval of 60 to 80 years or more and replaces the entire stands with high intensity fire.
 - 3) Cold air drainage and periodic stand-replacement fire maintains the pure lodgepole forest type in valley bottoms and on flats.
 - 4) Uneven-age late-seral Shasta red fir stands are least likely to burn with high severity today and have been least affected by fire exclusion because of the long fire-return interval characteristic of high elevations.
 - 5) Uneven-age late-seral white fir/Douglas-fir stands with ponderosa pine have been most affected by fire exclusion and are more likely to burn with high severity today because of fuel buildups.
 - 6) The presence of all ages of ponderosa pine in stands on south-facing slopes indicates that they were open, mixed conifer stands historically. The dense growth of shade-tolerant firs under these pines, an effect of fire exclusion, represents substantial risk to these forest habitats.

The uniform structure and expanse of the even-age lodgepole pine stands in today's landscape and the density of trees in mixed conifer types indicate a departure from the historic conditions, particularly in the unmanaged forest at low elevations. The entire landscape also lacks both the structural diversity and the openings consistence with natural disturbance processes.

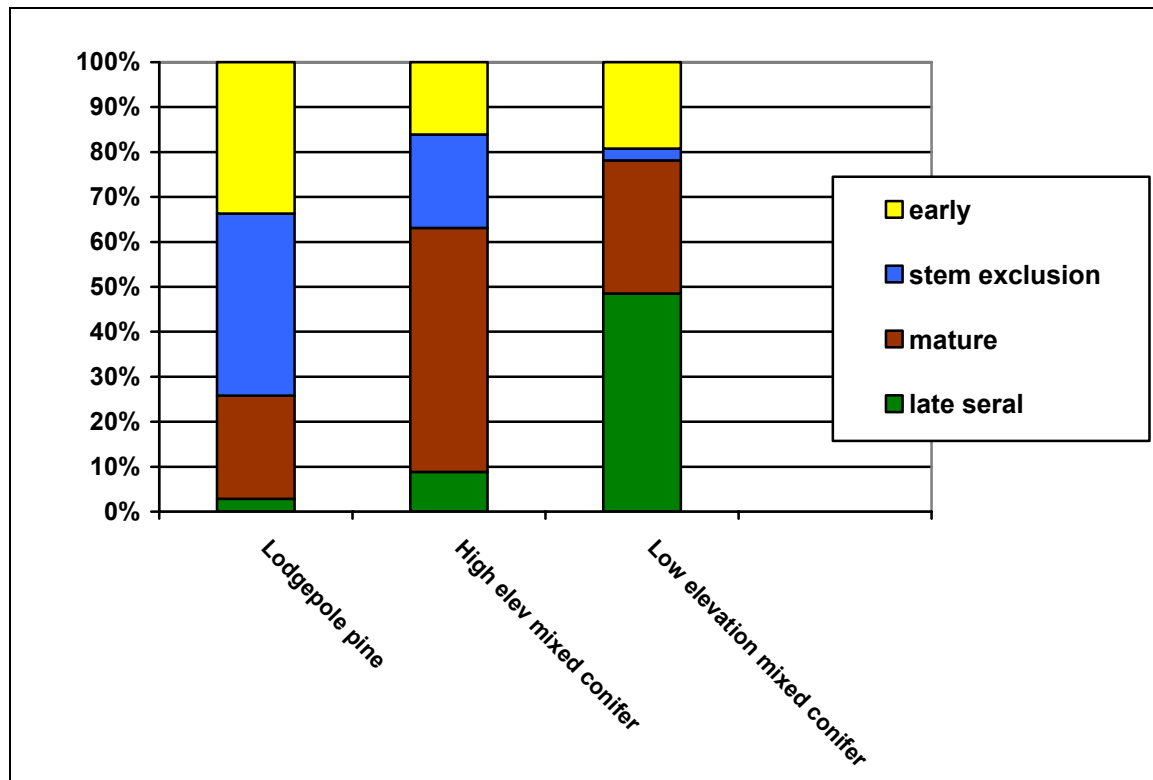


Figure 13. Distribution of current age classes by forest type in the D-Bug Planning Area.

The desired landscape condition would maintain large patches¹⁵ of four age-class structures by treating large areas of today's landscape. Within stands, the desired conditions would create a diversity of stand structure and fuels by using variable-density tree retention and by creating a mosaic of fuel reduction zones. In high severity regimes at high elevations, desired patch sizes would be large to approximate historic fire disturbance that covered thousands of acres. In low to moderate severity fire regimes, the desired vegetation pattern would be more variable and would be consistent with partial stand replacement fire effects. Historically, moderate severity fires produced a complex pattern of openings, and fire events typically killed 40 to 70 percent of the living trees in a stand. Where fires burned with low severity, historically on south aspects at low elevation, the desired conditions would maintain open, mature and late-seral stands with large, fire resistant trees such as ponderosa pine.

Existing and Desired Stand Conditions

In general, the stands proposed for commercial thinning are mostly unmanaged, even-age, stem exclusion stands of lodgepole pine and mature/late seral mixed conifer stands. The lodgepole pine stands originated after stand replacement fires in the late 1800s and early 1900s. Late-seral mixed conifer stands contain older trees that survived the fires of that era.

Stands proposed for non-commercial thinning are both managed and unmanaged. They include lodgepole pine plantations that originated as clearcuts in the 1970s and 80s. The proposed unmanaged non-commercial treatments also include small-diameter stands in

¹⁵ Landscape patches are contiguous areas of vegetation of the same age class, structure, and forest type.

both lodgepole pine and lodgepole/mixed conifer types. Many stands of the latter type have an unmerchantable overstory of both mature and dead lodgepole pine and an understory of dense, small-diameter conifers.

Forest types differ mostly with respect to species composition and site productivity (Table 15). High elevation stands are less productive because they are colder, and the poorest sites align with the pattern of cold air drainage. These cold flats are dominated by lodgepole pine. The high elevation mixed conifer stands that occupy the slopes above 5,000' are dominated by Shasta red fir and mountain hemlock. The low elevation mixed conifer below 5,000' is dominated by white fir and Douglas-fir. Many mixed conifer sites at both low and high elevations are dominated today by lodgepole pine, the pioneer tree after stand replacement fire. Today these pine stands have a dense understory of conifers.

Table 15. Stand summary for proposed D-Bug treatment units under Alternative 4. Alternative 4 is displayed as it contains the most units and represents the maximum treatment.

Unit(s)	Forest Type	Potential vegetation ¹⁶	Trees ¹⁷	Elevation (feet)	Site class ¹⁸
23-30, 32-37, 42, 43, 45-47, 57, 58, 62-74, 77-79, 87, 88, 99, 127, 134-143, 148-151, 153-155, 159, 165-173, 175, 177-179, 184-192, 195-197, 200, 201, 205-216, 223-246	Lodgepole	Lodgepole pine-Mountain Hemlock depauperate	LP, MH, SRF, WWP	4,000 to 6,000	LP - 40 MH - 80 SRF - 85

¹⁶ Potential vegetation is named for the most shade tolerant tree species on the site that would dominate the stand in the absence of disturbance over a long period of time. Groups of the most commonly occurring Plant Associations in proposed harvest units are listed in order of abundance.

¹⁷ Tree species codes: DF = Douglas-fir, MH = mountain hemlock, WH = western hemlock, WF = white fir, WWP = western white pine, PP = ponderosa pine, SRF = Shasta red fir, PSF = Pacific silver fir. ES = Englemann spruce

¹⁸ Site class = 100-year tree height growth potential for Douglas-fir, white fir, mountain hemlock; 50-year tree height growth potential for lodgepole pine, Shasta red fir, western hemlock. The lodgepole pine site class of 40 for these stands is a conservative number used for modeling. Many lodgepole pine sites within the planning area have a site class of 50 or higher.

Unit(s)	Forest Type	Potential vegetation ¹⁶	Trees ¹⁷	Elevation (feet)	Site class ¹⁸
1, 4, 5, 11, 13, 14, 16-22, 40, 41, 44, 49, 51, 52, 59-61, 75, 76, 80, 85, 93, 95, 97, 105, 106, 108, 111, 112, 116, 119-121, 125, 130, 133, 146, 147, 152, 156, 164	Lodgepole / Mixed conifer	White fir- Shasta red fir / common prince's pine / threeleaf anemone & Mountain hemlock / grouse huckleberry / common prince's pine	LP, WF, MH, SRF, PSF, WWP, DF	4,000 to 6,000	LP - 45 MH - 80 SRF - 85 WF - 100 DF - 130
100-104, 107, 109, 110, 113-115, 117, 118, 122-124, 126, 128, 129, 131, 132, 144, 145, 157, 158, 160-163, 174, 198, 222	Low Elevation Mixed Conifer	White fir / rhododendron - Oregon grape	DF, WF, WH, SRF, PP, WWP	4,000 to 5,000	DF- 130 WF - 100 WH - 75
2, 3, 6-10, 12, 15, 31, 34, 38, 48, 50, 53, 55, 56, 81-84, 86, 89-94, 96, 98, 176, 193, 194, 199, 202-204	High Elevation Mixed Conifer	Shasta red fir – mountain hemlock / pinemat manzanita / common prince's pine & Mountain hemlock / grouse huckleberry / common prince's pine	LP, WF, MH, SRF, PSF, WWP, DF, ES	4,500 to 6,000	LP - 45 MH - 80 SRF - 85

Desired stand conditions would include more open canopies and larger, more fire-resilient trees such as Shasta red fir and Douglas-fir in the mixed conifer forest. The added light from thinning would accelerate tree growth and understory development.

Variable density thinning¹⁹ and individual tree release²⁰ combined with fuel treatments would restore open conditions in mixed conifer stands at lower elevation. These vegetation and fuel conditions are characteristic of a moderate severity fire regime. At higher elevations, moderate thinning²¹, individual tree release and fuel reduction in mixed conifer would be used to advance a more fire-resilient stand structure. In lodgepole pine stands, a heavy thinning²² and overstory removal is designed to reduce/prevent and suppress mountain pine beetle attacks. Variable density lodgepole thinning would also be used to achieve the desired within stand variability caused by the patchiness of mountain pine beetle mortality in unmanaged stands (British Columbia FPB, 2007). The various treatments would leave adequately stocked stands (Blackburn, 2008) that would help prevent major losses of dominant and co-dominant trees.

Twenty to thirty years hence, multi-age layered stand structures would result from the proposed treatments. Lodgepole pine sites would remain open longer than the more productive mixed conifer sites (Figure 14).

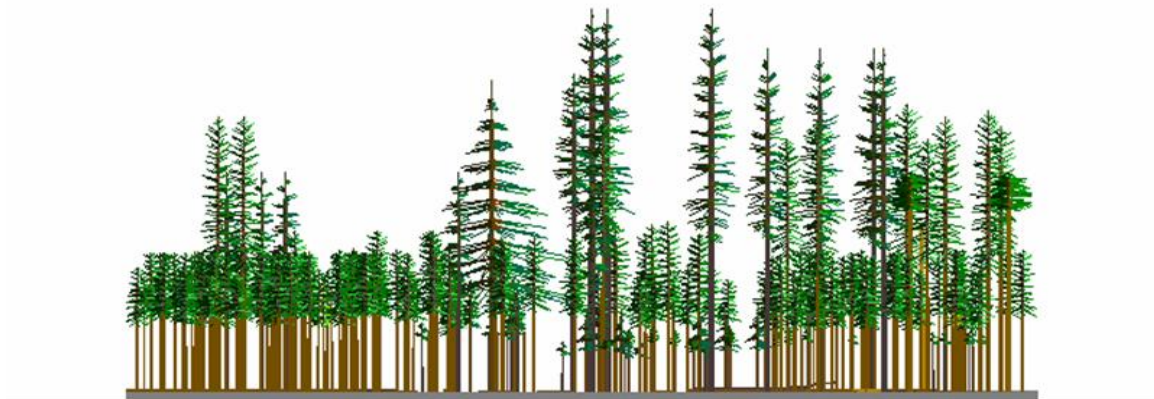


Figure 14. Desired Stand Conditions. Example of a multi-age, mixed conifer stand 30 years after thinning; this shows large overstory trees released by thinning and a layered understory that developed under an open canopy.

Proposed Thinning Treatments

Commercial and non-commercial thinning in uplands and portions of riparian reserves is proposed to meet the purpose and need (as described in Chapter 1), to achieve desired conditions (as described above), and to fulfill several watershed analysis recommendations (also summarized above). The emphasis with mixed conifer stands is to either advance the stem exclusion stage or maintain a mature stand structure, thus increasing fire resiliency. In lodgepole pine stands, the principal objectives would be to

¹⁹ Variable density thinning retains a range of tree sizes, and spacing between retained trees would range from 15 to 50 feet, equating to 194 to 20 residual overstory or midstory trees per acre.

²⁰ Individual tree release treatments would be used to remove competition around dominant, full crowned pines by cutting all small-diameter trees within a cutting radius of 20' to 50'.

²¹ Moderate thinning retains from 70 to 100 large trees per acre greater than 7 inches in diameter.

²² Heavy thinning retains 20 to 70 large trees per acre greater than 5 inches in diameter. Overstory removal retains 20 trees per acre greater than 5 inches in diameter in the midstory or overstory.

perpetuate uneven-age mature stands that may resist mountain pine beetle attacks and, in the event of a wildfire, to prevent crown fire behavior in roadside stands.

Two types of treatments are proposed in mixed conifer stands to reduce stand density and fuels (Table 16):

- 1) Thinning from below from diameter classes greater than 3" DBH (50 to 90 TPA greater than 7" retained);
- 2) Non-commercial overstory removal and precommercial thinning with mastication or hand piling.

Three types of treatments are proposed in lodgepole pine and lodgepole / mixed conifer stands to reduce density and to prevent the buildup of fuels (Table 16):

- 1) Proportional thinning of trees from diameter classes greater than 3" DBH (20 to 70 TPA greater than 5" retained);
- 2) Overstory removal of trees greater than 5" DBH (20 TPA greater than 5" retained) and;
- 3) Non-commercial overstory removal and small-tree thinning with mastication or hand piling.

A "no thin" prescription would apply to portions of pure lodgepole pine stands to avoid treating the less merchantable areas within stands, to achieve a variable stand density, and to meet "clumped" green-tree retention guidelines (USDA/USDI 1994, C-41).

The action alternatives include 200-300 acres of mixed conifer stands that qualify as nesting, roosting, and foraging habitat for Northern Spotted Owls. These acres would be thinned to maintain a 60% canopy closure to meet short-term habitat needs of the species. Elsewhere, a heavier thinning would occur in order to achieve more crown separation to lower the probability of stand replacement fire and meet the purpose and need.

Table 16. Four commercial and non-commercial treatment types proposed.

Treatment Type	Acres ²³			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Lodgepole Thinning	0	4,685	3,506	6,495
Lodgepole Overstory Removal	0	59	0	241
Mixed conifer Thinning	0	2,247	1,815	2,247
Non – commercial Thinning	0	2,013	1,407	2,213
No thin ²⁴	0	322	236	513

²³ Lodgepole thinning acreage is the sum of Prescriptions 2-4 (Chapter 2, Silvicultural Prescriptions by Alternative) minus no thin acres within stands where prescription 2 would apply. Lodgepole Overstory Removal is the sum of prescription 1 acres. Mixed Conifer Thinning is the sum of prescriptions 9-13 acres. Non-commercial thinning acreage is the sum of prescriptions 5-8 acres.

Scientific Controversy and Efficacy of Treatments

During scoping, conservation groups stated that there is scientific controversy surrounding the logging of lodgepole pine to prevent and suppress the mountain pine beetle outbreak and they requested consideration and disclosure of this controversy. At the center of this controversy are the conflicting perspectives on using active forest management versus allowing natural processes to proceed without management intervention. *Logging to Control Insects: the Science and Myths Behind Managing Forest Insect Pests* (Black, 2005) represents the following arguments in favor of allowing natural disturbance processes to occur without management:

- Management has detrimental impacts. Logging roads are vectors for invasive plants, cause fragmentation of existing forest habitat and allow the vehicle access that may harass wildlife. Logging damages residual trees that are intended to function as a future forest structure. Logging may have detrimental consequences to ecological relationships between lodgepole pine forests, mountain pine beetles, fire and fungi.
- There is little evidence that mountain pine beetle mortality contributes to higher fire hazard.
- There is little evidence that logging can control bark beetles once an outbreak has started.
- Drought and associated high-severity fire events are principal drivers of ecosystems affected by mountain pine beetle outbreaks. Management cannot alter or prevent the effects of wildfire under severe weather conditions.
- Management simplifies forest structure and complex wildlife habitats.

On the other hand, most research on the effects of thinning to prevent mountain pine beetle outbreaks demonstrates the potential benefits of reducing beetle mortality. In fact, the bulk of the literature cited by Black (2005) says that prevention of bark beetle attacks by thinning overly dense forest before, rather than after an outbreak has started is one of the best methods of reducing infestation and reducing mortality.

The following scientific principals were used to develop the proposed thinning prescriptions and the extent of their application in the D-Bug planning area:

- It is very probable that a high proportion of lodgepole pine stands in the D-Bug area will be infested within the next few years and result in as much as 90% mortality of the overstory pines (Goheen, 2008).
- Although likely effective at the stand level proposed in D-Bug, forest management is unlikely to prevent an outbreak, at a landscape scale, because of the extent of mature lodgepole forest that would be unmanaged surrounding the D-Bug planning area, the uncertainty of climatic effects on tree stress, and the ability of large numbers of insects to overcome healthy trees (Romme et al, 1986).
- Thinning may reduce tree-to-tree competition, increase tree vigor and thus reduce the frequency of mountain pine beetle attacks (Amman and Logan, 1998).

²⁴ No thin treatment represents 10% of stand area where no treatment areas would be located within prescriptions 1 and 2.

- Thinning to a wide spacing of 3 to 4 meters between residual trees may create the most favorable microclimate for “beetle-proofing” a stand (Whitehead and Russo, 2005).
- Thinning lodgepole pine stands may significantly reduce mortality compared to no treatment (Cole et al., 1983).
- Branch wood and needle distributions in dense, untreated lodgepole stands are concentrated in the upper half of the canopy compared to thinned stands. Thirty years after thinning, the fine fuels are more uniformly distributed from the surface to the upper canopy (Gary, 1978). Therefore, thinning is a good long-term strategy for reducing crown fire activity, especially if mortality is reduced by the treatment.
- A well-designed shaded fuelbreak will alter the behavior of wildland fire entering the fuel-altered zone (Agee et al, 2000).
- A multi-age, multi-size tree distribution is often the natural structural effect of mountain pine beetle activity in unmanaged, mature lodgepole stands (British Columbia FPB, 2007). Setting the stage for the development of a similar structure while removing trees to reduce fuel loading in the future are objectives for the proposed variable-density retention.

Also during scoping, concerns were raised regarding the regrowth of trees following the thinning and overstory removal treatment in lodgepole pine stands. One commenter was concerned that an overabundance of lodgepole pine would regenerate after the stands are treated with thinning or overstory removals while another was concerned that such treatments would lead to very poor regeneration of seedlings due to the low productivity of the soils, harvest impacts, and the climate, referencing data showing poor growth rates of nearby plantations in the planning area.

Both these commenters observed specific locations in the planning area where plantations are stocked with high seedling densities and extreme competition, resulting in slow growth. Previous treatments in the area lead to these conditions because most historic treatments were clearcuts that were also broadcast burned. As such, lodgepole regeneration was stimulated by the broadcast burning, leading to densely stocked plantations. These concerns are addressed in the action alternatives where no burning would occur in any lodgepole pine units. Instead, under the D-Bug action alternatives, the lodgepole treatments would receive only mechanical fuel removal instead of using fire to remove activity fuels. Moreover, the lodgepole treatments in the action alternatives, including areas of overstory removal that leave as little as 20 trees per acre, would maintain both an overstory and an existing mid and understory that would retard the propensity of lodgepole pine to densely stock the understory. This phenomenon is born out in lodgepole stands in the planning area that were thinned over 30 years ago south of Highway 230. The established residual leave trees more effectively compete for available soil moisture keeping new understory seedlings from overstocking the area. As such, the advanced regeneration already present in these overstory removal areas would remain largely intact (except where it is lost in skid trails which is estimated to be less than 30% of a treatment area), and the areas would not function as clearcuts. The retention of live overstory, mid story, and understory trees in these overstory removal areas does not represent a regeneration harvest nor would they function as such. Post-treatment stands would remain stocked to meet management guidelines necessary to prevent major losses of dominant and co-dominant trees (Blackburn 2008), and future stand development would proceed with larger-sized trees,

fuller crowns, and higher growth rates than some of the overstocked historic clearcuts in the planning area.

Direct and Indirect Effects

Direct effects are those that are triggered immediately as a result of implementation at the stand scale. Indirect effects are those that would occur within the treatment areas and at the landscape-scale over a period of 3 to 5 decades (Table 17). Canopy closures, tree numbers and sizes were estimated using a stand growth-and-yield model (Dixon, 2003). Average canopy closures are grouped by the forest types and projected over a 30-year period, the likely maintenance interval for proposed shaded fuelbreaks (Figure 15).

Table 17. Summary of Direct and Indirect Effects to Vegetation.

Treatment	Vegetation Change	Primary Effect (Beneficial/ Adverse)	Duration (yrs)	Treatment Acres by Alternative			
				1	2	3	4
Commercial Thinning	Lower stand densities & canopy closure / variable stand density and tree sizes retained	Beneficial-- maintain species diversity, increase fire-resistant species, reduce pine beetle habitat and improve structural diversity	30+	0	6,990	5,321	8,983
	Lower amounts of live trees, snags, and forest floor litter / reduced branch and needle density in upper canopy	Adverse - loss of organic matter and nutrients Beneficial – reduce hazard of both high severity and stand replacement fire					
Non-commercial Thinning	Lower tree density & canopy closure	Beneficial— accelerate tree growth, increase fire-resistance, reduce insect hazard to pines	30+	0	2,026	1,408	2,213

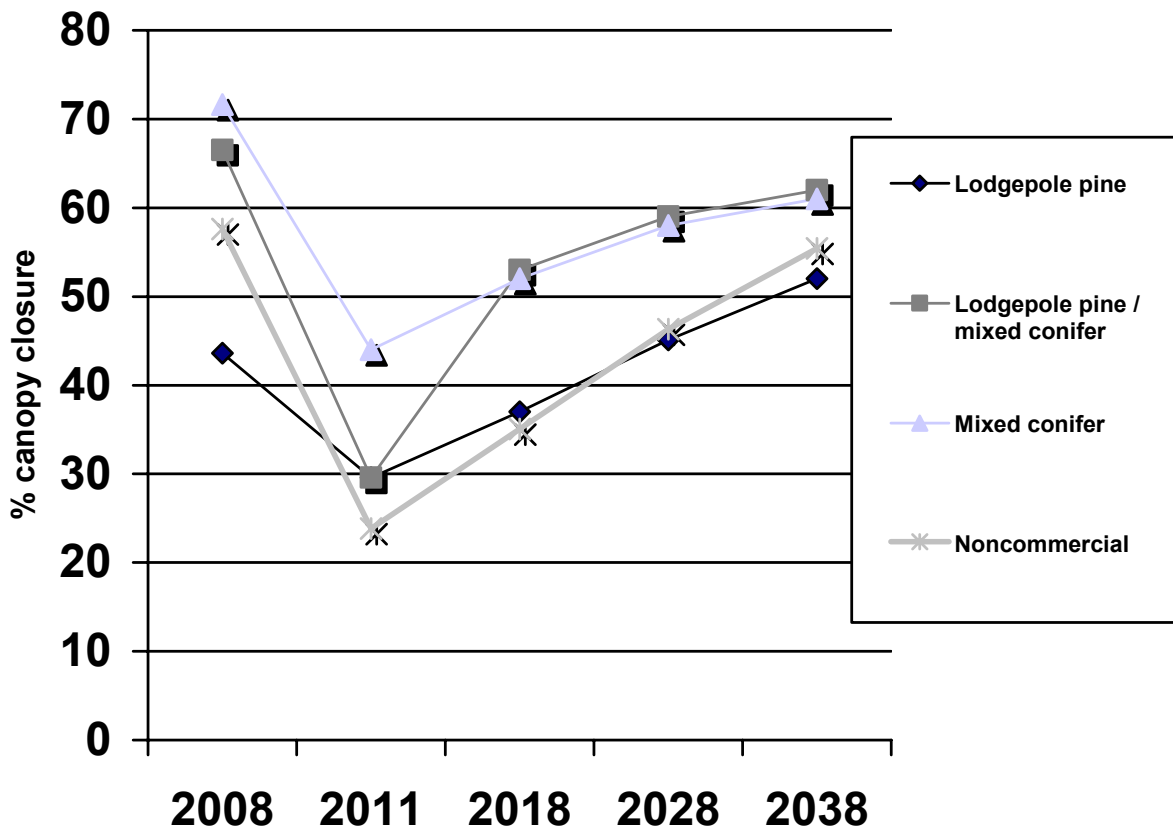


Figure 15. Average canopy closure for four treatment groups before and after thinning and fuel treatments. The 2008 data represents pre-treatment canopy closure and 2011 represents post thinning and post fuel treatment values. Over the projection period, Alternative 1 would result in canopy closure values (not shown) rising slightly from 2008 conditions in all forest types except mature lodgepole stands. In the the lodgepole stands, it is projected that 90% mortality in overstory lodgepole pine would reduce the canopy closure.

The action alternatives would reduce stand density and canopy closure in all stand types meeting elements 1 and 4 of the purpose and need (Table 11) while establishing stand trajectories to meet desired conditions. The tradeoff for this beneficial reduction in canopy closure would be the organic material removed from these sites. Immediately following thinning, stand canopy closures would vary from 24% to 44% depending on the forest type, thinning intensity, and the amount of un-thinned area within stands (Figure 15).

Variable density thinning in lodgepole pine would create a range of canopy closures within stands (prescription 2, Table 2). Heavy thinning would reduce canopy closure to less than 20% over as much as 45% of the pure lodgepole stands and thus create openings in these stands. Overstory removal (prescription 1, Table 2) would also reduce canopy closure to less than 20% over as much as 85% of the stand area. The beneficial direct effects of thinning would increase future species diversity, reduce pine beetle habitat and diversify the pattern of age classes within stands, which would more closely approximate the natural disturbance regime. These effects would be greatest for

Alternative 4 because of the total thinning acreages and increased overstory removal acres. The same beneficial effects would be less for Alternative 2. Alternative 3 would realize the fewest beneficial effects because of lower lodgepole pine and mixed conifer thinning acres and no overstory removal treatments (Table 16).

As a whole, the long-term indirect effects of the action alternatives in stem exclusion and mature lodgepole stands would be beneficial by reducing mountain pine beetle habitat and reducing fuels. In mixed conifer stands, the long-term beneficial effects would increase tree size and fire resilience. At the individual tree scale, thinning would also increase tree vigor in all forest types. At the stand scale, understory growth would initiate the layering that is characteristic of late seral structure while fuel treatments would reduce the likelihood of stand replacement fire effects, particularly in the mixed conifer types.

The range of effects by alternative on mountain pine beetle habitat and reduced fire hazard would respond to Issue 6, the extent and intensity of proposed treatments of lodgepole pine. These beneficial effects (reduced pine beetle habitat and fire hazard) would be achieved by increasing lodgepole thinning and overstory removal as well as increasing lodgepole treatments acres south of Highway 230 and west of Highway 138 to the south of Diamond Lake. Alternative 4 has the larger acreage of lodgepole pine treatments and thus reduces the area that may experience a pine beetle infestation. Alternative 2 modifies pine beetle habitat and fuels less. Alternative 3 would have the least effect on beetle habitat and fuels (Table 16).

In the absence of fire, the organic matter removed by thinning and fuel treatments may result in a long-term loss of organic matter in low-productivity lodgepole stands. This treatment effect would be a trade-off for the more severe organic matter reduction that a fire may cause if these stands burned without treatment (Tables 39 and 40). The indirect effects of the action alternatives would be comparable to treatment acres, with Alternative 4 having the greatest indirect benefits followed by Alternative 2 and Alternative 3 because of fewer thinning and fuel reduction acres.

Cumulative Effects

The potential for the action alternatives to result in cumulative effects is addressed at the scale of the planning area (Figure 1). The time frame for analyzing cumulative effects is 30 to 50 years, the period of time that proposed treatments would influence today's pattern of openings (early seral and open mature/ late-seral age classes).

Open canopy conditions exist in today's landscape in early-seral vegetation, in some mature lodgepole pine stands and in recent thinning in low elevation mixed conifer. Early seral vegetation varies by forest type from less than 20% in high elevation mixed conifer to 35% in lodgepole pine (Figure 13). Based on the premise that ecological processes function more naturally when they are within the historic range of variability (USDA 1993), the lodgepole ecosystem may become stressed if conditions exceed the range of variation for open, early seral vegetation.

Open conditions in today's low and high-elevation mixed conifer forests are well below reference conditions, particularly in the mature and late-seral age classes where most thinning would be done. Under reference conditions, the open late-seral stand condition would occupy about 40% of the low elevation mixed conifer and about 35% of the high elevation Shasta red fir type, while current open canopy conditions occupies less than 20% of the landscape today (Barrett et al., 2004 and Shlisky, 2003).

A measure of departure from reference conditions was established to help assess cumulative effects for lodgepole pine treatments (Table 18). The historic range of variation of open lodgepole pine forest is unknown, although that variation would likely be extreme in a high severity fire regime and may vary over time from a very low amount of opening to much of the entire ecosystem within the planning area.

Table 18. Measure and Analysis Framework for Vegetation Conditions.

Vegetation Condition	Measure	Departure Threshold	Analysis Timeframe
Distribution of open lodgepole pine vegetation	Percent of area in early seral or Open mature age-class	>20% of lodgepole pine in early seral or > 30% open mature age class	30-50 years

Today, early seral vegetation in the planning area is approximately 35% of the lodgepole pine forest (see Figure 13). Alternative treatments would increase early-seral lodgepole from 7% to 14% of the D-Bug planning area in proportion to post-treatment early-seral acres (Table 19).²⁵ The additional open stand conditions created by proposed treatments would increase the current level of such stand conditions as much as 14% with Alternative 4. Post-treatment early-seral lodgepole stands would approach the mean for the reference, open-canopy condition in lodgepole forest, or approximately 45 to 50% of the forest type (Pohl, 2003).

Table 19. Acres of lodgepole pine thinning and post treatment early-seral conditions.

Treatment Type and Post-treatment Age Class Condition	Acres			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Lodgepole Thinning	0	3,679	2,759	5,203
Lodgepole Overstory Removal	0	59	0	241
Post-treatment early-seral lodgepole forest	0	1,705	1,242	2,534
Post-treatment early-seral percentage of D-Bug planning area lodgepole forest ²⁶	35%	45%	42%	49%

²⁵ Post-treatment early-seral lodgepole pine acres would be those areas where canopy closure is reduced below 20% and retention of mature trees would be a minimum. Variable density thinning (prescription 2, Table 2) would reduce canopy closure to less than 20% over as much as 45% of the pure lodgepole thinning stands and thus create openings in these stands. The overstory removal (prescription 1, Table 2) would also reduce canopy closure to less than 20% over as much as 85% of the stand area.

²⁶ Approximately 44% of the D-Bug planning area (18,000 acres) is occupied by pure lodgepole pine forest including lodgepole/ mixed conifer sites.

Based on the past activities (Table 12), approximately 6% of the Clearwater, Lemolo Lake and Diamond Lake watersheds has been harvested in the last 30+ years in all forest types. Many of the 9,000 acres of regeneration harvest since 1970 are early seral opening today including the lodgepole regeneration harvest units.

The lodgepole thinning proposed by the action alternatives would beneficially open mature lodgepole stands, thereby altering mountain pine beetle habitat and reducing fuels. These treatments would also have a cumulative effect of adding to existing openings, but would not likely exceed the historic range of variation for open stand conditions in the lodgepole forest. Alternative 4 has the greatest cumulative effect based on post treatment early-seral acres. Alternative 2 effects would be less, while Alternative 3 would have the least effect on openings in lodgepole forest.

Aquatic Conservation Strategy

As disclosed above in this section on Forest Vegetation, the action alternatives would move landscape patterns toward more open, structurally diverse and fire-resilient forests while not exceeding the range of variation for the total amount of opening in the early seral and mature lodgepole forest. As such, the action alternatives are consistent with the goal of the Aquatic Conservation Strategy of restoring native disturbance regimes and creating a pattern of forest age classes that is more like reference conditions for these forest types.

FUELS - TRACKED AS A SIGNIFICANT ISSUE

During scoping, concerns were raised regarding the location, width, and characteristics of thinning treatments proposed for some of the fuelbreaks. Some members of the public questioned the effectiveness of, and impact from, the fuelbreaks and expressed doubt over the effectiveness and necessity of the fuelbreaks, while others encouraged the treatment of even more area in this way. This issue is tracked by total acres of roadside fuelbreaks and several stand level indicators of fire behavior (Table 11).

Several groups felt that the fuelbreaks along the Kelsey Point, Thirsty Creek, and Windigo Pass roads were redundant and not a priority, given they are not within the Lemolo Lake Wildland Urban Interface (WUI). This is tracked by acres of commercial thinning along these roads (Table 11) with an accompanying discussion.

Both Lemolo Lake and Diamond Lake areas are identified as communities at risk in the federal register (volume 66, number 160) and are within identified WUI's in respective Community Wildfire Protection Plans (CWPPs) according to the Healthy Forest Restoration Act (HFRA). For additional information about these CWPPs including recommended fuels treatments and this proposed projects relationship to HFRA, see Chapter 1.

The Diamond Lake / Lemolo Lake Vegetation Management Plan and WA Iteration (WA) (USDA, Umpqua National Forest, 2008) encompasses the D-Bug planning area and provides a meaningful landscape-scale context for discussing fire and fuel conditions. A detailed discussion of the reference (historic), existing, and desired future conditions is presented in the previous section of this chapter under Forest Vegetation.

Existing conditions for planning area stands were determined using Stand Exams (SE) and a less formal process of field data collection (summer of 2007). Grouping of like stands was used to characterize the various stands and prescribe treatments. Predictions about future conditions were made using Forest Vegetation Simulator (FVS) (Dixon, 2003) and Fire and Fuels Extension to the FVS (Reinhardt and Crookston,

2003). At the landscape scale, additional satellite based information was used from LandFire²⁷ and processed using FlamMap²⁸ (Finney et al., 2007).

To reduce fire hazard in western forests, scientific findings overwhelmingly support a combination of managing tree density, stand canopy characteristics (e.g. canopy bulk density, canopy base height), tree size class distribution, and species composition in combination with surface fuel treatments. The most effective wildfire hazard treatments (“fuels” treatments) target crown canopy, “ladder”, and surface fuels (Graham et al. 1999, Peterson et al. 2005, Graham et al. 2004, Agee and Skinner 2005). Crown fires are often considered the primary threat to forest resources as well as human values and firefighter and public safety. Crown fires also present the greatest challenges in terms of resistance to control and therefore are most likely to become large and costly (Graham et al. 2004). However, treatment of surface fuels is also important; fuels treatments that ignore surface fuels can increase some measure of fire hazard (Graham et al. 1999).

In the case of this project, it is not possible to treat the entire landscape with fuels treatments. Treatment over much of the area would not be economically feasible or appropriate given the land allocations present (Table 1, Figures 3 and 4). Therefore it is appropriate to focus fuels treatments with emphasis on areas that protect safety or improvements, provide safe evacuation routes, and provide strategic locations for firefighters to base suppression efforts. Proposed fuels treatments include fuelbreaks²⁹, as well as defensible space around structures, improvements, and areas of high human use. Treatments would increase stand resiliency to uncharacteristic fire behavior by protecting large diameter trees from fire-caused mortality. Some units are also designed to reduce potential fuel loads in stands with substantial lodgepole at high risk to heavy mortality from bark beetle activity anticipated in this area (Goheen, 2008).

The objective of fuels treatment is to alter fire behavior within the treated area. Fuelbreaks are not designed to “stop” fires, but to allow firefighters a higher probability of success. In this case, fuelbreaks are also designed to provide a valuable safety cushion between hazardous fire behavior and the public should an evacuation become necessary. As in any fuels treatment, finite resources limit the magnitude and/or extent of treatments, particularly when treatments generate low- or no-value products.

Existing Conditions

The vegetation types within the planning area (see Forest Vegetation section) are each uniquely adapted to periodic disturbance from wildland fire. For example, some species, such as ponderosa pine and Douglas-fir, have traits that help them survive frequent low intensity fire, while others, such as lodgepole pine, have evolved to quickly recolonize areas after wildfire. These species historically depended on a fire disturbance regime to maintain or create forest structures resistant or resilient to insects, disease, and uncharacteristically large or intense wildfire (USDA, Umpqua National Forest, 2008). The vegetation types discussed in the Forest Vegetation section are grouped into four general vegetation types (Table 15). In the discussion that follows, the mixed conifer

²⁷ Satellite derived data is available at LandFire.gov for the lower 48 states that describe forest and fuels conditions appropriate for landscape level analysis in a grid format (maximum resolution of 30M).

²⁸ FlamMap model creates raster maps of fire behavior outputs based on LandFire inputs and a Digital Elevation Model (DEM).

²⁹ Fuelbreaks in this document refer to “shaded” fuelbreaks, defined as those “created by altering surface fuels, increasing the height to the base of live crown, and opening the canopy by removing trees” (Agee et al., 2000).

type includes both high and low elevation types and lodgepole pine with a conifer understory.

Lodgepole Pine

Both low intensity and stand replacement fire was historically common in pure lodgepole stands in the planning area, although lodgepole of the Pacific Northwest are generally considered non-serotinous (can regenerate without fire). Historically, these fires burned in a patchy mosaic creating patches of different age classes over the landscape (Arno 2000, Agee 1993) with different degrees of susceptibility to future insects and stand replacing wildfire. The fire return interval for lodgepole pine stands in this area is thought to be about 60 to 80 years (Agee 1993; USDA, Umpqua National Forest, 2008). Low intensity fires also occurred in lodgepole pine forests of the Pacific Northwest; these fires often spread slowly from log-to-log in what is often referred to as “cigarette burns”³⁰. Prior to fire exclusion, these low intensity fires effectively reduced surface fuel loads between the large-scale stand replacement fire events, and they helped minimize fire severity to soil. Prior to fire exclusion, most fuel conditions consisted of light fuels in low quantities while the vast majority of current conditions consist of heavy fuels in higher concentrations (USDA, Umpqua National Forest, 1998, Appendix A).

Effective fire exclusion over the last century, combined with widespread anthropogenic fire use and lightning caused fire in the late 19th and early 20th century³¹ in the planning area, have created extensive areas dominated by mature lodgepole (USDA, Umpqua National Forest, 2008). When large areas of a landscape are occupied by mature lodgepole, fires of uncharacteristic size and intensity, and/or uncharacteristically widespread insect outbreaks, often occur. When these conditions exist, interactions between wildfire and beetle outbreaks may exacerbate the problem, particularly in areas of high human use and values. The combinations of fire exclusion and bark beetle activity have created, or are predicted to create, unusually high surface fuel loads that will result in higher soil severity during a fire relative to reference conditions.

Most available research suggests that beetle caused mortality in lodgepole pine at a large scale decreases foliar moisture content (while needles remain on the trees following mortality) and increase fuel loads as branchwood and stems begin to fall, causing increases in fire hazard (Kaufmann et al. 2008; Lynch et al., 2006; Turner et al 1999; Page and Jenkins 2007). Most scientists, however, acknowledge that additional research is necessary in this area and hazards need to be considered in the context of the landscape. In the planning area, it is anticipated that existing and projected hazardous fuel loads would threaten human safety, structures, large diameter trees, and other resources unless managed.

The current widespread mature lodgepole pine conditions (see Forest Vegetation section), combined with the current and predicted degree of bark beetle mortality, create a hazard of large and uncontrollable wildfire. Such a large fire would have more severe effects on soil and nutrients than would be expected under reference conditions. Wildfire hazard is particularly high in the period of time after mortality of the trees and before the needles fall off (usually 1 to 3 years). Hazard may abate for a time, but again

³⁰ Lodgepole pine stands generally lack enough fine fuels at the surface to carry low intensity fire. The tendency of the logs to rot from the inside out cause the cigarette-like tendency typical of low intensity fire spread prior to fire exclusion (Agee 1993).

³¹ According to analysis done for the Vegetation Management Plan and Watershed Analysis Iteration for this area, use of fire for clearing vegetation was widespread among stockmen. At least 3 large conflagrations can be documented between 1880 and 1910, at least some of which were started by lightning storms.

increases as dead trees fall and create heavy surface fuel loads, particularly when wind events cause rapid accumulations. This abnormal disturbance regime tends to perpetuate itself as another single age class of lodgepole regenerates over large areas of the landscape (as opposed to smaller scattered patches found in reference conditions). There is a need for conditions to be managed where they occur near high visitor use areas, within the Wildland Urban Interface (WUI), and near evacuation routes. There is also a need to restore patches of differing age classes that would be more resilient, at the landscape scale, to widespread disturbance in the future and to reduce existing or potential fuel loads at the stand scale to better approximate reference conditions. Most treatment units are also intended to serve as fuelbreaks, giving firefighters tactical options to safely manage a wildfire.

There is currently a “moderate”³² crown fire hazard in lodgepole pine within proposed treatment units. This means it would not take a particularly unusual weather event to cause a crown fire in these stands. This hazard will increase as bark beetle activity continues.

Mixed Conifer including Lodgepole overstory with mixed conifer understory

The mixed conifer in the planning area historically experienced more frequent fires of low to moderate intensity, particularly in the lower elevations of the planning area. These fires killed small patches of trees and tended to leave the largest fire resistant trees such as ponderosa pine and mature Shasta red fir and Douglas-fir. Fire exclusion has resulted in higher densities of shade tolerant trees such as white fir with uncharacteristically high surface fuel loadings (USDA, Umpqua National Forest, 2008; Agee 1993). Additionally, a higher percentage of fire intolerant species can now be found than existed previously (USDA, Umpqua National Forest, 2008). The current bark beetle activity is expected to increase surface fuel loadings where pine species are present. At the landscape scale, fire exclusion has also caused a loss of openings and variation in a once relatively patchy landscape (USDA, Umpqua National Forest, 2008). These conditions favor a less variable (spatial and temporal) fire regime tending towards higher intensity fires and larger fire size than those experienced in the past (O’Laughlin and Cook 2003, Hessburg et al. 2005).

Most stands in mixed conifer within the planning area are generally rated as a “High⁵” category for crown fire hazard. This means that a crown fire could move through these areas readily, even with a fairly low wind speed.

Fire Hazard near structures and evacuation routes

A landscape analysis of crown fire hazard indicates much of the planning area near structures and identified evacuation routes is currently rated a high hazard. There are hazardous conditions that could result in crown fire; current crown fire hazard ranges from moderate to high (see project file). The CWPP’s for these communities also acknowledge these hazardous conditions. Current and predicted beetle mortality in these areas will further exacerbate the problem.

Local fire managers have expressed concerns that some structures, including the Diamond Lake recreation residences on the west shore, would not be defensible under severe weather conditions. Furthermore, there are currently no treatments of evacuation routes designed for protecting evacuees or ingress/egress of firefighters.

³² Based on a classification system of Crown Fire Hazard from Fiedler et al. (2004) based on Crowning Index and Torching Index as calculated in FVS-FFE.

Desired Condition

In general, there is a need to lower the existing fire hazard to protect human safety and improvements in and around the Diamond Lake and Lemolo Lake WUI's including evacuation routes, recreation residents, lodges, campgrounds, administrative sites, and other areas with high visitor use. There is also a need to modify stand conditions where feasible to mimic historical stand structures, protect large "legacy trees" and other natural resources from uncharacteristic wildfire effects, and break up the continuity of mature lodgepole.

The desired condition for reducing fire hazard is effective and well placed fuelbreaks³³ to protect structures and improvements, shield evacuating public, and provide tactical options for firefighters to safely and efficiently manage a wildfire that would remain effective for at least 10 to 30 years. The desired condition in areas with substantial lodgepole pine at risk to bark beetle-caused mortality is the preemptive removal of future fuel loadings. The desired condition within fuelbreaks include stand conditions that moderate fire behavior so the fire can be controlled, fire effects would be within historical context, and the public can evacuate safely if it becomes necessary.

Low or moderate crown fire hazard ratings (see following section) are desired within fuelbreaks and defensible space units, particularly near the center of fuelbreaks (nearest the roads in this case) and nearest structures. A reduction of flame lengths to less than 8 feet near structures and evacuation routes is also desired. Such surface fuel reductions would allow fire fighters to protect the WUIs and enhance the cost-effectiveness of fuel treatments.

Direct and Indirect Effects

For fire and fuels, direct effects are those that would occur at the stand scale. Indirect effects are those that would occur at the landscape scale and/or later in time. For this analysis, the watersheds are used as a basis to compare landscape scale effects from fire disturbances. Direct and indirect effects are combined in this section.

All action alternatives would thin and remove trees from the stands, thus reducing canopy continuity and the potential for crown fire spread. All action alternatives also treat the midstory or "ladder fuels" and surface fuels within designated portions of treatment units. Treatments are nearly identical between alternatives; alternatives differ in geographic extent of treatments as outlined in Chapter 2. Generally, Alternative 4 treats the most acreage among the action alternatives followed respectively by Alternatives 2 and 3.

The projection period chosen for fuels analysis was 30 years (2008 – 2038). This time period represents the maximum estimated maintenance interval when additional work would be required to maintain the treatment effectiveness. Output was calculated at time intervals that include: immediately pre-treatment (2008, the existing condition), the first year following all treatment (2011), and 3 cycles of 10 year intervals (from pre-treatment) to the year 2038. A complete analysis and detailed description can be found in the project record.

³³ The value of established fuelbreaks during wildfire suppression is well tested and documented (WFLC 2008, Weatherspoon and Skinner 1996, USDA/USDI 2007, Loehle 2004, Schroeder 2006). However, measuring success in this treatment type is elusive and a subject of debate (Agee et al. 2000) leading some researchers to question the value of improperly placed fuelbreaks or fuelbreaks planned without a landscape context specific to local environmental factors (Finney and Cohen 2003, Van Wagtendonk 1996).

Three indicators were selected to represent each of the three fuels strata responsible for fire spread; surface, ladder, and crown. The same indicators were used between each alternative and for each vegetation type (for complete details, see the project record).

Crown fire hazard and the hazard associated with ladder fuels has been calculated and classified³⁴ for the alternatives. The action alternatives reduce the potential for crown fire to carry or initiate within treatment units and maintain manageable fire behavior in surface fuels by treating activity fuels in the highest priority areas, such as adjacent to buildings and visitor use areas and near the center of fuelbreaks where the most benign fire behavior is needed (project record).

For most vegetation types, existing crown fire hazard is considered high and would remain if no action were taken. The treatments in action alternatives would reduce the hazard to a moderate or low rating for 5 to 10 years before the effectiveness begins to taper off, eventually reaching levels consistent with existing conditions. The mastication treatment would further enhance treatment effectiveness and longevity in each vegetation type by reducing surface and ladder fuels. For example, Figure 16 shows the Crowning Index (CI)³⁵ for lodgepole pine with a mixed conifer understory. The existing condition (2008) represents a high crown fire hazard. The treatments detailed in all action alternatives would immediately reduce the hazard to moderate for areas that do not receive the additional mastication, or low for areas that do. The other vegetation types respond in a very similar way (see project record for additional detail). According to this analysis and knowledge of local managers, the duration of treatment effectiveness would last from 10 to 30 years.

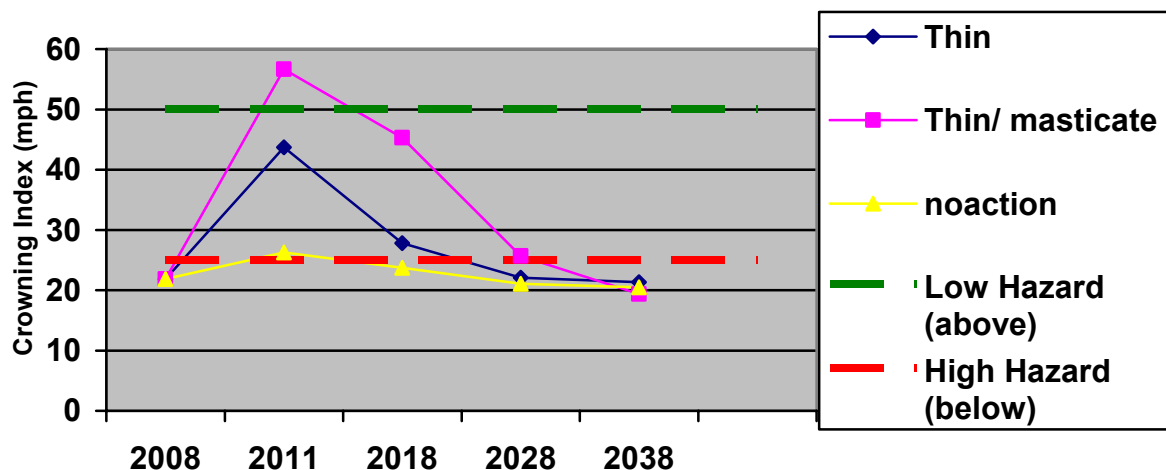


Figure 16. Crowning Index in Lodgepole/Mixed Conifer.

³⁴ Classifications are based on Crowning Index (CI) and Torching Index (TI). Classifications into High (<25mph), Moderate (25-50 mph), and Low (50 mph+) are based on Fiedler et al. (2004).

³⁵ Crowning Index (CI) and Torching Index (TI) are used to measure the propensity of a stand to crown fire, defined respectively as the 20 foot wind speed (higher value represents a lower hazard) necessary to sustain and initiate a crown fire (see glossary). These classifications are discussed below while more details (i.e. changes to the actual values for CI and TI) are available in the Project Record.

A very similar pattern was modeled for torching hazard for all treatment units in action alternatives as shown here for crown fire hazard (Figure 16, Table 20). Surface fuel flame lengths following treatment under action alternatives generally do not change drastically with treatment and stay below 8 feet in height under the severe fire behavior weather conditions assumed in modeling. This is important because it means the fire could be successfully attacked by ground forces under the action alternatives.

Table 20. Wildfire hazard indicators per vegetation type before and after treatment (including mastication).

Vegetation Type	Crown Fire Hazard*		Ladder Fuel Hazard*		Flame Length <8’*	
	2008	2011	2008	2011	2008	2011
LP	Mod	Low	High	Mod	Yes	Yes
LPMC	High	Low	High	Mod	Yes	Yes
MC	High	Mod	High	Mod/Low	Yes	Yes
LP = Lodgepole pine LPMC = Lodgepole pine with an understory of mixed conifer including submerchantable stands. MC = Mixed conifer including both “high” and “low elevation” mixed conifer identified in the Forest Vegetation section. *Differences in alternatives are expressed as differences in the extents of these results (see Alternatives section of Chapter 2.						

These changes to fire behavior within fuelbreaks are verification of their effectiveness in changing fire behavior of a fire that may enter a fuelbreak. Moreover, fuelbreaks provide fire fighters the opportunity to safely defend the WUIs and evacuate routes when the need arises. Under extreme fire weather, without fuelbreaks, fire fighters may not be deployed to these areas. Since Alternative 4 treats the greatest acreage (Table 21), it best meets element 2 of the purpose and need. Alternative 4 also treats the most acres within the WUIs, along evacuation routes, and within fuelbreaks separating the Lemolo WUI from wilderness and roadless areas. These are measures of meeting the purpose and need that are considered important in terms of effectiveness (Table 11).

Thinning under the action alternatives would have the landscape (indirect) effect of lowering the risk of crown fire and other uncontrollable fire behavior and reducing uncharacteristic wildfire effects to the WUIs and evacuation routes and provide fuelbreaks that would give fire fighters operational advantages to safely manage a wildfire. These action alternatives would also reduce the risk of crown fire to areas outside WUI and the treatment units. This is because fire behavior would be subdued in treatment areas and as it passes back into untreated areas it takes time to rebuild momentum leaving an area of lower fire effects that “shadows” the treatment areas (Figure 16, Table 21).

During scoping, an issue was raised regarding the need for “redundant” fuelbreaks in the Windigo Pass areas. There is substantial research linking:

- 1) lower burn probability with treatment of greater proportions of a landscape (Finney 2001, Finney et al. 2007);
- 2) reductions in fire size with compartmentalizing areas using fuelbreaks (Agee 2000, Rigolot 2002, Quincy Library Group 1997);

- 3) reductions in rate of spread and area burned with additional overlapping patterns of treatments that disconnected fuel continuity (Finney 2001, Palma et al. 2007, Loehle 2004, Finney et al. 2007); and
- 4) increasing the resiliency of untreated acres to stand replacement fire in proximity to treated acres in what is sometimes called a “fire shadow”³⁶ or “leverage”³⁷ (Loehle 2004, Ager et al. 2007) (Table 21).

Table 21. Summary of reduction in fire hazard to area outside treatment units.

Treatment type	Total Acres of Treatment	Acres effectively treated (total acres x 1.5)	Additional number ³⁸ of acres outside of treated area protected by treatment units
Alternative 1	0	0	0
Alternative 2	9,015	13,523	4,508
Alternative 3	6,728	10,092	3,364
Alternative 4	11,513	17,270	5,757

Additional fuelbreaks may also serve as “back-up” or secondary fuelbreaks should one fail (i.e. firefighters do not arrive in time to stop fire burning through primary fuelbreak). Because visitor use and motorized access mainly occurs along or near roads, roadside vegetation is often where fires start (e.g. cigarettes, non-functional spark arrestors, vehicle fires, sparks from roadwork). An additional benefit of fuels treatments along roads is the higher probability of suppression success when fires start in this area. This success is based on relatively early detection, slow rate of spread, and controllable fire behavior compared to untreated vegetation.

Table 11 shows the potential treatment acres by alternative that would beneficially lower fire hazard within fuelbreaks along Windigo Pass, Kelsay Point road and Thirsty Creek road, thereby further reducing crown fire hazard and increasing the chances firefighters would successfully stop a fire coming from the Thielsen Wilderness area. Alternative 4 treats the most acreage in this area, with 995 acres treated. Alternative 2 and 3 treat 970 and 391 acres respectively. Alternative 1 would treat no acreage in these areas.

The fuelbreaks under the action alternatives would help reduce the risk of uncharacteristic fire and the effects of those fires in adjacent landscapes, provide protection to structures and improvements, and provide safe evacuation opportunities for

³⁶ In terms of fire effects, the “shadow effect” (or “fire shadows”) is expressed as lower intensity or severity fire behavior or unburned vegetation downwind of fuels treatment units (assuming the fire is not stopped by suppression at the treated area). As the fire burns into the treated area, fire behavior is subdued. As the fire passes back into untreated area, it takes time to rebuild momentum, leaving an area with lower fire effects that “shadow” the treatment unit.

³⁷ Leverage is the theory that a single acre of fuel reduction can protect, or lessen impacts on, additional (untreated) acres. It is expressed as the number of acres protected per acre treated. Well placed, strategically positioned fuels treatments of sufficient size have higher leverage than small or random treatments. Based on simulation modeling by Loehle (2004), a conservative estimate by the fire ecologist of leverage in this project would be 1.5 / 1.

³⁸ Additional acres protected is calculated as the leverage (1.5) by total acres treated per alternative (acres * 1.5).

a period of between 10 and 30 years. They would drastically increase the chances that a large fire would be stopped at the fuelbreak. As the treated stands develop larger diameter trees with thicker bark, the efficacy of the fuelbreaks is predicted to increase over the decades as long as maintenance treatments occur.

Connected/Similar Actions

Of the connected/similar actions described in Chapter 2, only 2 are pertinent to fire and fuels. About 300 acres of precommercial thinning (PCT) is proposed to occur within the planning area in each action alternative. The direct effect of the PCT treatments would be a short-term increase in surface fuels for a period of about 5 years, resulting in an increased risk of higher intensity fire behavior for a short time, until the slash is broken down and decomposed. In the long run, the increased distance between the thinned sapling and pole-size trees would have the indirect effect of moderating future fire behavior (by slowing a fire down) by separating and reducing these “ladder fuels”. This would further lower the risk of tree and stand mortality, should a future wildfire occur.

The second connected action would be wildlife down log creation that would occur in each action alternative. This action would create between 800 and 1,164 downed logs through methods such as inoculation or girdling/felling. These logs would be retained on the landscape as wildlife habitat and are not expected to present a hazard for torching or fire spread due to the wide spacing of the logs, their large size, and the low density of these additional fuels.

Cumulative Effects

The area chosen for cumulative effects is the entire Diamond Lake and Lemolo Lake Fifth Field Watersheds and the Clearwater River Headwaters and Stump Lake Sixth Field subwatersheds (see Tables 12 through 14). The time frame for analyzing cumulative effects is all past management since the early 1900's and for 30 years into the future. This area was chosen because it fully encompasses all treatment units and any potential interactions in terms of fire behavior between treatment units or adjacent or nearby stands. The time frame was chosen as it represents the estimated earliest timeframe that could impact fuels concerns and the maximum useful lifespan of the fuelbreaks and defensible space treatments.

There have been numerous timber sales within the analysis area for cumulative effects that may have influenced stand conditions and fuel loadings (see Tables 12 and 13). The impacts from these sales, and any other unlisted sales or management actions, are captured by current stand exam and fuel loading data collected following these actions. There are no reasonably foreseeable future timber sales (see Table 14) in the analysis area at this time.

Within the analysis area, numerous non-commercial thinning units have been thinned in the past (Table 12) and several are presently ongoing (Table 13) and scheduled to continue in the reasonably foreseeable future (Table 14). These thinnings were done as precommercial thins or specifically for fuels reduction purposes. Many of these units were hand piled and burned. Hundreds of acres have also been underburned in the analysis area. Burning had the beneficial effect of lowering surface fuel loads and thinning small diameter trees. These past practices have reduced fuel loadings over much of the area, have increased the distance between tree crowns (lessening the risk of crown fires), and have lowered the risk of stand loss to potential wildfires within thinned areas and changed the current baseline surface fuel conditions in the managed

stands. These previous, ongoing, or future activities will enhance the effectiveness of activities proposed under action alternatives.

Past thinning and burning, when combined with a given action alternative, would have the beneficial cumulative effect of further reducing crown fire potential by reducing fire hazard and lowering the probability of stand replacement fire. The magnitude of this effect would not differ by alternative. Alternative 1 would not contribute to this beneficial cumulative effect of reducing fuels across the landscape, as no treatment would occur.

COARSE WOODY DEBRIS

Coarse woody debris (CWD) is defined here as standing dead trees (snags) and large down woody debris (≥ 6 " diameter). These forest components provide essential habitat for many species of wildlife, plants, fungi, liverworts, mosses, lichens, and drives critical ecological processes. Coarse wood helps provide for the maintenance and eventual recovery of late-successional organisms in the matrix land allocation (ROD B-7).

Relevant Standards and Guidelines

Forest Plan standards and guidelines and management area prescriptions were considered "mitigation measures" as discussed in the LRMP (USDA, Forest Service, 1990, II-23), and for snags, were designed to provide a continuous supply of snags through time as well as providing snags on harvest areas in conjunction with timber harvest activities (USDA, Forest Service, 1990, IV-78). The standards and guidelines and management area prescriptions for snags and down wood in the LRMP include:

- Wildlife S&G#1 - Woody material to provide wildlife cover will be retained on 10 percent of the area of all regeneration harvest units (D-22).
- Wildlife S&G#2 - Down, dead woody material (20 feet or more in length and a minimum of 12 inches in diameter at the small end) will be left at the rate of two per acre on each unit that is regeneration harvested. Additional material will be left when logs have little or no commercial value and do not produce an unacceptable fire hazard (D-22).
- Wildlife S&G#18 - When possible, wildlife trees (snags and green culls) will be left standing in areas of timber harvest. This habitat will be in addition to that provided by implementing the snag habitat prescriptions (D-23).
- Management Area 10 - Adequate snag habitat must be provided in this management area to meet the 60 percent potential population capability (PPC) for cavity nesters (LRMP IV-128). A snag is defined by the LRMP as any dead, partially dead or defective (cull) tree at least ten inches in diameter at breast height and at least six feet tall (LRMP III-72).

Modifications for snag habitat prescriptions (and down wood) were provided by the Northwest Forest Plan (1994), which led to watershed analyses (WAs) and other assessments. These modifications are based on site specific information and the latest scientific information. The standards and guidelines in the Northwest Forest Plan were designed, in part, to maintain [through time] ecological components such as down logs, snags, and large trees (ROD B-2).

For coarse woody debris management within matrix lands, a standard and guideline calls for the "develop models for groups of plant associations and stand types that can be used as a baseline for developing prescriptions" (ROD C-40). DecAID (Mellen et al. 2006) was developed to address this standard and guideline.

2008 Diamond Lake / Lemolo Lake Vegetation Management Plan and Watershed Analysis Iteration Recommendations for Downed Wood

This document recommends that felled hazard trees be left on-site where possible; otherwise they should be placed in small aggregations in more suitable locations around recreation sites.

Coarse Woody Debris and Fuels Treatments

The action alternatives for the D-Bug project are aimed at reducing fuels within identified wildland urban interface (WUI) areas and along identified evacuation routes and fuelbreaks. Large, landscape scale treatments were not practical for this planning area due to the IRA and congressionally reserved land allocations within and adjacent to the planning area (Figure 3, Table 22).

Table 22. Selected land allocations adjacent to the D-Bug planning area.

Land Allocation	Acres
Oregon Cascades Recreation Area	85,874
Crater Lake National Park(Forested Portion)	183,224
Mt. Bailey Inventoried Roadless Area (IRA)	18,415
Mt. Thielsen Wilderness	22,168
Sherwood IRA	2,449
Thirsty Creek Appendage IRA	2,255
TOTAL	314,385

The majority of the treatments within all action alternatives occur within $\pm 1,000$ feet around structures, evacuation routes and existing roads to be utilized as fuelbreaks (72% are within 1,000 feet of a road in Alternative 2, 76% in Alternative 3, and 61% in Alternative 4). Additionally, all action alternatives contain units of lodgepole pine dominated stands which are being treated to reduce potential within-stand mortality and the subsequent increase in fuel loading from the spread of the mountain pine beetle.

For this analysis, lodgepole and mixed conifer roadside stands would be managed for 30% tolerance levels (TL) or lower for snag and downed wood cover as described in DecAID (Mellen et al. 2006). This is because managing for higher levels of snags and CWD along these areas would be inconsistent with the purpose and need. The surrounding landscape in some reserved allocations would provide areas of higher snag and CWD densities required by wildlife in this area. The purpose and need for this project is in part to create defensible fuelbreaks along evacuation routes and roadsides, and moderate to high levels of CWD would be counterproductive to lowering fire behavior and fuel loading. The 50% TL would be applied to 300 acres of mixed conifer stands within Northern spotted owl nesting, roosting or foraging (NFR) habitat in Alternatives 2 and 4 and the 202 acres of NRF in Alternative 3 to maintain structure and habitat for spotted owl prey species which depend upon CWD ground cover.

Stand Level Existing and Desired Conditions

A field inventory was conducted to help estimate CWD levels within the proposed treatment units. The units were divided into four strata (Table 23). Based on this inventory, the existing levels of snags and down wood appear to be similar to those

described in DecAID for the types of forest habitat in the analysis area. The proposed prescriptions common to all alternatives would not affect stand level tolerances for snag densities outside of the roadside treatment areas and WUI treatment areas, as all current snags would be retained (as feasible considering safety standards), with the exception of the small amount of salvage in each alternative. Additionally the high amount of mountain pine beetle mortality outside of treated stands is predicted to continue to increase snag densities across the landscape and in stands adjacent to treatment units.

Table 23. Results for the snag and coarse woody debris inventory in proposed treatment units. Results are shown for snag densities (snags/acre) with the 90% confidence intervals (CI), averages (AVG) and for tolerance levels (TL) provided by DecAID.

Sampled Strata	Snags ≥10" dbh			Snags ≥20" dbh		
	90% CI	AVG	TL	90% CI	AVG	TL
Lodgepole Pine with Beetle Mortality	21 to 40	31	80-100%	0	0	0%
Lodgepole Pine with no Beetle Mortality	5 to 12	8	0-30%	0 to 1	0.5	0-30%
Montane Mixed Conifer	16 – 26	21	50-80%	1 to 5	3	30-50%
Western Lowland Mixed Conifer	10 to 16	13	30-50%	1 to 2	1.5	0-30%

Currently, ground cover of coarse woody debris within lodgepole is above 30% TL, and all action alternatives harvested units would remain above the 30% TL post implementation (Figure 17). Ground cover within mixed conifer units documented from both on the ground survey and FVS modeling are currently below the 50% TL; therefore, a project design feature is prescribed to fall and retain 280 linear feet per acre ≥10" dbh of down wood within suitable Northern spotted owl nesting, roosting and foraging (NRF) habitat outside of fuelbreaks (Figure 18). Increased levels of downed wood benefits spotted owl prey species such as woodrats and flying squirrels and other small rodent prey by providing hiding and thermal cover.

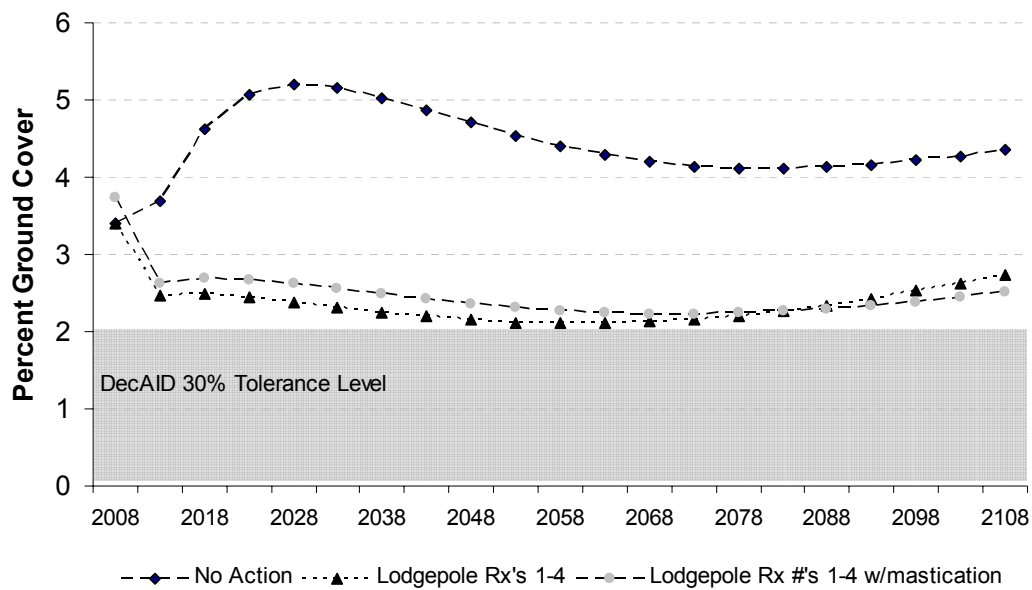


Figure 17. Percent ground cover of coarse woody debris in the no action alternative and within lodgepole dominated units with prescriptions 1-4 in the action alternatives with and without mastication. All species of downed wood were counted. The grey shading represents the DecAID 30% (low) tolerance level.

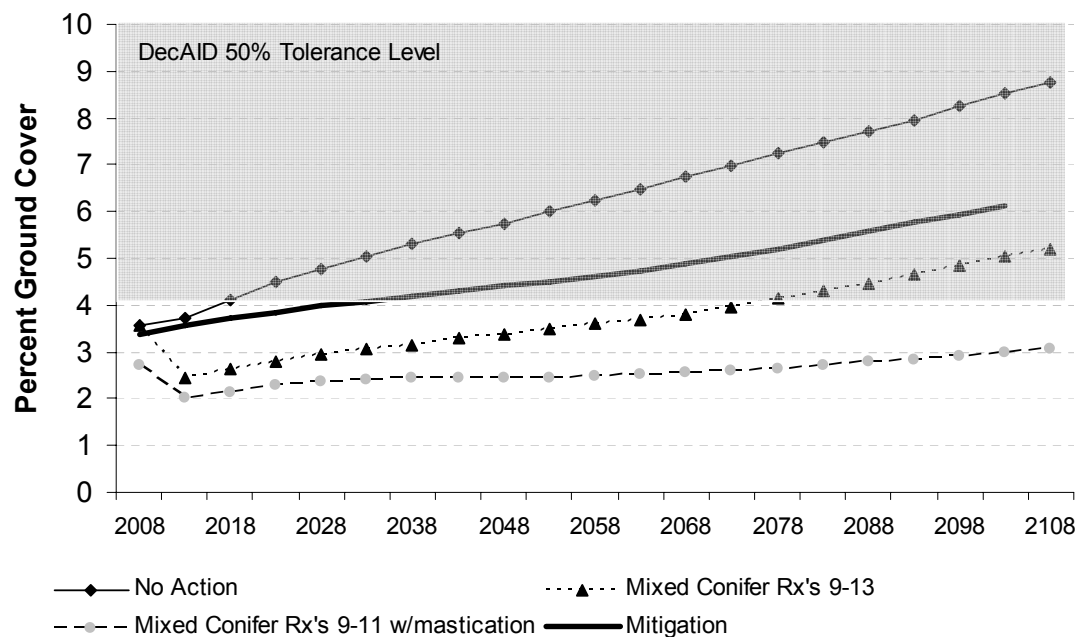


Figure 18. Percent ground cover of coarse woody debris in the no action alternative and within mixed conifer units with prescriptions 9-13 in the action alternatives with and without mastication.

The roadside treatment stands desired condition is to be open enough to be able to alter wildfire behavior from a crow fire to a surface fire, and to give firefighters a higher

probability of success in managing fire. In the areas outside of the roadside, the desired condition is to increase stand resiliency to wildfire.

Landscape Level Effects

Levels of snags and downed wood vary across landscapes, forest types and land allocations (Table 22). Some areas are managed as or are wilderness or reserved land allocations that restrict commercial harvest of trees. Crater Lake National Park has an active wildfire use program, allowing naturally ignited fires to be managed rather than suppressed which has and will continue to create areas with high levels of snags and CWD within them. Recent fires³⁹ are current sources of high snag and CWD densities. Mountain pine beetles are allowed to disperse on their own throughout these areas and are also creating patches of high snag densities and CWD accumulations.

The landscape⁴⁰ for the CWD analysis area (130,000 acres) was broadly stratified into three DecAID wildlife habitat types; lodgepole pine, montane mixed conifer and western lowland conifer and hardwood forest. Approximately 53% of the landscape is montane mixed conifer, 30% is lodgepole, and 17% is western lowland conifer and hardwood forest. Acres of silvicultural prescriptions by alternative were used to adjust the landscape distributions for snags ≥ 10 " dbh and results are shown in Figure 19.

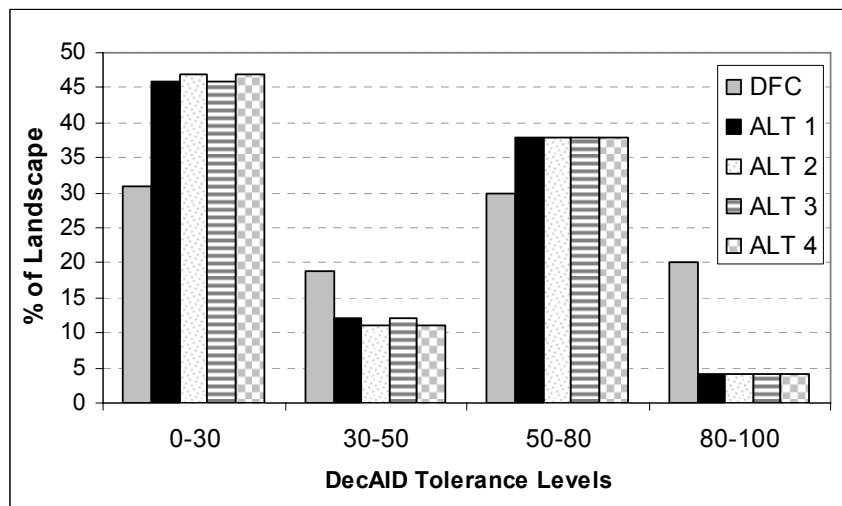


Figure 19. The existing distribution of snags ≥ 10 " dbh (Alternative 1) in terms of DecAID tolerance levels, compared with the desired future condition (DFC) and the resulting distribution post implementation of the action alternatives considered for the D-Bug project.

³⁹ Crater Lake NP has had 2 recent wildland fire use fires, the Bybee Complex (2006) which burned 3,100 acres and is 10 miles south of the planning area and an unnamed fire in 1994 which burned 155 acres and is a ½ mile south of the planning area. On the Umpqua N.F. the Kelsay fire (2003) burned 1,440 acres and is 2 miles north of the planning area; 250 acres of this fire was salvaged.

⁴⁰ To determine the landscape distribution of snag densities, based on TL, each habitat type was also stratified into open, small/medium and large tree structural stages. Then, the percentage of structure stages and habitat types were used to prorate the snag density distribution for the landscape. The DFC was determined by utilizing the Fire Regime Condition Class potential natural vegetation reference conditions, prorating the landscape for the amount of Shasta red fir (which corresponds to the montane mixed conifer in DecAID), lodgepole, and mixed conifer groups that occur in the 130,000 acre CWD analysis area.

Due to the relatively small percentage of the landscape being treated⁴¹ under the action alternatives, differences among alternatives is very small. The existing (no action) and post treatment landscape for all action alternatives has higher levels of the landscape with low snag levels (0-30% TL) and a low percent of the landscape with high snag levels (80-100% TL), due in part to past timber harvest and fire exclusion. However, within the planning area the amount of the landscape with no snags is higher than what DecAID describes for this type of landscape (13% of the DecAID landscape has no snags ≥ 10 " dbh, compared with 4% in the analysis area, and 31% of the DecAID landscape has no snags ≥ 20 " dbh, compared with 4% of the analysis area). The amount of high density snag habitat (80-100% TL) is expected to increase with the spread of the mountain pine beetle and the likelihood of a wildfire within the planning area and surrounding landscape of reserved land allocations. Both Alternatives 2 and 4 contain the same amount of salvage harvest of standing dead beetle killed lodgepole (Prescription 4) which would reduce 1% of the landscape within the 30-50% TL, to a lower snag level (0-30% TL);.

The existing, desired and resulting densities of snags per acre ≥ 20 " dbh related to DecAID tolerance levels are shown in Figure 20. Due to the negligible numbers of existing lodgepole snags ≥ 20 " within the planning area, and the very small percentage and amount of mixed conifer⁴² harvest that would occur in the action alternatives, there is no difference among the action alternatives in the landscape distribution of ≥ 20 " snags per acre, thus there are no substantial effects to the species that rely on this habitat. The amount of 50-80% TL areas of the landscape are expected to stay relatively stable as the lower TL groups age and increase in snag densities over time while existing 50-80% TL areas increase in snag densities to 80-100% TL. The amount of the landscape with high snag densities (80-100% TL) would continue to increase, especially in reserved land allocations with the continued spread of the mountain pine beetle and the likelihood of a large scale wildfire.

At the landscape-scale, the action alternatives would have very little effect to overall snag recruitment or downed wood levels due to the small magnitude of the proposed treatments. There are over 314,000 acres of reserved land allocations directly adjacent to the D-Bug planning area that contain areas of moderate to high snag and CWD densities, while the D-Bug project at most will manage 11,183 acres, or 4% of that area. However Alternatives 2 and 4 do move the landscape slightly away from DFC with respect to ≥ 10 " snags, by slightly increasing the amount of 0-30% TL areas of snag densities and slightly decreasing the amount of 30-50% TL areas of snag densities. Alternatives 1 and 3 maintain the same, slightly higher levels of 30-50% TL snag densities.

⁴¹ The action alternatives would treat up to 11,183 acres that occur primarily in two 5th field watersheds (Diamond Lake and Lemolo Lake) and one 6th field watershed (Clearwater River Headwaters), which covers about 130,000 acres (including the lakes). Alternative 2 would treat up to 7% of the 130,000 acres, Alternative 3 treats 5%, and Alternative 4 treats 9%.

⁴² The mixed conifer stands are the primary source of snags ≥ 20 ".

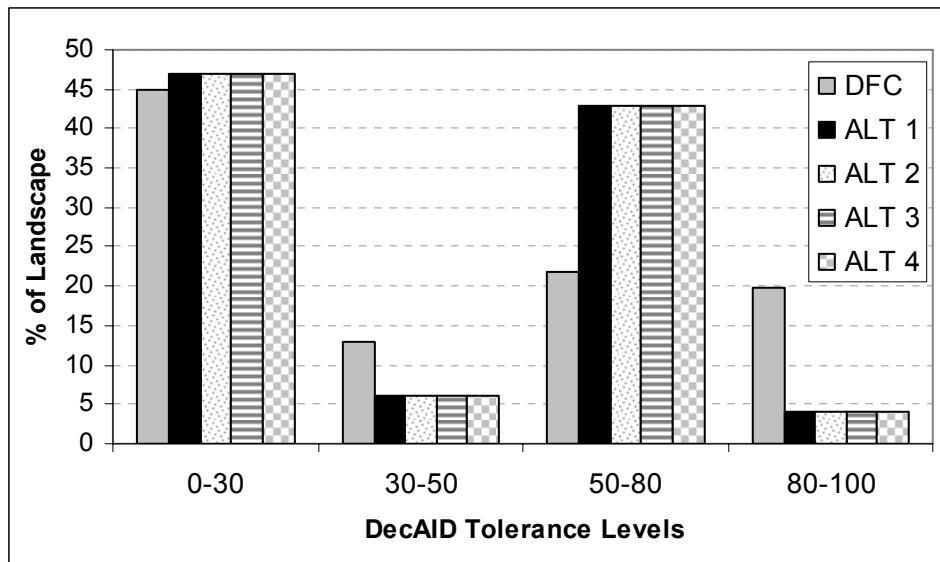


Figure 20. The existing distribution of snags $\geq 20''$ dbh (Alternative 1) in terms of DecAID tolerance levels, compared with the desired future condition (DFC) and the resulting distribution post implementation of the action alternatives considered for the D-Bug project.

Stand Level Direct and Indirect Effects

At the stand level in the action alternatives, the snag species composition would shift over time in units with conifer species other than lodgepole, as prescriptions 1-4 predominately remove live lodgepole $>5''$ dbh and retain other conifer species. These stands would shift to become dominated by conifer species other than lodgepole, and therefore future snags would be larger in diameter than they are currently, since other conifers have more potential to grow larger than lodgepole. Alternative 1 would maintain current snag and CWD densities, and would increase snag densities and CWD densities (of primarily small diameter lodgepole pine due to pine beetle mortality) more than the action alternatives, thus maintaining snag habitat for dependant species. Of the action alternatives, Alternative 3 would retain the highest number of snags and downed wood cover (primarily lodgepole snags) in the short term as it would have less thinning and overstory removal of lodgepole pine than Alternatives 2 or 4. Alternative 4 would remove and reduce recruitment of the most snags and downed wood cover as it has the most thinning and overstory removal of lodgepole pine. None of the action alternatives reduces snags or down wood below a tolerance level that would preclude meeting standards and guidelines.

Within mixed conifer units, Alternative 3 contains the least amount of thinning and mastication which would result in the highest levels of snags and downed wood among action alternatives, while Alternatives 2 and 4 contain the same, higher number of acres of mixed conifer harvest and mastication. This difference among action alternatives in mixed conifer stands is slight however, as the difference in acres of mixed conifer harvest in Alternative 3 verses Alternatives 2 and 4 is 432 acres. All action alternatives would maintain 50% TL for downed wood within the NRF portions of treated stands, thus meeting standards and guidelines for down wood.

Cumulative Effects

Overall, when combined with past fuels reduction projects, all action alternatives would help reduce the hazard of a large scale, uncharacteristic wildfire more so than Alternative 1. The action alternatives would decrease the potential for large scale, high severity fire and increase the potential for smaller scale fires to create snag patches and areas of future downed wood recruitment from fallen snags.

When combined with other past, present, and reasonably foreseeable projects (Tables 12-14), snag densities are predicted to increase across the analysis area, primarily from the unmanaged mountain pine beetle infestation that would continue to spread in other land allocations, and from future fires. Because most of the treatments in the D-Bug action alternatives occur within 1,000 feet of a road, this project would not substantially contribute to cumulative effects of reduced snag densities across the landscape. At the stand scale, individual stand densities of snags would be reduced in order to meet the purpose and need, but given the context of this project (less than 9% of the analysis area would be treated), this cumulative effect is considered to be minor.

SENSITIVE WILDLIFE SPECIES

The National Forest Management Act (16 U.S.C. 1600) requires the Forest Service to maintain viable populations of existing native and desired non-native wildlife in the planning area (36 CFR 219.19). Guidelines for each planning area must provide for a diversity of plant and animal communities based on the suitability of the specific land area. The Forest Service established a Sensitive Species Program and a Biological Evaluation process (FSM 2672.4) to ensure species population viability. Regional Foresters are responsible for identifying and maintaining a list of sensitive species occurring within their Region. This list includes species for which there is a documented concern for viability within one or more administrative unit within the species' historic range (FSM 2670.22, WO Amendment 2600-95-7). These species may require special management emphasis to ensure their viability and to preclude trends toward endangerment that would result in the need for Federal listing. This regional list was last updated on January 31, 2008.

The Forest Service Manual (FSM 2672.4) requires a biological evaluation to determine potential effects of proposed ground-disturbing activities on sensitive species. This evaluation analyzes the alternatives and discusses the potential effects on the population or its habitat within the area and on the species as a whole, and makes recommendations for removing, avoiding, or compensating for adverse effects.

Relevant Standards and Guidelines

Any management activity that will negatively affect plant or animal species listed on the Regional Forester's Sensitive Species list, or their habitat will be modified to either avoid (preferable) or minimize the impact. Activities will not be permitted if they will result in the loss of a colony or subpopulation that is important in the natural distribution of the species.

A pre-field review was performed to determine which sensitive species are most likely to be impacted by the proposed alternatives. Table 24 summarizes the presence or absence of sensitive wildlife species and/or their habitat within or adjacent (in terms of potential impacts – e.g., noise) to the actual proposed ground disturbance areas, and the anticipated effects to each species. It is based on the latest documented survey and occurrence data, scientific literature review and GIS analysis.

Impact or effect determinations are made on each species, based on this review. If an impact or effect is anticipated, further analysis and discussion of the direct, indirect and cumulative effects is provided in the following sections. Direct effects are defined as those effects that would occur immediately as a result of implementation. Indirect effects are those that would typically occur over longer time periods.

Table 24. Listed and Sensitive Wildlife Species Relevant⁴³ to the D-Bug Project, Their Habitat, and Anticipated Effects.

Sensitive Species	Habitat Description/Information	Is species or habitat in or adjacent?	Is impact or effect expected under action alternatives?	Loss of viability or trend?
Northern spotted owl	Old growth conifer forests or younger forests with old growth remnant structures such as large trees, snags and down wood.	Yes, there are 7 historic owl cores within 2 miles of the planning area.	May effect, but not likely to adversely affect – see discussion.	No loss of population viability or trend towards Federal listing would occur as a result of any alternative.
Johnson's hairstreak	Conifer forests; larvae feeds on mistletoe growing on western hemlock and other conifers. Ranges from 2,000-6,000 ft elevation; suspected on the Umpqua.	Yes, conifers with mistletoe are present in planning area.	May impact individuals or habitat.	No loss of population viability or trend towards Federal listing would occur as a result of any alternative.
Coronis fritillary	Various habitats, grasslands, shrubland/ chaparral, conifer and hardwood woodlands; larvae feed on violet, adults on bull thistle, other composites and chokecherry; suspected on the Umpqua.	Yes, conifer woodlands with violets are present within the planning area.	May impact individuals or habitat.	No loss of population viability or trend towards Federal listing would occur as a result of any alternative.
Mardon skipper	Isolated populations in grasslands within mixed conifer forests in SW OR; larvae feed on fescue bunchgrasses, adults feed on flower nectar; suspected on the Umpqua.	Yes, patches of fescue exist in the planning area.	May impact individuals or habitat.	No loss of population viability or trend towards Federal listing would occur as a result of any alternative.
Evening fieldslug	Perennially wet meadows in forested habitats, found in areas where soil and vegetation are constantly saturated; Ranges from low to mid-elevations; found in both western and eastern cascades; suspected on the Umpqua.	Yes, perennially wet meadows within the planning area occur.	May impact individuals or habitat.	No loss of population viability or trend towards Federal listing would occur as a result of any alternative.
Salamander slug	Leaf litter under bushes in coniferous forests; some specimens found in Lane county; suspected on the	Low probability, habitat is present; no specimens have been detected in mollusk	May impact individuals or habitat.	No loss of population viability or trend towards Federal listing would occur as a

⁴³ The following species have no habitat or anticipated effects in the planning area and will not be discussed further: Siskiyou short-horned grasshopper; Oregon shoulderband; Chase's sideband; Foothill yellow-legged frog; Oregon spotted-frog; Northwestern pond turtle; American peregrine falcon; purple martin; and Pacific pallid bat. For a list of all species considered, see the Wildlife BE (Project File). In addition, species with a determination of "no impact" with the exception of the Northern spotted owl, will not be discussed further; see the Wildlife BE for full disclosure. Alternative 1 has no impact or no effect on all listed or sensitive species.

Sensitive Species	Habitat Description/Information	Is species or habitat in or adjacent?	Is impact or effect expected under action alternatives?	Loss of viability or trend?
	Umpqua.	surveys.		result of any alternative.
Crater Lake tightcoil	Perennially wet areas in mature conifer forests within 10 m of open water. Generally in areas that remain under snow for long periods in the winter. Ranges from 2,000-6,500 ft. Documented within the planning area on the Diamond Lake RD.	Yes, habitat and populations present in planning area.	No Impact is expected due to buffers; indirect benefit by reducing fire hazard near wetlands.	No loss of population viability or trend towards Federal listing would occur as a result of any alternative.
Pristine springsnail	Aquatic snail; small undisturbed cold springs or seeps with coarse gravel/cobble substrate; suspected on the Umpqua.	Low probability, habitat is extremely limited	No Impact is expected due to buffers; indirect benefit of reducing fire hazard.	No loss of population viability or trend towards Federal listing would occur as a result of any alternative.
Horned Grebe	Selects small ponds and lake inlets with mix of emergent vegetation and open water for breeding; forages in open fresh or salt water; Rare breeder east of the Cascades; Uncommon winter resident of Umpqua valley in areas of open, ice-free water; documented at Diamond Lake.	Yes, the species has been documented on Diamond and Lemolo Lakes.	No Impact is expected as there would be no effects to water quality or streamflow.	No loss of population viability or trend towards Federal listing would occur as a result of any alternative.
Red-necked Grebe	Winters on the Pacific and Atlantic oceans, breeds on freshwater lakes. Consistently breeds only at Klamath Lake. One summer record for Diamond Lake (1931); extremely rare in winter away from the coast; would be a rare migrant on Diamond Lake.	Yes, the species has been documented on Diamond and Lemolo Lakes.	No Impact is expected as there would be no effects to water quality or streamflow.	No loss of population viability or trend towards Federal listing would occur as a result of any alternative.
Harlequin Duck	Swift, rocky, large streams or rivers. Nest under rock overhangs, vegetation or streamside debris. Late spring migrant or summer visitor. Documented on Fish Creek and North Umpqua River on Diamond Lake RD.	Low probability, streams adjacent to units are too small and not suitable for nesting.	No Impact is expected as nesting habitat would not be impacted and there would be no effects to water quality or streamflow.	No loss of population viability or trend towards Federal listing would occur as a result of any alternative.
Bufflehead	Nest in tree or snag cavities near high Cascade lakes and ponds. Uncommon spring migrant and common fall migrant. Nesting has been documented on Diamond Lake.	Yes, they have been observed on Diamond Lake.	May impact individuals or habitat.	No loss of population viability or trend towards Federal listing would occur as a result of any alternative.
Bald Eagle	Nest on cliff face ledges or large trees in close proximity to large bodies of water. There are currently 2 breeding pairs on Diamond Lake and one pair on Lemolo Lake.	Yes, three known pairs are nesting around Diamond and Lemolo Lakes.	May impact individuals or habitat.	No loss of population viability or trend towards Federal listing would occur as a result of any alternative.

Sensitive Species	Habitat Description/Information	Is species or habitat in or adjacent?	Is impact or effect expected under action alternatives?	Loss of viability or trend?
Yellow Rail	Wet meadows and freshwater marshes. Considered a very local summer resident of the Klamath Basin and a vagrant elsewhere. Suspected on the Umpqua.	Yes, limited wet meadow habitat is present within the planning area	May impact individuals or habitat.	No loss of population viability or trend towards Federal listing would occur as a result of any alternative.
Lewis's Woodpecker	Open pine forests and oak woodlands near water; Primary cavity excavator; Migrant in Douglas county; documented on Diamond Lake RD in summer and fall.	Yes, suitable pine forest occurs within the planning area.	May impact individuals or habitat.	No loss of population viability or trend towards Federal listing would occur as a result of any alternative.
White-headed Woodpecker	Open ponderosa pine stands or mixed conifer forests dominated by ponderosa pine; primary cavity excavator; Permanent resident in upper reaches of Umpqua River basin.	Yes, suitable pine and mixed conifer forest occurs within the planning area.	May impact individuals or habitat.	No loss of population viability or trend towards Federal listing would occur as a result of any alternative.
Black Swift	Aerial; forages over forests and open areas. Nests behind waterfalls in wet cliffs. Forages over several square kilometers. Documented occurrences on North Umpqua and Diamond Lake RDs.	Low probability; forested habitat occurs, but there are no waterfalls in the planning area.	No impact is expected due to lack of direct or indirect effects.	No loss of population viability or trend towards Federal listing would occur as a result of any alternative.
Pacific fringed myotis	Grasslands, conifer and oak woodlands. Uses caves, mines, buildings, bridges, trees and snags. Aerial feeder, but can glean from foliage and ground. Maternal roosts sensitive to human disturbance. One documented record on Diamond Lake RD.	Probable, habitat occurs within the planning area.	May impact individuals or habitat.	No loss of population viability or trend towards Federal listing would occur as a result of any alternative.
Townsend's big-eared bat	Pine-fir-hemlock-broadleaf forested areas, and areas with mosaic of woodland, grassland or shrubland. Aerial feeder. Uses caves and mines for breeding and hibernaculum; observed in breeding caves on Umpqua National Forest.	Yes, an occupied cave is adjacent to the planning area.	May impact individuals or habitat.	No loss of population viability or trend towards Federal listing would occur as a result of any alternative.
Pacific fisher	Late-successional forests with high canopy closure. Associated with riparian areas. Large dead wood important, dens usually within cavities of large trees and snags. Documented occurrence on the Diamond Lake Ranger District.	Yes, suitable habitat does occur, and the species has been documented in the planning area.	May impact individuals or habitat.	No loss of population viability or trend towards Federal listing would occur as a result of any alternative.
Wolverine	Remote, high elevation subalpine and alpine forests to above timberline. Found in a variety of habitats, do not avoid open areas. Anecdotal observations.	Yes, suitable winter habitat does occur.	May impact individuals or habitat.	No loss of population viability or trend towards Federal listing would occur as a result of any alternative.

Northern Spotted Owl (*Strix occidentalis caurina*)

The Northern Spotted Owl was listed as Threatened under the Endangered Species Act in 1990 and Critical Habitat was designated in 1992 (USDI, 1992). They are associated with mature and old-growth coniferous and mixed conifer-hardwood forests that have structures and characteristics suitable for nesting, roosting and foraging (USDI 2008). Nesting, roosting, and foraging habitat (NRF) for the spotted owl is strongly associated with late-successional forests containing large conifers with broken tops or cavities for nesting, multiple canopy layers for thermal regulation and protection from predation and adequate amounts of large dead wood on the forest floor to support populations of prey (Thomas et al. 1990). Northern Spotted Owls prey upon flying squirrels (*Glaucomys sabrinus*) and woodrats (*Neotoma* spp.) preferentially, but they will consume other rodents (Zabel et al. 1995).

In May of 2008 the recovery plan for the Northern Spotted Owl was finalized (USDI 2008). According to the recovery plan, “the most important range-wide threats to the spotted owl are competition with barred owls, ongoing loss of suitable habitat as a result of timber harvest and catastrophic fire, and loss of amount and distribution of suitable habitat as a result of past activities and disturbances” (USDI 2008). The recovery plan created a series of reserves, known as Managed Owl Conservation Areas (MOCA) within Federal lands, as well as Conservation Support Areas (CSAs) outside of Federal lands to support the MOCA network and assist in achieving the recovery criteria. The recovery plan created 3 Recovery Criteria as well as 32 Recovery Actions which are activities deemed necessary to achieve the recovery criteria or to determine whether the recovery criteria have been met.

Existing Condition

There are 13 Northern Spotted Owl Occupancy Map (NSOOM) points within 1.2 miles of units proposed for the D-Bug action alternatives, 10 of which are computer generated (USDI et al. 2007). According to the recovery plan, old lodgepole pine forests within the planning area do not contain trees of sufficient diameter and are “likely not important Northern Spotted Owl habitat” (USDI 2008). Seven of the computer generated points and 2 documented pairs contain lodgepole pine habitat in treatment units within their 1.2 mile home range and/or 0.5 mile core area. As lodgepole pine is “likely not important” habitat, harvest units within lodgepole would not be considered to be adversely affecting spotted owl habitat.

Much of the mixed conifer habitat proposed for treatment within the action alternatives are in units designed to serve as fuelbreaks and evacuation routes along major roads (Highway 138, State Route 230, Lemolo Lake (Rd. 2610), Windigo Pass (Rd. 6000), Thirsty Creek (Rd. 6000-99) and the Diamond Lake loop road (Rd. 4795). Male spotted owls have been documented to have ‘statistically significant’ higher levels of stressor hormones when their home range was within 0.41 km (410 m or about 1354 feet) of a major logging road (Wasser et al. 1997). Therefore, impacts to stands within 410 m of the roads mentioned above are not considered to adversely affect spotted owl habitat, as these areas are already sources of disturbance related stress and as such, are correspondingly lower quality habitat. The 410 meter zone reduces the affected spotted owl habitat to less than 300 acres of suitable NRF habitat in Alternatives 2 and 4, and less than 200 acres in Alternative 3 (Table 25).

Table 25. Acres of Northern Spotted Owl Nesting, Roosting and Foraging habitat by unit numbers in the action alternatives.

Alternatives 2 & 4		Alternative 3	
UNIT	Acres	UNIT	Acres
115	61.4	115	17.3
118	75.8	118	75.8
144	27.0	144	4.3
145	34.1	145	4.6
158	41.7	158	41.7
176	30.6	176	30.6
194	19.1	194	19.1
Total NRF	289.7	Total NRF	193.4

The closest Critical Habitat Unit (CHU), OR-28 is 2.4 miles to the northwest of the planning area and 2.6 miles from the nearest unit. OR-28 is over 120,000 acres and contains portions of the Umpqua and Willamette NF's. The closest MOCA⁴⁴ is 6.5 miles to the northwest of the planning area and contains portions of the CHU and portions of the Umpqua and Willamette NF's. Because both the CHU and MOCA are farther away than an average spotted owl home range (which is about 1.2 miles, USDI, 2008), they are not considered in the effects analysis for this project as owls utilizing the project area likely would not utilize the CHU or MOCAs.

Direct and Indirect Effects

The direct and indirect effects are analyzed at two scales, 1) stand-scale and 2) the planning area. There would be no direct effects to the Northern Spotted Owl as a result of any action alternative, as all action alternatives proposing harvest in NRF habitat (the units listed in Table 25) will be prohibited from conducting any timber harvest or road construction operations from March 1 to July 15, the breeding season for the spotted owl. Alternative 1 would have no direct effects as no timber harvest or fuels reduction activities would take place. Indirectly, this alternative does not improve stand resiliency to crown fire, which if it occurred, would degrade spotted owl habitat in the short term.

Mixed conifer stands within 410 m of a major road would be thinned to approximately 36% overstory canopy closure. This would drop them slightly below dispersal levels of overstory canopy cover, but these areas are unlikely to be heavily used by spotted owls due to their proximity to roads and the associated disturbance from passing vehicles. This level of treatment would substantially increase the within stand resiliency to crown replacing fire which would provide some level of long term benefit to spotted owls. In the portions of units with NRF habitat in Table 25, canopy cover would be only slightly reduced, retaining about 60% overstory canopy cover. This would retain its ability to function as NRF habitat, but it would lessen the ability of these portions of treated stands to withstand crown replacing fire. Neither treatment would appreciably reduce the average stand tree diameters. No road building, mastication or underburning would occur in suitable NRF habitat. As Alternative 2 and 4 contain the most harvest of

⁴⁴ OMOCA12 (Oregon MOCA) is about 69,000 acres in size.

suitable NRF habitat, they would result in more impacts than Alternative 3, as well as more long term benefits of increased stand resiliency. The connected and similar actions associated with the action alternatives would have no effect to the Northern Spotted Owl as they would occur outside of suitable owl habitat.

Of the 33 Recovery Actions documented in the 2008 Recovery Plan (USDI 2008), the following 3 pertain to the D-Bug Project:

- Recovery Action 6: Identify, maintain, and restore approximately 30–35 percent of the total dry forest (ponderosa pine, Douglas-fir, and dry grand fir plant association group) habitat-capable area as spatially dynamic high quality spotted owl habitat patches, and approximately 50–75 percent of the total moist forests (moist grand fir, western hemlock, and Pacific silver fir plant association groups) habitat-capable area as high-quality spotted owl habitat patches.
- Recovery Action 7: Manage lands in these Provinces outside of the high quality habitat patches to restore ecological processes and functions, and to reduce the potential for significant losses by stand-replacement fires, insects, and disease.
- Recovery Action 32: Maintain substantially all of the older and more structurally complex multi-layered conifer forests on Federal lands outside of MOCAs in the Olympic Peninsula, Western Washington Cascades, Western Oregon Cascades, Oregon Coast Range, Oregon and California Klamath, and California Coast Provinces, allowing for other threats, such as fire and insects, to be addressed by restoration management actions. These forests are characterized as having large diameter trees, high amounts of canopy cover, and decadence components such as broken topped live trees, mistletoe, cavities, large snags, and fallen trees.

While the D-Bug Project falls on the eastern boundary of the Western Oregon Cascades province, much of the habitat within the D-Bug Project Area more closely resembles Eastern Oregon Cascades habitat, so these Eastern Oregon Cascades province recovery actions (6 and 7) are addressed as they pertain to the D-Bug project.

The D-Bug project is consistent with Recovery Action 6, as only 300 acres of suitable NRF habitat would be treated within any alternative, and overstory canopy covers within suitable NRF habitat would be maintained at about 60% to maintain its ability to function as NRF.

The D-Bug project is consistent with Recovery Action 7, as the intention of all silvicultural treatments is to reduce the within stand risk of stand replacement fire and to limit the within stand spread of the mountain pine beetle. Alternative one is not consistent with this Recovery Action as it does not reduce the potential for 'significant' losses by stand-replacement fire or losses from insects.

The D-Bug project is also consistent with Recovery Action 32. This Recovery Action pertains to all identified mixed conifer stands with suitable nesting, roosting and foraging habitat within the project area. All alternatives are consistent with this recovery action. The no action alternative would maintain existing older and structurally complex multilayered conifer forest, but it would not address threats to these stands by wildfire. The action alternatives would reduce some canopy closures in suitable spotted owl habitat within 410 meters of Highway 138 below 60% and remove some 'large' diameter trees, but this treatment would increase the within stand resiliency to crown fire which

would maintain the habitats suitability for spotted owls into the future. In areas of suitable NRF habitat farther than 410 meters away from Highway 138, canopy closures would be maintained at about 60%, but the within stand resiliency to crown fire would still be slightly improved as a result of the thinning. In addition, moderate levels of downed wood cover and snags would be maintained in the NRF habitat.

Cumulative Effects

Cumulative effects for the Northern Spotted Owl are analyzed across their potential range in Oregon, Washington and Northern California. Past clearcut timber harvesting of late-successional and old growth forests is the management action that has had the largest cumulative impact on spotted owls through the removal of NRF habitat, both on forest (Table 12) and within the owls range. Commercial thinning would also cumulatively add to past and future commercial thinning and past, ongoing and future pre-commercial thinning (Tables 12-14), which is designed to accelerate stand structure, benefiting late successional species like the owl. Projects that are designed to accelerate the development of future habitat would also lower the risk of future loss of habitat to wildfire, by making the stands more fire resilient. Thus, because of the minimal effects of the action alternatives, when considered in the context of past, present, and foreseeable actions across the species range, it is determined that there are no consequential negative cumulative effects associated with any alternative considered for the D-Bug Project.

Determination of Impact

There would be a small reduction in canopy cover in suitable NRF habitat and slight increase in the resiliency of the affected NRF habitat to crown replacement fires; therefore, it is determined that the action alternatives **may affect, but are not likely to adversely affect** the Northern Spotted Owl because of the limited scale of the impact and the retention of all suitable NRF habitat within the project area. Alternative 1 would have no effect to individuals or habitat for the Northern Spotted Owl.

Johnson's Hairstreak (*Callophrys johnsoni*)

This species is a small (1-1 3/8"), brownish butterfly that depends on coniferous forests that contain mistletoes of the genus *Arceuthobium* (Black and Lauvray 2005). Johnson's hairstreaks prefer late-successional forests with high levels of mistletoe, but they may also be found in younger forests with dwarf mistletoe (Black and Lauvray 2005). Mistletoe serves as the host plant for their eggs, and larvae feed on mistletoe and Chrysalids hibernate in mistletoe masses. Timber harvest activities that select trees with mistletoe for removal have reduced foraging habitat for this species, in particular areas of harvest within mixed conifer stands (as opposed to pure lodgepole stands).

Existing Condition

Johnson's hairstreak was not observed during field reconnaissance for this project. However, suitable late-successional conifer forest with mistletoe does exist within the planning area, and within harvest units, therefore it is assumed that the species occurs within the planning area. Johnson's hairstreaks have been documented four miles west of the D-Bug planning area on the Diamond Lake Ranger District and elsewhere in Douglas County (Opler et al. 2006).

Direct and Indirect Effects

Alternative 1 would have no direct or indirect effects as no trees hosting dwarf mistletoe would be removed. Alternatives 2, 3, and 4 would potentially all result in some direct

mortality to Johnson's hairstreak larvae as lodgepole trees containing mistletoe are proposed to be removed in favor of retaining trees without mistletoe. Alternative 4 would result in the most indirect effects as it proposes harvesting the most late successional habitat (primarily lodgepole), with Alternative 2 harvesting 2,500 acres less lodgepole, and Alternative 3 harvesting the least amount of lodgepole in the action alternatives. Alternatives 2 and 4 harvest the same amount of mixed conifer habitat, and it is these stands that are most likely to contain Johnson's hairstreak due to their higher moisture content and increased forest floor diversity of flowering plants. However, much of the mistletoe in planned units is in the older trees, in particular the older mountain hemlock (a species that is less likely to be harvested due to poor market demand). Indirect effects include a potential reduced rate of spread of mistletoe in stands adjacent to harvest units as source populations of mistletoe would be removed, reducing future availability of mistletoe as a food source across all action alternatives. However, Alternative 4, which would treat approximately 28% of the 42,000-acre planning area, leaves the rest of the area unmanaged for mistletoe spread. All action alternatives contain the same amount of underburning, which would have a short term impact to nectar producing flowers. The connected and similar actions associated with the action alternatives would have no effect to the Johnson's hairstreak butterfly.

Cumulative Effects

Alternative 1 would have no cumulative impact as no timber harvest or fuel reduction activities would take place. Cumulative effects for the Johnson's hairstreak are analyzed over the entire planning area, encompassing nine 6th field watersheds, (125,990 acres) as mistletoe is spread throughout the planning area. Over the past 60 years, approximately 9% of the nine 6th field watersheds have been harvested (regeneration, shelterwood, and commercially thinned) which would have removed most of the mistletoe present within harvested stands (Table 12). Alternative 4 would double the amount of historic harvest within the nine 6th field watersheds by harvesting an additional 9% of the area, with Alternative 2 increasing harvest by 8%, and Alternative 3 by harvesting 5% over past amounts. These acres, when considered together, contribute to a minor loss of mistletoe across the landscape because at least 82% of the watersheds would have no additional harvest as there are no future activities planned for removing vegetation, thus maintaining mistletoe across the landscape and limiting the potential for cumulative effects.

Determination of Impact

All action alternatives would result in the loss of trees harboring mistletoe, therefore it is determined that the action alternatives **may impact individuals or habitat but are not likely to contribute to a trend toward federal listing or loss of viability** of Johnson's hairstreak, because of the limited extent of the loss of mistletoe when compared to the range of this species and the amount of adjacent reserved land allocations. There would be sufficient unharvested areas within the nine 6th field watersheds (including the Oregon Cascades Recreation Area and the Mount Bailey and Thirsty Creek Appendage Inventoried Roadless Areas) to harbor mistletoe host trees to maintain population viability of Johnson's hairstreak. Alternative 1 would have no impact to individuals or habitat for Johnson's hairstreak.

Coronis fritillary (Speyeria coronis coronis)

This is relatively large (~3") yellow-orange butterfly with black markings on the upperside of the wing, with silver spots on the underside of the hind wing (Scheuering 2006, Opler et al. 2006). They are found in a variety of habitats, including conifer forests and

grasslands where violets (*Viola* spp.), the principle food source of larvae, are present (Scheuering 2006). Loss of grassland or montane meadow habitat is the primary threat to this species.

Existing Condition

Coronis fritillaria were not observed during field reconnaissance for this project. However, suitable montane meadow and coniferous forest exists in the planning area, therefore it is assumed that the species occurs within the planning area. *Coronis fritillaria* have been documented in Douglas County (Opler et al. 2006).

Direct and Indirect Effects

Alternative 1 would have no direct or indirect effects as no grasslands, meadows or nectar producing flowers would be impacted. No meadows with the potential to have violets in them would be impacted from timber harvest or other associated activities in any action alternative. Mixed conifer stands within all action alternatives do have some *Viola* species present, but they fall within the no harvest buffers (Helliwell personal communication 2008); therefore, none of the action alternatives would impact the primary food source of *Coronis fritillaria* larvae, so no direct effects would occur from any alternatives.

Indirect effects include the potential loss of other nectar producing flower species by mechanized harvest equipment and temporary road construction, primarily within mixed conifer stands which have moist understory microclimates suitable for flower growth. Alternatives 2 and 4 contain the same amount of mixed conifer harvest, while Alternative 3 would have less indirect effects to *Coronis fritillaria* nectar sources as it proposes to harvest about 400 acres less mixed conifer habitat. All action alternatives contain the same units of underburning, which would have short term impact to nectar producing flowers. The connected and similar actions associated with the action alternatives would have no effect to the *Coronis fritillaria*.

Cumulative Effects

Alternative 1 would have no cumulative impact as no timber harvest or fuel reduction activities would take place. Cumulative effects for the *Coronis fritillaria* are analyzed over the entire planning area, encompassing nine 6th field watersheds, (125,990 acres) where suitable grasslands, meadows or mixed conifer habitat occurs. Alternative 1 would have no cumulative impact as no timber harvest or fuel reduction activities would take place. Alternatives 2 and 4 would add the most cumulative impact to the past, present and foreseeable impacts to mixed conifer stands with nectar producing flowers, with Alternative 3 adding less cumulative impact than any other action alternative. These acres, when considered together, contribute to a minor loss of nectar producing flowers across the landscape because at least 82% of the watersheds would have no additional harvest as there are no future activities planned for removing vegetation, thus maintaining nectar producing flowers and grasslands across the landscape and limiting the potential for cumulative effects.

Determination of Impact

All action alternatives would result in the loss of some nectar producing flowers through harvest in mixed conifer stands, therefore it is **determined that the action alternatives may impact individuals or habitat but are not likely to contribute to a trend toward**

federal listing or loss of viability of the *Coronis fritillary*. This is because of the small amount of impact to nectar producing flowers throughout the range of the species and the amount of adjacent reserved land allocations. Alternative 1 would have no impact to individuals or habitat for the *Coronis fritillary*.

Mardon Skipper (*Polites mardon*)

The Mardon skipper is a small (<1") tawny-orange butterfly with a hairy body (Kerwin and Huff 2007). Larvae feed on native bunchgrasses including Idaho fescue (*Festuca idahoensis*), while adults feed on a variety of flower nectar sources. It is a Federal candidate for listing under the ESA due to habitat destruction or degradation of its obligate grassland habitats, encroachment of non-native vegetation, and successional loss of grasslands to forest (USDI 2004a).

Existing Condition

Mardon skipper were not observed during field reconnaissance for this project. However, there are limited amounts of suitable grassland habitat containing Idaho fescue within the planning area; therefore it is assumed the species occurs within the planning area. Mardon skipper have been documented on the southern portion of the Rogue River National Forest.

Direct and Indirect Effects

Alternative 1 would have no direct or indirect effects as no grassland habitats or nectar producing flowers would be impacted. No meadows with the potential to have Idaho fescue in them would be impacted due to timber harvest or other associated activities in any alternative. Indirect effects include the potential loss of other nectar producing flower species by mechanized harvest equipment and temporary road construction, within mixed conifer stands which have moist understory microclimates suitable for flower growth, as well as lodgepole stands which contain phlox (*Phlox diffusa*), which is a source of nectar used by Mardon skippers. Alternatives 2 and 4 contain the same amount of mixed conifer harvest, while Alternative 3 would have less indirect effects to Mardon skipper nectar sources as it proposes to harvest >400 acres less mixed conifer habitat. Alternative 4 would have the most indirect effects to Mardon skipper as it contains more than 2,000 additional acres of lodgepole than proposed in Alternative 2 and approximately 4,000 additional acres of lodgepole than Alternative 3. All action alternatives contain the same 2 units of underburning, which would have short term impact to nectar producing flowers. The connected and similar actions associated with the action alternatives would have no effect to the Mardon skipper.

Cumulative Effects

Cumulative effects for the *Coronis fritillary* and Mardon skipper are analyzed over the entire planning area, encompassing nine 6th field watersheds, (125,990 acres) where suitable grasslands, meadows or mixed conifer habitat occurs adjacent to harvest units. Alternative 1 would have no cumulative impact as no timber harvest would take place. Alternatives 2 and 4 would add the most cumulative impact to the past, present and foreseeable impacts (Tables 12-14) from timber harvest to mixed conifer stands with nectar producing flowers, with Alternative 3 adding less cumulative impact than any other action alternative. No alternative would add to the cumulative impacts to grasslands or meadows which are most important to these species.

Determination of Impact

All action alternatives would result in the loss of some nectar producing flowers through harvest in mixed conifer and lodgepole stands, therefore it is determined that the action alternatives **may impact individuals or habitat but are not likely to contribute to a trend toward federal listing or loss of viability** of the Mardon skipper. This is because of the small amount of impact to nectar producing flowers throughout the range of the species' and the amount of adjacent reserved land allocations. Alternative 1 would have no impact to individuals or habitat for either species.

Evening Fieldslug (*Deroceras hesperium*)

The evening fieldslug is a medium sized slug (>.5" long), associated with perennially wet meadows in coniferous forests in microsites containing herbaceous vegetation edging water or under damp litter (Burke and Duncan 2005). They feed on microorganisms and plant matter. Threats to this species include loss or degradation of wetland habitat, especially activities that alter moisture regimes on the edges of wet meadows, as well as fire of any severity (Burke and Duncan 2005).

Existing Condition

Evening fieldslugs were not observed during field reconnaissance for this project. However, there are perennially wet meadows in and adjacent to coniferous forest within the planning area; therefore it is assumed the species occurs within the planning area. Evening fieldslugs have been documented on the western cascades of Oregon.

Direct and Indirect Effects

Alternative 1 would have no direct effects as no timber harvest would take place; however, indirectly, increased fire hazard resulting from untreated fuels may intensify fire severity near wetlands, which would be a detriment to evening fieldslugs. No wetland habitats would be directly impacted by timber harvest or fuels reduction activities as all wetlands are buffered by a minimum of 50 feet from where the wetland transitions to forest (most are buffered by 150 feet); therefore there would be no direct effects to the evening fieldslug as a result of timber harvest or fuels reduction activities from any of the action alternatives. Indirect effects of thinning adjacent to wetlands (primarily the eastern shore of Lemolo Lake and the southern meadows adjacent to Silent Creek south of Diamond Lake) potentially include some level of increased desiccation along wetland edges through increased solar penetration and wind which may reduce the amount of suitable moist microclimates for evening fieldslugs. Both Alternatives 2 and 4 contain the same amount of thinning adjacent to wetlands, while Alternative 3 has slightly less thinning adjacent to wetlands on the eastern shore of Lemolo Lake. While there is no treatment directly adjacent to potentially occupied wetlands, the treatments adjacent to wetlands would benefit the wetlands indirectly by creating a "shadow effect" where fire behavior is reduced in adjacent areas of untreated stands or habitat. This "shadow effect" is estimated to be 1.5 times the size of the treatment unit, thus many of the buffered wetlands would encounter minimized fire behavior as a result of thinning in adjacent stands (see Table 21). No underburning would occur in stands with suitable habitat, so there would be no direct or indirect effects from underburning. No temporary roads would be constructed through wetlands or moist meadows in any alternative. The connected and similar actions associated with the action alternatives would have no effect to the evening fieldslug.

Cumulative Effects

Cumulative effects for the evening fieldslug are analyzed over the entire planning area, encompassing nine 6th field watersheds, (125,990 acres) where suitable wetlands or wet meadows within conifer habitat occur adjacent to harvest units. Alternative 1 would have no cumulative impact as no timber harvest would take place. Alternatives 2 and 4 would add the most cumulative impact to the past, present and foreseeable impacts (Tables 12-14) from timber harvest and road building to wetlands and wet meadows, with Alternative 3 adding less cumulative impact than any other action alternative.

Determination of Impact

All action alternatives would result in minimal desiccation of some wetland or wet meadow habitats within or adjacent to mixed conifer units, therefore it is determined that the action alternatives **may impact individuals or habitat but are not likely to contribute to a trend toward federal listing or loss of viability** of the evening fieldslug. This is because of the minimal amount of wetland habitat impacted and the adjacent reserved land allocations which are managed to preserve wetland habitats. Alternative 1 would have no impact to individuals or habitat for the evening fieldslug.

Salamander Slug (*Gliabates oregonius*)

The salamander slug, also known as the “axe tail” slug, is a small slug (< 0.5” long) associated with leaf litter in conifer forests in moderate elevations in the western Cascades. The salamander slug is a predatory slug, thus they prefer habitats with an abundance of other slugs to predate on. Threats to this species include activities that lead to a loss of microhabitat through desiccation resulting from alteration of moisture regimes (including fire) or loss of deciduous leaf cover which also alters microhabitat moisture.

Existing Condition

Salamander slugs were not observed during field reconnaissance for this project. However, there are conifer forests with a deciduous component to provide leaf litter habitat for this species in the planning area, therefore it is assumed the species occurs within the planning area, primarily in the lower elevation mixed conifer units along Highway 138. There are no known locations of Salamander slug populations on the Umpqua NF, the closest known populations are to the north in the Willamette NF.

Direct and Indirect Effects

Alternative 1 would have no direct effects as no timber harvest would take place; however, indirectly, increased fire hazard resulting from untreated fuels may intensify fire severity near wetlands, which would be a detriment to salamander slugs. All action alternatives contain the same units and prescriptions in the suitable mixed conifer habitat along Highway 138, therefore the direct and indirect effects for action alternatives are identical. Mechanical harvest and mastication, as well as temporary road construction in these lower elevation mixed conifer stands would disturb the shrubby deciduous understory, and would therefore have the potential for direct mortality to salamander slugs by crushing with harvesting equipment. However, the majority of high quality, moist habitat more likely to harbor an abundance of other slug prey is within the riparian reserve portions of units which contain buffers of 50 to 300 feet. Indirect effects from all action alternatives could include microsite desiccation along the edges of riparian buffers which could reduce the amount of suitable moist habitat for foraging salamander slugs. There would be no direct or indirect effects from underburning, as no underburning

would occur within potentially occupied stands. While there is no treatment directly within these riparian areas, the treatments adjacent to riparian areas would benefit the riparian areas indirectly by creating a “shadow effect” where fire behavior is reduced in adjacent areas of untreated stands or habitat. This “shadow effect” is estimated to be 1.5 times the size of the treatment unit, thus many of the buffered riparian areas would encounter minimized fire behavior as a result of thinning in adjacent stands (Table 21). The connected and similar actions associated with the action alternatives would have no effect to the salamander slug.

Cumulative Effects

Cumulative effects for the salamander slug are analyzed over the Lake Creek, Clearwater Creek Headwaters and Stump Lake 6th field watersheds (encompassing 42,378 acres) which encompass the potentially suitable lower elevation mixed conifer habitat with harvest units in the D-Bug planning area. Alternative 1 would have no cumulative impact as no timber harvest would take place. Alternatives 2, 3 and 4 would add the same minor cumulative impact to the past, present and foreseeable impacts from timber harvest (Tables 12-14) to suitable deciduous understory habitat.

Determination of Impact

All action alternatives would result in disturbance to suitable shrubby herbaceous understories within lower elevation mixed conifer units, therefore it is determined that the action alternatives **may impact individuals or habitat but are not likely to contribute to a trend toward federal listing or loss of viability** of the salamander slug. This is because of the minimal amount of treatment proposed in mixed conifer habitat throughout the planning area and the amount of mixed conifer habitat in adjacent reserved land allocations. Alternative 1 would have no impact to individuals or habitat for the salamander slug.

Bufflehead (*Bucephala albeola*)

The Bufflehead is the smallest diving duck in North America. They are cavity nesters who frequent freshwater permanent ponds in woodlands throughout North America during the breeding season and over winter in both fresh and saltwater along coastal areas (Gauthier 1993). They nest in the abandoned cavities of Northern flickers, will nest over 1,300 feet away from water, and often reuse the same nest site in successive years (Gauthier 1993). Threats to Buffleheads include lack of nest sites (loss of trees or absence of cavities), and competition for food with fishes in wetlands with low nutrients.

Existing Condition

Buffleheads have been observed on Diamond Lake and the Diamond Lake Resort sewage ponds regularly in May through September (Umpqua Valley Audubon Society 2006). In 1989 and 1990 they were documented nesting at the Diamond Lake Sewage Ponds (Fix 1990). As Bufflehead are regularly observed on Diamond Lake and the sewage ponds during the breeding season it is likely that they nest nearby, though no nests have been documented. There are no recorded observations of Bufflehead at Lemolo Lake, but it is likely that this lake may also be frequented by Bufflehead.

Direct and Indirect Effects

There would be no direct or indirect effects to Bufflehead as a result of Alternative 1 as no timber harvest or fuels reduction activities would take place. All action alternatives include harvest of units adjacent to Diamond Lake, the sewage ponds and Lemolo Lake in mixed conifer habitats that contain Northern Flicker cavities. As timber harvest

activities would be occurring during the breeding season, all action alternatives may cause direct mortality to the eggs of nesting Bufflehead through nest site disturbance (causing nest abandonment), or hazard tree falling of snags containing cavities used by nesting Bufflehead. Additionally, proposed underburning in units 82 and 53, contained in all action alternatives, may result in the consumption of snags containing nesting Bufflehead, resulting in direct mortality if young have not fledged from the nest. Indirect effects common to all action alternatives include disturbance of nesting or roosting Bufflehead, alteration of nest microclimate due to reduced canopy closure, and reduction of snags that could be utilized in the future for nesting cavities. There would be no indirect effects to Bufflehead foraging habitat as a result of any action alternative as no impact to water quality or streamflow quantity are expected. Timber harvest and fuels reduction activities may provide a long term benefit to suitable Bufflehead nesting habitat within treatment units by reducing the risk of high severity fire in treated stands and stands directly adjacent to treatment units (Table 21). The connected and similar actions associated with the action alternatives would have no effect to the Bufflehead.

Cumulative Effects

Cumulative effects for Bufflehead are analyzed across their potential range, extending from the Pacific coast throughout the interior Pacific Northwest of North America. Alternative 1 would result in no additional cumulative effects as no harvest or fuels reduction activities would occur. All action alternatives would add the same minor level of cumulative impact to Bufflehead breeding habitats across its range by reducing some snag densities, but would not add any impacts to foraging habitats.

Determination of Impact

Timber harvest and fuel reduction activities adjacent to Diamond Lake, the sewage ponds and Lemolo Lake may impact Bufflehead nest cavities or roosting sites, therefore it is determined that the action alternatives **may impact individuals or habitat but are not likely to contribute to a trend toward federal listing or loss of viability of** Bufflehead. This is because the amount of habitat impacted is minimal when compared to the amount of available habitat across the Diamond Lake Ranger District and adjacent reserved land allocations. Alternative 1 would have no impact to individuals or habitat for the Bufflehead.

Bald Eagle (*Haliaeetus leucocephalus*)

The Bald Eagle is a wide ranging raptor, easily identified by its large size, white head, brown body and yellow bill and legs. They nest close to large bodies of water including lakes, rivers and oceans. They require large trees and snags with stout limbs to support their large platform nests and roosting sites. They feed primarily on fish, but they are opportunistic predators of waterfowl and shorebirds, and also scavenge on carrion. They have a long breeding season, extending from January through the end of August.

The Bald Eagle was listed as Threatened under the ESA from 1978 through 2007 when they were delisted (USDI 2007b). In 1974 Oregon was estimated to have 63 breeding pairs of Bald eagles, while in 2007 Oregon was estimated to have 470 breeding pairs (USDI 1978, USDI 2007b). While the Bald Eagle is no longer listed under the ESA, it was originally, and continues to be protected by the Bald Eagle Protection Act (1940) which was amended to include Golden Eagles in 1962 to become the Bald and Golden Eagle Protection Act. Additionally the Bald Eagle is covered under the Migratory Bird Treaty Act (MBTA).

Existing Condition

Bald Eagles have been documented nesting along Diamond and Lemolo Lakes since the early 1980's. They have been observed throughout the year, and there are two currently active nests on Diamond Lake and one active nest on Lemolo Lake (Table 26). The two nests on Diamond Lake are in large Shasta red firs, but they roost along the lake on larger diameter snags of several different species including white fir, Douglas-fir, and ponderosa pine. The Lemolo Lake nest is in a large diameter ponderosa pine, and this pair also utilizes larger diameter snags along Lemolo Lake as roosts to forage from.

Table 26. Reproductive history of Bald Eagles at Diamond and Lemolo Lakes from 2000-2007.

Diamond Lake		
Site Name	Time Period	Young Fledged
Rocky Point	2000-2004	6 Total
	2005-2007	3* Total; (1* in 2005, 2 in 2007)
Silent Creek	2000-2004	6 Total
	2005-2007	1* (1* in 2005)
Lemolo Lake		
Site Name	Time Period	Young Fledged
Lemolo Lake	2000-2004	4 Total
	2005-2007	1* (1* in 2005)

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The WA documents the desired condition as uneven-aged, moderately dense forests with abundant large-diameter potential nest trees. Ponderosa pine is the most desirable species, followed by Douglas-fir and Shasta red fir. These species all can provide a relatively open crown that allows large bodied birds like eagles to access nest locations. A moderately stocked understory would also discourage some human uses and would provide screening of nest activities. Foraging habitat was identified as the 100 yard band around both Lemolo Lake and Diamond Lake. Within this area the desired future condition is to have frequent large diameter trees and snags that provide perch sites. On the north, south and west sides of the lake there are abundant sites that provide some security and suitable perch locations. The concentration of recreational developments on the east side of the lake offers less seclusion and fewer perch sites.

Stands containing large legacy trees from the historic fire regime are high priority for thinning to alleviate the risk of premature mortality from excessive competition, insects, disease, and fire. Retaining snags wherever feasible unless they constitute an immediate public safety hazard is also recommended, as is retaining dense shrubs within and around areas that have large trees that could be used as eagle perch sites. In areas where these trees don't presently occur but they are desired; a long-term solution may be to plant suitable species (Douglas-fir, white pine, ponderosa pine) such that they will lean over the water.

Recommendations from the National Bald Eagle Management Guidelines (USDI 2007a), Category C. Timber Operations and Forestry Practices.

- Avoid timber harvesting operations, including road construction and chain saw and yarding operations, during the breeding season (January 1 through August 31) within 660 feet of the nest. The distance may be decreased to 330 feet around alternate nests within a particular territory, including nests that were attended during the current breeding season but not used to raise young, after eggs laid in another nest within the territory have hatched.
- Selective thinning and other silviculture management practices designed to conserve or enhance habitat, including prescribed burning close to the nest tree, should not be undertaken outside the breeding season without consulting the planning wildlife biologist to check nesting status of eagles prior to treatment.

Direct and Indirect Effects

Alternative 1 would have no direct or indirect effects as no timber harvest or fuels reduction activities would take place. Alternatives 2 and 4 have slightly more fuels reduction treatments proposed adjacent to the Silent Creek nest site as Unit 199 in both alternatives include 281 acres of non-commercial fuels reduction thinning (trees <7" dbh), while Alternative 3 treats 132 acres of Unit 199. While there would be more short term disturbance (noise from chainsaws) adjacent to the Silent Creek nest site during the non-breeding season under Alternatives 2 and 4, the increased unit width and leveraged acres would increase the fire resiliency of the nest stand to wildfires moving from Diamond Lake westward post treatment, with slightly less benefits in Alternative 3 due to the smaller unit size.

The Rocky Point nest site is surrounded by the same units with the same prescriptions in all action alternatives. The nest has a 330 foot no harvest buffer around it in all alternatives as specified by the National Bald Eagle Management Guidelines (USDI 2007a). Silvicultural prescriptions for the adjacent stands have been written (Project File) to favor the retention of Shasta red fir and ponderosa pine, preferred species for nest trees. As harvest treatments would occur outside of the breeding season, short term disturbance in the form of noise and smoke resulting in short term displacement may affect eagles roosting nearby, but no direct mortality would take place as a result of these disturbances. Fuels reduction treatments may occur during the breeding season only if the eagles are not breeding to minimize potential disturbance to nesting or fledging eagles. Territorial occupancy has been documented to continue without adverse effects to productivity after selective harvest in the fall adjacent to other Bald eagle nest sites in Oregon (Arnett et al. 2001). In 2007, the area comprised of unit 84 was non-commercially thinned (all trees 5" dbh and less) and pile burned after the breeding season, with no impacts to eagles as the pair returned to this area in 2008.

There are no harvest units within ½ mile of the Lemolo Lake nest site in any action alternative. Among the action alternatives, Alternatives 2 and 4 contain more acres of harvest units adjacent to Lemolo Lake, but the increase in acres from Alternative 3 is strictly in lodgepole dominated stands which are rarely used by eagles for roosting. Due to the distance of the proposed units from the Lemolo nest site there would be no direct effects to the eagles nesting at this site. Short term indirect effects include disturbance of roost sites adjacent to Lemolo Lake near the lodge area during logging or fuels reduction activities. As there are no harvest units directly adjacent to the nest stand,

there is no expected reduction in the probability of crown fire entering the Lemolo Lake nesting stand as a result of any alternative.

As there are no expected impacts to water quality or streamflow as described in the aquatic section, there would be no effects to the foraging habitat in Diamond or Lemolo lakes from any action alternative. The connected and similar actions associated with the action alternatives would have no effect on the Bald Eagle.

Cumulative Effects

Cumulative effects for the Bald Eagle are analyzed across their potential range, extending from the Pacific coast throughout the interior Pacific Northwest of North America. Alternative 1 would result in no additional cumulative effects as no harvest or fuels reduction activities would occur. Alternatives 2 and 4 may result in a slight beneficial increase in fire resiliency of the nest stands within the planning area as compared to Alternative 3, but the difference would be very small. All action alternatives would have a minor contribution to disturbance cumulative impacts to Bald eagle breeding habitats across its range, but would not add any impacts to foraging habitats.

Determination of Impact

Timber harvest and fuel reduction activities adjacent to Diamond Lake and Lemolo Lake may result in short term noise and smoke disturbance outside of the nesting season, therefore it is determined that the action alternatives **may impact individuals or habitat but are not likely to contribute to a trend toward federal listing or loss of viability** of the Bald Eagle. This is because of the small scale of disturbance and the long term benefit to Bald Eagles as a result of the action alternatives improving the resiliency to crown fire within nest stands adjacent to Diamond Lake. Alternative 1 would have no impact to individuals or habitat for the Bald Eagle.

Yellow Rail (*Coturnicops noveboracensis*)

The Yellow Rail is an incredibly secretive bird that is generally only identified by the insect-like ticking vocalizations of males at night (Audubon Society Watchlist⁴⁵ 2007a). They breed in large wet meadows or marshes with sedges and grasses, while they over winter in salt marshes, rice fields and wet meadows. They feed on freshwater snails, insects, small crustaceans and seeds (Audubon Society Watchlist 2007a). Threats to Yellow Rails include loss of wetland habitats required for breeding through the draining of wetlands for agriculture and flood control.

Existing Condition

There are no observations of Yellow rail within the planning area, or on the Umpqua National Forest. The closest known detection of this species is approximately 12 miles northeast of the planning area at Big Marsh on the Deschutes National Forest. There is some potential, low quality habitat along the Silent Creek marshes below Diamond Lake, and in Toolbox Meadow. However, in volunteer point count surveys from 1996-2006 the species was not detected in these locations (Umpqua Valley Audubon Society 2006). Additional surveys by Forest Service personnel were conducted in 2003 in the Silent Creek marshes and no Yellow Rails were detected (USDA 2004). The Yellow Rail is a notoriously difficult bird to survey for, and as a result its presence within the planning

⁴⁵ They are on the Audubon Society's Watchlist as a red species, meaning that their population is declining rapidly/and or they have small populations, face major conservation threats, and are typically threatened in their global distribution (Audubon Society Watchlist 2007a).

area cannot be discounted without having completed multiple years of species specific nocturnal call-response surveys (Conway and Nadeau 2005).

Direct and Indirect Effects

Alternative 1 would have no direct or indirect effects as no timber harvest or fuels reduction activities would take place. There would be no direct effects to this species as no suitable nesting habitat would be harvested or affected by fuels treatments due to the wetland buffers common to all action alternatives. Indirect effects common to all action alternatives include noise disturbance as the result of mechanical timber harvest and mastication of fuels which could result in short term displacement. The treatments adjacent to wetlands would benefit the wetlands indirectly by creating a “shadow effect” where fire behavior is reduced in adjacent areas of untreated stands or habitat as discussed previously (Table 21). There would be no indirect effects to Yellow Rail foraging habitat as a result of any action alternative as there is not expected to be any impact to water quality or streamflow quantity. The connected and similar actions associated with the action alternatives would have no effect to the Yellow Rail as they occur outside of potential rail habitat.

Cumulative Effects

Cumulative effects for the Yellow Rail are analyzed across their potential range in Oregon, extending from the Diamond and Lemolo Lake areas to Klamath National Wildlife Refuge to the coast of northern California. The cumulative impacts of all action alternatives, when added to past, present, and reasonably foreseeable actions (Tables 12-14) would be insignificant across the range of the Yellow Rail in Oregon and northern California, because of the limited indirect effects of disturbance related to this project.

Determination of Impact

There is a possibility that there could be some short term disturbance to Yellow Rail’s through noise and smoke disturbance, therefore it is determined that the action alternatives **may impact individuals or habitat but are not likely to contribute to a trend toward federal listing or loss of viability** of the Yellow Rail. This is because of the small scale of disturbance and small amount of habitat associated with the project as compared to the overall range of the species. Over the long term, there would be a benefit to Yellow Rails as a result of the action alternatives decreasing the risk of a high severity wildfire which could impact water quality in foraging habitat. Alternative 1 would have no impact to individuals or habitat for the Yellow Rail.

Lewis’s Woodpecker (*Melanerpes lewis*) and White-headed Woodpecker (*Picoides albolarvatus*)

Lewis’s Woodpecker is a medium sized woodpecker associated with open woodland habitats near water, and breeding habitats include an open canopy with large diameter dead or dying trees (Marshalls et al. 2003). They are a secondary cavity nester, utilizing previously excavated cavities of Northern Flickers (*Colaptes auratus*) and Hairy Woodpeckers (*Picoides villosus*). They forage on insects during the spring and summer, while in the fall and winter they forage on fruit and acorns (Marshall et al. 2003). During the fall, Lewis’s Woodpeckers move to lower elevations in eastern Oregon. This species has undergone “drastic” declines in its breeding range in the state, possibly due to a loss of suitable habitat, loss of nest and food storage trees, competition for cavities, and pesticides (Marshall et al. 2003). It is a “red” listed species on the Audubon Society Watchlist (Audubon Society 2007c).

The white-headed woodpecker is a stunning woodpecker, unmistakable for any other woodpecker species by its mostly white head and fully black body. They inhabit mostly open ponderosa pine or mixed conifer forests with a strong ponderosa pine component (Marshall et al. 2003). They prefer a relatively open canopy with a sparse understory and larger trees and snags for nesting and foraging. They readily use habitat that has been burned or thinned if sufficient numbers of larger trees and snags are retained (Audubon Society Watchlist 2007d). They are primary cavity excavators who feed on seeds, invertebrates and sap (Marshall et al. 2003). Threats to this species include silvicultural practices which remove larger trees and snags, and habitat fragmentation and fire suppression which allow for an increase in shrub cover, thus removing foraging habitat and reducing snag recruitment (Audubon Society Watchlist 2007d).

Existing Condition

Lewis's Woodpecker is regularly detected in the fall migrating through the planning area. Survey's from 1996-2006 regularly detected Lewis's Woodpecker along the Lemolo Lake Road and South Shore meadow in September (Umpqua Valley Audubon Society 2006). Fix (1990) considers Lewis's Woodpecker a scarce, but regular fall migrant. It is likely that the species is in the planning area during fall migration.

Point count surveys from 1996-2006 failed to detect any White-headed Woodpeckers in the planning area (Umpqua Valley Audubon Society 2006). Fix (1990) considered the species a casual visitor to the Diamond Lake RD, but never actually observed the species on the District. The nearest Breeding Bird Survey route closest to the planning area (approximately 7 miles to the west), Clearwater (#69051) has no detections for the White-headed Woodpecker (Sauer et al. 2006). The species may be present in the planning area in very low numbers.

Direct and Indirect Effects to Both Woodpeckers

Alternative 1 would have no direct effects as no timber harvest or fuels reduction activities would take place; however, it would have the most beneficial indirect effects to both woodpeckers of any alternative as it would allow for the most snag recruitment by not limiting the spread of mountain pine beetles or decreasing the risk of wildfire. None of the action alternatives are likely to cause direct effects (mortality) to either woodpecker as it does not appear that these species nest within the planning area, and they highly mobile and able to move away from harvest or fuels reduction related activities. There is limited suitable ponderosa pine habitat within the D-Bug planning area, but the units with the most ponderosa pine are proposed to be underburned and thinned to release existing ponderosa pine from encroachment of other smaller, less fire tolerant conifer species. White-headed woodpeckers, if present, would benefit from the increased openness of treated stands containing ponderosa pine. Alternatives 2 and 4 contain the same amount of thinning and underburning, while Alternative 3 has 68 acres fewer than the other two action alternatives.

Both woodpeckers likely benefit from mountain pine beetle disturbance as they increase lodgepole pine snag densities which they forage off of and result in more open canopies which they prefer to forage in; however, mountain pine beetles are not a preferred food source. Therefore Alternative 4, as it contains the most harvest and temporary road building of all alternatives, would have the most indirect adverse effects to both woodpeckers, followed by Alternative 2, with Alternative 3 having the least adverse effects to snag densities, loss of lodgepole pine foraging habitat and least road densities. Additional indirect effects of the action alternatives includes short term disturbance of foraging within stands being actively harvested or treated for fuels reduction. The

underburning common to all alternatives would provide limited benefits to foraging Lewis's Woodpeckers by potentially increasing snag densities and stirring up flying insects and providing additional short term foraging opportunities. The connected and similar actions associated with the action alternatives would have no effect to either woodpecker or their habitat.

Cumulative Effects

Cumulative effects for the Lewis' woodpecker are analyzed across their potential range in Oregon, extending from the D-Bug planning area to southern British Columbia and Alberta in Canada, and for the white-headed woodpecker, from southern British Columbia to southern Sierra's in California. Cumulative effects for White-headed Woodpeckers are analyzed across their potential range in Oregon, extending from the D-Bug planning area to southern British Columbia and the southern Sierra's in California. Mountain pine beetle activity is increasing throughout northwestern North America, with large levels of snag recruitment occurring. The limited scale of harvest proposed in all action alternatives compared to the current and predicted spread of mountain pine beetles and overall current and predicted increases in the size of wildfires (Westerling et al. 2006, Skinner 2007) throughout the range of both woodpeckers results in an insignificant cumulative loss of snags for foraging habitat, when combined with past, present, and future activities (Tables 12-14).

Determination of Impact

There would be a reduction of current and future snag recruitment as a result of implementation of all action alternatives, therefore it is determined that the action alternatives **may impact individuals or habitat but are not likely to contribute to a trend toward federal listing or loss of viability** of Lewis's or White-headed woodpeckers. This is because it is at an insignificant scale compared to the range of both woodpeckers and because of the amount of protected habitat in the adjacent reserved land allocations. Alternative 1 would have no impact to individuals or habitat for either woodpecker.

Pacific Fringed Myotis (*Myotis thysanodes vespertinus*) and Townsend's Big-eared Bat (*Corynorhinus townsendii*)

The fringed myotis is a small bodied bat that occurs west of the Cascades in Washington, Oregon, and northern California (Weller 2005). They occupy a wide variety of habitats, including oak woodlands and ponderosa pine and mixed conifer forests from sea level to above 9,000 ft. They utilize a variety of different types of roosts, including caves, mines, bridges, crevices in buildings, and underneath bark in a number of tree species (Keinath 2004, Weller 2005). Their diet consists mainly of beetles and moths (Keinath 2004).

Townsend's big-eared bat has, as its name implies, big, long ears and prominent bumps on either side of its nose. They occur across the western United States, and their distribution is correlated to the distribution of caves and abandoned mines, but they would utilize buildings, bridges or hollow trees for roosting (Piaggio and Sherwin 2005). Townsend's big-eared bats can utilize a variety of habitats from coniferous forests, deserts, prairies, riparian areas, agricultural areas, and coastal habitats, in elevations from sea level to 11,000 ft (Piaggio and Sherwin 2005). They specialize in feeding on moths, which comprise over 90% of their diet.

Threats to both species include roost loss and modification through human manipulation or disturbance; habitat alteration through loss of large snags used for roosting by timber

harvest practices; loss of riparian habitat; and agricultural use of pesticides which can directly cause mortality, reduce reproduction and reduce insect prey populations (Keinarth 2004, Piaggio and Sherwin 2005).

Existing Condition

Pacific fringed myotis have been observed on the Diamond Lake RD in 1983 on the bridge to Toketee Falls. In the Oregon Natural Heritage Information Center database, Pacific fringed myotis detections fall mainly along the western front of the Cascades, and on the Umatilla and Wallowa Whitman National Forests in northeastern Oregon. There is a cave occupied by Townsend's big-eared bat approximately 3 ½ miles west of the planning area. The cave is used for both winter hibernacula and summer roosting by Townsend's big-eared bat. The entire planning area represents suitable foraging habitat for both species, and the mixed conifer portions of the planning area represent suitable roosting habitat for the Pacific fringed myotis.

Direct and Indirect Effects

Alternative 1 would have no direct effects to either species as no timber harvest or fuels reduction activities would take place. Any falling of larger diameter (>10" dbh) snags that occurs under any action alternative may lead to direct mortality to either bat species, if they don't fly away when the trees are felled. Alternative 4 contains the most harvest of any action alternative, thus it has the highest potential for direct mortality, followed by Alternative 2, and to a much lesser extent Alternative 3 (due to the approximately 430 acres fewer of mixed conifer harvest, which would contain a higher density of larger diameter snags than would the lodgepole stands). Pacific fringed myotis may roost in larger diameter lodgepole snags, as they use a variety of tree species for roosting. Indirect effects include noise disturbance from timber harvest, road building and fuels reduction activities to roosting bats. Underburning common to all action alternatives may create additional snags for future use as roost sites, but also may result in the loss of existing snags, in particular older, more decayed snags. Timber harvest and fuels reduction activities would not result in an impact to populations of prey species for either bat; therefore there would be no impact to foraging success for either bat. Riparian no-cut buffers, where prescribed, would also limit impacts to both species foraging, as riparian areas are often preferentially used for foraging due to higher insect prey levels. The connected and similar actions associated with the action alternatives would have no effect to the Pacific fringed myotis or Townsend's big-eared bat.

Cumulative Effects

Cumulative effects for both species span their potential ranges throughout the Western United States. The limited size and intensity of harvest associated with the action alternatives, when added to the range wide existing impacts, and planning area past, present, and future actions (Tables 12-14) would contribute minimal impacts to these species. In addition, as no maternal dens would be impacted, there would be no cumulative impacts to hibernacula with this project.

Determination of Impact

There would be a minor reduction of current and future snag recruitment as a result of implementation of all action alternatives, therefore it is determined that the action alternatives **may impact individuals or habitat but are not likely to contribute to a trend toward federal listing or loss of viability** for the Pacific fringed myotis or Townsend's big-eared bat. This is because it is at an insignificant scale compared to the range of both bat species and the amount of reserved land allocations adjacent to the

planning area. Alternative 1 would have no impact to individuals or habitat for the Pacific fringed myotis or Townsend's big-eared bat.

Pacific Fisher (*Martes pennanti*)

The Pacific Fisher is a small carnivore (6-13 lbs) found primarily in low to mid elevation coniferous forests. They have a large home range⁴⁶ and require large live trees, snags and downed logs for denning and resting, along with abundant physical structure near the ground for their small mammal prey (Aubry and Lewis 2003, Powell et al. 2003). Fishers generally avoid clearcuts and forested habitats with less than 40% canopy cover (Aubry and Lewis 2003). Fisher are believed to have been extirpated from Oregon in the early 1950's by a combination of trapping (for their pelts), poisoning from predator control measures, and a loss of habitat as a result of timber harvest and human development. From 1961-1981 fishers were reintroduced to the southern cascades from populations in south-central British Columbia and northern Minnesota to control porcupine populations which were damaging forest plantations in the area (Aubry and Lewis 2003). Fisher captured in southwestern Oregon were more genetically similar to fisher in British Columbia and Minnesota than to fishers captured in the northern Siskiyou mountains of California (Aubry and Lewis 2003).

In a study of radio-collared fisher on the Rogue River National Forest and Crater Lake National Park approximately six miles to the southwest of the planning area, fisher were found to prefer stands of unmanaged forests (with no signs of past timber harvest); they denned primarily in live and dead Douglas-fir and incense-cedar; and preferred trees with mistletoe brooms for resting (Aubry and Raley 2006). Fishers in this study rarely used habitat above 5,100 ft, and the authors did not consider habitat above that elevation to be suitable for denning or resting (Aubry and Raley 2006).

The fisher has been petitioned to be listed under the ESA three times in the past 16 years. In June of 2005 the U.S. Fish and Wildlife Service (USFWS) found the fisher in the West Coast Distinct Population Segment (DPS) warranted to be listed, but was precluded by other higher priority listings (USDI 2004b).

Existing Condition

Fisher have been detected throughout the planning area through photo bait station monitoring and through Aubry and Raley's (2006) telemetry study, where they tracked a dispersing juvenile male across the Diamond Lake RD to the Big Marsh area on the Deschutes NF. In the summer/fall of 2007, 63 track plate stations were deployed and monitored to document small carnivore presence in the planning area; pine marten were detected, but fisher were not detected (Davis and Chapman 2007). During the winter of 2007-2008, 4 camera bait stations were deployed in the planning area for a minimum of one month each; again, detecting pine marten only (Hadwen and Chapman 2008). Within the past 18 years there have been 6 documented sightings of fisher within the general planning area, the nearest sighting was directly adjacent to the north end of Diamond Lake. The planning area is on the higher⁴⁷ elevation end of the observed habitat use for fisher on the Rogue River-Siskiyou National Forest.

⁴⁶ Home ranges for males averaged ~147 km² in breeding season and ~62 km² during the non-breeding season and females averaged ~25 km² (Aubry and Raley 2006).

⁴⁷ The mean elevation of the treatment units is 4,918 ft, with a minimum elevation of 3,927 ft and a maximum elevation of 5,908 ft.

Direct and Indirect Effects

Alternative 1 would have no direct effects to fisher as no timber harvest or fuels reduction activities would take place. Indirectly, a stand replacement wildfire that may result if no action is taken to reduce fuels would degrade or eliminate suitable habitat for the fisher.

There would be no direct effects (mortality) as the result of any action alternative as the most suitable habitat for natal denning within the planning area is the same habitat that contains suitable Northern Spotted Owl nesting, roosting and foraging habitat. Therefore, these units would have seasonal harvest restrictions until after July 15th, by which time juveniles are mobile and able to travel with their mothers and disperse away from harvest or fuel reduction activities (Aubry and Raley 2006).

Indirect effects would occur primarily in the mixed conifer stands, as lodgepole stands within harvest units below 5,100 ft do not contain trees of sufficient diameter (Table 23), nor are they of sufficiently closed canopy (averaging below 30% in pure lodgepole stand, Morrison 2008) to support maternal denning or resting sites. Fishers on the Rogue River-Siskiyou NF utilized den and rest sites with canopy covers of 80% or higher and with snags averaging 44" dbh (ranging from 11" to 77" dbh) (Aubry and Raley 2006). The mixed conifer stands within the D-Bug project have canopy closures between 50-60% currently, and would be reduced to between 30-40% canopy closure after treatment (except within the 300 acres of suitable nesting, roosting and foraging habitat in Alternatives 2 and 4 where canopy cover would be maintained at about 60%). The fishers studied on the Rogue River-Siskiyou NF utilized cavities in large live trees and snags, as well as hollow logs for maternal dens. The average dbh for maternal dens was 38", but ranged from 14-54" dbh; because of this range of diameters, potential future maternal den trees may be removed. Thinning to canopy covers below 40% would also increase the amount of snow that accumulates on the forest floor, resulting in fishers potentially avoiding these areas as they are a heavier bodied animal who would sink in deep snow (Rainer 1983, Weir and Harestad 2003). Fishers also utilize mistletoe brooms in fir and cedar species as preferred rest sites. As all action alternatives prescriptions call for preferentially harvesting trees with mistletoe brooms within lodgepole stands, potential fisher rest sites would be removed by each action alternative. Therefore Alternatives 2 and 4 would impact the most denning and resting mixed conifer habitat, while Alternative 3 would impact over 400 acres less of mixed conifer (Table 27).

Table 27. Acres of potential Fisher habitat (harvest units below 5,100 ft in elevation containing mixed conifer habitat) impacted by each action alternative.

	Alt. 2	% of Mixed Conifer <5,100 ft in Planning Area	Alt. 3	% of Mixed Conifer <5,100 ft in Planning Area	Alt. 4	% of Mixed Conifer <5,100 ft in Planning Area
Total Acres of Mixed Conifer Harvest <5,100 ft	1,688	12%	1,260	9%	1,688	12%
Miles of New Temp Road <5,100 ft	6.5	---	5.5	---	8.3	---

Fisher have been documented to travel across the planning area to the Deschutes National Forest (Aubry and Raley 2006). While timber harvest, fuels reduction and temporary road building activities proposed in all alternatives would not directly benefit fisher habitat⁴⁸, none of the alternatives proposed would preclude fisher from moving through the planning area. On the Rogue River-Siskiyou National Forest both male and female fisher were observed denning, resting and moving through areas with >66% of the overstory trees removed, though males used a wider variety of habitats than females (Aubry and Raley 2006). Though fisher will use cut over habitat, they used unmanaged forests more often for denning and resting (Aubry and Raley 2006).

Fishers can be adversely affected by roads, OHV's and snowmobiles. Within this portion of the planning area temporary roads, which would be obliterated after use, would potentially be utilized as snowmobile and OHV trails prior to removal, thus disturbance would continue after logging operations cease until the roads have been obliterated and blocked off. Alternative 4 has the most new temporary road construction planned, resulting in the highest potential to affect fisher, followed by Alternative 2, while Alternative 3 has the least amount of new road construction (Table 27). Off trail snowmobile use in thinned mixed conifer stands would continue for up to 10 years post project implementation. Increased traffic would result in fisher avoiding habitat adjacent to roads or areas utilized by snowmobiles, and would increase the mobility of fur trappers who use the area to trap pine marten, which could lead to fisher being trapped as well. Additionally in order to meet the purpose and need, roadside fuels reduction treatments would remove key pieces of fisher habitat like hollow log structures, and downed wood cover.

All harvest within suitable mixed conifer fisher habitat would serve to reduce the within stand risk of stand replacing crown fire. Though harvest would reduce canopy cover below preferred densities, remove potential denning and resting sites, and temporarily increase road densities, there would be a long term benefit to fisher habitat by increasing the treated stands resiliency to stand replacement crown fire. Timber removal and fuels treatments may fragment or degrade habitat in the short term in order to prevent high severity fire that would eliminate habitat altogether for decades (USDI 2004b). The connected and similar actions associated with the action alternatives would have no effect to the Pacific Fisher.

Cumulative Effects

Fishers that occur within the D-Bug planning area are likely genetically distinct and geographically isolated by Interstate 5 from fisher found west of I-5 near Mount Ashland (Aubry and Raley 2006). Cumulative effects for fisher are analyzed at the current range of the genetically distinct sub-population extending from the Rogue River-Siskiyou N.F. east of I-5 through Crater Lake National Park, through the Umpqua National Forest and north and east to the Willamette and Deschutes National Forests. Ongoing timber sales and reasonably foreseeable timber sales (Tables 13 and 14) in the planning area and within adjacent forests are often designed to improve fire resiliency as well as accelerate the development of older forest structure. There is no reasonably foreseeable project in the planning area (Table 14) that would result in a substantial loss of fisher habitat; therefore, no cumulative effects would occur.

⁴⁸ The treatment areas within suitable fisher habitat in the D-Bug planning area are at most 19 km² of treatment (Alternative 4), 16 km² (Alternative 2) and 12 km² (Alternative 1), which is less than one average female home range (25 km²) as observed on the Rogue River-Siskiyou NF.

Determination of Impact

Although limited in scale, because there would be a reduction of current and future snag recruitment, a decrease in canopy closure within treatment units below preferred levels, a loss of resting structures, and an increase in vehicle and trapper access to fisher habitat as a result of implementation of all action alternatives, it is determined that the action alternatives **may impact individuals or habitat but are not likely to contribute to a trend toward federal listing or loss of viability** for the Pacific fisher. This is because of the limited amount of suitable fisher habitat impacted as a result of any action alternative and the amount of protected fisher habitat in adjacent reserved land allocations. Alternative 1 would have no impact to individuals or habitat for the Pacific fisher.

Wolverine (*Gulo gulo*)

The wolverine is the most rare carnivore in North America, with stout limbs, long thick brown fur with two lighter brown stripes that extend from the shoulder to the rump (Aubry et al. 2007, Stone 2007c). The current range of the wolverine is not well understood. Aubry et al. (2007) analyzed occurrence data throughout the U.S. and determined that through current records (1995-2005) the range of the wolverine was reduced to Washington, Idaho, Montana and Wyoming and the wolverine was likely extirpated in Oregon. Recently however, a wolverine⁴⁹ has been repeatedly photographed on the Tahoe NF, when the last known sighting of a wolverine in California was 1922. Wolverines are a wide ranging⁵⁰ species, but their primary habitat is high elevations with alpine vegetation and deep snow cover that extends well into spring. They utilize talus cirques for maternal denning in areas with deep snow cover. Threats to the wolverine are primarily activities that influence sub-alpine and alpine communities including timber harvesting, backcountry skiing and snowmobiling, roads, predator trapping, and high road densities (Stone 2007c).

Existing Condition

Surveys to detect wolverines and other forest carnivores occurred from 1994-2000 in the greater Diamond Lake area, but they did not detect any wolverines. Helicopter surveys to detect wolverines occurred over the Mount Thielsen Wilderness, Sky Lakes Wilderness (on the Rogue River-Siskiyou NF) and Crater Lake National Park from 2001-2004, but no wolverines were detected (potential den sites were investigated, but no sign of wolverines were found). However, Mount Bailey, Mount Thielsen and Crater Lake National Park still provide suitable wolverine habitat, and there may be wolverines present. The last documented wolverine sighting in Oregon was in 1992. Wolverine may still be present within the planning area during any part of the year.

Direct and Indirect Effects

Alternative 1 would have no direct effects to wolverine as no timber harvest or fuels reduction activities would take place. Indirectly, Alternative 1 would not help prevent stand replacement fire that would eliminate habitat for decades.

⁴⁹ The origins of that wolverine are now in question due to genetic analysis of hair which identified it to be more similar to wolverines located in the Rocky Mountain than to historical Sierra Nevada wolverines (Fimrite 2008).

⁵⁰ They are a wide ranging species with males having home ranges up to 400 mi² while females with young have much smaller home ranges from 40-160 mi² (Stone 2007c).

Proposed activities during the wolverine breeding season (January to June) would be limited generally to roadsides as snow levels are usually too high in June to operate in areas proposed for harvest that would be located away from roads. There is no suitable habitat within treatment areas for wolverine maternal denning. Because of these limited impacts, there would be no direct effects to wolverines as a result of the implementation of any action alternative proposed for the D-Bug project.

Indirect effects to wolverine habitat include increased temporary road densities (short-term), fragmentation of forested landscapes, and disturbance through increased human presence in potential foraging habitat from all action alternatives. Wolverine are adversely affected by roads in that they avoid areas with higher road densities and increased human presence (Copeland et al. 2007, Ruggiero et al. 2007). Within the planning area, these temporary roads, though planned for obliteration would potentially be utilized as snowmobile and OHV trails prior to removal, thus disturbance would continue after logging operations cease until the roads have been obliterated and blocked off. Increased traffic may result in wolverine avoiding habitat adjacent to roads, and would increase the mobility of fur trappers who use the area to trap pine marten, which could lead to wolverine being trapped, and increases the likelihood of being killed by vehicles. Alternative 4 has the most new temporary road construction planned, followed by Alternative 2, while Alternative 3 has the least amount of new road construction (Table 27). Additionally Alternative 4 proposes an additional 1,891 acres of prescriptions 1 and 2 in lodgepole stands as compared to Alternative 2 and 2,756 additional acres than Alternative 3, which would result in tree spacing large enough to make these stands available for cross country travel by snowmobiles.

Increased timber harvest, particularly within lodgepole pine dominated units with prescriptions 1 and 2 would result in increased habitat fragmentation for wolverines due to decreased canopy covers, decreased snag abundance, decreased ground cover abundance in areas with mastication and grapple piling of slash, and increased temporary road densities in the short term. Alternative 4 has the most acres of harvest⁵¹ followed by Alternative 2, with Alternative 3 having the least amount of harvest. Timber harvest and fuels treatments would also result in increased human use of the areas of suitable habitat, both during harvest and fuels reduction activities, and potential cross country snowmobile use during the winter in heavily thinned stands. Wolverines have been described to be very sensitive to human disturbance and avoid areas used by humans, but it is not well understood if this is a cause-effect relationship or an artifact resulting from wolverine habitat preferences for places unable to be developed by humans (Copeland et al. 2007). Increased human disturbance can cause wolverine to avoid areas of suitable foraging or dispersal habitat.

All harvest units in the D-Bug planning area are in suitable wolverine habitat during the winter and would serve to reduce the within stand risk of stand replacing crown fire. Though harvest would reduce canopy cover below preferred densities, remove potential maternal denning and resting sites, and temporarily increase road densities, there would be a long term benefit to wolverine habitat by increasing the treated stands resiliency to stand replacement crown fire. Timber removal and thinning prescriptions in response to insects outbreaks may fragment or degrade habitat in the short term in order to prevent stand replacement fire that would eliminate habitat altogether for decades. The

⁵¹ The area treated in the D-Bug planning area is at most 47 km² of treatment (Alternative 4), 37 km² (Alternative 2) and 27 km² (Alternative 1) which is less than one female home range which can varies from 71 – 416 km² (Stone 2007c).

connected and similar actions associated with the action alternatives would have no effect to the wolverine.

Cumulative Effects

Wolverine that may occur within the D-Bug planning area may have home ranges extending over 1,000 km². The lack of certainty of the current range of the wolverine, coupled with their ability to disperse over wide areas require that cumulative effects be considered throughout their potential range, extending southward from the Sierra Nevada's of California, to the north Cascades of Washington State to the Rockies of Montana and Wyoming and central Idaho (Aubry et al. 2007). Due to their preference for high elevation alpine vegetation and deep snow depths, warming winter temperatures and receding glaciers may already be having an effect on wolverine denning habitat, but this has not been studied adequately (Ruggiero et al. 2007). Because no natal denning habitat is likely to be affected and such a small portion of a potential wolverine's home range would be affected by any action alternative, the D-Bug project would not incrementally add to the past, present and reasonably foreseeable future actions on Forest (Tables 12-14) to impact wolverine habitat.

Determination of Impact

There would be an increase in short term road densities, fragmentation of forested landscapes, and disturbance through increased human presence in potential foraging habitat for wolverine; therefore, it is determined that the action alternatives **may impact individuals or habitat but are not likely to contribute to a trend toward federal listing or loss of viability** for the Pacific wolverine. This is because of the large range of individual wolverines in comparison to the limited amount of habitat affected by any action alternative and the large amount of wolverine habitat in adjacent reserved land allocations, as well as the lack of any documented wolverine in the area. Alternative 1 would have no impact to individuals or habitat for the wolverine.

Rare and Uncommon Species

The Great Gray Owl (*Strix nebulosa*) is considered to be a regionally Rare and Uncommon wildlife species whose known range includes the Umpqua National Forest and the D-Bug planning area. The Great Gray Owl is not included on the Regional Forester's Sensitive Species list for the Umpqua National Forest (updated January 2008), but it is included on the Regional Forester's sensitive species in Washington State. Great Gray Owls have been observed within the planning area, in the greater Lemolo Lake area and at the southern end of Diamond Lake. However the harvest units in the action alternatives are not of an age/size class or positioned within 200 meters of openings greater than 10 acres to meet stand criteria for suitable nesting habitat (i.e. 38-42" dbh trees); therefore none of the action alternatives would be expected to cause a consequential negative direct, indirect, or cumulative impact on the species habitat or the persistence of the species at the site (Quintana-Coyer et al. 2004). Alternative 1 would have no impact to this species.

Road Impacts to Wildlife

The impacts of roads to wildlife occur on several different levels. Roads are an obvious source of mortality for all types of wildlife, both directly by vehicle collisions, and indirectly by increased habitat fragmentation which leads to increased energetic expenses and increased access to hunters, poachers, and predators (Forman et al. 2003, Gaines et al. 2003, Glista et al. 2007). Roads can cause displacement or

avoidance resulting in animals altering their use of habitats in response to roads (Forman et al. 2003, Gaines et al. 2003). Road traffic and vehicular noise can be a stressor to wildlife, increasing stress hormones which can decrease survival and reproductive fitness (Wasser et al. 1997, Creel et al. 2002, Gaines et al. 2003).

In addition to regular passenger vehicles, roads, including new temporary roads and existing forest roads can result in increased use by summer off highway vehicles (OHV's) and snowmobiles. OHV sales have increased 174% from 1993-2003 in the United States, and 22% of the population of Oregon participate in OHV recreation (USDA 2005). These vehicles are able to travel farther and faster than passenger vehicles on forest roads which can increase disturbance to wildlife. Snowmobiles and summer OHV's have been demonstrated to cause avoidance of roads and roadsides by animals such as elk, deer, wolverine, and amphibians (Gaines et al. 2003, Rowland et al. 2004). Increases in OHV traffic can also increase user-created OHV trails in areas where timber harvest has reduced tree densities to spacing that allow for OHV's to travel cross country. User-created OHV trails have the same fragmentation effects as roads do, but their greater density can worsen impacts (Gaines et al. 2003). See the Recreation Specialist discussion in Chapter 3 of the EIS for locations for use and area closures for OHV's. Snowmobiles produce similar effects to wildlife as OHV's, but can also cause additional impacts; however, cross country travel in snowmobiles is not prohibited across much of the planning area (See the Recreation discussion in Chapter 3 of the EIS). Snowmobile trails increase access to trappers, cause higher levels of stress to elk than do vehicles, and can compact subnivean⁵² zones which provide habitat for the small mammal prey of marten, fisher and bobcats (Trotchta 1999, Creel et al. 2002, Gaines et al. 2003). For a generalized documentation of effects of roads to wildlife see Table 28.

Table 28. Table of generalized road, trail, and snowmobile impacts by species or group of species found within the D-Bug planning area. Table modified from Gaines et al. (2003).

Species or Group	Road-Associated Factors	Motorized Trail Factors	Snowmobile Route Factors
Northern Spotted Owl	Snag reduction; Edge effects; Disturbance at a specific site; Vehicle collision mortality; Increased stressor hormones.	Disturbance at specific sites	N/A
Cavity Nesters	Snag reduction; Edge effects; CWD reduction.	N/A	N/A
Fisher	Snag reduction; Edge effects; CWD reduction; Increased trapping; Vehicle collision mortality; Habitat loss or fragmentation; Movement barrier or filter; Displacement or avoidance.	Increased trapping	Increased trapping; Displacement or avoidance.
American Pine Marten ^a	Snag reduction; Edge effects; CWD reduction; Increased trapping;	Increased trapping	Increased trapping; Subnivean habitat alteration resulting in reduced prey.

⁵² Open spaces underneath snow.

Species or Group	Road-Associated Factors	Motorized Trail Factors	Snowmobile Route Factors
	Vehicle collision mortality; Habitat loss or fragmentation; Movement barrier or filter.		
Elk	Increased hunting & poaching; Vehicle collision mortality; Displacement or avoidance; Disturbance at specific site.	Increased Hunting; Poaching; Displacement or avoidance; Disturbance at specific site.	Displacement or avoidance; Disturbance at a specific site; Increased stressor hormones.
Amphibians ^b	Avoidance; Edge effects; Movement barrier or filter; Vehicle collision mortality.	Avoidance; Movement barrier or filter	N/A

^a Gaines et al. 2003 and Trochta 1999. ^b Forman et al. 2003

Conversely, roads can provide benefits and increase habitat quality for some wildlife species. They can create new microhabitat (e.g. drainage ditches, areas of water retention) that can be used as breeding habitat for some amphibian species (Forman et al. 2003). Roadside populations of small mammals can increase as a result of increased seed production from nitrogen run-off which can increase the vigor of roadside grass, as well as the lack of competition for forage from large herbivores who avoid roadsides (Forman et al. 2003). Ravens, some raptor species, and herons can congregate along roadsides for increased foraging opportunities on roadkill, and roadside small mammal and amphibian populations (Forman et al. 2003).

Overall, road densities would drop slightly as a result of the selection of any of the action alternatives. However increased openness in stand conditions, particularly in units with prescriptions 1 and 2 would result in an increased ability for cross country travel for summer OHV's and snowmobiles. Areas of current high OHV and snowmobile use, particularly in the Lemolo Lake area may increase in cross country travel under Alternative 4 with the additional units containing prescription 1⁵³ that are not found in any other action alternative.

Potential Wilderness Areas and Inventoried Roadless Areas (IRA's)

Inventoried roadless areas and areas without roads are important areas ecologically for wildlife, as habitat fragmentation and habitat loss is the leading cause of global wildlife population declines (Strittholt and Dellasala 2001). The Forest Service (2001) in the Roadless Area Conservation Final Rule stated, "Roadless areas are more likely than roaded areas to support greater ecosystem health, including the diversity of native and desired nonnative plant and animal communities due to the absence of disturbances caused by roads and accompanying activities. Inventoried roadless areas also conserve native biodiversity by serving as a bulwark against the spread of nonnative invasive species...More than 65% of all Forest Service sensitive species are directly or indirectly affected by inventoried roadless areas..." While the preceding statement was directed at inventoried roadless areas (IRAs), the same can be said for all larger blocks of forest system lands without roads.

⁵³ Prescription 1 would leave 20 trees per acre and leave 46 ft between trees which would make cross country OHV and snowmobile travel easier.

The D-Bug project proposes treating 344 acres of IRA's in Alternatives 2 and 4 and 163 acres in Alternative 3 along the edges of the Mount Bailey and Thirst Creek Appendage IRA. No road building is proposed in either IRA. The area south of Highways 230 and 138 form a 70,000 acre area without roads which spans the Umpqua NF, Crater Lake N.P. and the Rogue River-Siskiyou NF, and is defined by the FSH 1909.12(70) as a potential wilderness area. Alternative 4 contains 8 miles of new temporary roads within the northern portion of this area (Table 29). The effect of this would be the fragmentation of 1,353 acres of habitat for sensitive, management indicator and landbird species including the pine marten and cavity nesting birds, as well as increased access to this area by summer⁵⁴ OHV's and snowmobiles. During logging operations these roads would be signed for logging use only, but may allow increased access for vehicle traffic (other than logging traffic), increasing the likelihood of direct effects to wildlife through vehicle collisions and the indirect effect of disturbance. However, new temporary roads would be removed and access would be blocked off after logging operations have been completed. The footprint from the road beds would likely still be visible for up to 30 years after project implementation (Morrison personal communication 2008), but as they would not be traveled on by OHV's, impacts to wildlife would be reduced over the long term. The thinning prescriptions for this potential wilderness area would leave stand conditions open enough to allow for cross country travel by snowmobiles for decades in this area due to the slow vegetation growth in these cold pumice soils. While road decommissioning proposed for all action alternatives would reduce road densities lower than the no action alternative, the associated disturbances with increased snowmobile use and decommissioned road beds would last up to 20 years before stands and road beds have vegetation recovered sufficiently to discourage cross country travel.

Table 29. Miles of roads and densities of roads by alternative during and after implementation.

	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Total Miles of Roads in Planning Area During Implementation	186	207	196	217
Open Road Density/Mile During Project Implementation	2.83	3.15	2.98	3.30
Total Miles of Roads in Planning Area After Implementation	186	181	183	181
Open Road Density/Mile After Project Implementation	2.83	2.75	2.78	2.75

MANAGEMENT INDICATOR SPECIES

The Umpqua National Forest Land Management Plan (USDA, Forest Service, 1990) designated 7 species, and one group of species (cavity nesters) as Management Indicator Species (MIS) (Table 30). They were selected to track and evaluate the effects of Forest management activities on all wildlife species that occur on the Forest. The Northern Spotted Owl, pine marten, and Pileated Woodpecker represent mature and old

⁵⁴ The Forest is in the process of complying with the Travel Management Rule, which will determine areas of the Forest open and closed to summer OHV traffic. Depending on the outcome of that process, some areas in the D-Bug Planning Area may have less impacts than anticipated.

growth conifer habitats. Primary cavity excavators represent the dead and defective tree habitat. Big game winter range is represented by Roosevelt elk and the black-tailed deer. The Bald Eagle and Peregrine Falcon are sensitive species that require special management and were discussed under the sensitive species section and will not be discussed further.

Standards and Guidelines⁵⁵ pertaining to MIS

- S&G 14. Pine Marten Habitats - Provide one habitat area for every 4,000 to 5,000 acres of suitable habitat. Habitat will be distributed in such a way that any given habitat unit will be connected to two or more other suitable habitats.
- S&G 17. When planning timber sales in important big game areas, a habitat effectiveness model (“A Model to Evaluate Elk Habitat in Western Oregon” or similar model) will be used to compare the impact of various alternatives on big game habitat.

Table 30. List of the Umpqua National Forests Management Indicator Species and a description of their habitat.

Common Name	Scientific Name	Indicator Habitat Attribute	Species or Habitat Present?
Northern Spotted Owl	<i>Strix occidentalis caurina</i>	Mature or old growth forested habitats.	Yes, discussed previously.
Pileated Woodpecker	<i>Dryocopus pileatus</i>	Mature forested habitats with large (>20”dbh) snags.	Yes
Cavity Nesters		Snags and defective trees.	Yes
Roosevelt Elk	<i>Cervus elaphus roosevelti</i>	Managed forest conditions and early successional vegetation.	Yes
Blacktail Deer	<i>Odocoileus hemionus</i>	Managed forest conditions and early successional vegetation.	Very limited due to elevation.
Pine Marten	<i>Martes americana</i>	Mature or old growth high elevation lodgepole pine and mountain hemlock.	Yes
Bald Eagle	<i>Haliaeetus leucocephalus</i>	Large trees next to large bodies of water, in particular ponderosa and Shasta red fir.	Yes, discussed previously.
Peregrine Falcon	<i>Falco peregrinus</i>	Ledges and rock outcrops suitable for use as eyries.	No – not discussed further.

Primary Cavity Nesters including Pileated Woodpeckers (*Dryocopus pileatus*)

Primary cavity nesters are birds who excavate cavities in both live and dead trees for foraging and nesting purposes. These cavities may then be used by a wide variety of secondary cavity nesters. The Forest Plan has standards and guidelines that pertain to primary cavity nesters and snag habitat, which were addressed in the coarse woody debris section. In addition to snag and downed wood standards, the Forest contains a

⁵⁵ S&G 13 from the LRMP for Pileated Woodpecker Habitats was superseded by the Northwest Forest Plan Late Successional Reserve land allocation, which encompasses all previous Pileated Woodpecker Habitats.

standard and guideline requiring the forest to provide for adequate snag habitat to meet 60% potential population capability (PPC) for cavity nesters (USDA, Forest Service, 1990). The potential population capacity (PPC) provides an indicator of the number of cavity-nesting species likely to be present on the Forest in comparison to the Forest's total potential.

Primary cavity nesters require habitat with adequate levels of dead and dying trees of sufficient size and densities to support sufficient nesting and foraging opportunities to maintain self sustaining breeding populations. DecAID, which contains a summary of the best available information on snag and coarse wood requirements for a host of wildlife species (including primary cavity nesters) documents that much higher levels of snag retention are required to maintain individual species than what was originally required by the LRMP (USDA, Forest Service, 1990; Mellen et al. 2007).

Populations of primary cavity nesters on the Umpqua N.F. likely spend portions of their life on adjacent forested lands, therefore population trends for these species are discussed at the statewide level where sufficient long term population monitoring data is available to determine population trends. The Breeding Bird Survey (BBS) consists of 136 routes in Oregon, and one of them (69051, Clearwater) is about 4 ½ miles west of the planning area (Sauer et al. 2006). Population trends for primary cavity nesters are shown in Table 31.

Table 31. List of the cavity nesters present on the Umpqua National Forest and their population trends for Oregon from 1966-2006. Data courtesy of Sauer et al. 2006.

Species	Local status	Population Trend for Oregon (1996-2006)
Red-breasted Sapsucker	Common	Stable
Hairy Woodpecker	Common	Stable*
Northern Flicker	Common	Decreasing
Pileated Woodpecker	Common	Increasing
Downy Woodpecker	Uncommon	Decreasing
Black-backed Woodpecker	Uncommon	Decreasing*
White-headed Woodpecker	Uncommon	Stable*
Lewis' Woodpecker	Uncommon	Decreasing*

*Not a statistically 'significant' trend.

Direct and Indirect Effects

Direct and indirect effects for primary cavity nesters are analyzed at the planning area scale. Alternative 1 would result in a net increase in snags over time, especially within lodgepole dominated stands and mixed conifer stands containing a lodgepole understory, providing the most benefit to cavity nesters over the short term as it would provide for the most available snags. This is due in part to the anticipated spread of the mountain pine beetle, and the increasing risk of stand replacing fire in both lodgepole and mixed conifer stands which would create higher snag densities. Pileated Woodpeckers, Black-backed Woodpeckers, White-headed Woodpeckers and Hairy Woodpeckers all benefit from insect and fire disturbance in the initial 3-5 years post fire or beetle outbreak as insect populations increase during this time in recently killed trees (Bull 1987; Corace et al. 2001; Dudley 2005; and, Covert-Bratland et al. 2006). Black-

backed Woodpeckers⁵⁶ (BBWO) in particular benefit from mountain pine beetle infestations as the beetles are a primary prey source.

All action alternatives would reduce within stand snag levels as snags are routinely felled within harvest units to reduce hazards to timber fallers working within the stands. Snag densities, primarily of snags between 10-20" dbh would be reduced below DecAID's 30% tolerance level in all treated stands immediately post treatment in all action alternatives (Figures 19 & 20). Alternative 4 contains the most acres of lodgepole harvest, thus reducing the most snags densities, followed by Alternative 2, then Alternative 3 (Table 32). Prescriptions 1-3 for lodgepole dominated stands common to all action alternatives would allow for the retention of all standing lodgepole snags (except those deemed as hazard trees during logging), while prescription 4 calls for the removal of existing lodgepole snags. Alternatives 2 and 4 both contain 375 acres of snag removal (salvage of dead lodgepole in prescription 4) compared to 282 acres in Alternative 3. However, across the entire planning area and into adjacent reserved land allocations (Mt. Bailey Wilderness, Inventoried Roadless Areas, and the Oregon Cascades Recreation Area), mountain pine beetles would spread unchecked, providing thousands of acres of new lodgepole pine snags for use by primary cavity nesters, therefore the magnitude of the direct effects is limited when compared to the overall landscape outside of the planning area. None of the action alternatives reduce snags or down wood below a level that would preclude meeting standards and guidelines.

Table 32. Acres of lodgepole harvest by alternative, and the overall percent of lodgepole proposed to be harvested within the planning area.

Alternatives	Acres of Lodgepole Harvest	% of Lodgepole Proposed for Harvest in Planning Area	Acres of Mixed Conifer Harvest	% of Mixed Conifer Proposed for Harvest in Planning Area
Alternative 2	4,744	27%	2,258	10%
Alternative 3	3,506	20%	1,829	8%
Alternative 4	6,948	39%	2,258	10%

The combination of commercial thinning and proposed fuel reduction treatments would benefit both treated stands and an area directly adjacent to the treated stands indirectly by creating a "shadow effect" where fire behavior is reduced in adjacent areas of untreated stands or habitat. This "shadow effect" is estimated to be 1.5 times the size of the treatment unit, and would result in minimized fire behavior as a result of thinning in adjacent stands (Table 21). Additionally, fuel breaks proposed under the action alternatives would aid firefighters to better contain fires at smaller scales.

Cumulative Effects

Cumulative effects for cavity nesters extend throughout the potential range of birds utilizing the Umpqua National Forest. Past timber harvesting on the Umpqua NF (Table 12) as well as on adjacent National Forest's, Bureau of Land Management and private

⁵⁶ In a study on the neighboring Deschutes N.F. in lodgepole dominated woodlands during a mountain pine beetle outbreak, BBWO selected for mature unlogged stands of lodgepole to establish home ranges, and selectively foraged on older lodgepole with higher incidences of mountain pine beetles (Goggans et al. 1989). BBWO in this study nested exclusively in lodgepole cavities, in both live and dead trees, and fed mainly on wood-boring beetles, especially larvae and pupae of mountain pine beetles (Goggans et al. 1989).

lands has had the greatest influence on habitat condition and availability for primary cavity excavators. However, the trend in clearcut harvesting on federal forest lands that caused the concerns for decreasing populations of primary cavity excavators has largely been decreased by the NWFP. Currently, insects and wildfire are the most dramatic influences on the availability of snags across Oregon. The alternatives proposed by the D-Bug project would only affect the snag densities and recruitment within treatment units, thus this cumulative impact would be minor in comparison with the ongoing spread of mountain pine beetle disturbances and wildfires.

Summary of Effects

No alternative considered for the D-Bug project would affect the population trends or viability for primary cavity nesters on a scale that would affect population trends throughout their range on the Umpqua National Forest, as the impacts associated with all alternatives are insignificant when compared to the overall range of the species and the amount of habitat in adjacent reserved land allocations that would remain untreated.

Roosevelt Elk and Black-tailed Deer - Big Game Winter Range

The Umpqua National Forest LRMP designated 198,146 acres of big game winter range as Management Area 11⁵⁷ (USDA, Forest Service, 1990); very little of this management area lies within the planning area. In the D-Bug Project, approximately 500 acres of winter range would be treated in each action alternative (Units 115, 118 and 119 in each alternative). Within the winter range treatments thinning would reduce TPA from 52 to approximately 30, and overstory canopy cover would be reduced from an existing 51% to 38% after harvest. With this project, no openings would be created within winter range. Existing forage:cover ratio is 10:90 in the D-Bug planning area. The present trend is for decreasing forage due to regrowth of past clearcuts in the area that would soon no longer provide forage. Areas of beetle killed lodgepole pine are regenerating into a carpet of lodgepole seedlings with very little long term forage being produced.

The D-Bug planning area also encompasses portions of the Indigo, Dixon and Rogue⁵⁸ Wildlife Management Units (WMU), established and managed by the Oregon Department of Fish and Wildlife. In the 3 WMU's, elk and deer numbers are declining, and the forage to cover ratios are trending toward increased cover. Within the 3 WMU's, the action alternatives treat less than 2% of the total WMU acreage.

Direct and Indirect Effects

The direct and indirect effects to big game winter range were analyzed at the planning area scale. Alternative 1 would maintain the current forage:cover ratio and declining trend in forage habitat resulting in poorer future forage habitat and winter range conditions. Alternative 4 would provide the best forage to cover ratio of all alternatives (Table 33); however there is unlikely to be an increase in high quality forage for both elk and deer because Alternative 4 has an increase in harvest in lodgepole dominated stands and it is unlikely to increase in palatable forage in the heavily thinned lodgepole stands. Alternative 4 would result in more landings, which would be seeded to prevent

⁵⁷ These areas emphasize winter range management achieved through forage and cover production on land suitable for occupancy by deer and elk. A 60:40 ratio of forage to cover habitat was once considered optimum for winter range, but more recent studies suggest smaller ratios may be suitable as long as the interspersions of forage and cover is good (Larkin et al. 2004). Ultimately however, forage is the limiting factor in the planning area.

⁵⁸ The Indigo WMU is 1.2 million acres and is located in the western Cascades east of Interstate 5, and north of State Highway 138. The Dixon WMU is over 1 million acres and borders the Indigo WMU to the south. The Rogue WMU is 955,000 acres located on the Rogue River-Siskiyou NF.

establishment of invasive plant species, but these areas would not account for a substantial increase in available elk or deer forage. No alternatives would create openings in areas suitable to producing increased forage for big game.

Table 33. Forage to cover ratio by each action alternative.

	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Forage:Cover Ratio	10:90	21:79	18:82	27:73
HE_s* for Size and Space of Forage:Cover	0.658	0.655	0.641	0.691
HE_r^ for Road Density	0.250	0.234	0.245	0.224

*HE_s is a habitat effectiveness index derived from sizing and spacing of forage and cover areas.

^HE_r is a habitat effectiveness index derived from the density of roads open to vehicular traffic.

Additionally Alternative 4 contains the highest densities of temporary roads of any alternative (Table 29). HE_r is a habitat effectiveness index derived from the density of roads open to vehicular traffic. The closer the value is to 1 indicates that elk are better able to utilize more of the analysis area, while lower values as seen in Table 33 indicate that the area is fragmented and less of the planning area is free from the disturbance related to roads. The additional temporary roads created in Alternative 4 not present in Alternative 2 are in lodgepole dominated stands with low-productivity soil conditions. Though they would be subsoiled and some would be planted with seed after they are used, they would not provide a substantial increase in forage, and they may potentially increase OHV use (prior to subsoiling) in these areas leading to increased disturbance to elk and deer. Road densities would decrease after the implementation of any action alternative as compared to the no action alternative, as a small amount of existing road is being proposed for decommissioning.

Roadside treatments in all alternatives would be arranged to ensure that there are some areas of clumped retention to provide for roadside hiding cover for deer and elk to help limit areas where elk and deer may be more visible to hunters traveling along roads. All alternatives treat along the same major roads, however Alternatives 2 and 4 treat additional roadside acres along both sides of the Thirsty Creek Road and the south side of the Kelsay Point Road, increasing hunter visibility in these areas when compared to Alternative 3 which does not contain units on the Kelsay Point Road and only treats the northern side of the Thirsty Creek Road. Due to need for roadside treatments to act as fuelbreaks, sight distance into stands adjacent to roads would increase as a result of the proposed thinning in all action alternatives. Mastication of small diameter material which provides much of the current roadside cover would generally occur within about 80 feet of roadsides in all action alternatives, limiting the amount of habitat where elk and deer could be more visible to hunters traveling along roads.

Cumulative Effects

The cumulative effects of this project are analyzed at the WMU-scale. This is the spatial scale at which big game populations are monitored by Oregon Department of Fish and Wildlife. At this scale, about 23% of the Federal forest land is in a reserved land allocation and clearcut harvesting is not expected to occur in the foreseeable future. This suggests a continued decline in the amount of forage habitat within these WMU's over the next 1-2 decades. However, future wildfires would increase forage availability for both deer and elk. Most of the larger patches of forage habitat are likely to continue to

occur on private forest land, which are located toward the western boundaries of these three WMU's.

None of the action alternative considered for the D-Bug project would affect the declining population and habitat trends for Roosevelt elk or Black-tailed deer throughout their range on the Umpqua National Forest, as the anticipated increase in forage from the action alternatives and continued loss of forage in the no action alternative are inconsequential when compared to the overall range of the species and the WMU's.

Given the past, present and foreseeable actions (Tables 12-14), the direct and indirect effects of the action alternatives (when added to foreseeable future actions) would not affect the declining trend in forage habitat and forage:cover ratios within the WMU. The population viability of Roosevelt elk or Black-tailed deer would not be reduced by the action alternatives because the acres of impact when compared to the size of the WMU's would have no effect to habitat trends for these species.

Pine Marten (*Martes americana*)

Pine marten are an MIS for high elevation lodgepole pine and mountain hemlock ecoclasses. The Northwest Forest Plan Late Successional Reserves, congressionally reserved lands (Wilderness, Inventoried Roadless Areas, and the Oregon Cascades Recreation Area), and historical Northern Spotted Owl 100-acre cores encompassed most of the suitable pine marten habitat on the Umpqua N.F. However, three additional 160 acre pine marten habitats were created on the Diamond Lake Ranger District to ensure that there was a minimum of 3 miles between protected lands with suitable pine marten habitat to meet LRMP standard and guidelines for pine marten habitats. These pine marten habitats all have a minimum of 50% canopy cover of ≥ 100 year old trees with a minimum of 2 dead or down trees per acre. These pine marten areas were created to allow for dispersal of pine marten between reserved land allocations and pine marten reserves to be able to maintain a viable pine marten population on the Umpqua National Forest. One pine marten habitat core is within the D-Bug planning area, but is outside of any proposed treatment units.

Pine marten are small carnivores found in higher elevations, in mesic, late successional stands of conifers, including lodgepole, hemlock and fir. They require high densities of snags and in particular downed logs for denning and resting, and to serve as subnivean winter habitat for their small rodent prey (Bull and Blumton 1999, Powell et al. 2003). In winter, marten use structurally complex forests and avoid openings (Powell et al. 1999). On a smaller scale, martens abandon or fail to colonize home range size landscapes with less than about 60% mature forest cover (Powell et al. 1999). Marten avoid regenerating clearcuts for several decades (Powell et al. 1999). Martens prefer older forested habitats with closed canopies and high levels of structural complexity on the forest floor over clearcuts or forest openings. (Jones and Raphael 1991, Chapin et al. 1998, Powell et al. 1999, Bull et al. 2005).

Direct and Indirect Effects

Alternative 1 would have no direct effects to marten as no timber harvest or fuels reduction activities would take place. Indirectly, Alternative 1 has an increased hazard for stand replacement fire, which may consume suitable pine marten habitat, rendering it unusable until burned habitats regenerate.

Marten give birth in cavities in larger logs and trees often close to the ground, from early April through May, and juveniles stay with their mothers for up to three months (Powell et al. 1999, Bull and Heater 2001). Direct mortality may occur from logging operations that

take place prior to June 1st, while juvenile marten are not mobile or able to flee from maternal dens. Alternative 4 contains the most amount of marten habitat (lodgepole pine) harvest; therefore it has the potential to directly affect the most marten, followed by Alternative 2, then Alternative 3.

Indirect effects to pine marten from timber harvest and fuels reduction activities include noise disturbance; loss of suitable denning, foraging, and resting habitat for themselves and their prey; increased habitat fragmentation; increased energetic costs due to increased home range sizes necessitated by increased fragmentation; and increased potential for trapping and predation. Of these effects, habitat fragmentation constitutes the largest impact, as the prescriptions for lodgepole dominated units would result in canopy cover (Table 15) and downed wood reductions (Figures 17 and 18) that would render the habitat unsuitable for anything other than dispersal habitat. Marten have been documented to tolerate low levels of fragmentation, but no martens were found with home ranges that had more than 30% fragmentation (Buskirk and Zielinski 1999).

Pine marten habitat suitability was modeled for the Cascade Mountains of Oregon and through this modeling pine marten habitat across the Umpqua NF (Table 34, Figure 21) was quantified as either suitable or optimum (Hirzel et al. 2006, Davis and Chapman 2008). Suitable habitat was defined as having a HSI (Habitat Suitability Index) value >35, and optimum habitat was defined as having an HSI value >75 (Hirzel et al. 2006). All prescriptions in suitable pine marten habitat result in unsuitable habitat due to the decreased canopy covers resulting from proposed harvest. Each action alternative drops canopy cover and downed wood densities below suitable habitat levels for pine marten, therefore each action alternative removed suitable and optimum pine marten habitat (Table 34). Alternative 4 would remove the most suitable habitat, including 31% of the Forest's optimum habitat, followed by Alternative 2, with Alternative 3 removing the least amount of pine marten habitat of the action alternatives.

Table 34. Pine marten habitat availability on the Umpqua National Forest by alternative based upon a pine marten habitat suitability map by Davis and Chapman (2008) for the Cascades of Oregon.

			Alternative 2		Alternative 3		Alternative 4	
Habitat Quality	Total Forest Habitat (Acres)	% Habitat in Reserved ⁵⁹ Land Allocation	Total Forest Acres	% Loss	Total Forest Acres	% Loss	Total Forest Acres	% Loss
Suitable	61,401	67%	59,294	-3%	59,584	-3%	57,654	-6%
Optimum	4,499	41%	3,651	-19%	3,962	-12%	3,084	-31%

While the action alternatives would remove optimum and suitable pine marten habitat, they would also reduce the within stand probability to crown fire. Thirty years post treatment, canopy covers and snag levels within treated stands of lodgepole pine would recover to levels slightly below levels modeled for the no action alternative (Figures 15, 17, 18). However, in the event of a wildfire within the homogenous stands of lodgepole in the planning area, more marten habitat would likely be removed, and recovery

⁵⁹ *Reserved land allocations are wilderness, inventoried roadless areas (IRAs), and the Oregon Cascades Recreation Area (OCRA). All action alternatives include harvest along the edges of the IRAs and the OCRA therefore habitat loss for pine marten includes very small amounts of habitat in the reserved land allocations.

timeframes would likely be longer than the thirty years modeled for treated stands due to crown fire spread in Alternative 1 (see Fuels Section). Wildfires that completely consume the understory and/or reduce the canopy closure to less than 30 percent are detrimental to American pine marten populations in the short-term, until the burned forests can recover canopy closures and structural complexity (Snyder 1991). The action alternatives would reduce the risk of within stand crown replacement fire, and may disrupt the flow of fire across the landscape, allowing for additional time to suppress wildfires in the planning area and potentially smaller wildfires than predicted in Alternative 1 (see Fuels Section).

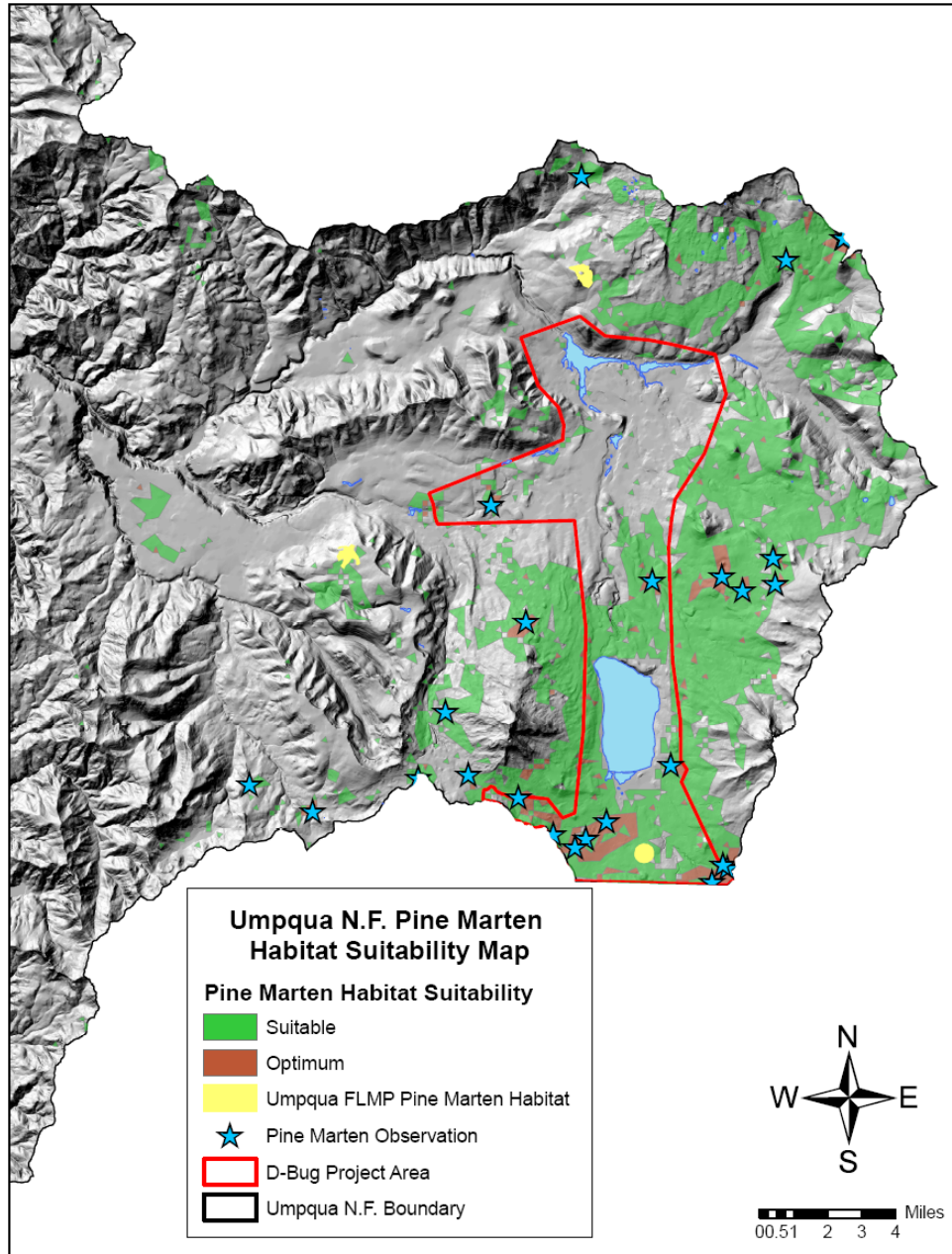


Figure 21. Map of suitable and optimum pine marten habitat on the Umpqua National Forest.

Cumulative Effects

The cumulative effects of this project are analyzed at the Forest scale. Any additional harvest of lodgepole pine on the Umpqua NF would require another forest plan amendment, and there are no reasonably foreseeable future harvests planned within the planning area. Therefore, very little additional contiguous pine marten habitat that would be available to harvest if an action alternative is selected would be impacted, as the remaining contiguous suitable and optimum habitat falls within reserved land allocations (67% of suitable and 41% of optimum habitat is in reserved land allocations) which do not generally permit large scale timber harvest (Table 34). Due to their preference for deep snow depths, warming winter temperatures may already be having an effect on marten foraging habitat (Carroll 2007). Wildfire would continue to be a major threat to pine marten habitat across its suitable habitat on the Umpqua National Forest. However, because of the lack of overlapping direct or indirect effects from past or future projects, there would be no cumulative effects to marten.

Summary of Effects

Despite the possibility of the loss of 31% of the Umpqua National Forest's optimum pine marten habitat in Alternative 4 for up to 30 years, no action alternative considered for the D-Bug project would affect the population viability of the pine marten on the Umpqua National Forest because the majority of their habitat is within reserved land allocations. However, all action alternatives would result in a downward trend for pine marten habitat in the short term as they would reduce the amount of suitable and optimum habitat available for pine marten on the Forest in the short term, but may result in a less negative trend in the longer term future (~30 years) due to increases of within-stand fire resiliency. The no action alternative would maintain the current habitat trend for the pine marten across the forest in the short term, but may result in higher levels of habitat loss in the future to stand replacing wildfire.

LANDBIRDS

Population declines of some landbirds resulted in the creation of a Landbird Strategic Plan (USDA 2000) that set management goals and actions for providing sustainable habitat for them. The Landbird Strategic Plan called for utilizing Bird Conservation Plans developed regionally by Partners in Flight working groups to incorporate landbird management into forest plans and at all levels of the Forest Service (USDA 2000).

In addition, Executive Order (EO) 13186, signed January 10, 2001, lists several responsibilities of federal agencies to protect migratory birds. The Memorandum of Understanding (MOU) between USDA Forest Service and USDI Fish and Wildlife Service, signed January 17, 2001⁶⁰ also contains conservation measures that are still applicable for use in environmental planning today. The MOU continues to provide guidance for the two federal agencies until more detailed direction is developed pursuant to the executive order.

The Forest Plan has no specific standards and guidelines for landbirds, other than for cavity nesters (discussed previously), raptors (protected from human disturbance until nesting and fledging is complete), and TES species (e.g., Northern Spotted Owl) (USDA, Forest Service, 1990).

⁶⁰ The 2001 MOU with the USFWS is expired, although still applicable to planning projects undertaken by the Forest.

Existing Conditions for Landbirds

The D-Bug planning area falls along the crest of the Cascades, therefore two separate conservation plans will be considered, one strategy for landbirds in the coniferous forests of western Oregon and Washington (Altman 1999) and one for the landbirds of the East slope of the Cascade mountains in Oregon and Washington (Altman 2000, Table 35). Focal species are identified within the plan to represent habitat attributes such that the most important components in a functioning coniferous ecosystem are represented, and many other species will also be conserved (Altman 1999). Units within the D-Bug planning area in the Western Cascades portion contain old growth, mature-multi-layered forest, and montane wet forests habitats (Table 35). The Eastern Cascades portions of the D-Bug planning area contain mixed conifer and old-growth lodgepole habitats (Table 35). There are no Important Bird Areas (areas identified by the Audubon Society to be protected and managed for preserving bird populations and other biodiversity) within the planning area.

Table 35. Landbirds identified by the Oregon/Washington Partners In Flight Conservation Plans for the Western Forests and East Slope of the Cascades (Altman 1999 & 2000) representing habitats found within the D-Bug planning area.

Common Name	Habitat Attribute	Status in Planning area ^{1,2,3} and in Oregon and Cascades
Old Growth		
Vaux's Swift	Large Snags	Common spring and fall migrant. Stable in Oregon and Cascades.
Brown Creeper*	Large Trees	Year round resident, but in low to moderate densities. Stable in Oregon, decreasing in Cascades.
Red Crossbill	Conifer Cones	Year round resident, but numbers fluctuate greatly between year (low of 8 detected in 1992 high of 230 detected in 2003 ¹). Stable in Oregon and Cascades.
Mature Forest: Multi Layered		
Pileated Woodpecker	Large Snags	Very uncommon in the planning area, uncommon on the rest of the Diamond Lake RD (DLRD); discussed previously. Stable in Oregon and Cascades.
Varied Thrush	Mid-story Tree Layers	Uncommon summer resident, more common during spring and fall migration. Stable in Oregon and Cascades.
Hermit Warbler	Closed Canopy	Common summer resident, however avoids lodgepole stands. Stable in Oregon and Cascades.
Pacific-slope Flycatcher	Deciduous Canopy/subcanopy Trees	Uncommon in the planning area, common resident west of the planning area in lower elevations. No statistics in BBS routes.
Hammond's Flycatcher	Open Mid-story	Uncommon in the planning area, absent from lodgepole stands, more common in the rest of the DLRD. Stable in Oregon, increasing in Cascades.
Wilson's Warbler	Deciduous Understory	Spring migrant in planning area and the rest of the DLRD, rare resident. Stable in Oregon, decreasing in Cascades.
Winter Wren	Forest Floor Complexity	Very uncommon in the planning area, as there is very little low forest floor complexity in planning area. Stable in Oregon and Cascades.
Forest Inclusions/Unique Habitats		
Lincoln's sparrow	Montane Wet Meadows	Summer resident around south shore of Diamond Lake, Toolbox Meadows, DL Sewage ponds. Increasing in Oregon and stable

Common Name	Habitat Attribute	Status in Planning area ^{1,2,3} and in Oregon and Cascades
		in Cascades.
East Slope Cascades Focal Species		
Mixed Conifer		
Williamson's sapsucker [^]	Large Snags	Very rare, documented in the planning area. Stable in Oregon and Cascades.
Flammulated Owl [^]	Interspersion Grassy Openings and Dense Thickets	Very rare to the DLRD, not documented in the planning area. No statistics in BBS routes.
Hermit Thrush	Multi-Layered/Dense Canopy/Vertical Cover	Common on the DLRD and observed within the planning area. Stable in Oregon and Cascades.
Unique Habitats		
Black-backed Woodpecker	Old Growth Lodgepole Pine	Uncommon but present throughout the planning area. May become more common with increase in mountain pine beetle activity. Stable in Oregon and Cascades. Discussed previously.

^{*}Also East Slope focal species for large trees; [^]Also Audubon Society Watchlist Species for 2007; ¹Altman 1999; ²Altman 2000; ³Marshall et al. 2003; ⁴Fix 1990; ⁵Umpqua Valley Audubon 2006.

Direct and Indirect Effects

The direct and indirect effects to landbirds were analyzed at the planning area scale. Alternative 1 would have no direct impacts to landbirds because no thinning, fuels treatments, or other habitat modifying activities would occur. Alternatives 2, 3, and 4 would cause changes to landbird habitats that would occur over the next 10-30 years.

Western Cascades Old Growth and Mature Forests: Multi-layered

These forest types occur in units along Highway 138, west of Lemolo Junction. All action alternatives contain the same units and prescriptions, therefore effects are the same among action alternatives. Direct effects include some potential for loss of nest structures and young that have not fledged by early June, including Brown Creepers, Varied Thrush, Hermit Warbler, and Pacific Slope and Hammond's Flycatchers. Spring and fall migrants would have no direct effects.

The main indirect effects are the reduced canopy covers and potential loss of snags being felled as hazard trees. Pileated Woodpeckers, Wilson's Warblers and Hammond's Flycatchers can benefit from the increased habitat heterogeneity that would result from thinning. Other species like Brown Creepers and Winter Wrens would likely respond negatively due to increased habitat fragmentation and forest floor disturbance (Vanderwel et al. 2007). Riparian no-cut buffers, where prescribed, would limit impacts to Pacific-slope flycatchers and varied thrush. Lincoln's Sparrow would not be affected by the action alternatives as their habitat falls within riparian buffers and would not be treated. All species in these habitats would benefit from the treatments in the event of a future wildfire, as the probability of crown replacing fire is reduced within treated and adjacent stands, and treated stands would serve as refugia habitat in the event of landscape scale wildfire.

East Slope Cascades Mixed Conifer and Old-growth Lodgepole

The D-Bug planning area contains very little ponderosa pine in harvest units, and the Flammulated Owl and Williamsons Sapsucker are rarely encountered in the planning area. The mixed conifer units around the northern half of Diamond Lake, and along the Thirsty Creek road contain some ponderosa pine. Harvest would occur during the breeding season, and these two species may be breeding within treatment units, therefore there is some chance for direct mortality to eggs and young that have not fledged through harvest of nest trees. Alternatives 2 and 4 treat the same mixed conifer units, while Alternative 3 does not treat along Thirsty Creek road, therefore it would have less direct effects to Flammulated owls and Williamson's Sapsuckers. Hermit thrush are confirmed breeders in the planning area, and the ground based harvest of the mixed conifer units would potentially cause mortality to the eggs and young that have not fledged of this species as harvest would occur during the breeding season, while these birds are nesting.

Indirect effects to mixed conifer habitat include reduced canopy cover, the potential loss of snags within units, and ground disturbance. Additionally, underburning would occur in some units which would benefit Williamson's Sapsucker by potentially recruiting snags, but would adversely affect Hermit Thrush in the short term by consuming ground vegetation they use for cover. Long term, the thinning and fuels reduction work would beneficially affect these species in the event of a wildfire by increasing the fire resiliency both within and adjacent to stands that are at risk of crown replacing wildfire (Table 21).

Cumulative Effects

None of the action alternatives considered for the D-Bug project would alter the population trends observed for these species throughout Oregon, or the Cascades of Washington and Oregon as the small scale disturbance and/or habitat effects of the alternatives are limited to small portions of their overall ranges. Therefore, when combining this project with other past, present, or future projects (Tables 12-14), there would be no measurable cumulative effects to landbirds.

UNIQUE HABITATS

Unique habitats are non-forested openings that vary in size from 1 to 75 acres and include meadows, hardwood stands, wetlands, ponds, caves, cliffs, and rock outcrops (USDA, Forest Service, 1990). They are important due to their scarcity in the forest environment and high wildlife and plant values (Ch. 2 FEMAT 1994; USDA, Forest Service, 1990). Approximately 85% of the plant species diversity of the Western Cascades is found in non-forested habitats (Hickman 1976) which make up about 3% of the Umpqua National Forest. Unique habitats, in the 42,000 acre D-Bug planning area, account for less than 1% of the area. The majority of unique habitats in the planning area are wet meadows associated with Diamond and Lemolo Lakes. Many of these wetlands include rare or unusual plant and animal species.

Existing and Desired Conditions

There are approximately 191.6 acres of unique habitats mapped immediately adjacent to project units (Table 36). These openings range from 0.5 to 12.5 acres in size.

Table 36. Proposed Treatment Units Adjacent to Unique Habitats.

Unique Habitat Type	Location	Acres	Adjacent Unit(s)	Buffer Size (feet)
tufted hairgrass wetland	E of Silent Ck	1.4	25	0*
tufted hairgrass wetland	E of Silent Ck	0.5	25	0*
sedge wetland	E of Silent Ck, near Bailey Trailhead	5.9	28	150
sedge wetland	W of Silent Ck, dissected	2.9	34	150
tufted hairgrass wetland	S of Horse Lk, dissected	0.8	35	0*
pond	Horse Lk	2.0	35	0*
sedge wetland	N Diamond Lk springs	1.0	95	150
wetland	N of Diamond Lk, W of Hwy 138	1.1	97	150
wetland	S Lemolo stringer	11.4	162	150
wetland	S Lemolo stringer	3.4	162	150
sedge wetland	Lemolo S inlet W	6.6	164	150
wetland	Lemolo, Lake Ck	2.6	185	150
sedge wetland	Lemolo, N. Umpqua inlet	3.7	189	150
dry meadow	E of Silent Ck	1.3	18, 19	150
tufted hairgrass wetland	E of Silent Ck	26.1	18, 22, 25	150/0*
pond	Teal Lk	2.1	32, 33, 35	150/0*
wetland	W of Silent Ck, dissected	11.7	32, 34, 35	150/0*
sedge wetland	S of Diamond Lk	95.7	32, 35	150/0*
sedge wetland	S of Horse Lk, dissected	2.0	34, 35	150/0*
meadow mosaic	Rabbit Ck	4.3	53, 54, 56, 215	50
Spruce meadow mosaic	E hwy 138, N of DL	96, 95		150
TOTAL		191.6		

* There would be no buffer adjacent to pre-commercial thinning units in order to accelerate tree growth for habitat and reduce uncharacteristic fire risk around the unique habitats.

The desired condition is to maintain the habitat quality of the unique habitats. This includes restricting introduction of invasive species and reducing the potential for uncharacteristic wildfire impacts. In addition, water table levels in wetlands should be maintained as described under Objective 7 of the Aquatic Conservation Strategy.

Direct and Indirect Effects

Alternative 1 would result in no direct effects to unique habitats because no activities would occur in or near them. These habitats would indirectly be at increased risk from uncharacteristic wildfire under this alternative due to dense stand conditions that would

remain unmanaged. In the event of a wildfire, these mostly wet meadows would be impacted primarily along the ecotones where a stand replacement type fire would reduce moist conifer edges in some places. Otherwise, the dominant wetland species, including bog huckleberry, bog birch and sedges, would rapidly resprout following a fire. Road 6592-100 would continue to bisect two wetlands south of Diamond Lake.

The unique habitats would receive a 150 ft buffer under all action alternatives with a few exceptions. Units 25 and 35 at the south end of Diamond Lake are designed to non-commercially treat dense, young lodgepole pine plantations. Because of the flat topography, well-drained pumice soils, and low current biological diversity in these plantations no direct or indirect adverse impacts are anticipated upon the wetlands from thinning the adjacent plantations. There may be a slight benefit due to the acceleration of tree growth and reduction of uncharacteristic fire hazard under the action alternatives although there is little discernable wetland interface within these two plantations.

Units 53, 54, 56 and 215 surround a small meadow mosaic at the headwaters of Rabbit Creek between the Diamond Lake Campground and Highway 138. Unit 215 is only in Alternative 4. Because of the immediate proximity of abundant fuels in the form of dead lodgepole and spruce, only a 50 ft buffer is prescribed. This smaller buffer would still maintain practically all of the Englemann spruce ecotone around the meadows while allow for management of the surrounding fuels. Units 53 and 215 would only treat fuels; the former would be an underburn, the latter would involve mechanized fuels treatments. Unit 54 is a mixed conifer thinning that would leave 50-70 TPA while Unit 56 is a lodgepole pine thinning that would leave 90-200 TPA. Because these prescriptions all involve leaving much or most of the canopy, including the biggest trees, there should be limited indirect effect from alteration of the microclimatic in and immediately surrounding the meadow mosaic.

Otherwise the 150 ft prescribed buffer around the rest of the unique habitats would eliminate any direct effect to these areas. Because of the nature of the pumice soils surrounding the wetlands, no indirect impact upon the hydrologic regime is anticipated from removal of timber canopy (see the aquatic habitat section). Therefore, the action alternatives would be consistent with objective 7 of the Aquatic Conservation Strategy, which calls for the maintenance of water table elevation in meadows and wetlands.

A similar action associated with all of the action alternatives would obliterate and remove the crushed rock fill from 0.8 miles of road 6592-100 that bisects two wetlands south of Diamond Lake (contingent upon available funding). Restoration of the hydrologic regime in these wetlands would be a direct beneficial effect. Thinning under Alternatives 2, 3, and 4 would indirectly improve resilience to stand replacement fire in adjacent stands and along ecotones.

Cumulative Effects

Numerous activities have occurred historically that have resulted in the current condition of the unique habitats around Diamond and Lemolo Lakes, including lowering the lake level at Diamond Lake to facilitate past rotenone treatments. Lemolo Lake is a reservoir that flooded an area of extensive wetlands; these wetlands are also presumably tied to lake level fluctuations that reflect hydroelectric power generation and recreation needs. The action alternatives would partially reverse the impact of past actions, specifically the potential fire risk of overstocked lodgepole pine resulting from past timber harvest and hydrologic impact of road building through wetlands. Overall, there would be no cumulative effects to wetlands with implementation of any action alternative due to a lack of the effects of any of these actions overlapping with each other.

Aquatic Conservation Strategy

As disclosed above in this Unique Habitat section, no measurable impacts to the wetlands are expected from any of the proposed activities in any of the action alternatives including road work, thinning, burning, or yarding activities. As such, there would be no measurable effect upon water tables associated with the project's wet areas so wet areas would remain unaltered and wet, consistent with ACS objective 7.

INVASIVE PLANTS/NOXIOUS WEEDS

Invasive plant species are alien plants whose introduction do or are likely to cause economic or environmental harm, or harm to human health (USDA, Forest Service 2005a). Noxious weeds are plant species designated as such by the Secretary of Agriculture or by the responsible State official, and generally possess one or more of the following characteristics: aggressive and difficult to manage, poisonous, toxic, parasitic, a carrier or host of serious insects or disease, and being new to or not common to the United States. Noxious weeds infest over 420,000 acres of National Forests and Grasslands in the Pacific Northwest Region (USDA, Forest Service 2005a).

Relevant Standards and Guidelines

Forest Service Region 6 issued a Record of Decision (ROD) in October 2005, for the Pacific Northwest Region Invasive Plant Program Final Environmental Impact Statement. The 2005 ROD added a set of standards to Forest Plans (USDA, Forest Service 2005a). Several of the standards that are pertinent to this project are incorporated into the Botany Mitigation Measures in Chapter 2.

The Umpqua National Forest LRMP was also amended in 2003 with the following relevant standards and guidelines:

- Integrated weed management prevention and treatment strategies will be used to treat noxious weeds within the constraints of laws, policies and regulations and to meet Forest Management objectives. Methods may include manual (mowing, clipping, grubbing), biological, heated steam, competitive seeding, competitive planting, solarization, prescribed fire, grazing, chemical, or other applicable methods designed to control and/or eradicate the noxious weed. Biological controls tested and sanctioned by the US Department of Agriculture would be allowed to occur. Manual control methods within disturbed sites, such as along roads, trailheads, landings and within administrative sites would be allowed at any time.
- Require all ground disturbing machinery to be washed prior to entering and leaving the Forest, using the appropriate timber sale contract provisions and construction contract requirements.
- Require the use of certified-weed-free seed for all revegetation projects.
- Revegetate disturbed sites as soon as practical using native species unless there is no immediate resource concern and the site is anticipated to revegetate naturally to native species to desired cover standards.

Existing and Desired Conditions

The health of native plant communities throughout the Pacific Northwest is at risk by noxious weeds and other invasive plants. Introduced plant species thrive in new ecosystems for various reasons including a lack of natural predators, change in

disturbance regime, adaptations for growing on nutrient-poor soils, and allelopathic (plants with natural pesticides) abilities. As a result, many weeds are capable of out-competing native plants, ultimately altering the structure and lowering the diversity of native plant communities. The frequency of fire can also be altered in ways that are detrimental to natural ecosystems (Brooks et al. 2004, Harrod and Reichard 2001, Keely 2001). Further, different soil organisms predominate under different kinds of vegetation. Replacement of native plant communities with weed species can be expected to change soil microbial populations and nutrient cycling processes.

Roads are considered the first point of entry for weed species into a landscape, and roads serve as corridors along which plants move farther into the landscape. Logging, construction equipment and off-road vehicles have the potential to transport weed seed beyond roadsides to the disturbed soil that they concurrently generate. Invasive plant seed can also be moved by wind, water, animals, and humans. Most weeds take advantage of disturbed areas such as roadsides, trails, logged units, burns, rock quarries, mined sites and areas around human structures. Established populations serve as sources for further dispersal, especially along road, power line, and trail corridors.

The increase of noxious weed introductions on the Umpqua National Forest is directly related to expanding weed populations on nearby federal, state, and private lands. Populations of extremely aggressive species such as spotted knapweed, meadow knapweed, and rush skeletonweed have become roadside weeds on frequently traveled highways in Oregon and along arterial roads in the Umpqua and adjacent national forests. The greatest risk of human-caused noxious weed introduction into the proposed units is from seed-contaminated vehicles and equipment traveling through the planning area.

The Umpqua National Forest has classified its noxious weeds into four categories: high priority species (Forest Rating A), lower priority species (Forest Rating B), detection species (Forest Rating D), and other weeds of interest (Forest Rating O). The noxious weeds known⁶¹ to occur on the Diamond Lake Ranger District of the Umpqua National Forest are presented, by category, in Table 37.

Table 37. Noxious Weed List for the Umpqua National Forest.

Common Name	Scientific Name	D-Bug Planning Area?
High-Priority Species (Forest Rating A)		
Spotted knapweed	<i>Centaurea stoebe</i> ssp. <i>micranthos</i>	Yes
Diffuse knapweed	<i>Centaurea diffusa</i>	Yes
Scotch broom	<i>Cystisus scoparius</i>	Yes
Lower-Priority Species (Forest Rating B)		
Meadow Knapweed	<i>Centaurea nigrescens</i>	Yes
Bull Thistle	<i>Cirsium vulgare</i>	Yes
St. Johnswort	<i>Hypericum perforatum</i>	Yes
Tansy Ragwort	<i>Senecio jacobaea</i>	Yes
Other Weeds of Interest (Forest Rating O)		

⁶¹ The following weeds occur on the Forest, but not within the planning area. These weeds will continue to be monitored for: False brome, Italian thistle, yellow starthistle, Malta thistle, rush skeletonweed, Portuguese broom, French broom, English ivy, yellow toadflax, Japanese knotweed, giant knotweed, sulfur cinquefoil, puncture vine, gorse, Canada thistle, Himalayan blackberry, Medusahead rye, common burdock, poison hemlock, chickory, common teasel, common tansy.

Common Name	Scientific Name	D-Bug Planning Area?
Oxeye daisy	<i>Chrysanthemum leucanthemum</i>	Yes
Wild carrot	<i>Daucus carota</i>	Yes
Reed canarygrass	<i>Phalaris arundinacea</i>	Yes
Curly pondweed	<i>Potamogeton crispus</i>	Yes

Noxious weed surveys for the D-Bug project were conducted during the summer of 2008. The D-Bug planning area is relatively free of invasive weeds although the major highways, 138 and 230, provide corridors for movement of weeds from eastern Oregon and the Rogue Valley, respectively, onto the Umpqua National Forest. There are numerous infestations of spotted knapweed along both Highways' 138 and 230 adjacent to stands proposed for thinning and fuels treatment. These infestations have been spot sprayed with herbicide and monitored since 2003 so major seed sources within the planning area are being actively managed. However, new plants continue to appear along the highway shoulder and along adjacent FS roads, presumably from residual seed and possibly continued movement from infestations east of the Cascades. The small infestation of diffuse knapweed on Highway 138 near the Crater Lake north entrance appears to have been eradicated. Small numbers of diffuse knapweed plants have continued to be found and sprayed with herbicide along the Lemolo Lake Road.

St. Johnswort is the most prevalent weed in the area but even it is largely confined to roadsides. There are also isolated spots of meadow knapweed, Scotch broom, tansy ragwort, and bull thistle. The former two species, in particular, are limited enough in the vicinity to be hand pulled when they are encountered, although meadow knapweed is very abundant in other parts of the Umpqua National Forest.

Diamond Lake has small infestations of an aquatic nuisance plant, curly pondweed, near the South Shore and Thielsen View Campground boat launches. Reed canarygrass is abundant around the lake's shoreline, where it was likely planted for shoreline stabilization. There are isolated patches of it downstream along Lake Creek.

The desired condition for the watershed and planning area is to be free of priority noxious weed infestations and maintain plant communities that are resilient to the introduction and spread of all invasive plants. Disturbed areas, such as rock quarries and waste disposal areas are maintained free of invasive weeds to the degree practicable.

Direct, Indirect, and Cumulative Effects

Alternative 1 would not result in any direct effects because ground disturbing activities with the potential to encourage new noxious weed invasions, would not occur. Continued noxious weed inventory, monitoring, and management would be subject to funding levels and district priorities. Because of potential wildfire hazard associated with dying lodgepole pine, failure to address fuels under the no action alternative could result indirectly in more severely burned acres that would be susceptible to weed invasion. In general, lodgepole pine stands appear to be somewhat less susceptible to non-native weed invasion. This would be most true of the stands bordering Crater Lake National Park because of their exceptionally low soil nutrients, summer soil moisture and native species richness and cover (Stohlgren et al. 2002, Stohlgren et al. 1999).

Because there are a few short segments of existing road that would be scheduled for obliteration under the action alternatives there would be slightly more road remaining

under Alternative 1, resulting in slightly greater potential for long-term distribution of weeds along roadsides under this alternative. The absence of any roadwork under Alternative 1 would result in no road-related direct effects upon invasive plants. Because slightly more road would remain in the planning area under Alternative 1, there would be a minor indirect effect of greater potential weed spread over time on more road miles than the action alternatives.

Timber harvest and fuels reduction activities have the potential to directly affect weed spread under all action alternatives by vehicles and equipment carrying weeds to the areas where vegetation is being removed and soil disturbed. This potential would largely be mitigated through application of the prescribed prevention measures, particularly the vehicle washing requirement.

Weed spread and colonization would be indirectly facilitated by removing competing vegetation and disturbing the soil in the timber harvest units and fuelbreaks (Merriam et al. 2006). This is particularly acute where vegetation is removed immediately adjacent to the primary dispersal corridors (i.e. roads). The priority weed infestations are currently largely confined to the roadsides, with heavily traveled roads tending to have more diverse and abundant roadside weeds. The overstocked stands of lodgepole and Douglas-fir lining the highways in particular help to contain weeds to the road shoulders. The effect of thinning this vegetation would be partially mitigated by: treating known sites prior to timber harvest and fuels management activities (and continuing to manage the known sites); subsoiling and seeding temporary roads, landings and skid trails adjacent to landings; and post-project monitoring to detect and treat invasive weeds before they can establish. The amount of mitigation that would occur would be dependent upon available funding. If weed mitigation is not funded, or funding is delayed, there is the potential for weed infestations to become established that would be much more expensive to manage over the long-term.

It is anticipated that, at least in part, fuels treatments involving mastication would result in a mulch layer dense enough to reduce weed colonization; therefore, these areas would not be seeded. The area south of the Hwy 230/Hwy 138 junction is naturally depauperate of vegetation because of the excessively well-drained pumice soils with low organic content and harsh climatic conditions. This area would not be seeded under any alternative because of the low potential for seeding success, although the area would continue to be monitored for weed colonization. Because of the high-elevation, low soil productivity, low soil moisture and low native species richness and cover, this particular area is thought to be less prone to exotic weed invasion (Stohlgren et al. 2002, Stohlgren et al. 1999).

Opening some stands could indirectly result in greater use of OHVs and other off-road vehicles away from roadways in places where travel is currently precluded. Off-road vehicles have the potential to carry weed seed into areas that are difficult to monitor (Rooney 2005). This would most likely occur immediately adjacent to existing recreation areas including dispersed campsites. The same mitigation measures would be applied, but could be less effective because recreation use is less predictable. An off-highway vehicle (OHV) plan is currently being developed by the Forest that would restrict OHV use to predetermined areas, which would greatly reduce the risk of weed spread.

Roads indirectly affect weed spread by creating habitat for invasive weeds and providing corridors for movement of weeds. Alternative 2, 3 and 4 propose to construct 15.4, 10.0 and 25.1 miles of temporary road, respectively. Under all alternatives these temporary roads would be subsoiled and revegetated after the sale, contingent upon funding and

vegetation potential at each site. Road obliteration and revegetation, along with application of required weed prevention measures during timber sale operations and post-harvest monitoring, should mitigate the potential for weed invasion of the temporary roads. There are currently a total of 186 miles of roads in the planning area. Because there are a few short segments of existing road that would be scheduled for obliteration, Alternatives 2 and 4 would result in 181 miles of road subsequent to activities and Alternative 3 would result in 183 miles of road. This would result in a minor indirect benefit over the long-term because there would be 3-5 less miles of road in the planning area to facilitate weed movement under the action alternatives.

Because temporary roads would be obliterated and revegetated, there would be no cumulative impact of additional roads in the planning area under any of the action alternatives. In fact, the miles of road in the planning area would slightly decrease under all action alternatives. Numerous projects have occurred within the planning area that have contributed to soil disturbance and vegetation clearing that provide suitable habitat for weeds (Tables 12-14). However, most of these activities have been away from the major weed dispersal corridors. Only minor activities have occurred along Highway 138, which is the principle weed dispersal corridor. The other important weed corridors are roads 60 and 2610, both of which have had extensive, recent vegetation clearing for the purposes of fuels reduction and powerline maintenance. Activities along both roads have mostly involved thinning of small diameter trees (< 5" DBH) within 150 ft of either side of the road then hand-piling and burning the slash. Treatment units under Alternatives 2 and 4 actually overlap most of these acres so there would be little meaningful cumulative effect from the past actions. In fact, mitigation measures included in this project could partially alleviate some effects of the prior actions through revegetation, since very little revegetation was attempted as part of these past treatments. Alternative 3 overlaps slightly less of the past actions because it does not include units 134, 136 and 137 (102 ac) that border road 60. As a percentage of the landscape, total existing soil compaction within the planning area is very small at 2%, well below the LRMP standard of 20%. Therefore, the effects of both past soil disturbance and vegetation clearing along weed dispersal routes are relatively small and would not contribute to a meaningful cumulative effect when combined with this project.

THREATENED, ENDANGERED, AND SENSITIVE PLANT SPECIES

There are two species known or suspected to occur on the Forest that are listed under the Endangered Species Act. *Lupinus sulphureus* ssp. *kincaidii* is listed as threatened and has been documented on the Tiller Ranger District on the Umpqua National Forest. This species occurs in low-elevation upland prairies and is primarily known from Willamette Valley grasslands although there are isolated occurrences documented throughout the Umpqua basin as well. *Plagiobothrys hirtus* is listed as endangered and is confined to low-elevation wetlands in the vicinity of Sutherlin in northern Douglas County. It has not been documented on the Forest to date. The D-Bug planning area is far too high in elevation for there to be potential habitat for either of the federally listed species; therefore, there would be **no effect** to either species.

Several sensitive plants occur in these areas including: Lesser bladderwort (*Utricularia minor*), swaying bulrush (*Schoenoplectus subterminalis*), scheuchzeria (*Scheuchzeria palustris*), *Calypogeia sphagnicola*, *Tritomaria exsectiformis*, *Schistostega pennata*, and *Tomenthypnum nitens*. The latter four species are mosses and liverworts. There were no sensitive lichen species detected during surveys in the planning area. It is Forest Service policy to "ensure that Forest Service actions do not contribute to loss of viability

of any native or desired plant or contribute... trends towards Federal listing of any species” (FSM 2672.41). There are currently 39 vascular plant species 20 fungi, 12 lichens, and 24 bryophytes listed as Sensitive, on the Umpqua National Forest; only those species with potential habitat in the area and that are present^{62,63} in the planning area are listed in Table 38.

Table 38. A Project Effects Assessment for Threatened, Endangered & Sensitive Plants.

Taxa Group and Species	Potential Habitat	Species Present	Project Effects			
			Alt 1	Alt 2	Alt 3	Alt 4
Threatened or Endangered Plants						
<i>Lupinus sulphureus</i> ssp. <i>kincaidii</i>	No	No	NE	NE	NE	NE
<i>Plagiobothrys hirtus</i>	No	No	NE	NE	NE	NE
Bryophytes						
<i>Calypogeia sphagnicola</i>	Yes	No	NI	NI	NI	NI
<i>Schistostega pennata</i>	Yes	Yes	NI	NI	NI	NI
<i>Tomenthypnum nitens</i>	Yes	Yes	NI	NI	NI	NI
<i>Tritomaria exsectiformis</i>	Yes	Yes	NI	NI	NI	NI
Fungi						
<i>Boletus pulcherrimus</i>	Yes	N/A	NI	MIH	MIH	MIH
<i>Chroogomphus oculatus</i>	Yes	N/A	NI	MIH	MIH	MIH
<i>Cortinarius barlowensis</i>	Yes	N/A	NI	MIH	MIH	MIH
<i>Cudonia monticola</i>	Yes	N/A	NI	MIH	MIH	MIH
<i>Gastroboletus imbellus</i>	Yes	N/A	NI	MIH	MIH	MIH
<i>Gastroboletus vividus</i>	Yes	N/A	NI	MIH	MIH	MIH
<i>Gomphus bonarii</i>	Yes	N/A	NI	MIH	MIH	MIH
<i>Gymnomyces fragrans</i>	Yes	N/A	NI	MIH	MIH	MIH
<i>Leucogaster citrinus</i>	Yes	N/A	NI	MIH	MIH	MIH
<i>Pseudorhizina californica</i>	Yes	N/A	NI	MIH	MIH	MIH
<i>Stagnicola perplexa</i>	Yes	N/A	NI	MIH	MIH	MIH
<i>Turbinellus kauffmanii</i>	Yes	N/A	NI	MIH	MIH	MIH

⁶² The following species have potential habitat in the planning area but are not present; as such, no impacts are expected to occur. See the Botany BE (Project File) for a complete list: *Barbilophozia lycopodioides*, *Bryum calobryioides*, *Chiloscyphus gemmiparus*, *Encalypta brevicolla* var. *crumiana*, *Encalypta brevipes*, *Entosthodon fascicularis*, *Funaria muhlenbergii*, *Helodium blandowii*, *Jamesoniella autumnalis* var. *heterostipa*, *Marsupella emarginata* var. *aquatica*, *Meesia uliginosa*, *Polytrichum sphaerothecium*, *Rhizomnium nudum*, *Splachnum ampullaceum*, *Tayloria serrata*, *Tetraphis geniculata*, *Tetraplodon mniodes*, *Trematodon boasii*, *Chaenotheca subroscida*, *Dermatocarpon meiophyllizum*, *Leptogium burnetiae*, *Leptogium cyanescens*, *Lobaria linita*, *Panaria rubiginosa*, *Petigera neckeri*, *Pelitigera pacifica*, *Pseudocyphellaria mallota*, *Arnica viscosa*, *Botrychium manganense*, *Botrychium pumicola*, *Carex abrupta*, *Carex crawfordii*, *Carex diandra*, *Carex lasiocarpa* var. *americana*, *Carex serratodens*, *Carex vernacula*, *Cimicifuga elata*, *Collomia mazama*, *Cypripedium fasciculatum*, *Iliamna latibracteata*, *Ophioglossum pusillum*, *Polystichum californicum*, *Romanzoffia thompsonii*. NE – No Effect; NI – No Impact; MIH – May Impact Individuals or Habitat, But Will Not Likely Cause A Trend Towards Federal Listing or Loss of Viability.

⁶³ The following species have no potential habitat in the planning area and will not be discussed further; see the Botany BE (Project File) for the complete list: *Porcella bolanderi*, *Pseudoleskeella serpentinensis*, *Codiophorus depressum*, *Scouleria marginata*, *Nephroma occultum*, *Pseudocyphellaria rainierensis*, *Ramalina pollinaria*, *Usnea longissima*, *Dermocybe humboldtensis*, *Destuntzia rubra*, *Ramaria amyloidea*, *Ramaria aurantiiscescens*, *Ramaria largentii*, *Ramaria spinulosa* var. *diminutiva*, *Rhizopogon exiguous*, *Rhizopogon inquinatus*, *Adiantum jordanii*, *Arabis suffrutescens* var. *horizontalis*, *Asplenium septentrionale*, *Calamagrostis breweri*, *Calochortus umpquaensis*, *Carex nardina*, *Elatine brachysperma*, *Eucephalus vialis*, *Gentiana newberryi*, *Kalmiopsis fragrans*, *Lewisia columbiana* var. *columbiana*, *Lewisia leana*, *Pellaea andromedifolia*, *Perideridia erythrorhiza*, *Poa rhizomata*, *Rotula ramosior*, *Utricularia ochroleuca*, *Viola primulifolia* spp. *occidentalis*, *Wolffia borealis*, *Wolffia columbiana*, *Plastismatia lacunosa*, *Cypripedium montanum*.

Taxa Group and Species	Potential Habitat	Species Present	Project Effects			
Vascular Plants						
<i>Scheuchzeria palustris</i> var. <i>americana</i>	Yes	Yes	NI	NI	NI	NI
<i>Schoenoplectus subterminalis</i>	Yes	Yes	NI	NI	NI	NI
<i>Utricularia minor</i>	Yes	Yes	NI	NI	NI	NI
Strategic Species						
<i>Buxbaumia aphylla</i>	Yes	Yes	NI	MIH	MIH	MIH

Vascular Plants and Bryophytes

Lesser bladderwort, swaying bulrush and scheuchzeria

Lesser bladderwort (*Utricularia minor*) occurs in shallow areas of standing water in wetlands associated with both Lemolo and Diamond Lakes. This unusual wetland plant produces both dissected submerged leaves along with leaves that are modified into tiny helmet-shaped bladders for trapping microscopic aquatic animals. This carnivorous modification is an adaptation to the anaerobic environment from which nutrients are not readily extracted.

Swaying bulrush (*Schoenoplectus subterminalis*) is a sedge-like species with flaccid leaves that float on the water's surface. It occurs in the large wetland at the south end of Diamond Lake within shallow ponds of pond lilies that grade, without defined banks, into the wet sedge meadow. Smaller populations occur along the shallow margins of Horse and Teal Lakes.

Scheuchzeria is an unusual sedge-like plant with inflated fruits that occurs only in well-developed fens. This species occurs in a wetland on the stream terrace between Diamond and Lemolo Lakes and the wetland below Unit 162 south of Lemolo Lake. These are the only recorded sites of this species on the Umpqua National Forest.

Tomenthyphnum nitens and *Calypogeia sphagnicola*

Tomenthyphnum nitens is a wetland moss that is associated with the edges of hummocks while *Calypogeia sphagnicola* is a tiny liverwort that occurs as threads within mats of sphagnum mosses. Both species occur in the same wetland as Scheuchzeria along Lake Creek while the former also occurs in the wetland where Lake Creek enters Lemolo Lake.

Tritomaria exsectiformis and *Schistostega pennata*

Tritomaria exsectiformis grows on well-decayed logs and organic streambanks that are in immediate proximity to water. There are a few small, isolated sites of this liverwort along Silent Creek and Lake Creek. *Schistostega pennata* occurs in the wet lodgepole pine habitats adjacent to Diamond Lake. It is largely confined to the shaded, moist soil of uprooted trees although it has also been found in one hole in the ground along Silent Creek. Because it occurs in shaded areas, the new growth of germinating spores (called protonema) glows yellow-green⁶⁴ from reflected light. The wet pits where *S. pennata* can be found are always filled with a cloud of gnats and mosquitoes. This adaptation is important because the upturned trees which *S. pennata* depend upon only provide habitat for so many years before they decay into a mound of soil. Because the insects

⁶⁴ This luminescence is the product of lens-shaped cells that concentrate light on the chloroplasts. Because it glows from darkened crannies in the forest, it is sometimes known as goblin's gold. It also is unusual in having sticky spores that are transported to fresh substrates on insects and other animals.

and moss share the same habitat preference, the insects appear to facilitate transport of spores. The lodgepole pine surrounding Diamond Lake is currently at a late-mature stage and is subject to blowdown and breakage. This has created a flush of suitable habitat for *S. pennata* that should last into the near future.

Direct, Indirect, and Cumulative Effects

Lesser bladderwort, swaying bulrush, *scheuchzeria*, *Tomenthypnum nitens* and *Calypogeia sphagnicola* all occur in wetlands. These wetlands would receive a 150 ft buffer under all action alternatives, except in the non-commercial Units 25 and 35 at the south end of Diamond Lake. These two units are designed to non-commercially thin dense, young lodgepole pine plantations. Because of the flat topography, well-drained pumice soils, and low current biological diversity in these plantations no direct or indirect adverse impacts are anticipated upon the wetlands from non-commercial treatment of the adjacent plantations. There may be a slight benefit due to the acceleration of tree growth and reduction of uncharacteristic fire hazard under the action alternatives although there is little discernable wetland interface within these two plantations. For these reasons, there would be **no impact** to any of these species or their habitat.

Tritomaria exsectiformis occurs near units along the riparian zones of Silent Creek and Battery Springs. Other sites within the planning area are well away from proposed activities. There is also an isolated site of *Schistostega pennata* along Silent Creek. If streams were left unbuffered, these species could be affected by alteration of the hydrology of these creeks. Because they are dependent upon down wood and wind thrown trees, actions that would alter down wood recruitment within the riparian interface of these streams would also affect these species. However, Silent Creek and its tributaries would be buffered by at least a 60 to 80 ft no-entry buffer. The smaller prescribed buffer would be at upper reaches of the stream. The buffer would be carried to the slope break if it is greater than the prescribed 60 or 80 ft buffer. Because of the nature of this system, this would isolate the stream from any discernable direct or indirect effects. Specifically, the segment of Silent Creek adjacent to proposed units winds through a largely dissected landscape with a mostly narrow floodplain that rises sharply to broad pumice flats dominated by dry lodgepole stands where the proposed harvest units are located. No harvest or fuels treatments would occur along the stream or the adjacent slopes. Because the proposed harvest units are almost entirely elevated above the height of the riparian trees, there would be no change in the microclimate along the stream or wind events affecting wind thrown tree recruitment along the streams.

Battery Springs is similar to Silent Creek except that the creek is much smaller and, in the reach where *T. exsectiformis* occurs, winds through a fairly flat landscape lacking the sharp transition to dry lodgepole forest. For this reason, a larger no-entry buffer of 100 ft would separate the stream from the adjacent Units 163 and 164 starting at the spring initiation point and extending to the road 2614 crossing. Unit 163 is a mixed conifer stand that would only have whips felled and handpiled for burning so there would be little indirect adverse effect anticipated from this treatment. Unit 164 is mix of lodgepole pine and other conifers and would be thinned to 20-70 TPA. Because this unit would be very open subsequent to harvest the larger 100 ft, no-entry buffer would be necessary to reduce alteration of microclimatic conditions along the immediate riparian zone where *T. exsectiformis* occurs. A 100 ft buffer would be sufficient to eliminate any change in stream hydrology (see hydrology section). For these reasons, there would be **no impact** to *T. exsectiformis* or riparian habitat for *S. pennata* from treatments in any of the alternatives.

Schistostega pennata occurs mostly in the timbered wetland interface around Diamond Lake along with a couple of isolated sites in the Lemolo Lake and Spring River area. Proposed Units 2 and 94 are uphill, above the paved bike trail, from the *S. pennata* habitat along the northwest edge of Diamond Lake. These units are both mixed conifer stands that would be thinned leaving a 50 ft buffer around the lake and wetland edges. Because the hydrology of the *S. pennata* habitat is connected to the lake and the wind throw necessary for providing substrate is also connected with wind coming off the lake, no direct or indirect impact is anticipated from thinning uphill. Most of the habitat and recorded sites for this species are connected with wetlands at the south end of Diamond Lake. The wetlands all would receive 150 ft buffer with the exception of the plantations discussed above. No suitable habitat or substrate occurs within or immediately adjacent to these plantations. There are no treatments proposed in or near the isolated sites near Lemolo Lake or Spring River. Therefore, there would be **no impact** to *S. pennata* or its wetland associated habitat from the action alternatives.

Fungi

Because of their unreliable and often cryptic fruiting characteristics, pre-project surveys are not considered to be a reliable conservation tool for fungi. Conservation of fungi on Forest Service lands entails management of known sites, targeted surveys based on Regional priorities and consideration of habitat elements for fungi during project planning.

There is one location of a sensitive species of fungus within the D-Bug planning area. *Pseudorhizina californica* (formerly *Gyromitra californica*) is known from two sites on the Diamond Lake Ranger District. One site occurs along the moist stream terrace of Lake Creek but well away (approximately 700 ft, horizontal distance) from the nearest unit. No known sites of any sensitive fungi occur within any of the proposed units. Eleven additional species of fungi have been determined to have potential habitat within the planning area (Table 38). Occurrence of any of the other species would represent an expansion of their currently recognized habitat niche. None of the sensitive fungi appear to have particular fidelity to habitats within any of the proposed units but the published habitat requirements for rare fungi are only broadly described (Aurora 1986, Castellano et al. 1999, Castellano et al. 2003, Exeter et al. 2006) so it is difficult to confidently predict potential habitat. The following describes what is known about the habitat of the other species of fungi that appear to have potential habitat within the planning area based on available information:

There is a single known site on the Forest of *Boletus pulcherrimus* along the North Umpqua Trail. It is reported to occur on humus in association with the roots of conifers, including Douglas-fir and grand fir, and hardwoods, including big-leaf maple and tan oak. Most sites are in coastal forest.

Chroogomphus oculatus is known from only a single site in the Northwest Forest Plan area. This site is on the saddle at the head of a creek in a stand of mountain hemlock at 4,590 ft. on the Willamette National Forest.

This is one site of *Cortinarius barlowensis* on the Cottage Grove Ranger District. It is reported to occur on wood and litter in coastal to montane conifer forests at 25-4,729 ft in elevation with silver fir, western hemlock and mountain hemlock.

Cudonia monticola is a litter saprobe that has been reported on the Diamond Lake Ranger District. It is reported a little north of Lemolo Lake from behind a receding snowbank at 4,560 ft in a late mature stand in the Shasta red fir/thin-leaf

huckleberry/prince's pine plant association. It is also reported from 3,000 ft on the Cottage Grove Ranger District.

Gastroboletus imbellus is known only from the one site on the Willamette National Forest along the Ollalie ridge Trail at 5,000 ft in a stand of mountain hemlock and silver fir forest.

Gastroboletus vividus is reported from Shasta red fir and mountain hemlock above 5,400 ft. There are nearby sites on the Rogue River-Siskiyou National Forest at Jackson Gap and Crater Lake National Park but it has not ever been found on the Umpqua National Forest.

The nearest site of *Leucogaster citrinus* is south of Cavitt Falls on Roseburg BLM but it is reported to occur elsewhere at elevations up to 4893 ft in stands with white fir, subalpine fir, western white pine and lodgepole pine.

There is a site of *Stagnicola perplexa* known from the Rogue River National Forest in the vicinity of Crater Lake National Park, not far from the Diamond Lake Ranger District. It occurs on rotten wood and is reported in stands with Douglas-fir, western hemlock and alder at elevations of 1,149-4,526 ft.

There are five reported sites of *Turbinellus kauffmanii* (formerly *Gomphus kauffmanii*) on the Forest. One site is in the Steamboat drainage while the rest are on the Diamond Lake Ranger District. Reported elevations are 5,200 ft or higher where it is recorded with Shasta red fir, mountain hemlock, silver fir and white fir.

Direct, Indirect and Cumulative Effects

None of the Umpqua sensitive species appear to be specifically tied to lodgepole pine stands. Only the false-truffle species *Leucogaster citrinus* have been specifically reported to occur with lodgepole pine at all. In general, lodgepole pine stands appear to have relatively low fungal species richness (Cullings et al. 2000). Early seral species of fungi tend to persist as stands mature while additional species occur in older stands (Byrd et al. 2000, Bradbury et al. 1998). Therefore, it is anticipated that the direct effect of timber harvest in the lodgepole dominated stands would be a short-term reduction of fungal species richness in general due to habitat alteration, but that the potential for occurrence of any sensitive species of fungi is very low. Although Alternative 4 would harvest the most acres of lodgepole forest, there would be little difference among the action alternatives because the habitat is considered to be so poor for rare fungi.

Mixed conifer stands appear to represent the best potential habitat for rare species in the D-Bug planning area. Several species evidently prefer high elevation silver fir-mountain hemlock stands. There are no silver fir dominated stands within any of the units. Mountain hemlock is not a desired commercial timber species so proposed units avoided mountain hemlock dominated stands. However, it is a common species within many units, either as an incidental species or in patches within lodgepole pine stands where it would mostly remain unlogged. Mountain hemlock dominated stands are abundant in adjacent areas, particularly in areas without roads, recreation and wilderness areas. A few species of fungi are reported to have been collected in stands with red fir/Shasta red fir. There are Shasta red fir dominated or co-dominated stands at the north end of Diamond Lake including units 56, 95 and 194 along with unit 176 west of Lemolo Lake. White/grand fir and Douglas-fir are noted as associated conifers from known sites of several other rare fungi. These conifers dominate all or parts of stands between Clearwater Falls and Thielsen Creek including units 107, 115, 116 and 117. Mixed conifer units, including Douglas-fir, white fir and other conifers, also occur in stands

along the Thirsty Creek and Kelsay Point roads. These stands are the most likely to support the sensitive species of fungi discussed above.

Based on apparent suitable habitat, along with number and distribution of known sites, *Pseudorhizina californica* and *Turbinellus kauffmanii* are the most likely species to occur in mixed conifer stands in the D-Bug planning area. The related genera, *Gomphus* (primarily *G. floccosus*⁶⁵) and *Gyromitra* (primarily *G. esculenta*⁶³ and one observation of *G. infula*⁶³) were observed to be abundant in places within the planning area. These common species were observed to be mostly, but not entirely, along stream terraces and lower slopes, which are largely excluded from harvest units. Although the potential for any individual species of sensitive fungi to occur in any given unit is slim, the large amount of acres that would be managed under the action alternatives increase the possibility that a rare fungus could be present and be directly damaged by operations from host tree removal and habitat alteration. Alternative 3 proposes the least mixed conifer thinning (1,815 ac); Alternatives 2 and 4 both would harvest approximately 20% more mixed conifer acres (2,247 ac). Therefore there would be approximately a 20% greater chance of direct or indirect adverse impact to sensitive fungi and their habitat under these two alternatives. Potential impacts are substantially reduced in the mixed conifer units by retention of large green trees, retention of down wood, implementation of soil mitigation measures including topsoil retention and subsoiling, and riparian no-cut buffers.

All mixed conifer prescriptions involve thinning that would leave 50 to 90 TPA greater than 7" DBH. Total cover after harvest would be approximately 50% from trees greater than 7" DBH. This prescription should limit impacts to fungi by leaving host trees for mycorrhizal fungi and providing enough canopy cover to moderate microclimatic alteration of the stand. In a study conducted, in part, on the Diamond Lake Ranger District, Luoma et al. (2004) detected no treatment effect on fall mushroom or truffle standing crop when 40% of the basal area (BA) was left in a dispersed pattern similar to the mixed conifer prescription for D-Bug. Spring truffle biomass was down relative to the control but there was no 'statistically significant' difference to spring mushrooms in the 40% dispersed retention treatments. Retention trees in harvest units have been demonstrated to serve as important refugia for ectomycorrhizal fungi (Luoma et al. 2006).

Downed wood in the form of logs can greatly influence the diversity, distribution and abundance of fungi. This is particularly true of wood saprobes such as *Stagnicola perplexa* that subsist directly on decaying wood. But logs also serve to retain moisture under them as the ground elsewhere dries out. Decayed wood represents an important source of inoculum for recolonization of surrounding area following a disturbance (Jones et al. 2003). Several studies have associated down wood with fungal abundance and diversity (Mellen et al. 2006, Gomez et al. 2003, Amaranthus et al. 1996, Clarkson and Mills 1994). Surveys conducted in the D-Bug planning area indicate that there is currently about 2% log cover in both lodgepole and mixed conifer stands. Even in the mixed conifer stands, downed wood was comprised of 66% lodgepole pine logs. Modeling of coarse woody debris cover relative to proposed harvest and fuel reduction activities indicates that ground cover would drop slightly with activities and then progressively increases over the succeeding decades (see the coarse woody debris section).

⁶⁵ Common species are not expert verified.

Because of the advanced age of the lodgepole pine and beetle mortality, Alternative 1 would have the highest cover of downed wood, at least in the absence of uncharacteristic wildfire. There are no data available for providing an optimal or recommended amount of downed wood necessary for fungi (Mellen et al. 2006). Presumably more would be better, but this would have to be considered against the uncharacteristic wildfire hazard in stands with excessive coarse woody debris. The prescription for down wood within each unit does not differ between action alternatives although the total acreage of units affecting down wood does. Alternatives 2 and 4 harvest more acres of mixed conifer stands than Alternative 3. In the absence of wildfire, the indirect benefit of downed wood cover to fungi, as described above, would be less in Alternatives 2 and 4.

Jones et al. (2003) concluded that indirect changes in the biology and chemistry of soils following logging have as much or more effect on ectomycorrhizal fungal communities than impacts to the direct fungal inoculum. However, characterizing specifically how changes to the soil would alter fungal communities is difficult. Trappe (2008) found shifts in fungal communities with changes in the carbon to nitrogen ratios in nearby Crater Lake National Park. Otherwise, he found it difficult to separate the effect of soil properties from biological characteristics of the sites. Mechanized timber harvest and fuels treatment result in soil compaction. Soil compaction reduces pore space for root penetration, which should affect ectomycorrhizal formation (Amaranthus et al. 1996). Subsoiling of temporary roads, landings and skid trails near landings would partially reverse the effect of compaction on mycorrhizal fungi. Other soil mitigation measures involving stockpiling of topsoil to be returned to subsoiled sites, and maintenance of effective ground cover would ameliorate much, but not all, of the alteration of soil organic composition on fungal diversity and abundance. The highest acreage of soils affected would occur under Alternative 4; the least under Alternative 3 (see soils section).

Numerous timber sales and fuels reduction treatments have occurred throughout the planning area (Tables 12-14). The activities proposed under each of the action alternatives cumulatively add to the residual effects of similar past actions. Specifically, there are substantial acres of thinned stands associated with past timber and fuels management. There is also soil disturbance and compaction associated with these past activities plus the recreation areas, although existing soil compaction represents only 2% of the planning area. Most of the stand management has been in lodgepole pine dominated stands that, as discussed previously, appear to be poor habitat for sensitive fungi. Conversely, there are vast acres of similar habitats in the adjacent IRA's, areas without roads, wilderness and parklands that receive little, or no, thinning or fuels reduction management. Therefore, because the potential for all but two species of fungi being present is very low; the potential impacts to host trees and habitat would be of moderate intensity and primarily of short duration; the best apparent habitat (e.g. older stands, riparian stands) would be retained; the planning area is bordered by vast acreage of reserved land allocations; and the proposed activities are intended to reduce the risk of uncharacteristic wildfire that would potentially have greater impact on fungal diversity, it is determined that the action alternatives **may impact individuals or habitat but are not likely to contribute to a trend toward federal listing or loss of viability** for any sensitive species of fungi.

EFFECTS TO OTHER RARE, UNCOMMON, OR STRATEGIC SPECIES⁶⁶

Buxbaumia aphylla is a tiny moss that occurs on soil at high elevations and is considered to be a strategic species. Strategic species are seemingly rare species that little is known about. This curious moss has only microscopic, ephemeral leaves so it is only the small fruiting body that is observable by the naked eye. It is known from a Douglas-fir stand on the east side of the Kelsay Point road between units 146 and 196. It also occurs at the break between lodgepole-dominated unit 130 and the mixed-conifer unit 131. These units are included only in Alternatives 2 and 4.

Direct, Indirect and Cumulative Effects

None of the action alternatives would have a direct impact to known sites of *Buxbaumia aphylla* because the location that occurs within a unit would be provided a 75 ft radius, no-entry buffer. This distance roughly corresponds to the height of the dominant tree species at the site. This buffer is anticipated to ameliorate any indirect impacts to the microclimate of the site, which has a relatively open canopy already. This species appears to prefer small patches of bare soil, which is currently rare in the existing stands that currently have the forest floor covered with a thin, highly snow-compacted duff. Timber harvest would create additional substrate of bare soil, however there are likely other factors that would limit effective colonization of soil immediately subsequent to stand treatments including: unfavorable microclimatic conditions, inadequate spore dispersal vectors, and absence of other facilitating organisms such as the lichen *Cladonia* that locally appears to co-occur with *B. aphylla*. Units with what appears to be the best potential habitat (i.e., the units along the Thirsty Creek and Kelsay Point roads) for *B. aphylla* occur only in Alternatives 2 and 4.

There is the potential for direct adverse impacts to undiscovered locations under Alternatives 2 and 4. This species is very tiny while the planning area is very large. The capsules are known to be consumed by mice and possibly other organisms and there is no information on how predictably the fruiting bodies are produced. Therefore there is the potential that individual plants may be damaged or destroyed under all action alternatives. However, because the potential habitat was surveyed to minimize the potential for unknown sites, known sites are being buffered, and the proposed activities under all alternatives are designed to maintain relatively healthy forests over the long-term relative to the no-action alternative, each of the action alternatives are anticipated to have no worse than a neutral and possibly a beneficial effect to habitat over the long-term.

There would be no direct adverse impacts to *B. aphylla* or its habitat under Alternatives 1 and 3 because no activities occur within likely habitat. Alternative 1 and 3 do not manage the existing fire hazard conditions along Thirsty Creek or Kelsay Point roads, therefore the stands and immediately adjacent areas have greater potential for stand replacement fire. The extreme environmental conditions that would accompany a stand replacement fire in this area aren't likely to encourage survival or colonization of *B. aphylla*. Therefore, there would be a potential indirect adverse effect upon the species and its habitat due to the increased risk of uncharacteristic wildfire.

⁶⁶ Two additional species that have previously been considered to be of conservation concern, although they do not currently meet the criteria for Forest Service sensitive, are evaluated should their status be reconsidered. *Cypripedium montanum* and *Platismatia lacunosa* were surveyed for but not found in the project area. Therefore, no direct, indirect or cumulative effects would be anticipated to either species from actions associated with this timber sale.

Only the Charlene Timber Sale appears to have occurred recently in likely habitat for *B. aphylla*. The single site that was discovered was buffered from timber sale activities. Most of the potential suitable habitat for this species appears to lie within the Oregon Cascades Recreation Area and the Mt. Thielsen Wilderness Area where only recreation activities with minimal impact to suitable habitat occur; therefore there would be minimal adverse cumulative impacts to the species or its habitat under alternatives 2 and 4.

SOIL PRODUCTIVITY AND SUSTAINABILITY

The maintenance of soil productivity during forest management activities is critical to maintaining healthy forests and is addressed in the Umpqua National Forest Land and Resource Management Plan (1990) with several standards and guidelines. The primary focus of this analysis centers on past and predicted soil disturbances, the maintenance of ground cover, and changes to forest cover.

Relevant Standards and Guidelines

The standard and guidelines from the 1990 LRMP related to soil productivity include:

- Soil Productivity S&G 1, p IV-67: Requires that the combined total amount of unacceptable soil conditions (compaction, displacement of surface soil and severe burning) in proposed activity areas would not exceed 20 percent, including areas in roads and landings.
- Soil Productivity S&G 2, p IV-68: Requires maintenance of $\geq 25\%$ effective ground cover on areas with low erosion hazards and $\geq 45\%$ in areas with moderate erosion hazards to prevent loss of topsoil through erosion.
- Soil Productivity S&G 3, p IV-68: Requires maintenance of $\geq 65\%$ ground cover for surface organic material (defined as litter, duff and wood) on mineral soils with cold climatic conditions, low nutrient levels, and/or low water holding capacities.
- Soil productivity S&Gs 5, 10, 11, and 12 and other NWFP requirements are also addressed here as project design, mitigation measures, or as monitoring requirements in the soils section at the end of Chapter 2.
- Watershed Cumulative Effects and Water Quality S&G 5, IV-65: Requires permanent roads and landings on inventoried aquifer lands will be occupied by less than 5 percent of land area or a road density of 5.3 miles/square miles and will not disrupt natural drainage or intercept and transfer subsurface water to surface channels.

Existing and Desired Conditions

Past disturbance and the current condition in each of the proposed units was investigated in the field by the project Soil Scientist. For the most part, the proposed harvest units in the D-Bug planning area are in areas not previously harvested. Approximately 115 acres of existing skid trails and landings were identified along with 37 miles of unclassified roads and 15 miles of unclassified OHV trails. Past timber harvest primarily utilized ground-skidding using cables or tractors without suspending logs. Harvest and fuel treatments that occurred in the past is now considered as extreme disturbance by current standards. Regeneration of clear cuts was often difficult in some of the more harsh sites such as in the colder flats, dryer coarse pumice areas, or areas

with severe soil disturbance. Road densities in the planning area are 2.92 miles per square mile and road densities in aquifer related soil types⁶⁷ are even less.

Soils in the planning area are developed from Mazama ash, volcanic rock, and glacial debris. The flats around the Diamond and Lemolo Lake region contain relatively young, poorly developed coarse textured Volcanic soil (Andisols). Soil interpretations⁶⁸ for the planning area were made using the Umpqua Soil Resource Inventory (USDA 1976) and field review. This inventory provides landscape-scale soils information on broadly mapped areas (average size = 250 acres) that have distinctly unique geology, landform and soils. This information is summarized for each landform:

Cold-dry deep Pumice Flats – This landform is represented by Soil Mapping Landtypes 90 and 92. This feature represents 48 percent of the planning area between Lemolo and Diamond Lake. The combination of low fertility, cold air settling into these areas and the low moisture holding capacity of the coarse textured pumice creates a harsh environment in which lodgepole pine is best adapted and becomes the dominant species. These deep (>12 feet) sandy soils are excessively drained. There is little risk of overland flow so surface erosion (0 to 0.15 ton per acre per year) or mass soil movement and the potential for sediment delivery is low. Water can concentrate and flow over disturbances such as compacted skid trails, roads, and landings but quickly disperses and infiltrates once it flows from these disturbances. These landtypes were identified as important to the North Umpqua River aquifer in the 1990 Forest Plan. The minimum effective groundcover for this area is prescribed at 65%, in order to meet standards and guidelines for site productivity. The surface of these soils dries quickly giving them a low resiliency to disturbance.

Cold-moist Deep Pumice Flats – This landform is represented by Soil Mapping Landtypes 90, 92, and 96. This feature represents 25 percent of the planning area between Lemolo and Diamond Lake. Cold air settling into these areas creates a harsh environment in which lodgepole pine is best adapted and becomes the first species to move into these sites following disturbance. These deep (>12 feet) sandy soils are excessively drained and are identified as important to the North Umpqua River aquifer in the 1990 LRMP. However, where soil surface texture is loamy over coarse-textured pumice, soil moisture during the growing season tends to favor fir trees under the lodgepole where they are protected from frost. There is little risk of overland flow so surface erosion (0 to 0.15 ton per acre per year) or mass soil movement and the potential for sediment delivery is low. Water can concentrate and flow over disturbances such as compacted skid trails, roads, and landings but quickly disperses and infiltrates once it flows from these disturbances. These soils have a low to moderate resiliency to soil disturbances.

Gentle to Moderately Steep Glacial Deposits – This landform is represented by Soil Mapping Landtypes 92 and 96. These features represent 27 percent of the planning area between Lemolo and Diamond Lake. Soils in these areas range from less than three feet to eight feet in depth on slopes ranging from 20 to 50 percent. These slopes help to circulate the cold air, making it less of an issue than in the flats. These landforms favor high elevation mixed conifer forests. There is little risk of overland flow so surface erosion (0 to 0.15 ton per acre per year) or mass soil movement and

⁶⁷ Since the 1990 Land and Resource Management Plan, Soil Landtypes have been found to be less of a predictor to the High Cascade aquifer than the jointed and fracture underlying geology (Jefferson et. al 2006).

⁶⁸ Detailed soil properties of each landform are found in the Project File – Soils section.

the potential for sediment delivery is low. Water can concentrate and flow over disturbances such as compacted skid trails, roads, and landings but quickly disperses and infiltrates once it flows from these disturbances. This landform has been identified as important to the North Umpqua River aquifer in the 1990 LRMP. These soils are moderately sensitive to soil disturbance. The minimum effective groundcover for this area is prescribed at 65%, in order to meet standards and guidelines for site productivity.

Maintaining soil structure and soil organic matter, large woody material, and the forest litter is a critical element to long-term soil productivity. Unacceptable soil disturbance (severe compaction, displacement, or burned soil), effective ground cover, and maintenance of carbon and nitrogen balance are used as measures of the potential to have direct, indirect, or cumulative effects to long-term soil productivity and sustainability.

The desired condition for soils in the planning area is to keep cumulative soil disturbance to less than 20% of the treatment areas, and maintain at least 65% effective ground cover of surface organic material for soil productivity (LRMP IV-68 S&G 2). Forest soils are the primary stores of carbon and can store/sequester large amounts of greenhouse gases. A desired objective would be a carbon neutral project that sequesters or offsets more greenhouse gases than the project emits (IPCC 2007). Nitrogen is a common nutrient that is used to measure effects to site productivity and sustainability.

Direct and Indirect Effects

Direct and indirect effects are discussed at the scale of the treatment units. Direct effects would occur immediately as a result of thinning, fuel treatment, and road work while indirect effects would occur in the future as a result of potential wildfires. Predictions about future stand and fuel conditions were made using Forest Vegetation Simulator (FVS) (Dixon, 2003) and Fire and Fuels Extension to the FVS (Reinhardt and Crookston, 2003)⁶⁹. Predictions of direct effects of burning were made using First Order Fire Effects Modeling (FOFEM).

Excessive displacement, compaction, and severe heating of the soil (from fire) are all considered unacceptable soil disturbance under S&G 1. Soil compaction and displacement can exceed this standard whenever legacy disturbance (from past management) combines with any new disturbance to affect more than 20% of a given treatment area. Thinning and associated activities in the action alternatives can result in soil disturbance during yarding, burning and temporary road building. Use of cut-to-length logging techniques would reduce soil compaction and displacement compared with other ground-based systems because the processing equipment works on top of a slash mat.

Under Alternative 1, legacy soil displacement and compaction would remain at around 2% of the area analyzed and includes the land used for administrative sites at Lemolo and Diamond Lakes (parking lots, campsites, etc). Included in this 2% estimate are 52 miles of existing unclassified roads and OHV trails, and 115 acres of legacy landings and skid trails.

Under the action alternatives, approximately 965 to 1,771 acres of new soil disturbance is expected in the form of new temporary roads, log landings, and skid trails (Table 39). Subsoiling 460 to 870 acres of temporary roads, landings, and skid trails within 100 feet

⁶⁹ Summary of FVS-FFE runs and assumptions for Fire and Fuels – located in the D-Bug project files.

from each landing is included in D-Bug's project design. Following subsoiling, Alternatives 2, 3, and 4 would continue to meet soil standards and guidelines for soil disturbance averaging from 7% to 10% of treatment acres. Unacceptable soil disturbance would not exceed 20% in any single treatment area (Table 39) and overall compaction levels over the planning area of the North Umpqua River aquifer would not exceed 5% (FEIS IV-65), thus meeting Forest Plan Standards and Guidelines for compaction.

Table 39. Soil disturbance estimates from compacted and severely burned soil for the D-Bug activity areas.

Type of Soil Disturbance	Alt 1	Alt 2	Alt 3	Alt 4
Legacy Compaction*	226 ac	226 ac	226 ac	226 ac
New Compaction (perm roads)	0	0 ac	0	0
New Compaction (harvest, landings, temporary roads)	0	1,333 ac	965 ac	1,771 ac
Subsoiling (mitigation)	0	-635 ac	-456 ac	-870 ac
Severely Burned Soil** (fuel treatments)	0	41 ac	28 ac	52 ac
Net Soil Disturbance (% of treatment areas)	2%	8%	7%	10%
Severely burned soil (modeled wildfire***)	3,107 ac	1,733 ac	1,740 ac	1,733 ac
% Soil Disturbance from Wildfire	27%	15%	15%	15%

* Legacy Compaction includes compaction that already exists, prior to the implementation of D-Bug action, and includes unclassified roads, OHV trails, skid trails, and landings.

** Severely burned soil is a condition where soil has been heated to a point that alters soil structure resulting in increased soil erosion potential, and decreased soil organisms and nutrient holding capacity. Severely burned soil often occurs in the burning of large machine piles.

*** First Order Fire Effects Modeling (FOFEM). Results for Alternative 1 predict that severe soil disturbance during wildfire could be as high as 73% in some areas.

Alternative 3 would result in the least amount of compacted and severely burned soil following harvest and fuel treatments, while Alternative 4 would result in 4% more soil disturbance than Alternative 3 and 2% more than Alternative 2. This is primarily because Alternative 4 would ground skid more lodgepole pine stands where higher levels of soil compaction are expected. Alternative 4 would also construct 10 to 15 more miles of temporary roads than Alternatives 2 or 3; however, where subsoiling occurs on temporary roads, skid trails, and landings, these areas would be in a recovering condition.

Compaction from skid trails and landings within the harvest units would cause localized surface water to route and concentrate. However, this process would only carry water a relatively short distance before less compacted soil is reached where surface runoff would quickly infiltrate. With the typical low stream density and high infiltration of the High Cascade geology, Standards & Guidelines and Best Management Practices for soil protection, maintaining effective groundcover, and no cut buffers on perennial streams, it is very unlikely that surface water from soil compaction would have an effect on the North Umpqua River aquifer or that subsurface water runoff would reach stream channels (see Aquatics section for more information on the aquifer).

A minimum of 65% effective ground cover has been prescribed to mitigate both the risk of soil erosion and the need to maintain soil organic matter for long-term site productivity to meet Soil S&G 2. The forest floor typically accounts for 7% of the nitrogen found in a lodgepole ecosystem and as much as 20% in true fir. Loss of nitrogen in these ecosystems is directly proportional to forest floor consumption (Tiedemann et al. 2000).

The combined effect of harvest, landings, and fuel treatments would expose soil across 22% to 23% of the entire activity area under the action alternatives (Table 40). While limited effects on soil carbon⁷⁰ and ground cover would occur, disruption of natural processes such as surface erosion and nutrient cycling would be very limited under the action alternatives. Mastication would increase effective ground cover distribution after logging.

Table 40. Summary of Effective Ground Cover Predictions.

Exposed Soil	Alt 1	Alt 2	Alt 3	Alt 4
Harvest and Landings	0	1,413 ac	1,044 ac	1,867 ac
Fuel treatments	0	129 ac	93 ac	132 ac
% Exposed Soil from Management	0	22%	22%	23%
% Effective Groundcover	100%	78%	78%	77%
Exposed soil from a Wildfire	11,694	4,709	6,766	2,543
% Exposed Soil from Wildfire	51%	21%	30%	11%

First Order Fire Effects Modeling (FOFEM) was used to predict the direct effects of fuel loads on the soil resource and smoke emissions from prescribed burns and wildfire. Under Alternative 1, wildfire would expose the soil surface over the burn area by an average of 51% in mixed conifer and 73% in the lodgepole pine stands (Table 40). An indirect effect of the surface ash and soil exposed by wildfire would be to warm the soil surface earlier in the spring and release nutrients to the soil. Exposed soil near streams would increase the risk of sediment and nutrient delivery. Sediment delivery would not increase on the flats where water infiltration into the soil remains high. Hydrophobic soil conditions and reduced infiltration would occur locally beneath large wood which can smolder for long periods. Relative to Alternative 1, wildfire effects to ground cover and the soil within treatment areas would decrease under the action alternatives to 11% to 30% (Table 40).

⁷⁰ Forest management activities where biomass comes in contact with the soil, such as with mastication and with the use of soil amendments such as charcoal or biosolid application (Lal, 2005), can even increase soil carbon levels. Class A Biosolids refers to a compost by-product of municipal sewage. In Class A biosolids, 99% of the pathogens have been killed and it is not considered hazardous. Quality control and application rates are regulated under the direction of Oregon Department of Environmental Quality. A potential opportunity for mitigating ground cover loss on skid trails, temporary roads, and landings to help to capture carbon and improve soil productivity would be the application of Class A biosolids in conjunction with subsoiling. For D-Bug, biosolids are an option, but with limited funding, are unlikely to be used. If funding were available, biosolids would be applied as compost to the soil surface at a rate equivalent to 300 to 400 lb N per acre prior to subsoiling, benefiting soil productivity by slowly releasing nutrients, promoting soil restoration, rapid revegetation, enhanced CO₂ sequestration, soil structure, wildlife forage quality (Orton 2007), and increases to soil carbon (Lal, 2005). The Diamond Lake sewage treatment plant is considering developing a site for drying and composting, potentially making a local source of Class A biosolids available for soil restoration in D-Bug.

The direct and indirect effects of timber harvest and fuel reduction on long-term site productivity was considered by modeling⁷¹ the potential for nitrogen losses associated with the size and type of the treatments. Alternative 4 would result in a 1.6% potential decrease in nitrogen over a 40 year period compared to Alternative 1. The largest pools of nitrogen are located in the soil (81 to 87%) and the forest floor (7% lodgepole, 13% true fir). A theoretical removal of all other above ground woody material would only represent 6% of the total nitrogen pool. These direct effects would be mitigated by retaining effective ground cover under the action alternatives (Table 40). The potential effect for nutrient loss from harvest and fuel treatments depends on the distribution of the woody material in the forest. The largest portion of nutrients found in the harvested timber would be contained in the new growth found in needles, fine roots, and twigs (Kimmins, 1977). Ecosystem nitrogen is a key nutrient managed for long-term site productivity. The distribution of nitrogen in the ecosystem varies by stand age, climatic conditions, and the nutrient/moisture holding capacity of the soil.

The indirect effect of harvest and fuel treatments would be a lower soil burn severity hazard during a wildfire (Tables 39 and 40). Over the next forty years, taking no action to reduce fire hazard would carry 1.8 times the risk for severe soil heating over more than 1,374 acres (Table 39) when compared to the action alternatives.

Cumulative Effects

The D-Bug planning area has a moderate risk to experience severely burned soils from ground fires on soils that are relatively sensitive to disturbance. All action alternatives are within standards of acceptable disturbance and therefore would not add to past soil impacts that result in adverse cumulative effects to soil.

Cumulatively, considering recent and foreseeable activities (Tables 12-14) in the D-Bug planning area, there would be a net positive effect to long-term soil productivity. The “worst case” scenario would be increased soil compaction over 7% to 10% of the treatment area (Table 39). Off-setting these affected acres would be a potential 44% reduction of severely burned soil effects during a wildfire as a result of treatments under the action alternatives (Table 39). The action alternatives would lower the hazard of severe wildfire effects to soils, a beneficial cumulative effect that is expected when added to the beneficial effects of the past fuels reduction efforts around Diamond and Lemolo Lakes. These past and reasonably foreseeable future projects (Tables 12-14) also lower the long-term (10 to 20 years) potential of severe fire effects in the planning area, creating conditions for lower intensity burning in the event of wildfire.

CARBON

Carbon is an essential element when considering the potential effects of forest management on long-term soil productivity and contributions to global warming. Forests and forest products play a critical role in the carbon cycle. Down woody material and soil organic matter are two of the primary factors influencing site productivity and soil development.

Carbon capture⁷² (sequestration) can be defined as the net removal of greenhouse gases (reported in metric kilotons carbon dioxide equivalents⁷³) from the atmosphere

⁷¹ Biomass distribution was modeled using FS Veg. Nitrogen values were assigned to each component using values from Edmonds et. al., 1989.

⁷² Although most of the capture and release of carbon happens at the molecular scale, management decisions regarding carbon sequestration occur at the stand and landscape levels.

into long-lived carbon pools. These carbon pools are composed of live and dead aboveground and belowground biomass or wood products. Most soil carbon and available nutrients for plants are retained in the upper 10 inches of forest soils, where carbon is in its most stable form. Down woody material and soil organic matter are critical elements to site productivity and soil development. Without substantial disturbance, soil carbon can remain relatively constant or even increase through time (Smith et al. 2006). Fine roots and mycorrhizal fungi activity occur in the surface two inches of soil. Fine root development plays an important role in capturing of soil carbon (Lal, 2005) to improve long-term soil fertility and productivity (Marcot 2003). Forest soils that are low in organic matter are also less productive. Mazama ash soils, especially those that are finer textured, have the highest contents of organic carbon and nitrogen in western-montane forest soils (Meurisse et al. 1989).

The recommendations from the Intergovernmental Panel on Climate Change (IPCC) to reduce greenhouse gas emissions⁷⁴ from forest management includes the replacement of fossil energy sources with sustainably managed sources of biomass, substitution of high energy consuming products with wood, improving technology with regards to the use of fuel wood, and encouraging the recycling of forest products to provide even longer storage for carbon pools.

Direct and Indirect Effects

Due to fire exclusion the lodgepole pine and mixed conifer stands in the D-Bug planning area now carry a higher balance of carbon and nutrients in the vegetation and down wood where they are more exposed to the effects of wildfire than when stored as soil organic matter. An indirect effect of Alternative 1 is a higher future level of risk to ecosystem productivity from wildfire (Hatten et al. 2005) over the next 40 years. Under Alternative 1, direct effects to the soil productivity from wildfire would be 25% to 30% greater than under the action alternatives (Table 39). An indirect effect of no action would be a 12% greater risk in soil burn severity (Table 39) and 31% greater carbon emissions from wildfire (Figure 22) as dead and down timber increase during the first decade due to the beetle kill.

Under no action, a wildfire would have a direct effect to long-term soil productivity by potentially consuming greater than 80% of the litter and duff layer over a quarter of the burn area, potentially exposing about three-fourths⁷⁵ of the soil surface. Under a moderate severity ground fire scenario, depth-of-mortality⁷⁶ (60° C) would average approximately 2.5 inches in mixed conifer stands with 79% of the litter and duff potentially being consumed over half of the soil surface while depth-of-mortality would average 3 inches in lodgepole pine stands with all of the ground cover consumed over

⁷³ Global warming potential (GWP) is used to convert emissions of non-CO₂ gases into their CO₂ warming equivalents (CO₂eq). The CO₂eq of a non-CO₂ gas is calculated by multiplying the mass of the emissions of the non-CO₂ gas by its GWP, allowing for comparison of the total cumulative warming effects of different greenhouse gases over a specified time period. The warming effect of CO₂ is assigned a value of 1, and the warming effects of other gases are calculated as multiples of this value. GWPs used are for a 100-year time horizon from the IPCC Second Assessment Report (SAR) as updated by the Third Assessment Report (TAR). All GWPs used in this analysis are from the SAR. Emissions calculations relevant to the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol are also based on SAR GWPs.

⁷⁴ Greenhouse gas emissions and sequestration from direct, indirect, and connected actions are reported in carbon dioxide equivalents.

⁷⁵ FOFEM results using 6% soil moisture and 20% duff on SAF-Douglas-fir – western hemlock.

⁷⁶ Depth of mortality is the maximum soil depth where temperatures would be expected to reach 60 degrees Centigrade causing damage to plant roots.

91% of the stand under the same fire scenario. Deeper soil heating and longer burn durations would occur in areas of high fuel concentrations resulting in detrimental effects on soil organic matter due to increased soil loss through erosion in riparian areas (Hatten et al. 2005) (see Aquatics section).

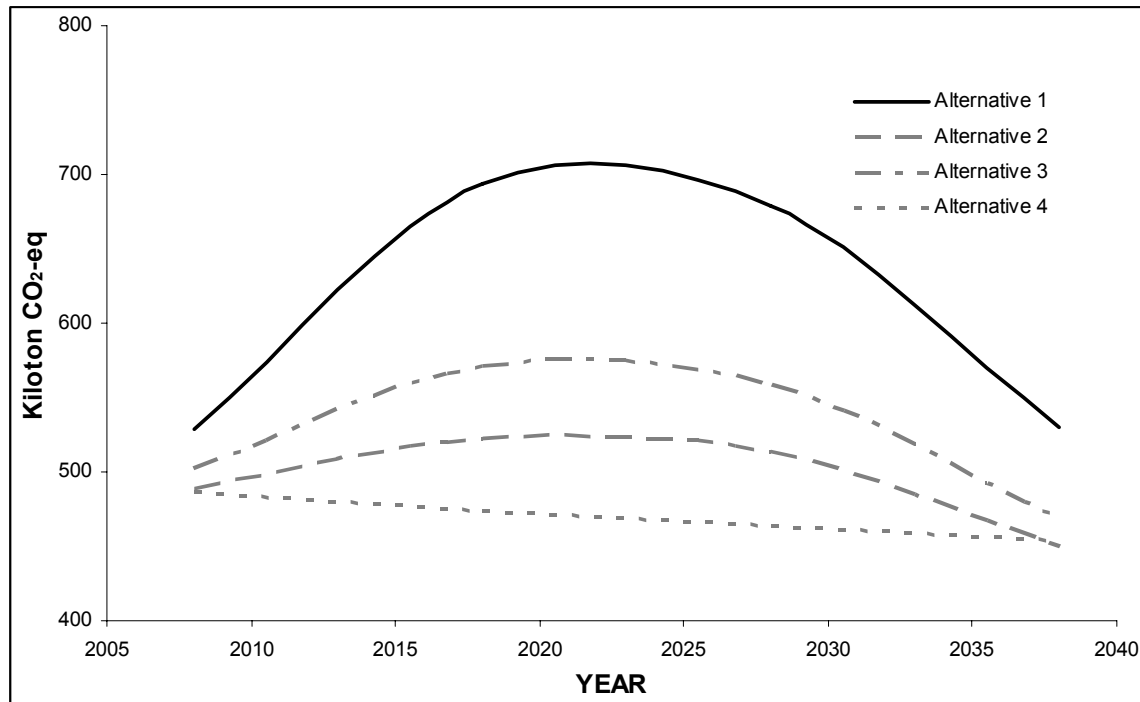


Figure 22: Emissions summary of wildfire hazard for each decade over a 40-year period following harvest and fuel treatments. Displayed in metric tons of carbon dioxide equivalents. As wildfire hazard increases, the potential emissions from a fire also increase.

Under Alternative 1, there would be a pulse of beetle-killed lodgepole during which carbon in the forest floor would have a mean residence time of around 3 years with about 30% decomposition occurring during the first year. Most of the large wood would have a residence time of over 80 years with 30% decomposition occurring during the first 40 years (Edmonds, 1991, Hart and Firestone 1991). Under the no action alternative, during the first decade, the decay of coarse woody debris could account for as much as a 15% increase in CO₂ emission during the first decade. By the fourth decade there could potentially be a 3% increase in total carbon primarily due to increased lodgepole regeneration and root development.

The action alternatives include harvest and fuels treatments to reduce future wildfire severity. Underburning would be more effective at reducing severity than other treatments such as thinning, crushing or mastication, and handpile burning. While these other treatments reduce burn intensity and rate-of-spread, they would not reduce burn duration and depth of soil heating during a ground fire. While Alternative 3 prescribes fire on fewer acres than Alternatives 2 and 4 and would lose 29% less CO₂ through smoke emissions, Alternative 3 would also carry a higher risk of wildfire effects.

Under the action alternatives, carbon loss from exhaust emissions would be an indirect effect of equipment use during logging, fuels reduction road work, log haul, soil restoration, and product milling of biomass/bio fuels (Table 41). Alternative 4 would emit

5% more carbon dioxide (CO₂eq) from exhaust emissions per thousand board feet than Alternatives 2 and 3. Carbon emissions during subsoiling operations would be equivalent to 0.36 metric kilotons of carbon dioxide under Alternative 3 and 0.51-0.69 kilotons under Alternatives 2 and 4 (Table 41).

Table 41: Harvest, Management, and Manufacturing summary of potential carbon emissions from D-Bug treatments. Displayed in metric kilotons of carbon dioxide equivalents (CO₂eq decade⁻¹).

Per Decade Emissions average over 40-years	Alt 1 kilotons CO ₂	Alt 2 kilotons CO ₂	Alt 3 kilotons CO ₂	Alt 4 kilotons CO ₂
SMOKE & EXHAUST EMISSIONS				
Road work	0	0.12	0.12	0.13
Temporary road const. & mitigation	0	0.11	0.08	0.17
Skid trail & Landing mitigation	0	0.51	0.36	0.69
Harvest, yard & haul systems	0	5.46	4.06	6.82
Biomass hazard reduction – exhaust	0	2.71	2.10	2.81
Biomass hazard reduction – smoke	0	115.44	81.46	115.44
Biomass removal & haul – exhaust	0	0.60	0.36	0.69
Lumber Mill Production	0	14.89	11.24	18.43
NET Decade Average	+0	+34.96	+24.94	+36.30

Forest Product Substitution

Forest product substitution (see IPCC recommendations in Relevant Guidelines section above) assumes that a non-renewable product such as steel would replace wood products if wood were not available. Alternative 4 would harvest enough timber to construct about 3,800 houses and would sequester 151 metric kilotons of CO₂ per decade averaged over 40 years (Table 42). Under Alternative 1, forest product substitution using steel stud construction to build the same 3,800 houses would emit 225 metric kilotons CO₂ into the atmosphere. Alternatives 2 and 3 would harvest less timber, would result in a steel frame house substitution of approximately 700-1,500 steel framed houses and would emit higher quantities of greenhouse gases (14 to 29 metric kilotons CO₂ per year) into the atmosphere than under Alternative 4⁷⁷.

All action alternatives would result in a negative net carbon balance and would offset through sequestration or energy substitution more greenhouse gases than they emit. The amount of greenhouse gases captured within the D-Bug project area in a single year (averaged over 40 years) would be equivalent to the average annual emissions of 389 to 411 cars (Table 42).

⁷⁷ For the purpose of hazardous fuels reduction and as a renewable energy source, Alternative 4 makes available 21,000 dry tons of biomass to offset 28 metric kilotons of CO₂ emission.

Table 42. Greenhouse Gas balance summary of direct and indirect effects associated with alternatives and wildfire hazards averaged over a 40-year following harvest and fuel treatments. Displayed in metric kilotons of carbon dioxide equivalents (CO₂-eq decade⁻¹). No Action would maintain 10,184 metric kilotons CO₂ per decade. Carbon emissions are displayed as positive (+), with carbon storage or capture displayed as negative (-).

Net Decade Emissions (+) and Sequestration (-) averaged over 40-years	Alt 1 kilotons CO₂	Alt 2 kilotons CO₂	Alt 3 kilotons CO₂	Alt 4 kilotons CO₂
EMISSIONS (+)				
Harvest, Mgt., & Manufacturing ⁷⁸	+0	+35	+25	+36
Wildfire Hazard ⁷⁹	<u>+608</u>	<u>+494</u>	<u>+525</u>	<u>+469</u>
NET 40-YEAR Avg Emissions	+608	+529	+550	+506
SEQUISTRATION (-) OFFSET				
Forest Carbon Pool (trees to soil)	-11,045	-10,073	-10,324	-10,052
Forest Products ⁸⁰	0	-122	-92	-151
Forest Products Substitution (steel) ⁸¹	+225	+43	+87	+0
RENEWABLE ENERGY (-) OFFSET				
Biomass utilization ⁸²	-0	-23	-17	-28
Fossil Fuel balance	<u>+28</u>	<u>+5</u>	<u>+14</u>	<u>+0</u>
NET 40-YR Sequestration & Energy	-10,792	-10,170	-10,332	-10,231
NET per DECADE AVERAGE GREENHOUSE GAS BALANCE (NET Emissions - NET Offset)	-10,184	-9,641	-9,782	-9,725
% Change from No Action		5%	4%	5%
Greenhouse Gas Savings (cars/year) ⁸³	411 cars	389 cars	394 cars	392 cars

Utilizing biomass (including logging slash) would greatly reduce smoke emissions of carbon from prescribed fires and exhaust emissions from mechanical treatments while providing a renewable source of energy. New and developing technologies with

⁷⁸ Refer to Table 41.

⁷⁹ Refer to Figure 22.

⁸⁰ Forest product substitution of wood for steel in construction uses a whole house approach which considers the life cycle of wood and steel construction from extraction through manufacturing, transportation, and on-site construction (Manriquez 2002).

⁸¹ The number of wood houses was calculated for each alternative using the formula: [Number of wood frame houses = (Tons Harvest – Hs)/Hw], where: Hs = 7.74 metric tons per steel framed house and Hw = 6.63 metric tons per wood framed house. GWP index wood frame houses = 39,810 kg CO₂-eq and steel frame houses = 59,290 kg CO₂-eq.

⁸² The relative carbon offset of biomass utilization was estimated using the heating value of oil (19.9 metric tons carbon/TJ). Woody feedstock has a heating value 71% that of oil. Oil was used as the substitution for biofuel.

⁸³ Greenhouse Gas Savings was calculated in gallons of gasoline consumed for a 2008 Ford Taurus with a rating of 28 mpg highway and average CO₂ emissions of 0.8506 lbs CO₂/mi or 0.4286 lbs CO₂/gallon of gasoline consumed. [http://www.terrass.com/carbon-footprint-calculator]. 15,000 miles per car was used as the average annual miles per car in Oregon.

potentials for reducing carbon emissions, sequestering carbon, and providing renewable energy are being developed and will become more cost effective over time. One such opportunity may be sustainable forest bioenergy production using in-woods fast-pyrolysis conversion including bio-oil production and bio-char incorporation⁸⁴. Should the technology be cost-effective, such wood fiber utilization may occur utilizing the 21 biomass collection landings under the action alternatives. This could potentially generate 1,000 gallons of bio-oil⁸⁵, 40,000 cubic feet of bio-gas (used to run the plant), and 102 metric tons of charcoal per acre of slash treatment in the non-merchantable lodgepole pine stands. The charcoal from this process could be added to the soil to sequester carbon (1.8 metric tons CO₂ per acre slash treated) where it would become biologically active. Adding charcoal would enhance the soil's fertility and water holding capacity. Such a set-up would have limited to no direct, indirect, or cumulative effects, since the material being used would already exist at landings, and the operation would use the existing biomass to generate its own power. Moreover, no sediment delivery is possible from the processing of biofuels because the landings are all located on flat ground well away from streams. Air emissions with the bio-oil and bio-fuel production would be substantially less than if the wood were simply burned in the open environment.

Cumulative Effects

Using wood products that replace more energy intensive products reduces carbon emissions (IPCC 2008). Within 40 years Alternative 1 maintains the largest net carbon balance equivalent to 10,184 metric kilotons CO₂ per decade average (Table 42). The treatments proposed in Alternatives 2, 3, and 4, would potentially reduce the net reference carbon balance by 4% to 5%. Alternative 1, however, would maintain higher risks during wildfire, would not provide a renewable forest product source, and would not provide biomass for renewable energy. Alternative 4 which would provide the most timber products and biomass for renewable energy also would have the greatest potential for mitigating wildfire hazard. Even with these tradeoffs, all alternatives would meet standards and guidelines for maintaining long-term soil productivity and would maintain a positive carbon balance. Savings of green house gases through sequestration of carbon or energy substitution would be equivalent to offsetting the emissions of 389 to 411 cars in Oregon. When combined with other past, present, and future projects (Tables 12-14), the D-Bug project positively contributes to maintaining carbon and reducing emissions over time.

AIR QUALITY

Standards for ambient air quality⁸⁶ are set by the Environmental Protection Agency (EPA) and are designed to protect human health and welfare. Air quality can be impacted by the presence of particulate matter and other pollutants produced by both prescribed burning and wildfire⁸⁷. Although smoke from wildfire is considered a natural

⁸⁴ A proposal was submitted May 2008 in cooperation with the University of Idaho, University of Montana, the Umpqua Nat'l For., and Renewable Oil International, LLC for funding to investigate the economic feasibility of in-woods biomass pyrolysis compared to a fixed centralized processing unit.

⁸⁵ The heating potential of bio-oil (75,500 BTU/gal) is 90% that of Ethanol (84,000 BTU/gal).

⁸⁶ Ambient air quality is defined under the Clean Air Act of 1963 as the air quality outside of industrial site boundaries.

⁸⁷ Although prescribed burning affects air quality in ways similar to wildfire, it offers some advantages over wildfire. Prescribed burning plans are developed and implemented to minimize impacts on the airshed by the consideration of atmospheric conditions, season of burn (e.g., burning is restricted between July 1 to

event by the EPA's Natural Events Policy (air quality standards do not apply), smoke generated from prescribed burning must meet federal and state air quality standards set forth in the Clean Air Act (CAA) (section 160).

The Forest Service is required to file a burn plan with Oregon Department of Environmental Quality (ODEQ) and would comply with the strict standards for air quality. ODEQ would not allow burning when atmospheric conditions exist that may result in an inversion or other atmospheric conditions that would cause air quality violations. ODEQ strictly regulates burning; as such, there is very little likelihood that the effects to air quality from any action alternative would exceed air quality standards, even when combined with other burning and pollution sources.

A Regional Haze Rule was designed by the EPA to call on states to establish goals for improving visibility in mandatory Class I areas and to develop long term strategies for reducing emissions of air pollutants that cause visibility impairment to these areas. At this time, Oregon does not yet have a State Implementation Strategy to deal with regional haze or visibility impairment so no standards are currently enforced. However, the importance of visibility in the nearest Class I airshed, Crater Lake National Park, is recognized.

Because prescribed burning is not a stationary source of pollutants and because no burning associated with this project is within a non-attainment area, Prevention of Significant Deterioration, and the conformity provisions (see glossary) of the CAA are not applicable and will not be discussed further.

Other air quality impacts that may occur related to prescribed burning include: temporary and localized loss of aesthetic qualities due to visibility reduction, reduced visibility on highways and roads causing potential safety issues, health problems for sensitive people (i.e. asthma), and human discomfort. These impacts may occur at pollutant levels that are within air quality standards. Smoke impacts to safety, human health or visibility that occur within air quality standards are termed "nuisance smoke".

Burning techniques that minimize consumption during the smoldering phase of burning directly reduce emissions production. When compared to a summer wildfire, early season (spring, early summer) or late fall burning lessens emissions output by reducing larger fuel consumption and leaving the majority of the moist duff, litter layer and larger woody material intact. The duff layer and large coarse woody debris generate the most emissions during the smoldering phase of combustion. Fall burns exceed spring burns in duff consumption and emission levels. Prior to burning, emissions are predicted given certain weather, burn prescription and site parameters, in order to meet State standards (Sandberg et al. 2002).

The closest smoke sensitive receptors⁸⁸ are Oakridge, Roseburg, Cottage Grove, which are no closer than 35 miles from the project. The closest Class I Airsheds are Diamond Peak Wilderness (about 10 miles to the north) and Crater Lake National Park (adjacent to the project area on the south). Although Mount Thielsen Wilderness, located directly to the east, is not a designated Class I Airshed, the importance of air quality in this area is also recognized.

September 15 under the Oregon Visibility Protection Plan), fuel and duff moisture, diurnal wind shifts, ignition techniques and rapid mop-up.

⁸⁸ Smoke Sensitive Receptors are areas designated by the State Board of Forestry, in consultation with the Department of Environmental Quality, that is provided the highest level of protection under the smoke management plan because of its past history of smoke incidents, density of population or other special legal status.

Particulate Matter

The major pollutant of concern from smoke is fine particulate matter (Sandberg et al. 2002), which can travel great distances, reduce visibility, and absorb and transmit harmful gases. EPA standards have been established for two classes of airborne particulate matter (PM) – PM 10 and PM 2.5. PM 10 is particulate matter less than 10 microns in diameter while PM 2.5 is a subset that is less than 2.5 microns in diameter. Studies indicate that 90 percent of all smoke particles emitted during wildland burning (both prescribed and wildfire) are PM 10; of these, the majority are PM 2.5 (Hardy et al. 2001). PM 2.5 causes the majority of air quality impacts. Human health studies on the effects of particulate matter indicate that fine particles are largely responsible for health effects (O'Neill et al. 1997).

Direct and Indirect Effects

Total particulate matter emissions were estimated for action alternatives using First Order Fire Effects Model (FOFEM) (Reinhardt et al. 1997) using data generated by the Fire and Fuels Extension to the Forest Vegetation Simulator model (Reinhardt & Crookston 2003). Only the treatments that use fire would produce emissions, while none of the other treatments (such as lop and scatter or cut-to-length/crushing) would directly impact air quality.

Total amounts of PM 2.5 are compared in Table 43 which displays the differences between emissions from fuels treatments that involve some form of burning (see Table 11, Chapter 2). In comparing the direct effects of the alternatives, Table 43 shows that total PM 2.5 increases with acreage treated per alternative.

The amounts of PM 2.5 displayed include all burning that could possibly occur. This project has been designed to encourage removal of biomass wherever it can be done without unreasonable environmental damage and economic feasible. Alternatives 2, 3, and 4 have a total of 2,201, 1,192, or 2,307 acres respectively available for biomass removals. The potential exists that biofuels would be produced within the planning area from woody biomass using pyrolysis, as described above in this Chapter under Carbon. In this process, wood is burned at a very high temperature with limited oxygen in a still, with the byproducts being charcoal and biofuel. Bench scale testing has shown that 75% of the dried wood waste will be gasified and vaporized in the reactor. Of that amount, 80% is recovered as bio-oil and 20% is non-condensable gas (Layton 2007). The amount of particulates produced in this process would be a minor fraction of the emissions if the woody material were burned in an open environment. Biomass processing via pyrolysis or biomass removal, in any amount, would remove that fuel source from the site and essentially eliminate the associated air pollutants. No wildfire is assumed for Alternative 1 for this analysis. However, if a wildfire occurs (Figure 22), it would produce elevated levels of PM 2.5 and for extended periods of time compared to the burning associated with fuels treatments. Furthermore, wildfires often occur during unfavorable atmospheric conditions that would amplify the impacts to humans.

Because not all units would be burned the same day and not all piles would be burned at the same time, the amount of emissions produced is not likely to affect population centers. This is because the emissions would last only a short time (the day of the burning) and would disperse rapidly, minimizing any direct effects to humans.

Table 43. Total PM 2.5 Emissions in Tons by Alternative.

Fuels Treatment	Burn Acres		CO ² Emissions (tons/acre)		Total CO ² Emissions (tons/acre)	
	Pile Burn	Under-burn	Pile Burn	Under-burn	Pile Burn	Under-burn
Alt 1	None ⁸⁹	None	NA	NA	NA	NA
Alt 2	4265	195	1	0.7	4,265	140
Alt 3	3077	131	1	0.7	3,077	90
Alt 4	6203	195	1	0.7	6,203	140

The effects of the emissions would cause temporary and short-term visibility impacts in the immediate project areas during ignition and burning of activity-created fuels, and the duration and extent of the effects would be affected by wind speed and direction. Weather systems can cause inversions that would affect dispersal of smoke down wind. The localized effects of burning in the project area would be short-term degradation of air quality from prescribed burning, primarily during the actual burning stage and during inversions. Smoke from prescribed burning may be visible to people driving through the area. Burning piles in the fall would have minimal impacts to hunters or dispersed recreation users; this is due primarily to the favorable dispersal of smoke in the fall. Hunters in the area may be affected for a short period of time (the day of the burn), but would not experience adverse long-term impacts. All burning would take place during favorable atmospheric conditions with particular attention to avoiding impacts to nearby Class 1 Airsheds.

Very minor amounts of particulates would be generated by roadwork and road use during harvest activities. This source of particulate matter is not expected to create measurable or lasting emissions.

Carbon Dioxide

The production of carbon dioxide (CO₂) from the burning of forest residues contributes to the accumulation of greenhouse gases within the earth's atmosphere⁹⁰ (Sandberg et al, 2002). Fires in the western United States are minor contributors of these gases, when compared to savannah and forest fires in the tropical regions of the earth (Sandberg et al. 2002). For the purposes of full disclosure, the following analysis of CO₂ emissions is provided.

Direct and Indirect Effects

Total CO₂ resulting from burning were estimated for action alternatives using First Order Fire Effects Model (FOFEM) (Reinhardt et al. 1997) using data generated by the Fire

⁸⁹ Emissions for Alternative 1 include the assumption that a wildfire would not occur. When a wildfire does occur, emissions resulting from action alternatives would be lower due to lower fuel loads and lower likelihood of large fire growth.

⁹⁰ Decomposition of organic material also produces CO₂ at a slower rate.

and Fuels Extension to the Forest Vegetation Simulator model (Reinhardt & Crookston 2003). Only the treatments that use fire would produce high amounts of CO₂. Although harvest operations would produce CO₂, it is a relatively small amount at a constant rate and would dissipate quickly to immeasurable levels (Table 41). None of the other treatments (such as lop and scatter or cut-to-length/crushing) would directly impact air quality because no burning would occur.

Levels of CO₂ are compared in Table 44, which display the differences between emissions from fuels treatments. Under Alternative 1, no direct emissions of CO₂ would occur from burning, as no fuels treatment would take place.

Table 44. Total CO₂ Emissions in Tons by Alternative.

Fuels Treatment	Burn Acres		CO ₂ Emissions (tons/acre)		Total CO ₂ Emissions (tons)	
	Pile Burn	Under-burn	Pile Burn	Under-burn	Pile Burn	Under-burn
Alt 1	None ⁹¹	None	NA	NA	NA	NA
Alt 2	4265	195	67.2	61.8	286,600	12,050
Alt 3	3077	131	67.2	61.8	206,770	8,100
Alt 4	6203	195	67.2	61.8	833,500	12,050

Considering the remoteness of the project area to any definable population centers, and the ability of firefighters to find fresh air during project implementation and during a wildfire event, no long term exposure to these gases would be expected; therefore, no direct or indirect effects to humans would occur from the fuel treatments. The potential for biomass removal would have the same effect on CO₂ as was discussed for PM 2.5 above.

Cumulative Effects

The area considered for cumulative effects for air quality is a 62 mile (100 km) radius from the edge of the project boundary. The cumulative effects analysis to air quality impacts is unique in that past impacts to air quality are usually not evident (i.e. there is no overlap in time). Additionally, there are no point sources of pollution in the analysis area. Smoke from wildfire would be unlikely to overlap in time for either spring or fall burn windows. There is a slight chance that Wild Fire Use⁹² (WFU) fire generated smoke from Crater Lake National Park may occur within the fall burn window. Other prescribed burns may take place during the D-Bug burn season, but because smoke impacts from prescribed burning are temporary events that occur for a discreet period of time, cumulative additions of pollutants from other sources are unlikely to overlap in time. Coordination with the ODEQ would be critical to minimizing cumulative air quality

⁹¹ Emissions for alternative 1 include the assumption that a wildfire would not occur. When a wildfire does occur, emissions resulting from action alternatives would be lower due to lower fuel loads and lower likelihood of large fire growth.

⁹² WFU fires are naturally ignited fires closely monitored and allowed to burn under specific weather and fuels conditions for resource benefits.

impacts from prescribed burns, wildfire use and other pollution sources. Burning would not take place when the cumulative addition of fire generated pollutants to levels already in the airshed would exceed air quality standards. Overall, no cumulative impacts from burning would be expected to occur under the action alternatives.

Aquatic Environment

The proposed action and its relationship to the aquatic environment were assessed during the scoping process. Concerns were raised over impacts of new temporary road construction and the reconstruction and use of existing snow trails as timber haul routes. This road issue was addressed in the development of Alternative 3, and the effects related to this issue are disclosed in this section and under the Terrestrial and Social Environments.

This aquatic analysis focuses on how the D-Bug alternatives affect riparian and aquatic physical and biological processes at various scales. This includes site specific disclosure at the scale of individual streams or thinning units and at various larger scales including the Diamond Lake, Lemolo Lake, and Clearwater watersheds⁹³ (Figure 23).

The compatibility with the objectives of the ACS is discussed in this section of Chapter 3 and under the headings of Forest Vegetation and Unique Habitats in the Terrestrial Environment section of this Chapter. The results of watershed analysis are presented, a description of the existing condition of the important physical and biological components of the ACS are discussed, and conclusions are presented regarding how the alternatives move conditions toward desired conditions in terms of all nine ACS objectives which include:

1. Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted.
2. Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian-dependent species.
3. Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.
4. Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.
5. Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.
6. Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The

⁹³ A “watershed” is a subdivision of land that is based on hydrologic drainage and defined by a national hierarchical system, which delineates hydrologic drainage in nested multi-level subdivisions (FGDC, 2004). The watershed level subdivides the “sub-basin” level (4th level). The 5th level watershed is subdivided by smaller subwatersheds (6th level).

timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.

7. Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.

8. Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability.

9. Maintain and restore habitat to support well-distributed populations of native plant, invertebrate and vertebrate riparian-dependent species.

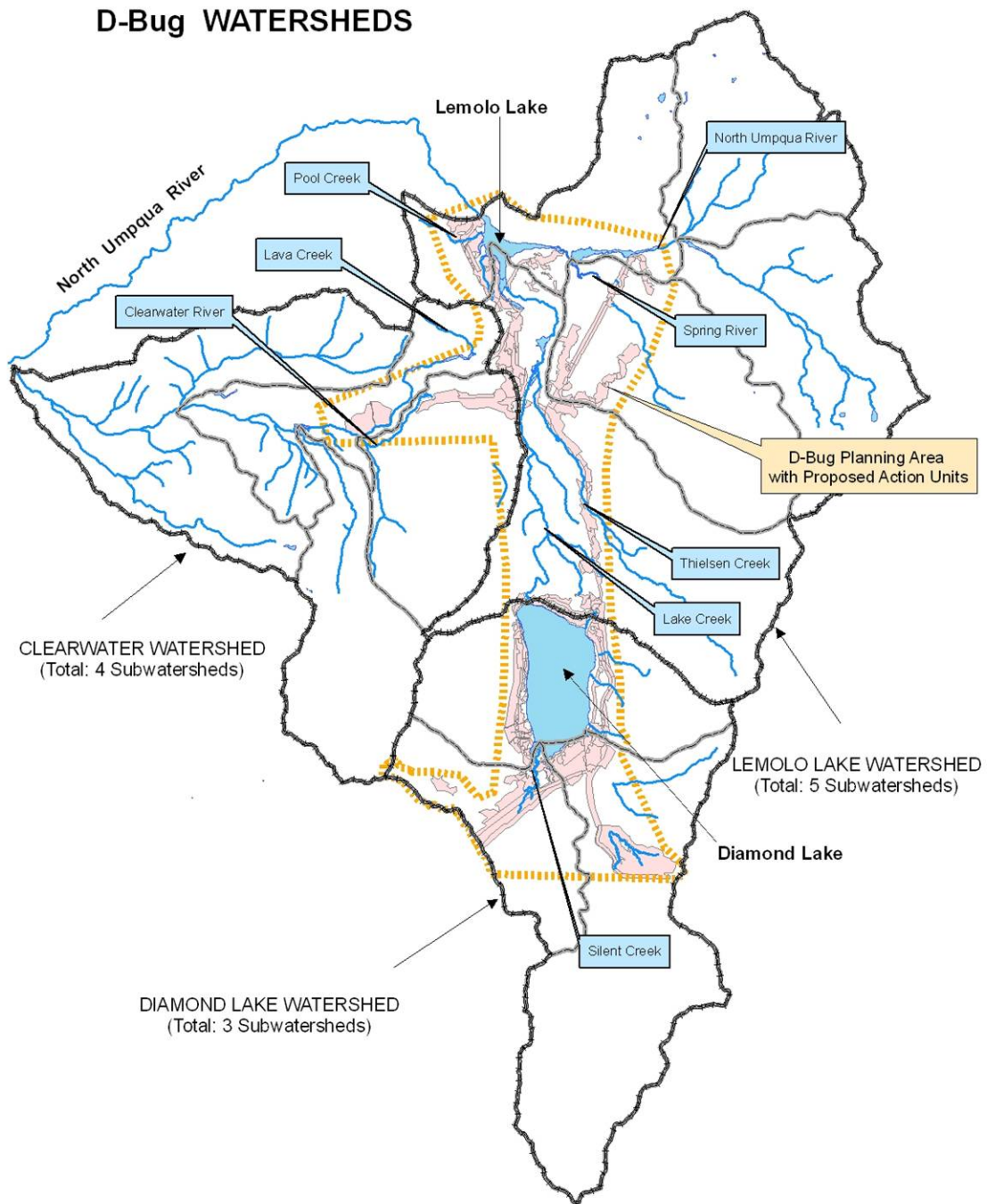


Figure 23. The three watersheds and eight subwatersheds that subdivide the D-Bug Planning Area with the Proposed Action Units.

The D-Bug planning area is located in three watersheds that includes eight subwatersheds, which together encompasses about 114,493 acres. Table 45 displays the total acreages of these watersheds and subwatersheds that include D-Bug activities. The North Umpqua River is the primary stream that drains into and from the planning area.

Table 45. Summary of 5th Level Watersheds and 6th Level Subwatersheds that include the D-Bug Planning Area.

Watershed Name 5th Level	Subwatershed Name 6th Level	Area (acres)	Stream Density (miles/square mile)	Fish Bearing Stream Miles (miles-Class II)
Clearwater		49,680*		
	Clearwater River Headwaters	11,324	0.6	7
	Stump Lake	9,404	1.9	14
Lemolo Lake		76,706*		
	Lake Creek	23,543	1.1	17
	Thirsty Creek	15,320	1.0	0
	Lemolo Reservoir	11,926	1.8	8
Diamond Lake		42,976*		
	Diamond Lake South	21,621	0.7	0
	Silent Creek	7,994	0.5	1
	Diamond Lake	13,361	0.5	0
Subwatershed Totals:		114,493	---	47

* Acreage for total watershed, which includes other subwatersheds not in the D-Bug planning area.

Note: D-Bug planning area is dispersed across the above eight subwatersheds located in Clearwater, Lemolo Lake, and Diamond Lake watersheds.

BENEFICIAL USES OF WATER

To meet the Clean Water Act and standards and guidelines in the Umpqua National Forest Land and Resource Management Plan, the beneficial uses of waters must be identified and management activities planned so they would not interfere with or be injurious to the beneficial uses of adjacent and downstream waters. The relevant beneficial uses of the North Umpqua River and planning area tributaries, including Lemolo and Diamond Lakes as determined by Oregon Department of Environmental Quality are: 1) public and private domestic water supply; 2) industrial water supply; 3) irrigation; 4) livestock watering; 5) resident fish and aquatic life; 6) wildlife and hunting; 7) fishing; 8) water contact recreation; and 9) aesthetic quality (ODEQ, 2003).

Relevant Standards and Guidelines

The relevant standard and guidelines from the Umpqua LRMP related to water quality include:

Water quality/riparian area S&G 1: All effective shading vegetation would be maintained on perennial streams unless a site-specific assessment shows that shade removal will not result in water temperature increase or degrade aquatic habitat.

Water quality/riparian area S&G 5: Streams would be designated for protection on timber sale maps (e.g.; Timber Sale Contract provision B6.5).

Water quality/riparian area S&G 12: The application of best management practices (BMPs) for the protection of water quality and beneficial uses (e.g.; fish habitat or potable water) would be monitored where ground disturbing activities occur.

Watershed cumulative effects and water quality, S&G 1: The beneficial uses of water must be identified and management activities planned so they would not interfere with or be injurious to the beneficial uses of adjacent and downstream waters.

Watershed cumulative effects and water quality S&G 2: Beneficial uses of water and aquatic habitats would not be degraded by turbidity, sediment, or scoured stream channels caused by timber harvest, road construction, and related activities.

Watershed Analysis Recommendations

The 1996 Upper Clearwater River and 1998 Diamond Lake/Lemolo Lake watershed analyses recommendations relevant to the D-Bug planning area include the following:

- Apply silvicultural programs to restore large conifers in Riparian Reserves if the need and treatment are consistent with the Aquatic Conservation Strategy.
- Prescribed fire for ecosystem maintenance and restoration should be allowed to burn within riparian reserves as fire did historically.

WATER QUALITY**Existing Conditions**

The Diamond Lake/Lemolo Lake and Upper Clearwater watershed analyses (USDA, Umpqua National Forest, 1996 and 1998) both characterize the overall perennial stream temperature as cool because of groundwater influence. The exception is Lake Creek. Since Lake Creek originates from the warmer surface water of Diamond Lake, summer stream temperatures are warmer than the typical High Cascade streams that are influenced by groundwater through seeps and springs. Lake Creek maximum summer water temperatures near the Diamond Lake outlet closely parallel summer daytime air temperatures. However, over the length of Lake Creek, from Diamond Lake to Lemolo Reservoir, additions of cool groundwater as well as tributary inflow help to reduce stream temperature. The maximum summer temperature for the mouth of Lake Creek at Lemolo Reservoir is about 10 degrees cooler than at the outlet by Diamond Lake (USDA, 1998). Riparian and topographic shade also contributes to the downstream cooling in Lake Creek.

Vegetation disturbance from timber harvest, road construction, and recreational management activities has been limited along Lake Creek over the past 60 years (USDA, 1998). Because of this atypical stream heating and little disturbance of the stream shade, the current water temperature profile in Lake Creek is likely similar to pre-

management activity. If any change has occurred, temperatures are likely to have improved since the 1940's, when sheep grazing ended.

Water rights for drinking water within the planning area are protected through the federal Safe Drinking Water Act (SDWA). The 1996 Amendments to the federal Safe Drinking Water Act provided new resources for drinking water protection. The lead State agencies implementing SDWA are Oregon's Department of Environmental Quality (DEQ) and Department of Human Services (DHS). As a result, DEQ and DHS have delineated the groundwater and surface water source areas which supply public water systems across Oregon, inventoried each of those areas to determine potential sources of contamination, and determined the most susceptible areas at risk for contamination.

The Diamond Lake Lodge/Resort uses springs for drinking water within the D-Bug planning area. Both the springs and the spring source area or the groundwater recharge zone are located within the planning area. DHS and DEQ completed a source water assessment report for this drinking water use on April 2004 (DHS and DEQ, 2004). The report identified that under a "worst-case" scenario the two potential contaminant sources within the groundwater source area were managed forest lands and Highway 138. To reduce the potential of future drinking water contamination, the report recommended that DHS setback standards be applied. A setback of 100 feet from the spring would be relevant to this site. The report also stated that "environmental contamination is not likely when contaminants are use and managed properly" along with Best Management Practices that are associated with the potential contaminant sources.

Nutrients (phosphorus and nitrogen) in planning area streams and bodies of water are naturally influenced by the High Cascade geology. The volcanic soils and bedrock in the upper North Umpqua sub-basin are relatively high in phosphorus and consequently most streams, bodies of water, and groundwater have high phosphorus concentrations. These nutrients can be utilized by algae, which in turn, can influence the water pH and dissolved oxygen (DO). When this occurs, the pH and dissolved oxygen levels can have extreme daily swings in response to algal metabolic processes.

The water quality history of Diamond Lake has been influence by the introduction of fish. The lake was naturally a fishless lake. In the early 20th century, the Oregon Department of Fish and Game began stocking the lake with trout and managing it as a recreational trout fishery. Tui chub were inadvertently introduced to the lake about mid-1940. The tui chub overpopulated the lake and degraded the fishery and water quality. The Oregon Department of Fish and Game treated the lake with rotenone in 1954 and later restocked with trout. Following the treatment, a thriving fishery was maintained for several decades. However, the tui chub was found again in the lake in the early 1990's. In 2001, the lake experienced large blue-green algae (cyanobacteria) blooms. The chub again overpopulated the lake and dramatically impacted the recreational fishery and water quality, changing the lake's nutrient cycling. The lake was drawn down and treated again in the fall of 2006 with rotenone.

The Oregon Department of Environmental Quality (ODEQ) has identified water quality impaired streams and bodies of water throughout the Sate of Oregon as required by the Clean Water Act, Section 303(d). The water quality listings for the D-Bug planning area are summarized in Table 46.

Lake Creek was first identified as water quality impaired in 1998 for elevated water temperatures. It was later updated to recognize a year around temperature impairment

and elevated pH. Both temperature and pH are influenced by the water quality of the outflow from Diamond Lake.

Diamond Lake was identified as water quality impaired and listed for pH and aquatic weeds/algae in 1998, and dissolved oxygen was added in 2004. For dissolved oxygen, pH, and aquatic weeds, resident fish and aquatic life are the most sensitive beneficial uses that occur in Diamond Lake and downstream in Lake Creek (ODEQ, 2006). Lemolo Reservoir was also listed in 1998 for elevated summer pH.

The water quality modeling for the Diamond Lake Total Maximum Daily Load⁹⁴ (ODEQ, 2006) in 2002 showed that inputs of nitrogen (N) and phosphorus (P) are largely natural. This is in agreement with a previous study of Diamond Lake from 1972-1977 by the US EPA (1978). The TMDL modeling results helped to determine that both nitrogen and phosphorus are however “pollutants” of concern within Diamond Lake. The introduction of tui chub and subsequent population explosion changed the lake biology, which had dramatic consequences on nutrient cycling within the lake, which ultimately led to algae blooms, high pH values, and reduced dissolved oxygen levels (DO). The modeling also indicated that it was necessary to remove the tui chub in order to meet water quality standards. Since the rotenone treatment of 2006, the water quality parameters of pH, dissolved oxygen, and aquatic weeds/algae have improved.

An Umpqua Basin Total Maximum Daily Load was approved in 2007. For stream temperature, no increase was allocated. For nutrients, since the loads from management activities in the watershed do not approach the loads that can be generated from internal lake processes, allocations for nitrogen and phosphorus are focused on internal lake loads in order to limit the blue-green algae production. As such, external watershed inputs from projects such as D-Bug, are allocated to approximate natural background levels (ODEQ, 2006). The pH and dissolved oxygen allocations are also linked to the same internal lake process.

The Lemolo Reservoir was listed for pH in 1998. However, the reservoir was delisted as part of the 2004 303(d) assessment under an exemption from numeric criteria, which is defined in Oregon Administrative Rules. ODEQ evaluated the reservoir pH condition in the 401 water quality certification process⁹⁵ for the North Umpqua Hydroelectric Project and found that the reservoir geometry and the general inherent nature of the impoundment create conditions conducive to increased pH. In summary, ODEQ’s findings state that the reservoir “qualifies for the exemption to the hydrogen ion concentration (pH) water quality standard” with reasonable assurance that the standard will be met through “Protection, Mitigation, and Enhancement measures” in the operation of the reservoir. These measures “include each practicable pH control technique known” at the time of hydropower evaluation (DEQ, 2002). Consequently, thinning projects similar to D-Bug would not influence the physical reservoir condition, which influenced the elevated pH levels, or likely contribute nutrients (see effects discussion).

⁹⁴ A Total Maximum Daily Load (TMDL) is the calculated amount of pollutant a water body can receive and still meet Oregon water quality standards.

⁹⁵ 401 water quality certification is identified in the Federal Clean Water Act and is the mechanism by which the State of Oregon evaluates whether an activity may proceed and meet water quality standards.

Table 46. Water Quality Listings in the D-Bug Planning Area.

Waterbody Name	River Mile	Parameter	Season	List Date	Status
Lake Creek	0 to 11.5	Temperature	Year Around (Non-spawning)	2004-06 (update)	Addressed by Umpqua Basin TMDL
Lake Creek	0 to 11.5	pH	Summer	2004-06 (update)	Addressed by Umpqua Basin TMDL
Diamond Lake	0 to 3.7	Dissolved Oxygen	Summer	2004-06 (update)	Addressed by Umpqua Basin TMDL
Diamond Lake	0 to 3.7	pH	Year Around	2004-06 (update)	Addressed by Umpqua Basin TMDL
Diamond Lake	0 to 3.7	Aquatic Weeds or Algae	Undefined	2004-06 (update)	Addressed by Umpqua Basin TMDL

Direct and Indirect Effects

Direct effects in the context of water quality are those that would occur in planning area streams or bodies of water within a unit. Direct effects are triggered immediately as a result of the D-Bug alternatives. Indirect effects are those that could either occur later in time or downstream of a unit at the drainage or larger scale.

Alternative 1 would result in no direct or indirect effects to water quality, since no riparian trees would be cut along perennial streams that could affect stream shade and influence stream temperature, pH, or dissolved oxygen. No ground disturbing activities would occur that would accelerate sediment delivery and attached nutrients, reduce water clarity, or impact groundwater quality or quantity. However, over the long-term, water quality could potentially decrease as a result of Alternative 1 if the expanding mountain pine beetle infestation area experienced a stand replacement wildfire in large portions of the planning area. In this case, canopy closure would be lost allowing increased solar radiation to affect stream temperatures and large scale release of abnormal levels of nutrients, which could stimulate algae growth, elevate pH, and reduce dissolved oxygen. There is more of a likelihood of such a crown type wildfire moving through the Wildland Urban Interface in the planning area under Alternative 1 than under the action alternatives due to higher fuel levels and limited fuelbreaks compared to the action alternatives (see Fuels Section).

Alternatives 2, 3, and 4 would not have a direct or indirect effect on stream temperature. The action alternatives would thin within riparian reserves, while retaining the effective shade in the primary stream shade zone along perennial streams as described in the “Northwest Forest Plan Temperature TMDL Implementation Strategies” (USDA/USDI, 2005). Best Management Practices including primary shade protection, stream course identification, limited operation near streams, and directional falling where applicable would ensure protection of perennial stream shade. The riparian reserve thinning would improve overall health and vigor of the riparian trees further protecting water quality

consistent with recommendations in Watershed Analysis. Therefore, the action alternatives would meet the water quality/riparian area Standard and Guideline 1. Streams within and adjacent to thinning units would be identified with applicable protection, which meets water quality Standard and Guideline 5.

Studies of potential nutrient release from harvest and fuel treatment have been focused on clear-cut harvest and fuels treatment such as broadcast burning. While clear-cut harvesting can release nitrogen that potentially would leach to adjacent surface waters during runoff periods (Brown, 1972 and 1973; Sollins et al. 1980; Sollins and McCorison, 1981; Harr and Fredriksen, 1988; MacDonald et al. 1991; Beschta et al, 1995), thinning treatments typically do not result in nitrogen delivery to streams. Nitrogen leaching to surface water is directly proportional to harvest extent (clear-cut versus thinning) (Prescott, 2002; Lindo and Visser, 2003). Thinning, compared to the creation of openings, reduces the likelihood of nitrogen losses to the soil and losses to the local streams. The process of organic nitrogen (i.e.; limbs, bark, needles, etc.) converting to available and mobile nitrogen in the soil profile is limited by the cool climate of the D-Bug planning area. The heaviest harvest prescription under the action alternatives (e.g.; Alternative 2- 59 acres and Alternative 4 – 227 acres) would likely elevate mobile nitrogen at the site scale in the surface soil, but would not move off the site or leach into streams. This is because of the limited amount of released nitrogen over time that would be utilized on-site in the soil by microbial activity or taken up and used by the smaller residual trees (MacDonald et al. 1991). The low stream density (Table 45) further reduces the likelihood of mobile nitrogen reaching surface water.

Therefore, nutrient input to the planning area streams, Diamond Lake, Lemolo Reservoir, and further downstream would remain at background levels as before treatment for all the action alternatives resulting in no direct or indirect effects and therefore consistent with the 2007 Umpqua Basin TMDL.

Dissolved oxygen (DO) and pH would not be affected by the action alternatives. According to the Umpqua Basin TMDL (ODEQ, 2006), Diamond Lake's high pH and low DO levels were a result of changes in the internal lake loading of nitrogen and phosphorus, not external nutrient loading from the watershed. The internal lake nutrient output is also the source of the pH problem in Lake Creek. The Diamond Lake water quality recovery that has been observed since 2006 would likely continue and the action alternatives would not hinder the progress. Therefore, the action alternatives would not result in higher nutrient input fluctuations to Diamond Lake, Lemolo Reservoir, or planning area streams that would influence DO or pH.

The small amount of underburning activity fuels within riparian reserves of both streams and lakes would not impact the overall effective shade along perennial streams, but would allow natural ecosystem maintenance and restoration that fire did historically (Watershed Analysis Recommendation 2). The riparian reserve underburn acres under Alternative 2 and 4 would be the same 29 acres while 26 acres would be underburned under Alternative 3. Overall, this is less than 0.5 percent of the total thinned acreage for each alternative. These acres are along intermittent streams or the north side of Diamond Lake where the influence on lake temperature is not a concern.

Although the underburning would potentially release nitrogen to the soil, the mobile nitrogen would remain local in the upper soil layer (Monleon et al, 1997) and would return to unburned levels within one season. Site released nitrogen would be utilized by microbial activity and/or understory vegetation. Since prescribed fire would not consume large amounts of organic matter (carbon), the surface carbon would help to "hold" fire-

released nitrogen at the site (Brady, 1990). Organic matter has been found to regulate nitrogen mobility in the soil by encouraging microorganism uptake of nitrogen (Stark and Hart, 1999; Prescott et al., 2003; Prescott, 2002). Therefore, any release of nitrogen associated with underburning would not be expected to impact water quality at the site or downstream.

Road reconstruction and construction of temporary roads under all action alternatives would address on-going turbidity sources and associated nutrient input at the stream crossings on road 4795-300 and two temporary roads. Alternative 4 would also replace an existing ford on road 4792-456 with a culvert. All of the crossings are on intermittent snowmelt runoff channels and located in gentle landscapes. The reconstruction of the crossings on intermittent channels are the only floodplain 'occupancy' that would occur through the action alternatives. The environmental effects of road reconstruction within a floodplain are consistent with the Standards and Guidelines for the LRMP and have been evaluated and declared in the Final EIS for the LRMP (1990). Since the activities in this project follow those Standards and Guidelines, this activity will not be declared separately for this project.

One temporary crossing would be at an existing ford near the summer homes. This site would deliver concentrated runoff and sediment from the road into Diamond Lake. The second temporary crossing would be over a wider and more incised channel on a temporary road in unit 73. This channel goes subsurface downstream and does not connect to another stream or to Diamond Lake.

The reconstruction of road 4795-300 crossing involves the replacement of a wooden culvert which would not support log haul without reconstruction. Downstream of this crossing, the stream flows into a wetland along Silent Creek. The reconstruction of road 4792-456 crossing replaces an existing ford with a culvert to address potential erosion (under Alternative 4 only).

The use of Best Management Practices and project design features (see Chapter 2) for the reconstruction and later removal of temporary crossings, including timing of in-stream work and erosion control measures, would minimize water quality effects at the immediate work site and downstream through the following winter seasons (water quality/riparian area S&G 12). All the action alternatives would contribute to turbid water with potential sediment bearing nutrient release. However, the predicted sediment delivery is relatively small (Table 48). This water quality impact would occur after the in-stream work because of the dry channel condition at the time of work. The indirect effects (turbid water and nutrient release) in response to snowmelt runoff and rain would be short-term (1 to 3 seasons) during the wet season and difficult to discern from background runoff. These water quality effects would lessen over time as mitigation measures (erosion control) become effective with time (by the second season).

Although Alternative 1 would not have the in-stream work effects, the potential long-term direct and indirect erosion and nutrient release effects at these crossings from chronic road drainage problems would not be corrected. Over the long-term (by the third season), the action alternatives would correct minor chronic road drainage problems providing a small benefiting water quality trend while Alternative 1 would not (Table 48).

All of the action alternative would operate on about 4% of the 979 acre groundwater source area for the Diamond Lake Lodge/Resort. A setback or buffer around the spring area of at least 100 feet would be applied under all action alternatives. Public water system Best Management Practices for the protection from sanitary hazards that are identified in the Oregon Administrative Rules (Chapter 333, Division 061) and relevant to

this setting would also be applied. These Best Management Practices (see Chapter 2) along with compaction BMP's were discussed with DHS (DHS personal communication, 2008) to ensure the protection of this drinking water system. Therefore, no direct or indirect effects to the Diamond Lake Lodge/Resort drinking water are expected from the action alternatives.

Cumulative Effects

Alternative 1 would result in no direct or indirect effects to water temperature, nutrients, pH, DO, or turbidity to incrementally add to possible downstream heating, algae responses, or stream turbidity due to past, present or reasonable foreseeable future disturbance. Therefore, Alternative 1 would not have a cumulative temperature, nutrients, pH, DO, or turbidity effect.

Alternative 1 would not remove the wetland road fill of road 6592-100 so it would maintain the loss of wetland function, which would be incrementally additive to past, present, or reasonably foreseeable loss of wetlands at multiple scales.

Alternatives 2, 3, and 4 would protect the effective shade along perennial streams. No direct or indirect effects to water temperature or groundwater quality and quantity would occur. Beneficial uses of water and aquatic habitats would not be degraded. Therefore, no accumulative stream temperature effect would occur.

The action alternatives would cause short-term indirect turbidity and sediment bearing nutrient release effects from in-stream work (stream crossing repair or temporary replacement). Since the spatial extent of the effect would be for the immediate stream, only similar activities on the same stream would influence a cumulative effect. However, no other activities would incrementally add to past, present, or reasonably foreseeable similar effects in these streams. Beneficial uses of water and aquatic habitats would not be degraded by pH, DO, turbidity, or scoured stream channels caused by timber harvest, road construction or reconstruction, and related activities as identified in the watershed cumulative effects and water quality standard and guideline 2. Therefore, no cumulative nutrients, pH, DO or turbidity effect would result from these action alternatives.

Aquatic Conservation Strategy

As disclosed above in this water quality section, no prolonged or adverse impacts to water quality or the associated beneficial uses of water are expected from any of the proposed activities in any of the action alternatives including those actions occurring in the riparian reserve land allocation. As such, the long-term trend of improving water quality in the watersheds will not be set back; water quality in planning area streams will continue to support healthy riparian, aquatic and wetland ecosystems consistent with ACS objective 4. Since the action alternatives apply all relevant standards and guidelines, and since they were developed to restore riparian ecosystem health at the stream reach and landscape scale, they are also in keeping with the overarching intent of the Aquatic Conservation Strategy (USDA/USDI, 1994).

CHEMICAL CONTAMINATION

All action alternatives present some risk of water contamination due to the use of fuel products and dust abatement chemicals that have the potential to enter streams if spilled or misapplied. The production of biofuels from woody biomass in the planning area also carries some risk of water contamination during the trucking of these products to the marketplace. The most commonly used dust abatement compounds by the Forest

Service are calcium and magnesium chloride and ligninsulfonates. These compounds are typically used on a limited basis and at low application rates, as compared to study areas where the most noticeable effects have been seen.

Dust abatement with calcium chloride, magnesium chloride, or ligninsulfonate would be applied to approximately 4 miles of Windigo Pass Road (road 60) in the Lemolo Lake Watershed (Thirsty Creek Subwatershed) under all the action alternatives. These products would be applied to gravel road surfaces used for log haul at a frequency of 1 treatment for every 1-5 million board feet of timber hauled (depending on site specific road conditions). Excessive rates of application could potentially increase either the surface runoff or the migration of the material through the soil to stream channels. The primary risk of water contamination would occur with a spill near a waterway. Concentrations in excess of 10,000 ppm could be expected if a transport truck spilled into a perennial stream.

Calcium and magnesium chloride are highly soluble and move through the soil with water. Their movement is largely dependent on the rate of application, the rate and frequency of rainfall, the drainage characteristics of the area of application and the chemical and physical nature of the soil. During periods of long duration or high intensity rainfall, in areas of high surface runoff, or in areas of high soil permeability, calcium and magnesium can move considerable distances either as surface runoff or as soil leachate (materials dissolved in water that is within the soil). Surface runoff typically drains into streams, lakes, or ponds whereas leachate feed ground water. Under these conditions it is the constituent ions of calcium, magnesium, and chloride (Ca^{2+} , Mg^{2+} , and Cl^{-}) that migrate through the environment.

Calcium and magnesium ions are readily held by soil particles while chlorides tend to remain in solution and potentially infiltrate ground water or runoff into surface waters. Calcium and magnesium are very common elements in soil and water and because they readily bond with soil particles they typically do not migrate far from their point of application, which is the case of dust abatement chemical application (USDA, 1997). Because chlorides do not bond well with soil particles and tend to migrate, their effects are more widespread. Although chloride is present in all natural waters it usually occurs in concentrations of less than 50 ppm (parts per million). Trout begin to suffer significant effects from chlorides when concentrations reach 400 ppm. Concentrations in excess of 10,000 ppm place all fresh water biota in immediate jeopardy. At typical application rates these concentrations would not be expected to occur (Bolander et al., 1999).

Ligninsulfonate is another type of dust abatement material that may be used with the action alternatives. Ligninsulfonates are the byproduct of pulp and paper mills. Lignin is extracted as a waste product from wood chips with the use of salts and sulfurous acid resulting in ligninsulfonate. Like calcium and magnesium chloride, ligninsulfonate move through the environment with water. With increasing amounts of rainfall ligninsulfonates are easily washed away. Clay soils hold these materials more tightly than other soil particles, but not tightly enough to hold them in the presence of flowing water. Although ligninsulfonates can be washed off the road surface, leaching from stabilized road soils has been found to be minor. Soils best suited for ligninsulfonate treatment are those with 70-100 percent of the particles pass through a 0.75 inch sieve and 20%–50% are silt and clay (Schwendeman 1981). Road 60 in the D-Bug planning area that would receive dust abatement compounds are composed of materials that are conducive to the application and retention of these compounds.

When introduced into a waterway, ligninsulfonate will increase the biological oxygen demand of the water and could impart a slight yellow tint to the water (Schwendeman 1981). Ligninsulfonates have been shown to exhibit direct toxic effects on rainbow trout. The LC50 at 48 hours (concentration of ligninsulfonate which would be lethal to 50% of the test population within 48 hours) was calculated to be 7,500 ppm. Effects on growth have been observed at sub-lethal concentrations as low as 160 ppm because ligninsulfonates seem to impair the activities of several digestive enzymes.

The discoloration of the water column that could occur may result in less light penetrating the water column and potentially affecting plant photosynthesis. The supply of oxygen to the system could be diminished, as ligninsulfonates bond with other materials, settle to the bottom and begin to decay. Concentrations in excess of biotic tolerance levels or concentrations that would be expected to impart color to the water column or increase the biological oxygen demand could be reached by excessive application rates or application during wet weather.

Direct Effects

A dust abatement spill or petroleum spill could potentially result in direct effects to aquatic resources and the beneficial uses of water. The haul routes within the planning area are often narrow where increased truck traffic elevates the potential for an accident. For Alternatives 2 and 4, the treated route would be the Windigo Pass Road (road 60). This road has drainage relief culverts, which disperse water to the immediate environment, and treatment ends before the North Umpqua River crossing, the only active stream. Since the drainage relief culverts do not carry surface water beyond the road prism, any spill near these culverts would not carry beyond the application. If an accident were to occur near a stream during the haul to the application road, fuel or dust abatement chemicals could enter live waterways. This could result in immediate physical harm from a truck entering a waterway, water pollution that could kill or otherwise harm aquatic organisms, and the additional disturbance associated with cleanup. Alternatives 2 and 4 have equal risk of water contamination from vehicle accident spill and Alternative 3 would have no risk since dust abatement would not be applied.

The risk of water contamination due to the application of dust abatement is minimized under all action alternatives with the absence of active stream channels within the treated road segment. Moreover, the application of dust abatement materials would occur in a window of time when no rain is forecast for at least three days. The buffering of applications away from perennial stream crossings, such as the North Umpqua River crossing, has been found to effectively mitigate pollution of adjacent waters (USDA 1999). The rate of application of dust abatement compounds in the D-Bug planning area would be limited to road 60 and therefore is not expected to contribute to adverse riparian or aquatic effects.

Based on the literature review and typical application rates for dust abatement purposes that would be used in the D-Bug planning area, effects from these compounds to plants and animals in the riparian and aquatic environments would be negligible.

Under all action alternatives, timber sale purchasers would be required to have spill prevention and recovery equipment on site, they would be required to develop spill prevention plans if substantial amounts of fuel, biofuel or other pollutants are stored in sale areas would be required in the timber sale contract. These requirements, detailed in Chapter 2 and in the Best Management Checklist (Analysis File) function to diminish

the chances of any direct effects to aquatic resources and the beneficial uses of water from project-related pollutants.

Indirect Effects

Pollution of off-site or downstream waters is possible if trucks transporting fuel, biofuel, or dust abatement compounds were to spill into the North Umpqua River or tributary stream enroute to or away from the project area. The likelihood of an accidental spill is believed to be low; however no mitigation measures would be applied to the transport of potential pollutants outside the timber sale areas.

Cumulative Effects

Most past and on-going land management operations throughout the Umpqua River basin such as silvicultural activities, timber sales, and all forms of road work use a variety of potentially polluting products (such as petroleum, concrete, adhesives, cleansers, herbicides, etc) that pose a risk of entering waterways if spilled or mishandled. The level of timber harvest and associated road work on Federal land located in the Diamond and Lemolo Lake Watersheds has diminished over the last two decades relative to the previous three decades. Therefore, the level of additive effects that can contaminate water from such actions has also diminished.

Potential contamination of waters within the North Umpqua River Sub-basin associated with private industrial forestry operations, intensive agricultural operations (using pesticides, fertilizers, other petroleum products, and herbicides), and city and town development and use by people (sewage, plus all the above mentioned potential pollutants and others not mentioned) has not diminished. Water contaminations from these sources can be expected to increase as demand for food and natural resources increases with the human populations. Therefore, the lower areas of the Umpqua River Basin are where the cumulative effects of all the additive forms and sources of water contamination would be most likely realized.

The chances of any of the D-Bug action alternatives resulting in any cumulative effects to water contamination hinges on whether a substantial spill of petroleum, biofuel, or dust abatement products occurs. Should a spill occur and clean-up measures fail, a cumulative effect could be realized. This is particularly true the further downstream an accidental spill occurs.

Aquatic Conservation Strategy

No impacts to water quality or the associated beneficial uses of water are expected from any of the proposed activities in any of the action alternatives including those actions occurring in the riparian reserve land allocations. Objective 4 of the Aquatic Conservation Strategy requires that water quality remain within the range that maintains the biological, physical, and chemical integrity of the aquatic and riparian communities. The action alternatives were designed to reduce the chances of uncharacteristic wildfire effects due to a lack of natural fire in both riparian and upland communities. The action alternatives pro-actively accomplish this in keeping with the broad landscape intent of the ACS while also meeting the specific requirements of ACS objective 4. Alternative 1 would not pro-actively implement this conservation strategy.

STREAM FLOWS

The streamflow regime for the area is uniquely influenced by High Cascade geology and spring snowmelt (USDA, Umpqua National Forest, 1998). The underlying geology is the controlling factor in the development of the High Cascade aquifer (USDA, Umpqua

National Forest, 1996; USDA, Umpqua National Forest, 1998; Ingebritsen, 1994). Streamflow is dominated by groundwater. The geologic characteristics influence a high volume and high storage capacity of groundwater that slowly releases to channels. The pumice soil of the area allows rapid water infiltration. The common occurrence of joints and fracture patterns in the bedrock provides the opportunity for rapid infiltration and migration of water vertically as well as horizontally over a wide area. Low stream density is common in this geology with the higher infiltration rates and less tendency for surface water to concentrate.

The 1990 Umpqua Land Resource Management Plan (LRMP) addressed the concept of the North Umpqua River aquifer and its importance for high quality and quantity of water. The LRMP identified the High Cascade aquifer in the context of surficial pumice deposits. However, after further evaluation that was disclosed in the Diamond Lake/Lemolo Lake and Upper Clearwater watershed analyses, the role of the surficial pumice soil is less certain. The research suggests that the underlying volcanic rocks are the controlling factor in the characteristics of the aquifer (Sherrod 1991). Since the aquifer is largely a function of the underground bedrock, the role of the surface soil in the overall function of the aquifer is minor.

The resulting streamflow regime is not only slow responding, but also persistent with small annual flow fluctuations between summer to winter flow. This flow condition provides cool and consistent summer flow while producing less winter responsive runoff. Annual river flow in the North Umpqua River below the Lemolo Reservoir, which includes the D-Bug planning area is approximately half of the annual precipitation for the watershed, which is typical of High Cascade streams. In contrast, streams in the Western Cascade sub-province, which do not exhibit the bedrock aquifer characteristics, tend to runoff over 70% of the precipitation because of much less storage ability in the older bedrock geology.

Relevant Standards and Guidelines

The relevant standard and guidelines from the Umpqua LRMP related to streamflow include:

Watershed cumulative effects and water quality, S&G 2: Beneficial uses of water and aquatic habitats would not be degraded by turbidity, sediment, or scoured stream channels caused by timber harvest, road construction, and related activities.

Watershed cumulative effects and water quality, S&G 4: Beneficial uses of water and aquatic habitat (water quality) would not be degraded by increased peak flows caused by canopy removal from timber harvest, road construction, and related activities.

Watershed Analysis Recommendations

The 1996 Upper Clearwater River and 1998 Diamond Lake/Lemolo Lake watershed analyses recommendations relevant to the D-Bug planning area include the following:

- Obliterate roads in Riparian Reserves where appropriate, considering short and long term transportation needs.
- Minimize disruptions of hydrologic flow paths.

Existing Conditions

The planning area is both within and above the transient snow zone (between 2,000 to 5,000 feet in elevation). The transient snow zone is the elevation zone where winter snow frequently occurs, but also melts a few days or weeks later. In this elevation zone, warm rain and possible wind can follow a snow storm causing rapid snowmelt during rain-on-snow. The resulting winter peak flows are an important fluvial process in the transient snow zone. In the Upper Willamette sub-basin, 88% of floods with a return period of greater than 6 years were associated with rain-on-snow events (Harr 1979, Christner 1981). Sizeable canopy openings can result in greater snow accumulation and more rapid snowmelt in the transient snow zone compared to locations lacking large canopy openings.

The forest canopy has a major influence on snow accumulation, distribution, and melting rates. Standard and guideline 4 requires an analysis of forest canopy conditions. This hydrologic recovery procedure (HRP) was used to estimate the hydrologic recovery of the forest canopy at the subwatershed, and watershed scales. An area is considered fully recovered when the canopy closure is 70% and the average tree diameter is eight inches (USDA, Forest Service, 1990). The hydrologic recovery level represents an area compilation of forest canopy re-development following disturbance. It also represents the potential influence on the streamflow and stream channel effects from floods. A hydrologic recovery of 75% or greater would maintain current peak flows and avoid adverse change to physical channel condition and associated factors such as water quality and fish habitat. Statistically discernible increases in peak flows have occurred when greater than 25% of smaller drainages have been clear-cut harvested and included roads; that is, the hydrologic recovery was less than 75% (Jones and Grant, 1996; Thomas and Megahan, 1998). Conditions below the 75% hydrologic recovery (i.e.; lower levels of hydrologic recovery) need further evaluation for potential peak flow cumulative effects from rapid snowmelt during rain-on-snow storms (following S&G 4).

The hydrologic recovery levels for the D-Bug planning area include two of the three watersheds and five of the eight subwatersheds. The Diamond Lake Watershed and the three subwatersheds that subdivide it are completely above the transient snow zone, which is outside of the analysis criteria and not included. The other five subwatersheds in the Lemolo Lake and Clearwater watersheds include portions in the transient snow zone.

The hydrologic recovery levels for all the transient snow zone subwatersheds are currently greater than the 75% level of concern. Stump Lake subwatershed has the lowest level at 87% while the remaining subwatersheds and the watershed scale are greater than 90% (Table 47).

Table 47. Current Hydrologic Recovery for the Five Subwatersheds.

Watershed	Subwatershed	Area (acres)	Hydrologic Recovery
Clearwater	Clearwater Headwaters	11,324	90%
	Stump Lake	9,404	87%
Lemolo Lake	Lake Creek	23,543	98%
	Lemolo Reservoir	11,926	92%
	Thirsty Creek	15,320	99%

The desired condition is the protection of flow regimes in keeping with ACS objective 6, while addressing the growing fuel load associated with the beetle infestation and moving these forest stands toward the desired range of natural variability.

Indirect Effects and Cumulative Effects

Peak flows represent an indirect effect rather than a direct small-scale effect. The Forest Plan (USDA, Forest Service, 1990) identified an analysis area of at least 1,000 acres to evaluate potential peak flow response. As such, only downstream indirect effects and cumulative effects are discussed for the peak flow analysis.

The overall hydrologic recovery analysis of snow accumulation and melt utilized research that was done on the Umpqua and Gifford Pinchot National Forests. This research indicated that a shelterwood canopy can allow about 60% greater snowpack runoff than mature forest (Storck et al. 1999) at the site scale. Therefore, the analysis for the action alternatives assumed at least a combined 40% canopy recovery condition for proposed thinning units and no recovery for heavier thinning (less than or equal to 20 TPA). These conservative assumptions allowed for a margin of safety in the analysis to address scale difference from the original study (site response versus larger area) and treatment difference (shelterwood versus thinning). In addition, the slow responding streamflow regime of the High Cascade streams also lessens the peak flow response.

Under Alternatives 2, 3 and 4, the proposed silvicultural treatments would increase the potential for snow accumulation in the thinned areas where overall canopy closure from 40-70 trees per acre would be less than 70%. However, the remaining leave trees in the thinned areas would buffer any snowpack from rapid snowmelt during rain-on-snow events. The leave trees would break up the flow of warm wind across the snow pack and substantially mitigate the rapid melt process. Because of the thinning treatment and the recovery of past harvesting, the resulting reduced hydrologic recovery level in the planning area would remain above the level of concern at the subwatershed and watershed scales.

The combined loss of canopy from the D-Bug thinning, recent harvest activity under the Lemolo Watershed Project Environmental Impact Statement, and the current recovery of past harvesting (Table 12) would slightly reduce the hydrologic condition about 1-2% at the watershed and subwatershed scales. However, the hydrologic recovery would not drop below 75% at any of these scales.

Therefore, the hydrologic recovery would maintain current peak flows and avoid adverse change to physical channel conditions and associated factors such as water quality and fish habitat (consistent with S&Gs 2 and 4, listed above). No cumulative peak flow effect is expected under the action alternatives when considering past, present, or reasonably foreseeable future activities.

The action alternatives would result in less predicted stand replacement fire, which is a long-term beneficial effect. Under the action alternatives, if a wildfire occurred in the planning area, the thinning, fuel treatments, and fire breaks would modify dense stand conditions that could cause a surface fire to torch into the crowns and carry across many acres. As such, a future wildfire under the action alternatives is more likely to create smaller pockets of stand replacement fire compared to Alternative 1. Thus, the action alternatives exert less chance of future peak flow increases and the potential impacts to the beneficial uses of water compared to Alternative 1.

Annual water yield increase studies in Western Oregon have usually evaluated clear-cut harvesting. These studies showed considerable annual water yield increases following harvest (Beschta et al., 1995) because of reduced evapotranspiration⁹⁶ with the loss of trees. Beschta et al. (1995) cited a review of over 90 watershed studies by Bosch and Hewlett (1982), which concluded that water yield increases are only detectable when at least 20-30 percent of a watershed has been harvested. However, Beschta et al (1995) also concluded that increased soil moisture from thinning or small group harvest would likely be utilized by the remaining trees and vegetation and have little effect on the annual water yield. Under similar soil and bedrock characteristics as the planning area, Fowler et al. (1987) found, when 22-50 percent of an area was harvested, no measurable water yield response occurred. It was felt that the local geology, which consisted of fractured bedrock with deep water movement as in the D-Bug planning area, contributed to the lack of water yield response. However, local soil moisture did seasonally increase.

Alternative 1 would not affect annual water yield since evapotranspiration would not be reduced. However, if wildfire occurred, Alternative 1 would likely bring to bear more chance of annual water yield increase than the action alternatives with reduced evapotranspiration from loss of continuous areas of trees.

Under Alternatives 2, 3 and 4, the increased snow accumulation and reduced interception of precipitation in the thinned areas (previously discussed under the peak flow) would likely extend the time of soil moisture at the site scale but not increase the amount of annual water yield from the overall harvest areas at larger scales. The amount of thinning in the three watersheds would be about 2-5 percent of the area. Therefore, no annual water yield increase, which could seasonally influence local stream, water-body, or wetland volumes, would be expected from the action alternatives.

The similar action common to all action alternatives is the decommissioning of 0.8 miles of road 6592-100, which is an abandoned segment of old Highway 230. This road segment was built through a wetland. The original construction placed fill in the wetland that interrupted surface and subsurface flow paths, which dried part of the wetland. The decommissioning would remove the road fill and reconnect these flow paths to restore wetland function consistent with ACS objective 7 which calls for the restoration of water table elevation in meadows and wetlands.

Under Alternative 1, the loss of wetland function because of road 6592-100 fill would not be corrected. The direct and indirect effects are the existing loss of wetland function over time. The cumulative effect is the potential additive loss of wetland acres at the subwatershed and watershed scales.

For all action alternatives, the fill removal would remove existing non-wetland vegetation, which is rooted in the dry fill, and potentially disturb the immediate wetland vegetation and soils adjacent to the road fill. A limited amount of fill soil and rock would likely remain in the wetland after fill removal. However, water would move more freely allowing wetland plants to reestablish. The positive indirect effects would be the future wetland function and wetland plant establishment.

Therefore, the decommissioning of road 6592-100 would likely have a small short-term direct effect on the existing wetland vegetation during the fill removal period. After fill

⁹⁶ Evapotranspiration is the removal of water from the soil by plant roots and the use of that water in the growth process (transpiration) plus the evaporation of any excess water from the surface of leaves. When trees are harvested in a clearcut, little to no evapotranspiration takes place until the regenerating stand of trees and shrubs reestablishes.

removal, the indirect response of reconnecting the wetland flow paths and establishing wetland vegetation would be a long-term benefit.

The cumulative response would be the gain of wetland acres at the subwatershed and watershed scales. The decommissioning and reconnected flow paths are consistent with Watershed Analysis recommendation listed above.

Aquatic Conservation Strategy

As disclosed above in this stream flow section, no impacts to flow regimes or the associated beneficial uses of water are expected from any of the proposed activities in any of the action alternatives including those actions occurring in riparian reserves such as density management, underburning, and other fuel reduction activities such as hand piling/burning, chipping and mastication. As such, the timing, magnitude, and duration of peak, high, and low flows are protected under all action alternatives, consistent with ACS objective 6. Moreover, the road decommission in a wetland would restore the presently impacted water table of that area, proactively addressing the requirements of ACS objective 7. Alternative 1 would not address this conservation strategy.

EROSION AND SEDIMENTATION

Sedimentation is the delivery of upslope materials into the aquatic environment. The sediment in streams originates from mass wasting (landslides), fluvial erosion (scoured stream channels), and surface erosion; all natural processes that can increase with management activities. Mass movement hazard throughout the planning area is low, and not considered to be a factor potentially affected by any of the alternatives. Both fluvial and surface erosion can occur, so they are addressed in this section. Road-related sedimentation from the existing road network, new temporary roads, and the reconstruction and maintenance of the log haul roads can contribute to the overall sediment regime in the planning area.

Surface Erosion

Surface erosion occurs when mineral soil is exposed to the erosive forces of water, wind and gravity. Surface erosion can result from logging and fuel treatments when the protective surface layer of duff and other materials such as wood and rock is removed or displaced exposing mineral soil to erosive forces. Activities such as dragging trees across the ground during yarding, burning activity-created fuels, road building, reconstruction, or decommissioning, and timber haul on existing dirt or gravel roads all can result in sedimentation of the aquatic environment where surface erosion is a concern. Wildfires can also result in surface erosion (Tables 39 and 40).

Relevant Standards and Guidelines

The relevant standards and guidelines related to surface erosion are found in the 1990 Umpqua NF Land and Resource Management Plan.

Soil standard and guideline 2 requires the establishment of a minimum amount of effective ground cover in order to meet acceptable levels of surface soil loss resulting from gravity, water, or wind action. The ground cover must exist within the first year following the end of a ground disturbing activity. Based on the low level of erosion risk in proposed units, effective ground cover (EGC) levels would be 25% in all gentle to moderately steep side slopes. However, 65% has been prescribed as a site productivity standard in the harsh site conditions on the flats due to frost cold pockets in the lodge pole and mountain hemlock sites. Prescribed under burning would be expected to

maintain an average effective ground cover of 70% while other prescriptions are expected to increase the ground cover from logging slash and mastication.

Soil standard and guideline 11 requires monitoring during and immediately following the implementation of individual unit burning to assess the adequacy of EGC during under burning with adjustments, as needed, in order to meet the requirements.

Soil standard and guideline 13 requires the use of erosion control measures such as seeding with native plants, weed-free straw, or other form of mulch, where existing ground cover is lost in area in excess of 0.5 acres.

Soils standard and guideline 16 requires the identification of erosion control in existing developed areas where pre-existing surface erosion is on-going.

Existing Conditions

Soils in the D-Bug planning area formed from Mount Mazama pumice and ash deposits that overlay substrata material which vary by landform position. This substratum range from bedrock, old buried soils, to glacial deposits. Water infiltration and soil drainage is usually excessive. Water from precipitation and snow melt is quickly absorbed by the soil with little if any concentrated surface water flow potential unless the soil is left in a compacted condition.

Surface water erosion and the potential for sediment delivery to streams are low. Based on field review of these existing disturbances sediment delivery to streams was determined to be a low risk throughout the planning area. Surface erosion that would occur on skid trails, landings, and roads where the soil is compacted would quickly be absorbed once it flowed onto more porous soil, with little risk of sediment delivery to streams. Concentrated areas of compaction were found to persist in units that were originally tractor harvested, on snow mobile trails, and in unclassified roads around the lake and around resort facilities, summer homes, and campgrounds.

Direct and Indirect Effects

Direct effects are defined as the short-term effects of sedimentation that might occur within planning area streams as an immediate result of the proposed road work, timber haul, logging and treatment of activity fuels with fire. Indirect effects would occur over longer periods. Surface erosion associated with roads can last much longer since revegetation is typically limited. Indirect effects are also those that may be expressed downstream of the management activity.

All alternatives, including no action, are considered to have a low risk of generating or delivering sediment to streams. All action alternatives are expected to exceed the soil erosion prescription for effective ground cover (see soil/site productivity section in this Chapter).

An analysis of soil erosion potential considers soil texture, slope steepness, changes in topography, precipitation and runoff potentials, vegetation cover, and incorporates disturbances previously discussed such as exposed, compacted, and severely burned soil. The risk of fire effects to the soil environment was evaluated for each alternative using FOFEM (Keane et al 1997). FOFEM modeling provides an average risk summary of the potential for direct effects as a result of wildfire and prescribed burning. The analysis showed that though bare ground would be created by wildfire under Alternative 1 as well as all three action alternatives, the potential for sediment delivery to streams is extremely low. This is because of the gentle and flat topography, the high water infiltration capacity of planning area soils, and the lack of overland flow of water to carry

soil into streams. As such there is generally no mechanism for the surface erosion associated with a fire to deliver sediment to planning area streams.

The primary source of stream sedimentation would come from roads. The potential for hill slope erosion and runoff from roads to deliver sediment to streams was evaluated using WEPP models (Eliot 2005). Temporary roads would be mostly located away from streams. However, there are two new temporary stream crossings that would be constructed across intermittent channels under all action alternatives. Mitigation measures require that temporary roads and landings be subsoiled to a minimum depth of 20 inches and planted to restore water infiltration and prevent surface water runoff. Also, mitigation measures call for minimizing landings and skid trail locations near streams, and establishing native vegetation and/or other forms of ground cover following treatments to breakup soil compaction. These mitigation measure, incorporated into all action alternatives, would lessen the length of time sediment would be delivered to these two intermittent streams.

Existing roads are another source of surface erosion that can lead to sedimentation of streams. Grading roads surfaces under the action alternatives to reduce wheel rutting would help decrease on-going erosion by more effectively dispersing surface water before it becomes concentrated runoff that can carry sediment to streams. The potential benefit from increased road maintenance in the planning area would be similar among the action alternatives. Under Alternatives 2 and 3 most of the haul roads used to access landings (60% to 70%) would use existing roads while under Alternative 4, 50% of the roads used would be new temporary roads (Table 48).

Increased logging traffic on roads located near streams, where surface water runoff could reach the stream, was modeled as a worst case scenario. The haul near streams could increase sediment delivery potential from 0.004 to 0.007 cubic yards at temporary stream crossings and from 0.06 to 0.10 cubic yards at permanent stream crossings located on system roads during the time of harvest and haul (Table 48). It is expected to subside the following year and continue to improve as riparian vegetation and soil rooting reestablishes. At existing stream crossings such as snow trails and other native surface roads, the sediment delivery potential would be expected to reduce from 0.1 to 0.006 cubic yards with the decreasing truck traffic and improvements in road drainage from surface grading.

Stream crossing improvements on existing system roads (Table 48) would have a net benefit of reducing the potential sediment delivery over the long term (5 years) once the soil disturbance associated with the reconstruction has revegetated. In the short term, the reconstruction of 1 existing crossing (under Alternatives 2 and 3, plus an additional crossing under Alternative 4), located in intermittent channels, would result in the production of sediment equal to about 2.5 cubic yards (equal to 2 ½ pickup loads per site). This amount of sediment could potentially be delivered during spring snow melt to downstream perennial channels in the Silent Creek and Lake Creek drainages. Culvert replacement may be the largest individual source of sediment delivery, but it equates to only 0.6 cubic yard (1/2 pickup load) more for Alternative 4 than Alternatives 2 and 3 because Alternative 4 would implement one more permanent crossing reconstruction.

Road maintenance and the above described reconstruction would result in beneficial effects for the action alternatives, because there would be less long-term road-related sediment. This is because the road maintenance activities associated with the action alternatives actually lessen long-term levels of surface erosion (Table 48). Overall the total 5-year sediment delivery prediction is expected to decrease by 0.06 cubic yards

with Alternative 4 and by 0.32 cubic yards with Alternatives 2 and 3 when compared with Alternative 1 due to the road maintenance associated with the action alternatives.

Table 48: Predicted cubic yards of road-related sediment delivery.

Roads	Alt 1	Alt 2	Alt 3	Alt 4
Undisturbed sediment balance, yd ³	0.08	0.00	0.03	0.03
Existing unused roads, yd ³	4.07	0.34	0.34	0.00
New temporary road construction/obliteration*, yd ³	0.00	0.10	0.07	0.07
Reuse existing roads/snowtrails, keep for future use, yd ³	0.00	2.18	2.18	2.18
Reuse existing road, obliterate after use	0.00	0.62	0.62	0.62
Net decrease in existing roads, miles	(0)	(11.8)	(11.3)	(11.9)
Reconstruct existing system road, yd ³ (number of stream crossing replacements--intermittent streams)	0.00 (0)	0.60 (1)	0.60 (1)	1.20 (2)
Road Maintenance before and after sale activities, yd ³	0.2	0.2	0.1	0.1
Net 5-year sediment total from roads, yd ³	4.39*	4.01	3.97	4.21
Net decrease in road sediment, yd ^{3***}	(0)	(-0.38)	(-0.42)	(-0.18)

*The term obliteration is used to describe the activities involved in restoring a road that is not part of the recognized transportation system such as an abandoned, unclassified road, or a temporary road.

**The term decommission is used to describe the activities involved in restoring the soil, water routing, and potential vegetation of a recognized system road.

*** One cubic yard (yd³) of sediment is approximately equivalent to a large pickup load.

Cumulative Effects

The potential of the D-Bug alternatives to result in cumulative effects in terms of the surface erosion process is addressed at the scale of the planning area over 5 years. This is the primary time scale that the D-Bug alternatives could influence surface erosion processes.

Considering the sum of the various mechanisms of surface erosion and associated sediment delivery, the action alternatives would all potentially deliver extremely low amount of surface erosion. The sediment sources associated with the action alternatives (the use of roads near stream and that cross streams and road-work at stream crossings) would only last for 1-2 years following implementation, and best management practices (Chapter 2) would help mitigate this to the extent practical. Given the very limited or benign effects of the action alternatives associated with surface erosion and the lack of past and future actions in the area, it is unlikely that any of the D-Bug alternatives would result in an incremental additive impact to the aquatic environment in terms of surface erosion.

Aquatic Conservation Strategy

At the scale of the 5th level watersheds, fire was the primary mechanism that triggered surface erosion during historic reference conditions. The historic sediment regime was one of occasional, but episodic sediment delivery following large scale fires in conjunction with spring snow melt that delivered the surface erosion to streams. Most of the sediment delivery probably came from fluvial erosion (triggered by large post-fire spring runoff), rather than from surface erosion. Such episodic sedimentation occurred in particular drainages, followed by years of little to no disturbance in nearby recovering areas (Reeves et al, 1995). The episodic pulses of sediment have been curtailed due to fire exclusion and replaced with sedimentation mostly from roads.

The action alternatives have an extremely low potential to deliver short-term increase in sedimentation due to road activities with essentially no impact to aquatic environments. Over the long-term, the action alternatives help to lessen chronic sediment delivery from surface erosion associated with roads through road maintenance and road reconstruction. These actions are responsive to road-related Watershed Analysis recommendations in terms managing fuel accumulations. The road work that would be done within riparian reserves is in full compliance with Northwest Forest Plan riparian reserve standards and guidelines. Moreover, the action alternatives respond to Aquatic Conservation Strategy objective 5 by accomplishing work on system roads that would incrementally affect the sediment regime in small localized areas.

Fluvial Erosion

Fluvial erosion is the erosion of stream banks and beds from the forces of water. Stream channels change both spatially and temporally under the fundamental influences of climate, geology, and topography. These factors help determine the streamflow and sediment regimes, as well as riparian vegetation which provides in-stream wood. Disturbances can affect stream channel form and the equilibrium between sediment input and output.

Relevant Standards and Guidelines

The relevant standard and guidelines from the LRMP related to fluvial erosion is watershed cumulative effects and water quality S&G 2: Beneficial uses of water and aquatic habitats would not be degraded by scoured stream channels caused by timber harvest, road construction, and related activities.

Existing Conditions

The proposed thinning units in the D-Bug planning area are generally located on a gentle landscape with surficial deposits that cover the young bedrock at varying thicknesses. The surficial deposits include variably compacted glacial deposits, weakly consolidated ash-flow, and well stratified lake deposits.

The more sensitive channels are associated with volcanic ash deposits, which tend to lack various sized substrates (cobbles and small to large boulders). These channels include perennial, intermittent, and interrupted streams. The interrupted channels are not connected downstream by surface flow. The interrupted channels are typically small and flow during the snowmelt season, which is similar to the intermittent channels. The flow in the interrupted channels eventually drains back into the soil and becomes subsurface water. The beneficial use of these interrupted channels is locally focused on wildlife and not downstream delivery to larger bodies of water.

Channel stability and fish habitat inventories have given insight into the erosional and channel morphological processes within headwater streams in these watersheds (USDA, Umpqua National Forest, 1998). The inventories have shown that stream channel stability is moderate to high for all types of geologic settings surveyed with little evidence of significant slope failure or mass wasting.

Channel adjustment from former heavy grazing by sheep in the watershed during the late 1800's and early 1900's may still be occurring to riparian areas (soil compaction) and stream channel (width/depth ratio). Significant adjustment in channel morphology following elimination of grazing disturbance has occurred on a decadal time scale.

The pool/riffle ratio appears low for the stream types in these watersheds when compared to other streams in different watersheds. The low representation of pools is not likely a result of a deficit in large woody material. Large woody material across these watersheds is moderately present. However, the inherent nature of the geology, with slow responding runoff events, does not often have sufficient stream energy to scour pools and maintain existing pools. Therefore, pools do not tend to dominate the channels.

Overall, channel stability within the managed watershed areas does not significantly differ from those in unmanaged and are relatively stable with properly functioning systems, which efficiently process both flow and sediment under the current condition (USDA, Umpqua National Forest, 1998). These channels appear to be inherently stable due to the nature of the streamflow regime, which is characterized by peak flows that generally are not high energy but rise and fall gradually in response to both snowmelt and rainfall events.

Direct and Indirect Effects

Direct effects from fluvial erosion are described at the scale of stream segments within or adjacent to harvest units and during the activity. Indirect effects are downstream of the unit at the subwatershed scale and greater, and after the activity over 2-3 decades.

Alternative 1 would not change existing fluvial erosion processes that are currently occurring. Future recruitment of large channel wood that would stabilize and provide storage of channel sediment would be delayed where the riparian is densely stocked. However, over the long-term, fluvial erosion could potentially increase as a result of Alternative 1 if the expanding mountain pine beetle infestation area experienced a stand replacing wildfire in large portions of the planning area. In this case, a loss of riparian root strength and potential increase in peak flow would risk changing the fluvial erosional balance that exists.

Alternatives 2, 3, and 4 would thin riparian reserves (see Riparian Forest Conditions in this Chapter). The riparian reserve thinning would retain no-harvest buffers along all perennial streams and some of the intermittent stream channels with steep and/or potentially unstable banks. The no-thin stream buffers ensure that harvest activity would not disturb stream banks or beds and the streamflow/sediment balance. The exception is where intermittent channels are gentle and bank and bed erosion has been determined to not be a risk. Thinning would occur along these channels with no buffers, but these streams would be identified for operation protection, which includes stream course identification, limited operations near streams, yarding away from channels, and directional falling where applicable.

None of the action alternatives would increase peak flows or accelerate sedimentation that would affect fluvial erosion (water quality S&G 2). The riparian reserve thinning

would improve overall health and vigor of the riparian leave trees and the potential future channel recruitment of large wood, while reducing the long-term risk of wildfire impacts on the riparian reserves. Therefore, no direct or indirect effects associated with fluvial erosion in the planning area streams would occur.

Cumulative Effects

Alternative 1 would not incrementally add to past, present, or reasonably foreseeable future activities to cause a cumulative fluvial erosion effect since no action would occur.

Since Alternatives 2, 3, and 4 would not cause any indirect fluvial erosion (as described above) that would incrementally add to past, present, or reasonably foreseeable future activities, no a cumulative fluvial erosion effect at any of the analysis scales would occur.

Aquatic Conservation Strategy

The historic sediment regime was one of occasional, but episodic sediment delivery following large scale fires. Wildfire occurred in particular drainages, followed by years of recovery with little to no disturbance (Reeves et al, 1995). Fire exclusion has temporarily curtailed the pre-management sediment regime of occasional, episodic sedimentation. Yet, as fire hazard builds due to the lack of natural fire in combination with the pine beetle outbreak, more extreme sediment pulses may be possible once wildfire escapes control efforts.

As discussed in the Forest Vegetation, Fuels, Riparian Reserve, and Erosion and Sedimentation sections on this Chapter, the D-Bug alternatives were purposefully designed to lower hazardous conditions and reduce the chances of uncharacteristic fire effects, which in turn, is expected to help maintain or restore the sediment regime. Moreover, the long-term benefits of the road maintenance and reconstruction activities under the action alternatives outweigh the small short-term impacts of road work to be implemented. As such, the action alternatives are consistent with ACS objective 5 which calls for the restoration of sediment regimes. Alternative 1 would not proactively address the Aquatic Conservation Strategy.

RIPARIAN RESERVES

During scoping, concerns were raised that thinning operations and associated slash burning and road building could impact riparian areas and other aspects of the aquatic environment. This issue was addressed by the application of best management practices, mitigation measures, and project design features that lessen impacts from logging, fuel treatments, and temporary road building. The effects related to riparian areas are disclosed in this section.

The riparian reserve land allocation was established in the Northwest Forest Plan as part of the Aquatic Conservation Strategy (USDA/USDI, 1994). This riparian reserve analysis is based on the guidance in the Northwest Forest Plan which, in general, is defined as one site potential tree height on non-fish bearing streams (either perennial or intermittent) and two site potential tree heights on fish bearing streams. No changes to these guidelines were made with either the 1998 Diamond/Lemolo Watershed Analysis or its 2008 iteration. A site potential tree height is the average maximum height of the tallest dominant tree at 200 years or older for a given area. The height of site potential trees used for analysis purposes was averaged at 180 feet. Site potential trees in the planning area actually vary in height from the shorter lodgepole pine forest type to the more productive white fir plant series.

The Aquatic Conservation Strategy was developed to restore and maintain the ecological health of watersheds and aquatic ecosystems. This strategy is based, in part, on natural disturbance processes. Proposed riparian actions are assessed in relation to the watershed's existing condition and any short or long-term effects to such conditions.

Existing and Desired Conditions

About 17% of the riparian reserves along streams in the combined watershed areas of Clearwater, Lemolo, and Diamond Lake have been affected by previous clearcuts and roads, with the amounts varying by watershed (Table 49). In the smaller D-Bug planning area, 4.1% of the riparian reserves have been previously affected by clearcutting and roading.

Table 49. Summary of Past Riparian Reserve Harvest and Roding by Watershed and Planning Area.

	Clearwater	Lemolo Lake	Diamond Lake*	Planning Area
Acres of Riparian Reserve Along Streams	5,108	7,210	1,163	4,025
Acres (%) Stream-Related Riparian Reserve Clearcut	859 (17%)	153 (2.1%)	5 (0.4%)	134 (3.3%)
Acres (%) Stream-Related Riparian Reserve in Permanent Roads	846 (16%)	331 (4.6%)	111 (9.5%)	31 (0.8%)
Total Acres (%) of Stream-Related Riparian Reserve Impacted	1,705 (34%)	484 (6.7%)	116 (10%)	165 (4.1%)
	2,305 acres (17%)			

*Statistics for the Diamond Lake watershed only include lands managed by the Forest Service; Crater Lake National Park manages a portion of this watershed.

Previously clearcut riparian reserves are now either Douglas-fir plantations or lodgepole pine regeneration sites, presently in the stem exclusion stage. These stem exclusion stands are very dense and generally lack tree species diversity due to planting and precommercial thinning practices, coupled with the lack of natural fire that would have help thin and diversify the dense second-growth. If left untreated, many stands are on a track to develop as closed, unnaturally dense and homogeneous stands that do not represent desired conditions for the riparian reserve land allocation.

A portion of the system road network⁹⁷ occurs within riparian areas. System roads have the potential to limit shade and deposition of large wood and debris to streams and riparian forests over long time periods, since these roads are long-term features. These conditions are usually only alleviated by road decommissioning when roadbeds are converted back to tree growing sites.

The planning area also has 25 miles of unclassified roads within or leading to the proposed units. These dead-end roads were built many years ago and many are now either abandoned or they are being used as recreation trails. These roads are referred to as "unclassified roads" by the Forest Service because they were never evaluated as part of the long-term road system. Under today's practices, many of the abandoned roads would have qualified as temporary roads that would have been obliterated

⁹⁷ System roads are defined as permanent roads that are needed for the long-term transportation system.

following logging use under today's standards. About 3.1 miles of these unclassified roads are located in the planning area's riparian reserves, equating to about 7.5 acres of land.

The desired condition for riparian reserves is increased species and structural diversity that would approximate the effects of fire that has been excluded, decrease the area occupied by permanent and unclassified roads, and lower the risk of stand replacement fire in keeping with ACS objectives 2, 3, 8, and 9.

Relevant Standards and Guidelines

The standards and guidelines for riparian reserves (as per the 1994 Northwest Forest Plans) specifically related to the D-Bug alternatives include:

Northwest Forest Plan TM-1 (c). Prohibit timber harvest except where silvicultural practices are applied to control stocking, to reestablish and manage stands, and to acquire desired vegetation characteristics needed to attain Aquatic Conservation Strategy objectives.

Northwest Forest Plan FM-1. Design fuel treatments to meet Aquatic Conservation Strategy objectives, and to minimize disturbance of riparian ground cover and vegetation. Strategies should recognize the role of fire in ecosystem function and identify those instances where fire suppression could be damaging to long-term ecosystem function.

Northwest Forest Plan FM-4. Design prescribed burning and prescriptions to contribute to attainment of Aquatic Conservation Strategy objectives.

Northwest Forest Plan FM-5. Rehabilitation treatment plans are prescribed as needed to attain ACS objectives whenever Riparian Reserves are significantly damaged by wildfire.

Northwest Forest Plan RA-2. Fell trees in Riparian Reserves when they pose a safety risk.

Watershed Analysis Recommendations

1998 Diamond Lake-Lemolo Lake Watershed Analysis:

- An accepted approach to minimizing wildfire size and of minimizing the impacts of fire suppression is to reduce the amount or continuity of ground and ladder fuels prior to the start of a wildfire in riparian reserves (pg. 219).
- Active silvicultural programs will be necessary to restore large conifers in riparian reserves.
- Prescribed fire for ecosystem maintenance and restoration should be allowed to burn within riparian reserves as fire did historically. These fires will be utilized to restore function and diversity to the system (pg. 220).
- Hazard reduction is recommended along the north shore of Diamond Lake due to high fuel loading, heavy public use and the existing fire hazard. Hazard reduction treatments should also include the riparian reserve.
- The fire hazard around existing buildings in the Diamond Lake composite can not be alleviated without treatment occurring within riparian reserves due to the proximity of the buildings to the reserve or the buildings actually being in the reserve. Areas of riparian reserve with high fuel loading on the west (by the summer homes) and south sides of Diamond Lake (around Teal Lake) should be treated. These areas have

high public use and due to improvements (summer homes and other developments/facilities), values at risk are high.

1996 Upper Clearwater Watershed Analysis

- Riparian vegetation should be restored to a fully functioning status throughout the area. Fully functioning status would include a range of conditions, from areas of early successional vegetation through mature old growth stands. Many stream segments currently have clearcut harvest units that have been cut down to, and in some cases across, the stream banks.
- Prescribed burning could help maintain this strategy by reducing the risk of stand replacement fires in or near riparian reserves. Planning prescribed burns in natural or activity fuels when conditions are right to meet resource objectives such as hazard reduction, maintenance of large coarse woody material, and protecting the riparian zone, is a far better alternative than an unplanned ignition during periods of high fire danger.

Proposed Riparian Reserve Treatments

The action alternatives would apply thinning and/or non-commercial fuel reduction to riparian reserves along streams where riparian conditions are presently outside the range of natural variability due to fire exclusion or previous management (Table 50).

Table 50. Proposed Vegetation and Fuel Treatments within Riparian Reserves of Streams.

Actions	Alt. 1	Alternative 2	Alternative 3	Alternative 4
Riparian Reserve Land Allocation Within Proposed Treatment Areas	N/A	887 acres	732 acres	915 acres
All Commercial Harvest in Riparian Reserves	0	414 acres (46%)	308 acres (42%)	432 acres (47%)
Lodgepole Thinning (Rx 2)	0	217	150	235
Mixed Conifer Thinning (Rx 9, 10, 11 & 13)	0	197	158	197
Non-Commercial Fuel Treatments in Riparian Reserves	0	225 acres (29%)	206 acres (28%)	265 acres (29%)
Grand Total All Riparian Reserve Treatments Along Streams	0	669 acres (75%)	517 acres (71%)	697 acres (76%)

The riparian reserve acres located in the proposed treatment areas would be treated under the action alternatives in order to attain the long-term objectives of the Aquatic Conservation Strategy. The riparian reserve thinning prescriptions would be the same as in the adjacent uplands, which involves low thinning (where the smaller trees are harvested) in mixed conifer stands and heavy thinning in stands with lodgepole overstories that are susceptible to mountain pine beetle mortality (Table 50).

All perennial streams, where commercial harvest is proposed, would receive 50-60 foot no cut buffers to maintain the primary shade zone under the action alternatives. On

some of the intermittent streams, commercial treatments would occur along the channels with stable streambanks on gentle to flat slopes. Thinning would occur along these channels with no buffers in order to maximize the long-term positive effects of the thinning. No trees would be yarded across the channels, and no equipment would operate within 40 feet of a channel, except at existing stream crossings.

Road work in the riparian reserve would be necessary in order to access the treatments areas for log removal and haul (Table 51).

Table 51. Road Activities within Riparian Reserves to Provide Access for Treatments.

	Alt. 1	Alternative 2	Alternative 3	Alternative 4
New permanent roads	0	0	0	0
New temporary roads (obliterated following use)**	0	1.5 acres	1.4 acres	1.5 acres
Reuse unclassified road, retain	0	4.6 acres	4.6 acres	4.6 acres
Reuse unclassified road, decommission	0	2.6 acres	2.6 acres	2.6 acres
<i>Change from existing condition</i>	<i>0</i>	<i>-2.0 acres of road in riparian reserve</i>	<i>-2.0 acres of road in riparian reserve</i>	<i>-2.0 acres of road in riparian reserve</i>

*A 20 foot road width was used to calculate the road acreage figures displayed in this table. This is a liberal estimate of the combined area of the actual road surface (typically about 14 feet wide) and additional width where trees on either side would be cut to allow truck passage.

**Temporary roads were not used in the calculation of net change from the existing condition since they are not long-term, permanent features.

Finally, there is a potential that some log landings would occur in the outer portions of riparian reserves; these landings would all be less than 1/8 acre in size and rehabilitated by subsoiling and revegetated as necessary or appropriate. None of the larger, 1-acre landings proposed for the processing of biomass would occur within the riparian reserve land allocation.

Direct and Indirect Effects

The direct effects to riparian forest conditions are defined as those occurring within the riparian reserve of treatment units over the short-term. The indirect effects are those that would occur within the riparian reserves of the treatment units over the long-term (continue for more than two decades), or that would occur beyond the immediate location of the treatment areas.

Under all three action alternatives, the construction of temporary roads within riparian reserves would result in short-term impacts to riparian forest conditions by disturbing soil, vegetation, and changing localized habitat conditions at the site scale. No such impacts would occur under Alternative 1 where no temporary roads would be built. The action alternatives would result in immediate losses of small-sized organisms, habitat, and site productivity at the immediate site of the road prisms. The duration of these impacts are expected to last up to two decades. The roads would be subsoiled following use and some of the displaced wood and duff would be pulled back across the roads (see soil mitigation measures in Chapter 2) accelerating recovery from the impacts. There is essentially no difference among the action alternatives with respect to the

amount of new temporary road impacts. The acres displayed in Table 51 include the cutting of trees parallel to the temporary road prisms to allow room for truck passage. Since the linear openings created with temporary road building can be expected to be at most 20 feet in width, the change in riparian forest crown closure associated with the temporary road building would be essentially no different than the crown closure changes from the thinning treatments, discussed below.

The thinning in the riparian mixed conifer stands under the action alternatives would lower the existing overstory canopy closure, (ranging from 50-60% today) down to between 25 and 45% (Figure 15). This drop in overstory canopy closure would gradually recover over several decades, as long as no fires or follow-up treatments occur. These changes in canopy closure would allow more light penetration in these mixed conifer stands, resulting in warmer and dryer riparian forest conditions compared to Alternative 1.

In contrast, the thinning under the action alternatives in commercial lodgepole pine stands would result in little overstory change compared to Alternative 1. This is because the thinning of the lodgepole pine overstory would approximate the loss of overstory trees from the mountain pine beetle infestation, which would proceed unchecked under Alternative 1. As such, there would be little difference in riparian reserve overstory canopy closure where lodgepole is thinned compared to no action where the beetle infestation is predicted to kill most of the overstory lodgepole.

The understories of lodgepole stands would be more affected by the action alternatives compared to Alternative 1. Under no action, the dead and toppling overstory lodgepole pine would add shade, habitat structures, and moisture retention to the forest floor that would be removed or interrupted under the action alternatives. During logging, the understory vegetation would be crushed, knocked down, and killed. Also, the fuel treatments such as mastication, grapple piling, hand piling, and chipping would further clear understory vegetation. This understory effect would also occur in mixed conifer understories where logging activities and fuel treatments would promote warmer, drier conditions in the forest of riparian reserves compared to Alternative 1.

The ground-based logging using mechanized and cut-to-length systems would be used to implement most all of the commercial thinning of riparian reserves under the action alternatives. These systems would exert direct impact to riparian reserves due to soil and vegetation disturbance. Soil disturbance results in a loss of site productivity, and vegetation clearing results in habitat modification. The three action alternatives would result in essentially the same amount of riparian impacts (Table 50). The actual amount of disturbance expected with the ground-based logging would be about 1/10 of the total ground-based logging acres displayed in Table 2, because skid trails typically affect about 10% of the area logged with ground-based systems. With the cut-to-length logging system, soil disturbance is lower compared to other ground based logging, because the equipment operates on top of a bed of tree branches that are laid in front of the machine as it works through the stand (USDA, Forest Service, 2003a). The tree branches provide a cushion resulting in less displacement and compaction of soil, but vegetation clearing is still an impact.

Both the thinning and fuel reduction treatments under the three action alternatives would also lower the rate of litter input to streams and the riparian forest floor which represents important nutrient cycling and food bases for aquatic and terrestrial organisms. This thinning effect may lower local populations of dependant aquatic organisms. Such effects would gradually subside over a period of 30 to 40 years.

Under the action alternatives, the various thinning and fuel prescriptions applied to the riparian reserve land allocation are not expected to exert unusual or extraordinary impacts to riparian forest conditions. This is because the thinning would approximate more open stand conditions desired in riparian areas, lower the risk of severe fire effects in the riparian reserves, and help introduce landscape-level pattern diversity in an otherwise homogenous landscape of mostly dense mature forests in the lodgepole pine areas.

The amount of prescribed underburning in the riparian reserves of streams is very limited in extent (3.1 acres in Alternatives 2 and 4 and 0.2 acres in Alternative 3) under the action alternatives. The small amount of underburning is expected to negatively affect existing down wood by consuming some of the advanced decay class logs now present on the riparian forest floor. Underburning is expected to create exposed soil in about 18% of the treatment area. Such areas are more prone to surface erosion and noxious weed introductions. These effects are typically short-term, since ground vegetation quickly recovers in the first two years following burning, so the magnitude of such effects would be limited. These impacts are described further in the soil and noxious weeds sections of this Chapter.

The fuel treatments that apply fire to concentrated slash piles, with handpile burning (Alternatives 2 and 4, 40 acres and Alternative 3, 37 acres) and grapple pile burning (Alternatives 2 and 4, 115 acres, and Alternative 3, 34 acres) would also result in direct effects to riparian reserves in terms of site productivity and bare soil exposure. Such concentrated pile burning typically removes the soil duff, mineral soil can be exposed, and small, low mobility organisms can be killed. The extent of these impacts in riparian reserves is very limited since grapple piles can be expected to affect about 5% of the acres listed above and hand piles about 3% of the treatment area listed above.

Disturbance of riparian ground cover, vegetation, and small organisms associated with the fuel treatments are minimized through mitigation because the concentrated slash piles would be burned during wet weather when site impacts are minimized. A mitigation measure incorporated into the action alternatives requires that underburning occur during moist conditions when large down wood and duff are less likely to be completely consumed. This measure is expected to lessen impacts and meet standard and guideline FM-1.

Standard and guideline FM-4 would also be met with the action alternatives since the fuel prescriptions in riparian reserves would lower activity fuels and other fuel accumulations to levels that would more closely approximate fuel loads in a natural fire regime. These activities are necessary in order to contribute to meeting the desired riparian forest conditions of improved species and structural diversity and lowering the risk of crown fire that could impact such diversity.

Though most of the riparian reserve acres that fall within treatment units would be treated in one way or another, ranging from 71% to 76% (Table 50), the amount of treatment in the context of the riparian reserves in the planning area equates to between 13% and 17% of the overall 4,025 acre network. These are relatively small scale effects for the riparian reserve network. Moreover, the 50-60 foot no cut buffers on all perennial streams and some of the intermittent streams would help moderate these effects providing a cooler, dense forest paralleling all the buffered channels.

Mitigation measures to minimize impacts from ground based logging include limiting the density of skid trails, restricting equipment entry to no closer than 40 feet from stream channels, and subsoiling of skid trails after use. These measures, detailed at the end of

Chapter 2, are included in all action alternatives and function to lower the extent and intensity of the impacts disclosed above.

Under Alternative 1, no soil disturbance or vegetation removal from logging or activity fuel reduction would occur, thus no organisms would be killed, no bare soil would be exposed, and no productivity losses would occur in riparian reserves.

Under the action alternatives about 1.5 acres of riparian reserve would be affected by temporary road construction and follow-up obliteration (Table 51). In the high elevation pumice soils, the effects from these temporary roads would be realized for several decades, because these unproductive soils are generally not resilient to impacts. As such, the adverse effects to riparian forest conditions such as loss of habitat, site productivity, and potential weed introductions are expected to continue for at least a decade following temporary road building/obliteration.

Though the action alternatives would result in new impacts to riparian vegetation and sites, they would also decommission 2.6 acres of existing, long-term road surface ultimately resulting in a net decrease of permanent road in the riparian reserve allocation (Table 51). All three action alternatives would result in the same net decrease of 2 acres of existing roads in the reserve, responding equally to the desired condition of decreased area occupied by permanent roads and addressing several aspects of the ACS. Alternative 1 would not construct any new temporary roads nor would it result in any beneficial long-term effects from decommissioning existing road beds in the riparian reserves of streams.

Thinning the mixed conifer stands under the action alternatives would lower snag and down wood recruitment rates compared to Alternative 1, by removing trees that would die from suppression mortality or from pine beetles. The majority of the snag recruitment loss from the low thinning in mixed conifer would be from smaller-sized trees because suppression mortality typically kills smaller, suppressed trees rather than the larger dominate trees. The lodgepole thinning would occur in the overstory, and as such would remove trees that would become snags and down wood recruitment to the riparian forest floor and streams. The loss of wood recruitment to perennial stream channels would be largely mitigated by the 50-60 foot no-cut buffers, since most of the wood that naturally recruits to streams comes from within the first 65 feet of the stream (Murphy and Koski, 1989; McDade et. al 1990).

The effects of this snag and down wood recruitment loss include the loss of habitat for aquatic and terrestrial species that depend on these habitat structures. Though habitats and habitat quality would be diminished, the relatively small amount of the thinning is not expected to result in riparian species population declines. In the context of the riparian reserve network of Diamond Lake, Lemolo Lake, and Upper Clearwater watersheds, this amount of potential recruitment loss is inconsequential.

The action alternatives in the mixed conifer stands would result in long-term beneficial effects to riparian forest structure and composition with increased fire resiliency and improved stand structural characteristics that more closely approximate the natural disturbance regime the fire regime compared to more closed stand conditions under Alternative 1. As such, under the action alternatives, S&G TM-1 (c) would be met because the silvicultural practices applied to control stocking in the riparian reserve contribute to meeting the desired vegetation characteristics needed to attain Aquatic Conservation Strategy objectives. Over time, the commercial thinning of the mixed conifer riparian stands would result in stands that are more likely to attain the characteristics of late seral forests compared to Alternative 1, thus meeting desired

conditions for riparian reserves. These beneficial effects would help to maintain habitat connectivity for riparian dependant species that rely on late-successional forest conditions. The magnitude of these beneficial effects from the action alternatives are limited since only 4-5% of the riparian reserve land allocation in the planning area would experience the benefits and the rate at which these effects would accrue over time is gradual.

Perhaps the most profound indirect effect to riparian reserve forest conditions under the D-Bug alternatives are the effects to fire behavior that would operate over several decades at both the stand and broader landscape scale. Dense homogenous forests have dramatically altered how wildfires burn today compared to how they burned historically under more open and heterogeneous forest structures. The homogenous forest structures that proliferate today exert increased potential for crown fires (Peterson et al, 2004; Powell et.al, 2001). Moreover, areas of older lodgepole pine are likely much more extensive today due to fire exclusion. As such insect mortality is predicted over larger areas with more severe fire effects compared to a more natural fire regime. Such uncharacteristic effects would be realized within the riparian reserves as well as the uplands. This is discussed in the Fuels section of this Chapter. Alternative 1 would do nothing to change this adverse trend. The chances of severe fire effects to forest floor soils and associated organisms would be elevated in the stands containing stem exclusion and mature lodgepole due to predicted fuel build-ups from the beetle infestation.

The combined effects of the thinning and treatment of fuels plus the fuelbreak implementation under the action alternatives would help modify fire behavior to reduce the likelihood that future wildfires might result in severe fire effects within the treatment areas and at the broader landscape (Table 21).

Under no action, the amount of the landscape likely to burn as a stand replacement fire, which includes riparian reserves, would be higher than under the action alternatives. In particular, such beneficial effects can carry over to larger areas, especially where treatment areas are clumped, such as along the Highway 138 and Highway 230 evacuation routes and the Thirsty/Kelsey fuelbreaks. This is because treatments applied on a substantial scale, as proposed under the action alternatives, can modify the spatial pattern of fuels over a landscape area that can modify wildfire behavior (Peterson et al. 2004). As such, nearby untreated forests and their riparian areas are expected to benefit from adjacent treatments where fuels have been reduced and canopy base heights increased. As a result, wildfire behavior in the area would burn at a lower intensity, spreading slower, which locally delays the forward progress of a fire and creates variability in the intensity of a wildfire as it moves across the landscape (Peterson, et al, 2004), and as described in the fuels section of this chapter (Table 21). Thus, the action alternatives would likely result in reduced fire intensities (in terms of heat generated and rate of spread), increased ability to manage wildfire and use future fires for their ecological benefits, and reduced fire severity (in terms of the fire effects on killing trees and impacting site productivity).

The riparian reserve network for the three fifth-level watersheds that D-Bug overlays (Diamond, Lemolo, and Upper Clearwater) equates to 13,480 acres. At this scale, all the above direct and indirect effects to riparian reserves would be very limited in extent and magnitude such that they would be substantially diluted at this larger watershed scale. The possible exception to this conclusion might be the beneficial indirect effect of reduced fire behavior both within and adjacent to fuel reduction treatments. Such an effect may be realized at the watershed scale if fire behavior is substantially modified by

the fuelbreaks and the concentrated thinning treatments around the lakes. In this case, Alternatives 2 and 4 would result in more such beneficial effects than Alternative 3. Scientific publications have concluded that fuelbreaks (that are maintained over time) are generally effective at modifying fire behavior except under the most extreme conditions (Weatherspoon and Skinner, 1996), and in areas where thinning and fuel treatments are consolidated without a lot of untreated edge, overall mortality is less (Agee and Skinner, 2005).

In summary, several types of localized direct and indirect adverse effects to riparian forest conditions can be expected to occur under all three action alternatives. The magnitude of these effects at the site-scale in relation to the planning area and the broader watershed scale are inconsequential. This is because both the extent and the duration of these impacts (as described above) are expected to be low. In contrast, the predicted changes to fire behavior as a result of the action alternatives could result in beneficial effects that operate at larger scales potentially over several decades.

STREAM CHANNELS

During scoping, several conservation groups were concerned that building new temporary spur roads, along with the retention of old abandoned roads could cause numerous environmental impacts including impacts to streams. The impacts to streams from the various forms of road construction and road work are disclosed in this section.

Streams in the planning area are primarily affected by roads that cross them or that exist near them, by the age of the adjacent forest that provides bank stability and large wood input, and by the effects of disturbance such as floods and fire.

Existing Condition and Desired Condition

Extensive stream surveys were done for the 1998 Diamond Lake/Lemolo Lake Watershed Analysis which found that overall, channel stability in both managed and unmanaged area was stable with properly functioning systems that effectively process both flow and sediment. (USDA, Umpqua National Forest, 1998). These surveys also found functioning levels of instream wood in most channels surveyed.

A survey of system roads that represented all potential haul roads was carried out to assess reconstruction needs. Aquatic connectivity is considered very good since only two problem stream crossings were found.

The desired condition for stream channels in the planning area are 1) decreased risk of road-related stream diversion and stream crossing failure, in keeping with ACS objective 5 that addresses the sediment regime; 2) improved levels of large instream wood recruitment potential in keeping with ACS objective 2 that addresses stream bed and bank conditions.

Riparian Reserve Road Standards and Guidelines from the Northwest Forest Plan

RF-2a. For each existing or planned road, meet Aquatic Conservation Strategy objectives by minimizing road and landing locations in riparian reserves.

RF-2e. For each existing or planned road, meet Aquatic Conservation Strategy objectives by minimizing disruption of natural hydrologic flow paths, including diversion of stream flow and interception of surface and subsurface flow.

RF-3a. Meet ACS objectives by reconstructing roads and associated drainage features that pose a substantial risk.

RF-3c. Meet ACS objectives by closing and stabilizing, or obliterating and stabilizing roads based on the ongoing and potential effects considering short-term and long-term transportation needs.

Roads Analysis and Previous NEPA Decisions

Since no road management activities would occur that would change access, current use or changes in traffic patterns or road standards, no roads analysis is needed to support the D-Bug project (USDA, Umpqua National Forest, 2008). The NEPA accomplished for the re-issuance of the Recreation Residences Special Use Permits resulted in a decision to decommission a portion of a system road that closely parallels the west shore of Diamond Lake (4795-300) and some of its spurs. Some of this same road would be used for D-Bug haul and presumably decommissioned at some point in time after D-Bug haul is done. The decommissioning under this previous decision is listed as the first two similar actions for each action alternative (Tables 4, 7, and 10) since it has the potential to be accomplished in coordination with D-Bug operations.

Proposed Road Treatments in Stream Channels

The action alternatives would all construct two temporary stream crossings in two different intermittent stream channels. These crossings are necessary to meet the overall objectives of the project. If these crossings were not constructed, more miles of temporary road construction would be necessary to provide access to the thinning areas. These temporary crossings would be obliterated following the log haul.

The action alternatives would also implement routine road reconstruction to achieve safe and effective haul conditions as described in Chapter 2. Specifically, in streams, Alternatives 2 and 3 would both replace an existing stream crossing in an intermittent tributary of Silent Creek on road 4795-300 which accesses units 61 and 62, west of Diamond Lake. Alternative 4 would replace the same intermittent Silent Creek tributary crossing plus it would replace a stream ford with a culvert in an unnamed intermittent stream on road 4792-456 road which accesses units 241 and 242, south of Lemolo Lake. These actions are proposed, in part, because the crossings both pose some risk of erosion.

Several mitigation measures are included as part of this instream road work in the intermittent channels (as detailed in the Road Construction and Reconstruction mitigation measures of Chapter 2) to lower or minimize the risk of water contamination and turbidity when equipment and workers are working in and near these streams.

Direct and Indirect Effects

The direct effects to stream channels are defined as those short-term effects at the immediate location of instream work areas over a period of up to 5 years. This is based on observations of the recovery time for in-channel and bank disturbances associated with temporary road construction at stream crossings and road reconstruction at crossing. The indirect effects to stream channels are defined as the long-term effects of the instream road work that could last longer than 5 years, plus any downstream effects in perennial streams in the planning area.

The effects to stream channels associated with temporary road construction, which includes two new crossings of intermittent channels, would result in direct impacts to channel banks and beds with equipment used to construct either temporary fords or temporary culverts. The work at stream fords and sections of road leading to the fords

plus the subsequent haul across these small dry channels would result in new disruption of these previously unaltered channels. Rock and other nearby fill would be placed in small intermittent streams, to allow trucks to cross the small channels. The placement of rock and/or culverts and the shaping of the fords/crossings with heavy equipment to prepare them for truck traffic would result in sedimentation at the time the work is done and again once late summer and fall rains begin. In addition, direct sediment input to the channels would occur while building the stream crossings and hauling logs and machinery across these two streams. Bare soil exposure would exist throughout the area of the stream crossing work and in the road approaches to the crossings. These direct effects to the banks and beds of the intermittent channels at these temporary crossings are predicted to deliver a relatively small amount of sediment (Table 48). The effects to channel beds and banks are expected to last for at least a decade until the channels redistribute bed materials and bank-side vegetation returns, while the effects of sedimentation are expected to dissipate within a few years.

For the existing stream crossings that would be reconstructed on the system road that crosses the Silent Creek tributary, channel banks and beds would be modified during the culvert replacement with equipment working on banks and within the channels to excavate existing fill material surrounding the existing culvert and backfill around the new culvert. The installation of a culvert at the non-functional ford in the intermittent channel south of Lemolo Lake would also result in increased surface erosion, but the small snow-melt channel is presently ill-defined, and barely formed as a channel, so effects to stream banks and beds would be very limited. These effects are expected to last for about 2 years, but the amount of actual sedimentation for the reconstruction is also relatively low (Table 48). Moreover, the erosion control measures and restrictions on the timing of work (listed at the end of Chapter 2, under road reconstruction) would effectively lower both the extent and duration of the work-site sedimentation. No short-term sedimentation would occur under Alternative 1 since no ground disturbing activities would take place.

Over the long-term, the action alternatives would result in beneficial effects to stream channel connectivity and to the sediment regime as a result of work done to improve existing stream crossings and road maintenance conducted near streams compared to Alternative 1, where no such work would occur. Alternatives 2, 3, and 4 would result in improved stream connectivity due to increase culvert capacity and longevity in the Silent Creek drainage, plus Alternative 4 would result in an additional channel improvement at the site of the non-functional ford in the Lake Creek drainage. These represent minor channel improvements, consistent with standard and guideline RF-3a. These minor benefits would not occur under Alternative 1. Moreover, the lower amount the predicted stream sedimentation as a result of road maintenance (Table 48) would also be a minor beneficial effect relative to Alternative 1, which has no haul-related road maintenance.

The short term effects to both riparian conditions and stream channels, taken in total (Table 52), are generally out-weighted by the longer-term beneficial effects. For instance, the accelerated attainment of desired riparian forest conditions through thinning of the mixed conifer riparian areas outweighs the short-term adverse effects such as small scale habitat losses, microclimate changes, and sediment delivery because the beneficial effects operate over a longer period of time resulting in more overall net benefits. More importantly, the beneficial effects of lowering stand densities and fuel loads in both the mixed conifer and lodgepole forest types, which would lower the risk of uncharacteristic fire effects in riparian areas and streams, outweighs the

localized, short-term impacts described above. The magnitude of this beneficial effect outweighs the adverse effects of the action alternatives.

Table 52. Summary of Riparian and Stream Actions and Effects.

Riparian Actions	Riparian/ Stream Change	Primary Effect (Beneficial and/or Adverse)	Duration	Amounts by Alternative			
				1	2	3	4
Com- mercial thinning	Less tree density & less crown closure.	Beneficial—improved species and structural diversity/late successional characteristics, lower risk of severe fire effects.	20-30 years	0 ac	414 ac	308 ac	432 ac
	Equipment operations	Adverse—drier microclimate, less litter to streams/forest floor, soil disturbance, risk of weed introductions	10-20 years				
	Lessened snag and down wood recruitment process	Adverse—loss of suppression mortality in smaller-sized trees and in overstory lodgepole Beneficial—accelerated growth of leave trees for future recruitment of larger snags/down wood	30 years up to 60 years				
Non- commer- cial fuel treatments	Lower surface and ladder fuels via mastication	Beneficial—moves stands to more fire resilient condition Adverse—soil disturbance, loss of site productivity, risk of weed infestations	20-30 years	0	225 ac	206 ac	265 ac
	Obliteration of existing roads	Beneficial—improved riparian habitat connectivity	perpetuity	0	2.6 ac.	2.6 ac.	2.6 ac.

Riparian Actions	Riparian/ Stream Change	Primary Effect (Beneficial and/or Adverse)	Duration	Amounts by Alternative			
				1	2	3	4
Road work	New temporary construction	Adverse—loss of vegetation/habitat connectivity	20 years	0	1.5 ac	1.4 ac	1.5 ac
	Reconstruction of stream crossings/fords	Adverse—small scale sediment delivery and channel changes Beneficial—small scale erosion risk reduction	5 years 20+ years	0	1 site	1 site	2 sites
	Reuse and retain unclassified roads & trails	Adverse—continued impacts to riparian vegetation	40+ years	0	4.6 ac.	4.6 ac.	4.6 ac.

Cumulative Effects to Streams Channels and Riparian Forest Condition

The potential of the D-Bug action alternatives to result in either adverse or beneficial cumulative effects to riparian forest and stream conditions is addressed at the scale of the planning area. Since the direct and indirect effects of the action alternatives would result in low magnitude effects (as detailed above), it is reasonable to assume that these effects would only overlap with the effects of other past, present, and foreseeable future activities at the scale of the planning area rather than at the larger scale of fifth-level watersheds.

The adverse effects of the D-Bug action alternatives on riparian forest conditions such as lower snag and down wood recruitment levels would overlap with the 134 acres of past riparian clearcutting and riparian area occupied by system roads (Table 49) because the past clearcut areas are not yet producing a full complement of snag and down wood habitats and the system roads are producing no vegetation or wood recruitment potential. The added impacts from the D-Bug action alternatives on these habitat features would combine with the past impacts, resulting in an incremental additive impact to snags and down wood habitat structures in the riparian reserve network of the planning area. Likewise, the direct and indirect effects associated with the fuel treatments of the D-bug action alternatives would incrementally add to the on-going riparian effects associated with the 25.7 acres of underburning/handpile burning in riparian reserves under the Lemolo EIS in the vicinity of Lemolo Lake. However, since no riparian thinning is occurring with the sales of the Lemolo EIS, no additive effects from thinning are possible with that project.

The adverse effects of the D-Bug action alternatives to riparian forest conditions could also incrementally add to the on-going recreation impacts to riparian reserves with the human use and maintenance that occurs within developed and dispersed recreation sites along streams in the planning area. However the potential of additive, cumulative

effects in this situation are considered low since the extent and magnitude of the on-going recreational impacts are very limited in area and magnitude.

On the other hand, the beneficial effects of thinning and fuel reduction under the D-Bug action alternatives in both riparian and upland locations are expected to combine with the beneficial effects of both riparian and upland burning and fuel reduction of the Lemolo Lake and Diamond Lake Hazardous Fuels Projects and the Lemolo EIS activities. Taken together all these projects could help to lower the probability of stand replacement fire in the planning area's riparian reserves, incrementally improving riparian conditions over the long-term.

Impacts to streams and riparian forests have resulted from past road building and timber harvest in the D-Bug planning area (Table 12). The existing road network continues to exert local effects to streams at stream crossings and continues to impact riparian forest conditions in the planning area. The direct and indirect effects to streams and riparian forest conditions from the D-Bug action alternatives would add to the on-going impacts of the road system, resulting in low level cumulative effects to stream channels and to riparian forest conditions. The magnitude of these cumulative effects are considered limited because the additive effects from D-Bug are minor as disclosed above in the sections on direct and indirect effects. Moreover, the existing road network exerts low levels of impact to riparian areas with only 31 acres of riparian reserve occupied by permanent roads in the planning area (Table 49). Likewise, the low road density found in the planning area does not presently exert a profound influence on stream channels due to a low number of stream crossings and the very gentle terrain found in the planning area. As such the additive effects from D-Bug, though cumulative, are minor with very limited consequence to both riparian forest conditions and stream channel conditions.

The direct stream channel effects of the D-Bug action alternatives would also incrementally add to the impacts of work done in Lake Creek under the Diamond Lake Restoration EIS. This work was localized to the outflow of Diamond Lake, where Lake Creek begins. No D-Bug work would occur in Lake Creek, but the low level instream work in the planning area, under the action alternatives is considered cumulative in terms of the over-all stream network in the planning area. As such the additive effects from D-Bug are minor with very limited consequence to the stream channel network.

Under the Lemolo EIS, none of the new system or temporary roads crossed any streams, and no reconstruction or maintenance occurred at stream crossings. As such, no additive effects would be realized with projects covered under the Lemolo EIS in terms of stream channels.

Alternative 1 has the potential for future wildfires to result in more severe fire effects in riparian reserves than under the action alternatives. The lack of action under Alternative 1 would add to the effects of decades of fire exclusion. The uncharacteristically dense mixed conifer stands developed in the absence of fire and they are susceptible crown fires. Fire exclusion in the lodgepole forests has allowed more contiguous acres of stem exclusion and mature stands than would have occurred under the natural disturbance regime. Both these stand-level and landscape conditions would continue unchecked under Alternative 1 and present more long-term risk to riparian forest conditions.

Aquatic Conservation Strategy

The riparian reserves included in this project have developed unnaturally dense conditions (in the mixed conifer types), which do not reflect the historic disturbance

regime. Similarly, the exclusion of fire in the lodgepole landscape has made large areas susceptible to pine beetle mortality and uncharacteristic landscape amounts of fuel including riparian areas. The proposed thinning and the fuels treatments in the reserves under the action alternatives would implement Watershed Analysis recommendations (USDA, Umpqua National Forest, 1996 and 1998) to restore riparian conditions and to reduce risk of severe wildfire behavior.

These actions in riparian reserves are in compliance with Northwest Forest Plan riparian standard and guideline TM-1c which calls for the application of silvicultural practices to acquire desired vegetation characteristics needed to attain Aquatic Conservation Strategy objectives.

As disclosed above under the Riparian Reserve discussion, the action alternatives would restore species composition and structural diversity of plant communities, and they would continue to supply sufficient coarse woody debris in riparian areas. As such they are consistent with ACS objective 8. In addition, the restorative riparian thinning in mixed conifer stands would be consistent with ACS objective 9, because the thinning would provide long-term habitat for riparian dependant plant and animal species. By restoring more open stands like those that historically developed following disturbance, the dense stem exclusion and mature mixed conifer stands would be less prone to stand-replacement fire, and more likely to develop habitat characteristics needed by riparian dependant species. Finally, at the broader scale, the riparian forest treatments under the action alternatives advances the role of riparian reserves in providing connectivity within and between watersheds, consistent with ACS objective 2. By maximizing the amount of riparian treatment in uncharacteristically dense mixed conifer stands and by lowering densities of older lodgepole overstories, portions of the riparian reserve network in the planning area would be more representative of the lodgepole and mixed conifer disturbance regimes of both mixed conifer and lodgepole pine forest types. The Aquatic Conservation Strategy is based on natural disturbance processes (USDA/USDI, 1994).

Alternative 1 has the potential for future wildfires to result in more severe fire effects in riparian reserves than under the action alternatives. The lack of action under Alternative 1 would maintain the adverse trend of decades of fire exclusion. Uncharacteristically dense mixed conifer stands would continue to be susceptible to crown fires. Fire exclusion in the lodgepole forests has allowed more contiguous acres of stem exclusion and mature stands than would have occurred under the natural disturbance regime. Under no action, both these forest types would sustain more long-term risk to riparian forest conditions. As such, Alternative 1 would not proactively advance ACS objectives.

The instream road work (construction of temporary crossings, re-use of existing stream fords and crossings, and reconstruction of abandoned stream crossings) follows riparian reserve standards and guidelines for roads. Though short term, small scale adverse effects are expected under the action alternatives, the broader long-term objective of moving riparian stands toward more open conditions and less prone to severe fire effects addresses the overarching intent of the Aquatic Conservation Strategy.

FISH

There are five species of fish within the planning area--brown trout (*Salmo trutta*), rainbow trout (*Oncorhynchus mykiss*), brook trout (*Salvelinus fontinalis*), kokanee (*Oncorhynchus nerka kennerlyi*), and tui chub (*Gila bicolor*). It is uncertain whether any native fish existed in any of the planning area streams before the advent of fish stocking.

Though rainbow trout have been extensively introduced, a native strain may have been present. Diamond Lake is known to have been fishless prior to rainbow trout stocking in 1910.

The species currently present and their distribution are the direct result of fish stocking practices. Eastern brook trout overwhelmingly dominate rainbow trout wherever they overlap. Rainbow trout alone exist only in the Clearwater River above Stump Lake. Brook trout appear to have eliminated rainbow trout and any other fish species that may have been historically present from areas they have been able to access. In the few areas where rainbow trout are coexisting with brook trout, it appears to be the result of a low level of immigration from upstream areas. Also, the introduction of non-native fish to previously fishless lakes and streams has undoubtedly altered the structure and composition of the aquatic insect and amphibian communities originally present.

Brown trout are present in Lemolo Reservoir, Lake Creek, and the North Umpqua River. Brown trout distribution extends upstream from Lemolo Reservoir for approximately six miles in the North Umpqua River and approximately 11.5 miles in Lake Creek. Brown trout spawning has been observed in Spring River.

Rainbow trout are present in Diamond Lake, Silent Creek, Lemolo Reservoir, Thielsen Creek, and Lake Creek (Figure 23).

Brook trout are present in Lemolo Reservoir, Pit Lakes, Lava Creek, the Clearwater River, the North Umpqua River from its origin at Maidu Lake to Lemolo Reservoir, intermittently in Lake Creek, Thielsen Creek, and Poole Creek (Figure 23).

Kokanee reside in Lemolo Reservoir and enter the upper North Umpqua River and Spring River to spawn (Figure 23).

Tui chub are present in lower Lake Creek, Lemolo Reservoir and possibly Pit Lake #2.

The segment of the North Umpqua River between Soda Springs Dam and Lemolo Dam is dominated by resident trout, but it is not considered to be part of the affected environment since project effects are not expected to be realized anywhere below Lemolo reservoir. Soda Springs Dam, located 22 miles below Lemolo Reservoir, is a complete barrier to upstream fish passage, and consequently, represents the upper extent of anadromous fish in the North Umpqua system today. Five of the fish species that occupy the North Umpqua River below the hydroelectric development (22 miles downstream of Lemolo) have special status. Oregon Coast (OC) coho salmon are listed as a Threatened species under the Endangered Species Act, while Coastal cutthroat trout, spring Chinook salmon, steelhead, and Umpqua chub are all recognized by the Forest Service as sensitive species. None of these species are within the affected environment of the D-Bug project because of the sheer distance downstream from the project.

AQUATIC INVERTEBRATES

There are currently two aquatic invertebrates listed as sensitive by the USDA Forest Service Region 6 Regional Forester for the Umpqua National Forest:

Western ridged mussel (*Gonidea angulata*)

Western ridged mussels occur in streams of all sizes and are rarely found in lakes or reservoirs. They are found mainly in low to mid-elevation watersheds, and do not often inhabit high elevation headwater streams (Nedeau et. al 2000). As such the planning

area is unlikely to provide habitat for this freshwater mussel and is not considered to be part of the D-Bug affected environment.

Rotund Lanx (*Lanx subrotunda*)

The rotund lanx is a small freshwater limpet (length 10-20 mm). Current distribution appears to be scattered and local in portions of the North Umpqua River below the confluence with Little River, and Little River. It is not likely that this invertebrate occupies any of the streams in the planning area since a 2006 aquatic mollusk survey found this species in mainstem locations. As such the planning area is unlikely to provide habitat for this freshwater mussel and is not considered to be part of the D-Bug affected environment.

AQUATIC HABITATS

Existing Conditions

Diamond Lake and Lemolo Lake are the two largest fish bearing lakes in the analysis area, both representing long-term recreational fisheries. Diamond Lake was infested with tui chub, a small fish native to the Klamath basin that was inadvertently introduced in the early 1990s. In 2006 the water level of the lake was drawn down by eight feet in order to eradicate the chub with rotenone to kill all fish. In 2007 Diamond Lake was restocked with rainbow trout and the fishery has rebounded. Lemolo Reservoir is created by the Lemolo 1 diversion dam of the Toketee hydroelectric project. It also provides an important recreational fishery, but contains a population of tui chub, whose population remains fairly stable presumably due to deeper shorelines with less potential spawning habitat than Diamond Lake. Pit Lakes #1 and #2 are former gravel pits developed as small lakes that have been stocked with rainbow trout. They are located south of Lemolo Reservoir.

A detailed discussion of Lemolo Reservoir and Diamond Lake is available in the Lemolo/Diamond Lake Watershed Analysis and the Diamond Lake Restoration Final Environmental Impact Statement (USDA, Umpqua National Forest, 2004).

Most of the planning area streams flow through the High Cascade Geologic Province which is characterized by low stream density and slow storm runoff response in contrast to the more rapidly responding Western Cascades province as (see section on Fluvial Erosion). There are approximately 47 miles of fish bearing stream (Table 45) that make up the various subwatersheds that D-Bug overlays (Figure 23).

Brief descriptions of the habitat contained in each stream are provided below. For detailed descriptions, see Appendix A of the Lemolo/Diamond Lake Watershed Analysis (USDA, Umpqua National Forest, 1998) and Appendix E of the Upper Clearwater Watershed Analysis.

North Umpqua River

The North Umpqua River, upstream from Lemolo Lake, has a main stem length of approximately 9.8 miles. The river originates at the outflow from Maidu Lake. Summer water temperatures are cold throughout most of the channel main stem, typically ranging from 6-14°C, with temperatures above 15°C being rare to very rare.

The occurrence of instream large woody material in the North Umpqua River above Lemolo Reservoir is at fully functional levels throughout the low to mid reaches, with

somewhat high levels present in the upper half of the channel main stem. The pattern of pool frequency is unusual in the channel main stem; in that pool frequency is inversely proportional to woody debris frequency. Pool frequency ranges from low in the lower reaches to very low in the upper reaches.

Downstream from Lemolo Lake, the North Umpqua River flows for roughly 16 miles before entering Toketee Reservoir. From Toketee Reservoir, the river flows for another 4.5 miles before entering Soda Springs Reservoir. From Lemolo Reservoir, downstream to the end of the hydroelectric project at the Soda Springs dam, the North Umpqua River has been highly modified by dams, diversions, low flows, and canals.

Upper Clearwater River

The Clearwater River mainstem above Stump Lake has a main stem length of approximately 5 miles. It is a fundamentally intact cold water system. The North Umpqua Hydroelectric project minimally affects only the lower few hundred feet of habitat by slowing water velocity as it enters Stump Lake. Very little riparian timber harvest has occurred and riparian road construction has been limited. Only one timber harvest unit near the downstream end of the reach is partially within designated riparian reserves.

Lava Creek

Lava Creek, which is tributary of the Clearwater River, has a channel length of about 4.7 miles. Functioning woody material levels are very low and fine sediment deposition is high. It is likely that spawning habitat for rainbow trout and rearing space have been somewhat reduced from a combination of instream salvage, stream cleaning, and a stand replacing fire in portions of the watershed that occurred in 1910. High levels of fine sediment deposition most likely resulted from a combination of fire history, geologic factors, timber harvest, and road construction. Since most of Lava Creek mainstem flows through ash deposits, it is naturally susceptible to a high fine sediment load.

Spring River

Spring River originates from a large spring complex that produces the vast majority of the stream flow. Water emerging from the spring source is cold, approximately 5°C. The water warms considerably, most likely due to a very high width/depth ratio, in the short 1.0 mile channel length during the summer. Spring River is believed to be an important spawning area for brown trout and kokanee. Both species are known to enter the Spring River to spawn, and juvenile rearing is also likely to occur. The preference for spawning in Spring River is most likely due to a combination of stable flow, extensive deposits of spawning sized gravel and appropriate water temperature.

Poole Creek

Poole Creek has a channel length of approximately 1.2 miles, and is a tributary to Lemolo Reservoir. The lower half of the stream is low gradient with high sinuosity, while the upper portions channel gradient increases to over 10% with only about 25% of the stream classified as pool habitat.

Lake Creek

Lake Creek has a channel length of approximately 11.6 miles. Lake Creek originates at the outlet of Diamond Lake, and empties into Lemolo Reservoir. Lake Creek naturally contains warmer water because it is fed by the warm surface waters of Diamond Lake.

Stream habitat is fairly consistent as the stream passes primarily through low gradient topography. A considerable amount of stable, hydraulically functioning woody debris is present.

Thielsen Creek

Thielsen Creek has a channel length of approximately 12 miles, and is a tributary to Lake Creek. Summer stream temperatures are generally cold (5-9°C) with temperatures above 10°C occurring rarely. Large woody debris frequency is high in the lower reaches of the stream, and declining to a moderate level in the upper reaches. Woody debris appears to be the dominant pool creating feature throughout the stream.

Silent Creek

Silent Creek has a mainstem length of approximately 2 miles. It originates in pumice flats southwest of Diamond Lake and empties into the southwest corner of Diamond Lake. Summer water temperatures in Silent Creek are cold with temperatures of 4.5 to 7° C. It is mostly a wide, stable stream without scoured bed or banks.

Direct and Indirect Effects

For this analysis, direct effects are those potentially occurring in the immediate vicinity of the aquatic habitat type over the short-term. Short-term is considered to be during project implementation which could proceed for five years or more and shortly after implementation (within about 2 years of implementation). Indirect effects considered in this analysis are those effects that may occur over longer time periods (more than 2 years) or that may occur downstream of the immediate project area.

None of the action alternatives have the potential to affect any of the physical habitats occupied by resident fish and other aquatic organisms because all four road stream crossings occur in intermittent channels well away from fish and well away from perennial water and associated aquatic life. All perennial streams would have no cut buffers averaging 50 feet on either side of the stream which would mitigate any direct effects to aquatic organisms during thinning and fuel treatment operations.

No direct effects to physical stream habitats from peak flow increases are expected as a result of any of the action alternatives (as discussed in the section of stream flows), thus increased peak flows originating from the D-Bug alternatives would not occur in any project area streams or in any downstream areas either. Any turbidity or sedimentation associated with work in intermittent channels or log haul in the vicinity of streams is not expected to arrive to perennial downstream areas in any appreciable quantities to affect physical aquatic habitats where fish and other aquatic life occur. Similarly, no water quality impacts are expected to occur in any streams or lakes as a result of any of the D-Bug alternatives (as disclosed in the section on water quality).

The four impoundments that exist between the D-Bug area and where anadromous threatened and sensitive fish species exist, completely eliminate any risk of effects from peak flows, sedimentation, and turbidity to fish listed as threatened or sensitive and to any other aquatic organisms. The impoundments between the project area and Toketee Falls moderate the potential effects of water enrichment from both nutrient leaching and erosion. Before reaching the point of effect for the threatened Oregon Coast coho salmon and the sensitive salmonid fish species, runoff from the analysis area is influenced by impoundments in Lemolo, Toketee, and Soda Springs reservoirs, and diversion through approximately 20 miles of canals and four generators. A result of reservoir impoundment is that most fine sediment is removed from the system before

reaching areas downstream, thus making it nearly impossible for any effects of this project to impact threatened or sensitive species downstream.

None of the connected actions proposed under any of the action alternatives such as reforestation, down wood creation, subsoiling, noxious weed control, native species revegetation, and precommercial thinning, would result in any direct or indirect effects over the long-term or in downstream areas. All of these connected actions are minor activities of limited scope and duration that would result in no direct effects. As such, these connected actions would have no chance of resulting in either long-term effects or downstream effect to water quality, fish or fish habitats. No direct or indirect effects associated with Alternative 1 to fish or aquatic organisms are expected, because no ground disturbing activities would occur.

Cumulative Effects

Since no direct or indirect effects would occur to fish or aquatic organisms no cumulative effects are possible under any of the D-Bug alternatives.

ESSENTIAL FISH HABITAT (EFH) UNDER THE MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT (MSA)

The MSA requires Federal agencies to consult with the Secretary of Commerce regarding any action or proposed action authorized, funded, or undertaken by the agency that may adversely affect essential fish habitat (EFH) identified under this law. The MSA defines adverse effects as any impact, which reduces the quality and/or quantity of essential fish habitat. Adverse effects include direct, indirect, site specific or habitat wide impacts, including individual, cumulative or synergistic consequences of actions. This law deals with commercial fisheries. Coho and Chinook salmon are considered for this project.

Based on the above discussion of direct, indirect, and cumulative effects, the D-Bug Project is expected to have no chance of causing an effect upon essential fish habitat, the species considered, and their major freshwater prey species. Major prey species are considered to be a variety of aquatic macroinvertebrates, including but not limited to the aquatic and winged adult phase of the following insect groups: stoneflies, mayflies, caddisflies, and midges. No direct, indirect, cumulative, or synergistic effects to EFH are anticipated under the project. Coho and Chinook salmon are not found in the vicinity of the project planning area; and the chances of any effect being realized are so small as to be considered discountable and insignificant. Therefore, all action alternatives have been given the following EFH effects determination: Would Not Adversely Affect.

Social Environment

ECONOMICS

The disclosure of economic effects of each alternative is detailed in this section. This economic analysis focuses on the direct, indirect, and induced costs and benefits of the alternatives and the connected and similar actions described in Chapter 2. Since the purpose and need for action includes many activities that are not directly related to commercial timber harvest, impacts will be displayed as a “least cost” analysis. Net present value is normally used to compare the direct effects of the alternatives to the Federal Government, and is termed economic efficiency analysis. Net present value will be displayed as a means of comparing alternatives and as a measure of how much of the non-timber harvest activities can potentially be paid for with timber value. Impacts to

the general economy of the area are modeled using IMPLAN Professional, an input/output model developed by the Forest Service (IMPLAN 2000). Assumptions regarding the economic analysis are footnoted where appropriate.

Affected Environment

Most timber sales from the Diamond Lake Ranger District are purchased and operated by individuals and companies based in Douglas and Jackson Counties. The D-Bug project area is centrally located from several industrial centers in Douglas, Jackson, and Klamath counties. This analysis will address all three counties as the economic area.

Table 53 describes the population and employment statistics for the economic area as of 2006, according to the IMPLAN data. Total employment in the economic area is difficult to quantify exactly, as the Oregon Labor Market Information System (OLMIS), Census Bureau, and IMPLAN use different criteria to measure employment. Because of this, percentages and relative differences are used for analysis where possible.

Forestry and wood products sectors have declined in the last two decades in the economic area. Still, the logging, forestry and wood products sectors provide 6.0% of the economic area's employment, and 11.9% of the overall industrial output, according to the 2006 IMPLAN data. Total forestry and wood products industrial output for the economic area in 2006 was \$2.6 billion.

Table 53. 2006 Population and Employment (IMPLAN).

County	Total Population	Total Employment	Logging & Forestry Employment	Wood Products Mfg Employment	Forestry & Wood Products Empl %
Douglas	105,117	52,070	1,868	4,280	11.8
Jackson	197,071	123,497	2,852	1,687	3.7
Klamath	66,438	33,231	626	1,251	5.6
Totals	368,626	208,798	5,345	7,218	6.0

Douglas County continues to be more dependent on the wood products sectors than the rest of Oregon, and the other counties in the economic area. The trends in employment in the area show an ongoing shift from logging and wood products manufacturing toward retail sales and service sectors (OED 2002). Although overall non-farm employment in Douglas County is expected to grow by 11.8% between 2002 and 2012, lumber and wood products occupations are expected to decline by 3.4%. IMPLAN data through 2006 show an 11.9% decrease in forestry, logging and wood products manufacturing from 2002 in Douglas County. Woods products sector employment in Jackson and Klamath counties has actually increased from 2003 to 2006, recovering some from the slowdown in 2002. The average annual wages paid in the retail and service sectors (\$21,913 and \$24,915 respectively) are far less than the forestry, logging, and wood products manufacturing average wage (\$46,014) based on the 2006 IMPLAN data.

The Umpqua National Forest timber sale program has increased from about zero in 2002 to a fairly stable program of about 45 MMBF per year. The action alternatives as described represent a large portion of the Umpqua's potential sale program from 2009 through 2011. Douglas County would receive 25% of the gross receipts from the sale of

timber through non-stewardship contracts from the project. These payments would be from money returned to the Federal Treasury as shown in Table 54.

Economic Efficiency Analysis

The direct economic effects of the alternatives are displayed in Table 54. The standard criterion for deciding whether a government program can be justified on economic principles is net present value (NPV) – the discounted⁹⁸ monetized⁹⁹ value of expected net benefits (OMB A-94).

Many factors affect the NPV of a commercial timber harvest alternative, including what revenues and costs to include, the timing of these events, the species, size, and volume per acre harvested, and the logging systems used. Logging and transportation of logs to mills is by far the largest cost center in the commercial harvest treatments. Harvest volume per acre is a critical component in that low volumes, such as most of the lodgepole pine areas, push the logging costs per MBF very high. The action alternatives have been designed with the least-cost logging methods that are consistent with standards and guidelines. Generally, mechanical, ground-based logging methods are the lowest cost. Helicopter logging in low volume, low value stands would cost up to twice the value of the timber and would make any such project impossible to sell. In addition, transportation costs have risen dramatically over the last year as diesel prices have increased.

Biomass harvest has been modeled in this analysis. Biomass is considered small diameter trees, tops, and other woody material that does not meet sawlog specifications. Biomass can be used for energy production, fuelwood, pulp, or other specialty products. Generally, if this material is brought to the landing as part of the sawlog harvest operation, it may be economical to haul this material to a facility for production when the markets are favorable. Table 54 displays biomass amounts that may be economically feasible to produce.

The non-commercial harvest treatments are primarily fuel reduction operations. These are included in this analysis as they represent costs to the federal government, although not associated with any sale of timber.

Table 54. Economic Efficiency Analysis.

	Alt 2	Alt 3	Alt 4
Timber Volume (MBF) ¹⁰⁰	45,664	33,956	54,186
Total Commercial Harvest Acres	6,989	5,321	8,675
Volume (MBF)/Acre	6.5	6.4	6.3
Potential Biomass (green tons)	13,500	10,250	16,850
Total Treatment Acres	9,019	6,728	11,183
Total Present Value Benefits			

⁹⁸ Discounting is the process of calculating the present value of a future amount of money. 4% is the standard discount rate for long-term projects (OMB A-94).

⁹⁹ Lit. "to give the character of money to." A cost or benefit is monetized when it is expressed in terms of money.

¹⁰⁰ MBF is thousand board feet. The Forest Service estimates MBF using east-side Scribner rules, therefore the volume as shown, is higher than if west-side, long log Scribner rules would be applied.

	Alt 2	Alt 3	Alt 4
Gross Benefits	\$13,154,848	\$9,820,122	\$15,366,023
Value/MBF ¹⁰¹	\$288	\$289	\$284
Value/Commercial Harvest Acre	\$1,882	\$1,846	\$1,771
Total Present Value Costs			
FS Contract Prep & Admin	\$1,180,869	\$888,420	\$1,334,912
Logging	\$9,498,891	\$7,297,592	\$11,510,552
Timber Sale Slash Disposal	\$1,184,899	\$783,266	\$1,288,327
Road Work	\$82,408	\$79,995	\$85,263
Reforestation	\$82,028	\$0	\$98,844
Non-Timber Sale Treatments	\$1,029,060	\$970,365	\$961,202
Total Cost	\$13,016,947	\$9,993,787	\$15,267,366
Cost/MBF	\$285	\$294	\$282
Total Cost/Commercial Harvest Acre	\$1,862	\$1,878	\$1,795
Total Cost/Total Treatment Acre	\$1,443	\$1,485	\$1,365
Net Present Value	\$137,901	-\$173,665	\$98,657
NPV/ Commercial Harvest Acre	\$20	-\$33	\$11
Stumpage (2008 dollars)	\$2,401,000	\$1,654,251	\$2,404,059
Predicted Stumpage Price/MBF	\$52.58	\$48.72	\$44.37
Potential Return to the Federal Treasury (2008 dollars)	\$1,153,519	\$478,181	\$1,239,137

Forest Service planning costs are not included in the economic efficiency analysis since they are considered sunk costs¹⁰²(OMB A-94). It is estimated that this project has cost about \$750,000 to plan over the last two fiscal years. Based on the expected return to the Federal government shown in Table 54, all alternatives are close to or below cost, including planning, sale preparation, and administration, assuming the entire amount available for other treatments were sent to the Treasury instead. Alternative 1 is also below-cost since there would be no return to the U.S. Treasury with expenditures for planning.

The action alternatives would be marketed as up to seven individual contracts. These sales would be offered in a public auction to achieve the highest return possible¹⁰³. It is anticipated that some of the post-sale mitigation requirements and other treatments

¹⁰¹ West side delivered log prices have been adjusted to reflect equivalent east side values due to the differences in scaling rules.

¹⁰² Sunk costs are not factored into the cost efficiency analysis because they are incurred regardless of which alternative is selected.

¹⁰³ Individual timber sales would be appraised and offered at fair market value, or the minimum to cover reforestation costs and a \$0.50/ccf return to the Treasury, whichever is higher.

would not be fully paid for by stumpage¹⁰⁴ from the timber sales, especially the sales that are mostly low volume lodgepole pine stands. For Alternative 2, about \$86,000 of slash work associated with the commercial lodgepole stands would need to be funded with other sources. Alternative 3 would need \$202,000 and Alternative 4 would be able to cover the timber-related cost with stumpage.

Alternative 4 shows a negative net present value and would not be considered advantageous to the U.S. Government from an economic standpoint, due to the current low log market and relatively lower value tree species. Current low timber prices, low volume stands, and mitigation could make the timber sales uneconomic or too risky for purchasers, and could result in no bids for some or all of the sales.

Log prices fluctuate due to a variety of market forces, many of which are external to the market area and Oregon. The recent slowdown in nation-wide housing has caused the local log market to fall drastically. Figure 24 displays a composite log price average (\$/mbf) for the local Southern Oregon market since 1990 using Oregon Department of Forestry log price information. (ODF 2007) The data in Figure 24 are not adjusted for inflation and are equated to west side long log Scribner scaling rules. The economic efficiency analysis displayed in Table 54 uses average local log prices from the most recent four quarters (3rd qtr, 2007 through 2nd qtr 2008).

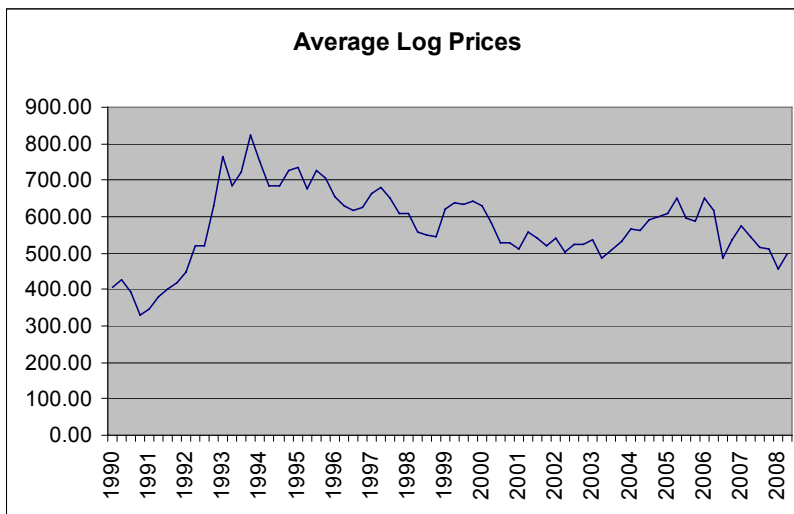


Figure 24. Average Composite Log Prices, Southern Oregon Market Area.

ODF data for the 2nd quarter of 2008 show the downward trend has slowed, but log prices have declined 23% in the last 2 years (Figure 24) and it is not clear when and at what level the market will stabilize. This decline in local log prices could impact the timber sale viability of each action alternative. As prices decline, less money would be available for post-sale activities, and the value of the timber would reach a point where an individual sale may not be marketable. It would be highly speculative to predict the local markets at the time of sale offer or operation.

¹⁰⁴ Stumpage is the value of the timber "on the stump." It is the timber sale contract minimum value and is determined by subtracting logging, road work, and slash disposal costs from the delivered log price. Timber sale purchasers may bid more in a competitive auction. The actual monetary return to the U.S. Treasury is determined by subtracting all post sale costs from the stumpage.

In terms of economic efficiency, Alternative 2 has the highest net present value, and has the potential to return the most money to the Federal Treasury. Alternative 2 has the highest predicted stumpage price, which would give it more of a cushion in this uncertain log market. This is due primarily to the stands that are commercially harvested, the slightly higher volume per acre and the species makeup in these stands.

In terms of a least cost analysis, several measures are important: total cost of all treatments and cost per acre. Table 54 displays these measures for the action alternatives. Alternative 3 is the least cost alternative, but treats the fewest acres and has the highest cost per acre. Alternative 4 treats the most acres and does it at the lowest cost per acre.

The minimum payments to the Treasury, payments to Douglas county, and legal and administrative rules for receipts from certain contracts limit how much of the stumpage from any particular sale can pay for other work. If all of the stumpage that is potentially available to return to the Treasury were in a form that could be spent on the project, all of the alternatives could cover the prescribed work from timber value.

It is estimated, however, that from 40% to 50% of the stumpage value would actually be available for other treatments through KV or stewardship receipts. Therefore, Alternative 2 would need an additional \$50,000 to \$290,000 from other sources, Alternative 3 would need an additional \$350,000 to \$500,000, and Alternative 4 would need up to an additional \$200,000 to fully implement the prescribed treatments. These amounts are in 2008 dollars, and could be spread over several years of implementation.

Economic Impact Analysis

The economic impact analysis using IMPLAN considers changes in employment and income due to changes in the economic activity of the county from each alternative. An individual timber sale may not substantially change the overall economic activity of the county, since the amount of timber volume represents a small percentage of the total demand. Timber sales from the National Forest are viewed as raw material available for the local industry, allowing production and support for jobs in the local economy to be sustained. Local National Forest timber would offset logs imported to the area, potentially reducing overall costs and increasing production.

Table 55 displays the results of the economic impact analysis by alternative. In general, the sale of timber from the National Forest would result in sustained or increased employment in the logging and wood products manufacturing sectors, in the forestry services (slash treatment, planting, etc.) and indirect and induced employment in many other sectors. Payments in lieu of taxes due to the counties in the economic area from timber receipts are not included in these figures, as they are accounted for in the return to the Federal Treasury shown in Table 54.

Other direct, indirect, and induced benefits are derived from road maintenance, reconstruction, fuels treatment, and other connected or similar activities (Chapter 2) that may be funded by revenue from the timber sales or other funding sources. These work activities are treated as costs in the benefit/cost analysis since they reduce the revenue to the Federal Treasury, but they have economic benefits to the local community since most are contracted services. These benefits are included in the economic impact analysis and in the numbers reported in Table 55. The IMPLAN output files that document the complete analysis by sector are part of the Economic analysis file.

The numbers in Table 55 are not intended to be absolute. The analysis should be used to compare the relative differences among alternatives. The value of each activity

included in the impact analysis was estimated from the cost and benefit analysis spreadsheets. An estimate was made of the percent of each activity's value that would be spent locally. The value to the wood products manufacturing sector was estimated to be 40% of the delivered log price, reflecting the difference between end product value and log cost to the mill. This difference can be widely variable based on mill efficiency and the choice of end products, but it approximates the value given for all of Oregon in 1998 (Gebert et al., 2002).

Table 55. Economic Impact Analysis.

	Alt 2		Alt 3		Alt 4	
	Value/%		Value/%		Value /%	
Change in Total Industrial Output	\$23,870,000	0.11	\$18,082,000	0.08	\$28,181,000	0.13
Change in Employment (# jobs)	181	0.09	137	0.07	211	0.10
Change in Labor Income	\$6,826,000	0.10	\$5,162,000	0.07	\$7,981,000	0.11

Direct, Indirect, and Cumulative Effects

Alternative 1 is not shown in Table 55 since by definition it would not change the conditions or level of economic activity in the project area. This alternative may, however, contribute to a decline in the local timber industry, since it would keep federal timber from the market, at least in the short-term. No attempt was made to quantify that impact, as it would be speculative to estimate the current and reasonably foreseeable timber supply in the local area.

Alternative 4 would provide the highest level of beneficial, direct and indirect effects to the local economy. These effects are relatively small in terms of the percentage of the economic area activity in each category, however the effects to particular sectors is much greater. Logging contractors, log truck operators, slash treatment contractors, and other forestry services located in the economic area would be impacted directly. Alternative 4 would provide 120 direct and indirect jobs in these sectors, or 2.1% of the total sector employment, and \$4,616,000 in labor income.

Implementation of any of the action alternatives would contribute to a beneficial cumulative effect of sustaining the wood products infrastructure in the economic area, when combined with past and present timber sales in the area (Tables 12 and 13) and on the Forest, including the Lobo, Tugboat, Lemolo, and Wapiti Timber Sales.

ACCESS FOR MANAGEMENT AND THE TRANSPORTATION SYSTEM – TRACKED AS A SIGNIFICANT ISSUE

During scoping, several conservation groups expressed concern over the construction of new temporary roads and the retention of existing unclassified roads, stating that they cause numerous environmental impacts including erosion, channeling water, spreading noxious weeds, and reducing wildlife habitat. This significant issue was addressed in the development of Alternative 3. The environmental effects of roads are disclosed in numerous places in this Chapter including the sections on forest wildlife, botany, water quality, mass wasting, surface erosion, riparian reserves, and fisheries. This section

displays the overall effects of the alternatives in terms of miles of roads, access, and economics and displays the acres treated by mile of temporary road built, in response to a request from conservation groups for this type of analysis.

Access for Management

To help quantify and track the issue of road use for thinning activities through the analysis the following indicators were developed:

- Miles of temporary road built.

Direct and Indirect Effects

Chapter 2 summarizes the road activities and effects to access in the planning area by alternative. Alternative 1 has no direct or indirect effects to the total miles of road in the watershed.

Access for management under the action alternatives would increase access for forest management activities only, as all new temporary road construction and reuse would be blocked and/or obliterated after use, with the exception of Trail 1457, which is an old road currently designated as an OHV trail. The current road density in the planning area is 2.83 miles/mile². Decommissioning of the three segments of road described in Chapter 2 would reduce the road density to 2.75 miles/mile² for Alternatives 2 and 4 and 2.78 miles/mile² for Alternative 3 (Table 29), slightly decreasing access for management. The effect of this decreased access for land managers is minimal, as two roads are short spurs and one road is currently blocked.

In addition to disclosing the amount of temporary road built, the acres accessed by the temporary roads were analyzed for full disclosure. Alternative 2 constructs then obliterates 15.4 miles of temporary road, accessing about 1,883 acres of commercial and non-commercial stands, resulting in about 122 acres of treatment accessed per mile of temporary road. Under Alternative 3, about 10 miles of temporary road is constructed then obliterated, accessing about 1,022 acres of commercial and non-commercial stands, resulting in the effect of treating 102 acres per mile of temporary road built. Under Alternative 4, about 25.1 miles of temporary road is constructed then obliterated, accessing about 3,503 acres of commercial and non-commercial stands, resulting in the effect of treating 139 acres per mile of temporary road built.

In comparing the action alternatives, Alternative 3 constructs and decommissions 5.4 fewer miles of road than Alternative 2, and 15.1 miles less than Alternative 4, while Alternative 2 constructs and decommissions 9.7 miles less temporary road than Alternative 4.

Transportation System

The transportation system in the D-Bug planning area provides access for commercial users, including forest product harvesters. Recreation use includes on hunting, hiking, fishing, winter sports, and driving for pleasure

The transportation system is described in the Forest Roads Analysis and in the Diamond Lake/Lemolo Lake and Clearwater River Watershed Analyses. These documents are included in the Project File and are incorporated by reference.

The transportation system is a network of existing roads, referred to as “system roads” because they are classified for long-term use. System roads are categorized and managed for various levels of access from closed roads that are only intended for administrative use such as logging or fire fighting (maintenance level 1 roads), to open

roads maintained for either high clearance vehicles (maintenance level 2 roads), or passenger cars (maintenance level 3 - 5 roads). This section discloses the effects of the alternatives on public access.

Relevant Standards and Guidelines

Transportation system standards and guidelines are listed on pages IV-81 to IV-85 of the LRMP. Of particular note are the following:

Road density should be the most economical system necessary to meet land management objectives. Evaluation of road development alternatives will be made for the planned uses considering safety, costs of transportation, and the effects upon lands and resources.

Assure short-term (temporary) roads are closed within one year of when the timber purchaser has completed contractual requirements for the portion of the timber sale served by the road. Re-establish vegetation cover to put land back into production within ten years of contract, lease, or permit termination on roads not remaining a permanent part of the Forest transportation system.

Forest development roads (system roads) will generally be open to use by vehicles licensed for highway travel, except when closed for one of the following reasons:

1. The mode of access causes unacceptable damage to, or negates adequate protection and management of Forest resources.
2. Safety hazards to the road user exist.
3. Prescriptions in the Forest Plan recommend closures in elk winter range.
4. To provide security to contractors/cooperators, special use permittees, private land owners, and Forest Service administrative facilities.
5. Road maintenance costs to keep a road open are high compared to existing or expected use of the road.

Roads closed for one of the above reasons may be closed either seasonally or year-around. Seasonal closures are preferred over year-around closures, wherever feasible, consistent with Forest Plan prescriptions, and if the objectives of the closure can be met.

Direct and Indirect Effects

Road reconstruction is generally intended to fix specific drainage concerns, perform deferred maintenance items, and bring the road surface to the design standard so it can facilitate timber haul. Specific road reconstruction activities are identified for each alternative in Chapter 2. Alternatives 2, 3 and 4 include decommissioning one stream crossing not associated with timber haul in the summer home area. The reconstruction and maintenance work would provide for safe and economical timber haul, as well as improved drainage capacity and lower risk of road failure.

Road maintenance is important for user comfort and safety, and protection of resources and the road facility. The Umpqua Forest-level Roads Analysis (USDA, Forest Service 2003) describes the current situation of declining budgets for road maintenance, the reduction in timber sale-related maintenance and the amount of maintenance that needs to be done on the Forest. Maintenance that would be performed by timber purchasers would provide a substantial portion of the total needs for several years. Alternative 2 would result in 67 miles of purchaser road maintenance over the period of the associated timber sales. Alternative 3 would result in slightly less purchaser

maintenance totaling 62 miles, while it would be increased to 70 miles in Alternative 4. Alternative 1 provides for no purchaser maintenance. Improved road maintenance results in higher degrees of user comfort and safety. In addition, well-maintained roads reduce the risk of road failures and the resulting ecological and economic effects. Alternative 1 would not result in any of these beneficial effects.

Under all action alternatives, road reconstruction would occur along 4.7 miles of system road, resulting in a beneficial effect of lowering the potential of road failure and loss of access along these haul routes. Alternative 1 would maintain the existing condition and not reconstruct these sites because no action would be taken under this alternative.

Cumulative Effects

The Diamond Lake/Lemolo Lake and Clearwater River Watersheds is the scale at which cumulative effects are analyzed for roads. The overall change in the number of total road miles in the planning area is small (<1%) for any of the action alternatives, when compared to Alternative 1. The decommissioning of the roads described in the similar actions under each action alternative reduces the existing road density by less than 0.08 miles/mile². Because of this small change, there would be no measurable decrease in road density, when combined with the lack of any present or future projects that would add or subtract from the road network (Tables 12-14). None of the other connected actions affect access for management or the transportation system.

RECREATION

Recreation opportunities and use within the watershed follow the goal outlined in the 1990 Land and Resource Management Plan (LRMP) for the Umpqua National Forest:

“...provide a broad spectrum of dispersed and developed recreation opportunities to all segments of society.”

Forest Plan Standards and Guidelines

- Developed Recreation S&G #5: Sites will be administered and maintained to provide visitor safety, sanitation, and protection of facility and site resources.
- Trails S&G #2: Existing system trail tread must be relocated, reconstructed or restored after logging activities are concluded. Logging slash will be cleaned up and signing restored.

Existing Conditions

Approximately 70 percent of the planning area is managed primarily for recreation. It contains the Diamond Lake Recreation Area (Figure 25), Lemolo Lake Recreation Composite (Figure 26), dispersed recreation, the Mt. Thielsen Wilderness and Oregon Cascades Recreation Area (OCRA), extensive summer and winter trail systems and portions of the Rogue-Umpqua Scenic Byway. The Diamond Lake-Lemolo Lake and Clearwater Watershed Analyses, and the 2006 Diamond Lake Winter Use Guide provide a thorough description of the recreational opportunities found in the area and are incorporated by reference.

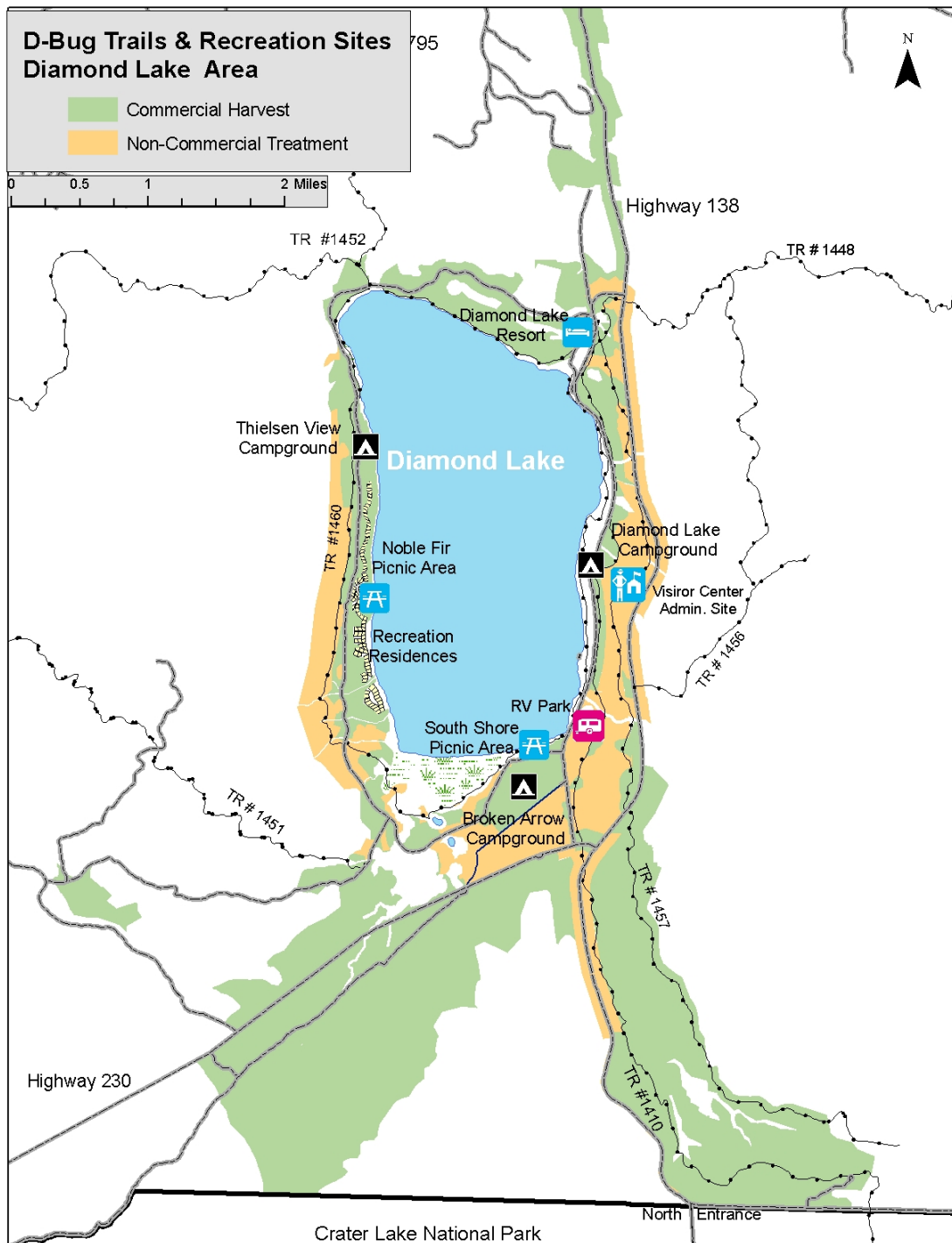


Figure 25. Major Recreation Sites and Trails in the Diamond Lake Recreation Area, with treatment areas under Alternative 4 shown as an example.

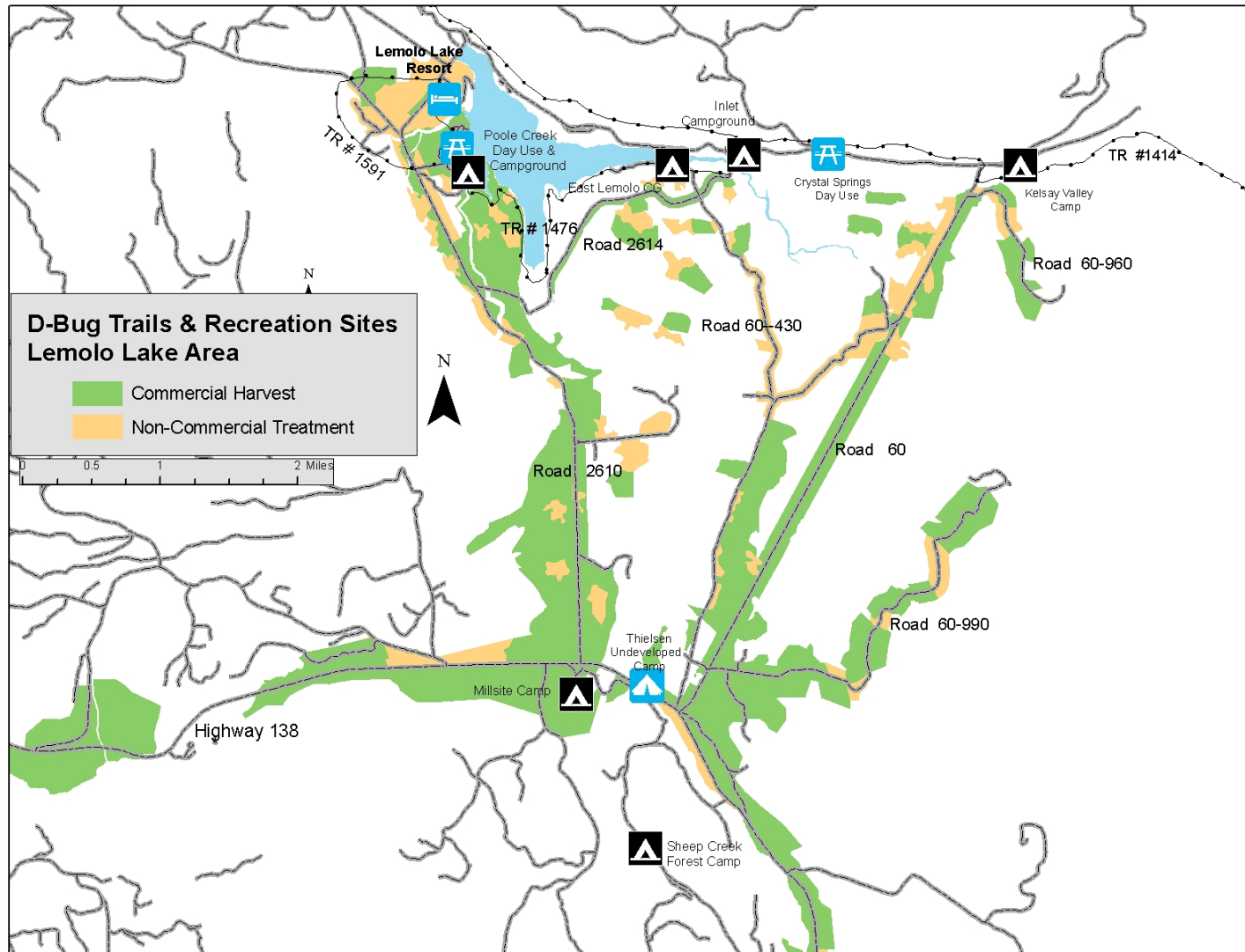


Figure 26. Major Recreation Sites and Trails in the Lemolo Lake Recreation Area, with treatment areas under Alternative 4 shown as an example.

Trails

During scoping, some conservation groups expressed concern that log haul on top of existing trails and thinning next to existing trails will negatively affect the trails and the recreation experience due to the impacts from logging and other fuel reduction treatments.

Umpqua Watersheds and Klamath-Siskiyou Wildlands Center state that log haul on snowmobile trail #1457 (a segment of the Summit Trail) and thinning in the vicinity of cross country ski trail #1410 (a segment of the North Crater Trail) would affect the recreation users and that off-road vehicle use¹⁰⁵ would increase as a result of the thinning and the log haul. Further, Oregon Wild states that use of trail #1457 as a haul road would degrade the potential wilderness area characteristics in the vicinity.

The following indicators quantify and track this issue:

- Miles of trail used for logging access.
- Acres of commercial and non-commercial treatment within 200 feet of trails.

Trails within the planning area comprise approximately 70 percent of the total number of trail miles within in Diamond Lake Ranger District. Trails vary from wilderness to paved handicap-accessible trails, accessing numerous lakes, creeks, mountains, and other points of interest. There are both motorized and non-motorized trails throughout the watershed, used in summer and winter by hikers, bicyclists, Off Highway Vehicles (OHVs), motorcyclists, cross-country (Nordic) skiers, and snowmobilers. Approximately 60% of these trails are part of the Winter Trails System. Many of the winter trails are groomed for motorized and non-motorized users by Diamond Lake Resort and snowmobile associations in cooperation with the Oregon State Snowmobile Association (OSSA).

Specific to the D-Bug project, the following trails (hiking and/or Nordic) are located in the planning area (Figures 25 and 26):

Diamond Lake area: North Crater Trail - # 1410; Howlock Mt. Trail - #1448; Mt. Bailey Trail - #1451; Mt. Thielsen Trail - #1456; Summit Trail - #1457; Dellenback Trail (including Diamond Lake Loop, North Shore, Thielsen View Connect, Silent Connect, and Broken Arrow North & South) - #1460; Pacific Crest Trail - #2000. Road 4793, Cinnamon Butte Road, is used as a Nordic trail in the winter.

Lemolo Lake area: The 860 spur (Pipeline Trail) and 800 spur (Basket Trail) are used by Nordic skiers. Other trails include the #1476, #1589, #1591 and portions of the Sidewinder Trail, the Poole Creek Loop Trail, and the Resort Connect Trail.

Clearwater area: Road 4785, and its spurs, 010, 012, and 060 are all used as Nordic trails in the winter.

Snowmobile (and/or ATV) routes include Road 4795 (Diamond Lake Loop Road), Crater Trail - #1457, Lake West Trail (along the 100 spur and Road 760), Road 4792 (Lemolo Lake Road); and the road system near Windigo Pass, including Roads 60, 430, 970, 2614, 1612, 410, 411, 570, 3401, 200, 500, 800.

¹⁰⁵ The Umpqua National Forest has begun the Travel Management process as required. A final determination of areas where summer OHV use is allowed will be made by September of 2009. Until such time, district travel management maps display areas that are open or closed to summer OHV use. Winter OHV use will not be considered during this planning process and will continue to follow existing use designations.

As stated above, scoping comments focused primarily on impacts from use of the Summit Trail (#1457) as a haul route, and thinning along the North Crater Trail (#1410).

Direct and Indirect Effects

Direct effects are those that would occur immediately at the trail site, while indirect effects are those that would occur in the future both at the stand and trail scale as vegetation grows over time.

Alternative 1 would have no direct effects on any trails as no activities would occur. Indirectly, the mountain pine beetle outbreak would continue to spread, killing trees across the landscape under no action. These dead trees may be a hazard to people where they are within falling distance of a trail. When they fall, these trees could damage or block the trail, and although remotely possible, people could be injured if they were present when the trees fell. In addition, as more trees die, the fire hazard increases. A widespread, high intensity fire would potentially damage existing trails, primarily through tree fall (trail blockage) after the fire has swept through the area.

There would be no direct effects to Trails 1456 and 2000, as no activity would occur along these trails. Indirectly, sounds may travel during operation of equipment under the action alternatives. However, given that one can hear the sounds of Highway 138 for almost ¼ mile up the trail, this impact is considered minor. No other activities and no past or future projects would affect these trails except for regular, routine trail maintenance; therefore, because the direct impacts are minor and there are no other impacts, there would be no cumulative effects to these trails.

In general, under the action alternatives, impacts to trail users include: tree felling across or along trails; visible slash, stumps, and burned areas (after slash treatment); more open tree spacing; increased sunlight; increased snow interception; increased noise from populated areas or roads; decreased feelings of solitude; and increased sight distance and visibility. These effects would last anywhere from 5 to 30 years, depending on the forest vegetation; impacts would decrease as vegetation grows. All direct impacts to the actual trail footprint, such as trees felled across the trail, would be mitigated by the purchaser, who would be required to return the trail to its pre-treatment condition (Forest Plan S&G Trails #2). To mitigate for safety concerns, all trails that cross areas of treatment or are within 200 feet of a treatment area would be signed as closed until the trail was safe for use. The details of these requirements are described at the end of Chapter 2.

The action alternatives would result in the beneficial effect of improving stand resiliency, reducing fire hazard, and decreasing the number of hazard trees that pose toppling hazards to trail users. Trails that have not been maintained due to lack of trail maintenance funding would potentially be improved by reducing the number of trees that may block the trail and by clearing of the trail if it is used during haul or movement of equipment.

Where trails coincide with a fuelbreak, the maintenance of the fuelbreak would periodically alter vegetation over time, causing a long term indirect effect. Once a fuelbreak is established, the maintenance can occur predominately through non-commercial methods. The continued maintenance would maintain a more open forest that may be visually pleasing to some, while to others, it may detract from the visitor's experience. Overall, the beneficial effect of lowering the fire hazard and having evacuation routes accessible for those using the area outweighs any negative impacts from non-commercial maintenance of fuelbreaks.

In the Diamond Lake area, Trails 1410, 1448, 1451, 1457, and 1460 are the primary trails that would be directly affected by the D-Bug action alternatives (Figure 25). Currently, portions of Trails 1410 and 1457 that are directly adjacent to Diamond Lake (between Road 4795 and Highway 138) are being heavily impacted by the current mountain pine beetle infestation, as are other trails in the vicinity. Trees are dying at rapid rates and the hazard from these trees is growing. As dead trees fall across the trails, funding for clearing these trees is diminishing, reducing the ability of users to maneuver over the trails.

Umpqua Watersheds and Klamath Siskiyou Wildlands expressed concern about Trails 1410 and 1457, primarily where they run adjacent to the Highway and along the OCRA boundary, south of the Highway 138/230 junction. All of the action alternatives would impact Trail 1410 through thinning or fuels treatments, which parallels Highway 138. Within 200 feet (either side) of the trail¹⁰⁶, commercial activity would occur on 281 acres, while non-commercial activity would occur on 92 acres parallel to Trail 1410. Under Alternative 3 within 200 feet of Trail 1410, commercial activity would occur on 124 acres, while non-commercial activity would occur on 82 acres. Impacts include those listed above and include visible stumps and slash, increased sight distances and increased sounds; however, no haul would occur on the trail. Instead, under Alternatives 2 and 4, temporary roads would cross the trail along 5 locations, while under Alternative 3, one road crossing would occur. Any direct impacts to Trail 1410, such as felled trees or disrupted tread, would be rehabilitated to its pre-disturbed state, as required by Forest Plan Trails S&G #2.

Under Alternatives 2 and 4, the 8.7-mile winter trail 1457 would be used as a haul route for 7.9 miles. This trail is partly within the footprint of the old Highway 138 and much of this trail can be driven today by a 4-wheel drive vehicle. Using this trail as a haul route would require some widening of the trail and felling of hazard trees, which would be a beneficial effect to snowmobile users, as the trail would be cleared and the potential for hazard trees to fall would be reduced; no haul would occur during winter, so there would be no direct impact to users from trail closures. The use of Trail 1457 for haul would be a negative impact for summer users, as the trail would be closed for summer use, primarily impacting mountain bike riders. However, these riders would also benefit in the long term by having the road cleared. Within 200 feet (either side) of the trail, commercial activity would occur on 201 acres, while non-commercial activity would occur on 134 acres. Under Alternative 3, haul would occur along 4.5 miles of Trail 1457, just east of Diamond Lake between Road 4795 and Highway 138. Alternative 3 proposes within 200 feet of the trail, commercial activity on 61 acres, while non-commercial activity would occur on 88 acres. Impacts include those listed above and include visible stumps and slash, increased sight distances and sounds. Any direct impacts to the trail, such as felled trees or disrupted tread, would be rehabilitated to its pre-disturbed state, as required by Forest Plan Trails S&G #2, which would likely improve the condition of the trail for many users.

Trail 1460, the paved Dellenback Trail, would also be directly affected by the action alternatives, as would the extensions of this trail that are located south of Diamond Lake. No equipment would be run on the trail surface, so no direct effects to the paved trail are expected to occur. Under all action alternatives, within 200 feet (either side) of the trail, commercial activity would occur on 274 acres, while non-commercial activity would occur on 194 acres. One haul road would cross the trail in Unit 33; however, this haul

¹⁰⁶ Both commercial and non-commercial activities extend beyond 200 feet in most places. Two-hundred feet was chosen as it represents the distance that most users would 'feel' an effect from activities.

road is an existing paved road and no additional impacts would be expected. In addition, commercial activity would occur within 200 feet of Trails 1460J, 1460K, 1460L, 1460H, 1481, and 1589L, which are all extensions or winter use loops that spur off of the Dellenback Trail. Within all these trails, commercial activity would occur alongside 98 acres and non-commercial activity along 48 acres.

Impacts to the Dellenback Trail and its' spurs include those listed above and involve visible stumps and slash, and increased sight distances and sounds. Some of the vegetation along this trail is quite dense. Thinning would potentially open up some vistas into the surrounding forests, possibly improving the scenic quality of the area for some users. The commercial and non-commercial activity that would occur along the trail under the D-Bug action alternatives would not be much different than the hazard tree falling that has been ongoing for several years at the Diamond Lake Campground. To mitigate for safety concerns, the trail would be detoured to the 4795 road and safety signs would be posted while workers are in the area. Work periods would be limited to Monday-Friday, 8:00 am - 6:00 pm, to alleviate safety concerns on the weekdays and to allow for use on weekends. This detour is expected to occur only for one season of work for the commercial activity. The non-commercial activity that extends beyond the Dellenback Trail involves using track mounted mastication machinery, chainsaws and hand tools to cut very small whips and brush; when track mounted machinery are working in the area, the segment of trail within 200 feet of where work is occurring may be closed for safety reasons.

A short segment of Trail 1451, which leads to the top of Mt. Bailey, would also be affected by 7 acres of commercial activity within 200 feet of the trail in Unit 29, as would the area surrounding the trailhead. About 0.2 miles of Trail 1451 lies within Unit 29; under Alternatives 2 and 4, the prescription would be overstory removal, retaining around 20 of the largest and healthiest lodgepole pine per acre, thus reducing the density of trees, opening up the canopy, increasing sunlight, and increasing the visibility of stumps and slash. Under Alternative 3, the prescription is variable thinning in lodgepole, retaining about 40 trees per acre. Thus, Alternative 3 would have less impact on this trail than Alternatives 2 and 4, particularly from a scenery standpoint. Within about 5 minutes of walking up the trail, these impacts would no longer be seen. Similarly, Trail 1479, a portion of the Silent Creek Trail near Trail 1451, would have work occurring over and along 0.3 miles of the trail and in the area where people park, with similar impacts as those described above. Any impacts to trail treads would be mitigated by the operator following treatment; the trail would also be closed during work periods. The length of trail affected by these treatments is small (0.5 miles between the two trails), when compared to the overall trail lengths (6.4 miles).

Trail 1448 that leads to Howlock Mountain, starts near the horse corrals and crosses Highway 138 before entering the OCRA and eventually the Mt. Thielsen Wilderness. About 1/3 of a mile of this trail runs through areas treated under all action alternatives. Within 200 feet of this trail, there would be 7 acres of commercial and 8.5 acres of non-commercial treatments. The effects to this trail would be the same as stated for other trails; this trail would also be closed during work periods.

Most of the trails used by winter OHV's are along existing roads that may be system roads or unclassified roads, such as the old Highway 138 and around Lemolo Lake (Figures 25 and 26). In addition, the trails around Poole Creek and Lemolo Lake Resort would be affected by treatments; most of these trails parallel or are along existing roads where treatments would overlap. Effects to those users are similar in that sight distances would be increased. Most winter users would notice very little change as they

travel over deep snowpacks and would not see stumps or slash. The treatments have the potential to open up the stands so that winter OHV's could travel deeper into the forest and move further off roads. However, this would only extend as deep into the stand as the treatment extends, which is generally less than 1500 feet from a main road. Beneficial effects of the action alternatives include better trail conditions as maintenance of the trail would occur during road maintenance or road reconstruction. In addition, there would be fewer hazard trees that would fall towards roads and the trail users, resulting in fewer trail blockages and blow down.

Cumulative Effects

Trail maintenance is the primary past, present, and reasonably foreseeable action that contributes to a beneficial cumulative effect to trails by maintaining trail conditions for users. Hazard tree felling along the Diamond Lake Campground is also beneficial for user safety, but the number of trees felled in the last 2 years may be detracting from the scenic experience for some users. There are no other past, present, or reasonably foreseeable actions that would impact the trails in the planning area. Therefore, because there are limited direct and indirect effects, mitigation would restore trail tread if damaged during operation, short-term trail closures would protect user safety, and trail maintenance is the only other action affecting trails in the area, there would be no potential for cumulative effects to trails in the D-Bug planning area.

Diamond Lake Recreation Area

The most concentrated developed recreation within this watershed is in the Diamond Lake Recreation Area (Figure 25). The Diamond Lake Recreation Area is approximately 8,100 acres and is centered around Diamond Lake with Mt. Bailey on the western side, Mt. Thielsen to the east, and Crater Lake National Park to the south. Diamond Lake is at an elevation of 5,182 feet, over 3,000 acres in size, and is approximately 3.5 miles long and 1.5 miles wide, and is surrounded by Road 4795. Diamond Lake is managed as a fishing lake by the Oregon Department of Fish and Wildlife (ODF&W) with a maximum speed limit on the lake of 10 mph.

Diamond Lake is a high use destination recreation area (approximately 700,000 Recreation Visitor Days [RVD's] per year). Diamond Lake has traditionally been recognized as a regionally and nationally renowned trout fishery with an average of over 100,000 angler days annually. Diamond Lake is identified in the LRMP as MA2, and is to be administered for concentrated developed recreation and has a Recreation Opportunity Spectrum (ROS)¹⁰⁷ class of Rural¹⁰⁸. To meet the recreational demand, the Diamond Lake Recreation Area contains extensive USFS and private permittee developments.

Campgrounds: The USFS operates and maintains three developed campgrounds (Diamond Lake, Broken Arrow and Thielsen View – Figure 25) with a capacity of 446 sites; two Day-Use areas (South Shore and Noble Fir); a hiker/biker camp (six sites); three group reservation areas; five boat ramps and docks; an overflow camping area; a Visitor Information Center; an administrative work center; sewer and water systems; and a paved bike path around the lake (the Dellenback Trail – see trails discussion).

¹⁰⁷ The ROS is an array of recreational activities, settings, and experiences used as a basic framework in planning and managing the recreation resource, and divided into the following classes: primitive; semiprimitive non-motorized; semiprimitive motorized; roaded modified; roaded natural; rural; and urban.

¹⁰⁸ Rural is an area characterized by substantially modified natural environment, with sights and sounds of humans readily evident and interaction between users often moderate to high.

Established Snow-Park sites include Three Lakes, South Diamond, North Crater, and Mt. Thielsen. The Diamond Lake Viewpoint and the Mt. Thielsen Viewpoint are pullouts or viewpoints that provide visitors with panoramic views of the area. Currently, there are hundreds to thousands of dead and/or dying trees within or adjacent to these campgrounds and/or other recreation sites. More trees continue to die every year from the mountain pine beetle outbreak.

The Diamond Lake area provides a wide variety of year-round recreational opportunities including: fishing, swimming, boating, camping, hiking, scenery viewing, birding, mountain biking, horseback riding, hunting, cross-country skiing, snowmobiling, dog-sledding and other snow play. Normal operating season for the USFS facilities is mid-April (depending on snow) through October, coinciding with the fishing season. During the winter months the campgrounds are closed and used for cross-country skiing and other winter sport activities.

Special Use Permit Areas: Other developments in the area are the Diamond Lake Resort (Diamond Lake Improvement Company), Diamond Lake RV Park, Summer Home Recreation Residences, and ODF&W. These developments operate under special use permits, and, with the exception of ODF&W, are privately owned facilities.

The Diamond Lake Resort (Figure 25), located primarily at the northeast corner of Diamond Lake, is a full service resort with 92 lodging units with capacity to lodge 500. There are four restaurants with a combined seating capacity of 665, two grocery stores, 2 marinas with a capacity for 186 boats, a gas station, 46 employee-housing units and miscellaneous support buildings. The resort has a water system and is connected to the USFS central sewer system. The resort has a total permit area of approximately 234 acres. Diamond Lake Resort operates year round. Major summer activities and services, in addition to lodging and fishing, are convention and reunion facilities, swimming, horse and bicycle rentals, charter boat service, boat and canoe rentals, and special events such as a square dance festival, a dock-dog competition, and a 4th of July Celebration. Major winter activities and services include snowmobile tours and rentals, inner tube sledding hill, ice skating, cross-country skiing and equipment rentals, and snow cat skiing on the west slope of Mt. Bailey.

Diamond Lake RV Park (Figure 25) is located at the southeast end of Diamond Lake on the east side of FSR 4795. The park has 140 spaces with full hook-ups (water, sewer, and electric), shower and laundry facilities and living quarters and maintenance building. It has a water system and is also connected to the Forest Service central sewer system. The permit area is 22.9 acres and is operated seasonally from mid-May through mid-October and closed during the winter months.

Diamond Lake Recreation Residences (Figure 25) are located along the west side of Diamond Lake between the lake shore and FSR 4795. There are 102 privately owned residences in the tract along the west shoreline of Diamond Lake that operate under a special use permit. Home lot sizes average approximately ½ acre with total permit acreage in the tract of 52 acres. Many of the summer homes have water and septic systems while others have no water and pit toilets. The residences are accessed by a series of unimproved roads off of Road 4795. Full time occupancy of the residences is not allowed and many are used only occasionally while others are used off and on year-round. Major uses are relaxation, fishing, biking, and winter sports (primarily snowmobiling). Access to the tract is closed by snow during the winter months with access by snowmobile or skiing.

ODF&W owns and manages a cabin, out building, and lake level control structure on the northwest corner of Diamond Lake at the outflow of Diamond Lake into Lake Creek. The cabin has a well and septic holding tank. Permit acreage is 3 acres. Use is primarily during the fishing season by Oregon State employees engaged in the management of the Diamond Lake fisheries.

The Lemolo Lake Recreation Area

The Lemolo Lake Recreation Area is approximately 1,290 acres and is centered around Lemolo Lake (Figure 26). Lemolo Lake is a man-made reservoir operated by PacificCorp as a hydroelectric facility. The lake is approximately 419 acres in size at an elevation of 4,230 feet. ODF&W is responsible for the fisheries management of Lemolo Lake and the lake has a maximum speed limit of 40 mph. The Lemolo Lake Recreation Area is identified in the LRMP as a MA2 and is to be administered for concentrated developed recreation. The ROS class is roaded natural (RN). There are also two special interest areas that do not overlap with the planning area: Crystal Spring and Spring River, identified in the LRMP as special management area MA6 to be managed for recreation with an ROS class of Roaded Natural¹⁰⁹. Though PacificCorp created Lemolo Lake for hydroelectric purposes, it has become a popular destination recreation area attracting both summer and winter recreationists. Similar to Diamond Lake, Lemolo Lake has both Forest Service and private permittee facilities to meet the recreational demand.

The USFS operates and maintains five campgrounds (Poole Creek, East Lemolo, Kelsay Valley, Inlet, and Bunker Hill – Figure 26) in the area with a combined capacity of 95 sites. Major activities during the summer include camping, boating, fishing, biking, OHV use, swimming, and sightseeing. The main winter activities are cross-country skiing and snowmobiling. The campgrounds usually operate from mid-May (once snow-free) until the end of October or November. Because of the high popularity of the area for fall elk hunting, the campgrounds will often remain open until the end of November, weather permitting. There are also approximately 20 dispersed unimproved campsites throughout the area.

Lemolo Lake Resort is a privately owned facility operating under a USFS special use permit, located along the north shore of Lemolo Lake. It is a full service facility with a capacity to lodge 32, and a restaurant and bar with seating capacity of 48. It has a trailer park with 36 spaces with full hook-ups and shower and laundry facilities, gas station, grocery store, boat ramp and docks, employee housing, and shop buildings. The resort has its own water supply and has septic tanks with drainfields. Major summer activities and services include fishing, boat rentals, water skiing, swimming, sightseeing, bicycling, ATV riding, and hiking. During the fall, the primary activities are fishing and hunting. During the winter, snowmobiling and cross-country skiing dominate the activities in the area.

Environmental Effects – Diamond Lake and Lemolo Lake Recreation Areas

Direct effects are those that would occur immediately at the recreation area, while indirect effects are those that would occur in the future both at the stand and recreation area scale as vegetation grows over time.

¹⁰⁹ Roaded natural is an area characterized by predominantly natural-appearing environments with moderate evidences of the sights and sounds of people. Such evidences usually harmonize with the natural environment.

Alternative 1 would have no direct effects on any recreation area as no activities would occur. Indirectly, the mountain pine beetle outbreak would continue to spread, killing trees across the landscape. Although hazard trees adjacent to buildings, roads and campsites are felled, the Forest has not been able to keep up with the number of trees dying. When they fall, these trees could damage structures or improvements, and although remotely possible, people could be injured if they were present when the trees fall. In addition, as more trees die, the fire hazard increases. A widespread, high intensity fire would potentially damage structures and other improvements, through direct consumption of structures, and through tree fall after the fire has swept through the area. If a fire occurred, the roads designated as evacuation routes may not be passable if fire were burning in the areas where high concentrations of fuels currently exist, endangering people living and recreating in these areas.

Effects Common to All Action Alternatives for the Diamond Lake and Lemolo Lake Recreation Area

In general, the primary effect to people living and recreating in the Diamond Lake and Lemolo Lake Recreation Areas would be from the sights and sounds of the commercial and non-commercial operations. The rural ROS would not change under any of the action alternatives for Diamond Lake, and the roaded natural ROS would be maintained at Lemolo Lake. Operating restrictions help reduce the impacts to visitors as work near the campgrounds would be prohibited between Memorial Day and Labor Day in the special use permit and developed recreation sites.

Under all action alternatives, the evacuation routes leading out of the recreation sites would be thinned or treated, reducing the fuels along to the evacuation routes, which gives people more time to evacuate under less extreme fire conditions. Hazard trees posing safety risks would continue to be felled as funding allows, thus meeting the purpose and need.

Where recreation sites coincide with a fuelbreak or an evacuation route, the maintenance of the fuelbreak would periodically alter vegetation over time, causing a long term indirect effect. Once a fuelbreak is established, the maintenance can occur predominately through non-commercial methods. The continued maintenance would maintain a more open forest that may be visually pleasing to some, while to others, it may detract from the visitor's experience. Overall, the beneficial effect of lowering the fire hazard and having evacuation routes accessible (thus meeting the purpose and need) outweighs any negative impacts from non-commercial maintenance of fuelbreaks.

Campgrounds: None of the action alternatives would have a direct effect on Diamond Lake Campground, Inlet, East Lemolo, Bunker Hill, or Crystal Springs Campgrounds at Lemolo Lake, as no activities are proposed in these area. Indirectly, the sounds from the commercial and non-commercial activities may be heard in the distance. However, this impact is anticipated to be small, as work hours would be limited to weekdays in any developed recreation sites, and currently, ongoing campground and road maintenance activity sounds can be frequently heard during the daytime. This indirect effect, combined with the past, present, and future hazard tree falling that occurs when the campgrounds are closed, would not contribute to a cumulative effect as these activities would not overlap.

The area behind the Visitor's Center that is directly across from the entrance to the Diamond Lake Campground would also be treated. Currently, many trees are dead and many hazard trees have been felled around the Visitor's Center and administrative site that has camping and trailer spots for employees. Hazard trees would continue to be

felled as safety concerns are raised. The thinning and fuels treatment proposed near this site under all action alternatives would reduce the concentration of hazard trees and improve the safety of the area, along with the evacuation routes leading out of the area.

Commercial activities, predominantly thinning of lodgepole pine, would occur around the Broken Arrow Campground and overflow area on about 118 acres, with some minor non-commercial activities near the road. At the Thielsen View Campground, 24 acres of commercial activity would occur. At Poole Creek Campground, commercial activities would occur on about 18 acres. At all campgrounds, activities would only occur before Memorial Day or after Labor Day, limiting the direct effects of noise and disturbance to few campers. The campsites within 200 feet of a work area would be closed while operations occur to minimize safety concerns. Indirectly, campers would notice more stumps and have a more open view of the stands adjacent to the campsites, although some screening vegetation would be left between campsites, to the extent practical. There would be fewer dead trees, with the scenic emphasis on the remaining green trees, which may make the area more scenically appealing to some users. In addition, the thinning and fuels reduction would directly and indirectly improve the evacuation routes leading out of this area by reducing fuels, thereby improving visitor safety. These direct and indirect effects, combined with the past, present, and future hazard tree falling that occurs when hazard trees are present and with other campground maintenance activities, would contribute to a beneficial cumulative effect of making the campgrounds safer from hazard trees and potential fires, thus meeting the purpose and need. There would also be a small cumulative effect of reduced vegetation as more hazard trees are felled over time in these developed campgrounds.

Special Use Permit Areas: Table 56 displays the locations of the Diamond Lake Resort, and Diamond Lake RV Park where treatments would occur within the permitted area. Under the action alternatives, the direct effects would be similar to those described under the campgrounds – people in the area during the operating period would be exposed to the sights and sounds of the operations. Mitigation includes no operation between Memorial Day and Labor Day in the permitted areas, limiting the extent and duration of this impact. Indirectly, people in the area would see more stumps, fewer snags, and a more open forest. Snag falling is permitted for safety reasons and is a past, present, and future action that is predicted to continue as trees continue to die. Indirect effects related to fuel reduction, reduced fire hazard, and evacuation routes are similar to those stated above.

Table 56. Commercial and Non-Commercial Treatments in the Special Use Permit Areas Under the Action Alternatives.

SUP Area	Approximate Acres Under Permit	Acres Commercial Treatment	Acres Non-Commercial Treatment	Total Acres of Treatment
Diamond Lake Resort	234	125	94	219
Diamond Lake RV Park	23	12	8	20
Recreation Residences	52	0 (110 acres treated around permitted lots)	0 (1 acre treated around permitted lots)	0 (111 acres treated around permitted lots)

The impact to the recreation residences occurs primarily adjacent to their permitted areas. No activities are proposed on the actual permitted area, primarily because of contract limitations and liabilities associated with logging close to structures, and because some permit holders are being proactive about managing vegetation on their permitted area in cooperation with the Forest. Activities would only occur before Memorial Day and after Labor Day, minimizing the impacts to permit holders.

The area surrounding the recreation residences would be treated primarily by commercial treatments under all action alternatives (Table 56). Short term impacts from commercial treatments include visible stumps and slash, increased visibility through the forest which increases visibility between the cabins and the road, decreased canopy closures which allow additional sunlight into the area, and for some residences, improved access through the use of the access roads (driveways) as haul routes. Slash treatment would be prioritized in this area, to reduce the visual impact for permit holders. If funded, planting and seeding of vegetation following final slash treatments would occur to encourage shrub growth along skid trails.

After completion of the project and over the long term, the ability of firefighters to potentially defend this WUI during a fire would increase. The defensible space created by thinning and fuels reduction, combined with the work some of the permit holders have been doing on their permitted areas, would increase the chance that firefighters could defend structures in the area. Maintenance of the fuelbreaks and defensible space would need to continue in order to maintain these beneficial effects (see Fuels section). Once a fuelbreak is established, non-commercial treatments can be used for maintenance.

Two connected actions of decommissioning the road south of the Noble Fir picnic site and decommissioning the ford crossing at the south end of the summer homes would restrict access; however, these two actions are authorized under a previous NEPA document¹¹⁰ that the recreation residences permittees had input into; no other effects are anticipated.

Dispersed Recreation/Other Sites – Affected Environment and Environmental Effects

Within the watershed there are also other smaller developed or dispersed campsites, a communications site, and Oregon Department of Transportation (ODOT) maintenance facility. Other developed sites affected by the project include Thielsen Forest Camp and Millsite Camp (surrounding the ODOT maintenance facility). These are mainly small campsites near streams and lakes, with improvements limited to vault toilets, tables, and fire rings. In addition, there are numerous dispersed sites within the watershed, primarily located along streams and rivers with numerous hunting camps in the Lakeview, Natural, and Lake Creek sub-watersheds. The major use activities for these areas are camping, hunting, hiking, and fishing. There are also seven snow parks located along Highways 138 and 230. Other uses include a power transmission line corridor along Road 2610 and Highway 138 from Lemolo Lake to Diamond Lake, and an ODOT maintenance building and sand shed located at the junction of Road 2610 and Highway 138. ROS

¹¹⁰ These two road projects were authorized under the 2006 Decision Memo for the Special Use Permit Re-Issuance for the Recreation Residences; this Decision Memo is incorporated by reference.

designations vary from Rural to semi-primitive motorized and semi-primitive non-motorized¹¹¹.

All of these types of dispersed recreation sites, overlooks, viewpoints, trailheads, snowparks, and/or picnic sites would be directly affected through the sites and sounds of the commercial and non-commercial activities that would occur surrounding these sites under the action alternatives. These impacts would be limited to when the treatments were actually occurring. The visual changes to the area would last until low vegetation grew in the area. The indirect effect would be similar to those stated above for areas within evacuation routes and fuelbreaks, benefiting users by providing better egress in case of a fire. ROS designations of semi-primitive motorized and/or roaded natural would not change under any action alternatives. Alternative 1 would have no direct or cumulative effects to these areas; however, the indirect effects would be similar to those described for the other recreation sites.

The Rogue-Umpqua Scenic Byway and Volcanic Legacy Scenic Byway

Affected Environment and Environmental Effects

The Rogue-Umpqua National Scenic Byway (Byway) extends 172 miles through the Rogue River and Umpqua National Forests, the Medford and Roseburg districts of the Bureau of Land Management, and local lands. The Byway forms a partial loop, off Interstate 5, between Roseburg on State Highway 138 and Gold Hill on State Highway 234. A 2.5 mile segment of the Volcanic Legacy Scenic Byway (VLSB) also lies in the planning area and runs from the junction of Highway 138 and 230 to the east toward Highway 97.

The Byway parallels 40 miles of the North Umpqua Wild and Scenic River, famed for its remarkable emerald green waters and steelhead trout habitat. The D-Bug planning area lies above the area designated as a Wild and Scenic River. Approximately 18 miles of the Byway lie within the planning area, within the segment known as the “High Cascades”. The Byway is known for its Natural, Scenic, and Recreational values. The 2002 corridor management plan describes the existing and desired future condition for the Byway and is incorporated by reference. The plan makes note of the importance of maintaining natural beauty of the area and makes reference to public safety, primarily in the form of providing safe enhancements, appropriate services, as well as sanitation in the area. Unlike the Diamond Lake Winter Recreation Plan, it does not make note of the deteriorating condition of the lodgepole forests around Diamond Lake, nor the hazard inherent with the build-up of the fuels within the evacuation routes (which are the roads in the Byway) for the area.

Alternative 1 would have no direct or cumulative effects to either Byway. Indirectly, as vegetation continues to grow and tree densities increase, more trees would die from the beetle infestation, negatively impacting some users. If a large scale fire were to burn through the area, the scenery would be dramatically changed from the green of a coniferous forest, to a landscape dominated by black or brown trees and vegetation. Given that the Byways are evacuation routes for the WUI's, an uncontrolled fire could

¹¹¹ Semi primitive motorized is an area characterized by predominantly unmodified natural environment of a size or location that provides a good-to-moderate opportunity for isolation from sights and sounds of people except for facilities essential for the use of motorized equipment. Semi primitive non-motorized is an area characterized by predominantly unmodified natural environment of a size or location that provides a good-to-moderate opportunity for isolation from sights and sounds of people. Motorized use is not permitted.

pose a hazard to people trying to evacuate, if vegetation close to the Highways caught fire and burned.

The primary direct and indirect effects to both Byways would be to the change in scenery caused by vegetation management under all action alternatives. The D-Bug project proposes to amend the 1990 LRMP, as much of the Byways are designated as 'retention' under the Visual Quality Objectives (VQO). By amending the LRMP, vegetation management would be allowed to occur in this area, which is not scenically stable. Many visitors would notice the change in vegetation. Treatments would open up views onto the large conifers that are currently hidden behind smaller diameter trees, improving the quality of the scenic environment for many users. More stumps would be visible (as they are now) after the project, detracting from some users' experiences. If funded, stumps would be flush cut within 50 feet of seen areas off of Highway's 138 and 230 to minimize the visual impact. However, given that the speed limit is 55 mph, some drivers won't notice the small stumps in the area, but would be more inclined to notice the large diameter trees in the more open forest that would be created after the project was implemented.

The Diamond Lake Viewpoint opened last year just off of Highway 138 near the entrance to Diamond Lake; it did not degrade the view from the highway and added a recreational point of interest for visitors. The Cinnamon Butte Snowpark is scheduled to be improved (widened) within the next several years and would have minimal to no impact on the views experienced along the Byway. The Oregon Department of Transportation felled hazard trees along the Byway west of the project area, but not within it. There are no other past, present, or reasonably foreseeable projects would overlap with the D-Bug project to contribute to a cumulative effect to the Byway; therefore, because the past projects have had no effect on the Byway, no cumulative effects to the Byway would occur with this project. The Winema National Forest has been conducting vegetation treatments similar to those proposed under the D-Bug project along the segment of the Volcanic Legacy Scenic Byway for several years. Crater Lake National Park has been using prescribed fire to thin vegetation along one segment of Highway 138 outside of the planning area. These two projects, when combined with the D-Bug project would contribute to a cumulative effect to the scenery of this segment of the VLSB, but that effect has generally been positive for most visitors.

OCRA, IRA'S, AND POTENTIAL WILDERNESS AREAS – TRACKED AS A SIGNIFICANT ISSUE

During scoping, a number of conservation groups raised the concern that the proposed thinning in the Oregon Cascades Recreation Area (OCRA), Inventoried Roadless Area (IRA), and other potential wilderness areas would impact the ecological importance and roadless characteristics of these areas.

Forest Plan Standards and Guidelines

- Dispersed Recreation S&G #3: The Oregon Cascades Recreation Area (OCRA) shall be jointly managed by the Deschutes, Willamette and Umpqua National Forests as directed by the management plan shown in Appendix E, and SPM no harvest and SPNM no harvest.
- Dispersed Recreation S&G #4: Unroaded recreation management areas (URMA – MA1) shall be managed in accordance with SPM-no harvest, SPNM-no harvest and unroaded concentrated direction.

The OCRA

Cascadia Wildlands Project states that in the OCRA, scheduled timber harvest activities on a programmed basis are not permitted. They state that the fuelbreaks located in the OCRA will require additional maintenance treatments that represent programmed harvest, which is in violation of the OCRA direction in the 1984 Act that created the OCRA.

The following indicator quantifies and tracks this issue:

- Acres of commercial thinning in the OCRA.

Affected Environment

The OCRA, created in the same legislation that enacted the Mt. Thielsen Wilderness (Oregon Wilderness Act of 1984, Public Law 98-328, Section 4), is along the west side of the Wilderness, and forms the eastern edge of the planning area (Figure 27). The OCRA boundary is set back at least 500 feet from Highway 138, and 200 feet from Road 60-990 (Thirsty Point Road). It is divided into seven management zones, of which two (Zones 6 and 7) are within the planning area. They are defined within the LRMP as MA5 with the objective to “...manage the area so as to maintain a near natural state while providing for a wide range of recreation activities.” Use varies throughout the zones, with the primary activities of camping, fishing, hiking, hunting, horseback riding, snowmobiling, and cross-country skiing.

In Zones 6 and 7, harvest of timber is allowed to prevent and control insects and to prevent catastrophic mortality from insects, disease, or fire; and/or when salvage of dead or damaged trees is done where leaving these trees threatens the health and safety of the public (USDA, Forest Service, 1990 - Appendix E - 20, 22). In the Oregon Wilderness Act of 1984, the language which created the OCRA specifically states that the Secretary of Agriculture may permit activities “necessary to prevent and control wildfire, insects, disease, soil erosion, and other damaging agents including timber harvesting activities necessary to prevent catastrophic mortality from insects, diseases, or fire.”

The goal for the OCRA in Zone 6 is to emphasize opportunities for semi primitive motorized recreation and improve wildlife habitat. The goal for the OCRA for Zone 7 is to provide a variety of opportunities for non-motorized uses, in close proximity to the Diamond Lake Composite, and serve as a transition between the concentrated developed recreation use at Diamond Lake and Mt. Thielsen Wilderness.

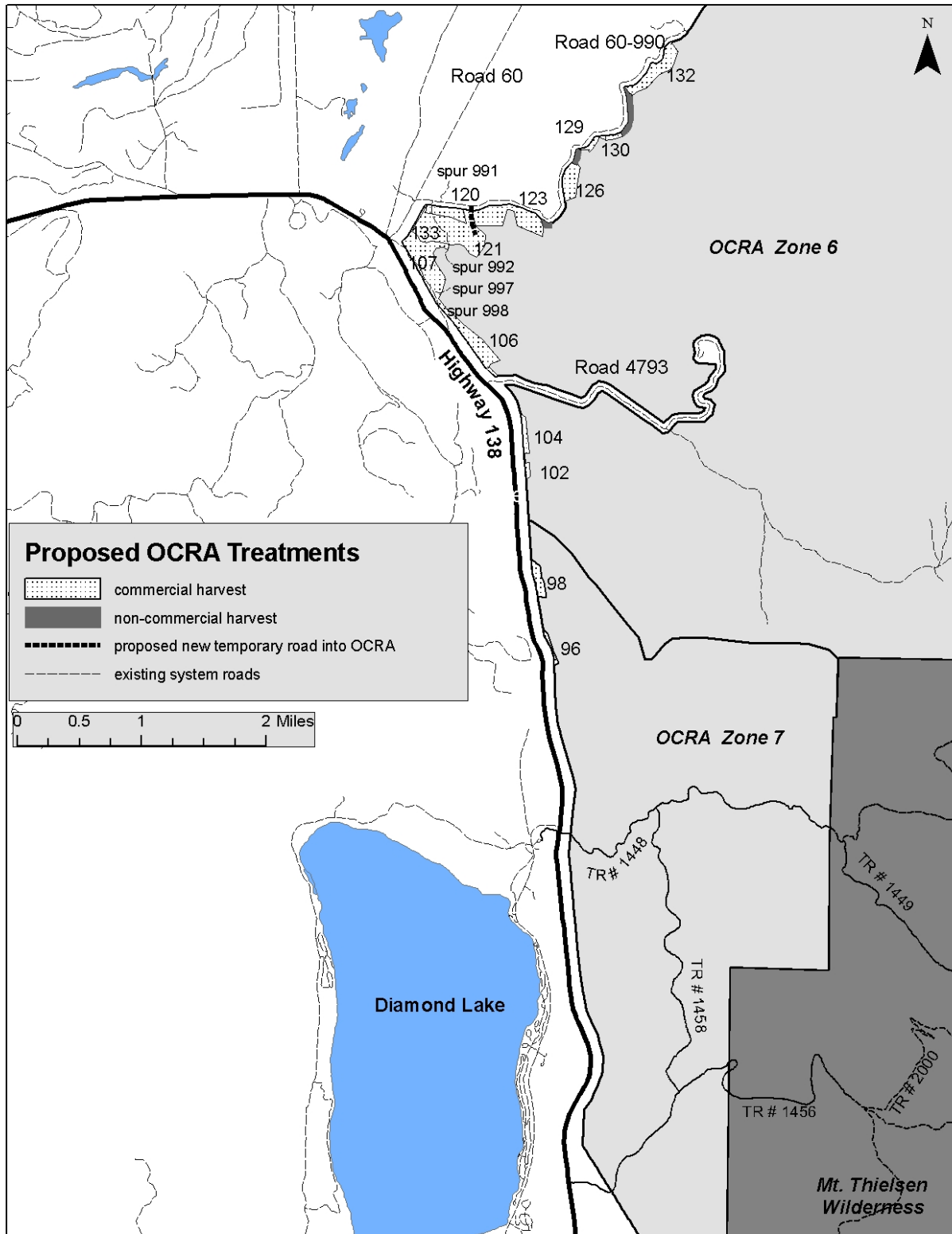


Figure 27. Location of the OCRA and proposed treatments under Alternatives 2 and 4. Alternative 3 treats a small subset of the area – see discussion for details.

Direct and Indirect Effects

Direct effects are those that would occur immediately following the activity at the stand scale, while indirect effects are those that would occur in the future both at the stand and OCRA scale. Effects are measured in terms of acres treated and the duration that the treatment would have on vegetation. Under Alternative 1, no action would occur that would directly affect the OCRA, which would maintain the present opportunities for solitude, but would not increase sight distance into the stands for wildlife or hunters. Indirectly, there may be a potential increase in the chance or likelihood of the area not proposed for treatment experiencing uncharacteristic wildfire effects, if no treatment occurred. Given the lack of direct effects and that only indirect effects are present, plus the lack of past and future actions, no cumulative effects would occur under Alternative 1. None of the connected or similar actions associated with any of the action alternatives occur in the OCRA, thus there would be no direct, indirect, or cumulative effects from those actions.

In response to the issue raised during scoping, Table 57 displays how each zone of the OCRA is affected by treatment activities by action alternative. Alternative 1 is not displayed as no acres are treated. The majority of the acreage treated is in Zone 6.

Table 57. Treatments in the OCRA by Alternative.

Alternatives	Zone	Acres Commercial (Prescriptions 1-4, 9-13)	Acres Non- Commercial (Prescriptions 5-8)	Total Acres
2 and 4	6	301	15	316
3	6	99	0	99
2, 3, and 4	7	17	0	17

In general, the direct effects of the commercial thinning and non-commercial treatments under all action alternatives would impact both the visual quality (see visuals section) and the 'character' of the OCRA by increasing sight distance into the thinned stands and reducing the closed 'feel' of the forests. Indirect effects include increased fire resiliency of the stands treated over time, as described in the fuels section. The direct effects are limited in extent, given that all proposed treatment units extend no further than about 3,100 feet into the OCRA and in total, 333 acres of the OCRA would be treated. The sounds and sights coming from Highway 138 are still heard up to ½ mile from the highway, depending on slope and aspect. Opening up the stands (increasing the distance between trees) may increase the distance one has to travel into the OCRA to find solitude.

For Zone 6, recreation is managed as semi-primitive motorized, where there are moderate opportunities for solitude, tranquility, and closeness to nature. Zone 6 is 12,806 acres in size. Under all action alternatives, proposed OCRA treatments are within about 3,100 feet or less of an existing road. The direct effect of opening of the canopy under the action alternatives would allow for additional sight distance for hunters, potentially increasing their opportunities for success (see wildlife section for impacts to big game); however, this opportunity would only occur as far as the treatments extent into the OCRA, limiting the magnitude of this effect.

The treatments along the edge of the OCRA would reduce a visitor's chance for solitude only as far as the treatment extends, which is at most 3,100 feet from the OCRA boundary. Given that there is already a 200 to 500-foot buffer between existing roads and the boundary of the OCRA, most users would not be able to distinguish this reduction in solitude. Furthermore, Unit 121, which extends the furthest into the OCRA, is surrounded by roads and includes an existing spur road that is within the OCRA, limiting the ability to experience solitude. In comparing alternatives, Alternatives 2 and 4 would have the most impact on solitude and sight distance in the OCRA, since treatments extend the furthest into the OCRA and more acres are treated (Table 57). Alternative 3 treatments extend less than 1,400 feet from the OCRA boundary and would have a smaller impact on solitude and sight distance. All effects to solitude would begin to diminish in one to two decades (Figure 15) following treatment, as crown closure increases and sight distance decreases.

There is also the potential effect to winter OHV users since use by winter vehicles on and off of designated trails is allowed in this zone. However, most users stay on designated trails and where they are permitted, as many of riders prefer loop rides. Use by summer OHV's both on and off trail is permitted in designated areas; most summer users utilize the single lane gravel roads as their primary travel route. Road 60 is heavily used as a winter OHV route and is also used by summer/fall OHV's, particularly during hunting season. The existing spur roads 992, 997 and 998, which are all within the OCRA boundary, lead to several D-Bug units into OCRA Zone 6 and would be brushed out for logging. The use of these roads during logging under Alternatives 2 and 4 only, combined with the opening of the canopy from thinning would provide the largest opportunity for OHV's to go off road (from these existing spurs) and into the forest during both summer and winter. However, this opportunity would be limited in extent as the treatments extend less than 3,100' from the OCRA boundary in Zone 6. These existing spur roads are permanent roads that would not be decommissioned, so the duration of the ability to use these roads would be long term. However, use of this area is not expected to increase as the primary OHV use is focused on Road 60. Alternative 3 does not propose any units in this area, and would not use or improve these roads or the ability for OHV's to move off road.

One new temporary spur road (0.22 miles) would be constructed and subsequently decommissioned in the OCRA in Zone 6 under Alternatives 2 and 4 only (Figure 27). The direct effects of temporary road construction would be to reduce canopy closure by removing all vegetation from the width of the road, which would result in increasing sight distance and decreasing solitude. This would potentially have a longer impact than some of the thinning prescriptions, as it may take longer for the road to re-grow vegetation (up to 15 or more years until natural shrubs and/or small trees would regrow on the site; less if vegetation is planted). Alternative 3 does not propose this temporary road, thus would have no impacts to this part of the OCRA.

For the 7,059-acre Zone 7, about 17 acres are affected by commercial treatment (Table 57) under the action alternatives. The effects of thinning and fuels reduction on these 17 acres, along Highway 138, would predominantly be to increase sight distance for hunters to view and stalk big game. The extent of the treatment into Zone 7 is at most, 420 feet from the OCRA boundary, substantially limiting the magnitude and intensity of this effect. It is likely no users would notice this impact because it is so limited in extent. No motorized vehicles are allowed in this zone, so there would be no effect to OHV use either in winter or summer. In addition, no new temporary roads would be built into this zone.

During scoping, Cascadia Wildlands Project also indicated the maintenance would be needed in the fuelbreaks and would represent programmed timber harvest in the OCRA. While fuelbreak maintenance is not a reasonably foreseeable action that can be analyzed with this project, it is important to note that once a fuelbreak is established, maintenance can occur primarily through non-commercial methods, thus keeping with the intent of the OCRA to prohibit programmed timber harvest. The actions associated with Alternatives 2, 3, and 4 are in compliance with all aspects of management of the OCRA, as documented in the 1990 LRMP.

Cumulative Effects

Overall, the D-Bug project would treat 2.6% of Zone 6 and less than 1% of Zone 7. This limited amount of treatment in the OCRA, along an existing state highway, constitutes very minor direct and indirect effects. There are no past or future projects that would overlap with the D-Bug project that would contribute to a cumulative effect; therefore, there would be no cumulative effects to the OCRA with implementation of any action alternative.

Impacts to Potential Wilderness

The Forest Service Handbook 1909.12 (70) sets for the guidance on evaluating project impacts to areas that may be considered as potential wilderness areas. Areas qualify for placement on the potential wilderness inventory if they meet the statutory definition of wilderness¹¹². The OCRA meets criteria one only, as it contains roads that are permanently authorized, and as such, does not meet the Forest Service's definition of potential wilderness.

Inventoried Roadless Area's (IRAs)¹¹³ – Tracked as a Significant Issue

Umpqua Watersheds and Klamath-Siskiyou Wildlands Center state that putting fuelbreaks (which require periodic maintenance) along the Thirsty Creek Road and Kelsey Point Road along the edge of the IRA's violates the 2001 Roadless Area Conservation Final Rule (2001 Roadless Rule), which states that any cutting of timber in an IRA must be infrequent. Tim Ballard, Kim Treadwell, Randall Ballard, and Linda Quintero are concerned over the precedent that would be established in active management of inventoried roadless areas.

The following indicator quantifies and tracks this issue:

- Acres of forest treated within Inventoried Roadless Areas.

Existing Condition

Roadless area management became a national issue in 1972 when the Forest Service initiated a review of certain areas of National Forest System (NFS) Lands greater than 5,000 acres to determine their suitability for inclusion in the National Wilderness Preservation System. This planning process was called Roadless Area Review and

¹¹² Wilderness areas are: 1) Areas contain 5,000 acres or more; 2) Areas contain less than 5,000 acres, but can meet one or more of the following criteria: a) areas can be preserved due to physical terrain and natural conditions; b) areas are self-contained ecosystems, such as an island, that can be effectively managed as a separate unit of the National Wilderness Preservation System; c) areas are contiguous to existing wilderness, primitive areas, Administration-endorsed wilderness, or potential wilderness in other Federal ownership, regardless of size; 3) areas do not contain forest roads or other permanently authorized roads, except as permitted in areas east of the 100th meridian. To be considered as potential wilderness, an area must meet either options 1 and 3, or options 2 and 3.

¹¹³ See DEIS Chapter 1 for an update on the current status of the roadless rules.

Evaluation (RARE). This initial process (sometimes referred to as RARE I) identified lands meeting certain criteria for wilderness lands. The second and final review process, The Roadless Area Review and Evaluation II (RARE II), resulted in a nationwide inventory of roadless areas. Two of these inventoried roadless areas, Mt. Bailey and the Thirsty Appendage, are identified in Appendix C of the 1990 Umpqua LRMP and are within the D-Bug Planning Area.

Protection of inventoried roadless areas falls under the Roadless Area Conservation Final Rule, effective March 13, 2001. The 2001 Roadless Rule generally prohibits timber cutting, sale or removal in IRA's (36 CFR §294.13). An exception to this is when "the cutting, sale, or removal of generally small diameter timber"¹¹⁴ is needed for one of the following purposes and will maintain or improve one or more of the roadless area characteristics¹¹⁵. The D-Bug Project focuses on removing small diameter timber along the edges of two IRA's to "maintain or restore the characteristics of ecosystem composition and structure, such as to reduce the risk of uncharacteristic wildfire effects, within the range of variability that would be expected to occur under natural disturbance regimes of the current climactic period" [36 CFR §294.13(b)(1)(ii)].

Currently, decades of fire exclusion, combined with the widespread mortality from the past and on-going mountain pine beetle infestation has left the area in a condition where a stand replacing fire would be of higher intensity and severity, when compared to fires that burned in the reference conditions (USDA, Umpqua National Forest, 2008).

The Thirsty Creek IRA (Figure 28) is 2,257 acres in size and is bordered by existing Forest Service roads around 80% of its perimeter. The distance between the road systems averages one mile and seven existing regeneration harvest units lie adjacent to its boundaries. Appendix C of the 1990 LRMP rates the opportunity for solitude in this area as poor, primarily because the area is surrounded by roads, which heavily influence the area. Although less than 5,000 acres, this area was included as an IRA because it is the appendage that is left over from the RARE II studies and the enactment of the OCRA legislation. After enactment of the OCRA, this tract of land was moved into the IRA category. The Recreation Opportunity Spectrum¹¹⁶ (ROS) for this IRA is Roaded Natural for the majority of the IRA, and Semi-Primitive Motorized for the northern tip of the IRA

¹¹⁴ The 2001 Roadless Rule did not specifically define what constitutes "generally small diameter timber". Instead, project planning "will consider how the cutting or removal of various size classes of trees would affect the potential for future development of the stand, and the characteristics and interrelationships of plant and animal communities associated with the site and the overall landscape. Site productivity due to factors such as moisture and elevational gradients, site aspect, and soil types will be considered, as well as how such cutting or removal of various size classes of standing or down timber would mimic the role and legacies of natural disturbance regimes in providing the habitat patches, connectivity, and structural diversity critical to maintaining biological diversity. In all cases, the cutting, sale, or removal of small diameter timber will be consistent with maintaining or improving one or more of the roadless area characteristics" (see Final Rule, Federal Register, Volume 66, No. 9, 3257).

¹¹⁵ Roadless area characteristics, as defined by 36 §CFR 294.11, are resources or features that are often present in and characterize inventoried roadless areas, including 1) high quality or undisturbed soil, water, and air; 2) sources of public drinking water; 3) diversity of plant and animal communities; 4) habitat for threatened, endangered, proposed, candidate, and sensitive species and for those species dependent on large, undisturbed areas of land; 5) primitive, semi-primitive non-motorized and semi-primitive motorized classes of dispersed recreation; 6) reference landscapes; 7) natural appearing landscapes with high scenic quality; 8) traditional cultural properties and sacred sites; and 9) other locally identified unique characteristics.

¹¹⁶ The Recreation Opportunity Spectrum is an array of recreational activities, settings, and experiences used as a basic framework in planning and managing the recreation resource, and divided into the following classes (these range from the most opportunities for solitude to the least): primitive, semi primitive non-motorized, semi primitive motorized, roaded modified, roaded natural, rural, and urban.

near Kelsay Point. The roadless characteristics applicable to this IRA include the opportunity of semi-primitive motorized recreation. Under the 1990 LRMP, this area was not assigned a prescription of roadless and remains in Management Area 10.

The Mt. Bailey IRA (Figure 28) is 18,627 acres in size and is heavily bordered on its northern boundaries by existing roads and regeneration harvest units; it is bordered on its east side and heavily influenced by motorized and non-motorized recreation within the Diamond Lake Recreation Composite and by Road 4795. The paved Dellenback Trail #1460 lies within the IRA, inside its eastern edge. Appendix C of the 1990 FEIS to the LRMP rates the opportunity for solitude in this IRA as moderate. The RARE II process indicated this area had a medium wilderness potential. The ROS for this IRA is divided between semi-primitive motorized, semi-primitive non-motorized, and roaded natural. The roadless characteristics applicable to this IRA include habitat for TES species; species dependent on large, undisturbed areas of land for the portion of the IRA where motorized recreation is prohibited; the opportunity of semi-primitive non-motorized and motorized recreation; reference landscapes and in some portions, naturally appearing landscapes with high scenic quality. Appendix C of the 1990 LRMP discloses that about 40% of the Mt. Bailey IRA is assigned a roadless prescription, which is prescription A1-1 within Management Area 1 (the eastern portion of this IRA).

Direct and Indirect Effects

Direct effects are those that would occur immediately following activity at the stand scale, while indirect effects are those that would occur in the future both at the stand and IRA scale. Table 58 summarizes the acres treated in each IRA, which documents how each alternative affects the issue raised in scoping.

Table 58. Acres of commercial and non-commercial treatment by IRA by Alternative.

Alternative	Thirsty Creek IRA commercial treatment	Thirsty Creek IRA non-commercial treatment	Mt. Bailey IRA commercial treatment	Mt. Bailey IRA non-commercial treatment	Total IRA treatment acres
2 and 4	335	33	286	312	966
3	0	0	221	163	387

Alternative 1 would not remove any vegetation from either IRA and would retain all current IRA characteristics. There would be no impacts to solitude or sight distance. No fuels would be reduced and stands would continue on their current trajectories as fire would continue to be excluded. The mountain pine beetle infestation would continue to progress and more trees adjacent to and within the Lemolo Lake and Diamond Lake WUI's would die. Fire hazard would continue to increase over time.

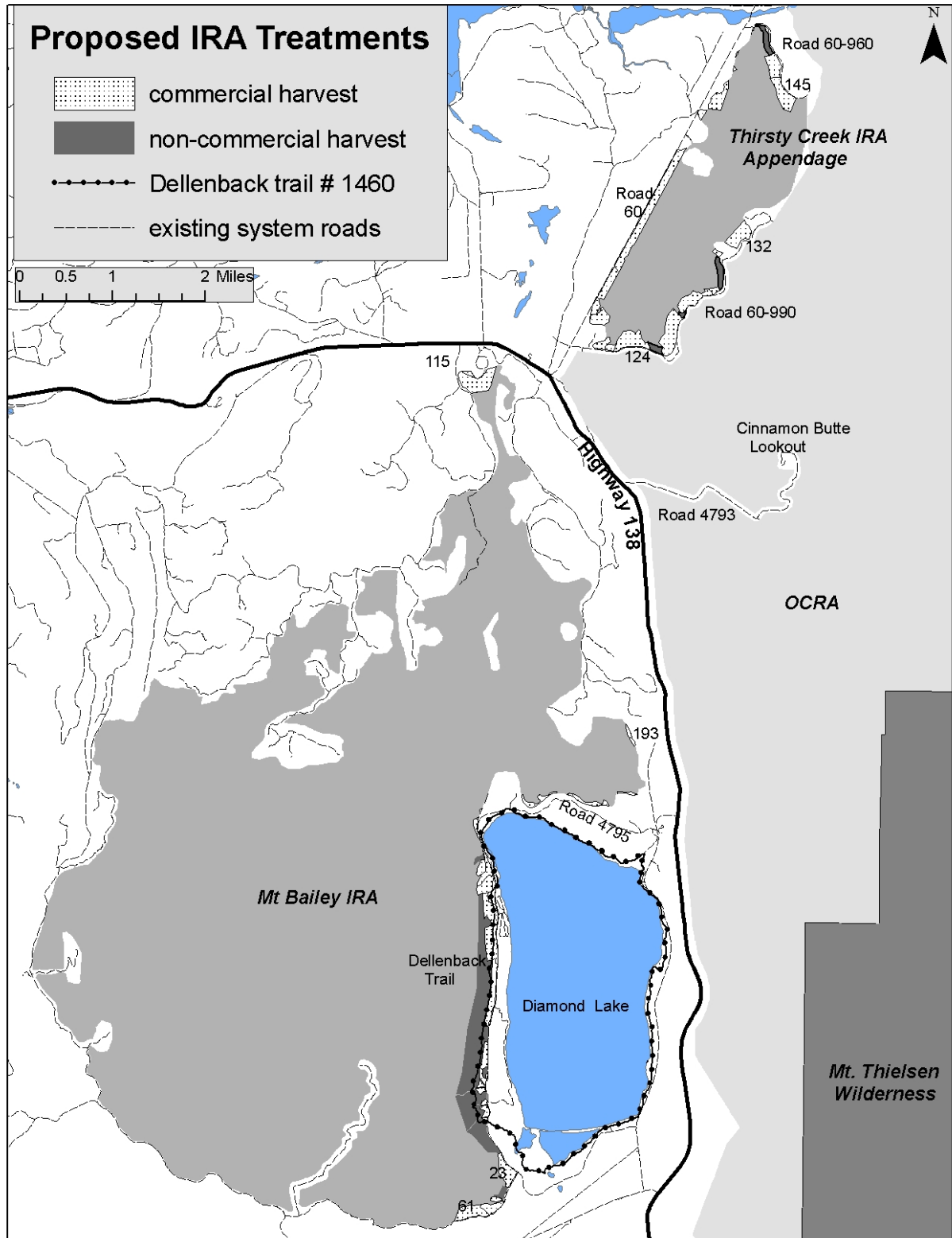


Figure 28. The Mount Bailey and Thirsty Creek Inventoried Roadless Areas and the proposed treatments under Alternatives 2 and 4. Alternative 3 treats a smaller subset of acres – see discussion for details.

Effects Common to All Action Alternatives

The treatments along the IRA's were designed to create fuelbreaks within the WUI's or to reduce fuels along designated evacuation routes, while maintaining roadless characteristics. The direct effect of commercial and non-commercial removal of small diameter trees under the action alternatives would be to open the stands, and increase the distance between the tree canopies, which in turn increases visibility into the stand and may reduce the opportunity for solitude. The treatments would also decrease small trees that are likely to serve as ladder fuels, and reduce ground level fuel loads. As described in the fuels section, by reducing tree densities and ground fuels, there is an indirect beneficial effect of reducing the risk of uncharacteristic wildfire effects. In addition, as shown in the fuels section (Table 21), additional acres outside of the areas treated would also benefit in reducing uncharacteristic wildlife effects. A widespread wildfire with uncharacteristic effects would have the potential to degrade the characteristics many people find desirable in these IRA's. No temporary road building is proposed under any of the action alternatives.

Once a fuelbreak is established, non-commercial methods are typically used to maintain the fuelbreak, as stated under the OCRA discussion. If the fuelbreak were maintained in the WUI's and along evacuation routes at periodic intervals, the cutting or removal of vegetation would predominately involve very small whips and shrubs instead of trees¹¹⁷. The 2001 Roadless Rule allows for an exception for the removal of generally small diameter trees to reduce the risk of uncharacteristic wildfire effects. Any future maintenance that removed small whips and shrubs would be consistent with the intent of the 2001 Roadless Rule.

The 2001 Roadless Rule contains an exception that allows for the cutting of 'generally small diameter' trees, as stated previously. The project silviculturalist documented stand conditions throughout the planning area and modeled mean stand diameters by vegetation type (Table 59). DecAID¹¹⁸, a model used by the project wildlife biologist for snag and large wood analysis, cites that small diameter trees within the analysis area in the small/medium condition class range from 10" to 19" dbh. By using these guidelines, a generally small diameter tree range for the D-Bug planning area is between 10" and 19". Trees in this diameter range often act as the primary ladder fuels in most stands that would carry a fire into the crowns, creating a fire where uncharacteristic effects may occur due to unnaturally high fuel loads.

Thinning from below or low thinning, is the primary prescription for all commercial operations, except in pure lodgepole stands, where removing overstory trees is prescribed to reduce the habitat for the mountain pine beetle. Table 59 depicts the mean diameter of stands proposed for both commercial and non-commercial removal.

Table 59. Average Mean Diameter of Trees Removed, and Pre and Post Treatment by Vegetation Type.

Vegetation Type	Prescription Numbers	Average Mean Diameter of Trees Cut
Mature Lodgepole	1-2	9.2"

¹¹⁷ A tree has a single woody stem and is at least 20 feet tall.

¹¹⁸ The DecAID data set was developed from a region-wide inventory of unmanaged stands of various forest types.

Vegetation Type	Prescription Numbers	Average Mean Diameter of Trees Cut
Other Lodgepole	3-4	about 9"
Non-Commercial	5-8	3"
Mixed Conifer	9-13	13"

As shown in Table 59, on average, trees cut in the IRA would range from 3" to 13", which is at the low end of the range of 10" to 19", thus meeting the intent of the 2001 Roadless Rule of cutting generally small diameter trees.

Thirsty Creek Appendage IRA

The effects described above are limited to the edges of the Thirsty Creek IRA and extend no further than 1,100' into the IRA under Alternatives 2 and 4 (Unit 122 and 124 extend the furthest into the IRA). In response to the issue raised in scoping, Alternative 3 does not propose treatment into this IRA, thus there would be no direct, indirect, or cumulative effects from Alternative 3. This IRA is of most concern to the conservation groups, primarily due to its connectivity to the OCRA and thus indirectly its connectivity to the Mt. Thielsen Wilderness. For Alternatives 2 and 4, the following units (or portions of units), and their prescriptions are located in the Thirsty Creek IRA (Table 60).

Table 60. Units within the Thirsty Creek IRA Under Alternatives 2 and 4.

Unit Numbers	Prescription (see Table 2)	Acres
121, 136, 140, 141	2	45.2
134, 137, 138	3	76.8
130	4	3.5
125, 127, 131, 196	6 (non-commercial)	32.5
144	9	19.7
122, 126, 129, 132	11	121.2
124, 145	13	59.5
TOTALS		358.4 (335.9 commercial; 32.5 non-commercial)

Because the opportunities for solitude in this IRA are poor, the commercial and non-commercial treatments under Alternatives 2 and 4 that extend into the IRA would have little influence on solitude. Hunters are the primary users of the area during the fall; they may experience an increase in hunting success as their ability to see and stalk big game is increased and forage slightly increases. Road 60, which forms the western border of this IRA, is used primarily as a snowmobile trail in winter. Most users stay on designated trails or where they are permitted. Opening up the stands along Road 60 has the potential to increase OHV traffic into this IRA, which allows for motorized use. Generally speaking, most OHV users utilize designated roads and trails; however, some users enjoy off-roading and would maneuver their OHV's off road where the canopy is opened. Depending on the treatment intensity and forest type, summer OHV use may

be limited by the residual slash and inability to maneuver an OHV off road (especially in mixed conifer stands). Winter OHV use would not be impeded by slash and would be able to move about off of designated trails. Impacts of increased winter use are disclosed under the wildlife section; impacts to recreationists, however, vary depending on the user. OHV users would potentially have an increased area to ride in, furthering their enjoyment. Recreationists that prefer non-motorized use may find that their recreation experience is impaired by additional OHV use. Since the treatments extend no further than 1,100 feet into the IRA, however, this impact is expected to be minimal. The existing ROS of roaded natural and semi-primitive motorized would be maintained under all alternatives.

Appendix C of the Umpqua National Forest Final Environmental Impact Statement (USDA, Forest Service, 1990) also recognizes the fire hazard as increasing in this IRA due to the mountain pine beetle infestation (USDA, Forest Service, 1990), and continued fire exclusion has exacerbated this hazard. Alternatives 2 and 4 increase the fire resiliency of the stands and decrease the risk of uncharacteristic wildfire effects by reducing ground and ladder fuels and by increasing the spacing between the trees, helping to restore the reference condition both directly to the acres treated and indirectly to adjacent acres within this IRA to one of a more naturally occurring fire regime. All treatments are in keeping with the 2001 Roadless Rule, since no roads would be constructed and harvest would be limited to generally small diameter trees. Alternative 3 does not have the beneficial effects of increasing stand resiliency and decreasing uncharacteristic wildfire effects, thus resulting in an increased chance that this area would experience high intensity fire, which has the potential to degrade the recreation opportunity characteristic important to this roadless area.

Impacts to Roadless Characteristics

For the Thirsty Creek IRA, the roadless characteristic of recreation opportunity would be maintained and even enhanced for some users, as the recreation opportunity would not change. For those who prefer non-motorized use, individual users would be impacted, but because the recreation opportunity is classified as semi primitive motorized, the overall recreation opportunity would not be degraded, thus maintaining this roadless characteristic. Treatments under Alternatives 2 and 4 also help restore the reference condition as stated previously, while Alternative 3 forgoes this opportunity. Approximately 84% of the IRA would remain untouched. No roads would be built in the IRA, as none were needed to facilitate the prescription, thus also maintaining roadless characteristics.

Impacts to Potential Wilderness

The Thirsty Creek IRA meets criteria 2 and 3 for potential wilderness, as it is less than 5,000 acres and it is contiguous to an existing 'primitive' area (the OCRA). The capability for this area to be wilderness depends on its natural characteristics, whether it is undeveloped, its opportunity for solitude, or primitive or unconfined recreation, its special features and values, and its manageability. The Thirsty Creek IRA has had limited impacts to its natural character, with the exception of the 900 spur road, which extends up the southeast side of the IRA. The 1990 LRMP evaluated this IRA as having a low potential for solitude, given that it has roads on three of its four sides and it is small in size. The ROS for this IRA is semi-primitive motorized and roaded natural, so the opportunity for primitive or unconfined recreation is also low. There are no known unique features or sites in the IRA, and managing it as wilderness would be difficult given it is virtually surrounded by roads.

Thinning and fuels reduction activities under Alternatives 2 and 4 would reduce the natural character of about 358 acres, further reducing the area's capability to become wilderness. Alternatives 1 and 3 would not impact this IRA, maintaining the areas capability to become future wilderness.

Mt. Bailey IRA

The effects described as common to all IRA's are limited primarily to the eastern edge of the Mt. Bailey IRA, between the 4795 Road and the Dellenback Trail. The treatments extend no further than 1,900' into the IRA under Alternatives 2 and 4, and no further than 1600' into the IRA under Alternative 3. West of the Dellenback Trail, only non-commercial treatments would occur. The following units (or portions of units), and their prescriptions are located in the Mt. Bailey IRA (Tables 61 and 62):

Table 61. Units within the Mt. Bailey IRA Under Alternatives 2 and 4.

Unit Numbers	Prescription (see Table 2)	Acres
29	1	15
61	2	24.4
4, 12, 23, 85, 94, 116	3	118.9
1, 80, 93	4	25
199	5 (non-commercial)	280.5
13, 14, 20, 26	6 (non-commercial)	27
92	7 (non-commercial)	4
8, 15, 86	9	41.9
3, 91, 115	10	53.9
193	12	4.4
TOTALS		595 (283.5 commercial; 311.5 non-commercial)

Table 62. Units within the Mt. Bailey IRA Under Alternative 3.

Unit Numbers	Prescription	Acres (rounded)
29, 61	2	39.4
4, 12, 23, 85, 94	3	116.2
1, 80, 93	4	8.6
199	5 (non-commercial)	132
13, 14, 20, 26	6 (non-commercial)	27
92	7 (non-commercial)	4
8, 15, 86	9	41.9
3, 91	10	12.9
TOTALS		382

Unit Numbers	Prescription	Acres (rounded)
		(219 commercial; 163 non-commercial)

The Mt. Bailey IRA has a greater opportunity for solitude than the Thirsty Creek IRA. As stated previously, however, the effects of the commercial and non-commercial treatments under the action alternatives extend no further than 1,900' into the IRA, where little influence to solitude would be felt, particularly because the paved Dellenback Trail is within the IRA and the 4795 Road runs the length of the eastern edge of the IRA. The same statement is true for the northern tips of units 80, 85, 86, which are located north of Diamond Lake just off of Road 4795 in the Mt. Bailey IRA, and are also influenced by this road; therefore, chances of solitude in these areas is low. Unit 193 is partially within the IRA (it extends 230' into the IRA) along an extension of the IRA that comes to the edge of a spur road. Finally, Units 115 and 116 are located at the northern most amoeboid tip of the IRA, within 1000 feet of the sand shed area and Highway 138. The sand shed is heavily used by the Oregon Department of Transportation (ODOT) for gravel storage and use year-round, and is used by hunters as a dispersed campsite during fall, leaving little chance for solitude. These units are also surrounded by roads on all but their southern edge.

Hunters are the primary users of the areas adjacent to units 115, 116, and 193 and often use the sand shed area as a dispersed campsite. Thinning and fuels treatments have the potential to increase sight distances for both hunters and wildlife under Alternatives 2 and 4 only; no effects to these areas would occur under Alternative 3 as these units are not included in this alternative.

The Mt. Bailey IRA designation under the LRMP does allow for semi primitive motorized use in some areas; all parts of the IRA affected by the D-Bug project are categorized as semi primitive non-motorized; no roads would be built in this area, thus complying with LRMP direction for this IRA. The area east of the Dellenback Trail and all of the Diamond Lake Recreation Area, is categorized as rural, and there is very little chance for solitude given the extensive year-round use in the area. Forest Closure Number 204 documents that the Dellenback Trail is specifically listed as closed to motorized use, and is within the IRA boundary. Road 4795, which forms the eastern border of the IRA, is used heavily as a snowmobile trail in the winter. Forest Closure Number 203 documents that this trail may be used by snowmobiles or Class I ATV's. None of these closures, restrictions, or permissions would be changed under this project. For the most part, OHV users stay on designated trails or where they are permitted. Although unauthorized use may occur into the non-motorized portion of the IRA as some users may try to use the Dellenback Trail, no unauthorized uses are expected to occur under any of the action alternatives since closures are posted, trails are designated, and forest patrols would be ongoing, deterring uncontrolled OHV use or use in areas that are specifically prohibited.

The existing ROS of roaded natural, semi-primitive motorized, and semi-primitive non-motorized would be maintained under all alternatives. Snow cat skiing is offered on Mt. Bailey; however, this area would not be affected by the D-Bug project and will not be discussed further.

Appendix C of the Umpqua National Forest Final Environmental Impact Statement (USDA, Forest Service, 1990) also recognizes the fire hazard as increasing in this IRA due to the mountain pine beetle infestation (USDA, Forest Service, 1990) and decades

of fire exclusion has exacerbated this hazard. Alternatives 2-4 increase the fire resiliency and decrease the risk of uncharacteristic wildfire effects by reducing ground and ladder fuels and by increasing the spacing between the trees; these treatments also extend into adjacent stands, providing additional effectiveness of the treatments (Table 21). This is in keeping with the 2001 Roadless Rule, since no roads would be constructed and harvest would be limited to small diameter trees.

During project development, a field trip to the area adjacent to this IRA and within the Diamond Lake WUI documented support amongst all groups that reducing the risk of uncharacteristic wildfire effects in this area would be beneficial, given its adjacency to the summer homes and the recreation area.

Impacts to Roadless Characteristics

The roadless characteristics for this IRA would primarily be maintained as the vast majority of the IRA (97%) would be unmanaged. Since most of the impacts occur near or adjacent to roads, the wildlife biologist documented that roads are the primary impact to wildlife species in IRA's; since no roads would be constructed, impacts to wildlife would be limited to disturbance related to the potential increase in OHV use. Recreation opportunities would be maintained in their current conditions. The treatments proposed under the action alternatives help restore reference conditions. The highest scenic quality (see visuals section) for this IRA is found along the Mt. Bailey trail and above timberline, which the D-Bug project does not affect. Also, visitors walking or biking along the Dellenback Trail are occasionally subjected to viewing stumps, as hazard trees created by the mountain pine beetle are occasionally cut; therefore, evidence of management repeatedly occurs along the trail. No roads would be built in the IRA, thus also maintaining roadless characteristics.

Impacts to Potential Wilderness

The Mt. Bailey IRA meets criteria 1 and 3 for potential wilderness, as it is greater than 5,000 acres and with the exception of the 3703-380 road, is free of roads. The capability for this area to be wilderness is higher than the Thirsty Creek IRA. The Mt. Bailey IRA has had limited impacts to its natural character, with the exception of the 380 spur road, which extends up into the north/central part of the IRA. The 1990 LRMP evaluated this IRA as having a moderate potential for solitude, primarily because of the winter motorized use that is allowed in the area. The ROS for portions of this IRA are semi-primitive motorized and roaded natural, so the opportunity for primitive or unconfined recreation is low, as the terrain is moderate. There are several unique features in this IRA, including striking views and habitat for rare plants. Managing it as wilderness would be somewhat difficult, as motorized use is permitted within much of the IRA.

Thinning and fuels reduction activities under the action alternatives would reduce the natural character of about 595 acres under Alternatives 2 and 4, and 382 acres under Alternative 3, slightly reducing the area's capability to become wilderness. Most of the activities under the action alternatives take place within the area adjacent to the Diamond Lake Composite, which has a ROS of rural. Regardless, the D-Bug action alternatives affect 3% of the IRA. This limited amount of treatment would not preclude future options for wilderness for this IRA, given that over 18,000 acres would remain untreated. Alternative 1 would not impact this IRA, maintaining the areas capability to become future wilderness.

Cumulative Effects

The Diamond Lake Ranger District has completed removal of whips and non-commercial vegetation along Road 60. This is the only past action that has occurred in the Thirsty Creek IRA that has cut or removed vegetation. This past action had very limited direct or indirect effects in the IRA, but has reduced some of the fuel loading along the road. When combining this past action with implementation of any of the action alternatives, and given that there are no reasonably foreseeable actions that are proposed to occur in the Thirsty Creek IRA, there would be some beneficial cumulative effect to reducing fuels in this IRA and to creating strategically located fuelbreaks near the Lemolo Lake WUI.

Minor brushing of small whips has occurred along the edge of the Mt. Bailey IRA with the Diamond Lake Hazardous Fuels Project – Phase II along the 4795 Road and Dellenback Trail (2006-2007). Yearly hazard tree felling and other maintenance activities also occur along the Dellenback Trail. It is reasonable to assume that trail maintenance would continue. The combination of these past projects with implementation of any of the action alternatives of the D-Bug Project, plus continued maintenance of the trail constitutes a minor cumulative effect to vegetation in the Mt. Bailey IRA. However, as both the past and current actions reduce the risk of uncharacteristic wildfire effects and removed or continue to remove generally small diameter trees, this effect would be beneficial, as the actions help to maintain ecosystem composition and structure, as described in the 2001 Roadless Rule.

Several members of the public stated that they were concerned about entering roadless areas as it would be precedent setting. The D-Bug Project's purpose and need do not conflict with the intent of the 2001 Roadless Rule. The final rule discusses the importance of having the ability to thin small diameter trees "that became established as a result of missed fire return intervals due to fire suppression and the condition of which greatly increases the likelihood of uncharacteristic wildfire effects" (see Final Rule, Federal Register, Volume 66, No. 9, 3257). It is unknown if any additional projects in these IRA's or other IRA's will be proposed in the near future.

Potential Wilderness Areas¹¹⁹ - Tracked as a Significant Issue

Umpqua Watersheds, Oregon Wild and Klamath-Siskiyou Wildlands Center state that thinning units 72, 73, and 115 are in areas with no roads, which may be considered as potential wilderness areas, and that the proposed treatments could severely degrade the rare features and the potential wilderness characteristics of these important areas.

The following indicator quantifies and tracks this issue:

- Acres of treatment in potential wilderness areas (excluding overlap with IRAs and the OCRA).

Existing Condition

The existing condition is based on areas that may be considered as potential wilderness under FSH 1909.12 (70). The FSH describes the criteria for considering an area as potential wilderness, and was described previously. The Forest determined which areas may be considered as potential wilderness based on GIS mapping. Currently, these

¹¹⁹ Potential Wilderness Areas may sometimes be identified as potential wilderness areas, or uninventoried roadless areas, are areas of land that were not identified as IRA's during the development of the Umpqua National Forest Land and Resource Management Plan and are not displayed in Appendix C of the LRMP.

areas are designated as matrix lands under the Forest Plan, as amended. The conservation groups indicate that these areas provide habitat for a variety of species, maintain high water quality, and offer solitude and a sense of place for human communities and should not be harvested.

These areas without roads are located outside of the IRA's. The 2001 Roadless Area FEIS also considered these areas and defined them as any area without the presence of classified¹²⁰ (system) roads, of a size and configuration sufficient to protect the inherent characteristics associated with its roadless condition.

There are four different possible potential wilderness areas that lie within or have a portion of their acreage within the planning area. These potential wilderness areas and areas without roads range in size from hundreds to tens of thousands of acres (Table 63) (Figure 29) and are affected by the D-Bug action alternatives. The four areas that lie outside of IRA's, the OCRA, the Wilderness, and the National Park Service lands, range in size from 17 acres to almost 3,300 acres within the planning area. Specific to the scoping comment, D-Bug Units 72, 73, and 115 lie within areas of concern to the conservation groups; however, all potential wilderness areas are discussed for full disclosure.

¹²⁰ Classified roads are those permanent roads intended for long-term use that are tracked as part of the Forest's transportation system.

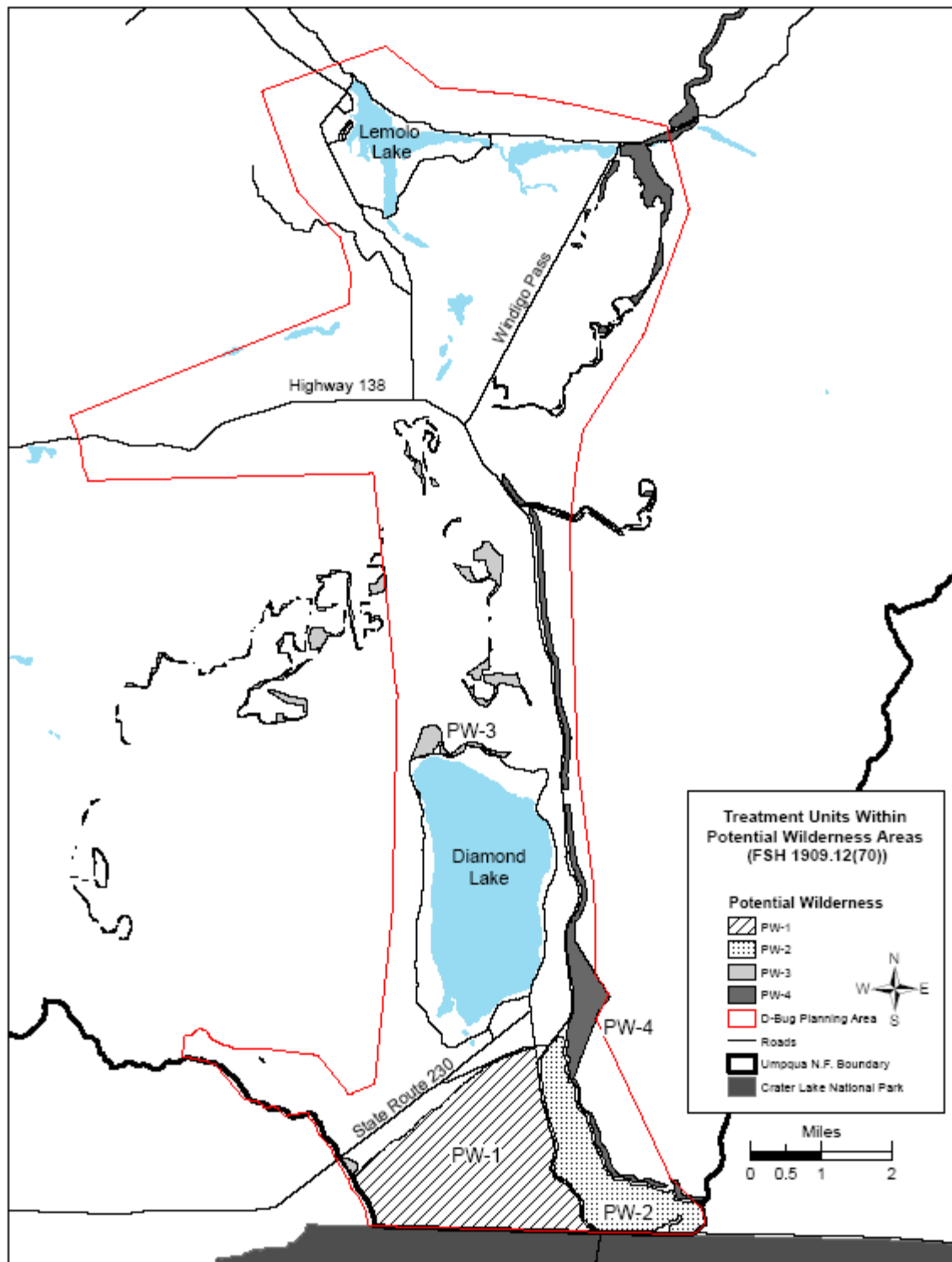


Figure 29. Potential Wilderness Areas in the D-Bug Planning Area.

Direct and Indirect Effects

Direct effects are those that would occur immediately following activity at the stand scale, while indirect effects are those that would occur in the future both at the stand and potential wilderness area scale.

Alternative 1 would maintain all of the potential wilderness areas. All opportunities for solitude would remain, all inherent characteristics of the area would be retained, and no impacts from temporary roads would occur. Indirectly, if a fire were to burn through the area, sight distance would increase and the visitor's ability to experience solitude would decrease. Other characteristics important to these areas may be negatively affected by fire. Because there are no direct effects and no past or future actions, no cumulative effects would occur.

The eight potential wilderness areas as mapped by Oregon Wild are affected differently under each alternative (Table 63).

Table 63. D-Bug Treatment Acres Within Potential Wilderness Areas.

Potential Wilderness (PW) Area	Total Acres of PW Area ¹²¹	Total Acres in Planning Area ¹²² (Alternative 1)	Alternative 2 – Treatment Acres	Alternative 3 – Treatment Acres	Alternative 4 – Treatment Acres
PW – 1	70,363	3,283	271	271	1,425
PW – 2	1,434	1,246	794	142	1,119
PW – 3	18,757	732	68	66	68
PW – 4	67,015	1,554	382	289	457
TOTALS	157,569	6,815	1,515	768	3,069

Effects Common to All Action Alternatives

In general, timber harvest and fuels treatments would increase the distance between trees through tree removal and burning. This increased distance between trees has the direct effect of opening the stand, allowing for more visibility into and out of the stand. This increased sight distance would detract from the sense of solitude a visitor might have in an area without roads, especially as distance from roads increases. For those seeking this type of experience, the overall effect from the action alternatives would be negative and would last up to 1 or 2 decades until vegetation regrows and canopies fill in. Direct impacts to recreationists during logging operations would be impacts from noise and traffic; during burning, some recreationists would be impacted by smoke, which may decrease overall visitor satisfaction.

¹²¹ These acres are the gross totals of the potential wilderness areas, which includes IRA's, OCRA, Wilderness, and Park Service lands.

¹²² Gross acres of the potential wilderness areas are displayed in the previous column, whereas this column displays acres potentially affected by the project, which excludes IRA's, OCRA, Wilderness, (these land allocations are discussed separately) and Park Service lands. IRA's, OCRA, and Wilderness lands are disclosed separately.

Where big game are present, treatments would increase sight distance into the stands, which equates to a beneficial effect for a hunters ability to see and stalk game. Where trapping occurs, trappers would be able to move more freely through the stands, potentially increasing the area they find suitable for trapping (a beneficial effect for trappers). The duration of these effects would also last one to two decades, until vegetation fills in. The wildlife section details how these beneficial effects to recreationists would potentially adversely affect the wildlife species that is being pursued.

In general, OHV users may see an increase in areas that are available for off trail use. Many users stay on designated trails or where they are permitted. Winter OHV users have the potential to go further into the forest, off trail, as stands are opened up and views increase. This may be a beneficial effect for these users, who would have more options available to them for winter use. This effect could last for multiple decades until newly growing vegetation reaches a height that would impede vehicle movement.

Summer OHV users may also have the potential to go further into the forest, off trail; however, residual slash may severely limit this potential, as uneven terrain, and obstacles would prevent some use. Subsoiling of temporary roads would also limit the ability of summer OHV users to move off trail, as subsoiling creates a very uneven surface that makes even walking difficult. The ability of summer OHV users to move off trail diminishes after 1 or 2 decades as vegetation grows.

The construction and subsequent decommissioning of new temporary roads, and the use of existing unclassified roads would also impact the potential wilderness areas. Table 64 displays the miles of road, by category, by potential wilderness area, that would be used for the D-Bug action alternatives.

Table 64. Miles of Temporary and Unclassified Roads in Potential Wilderness Areas.

Potential Wilderness Area	New Temporary Roads (miles)			Re-use Existing Unclassified Roads			Total Temporary/ Unclassified Roads Used		
	Alt 2	Alt 3	Alt 4	Alt 2	Alt 3	Alt 4	Alt 2	Alt 3	Alt 4
1	0	0	7.6	0.18	0.18	0.18	0.18	0.18	7.74
2	4.2	0	4.2	2.3	0.13	2.3	6.6	0.13	6.6
3	0.15	0.15	0.15	0.28	0.28	0.28	0.44	0.44	0.44
4	2.02	1.97	2.02	1.48	0.02	1.48	3.5	2.0	3.5
TOTALS	6.37	2.12	13.97	4.24	0.61	4.24	10.72	2.75	18.28

In general, temporary roads can disturb soils, encourage off trail use by OHV's, transport weeds, and disturb native flora and fauna. Management requirements and project design features listed in Chapter 2 help reduce the impact from temporary roads, as would the decommissioning of all new temporary roads under the action alternatives. Some of the existing unclassified roads would be retained, as they currently serve as snowmobile routes or are what is left of the old Highway 138.

Beneficial effects of thinning and fuels treatment include increasing tree spacing, decreasing ladder fuels, decreasing fuel loads, and increasing stand resiliency. By increasing the spacing between the trees and removing vegetation that acts as ladder fuels, the risk of a fire moving from the ground into the crown is reduced. Fire intensity

would also be diminished as the fuel loading would be reduced. Reducing the risk uncharacteristic fire effects helps maintain the characteristics that potential wilderness areas are valued for.

Effects to individual potential wilderness areas are described below.

PW-1

PW-1 (Figure 29), offers users a high degree of solitude, once the influences from Highway 230 and Road 760 to the northwest and Highway 138 from the east are no longer felt. Road 760 parallels Highway 230 at a distance of about 0.3 miles from the highway. Alternatives 2 and 3 treat the area closest to these two roads; treatment would occur less than 1,200 feet past Road 760 into the interior of PW-1, and less than 1,000' from Highway 138. At these points, human influences can still be heard in the form of highway traffic year round and snowmobile traffic in winter. Because of this, the impacts to the opportunities for solitude would be limited under Alternatives 2 and 3. Alternative 4 would treat stands about 4,300' into the area without roads south of Road 760 and at most, 1,000' west of Highway 138. Human influences are more difficult to distinguish at this distance and the opportunity for solitude is greater as distance from the road increases. Therefore, under Alternative 4, impacts to solitude would be greater and would extend deeper into the Potential Wilderness Area, limiting a forest visitor's ability to seek quiet and solitude, when compared to Alternatives 2 and 3.

Thinning and fuels treatment under the action alternatives would open the area visually (see visuals section) and would allow for greater sight distance and use by OHV's, particularly in winter¹²³ (see wildlife section for impacts to wildlife); the depth of that use is less under Alternatives 2 and 3 than under Alternative 4 due to the extent of treatments. Road 760 receives primarily snowmobile and ATV use; cross country skiers also use this trail, although it is heavily used by OHV's, which is often a deterrent to some Nordic users. Short term direct effects would occur to users of this area in the fall and summer (mostly dispersed recreationists), primarily in the form of disturbance from logging noises during harvest operations, and decreased visibility during slash treatments; since no winter logging is proposed, these types of effects would not occur to winter users. There are no formal hiking trails in the area, so disturbance to hikers is anticipated to be low to non-existent.

Alternative 4 treatments extend to the boundary of the Crater Lake National Park within this PW, at an approximate distance of 1 mile from Highway 230. Opening the stands may lead to illegal use by OHV's (both summer and winter) into the Park. This use would likely occur only where slopes do not exceed 50%. The area of greatest concern is where the treatment extends to the Park Boundary, at the southwest corner of the Forest's boundary with the Rogue River-Siskiyou National Forest and the Crater Lake National Park. Concern was expressed by Park managers about the potential for OHV users to enter the Park, where use off of designated trails or roads is prohibited. The boundary of Crater Lake National Park was surveyed by Forest Service survey crews and has been clearly marked, so travelers would know they are entering a different management area in the summer and fall; these boundaries may not be seen during the winter if snowpack is high. Educational signs with trail maps and boundary delineations could be put up at the nearest snow park facilities to ensure that users are aware of this

¹²³ It is against state law to ride a snowmobile on the road shoulders of State or Federal Highways. According to Umpqua National Forest law enforcement personnel, this is the most frequently cited infraction by winter OHV users. At the northern border of this potential wilderness area, snowmobiles regularly attempt to ride on the road shoulder.

boundary. Regardless, Alternative 4 has the greatest ability to impact the National Park through unauthorized OHV use as it harvests next to the park boundary. Impacts from this potential use include spread of noxious weeds, disturbance to wildlife, decreased user experiences because of noise and changes to the natural environment, and an overall reduction in solitude.

This Potential Wilderness Area is most heavily impacted by new temporary roads under Alternative 4. Over 7.5 miles of new temporary road and 0.18 miles of unclassified roads would be built and decommissioned or used under this Alternative. Although all newly constructed temporary roads would be decommissioned, the imprint of these roads would last on the landscape until ground cover is established, diminishing a user's enjoyment of the area, if they desire solitude and natural surroundings. OHV users may be attracted to these areas, both in summer and winter, and find it easier to move about off of existing roads and trails. For some users this would be a beneficial effect, while for other users, this would be a negative effect.

Impacts to Potential Wilderness

PW-1, which at 3,283 acres is the largest Potential Wilderness in the planning area, is directly contiguous to Crater Lake National Park, and extends into the Rogue River/Siskiyou National Forest. This area meets criteria 2 and 3, as it is connected to a national park that is managed and maintained in a natural state. This area has not been developed, as moderate opportunities for solitude that increase as the distance from the highways increase, and can be managed as wilderness given its connection to Crater Lake National Park. The impacts from Alternative 4 make it unlikely this area would be considered for future wilderness designation, as over 1,400 acres would be thinned and over 7 miles of new temporary road would be built. Alternatives 2 and 3 impact less of this area and use mostly existing roads, potentially maintaining options for future wilderness designation. Alternative 1 would not impact the ability to be considered as potential wilderness.

PW-2

As discussed previously, Units 72 (81 acres) and 73 (691 acres) are of concern to some conservation groups because these units lie predominately within PW-2 (Figure 29), although the eastern edge of Unit 73 is in PW-5. The opportunity for solitude is slightly more limited in this area than in PW-1, as it is bordered to the west and south by Highway 138 and to the east by a heavily used snowmobile trail (Trail 1457). The distance between the highway and the trail varies, but is less than 4000 feet. From this distance, the sounds from the highway can be heard year-round and during the winter, sounds from snowmobiles are present, particularly on weekends. Alternative 4 impacts this area the greatest as it treats the entire area along Highway 138 and the 1457 trail, decreasing the opportunity for solitude, since the resulting stand conditions would be much more open than under the current condition. Alternative 2 has the next greatest impact, as it treats the roadside strip along Highway 138, then it treats the large block of land from Highway 138 to Trail 1457. The decreased opportunity for solitude would last 1 to 2 decades, until vegetation fills in and sight distances are diminished. Where this large block is treated is where the greatest effects would be felt. Under Alternative 3, a narrow 400-foot strip adjacent to the highway on the eastern side would be thinned; this would not detract from the opportunity for solitude in the area, given the limited extent of the treatment. Short term direct effects under Alternatives 2 and 4 would occur to users of this area in the fall and summer (primarily hunters, ATV users, and dispersed recreationists), primarily in the form of disturbance from logging noises during harvest

operations, and decreased visibility during slash treatments; since no winter logging is proposed, these types of effects would not occur to winter users. The effects from thinning and fuels treatment under Alternative 3 would be confined to the small strip treated adjacent to the highway and would be of limited intensity and duration.

Trail 1410 parallels Highway 138 and is used as both a hiking and Nordic trail. It's adjacency to the highway exposes users to the sights and sounds of the highway; the potential to experience solitude on this trail is very low. The effects of thinning and fuels treatment under all action opportunities on this trail would be to increase sight distance and disturbance and decrease the opportunity for solitude due to the opening of the canopy and decreased density of trees.

Trail 1457 borders the OCRA and is a heavily used snowmobile trail, although it is also designated for hiking and Nordic use. The effects of thinning and fuels treatment under Alternatives 2 and 4 would be to increase sight distance and decrease the sense of solitude due to the opening of the canopy and decreased density of trees. Trail 1457 is an old road that has been moved into trail designation for OHV use. Using the old road would have limited effects, primarily through falling trees deemed as hazards along the road.

This Potential Wilderness Area is the second most impacted area by new temporary roads under Alternatives 2 and 4. About 4.2 miles of new temporary road and 2.3 miles of unclassified roads would be built and decommissioned or used under these Alternatives. Although all newly constructed temporary roads would be decommissioned (further deterring OHV summer use), the imprint of these roads would last on the landscape until ground cover is established, diminishing a user's enjoyment of the area, if they desire solitude and natural surroundings. OHV users may be attracted to these areas primarily in summer, and find it easier to move about off of existing roads and trails, although there is a high amount of down wood on the ground currently, limiting the ability to move off trail in the lodgepole pine forests. For some users this would be a beneficial effect, while for other users, this would be a negative effect. Alternative 3 proposes re-using 0.13 miles of existing unclassified roads and would have minimal impacts to the nature of the Potential Wilderness Area.

Impacts to Potential Wilderness

PW-2 is bordered by roads and trails along Highway 138. It meets criteria 2 and 3, as it is contiguous with the OCRA. As with PW-1, Alternative 4 would impact the area through thinning and temporary road building, impacting natural characteristics and the undeveloped nature of the area such that wilderness designation would be highly unlikely; Alternative 2 has the next greatest impact to this area. Since Alternative 3 only treats about a 400' strip adjacent to Highway 138, it would retain enough characteristics to not preclude future options for wilderness designation. Alternative 1 would not impact the ability to be considered as potential wilderness.

PW-4

PW-4 is made up of the edges of the Mt. Bailey Roadless Area that was originally not designated as part of the IRA (Figure 29). Of the 732 acres in the planning area, about 68 acres are affected by the action alternatives, and these impacts occur along the very edges and tip of the area. This area does not have any large intact tracts of land, as those adjacent areas are classified as an IRA. Because the impact of the 68 acres of treatment are so limited and occur directly adjacent to existing roads, there is very little direct impact to this area under the action alternatives. About 0.15 miles of temporary

spur roads are constructed into this area, while 0.28 miles of unclassified roads are used. Effects from roads to this Potential Wilderness Area would also be limited as the primary impact is from a small spur north of Diamond Lake, which would be decommissioned after use. There is an existing old roadbed on a ridge north of Diamond Lake that would be used; impacts to users in the area would be limited as this area would be logged either before Memorial Day or after Labor Day to limit disturbance to those using the Diamond Lake Recreation Area. The small portion of the area north of Diamond Lake is paralleled by Road 4795, which receives heavy winter OHV use and summer vehicle traffic. However, the small amount of treatment into the area made by the 68 acres is not expected to affect winter OHV use.

Impacts to Potential Wilderness

PW-4 encompasses the Mt. Bailey IRA, which is already designated as roadless, which was discussed under the IRA section. If evaluated independently, the small extensions (732 acres) of what is mapped as potential wilderness are small polygons that meet criteria 2 and 3. This area has very low capability for potential wilderness, as it is no longer free from impacts to its natural characteristics and it is no longer undeveloped (roads and regeneration harvest units make up the edges). There are no opportunities for solitude or primitive recreation, no special features or values, and it would be difficult to manage the additions, given their proximity to roads. The action alternatives treat the edges of this area, further detracting from potential wilderness area characteristics, making consideration for wilderness designation less likely. Alternative 1 would not impact the ability to be considered as potential wilderness.

PW-5

This Potential Wilderness Area is made up of the land that was not designated as OCRA and borders Trail 1457, Highway 138, Road 4793, and the Thirsty Creek IRA (Figure 29). It is a rather thin strip of land that is most impacted by the treatments along Highway 138. Because this area is so close to roads, opportunities for solitude are very limited. Impacts to recreationists would also be limited, although hunters who use this area would experience increased sight distances into the stands, which equates to a beneficial effect for a hunters ability to see and stalk game. The predominant impact from temporary roads would occur along Highway 138, where several small temporary spur roads would be located, and just off of Highway 138 near the Highway 230 junction where a short spur road enters a unit. Given that these roads primarily parallel the highway, the impacts of these roads would not be felt by most users as the solitude of the area is very low. OHV use is not allowed along the Highway road shoulder and there are few opportunities for OHV's to get off trail. OHV use occurs along Trail 1457, but the small edges of this area affected by the action alternatives would likely not be noticeable by most OHV users.

Impacts to Potential Wilderness

PW-5, outside the planning area, encompasses the OCRA, which was discussed previously. Independent of the OCRA, this Potential Wilderness Area meets criteria 2 and 3, in that it is adjacent to the OCRA and as mapped, does not contain roads. This area also has low capability for potential wilderness, as it is heavily influenced by Highway 138, diminishing its natural characteristics. It is not free from human presence, and there is no opportunity for solitude or primitive recreation. There are no special features or values, and given the proximity to Highway 138 and the current authorized use of motorized recreation, it would be difficult to manage as wilderness. All action alternatives would reduce the naturalness of this area, limiting its potential as future

wilderness. Alternative 1 would not impact the ability to be considered as potential wilderness.

Oregon Wild also sent scoping information concerning other areas without roads. These areas (four distinct areas) were analyzed to determine if they met the criteria for potential wilderness; one area was at the very southwestern edge of the planning area, one area was south of Highway 138 near Clearwater Campground, while the other two areas were near Lemolo Lake. None of these four areas met the criteria for potential wilderness and will not be discussed further.

Cumulative Effects

The Charlene Timber Sale had limited impacts to edge of PW-4 near Lemolo Lake (23 acres were thinned). In this particular area, all action alternatives would treat along the northern strip of road 60-960, contributing to the cumulative effect of increased treatment into this section of PW-4 only. Trail maintenance is an ongoing and future action in potential wilderness areas, where the trails occur; this action has an immeasurable impact on the area, but beneficially effects trail users by increasing user experiences. Therefore, given the very limited past actions, the present D-Bug actions, and the lack of reasonably foreseeable actions other than trail maintenance in any other PW, no cumulative effects are expected to occur.

Wilderness

Affected Environment

The Mt. Thielsen Wilderness lies to the east of the planning area and is 'buffered' by the OCRA. The Wilderness is identified in the LRMP as MA4¹²⁴ and is to be managed as part of the National System of Wilderness. Portions of the Pacific Crest Trail pass through the wilderness. The Visual Quality Objective (VQO) is preservation. Primary activities are hiking, climbing, fishing, camping, and horseback riding. The most concentrated use occurs around Mt. Thielsen and the Mt. Thielsen trail, with climbing as the main objective. Primary access to the Mt. Thielsen trail is from the trailhead parking area located off Highway 138 in the Diamond Lake area. Diamond Lake Resort also operates guided horse rides into the wilderness using the Howlock (1448) and Thielsen Creek (1449) trails. There are no D-Bug activities proposed in the Wilderness.

Environmental Effects

Because there are no D-Bug activities proposed in the Mt. Thielsen Wilderness, there are no direct or indirect effects. There are no connected or similar actions that would affect the wilderness and there are no reasonably foreseeable actions that would affect the wilderness. Because of the lack of direct and indirect effects, there are no cumulative effects to the Mt. Thielsen Wilderness.

¹²⁴ The management objective (desired condition) of the Mt. Thielsen Wilderness is to preserve and restore the integrity of the wilderness resource, provide consistent administration by all Forests and Districts involved, maintain and enhance the wilderness resource by managing wilderness under a non-degradation and enhancement policy; and provide a complementary variety of social and managerial settings using the Wilderness Resource Spectrum.

SCENERY MANAGEMENT/VISUAL QUALITY – TRACKED AS A SIGNIFICANT ISSUE

During scoping, an issue was raised by several conservation groups that the proposed activities along Highways 138 and 230 would degrade the scenic drives, and that the Visual Quality Objectives¹²⁵ (VQOs) of retention and partial retention should be retained instead of amending the VQOs along those routes.

The following indicator quantifies and tracks this issue:

During scoping, an issue was raised by several conservation groups that the proposed activities along Highways 138 and 230 would degrade the scenic drives, and that the Visual Quality Objectives¹²⁶ (VQOs) of retention and partial retention should be retained instead of amending the VQOs along those routes.

The following indicator quantifies and tracks this issue:

- Acres treated along Highway 138 and 230 that currently have retention or partial retention visual standards that would be moved into a lower visual level.

Relevant Standards and Guidelines

Visual Standards and Guidelines are listed on pages IV-19 to IV-26 of the LRMP. Specifically for this project, the Umpqua LRMP lists the following standards and guidelines:

- **Minimum Level** – The minimum acceptable level of visual quality shall be “maximum modification.”
- **Exceptions/Mitigation** – Proposed exceptions to meeting assigned VQOs will be identified through project environmental analysis and amendment procedures described in Forest Plan Chapter Five. Examples of some exceptions are areas where past management practices make it impractical to meet the adopted visual quality objectives (VQO), or areas where catastrophic loss is imminent or has occurred. Visual mitigation measures shall be developed for areas when VQOs are not met so that projected future visual conditions are consistent with the Forest Plan.
- **Duration of Visual Impact** – the duration objective pertaining to ground disturbance shown in Agriculture Handbook 462 shall be modified to be the same as partial retention. Within Retention and Partial Retention objective areas, duration shall be an evaluation criterion during project environmental analysis. Management techniques shall be explored during the analysis process to attain duration objectives.
- **Created Openings** – Created openings (timber harvest units) shall be shaped and blended to the extent practicable with the natural terrain. Openings shall be located to achieve the desired combination of multiple use considerations. The maximum percentage of created openings at any one time is based on the VQO

¹²⁵ The VQO inventory is divided into three components: the distance zone, the sensitivity level (constituent information), and the variety class (scenic attractiveness). The distance zones are described as FG-foreground, MG-middleground, and BG-background. The sensitivity level (1-highest, 2-average sensitivity, and 3-lowest) rates the concern for scenic quality. The visual inventory also describes the primary and sometimes the secondary place where a specific area can be viewed. This is usually from a prominent point of view or primary use area, or a particular road. Variety class relates to how distinct or common the visual resource is.

- objective and distance zone. For retention, this ranges between 5-15% maximum created openings. For partial retention, this ranges between 10-25% maximum created openings. For modification, a maximum of 15-30% of the landscape may be in created openings, while in maximum modification areas, up to 33% of the landscape may be in created openings.
- A harvest unit is considered to be a created opening when the average stand height is less than 20 feet tall in foreground and middle ground distance zones, and less than 4.5 feet tall in background distance zones.
 - Activity slash within viewsheds shall be treated commensurate with the VQO. Areas within 500 feet of sensitive routes shall have high priority for treatment. Viewsheds should be treated in a manner that avoids soil color contrast or denudation of the site.

Relevant Watershed Analysis Recommendations

The 2008 Watershed Analysis Iteration and Vegetation Management Plan, and the 2006 Winter Use Guide and Assessment (all incorporated by reference) each recognized that the stability of the scenic resource is currently at risk and recommend vegetative treatments to reduce the hazard of catastrophic wildfire and lower the potential impacts from insect outbreaks.

Existing and Desired Conditions

The Visual Management System is a management tool to recognize the scenic qualities of a specific area. It establishes criteria for identification and classification of the scenic quality as well as visitor's concern for scenic quality. Each visual quality objective (VQO) represents the degree of alteration from the natural appearing environment. The Umpqua LRMP applies the Visual Management System Inventory as a minimum standard that project proposals should achieve when implemented; this system was developed when the Forest was using regeneration harvest methods as the primary tool for timber harvest. Considerations were not given to the use of commercial thinning or to unnatural changes in the disturbance regimes of the forest when VQOs were assigned to a particular area.

Due to the high level of natural beauty, the high recreation use in the area, and the predominant use of clearcutting as a harvest method at that time, visual quality objectives of retention and partial retention were assigned to the majority of the planning area. Limited activity has occurred in the planning area and the scenic quality around Lemolo and Diamond Lakes has remained very high. The recreating public has been exposed to very limited, small-scale changes to the scenery (primarily recreation related improvements to the area – Tables 12 and 13).

Managing scenery resources has often been attempted by restricting activities from areas of high scenic value. This approach has limited the management opportunities in areas that are highly valued for scenery. In many cases, the hands-off approach in combination with fire exclusion has created conditions that are hazardous to the valued scenery attributes. Forest succession due to fire exclusion has gone unnoticed by most visitors; many visitors perceive the dense forest conditions that are visible from the primary travel routes and trails as being natural, while others are aware of and concerned about fuel build-up and the increasing fire hazard.

Natural forest disturbances are expected, but extensive areas of dead or dying trees (Haider and Hunt 2002, Ribe 1990), such as the destruction of the forest by fire or

flooding, are perceived negatively (Daniel 2001; Fanarioutu and Skuras 2004; Gobster 1994, 1995). Timber harvest practices and other activities that create unnatural appearing openings that do not mimic natural patterns lower scenic quality. The perceptions of disturbances are also effected by the viewing distance. Generally, the further from the disturbance, the less negatively it is perceived. The amount of dead woody material is also a predictor of negative scenic ratings for forest scenes (Arthur 1977, Brown and Daniel 1986, Haider 1994, Haider and Hunt 2002).

The visual resource is also described by the USDA's National Forest Scenery Management System (SMS) (Agriculture Handbook Number 701). While the Umpqua National Forest LRMP has not been amended to officially adopt this system, the scenic stability component of the SMS is important to consider in the D-Bug analysis. The D-Bug planning area was assessed in terms of how stable the scenic environment is in its current condition.

Scenic stability is diminishing because the existing scenic character cannot be sustained in light of the mountain pine beetle outbreak and the need to provide safe conditions in the concentrated developed recreation areas. More and more lodgepole pine trees are turning brown and dying as a result of the mountain pine beetle (Figure 30); while this is a natural process, these trees increase the hazard of a high intensity wildfire burning through the area, which would create a scenic landscape that is not desired (as well as putting people at risk).

The uncharacteristically dense stand conditions and the abundance of mature lodgepole pine forest in the area and surrounding landscapes is eroding the ability of the landscape to sustain the existing scenic quality. The quality of the scenery has recently dropped around Diamond Lake; less so around Lemolo Lake. Within the Diamond Lake Resort area and campgrounds, thousands of dead hazard trees have been felled and removed in the last three years. Many stumps are now obvious and some of the cut stumps are high and not yet masked by vegetative re-growth. Though the pine beetle outbreak has not yet had an impact on the Lemolo area, there are mature stands of lodgepole susceptible to beetle mortality near Lemolo and the uncharacteristically dense mixed conifer and young lodgepole forests are posing hazards in the wildland urban interface that must be addressed in both WUIs.



Figure 30. Mountain Pine Beetle Outbreak Along the East Shore of Diamond Lake.

Appendix J of the SMS utilizes two indicators to measure the conditions of and the impacts to scenery resources. The two indicators are Scenic Integrity¹²⁷ and Scenic Stability¹²⁸. Scenic integrity is very similar to visual quality, measuring visual impacts to scenery in terms of contrast of color, and distracting elements of unnatural form, line and texture. Scenic stability is a newly defined indicator that is used to measure the stability of scenic attributes given the conditions and stressors that may create potential hazards to the stability or resiliency of the valued scenery attributes.

Scenic stability provides sustainability information based on ecological processes that are necessary to conserve valued scenery for future generations. Sustainability of scenery is primarily based on two aspects of an area: 1) the set of scenery attributes that make up its socially valued scenic character, and 2) the historic range of variability of those attributes, which provides information about how scenery attributes were perpetuated within the ecosystem. The scenic stability analysis first identifies sustainability of individual scenery attributes that make up the valued¹²⁹ scenic character, then identifies the sustainability for a landscape's scenic character, through assignment of a scenic stability level.

Scenic stability ratings are from no stability to very high stability. Table 65 displays the scenic stability level in terms of risk (more aptly termed hazard), and stability.

Table 65. Scenic Stability Levels.

Ecosystem Risk to the Dominant Scenery Attributes	Stability of the Dominant Scenery Attributes	Resulting Scenic Stability Level¹³⁰
LOW RISK TO ALL (includes dominant and major attributes)	ALL ATTRIBUTES	VERY HIGH STABILITY
LOW RISK TO ALL	ALL ATTRIBUTES	HIGH STABILITY
HIGH RISK TO FEW	MOST ATTRIBUTES	MODERATE STABILITY
HIGH RISK TO SOME	SOME ATTRIBUTES	LOW STABILITY
HIGH RISK TO MOST	FEW ATTRIBUTES	VERY LOW STABILITY
HIGH RISK TO ALL	NO ATTRIBUTES	NO STABILITY

¹²⁷ Scenic Integrity measures the amount of visual disturbance that contrasts with and/or detracts from the natural or socially valued appearance in a landscape.

¹²⁸ Scenic Stability is the degree to which the valued scenic character and its scenery attributes can be sustained through time and ecological progression.

¹²⁹ Common valued scenery attributes of vegetation include aspen groves, meadows, big tree character and open forest canopies, which are highly influenced by ecosystem changes and imbalances. Other valued scenery attributes include water bodies, landforms and cultural features.

¹³⁰ VERY HIGH – all dominant and minor scenery attributes of the valued scenic character are present and likely to be sustained; HIGH – All dominant scenery attributes of the valued scenic character are present and are likely to be sustained, but some conditions and stressors present a low risk to the sustainability of dominant scenery attributes; MODERATE – Most attributes present and likely to be sustained, but a few have been lost or are in decline; LOW – Some attributes are present and likely to be sustained, but known conditions and stressors may seriously threatened or have eliminated some attributes; VERY LOW – Most dominant attributes are seriously threatened or absent to do conditions or stressors and are not likely to be sustained and those that remain may be moderately threatened, but are likely to be sustained; NO – All dominant attributes absent or seriously threatened and non are likely to be sustained, except for permanent landforms.

The D-Bug project area is highly valued for the scenic attractiveness and the recreation opportunities available to the public. Views of the lakes and vistas of Mt. Bailey and Mt. Thielsen make this area very scenic. The contrast of the snowcapped peaks and the coniferous forest make for dynamic scenes. When combined with Diamond Lake in the foreground, the view is very attractive. The dominant scenic attributes are the mountain peaks, the lakes and rivers, and the coniferous forest vegetation.

Ecological Context

The ecological processes that have purported the vegetation are well described in the Diamond Lake and Lemolo Lake Watershed Analyses. As described in the Vegetation section, this area is at an elevation that supports lodgepole pine and some mixed conifer species such as Douglas-fir, ponderosa pine, white fir and Shasta red fir. Fire has played a prominent role in the past, burning large areas, and “stretching for miles”, with stand replacement severity. Prior to fire exclusion, fires would leave patches or pockets of unburned timber related to riparian areas or weather patterns. Once fire fighting became well established to protect investments such as Diamond Lake Lodge, and other amenities, fires were put out as quickly as possible and thus the size of the fires were typically reduced to less than 10 acres. At a landscape scale, fire has been virtually excluded, except in nearby Crater Lake National Park, where fire has been applied as a management tool.

The amount of human use in the area increases the potential for human caused fires such as a campfire getting out of hand or releasing an ember into the adjacent forest vegetation. Lightning is known to strike Mt. Thielsen at high frequency. It is known that approximately 30% of the fires in this area have been human caused and 70% caused by lightning, and that as access has improved, human caused fires have increased. These factors, in combination with the hot dry summers that have occurred during the past 10 to 15 years leads to a fair conclusion that ignition is quite possible and increasingly so. In fact, on July 21, 2008, a lightning storm passing directly over the Crater Lake/Diamond Lake area resulted in two fires located on the southwestern edge of the planning area, both about 1 miles south of Highway 230 and one fire within the boundary of Crater Lake National Park, about 3 miles south of Highway 230. These fires were quickly suppressed.

The landscape, from a middleground or background view, is a very lush appearing landscape; thriving vegetation, abundant water and clear blue sky. However, from a foreground view, it is very apparent that all is not well. The lodgepole pine stands are often tinged with a brownish red color that is due to the mountain pine beetle infestations that have grown to an epidemic proportion. Forest Service Entomologist Don Goheen has predicted that the mortality rate for this area could be as much as 90% within the next 5 years (Goheen 2008). The planning area is comprised of about 44% lodgepole, of which about 8% of those acres are infested and the other 36% are in conditions that invite infestation. Due to fire exclusion, the lodgepole stands have grown to a density that the mountain pine beetle prefers.

There are other signs that cause concern for the stability of the forest stands in the area. The lodgepole pine stands are very densely stocked. The stand density has reduced the trees ability to develop a thriving appearance of lower branches and full canopy. From a five foot eye level, the lodgepole stands are a nearly continuous mass of poles ranging from 3 to 12 inches in diameter (DBH). Only the smallest trees of less than 3” DBH provide any green needle branches at eye level. The high canopy level is however very dense. The density of these stands has created conditions that are both very welcoming

to the mountain pine beetle, and very susceptible to high severity, large stand replacement fire.

These conditions are not localized but wide spread. The project is nearly surrounded by land allocations that have limited management opportunities, and are in a similar condition. The Mt. Bailey inventoried roadless area is adjacent to the west, Crater Lake National Park is adjacent to the south and the Mt. Thielsen Wilderness and the Oregon Cascade Recreation Area is adjacent to the east.

The hazardous conditions of the vegetation, the mountain pine beetle infestation in this area, and the potential for fire ignition and high fire severity conditions, makes the existing scenic stability low (Table 65).

In terms of scenic integrity, the D-Bug project area is a landscape of moderate to high scenic integrity (partial retention and retention), where there are few elements that detract from the scenic quality of the area. However, there are areas where stumps and slash are prominent in the foreground views around highly used recreation areas. These stumps detract from the natural appearance and degrade the scenic integrity. Dead and dying lodgepole pine trees are making the forest appear unhealthy to the recreating public.

Desired Condition

Due to the heavy recreational use in this project area, the desired scenic stability level is high (Table 65). The area has a high scenic attractiveness rating as well as high sensitivity level within the Visual Management System. The desired condition is a more sustainable balance between the valued scenery attributes and ecological stressors.

The desired condition of the lodgepole pine stands are a mix of structural stages, providing areas of visual access into the forest stands to view large conifer trees, intermixed with pockets of early seral stage trees that have branches at eye level and below. These conditions are within the historical range of variability and would be occurring in this area if fire exclusion would not have occurred. Mixed conifer stands would provide large tree character and diversity in species, as well as views of the large sized Shasta red fir and pine. The forest floor in the immediate foreground would generally be clear of dead woody material, but pockets of debris would be visible at distances of greater than 300 feet. Stands in and around recreational areas would be open stands that have fewer ladder fuels and an open canopy.

Visual Quality Objectives (VQOs)

Management of the visual resources requires proposed activities to comply with the assigned objective. For D-Bug, they include retention (high scenic integrity), partial retention (moderate scenic integrity), modification (low scenic integrity) or maximum modification (very low scenic integrity). In the areas with the VQO of retention, management activities are not evident to the average forest visitor. In partial retention, management activities are to remain visually subordinate to the characteristic landscape. In areas with a VQO of modification, management activities may visually dominate the landscape; however, roads and visible remnants from logging such as slash and stumps, etc. should remain visually subordinate to the landscape. The maximum modification VQO allows management activities of vegetative and landform alterations to dominate the landscape.

In order to meet the VQO of retention, management activities should not be evident – this would be nearly impossible to achieve under the any of D-Bug commercial or non-

commercial treatments, as more than one or two trees may be cut and more than one or two stumps may be evident. Even the VQO of partial retention may be difficult to achieve. In order to protect the WUI, reduce the hazard from the bug-killed trees, and lower the risk that the lodgepole pines in the area would succumb to the mountain pine beetle, trees would have to be removed and fuels would have to be treated. It would be impossible to do these activities and not be visually ‘seen’ by the average forest visitor. Therefore, in order to do any management activity in the planning area, the D-Bug project proposes to amend the Forest Plan’s VQO’s of retention and partial retention to allow for activities to occur in the planning area.

The majority of the planning area is classified as either retention or partial retention, as are most of the treated areas (both commercial and non-commercial units). Much of the area proposed for treatment can be seen from Highways 138 and/or 230, from the Mt. Bailey IRA, or from the Mt. Thielsen Wilderness Area. Table 66 describes the existing condition of the visual quality objectives found in the planning area; Alternative 1 is represented by the planning area acres.

Table 66. Acres of VQO Within the Planning Area and Within the Proposed Treatment Areas of Each Alternative.

Visual Quality Objective	Planning Area Acres (Alternative 1)	Alternative 2 – includes only areas to be treated	Alternative 3 – includes only areas to be treated	Alternative 4 – includes only areas to be treated
Preservation	5	0	0	0
Retention	15,191	3,320	2,850	3,490
Partial Retention	13,028	4,273	2,990	4,971
Modification	5,469	767	393	845
Maximum Modification	8,278	644	487	1,864
Totals	41,971	9,004	6,720	11,170

Highways 138 and 230, both the Lemolo Lake and Diamond Lake recreation composites (all of MA 2), and all roads and trails along or adjacent to these areas are classified as sensitivity level 1 under the Umpqua LRMP, which means that it has the highest sensitivity for concern over scenic quality; nearly all other roads and routes in the planning area have sensitivity level of 2, which is an average sensitivity.

Direct and Indirect Effects

The scale at which effects are analyzed is the planning area. Effects to visual quality are determined by considering each alternative in terms of impacts of treatments to the natural appearance of the area.

Alternative 1 would have no direct effect to the visual quality of the area because no ground disturbing activities would occur. Indirectly, however, Alternative 1 does not respond to the scenic instability of the area. With no action, existing trends and conditions would continue, including the mountain pine beetle infestation. As more lodgepole succumb to mountain pine beetles, their needles would turn brown; if mortality occurs as predicted, up to 90% of the lodgepole pine may die within a few years, creating a landscape of brown trees. As disclosed in the fire/fuels section, these areas

are susceptible to stand replacement fire, which would visually alter the area for decades, until new seedlings grew to a height sufficient to become the prominent feature in the viewshed (versus the blackened snags). This would affect scenic stability at a landscape scale that has reduced stability to low, and if not treated, is very likely to reduce the stability level even further to very low. Without intervention, the scenery is expected to decline over time until vegetation reestablished.

Effects to scenic stability are determined by considering each action alternative in terms of treatments and their effect on the existing conditions, and treatments that are done as preventative measures. For example, salvaging dead trees in a dense forest reduces the fuel load to directly improve resiliency to stand replacement fire, as does thinning the densities of the trees and canopy. As the stands move to a more fire resilient condition, the scenic stability is improved.

The direct effects of this project to the scenic stability are minimal at a landscape scale. There are not enough acres proposed to be treated to make any measurable difference to stability of the scenic attributes across the landscape. The project is not designed to fully eliminate the threat of further beetle infestations or fire, but acts to reduce the fire hazard where people congregate. Considering the treatment proposals from a foreground perspective, the scenic stability would be improved in the foreground areas. The campgrounds, lodges and recreation residences are all places where people experience the foreground scenery in a very connected manner, being within the forest canopy rather than just viewing the scenery from a distance. These foreground attributes create a large part of the recreational experience. Therefore, scenic stability will be address at two differing scales: foreground and landscape.

Effects Common to All Alternatives (Table 67)

Treatments¹³¹ are proposed primarily in foreground areas around the perimeter of the Diamond Lake and Lemolo Lake recreation areas, private recreation residences, and along Highways 138 and 230, Lemolo Lake Road, Windigo Pass Road, and Thirsty Creek Road. In general, the duration of the impact would last approximately 3 to 10 years, depending on the site, the type of slash treatment, and how rapid ground vegetation responds in the area. Units would be designed to blend with the landscape and avoid harsh edges as much as possible.

Burning would have the potential to directly and indirectly impact scenery, especially if the burn were 'hot' and consumed more slash or trees than planned; underburning is limited and not expected to result in major changes to the visual quality of the area. The effects from slash or pile burns would fade after a few years, as vegetation grows and the burned area no longer becomes visible. Areas in retention would be prioritized for pile burning to maintain scenery in the area.

In response to the issue raised during scoping, for the action alternatives, there are about 114 acres within 150 feet of Highway 230 where treatments would be most visible. Within this area, about 9.5 acres would move from Retention to Partial Retention, while 70.2 acres would move from Retention to Modification. About 28.8 acres would move from Partial Retention to Modification. About 5 acres would remain as Partial Retention after treatment.

Along Highway 138, there are about 564 acres within 150 that would be most visible after treatment. Within this area, about 210.5 acres would move from Retention to

¹³¹ For unit by unit affects to scenic integrity and visual quality objective, please see the Visuals/Scenery Specialist Report in the Project File.

Partial Retention, while 194.3 acres would move from Retention to Modification. About 135.1 acres would move from Partial Retention to Modification. About 24 acres would remain as Partial Retention after treatment. As vegetation grows on the forest floor, the visual impacts from the treatments would become less obvious and the area would return to its pre-treatment VQO. If funding was available, stumps greater than 7" dbh would be flush cut along Highways 138 and 230 where visible, for a maximum distance from the road of fifty feet in order to mitigate for the effect on visuals. However, since the vast majority of the project would use mechanized harvest methods, it is anticipated that most stumps would be around 6" to 8" in height, alleviating much of the need to flush cut stumps.

Table 67. Effects to Visuals/Scenery by Treatment Type by Alternative.

Treatment Type	Primary Effects (Beneficial/Adverse)	Resulting VQO for action alternatives	Alt 1	Alt 2	Alt 3	Alt 4
Salvaging Dead/Dying Lodgepole Pine (overstory removal retaining understory trees) Prescription 4	Beneficial – Reduces fuel loads near where people congregate. Reduces appearance of dead and dying trees, improving scenic stability. Adverse – Stumps may be visible and slash piles not immediately treated, detracting from the scenic quality.	Partial Retention in Middleground and Foreground No change to Background	0	59	0	241
Thinning Uninfested Lodgepole Pine (retaining ~50 TPA) and thinning low merchantability stands and salvaging dead and dying lodgepole pine (retaining 50- 200 TPA) Prescriptions 2-4	Beneficial – Reduces hazard/risk of further beetle infestation; limits effects of infestation in foreground, improving scenic stability. Opens vistas to large diameter trees in middleground in areas of lodgepole and mixed conifer. Creates conditions to manage wildfire as a ground fire instead of crown fire. Adverse – Stumps may be visible and slash piles not immediately treated would detract from the scenic quality.	Partial Retention in Middleground Modification in Foreground No Change to Background	0	4,685	3,506	6,482
Non-commercial treatments Prescriptions 5-8	Beneficial – Reduces fuel loads along evacuation routes and opens vistas to large diameter trees in middleground. Adverse – Stumps may be visible and slash piles not immediately treated would detract from the scenic quality.	Partial Retention in Middleground Modification to Partial Retention in Foreground	0	2,026	1,407	2,212

Treatment Type	Primary Effects (Beneficial/Adverse)	Resulting VQO for action alternatives	Alt 1	Alt 2	Alt 3	Alt 4
		No Change to Background				
Mixed Conifer Thinning (retaining 50-200 TPA) Prescriptions 9 - 13	Benefits scenic stability by focusing retention on fire resilient species and opens vistas to large diameter trees in middleground. Reduces canopy densities and fuel loads, creating a more fire and disease resilient stand. Adverse – Stumps may be visible and slash piles not immediately treated would detract from the scenic quality.	Partial Retention in Middleground Modification to Partial Retention in Foreground, depending on TPA retained No Change to Background	0	2,247	1,815	2,245

None of the connected or similar actions would have any lasting effects on the visual resources. Short term impacts include equipment visible in and along roads, yarders or other logging machinery visible on roads and near or within recreation sites. By amending the Forest Plan, all Standards and Guidelines would be met for visual quality objectives in the short term. In the long term, non-commercial methods may be used to maintain the fuelbreak, thus maintaining an open forest condition and desired scenic view.

Cumulative Effects

The scale at which cumulative effects are analyzed is the planning area. All past regeneration harvest was considered (9,972 acres in the planning area). The Forest Silviculturist estimated that areas that were regeneration harvested after 1985 may not have reached 20 feet in height, depending on the forest type and whether or not the unit was pre-commercially thinned. However, this analysis uses 1980 as the cut-off date in order to conservatively estimate the affects to visual quality.

Of the 9,972 acres that were regeneration harvested (clearcut, shelterwood, or final removal), about 6,876 acres were harvested after 1980. Under the existing condition, there are 474 acres harvested after 1980 that are in retention; this is 3% of the 15,191 acres assigned to retention in the planning area and is below the 5%-15% of the area allowed in openings under Standards and Guidelines (S&G's). There are 2,220 acres harvested after 1980 that are in partial retention; this is less than 17% percent of the 13,028 acres of partial retention in the planning area and is within the 10%-25% of the area allowed to be in openings under S&G's. For the modification VQO, there are currently 1,196 acres that were harvested after 1980 or 21% of the 5,469 acres of modification in the planning area, which is within the 15%-30% allowed for openings under S&G's. Finally, for maximum modification, there are 2,186 acres that were

harvested after 1980, or 26% of the 8,278 acres of maximum modification ground, which is below the 33% allowed for openings, thus meeting S&G's that address openings.

When adding the acres proposed to be treated, only those treatments that retain fewer than 50 trees per acre would be considered as openings from a visuals standpoint. The mixed conifer commercial thinning would retain enough trees so as to not contribute to the maximum acreage of allowable openings. The lodgepole pine prescription of retaining 20 trees per acre would be considered a regeneration harvest and would therefore contribute to the openings. Only these units would potentially contribute to cumulative effects.

Alternative 2 would add 44 acres as openings in retention acres, bringing the total openings under retention to 518 acres, or 3.4%; this is still below the acreage allowed for openings. Under partial retention, 15 acres would be considered as openings, increasing the total to 2,235 acres, or 17%; this is still below the acreage allowed for openings under Standards and Guidelines.

Alternative 3 would add zero acres as openings under retention, as no units occur in prescription 1, meaning that this alternative would not contribute to a cumulative effect within the retention VQO.

Alternative 4 would add 58 acres as openings under retention, bringing the total openings under retention to 532 acres, or 3.5%; this is still below the acreage allowed for openings. Under partial retention, 114 acres would be considered as openings, increasing the total to 2,334 acres, or 17.9%; this is still below the acreage allowed for openings. Under modification, 6 acres would be considered as openings, increasing the total to 1,202 acres, or 21.9%; this is still below the acreage allowed for openings. Finally, under maximum modification, 48 acres would be considered as openings, increasing the total to 2,234 acres, or 26.9%; this is still below the acreage allowed for openings, thus meeting S&G's that address openings.

The no action alternative has no cumulative effect on visuals, because it does not directly alter the landscape; should a wildfire burn, the visual quality would be potentially be degraded. As described above, Alternative 3 would not contribute to a cumulative effect, as no treatment acres are proposed that would add to the openings. Alternatives 2 and 4 add 49 and 241 acres respectively to an open condition by implementing prescription 1; however, given the current condition, these acreage changes are minor and constitute less than 1% change in VQOs from the existing condition for both alternatives. There would be no contribution to harvest unit openings from connected or similar actions.

When considering past timber sales as stated above, present activities, and the relatively few reasonably foreseeable activities (Table 14) in the planning area that would have the potential to affect visual quality, and by amending the Forest Plan to allow for treatments to occur in Retention and Partial Retention, no cumulative effects to the visual quality are anticipated to occur with the action alternatives.

NATIONAL FOREST MANAGEMENT ACT DETERMINATION OF SIGNIFICANCE – TRACKED AS A SIGNIFICANT ISSUE

In terms of the proposed Forest Plan Amendments, the responsible official will make a Determination of Significance of Change to the Forest Plan in the Decision Notice/Finding of No Significant Impact. In order to make that determination, FSH 1909.12, Section 5.32, outlines the factors to be used to determine whether a proposed

change to the LRMP is significant or not significant, based on National Forest Management Act requirements. A discussion of each of the proposed amendments (refer to Chapter 2 for more detail) under the action alternatives and the four factors follows. Alternative 1 would not amend the plan and is not discussed further.

Amendment 1: Amending the VQO objectives of Retention and Partial Retention along Highways 138 and 230.

Amendment 2: Amending Management Area 1 and its associated prescriptions to allow for limited timber harvest in and adjacent to the Diamond Lake WUI.

Amendment 3: Amending Management Area 2 and its associated prescriptions to allow for timber harvest units greater than ½ acre in size and commercial and personal use firewood cutting.

Amendment 4: Amending the LRMP to allow harvest in the climax lodgepole pine ecoclasses.

1. Timing. Determine whether the change is necessary during or after the plan period. In most cases, the later the change, the less likely it is to be significant for the forest plan.

The proposed amendments are necessary now in order to efficiently and effectively meet the purpose and need of the D-Bug Project. The Record of Decision for the Umpqua LRMP was signed in 1990 when the assumptions were that most harvest would be done through clearcutting of old-growth. The D-Bug project focuses on thinning and fuels reduction in WUIs and along evacuation routes in order to meet objectives outlined in the Community Wildfire Protection Plans, as recommended under the Healthy Forest Restoration Act; these were developed over a decade after the LRMP. The LRMP did not fully anticipate limited harvest to meet other objectives such as fuels reduction in areas occupied by people, especially when compounded by the magnitude and extent of the mountain pine beetle infestation near the recreation and special use permit sites. Currently, the LRMP is 18 years old and is scheduled for revision in 2013. The plan is currently at the end of the planning cycle. Therefore, timing is not considered to be a significant factor related to the amendments.

2. Location and Size. Define the relationship of the affected area to the overall planning area. In most cases, the smaller the area affected by the change, the less likely it is to be significant for the forest plan.

Amendment 1 allows for modification of the VQO along Highway 138 (540 acres) and Highway 230 (109 acres) and along trails and the campground. There are 28,219 acres of retention and partial retention in the planning area. There are about 7,600 acres of proposed treatment areas assigned to retention and partial retention under Alternative 2, about 5,800 under Alternative 3, and about 8,400 acres under Alternative 4. The action alternatives affect 21% of the acres in retention and partial retention under Alternative 3, about 27% under Alternative 2 and about 29% under Alternative 4; as shown in the VQO analysis, many of these acres would remain in partial retention following treatment. Moreover, there are large landscape areas to the South, West, and East outside of the planning area that would remain largely unmanaged where no changes to the scenery would occur. Overall, the small percentage of acres affected by the amendment is not considered significant for location and size.

Amendment 2 allows for about 62 acres of treatment in MA-1 under Alternatives 2 and 4, and 52 acres under Alternative 3. There are 8,389 acres in MA-1 west of Diamond Lake. Alternatives 2 and 4 affect 0.74% of the management area and Alternative 3 affects 0.62% of MA-1; therefore, because less than 1% of the MA would be treated and the location of the treatment is adjacent to existing roads and trails, location and size are not considered to be a significant factor for this amendment.

Amendment 3 allows for units greater than ½ acre in size to occur within MA-2 around Diamond Lake and Lemolo Lake. When the 1990 plan was written, it was assumed that timber harvest would be accomplished primarily through regeneration harvest. Prescription A4-1, which further defines MA-2, clarifies the intent of the ½ acre opening to apply to “selection cuts, clearcuts, and shelterwood cuts”; all but 5 acres of harvest within MA-2 is either thinning or non-commercial treatments, clearly meeting the intent of the plan to limit harvest openings. However, for the purposes of full disclosure, the plan is proposed for amendment of MA-2 for this project in order to allow for vegetation treatments to meet the purpose and need in these highly valued recreation sites. MA-2 comprises 7,141 acres around Diamond Lake, and 1,396 acres around Lemolo Lake. There are 2,910 acres of commercial (57% of the acres) and non-commercial (43% of the acres) treatments under Alternative 2, about 2,493 acres (63% commercial/37% non-commercial) under Alternative 3, and about 3,047 acres (54% commercial/46% non-commercial) under Alternative 4. The average unit size under Alternative 2 is 27.9 acres, Alternative 3 is 25.9 acres, and Alternative 4 is 28.7 acres. This is presently allowed under the plan because these are thinning or non-commercial treatments. Because the plan clearly limited the ½ acre opening to apply to regeneration-type silvicultural methods, the only prescription that would meet the definition of opening is prescription 1 which retains about 20 lodgepole pine trees per acre. There are only 5 acres of this prescription under Alternatives 2 and 4 in MA-2. Because the size of this unit is small in context of the total acres in MA-2 (0.06%), and the location is adjacent to existing developments, location and size are not determined to be a significant factor for this amendment.

Also, when the plan was written, firewood cutting was excluded from MA-2 since it was viewed as a potential conflict with recreationists. However given the extensive amount of dead lodgepole pine and the expansion of the mountain pine beetle infestation in MA-2, firewood cutting could be used as an economically viable method to remove dead trees in certain areas to meet the purpose and need. As detailed above, most of the thinning prescribed in lodgepole pine stands in MA-2 does not meet the definition of an opening. Firewood cutting permits, either commercial or personal use, would be used as a method to achieve silvicultural prescriptions, including the required leave trees. As concluded above, in the context of the acres in MA-2, the issuance of firewood permits as a means of implementing treatments is not determined to be a significant factor for this amendment.

Amendment 4 allows for harvest of lodgepole that was excluded from the Forest Plan because of its low productivity, small number of acres outside wilderness and the OCRA, and economic criteria used to evaluate harvest costs. Subsequent analyses of inventory data and ecology plot data both demonstrate that the lodgepole pine climax ecoclasses are suitable for timber production. The

climax lodgepole pine ecoclasses are on average, at the high end of site class 6 which an average site class of 39 (Blackburn 2007). An analysis by the SW Oregon Ecology group calculated a mean site index based on plot data for the climax lodgepole pine plant associations on the Umpqua National Forest. The site potential of the climax lodgepole pine stands proposed for treatment under the action alternatives is 50 cubic feet/ac/year or greater (Blackburn 2008). This is over the threshold of 20 cubic feet/ac/year established under the original National Forest Management Act regulations.

Regardless of the above analyses, the amendment is necessary to harvest in lodgepole with this project. There are approximately 1,105,000 acres of lodgepole within 50 miles of Diamond Lake, 57,700 acres of lodgepole on the forest, and 31,000 acres of lodgepole in the planning area. Alternative 2 proposes to treat 4,744 acres, Alternative 3 proposes 3,506 acres, and Alternative 4 proposes 6,735 acres. This equates to about 8%, 6%, 11.6% respectively, of the lodgepole on the Umpqua National Forest, and 15%, 11%, 21.7% of the lodgepole in the planning area. No other harvests of the lodgepole pine ecoclass are expected and an additional Forest Plan amendment would be necessary if such a project was undertaken. Therefore, location and size are not determined to be a significant factor for this amendment.

3. Goals, Objectives, and Outputs. Determine whether the change would alter long-term levels of goods and services projected by the 1990 LRMP. All four proposed amendments would not change existing goals or outputs as defined by the Forest Plan and they would not result in changes in the level of goods and services currently being produced, which are consistent with levels projected by the LRMP, as the lodgepole harvest would occur only for this project and would not be recalculated into the Forest's timber base. Therefore, the goals, objectives, and outputs are not considered to be a significant factor related to the proposed amendment.

4. Management Prescription. Determine whether the change in a management prescription is only for a specific situation or whether it would apply to future decisions throughout the planning area. All four proposed amendments amend the plan for this project only. No permanent changes to the Standards and Guidelines or Management Prescriptions would occur and once the D-Bug project was completed, the standards and guidelines and prescriptions would apply as written in the 1990 LRMP. Therefore, the change in management prescriptions and/or standards and guidelines is for this specific situation and project, and is not considered to be a significant factor related to the proposed amendments.

Specifically Required Disclosures

CULTURAL RESOURCES

The affected environment for cultural resources falls within the areas of proposed ground disturbing activities (timber harvest, fuels treatment, road construction, reconstruction, and decommissioning, subsoiling, landing construction, etc.).

Cultural resource surveys occurred based on pre-field analysis for the D-Bug Project area. Depending upon the location of planned activities, these surveys took the form of

inventory surveys with monitoring or impact area surveys. All the surveys were in fulfillment with the Inventory Strategy approved by the Oregon State Historic Preservation Office. A report documenting the surveys will be submitted to the State Historic Preservation Office as required under the Programmatic Agreement between Region 6 of the Forest Service, the Advisory Council of Historic Preservation, and the Oregon State Historic Preservation Office.

Prehistoric and historic resources were located during cultural surveys for the D-Bug Project. Some sites and resources are not considered substantial due to their lack of integrity or 'significance', as defined under the National Historic Preservation Act. All potentially National Register-eligible cultural resources have been protected by modifying treatments in areas with cultural resources, by establishing mitigation measures to use during project implementation, and/or by buffering the locations that may occur near proposed activities. Archaeological testing of several sites is planned to determine the sites' extent and a determination of eligibility to the National Register of Historic Places. Consultation has been completed with the Tribes concerning the archaeological testing. If further mitigation is required prior to the undertaking, this will be completed in consultation with the State Historic Preservation Office (SHPO) and the Tribes.

Direct, Indirect, and Cumulative Effects

The potential exists for unidentified cultural resources in the D-Bug Project area. Mitigation measures described in Chapter 2 would protect undiscovered cultural resources, lowering the potential for effects to these resources. Overall, proposed ground disturbing activities would have little potential to affect cultural resources. Standard contract provisions would provide for protection of cultural resources discovered during project implementation. The action alternatives may reduce the potential of damage to historic properties due to the reduced risk of high intensity fire occurrence. Alternative 1 would have no direct effects on any cultural resources. Indirectly, a wildfire may have the potential to burn or damage existing cultural resources, especially if the fire was of high intensity.

The Umpqua National Forest has sent a cover letter with the quarterly copies of the Schedule of Proposed Action (SOPA) to each of the Tribes. Each quarter, the cover letter highlights new projects and projects that may be of interest to the Tribes; D-Bug was identified as a new project when the project was first initiated. The Confederated Tribes of the Grand Ronde, Confederated Tribes of the Siletz, and the Cow Creek Band of Umpqua Tribe of Indians were contacted by Debra Barner, Heritage Program Manager for the Forest. Other contacts in the form of phone calls, letters, and opportunities to participate in public tours and public meetings, as well as meetings at Tribal offices were also utilized to interact with the Tribes. Under the treaties with the Tribes, no trust resources or reserved treaty rights are given for the lands managed by the Umpqua National Forest. Therefore, no effects to trust resources or reserved treaty rights would occur with any of the alternatives.

Potential effects from ongoing activities would not create cumulative effects on cultural resources with the additional activity associated with any of the action alternatives. Based on the results of the cultural resource surveys, review and mitigation of known resources, mitigation of undiscovered sites, and consultation with tribes, there would be no indirect or cumulative effects on the heritage resources as the result of implementing the D-Bug project. Direct effects will be mitigated in consultation with the Tribes and SHPO.

UNAVOIDABLE ADVERSE IMPACTS

Implementation of an action alternative may result in potential adverse environmental effects that may not be mitigated or avoided. Field reconnaissance and interdisciplinary analysis helped eliminate or mitigate many potential impacts. All Forest Plan Standards and Guidelines, Best Management Practices, project design features, and other mitigation measures and management requirements (found in Chapter 2) also lessen potential effects. The specific effects associated with project activities were discussed throughout this chapter.

The potential still exists for adverse impacts, even with mitigation and application of standards and guidelines and BMPs. As disclosed, disturbance to some wildlife species may occur; recreationists would have limited access to some recreation sites, both dispersed and developed, during harvest operations. These impacts vary by how long they last (duration) and how severe they are (intensity). Most of these effects are predicted to be short-term in nature (during harvest operations). Standards and Guidelines for Visual Quality Objectives have been amended where the effects of the treatments are unavoidable in the foreground areas; without the amendment, the project cannot proceed. All other effects would be within acceptable parameters. In addition, some monitoring is prescribed to ensure that effects are within the limits prescribed and that mitigation measures and BMPs are successful.

IRREVERSIBLE/IRRETRIEVABLE COMMITMENTS OF RESOURCES

Irreversible commitments are those that cannot be regained such as the quarrying and use of rock from a former rock-outcrop. Irretrievable commitments are those that are lost for a period of time such as the loss of timber productivity in the construction of a temporary road. Once the road is obliterated following log haul, timber production can be resumed. The timber production loss is irretrievable, but the action is not irreversible because timber production can resume.

Alternative 1 would result in irreversible losses of the economic value of beetle-killed timber. The mountain pine beetle infestation is predicted to progress over the next several years, potentially killing up to 90% of the largest lodgepole in infested stands (Goheen 2008). Once dead, the wood rapidly decays and become difficult to sell, especially in today's depressed timber market. As such, the commercial value of that timber would be lost or highly compromised. Under the action alternatives, irreversible economic losses can also be expected since even with preventative treatments, lodgepole pine trees will die from the infestation. However, assuming that an action alternative is implemented in a timely manner and that the infestation progresses relatively slowly, fewer economic losses can be expected compared to Alternative 1. This is especially true of Alternatives 2 and 4 that treat more of the lodgepole pine than Alternative 3. The Economics section in this chapter describes these conditions in more detail.

The implementation of Alternative 2 and 4 would result in the irretrievable effect of temporarily foreclosing the possible option of designating certain areas as wilderness areas. The assessment of the effects of the alternatives on potential wilderness characteristics and future designation concluded that harvest operations would preclude several areas from being considered as wilderness, due to the visibility of stumps and the footprints left from temporary roads and their subsequent decommissioning. However, over time, these impacts would subside and eventually not be visible on the landscape, making this impact irretrievable, but not irreversible.

Similarly, recreational experiences associated with summer and fall hiking and biking would be irretrievably lost under the action alternatives because some trails would be closed to use while logging and hauling in the vicinity would occur. This short-term loss is seasonal and expected to only last for the length of the season of operation. The Recreation section of this chapter describes these conditions in more detail.

All the action alternatives would result in an irretrievable loss of scenic values along Highways 138 and 230 and in the vicinity of several trails where tree stumps and bare soil would be evident for a number of years. Over time however, these losses would diminish as understory vegetation growth progresses. The Scenic Quality section of this chapter describes these conditions in more detail.

SHORT TERM IMPACTS VS. LONG TERM PRODUCTIVITY

NEPA requires consideration of the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity (40 CFR 1502.16). It is the intent of this project to continue to manage resources so that they are available for future generations. The harvest of trees and fuels treatments associated with this project is considered a short-term use of a renewable resource. As the harvested area would maintain vegetation, both in the understory and overstory, the use of the resource is considered as renewable; no impairment to the productivity of the land to continue growing trees is projected to occur as a result of implementing this project. In addition, the Forest silviculturist (Blackburn 2007 and 2008) has concluded that the productivity of the climax lodepole pine proposed for treatment is 50 cubic feet/acre/year or greater which is more than the threshold of 20 cubic feet/acre/year under the original National Forest Management Act for suitable timber lands.

The soils section of this document describes actions that would be taken in order to help maintain long term site productivity. Mitigation and project design features that would help retain effective ground cover and subsoiling some of the skid trails would help maintain the long-term productivity of the project.

UNIQUE HABITATS

Unique habitats are discussed under the terrestrial section of this Chapter. No further information will be added here.

WETLANDS AND FLOODPLAINS

Floodplains are associated with perennial streams and vary from only a few feet to much larger areas depending on the size of the stream and the topography of the streambanks and surrounding area. The environmental effects of all project activities within any floodplain are consistent with the Standards and Guidelines for the Umpqua National Forest LRMP and have been evaluated and declared in the LRMP Final EIS (March 1990). Since the activities in this project follow those Standards and Guidelines, this activity will not be declared separately for this sale.

Impacts to wetlands are disclosed in the aquatics section of this chapter and will not be discussed further.

PRIME FARMLANDS, RANGELANDS, FORESTLANDS, AND PARKLANDS

No prime farmlands, rangelands, forestlands or parklands exist within the area; therefore, no direct, indirect or cumulative effects would occur.

POTENTIAL OR UNUSUAL EXPENDITURES OF ENERGY

The action alternatives would require expenditures of fuel for workers to access the D-Bug Project for use of power equipment and to utilize the logging systems. The no action alternative would require no expenditure of fuel. No other direct, indirect, or cumulative effects are expected to occur with any of the action alternatives.

CONFLICTS WITH PLANS, POLICIES, OR OTHER JURISDICTIONS

Implementation of any of the alternatives would not conflict with the plans or policies of other jurisdictions, including the Tribes. This project would not conflict with any other policies, regulations, or laws, including the Clean Water Act, Endangered Species Act, and the National Historic Preservation Act. Effects to air quality and compliance with the Clean Air Act are described in this chapter. This project is outside of the Mt. Thielsen Wilderness.

CONSUMERS, CIVIL RIGHTS, MINORITY GROUPS, AND WOMEN

Contracting procedures would ensure that projects made available to contractors through this project would be advertised and awarded in a manner that gives proper consideration to minority and women-owned business groups. Because of this consideration, there would be no direct, indirect, or cumulative effects to consumers, civil rights, or minority groups with implementation of any of the alternatives.

ENVIRONMENTAL JUSTICE

On February 11, 1994, President Clinton signed Executive Order 12898. This order directs Federal agencies to address environmental justice by identifying and disclosing the effects of the proposed activities on minority and low-income populations. The effects of the proposed alternatives on the economic conditions of the State and county are disclosed in the Economics section of this document.

According to statistical data for Douglas County, 6.1% of the population is made up of minorities. Unemployment (8.2% versus 5.4% for the State at the end of 2007) is higher in the county, while poverty is about the same as the State average. The project occurs over 80 miles away from any large population centers (Roseburg or Medford) that would be directly affected by the project. The Wildland Urban Interface communities of Diamond Lake and Lemolo Lake are directly within the project area and would be directly affected by short-term trail and recreation site closures, as well as noise and impacts to scenery. Noise and operating impacts are mitigated by limiting operations both seasonally and during daylight hours. Both resorts at Diamond Lake and Lemolo Lake may see a beneficial impact as workers use the stores, restaurants, or lodge facilities.

The community of Toketee lies less than 10 air miles to the east; the Toketee Ranger Station is located in that community, along with housing for Forest Service and Pacificorp families. The community of Dry Creek, which is about 20 miles to the west, has a small store that could see an increase in business during logging and non-commercial operations. Both Toketee and Dry Creek may potentially be affected by an increase in log truck traffic, as would the recreating public. The communities of Idleyld Park and Glide, which lie about 50 miles to the west, may also see an increase in business and an increase in traffic. Cumulatively, the continued operation of the Wapiti, Tugboat, and Lobo sales may add to increases in traffic moving east to west and vice-versa, particularly when combined with the D-Bug project. In addition, the proposed

North Umpqua Highway Project would reconstruct portions of Highway 138 from milepost 52.8 to milepost 67.2, which is on the western edge of the planning area, further causing traffic congestion during the summer months. Overall, none of these increases would be comparable to the logging in the area in the late 1980's. No other adverse direct, indirect, or cumulative effects would occur.

Where there is concentrated and dispersed recreation, the effects to those recreating in the area would be greatest. These areas will be closed during operations to protect people from logging and non-commercial activities. Minority groups or low-income groups that use these areas may be impacted during logging operations by the increase in log truck traffic, an increase in noise, and a diminished capacity for dispersed camping. These groups may choose to recreate elsewhere. Adverse impacts to these groups would end when logging and other connected actions are completed. Overall, none of the action alternatives imposes any other additional hardships on minority or low-income communities; therefore, there would be no direct, indirect, or cumulative effects to environmental justice with any alternative. The no action alternative has no direct, indirect or cumulative effects on environmental justice, as no actions would be taken that would deter people from using the area.

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CHAPTER 4

LIST OF PREPARERS

Debbie Anderson	Umpqua National Forest, Supervisor's Office, IDT Leader. M.S. Forest Resources, Oregon State University, 1994; B.S. Forest Resources, Oregon State University, 1991; A.S. Forest Technology, Mt. Hood Community College, 1987. Over twenty-two years of Forest Service experience in fire, silviculture, and planning. Currently serving as Forest NEPA coordinator and team leader of the Forest Planning Team.
Galen Anderson	Umpqua National Forest, Supervisor's Office, Logging Systems Specialist. 26 years experience logging for private industry.
Miles Barkhurst	Umpqua National Forest, Supervisor's Office, Civil Engineer / Forest Road Manager. BSME, Environmental Geosciences Minor, Oregon State University, 1997. Twenty-five years Forest Service experience in transportation planning, road design and construction, road-related watershed restoration, and transportation system management.
Debra Barner	Umpqua National Forest, Supervisor's Office Forest Archaeologist. M.S. Anthropology, History, and History of Science 1982. Ten years private archaeological contracting and fourteen years with the Forest Service.
Josh Chapman	Umpqua National Forest, Supervisor's Office, Wildlife Biologist, B.S. Wildlife, Humboldt State University, 2004; B.A. English Literature, University of Victoria, British Columbia, 1998. 10 years of wildlife and natural resources related field work experience for the National Park Service, U.S. Geological Survey, and Forest Service. Currently working as the Wildlife Biologist for the Forest Planning Team.
Joel Detlef	Umpqua National Forest, Cottage Grove Ranger District, Forester/Logging Systems. B.S. Forestry, Humboldt State University, 2004; A.S. Landscape Horticulture and Arboriculture, San Francisco; 6 years US Marine Corps. 4 years experience on presale/timber marking crew.
Gabe Dumm	Umpqua National Forest, Supervisor's Office, Fire Ecologist. MS Forest Resources, University of Idaho, 2003; BS Conservation Social Sciences, University of Idaho (1998); A.A. Wilderness Management, Vermilion Community College, 1996. About 10 years of experience in wildfire suppression/prescribed burning, structural fire fighting (live-in career experience and training program, volunteer), wildland fire effects research, and resource (fuels) planning. Currently serving as Forest Fuels Planner and Fire Ecologist.

Barbara Fontaine	Umpqua National Forest, Timber Planning Team Fisheries Biologist. M.S. Fisheries Biology, Oregon State University, 1988; B.S. Wildlife Management. Humboldt State University, 1979. Twenty -six years of Forest Service experience in timber sale planning, fish and wildlife inventories, and habitat restoration. Also currently serving as the project coordinator for the Timber Planning Team.
Richard Helliwell	Umpqua National Forest, Supervisor's Office, Forest Botanist. B.A. Anthropology, University of Maryland, 1979; B.S. Biology, Southern Oregon State College, 1985. Botanist, Warm Springs Indian Reservation, 1985-1989; Botanist, Bear Springs Ranger District, Mt. Hood National Forest, 1989-1991; Botanist, Big Summit Ranger District, Ochoco National Forest, 1991-1995. Forest Botanist, Umpqua National Forest, 1995-present. Survey & Manage Bryophyte-Lichen Lead, Northwest Forest Plan Area, detail to PNW Regional Office, 2001-2004.
Steve Hofford	Umpqua National Forest, Supervisor's Office, Hydrologist. B.S. Watershed Science - Hydrology, Colorado State University, 1978; A.A.S. Electrical Instrumentation, Williamsport Area Community College, 1967. Over thirty years of experience in water resources with the Forest Service, Bureau of Land Management, and U. S. Geological Survey. Currently serving as Hydrologist on the Forest Planning Team.
Don Morrison	Umpqua National Forest, Supervisor's Office, Timber Sale Planning Team Forester. B.A. Botany, Humboldt State University, 1979; Certified Silviculturist, 2002 to present. Over thirty years of experience in forest inventory, soil science, silviculture, and landscape planning.
Steve Nelson	Umpqua National Forest, Supervisor's Office, Contracting Officer/Economic Analysis. B.S. Forestry, minor in Business Management, Humboldt State University, 1980. Forest Engineering Institute, Oregon State University, 1985. Twenty-seven years Forest Service experience in NEPA, Timber, Engineering, and Transportation Planning. Currently serving as Contracting Officer and Assistant Timber Staff Officer for the Umpqua National Forest.
Greg Orton	Umpqua National Forest, Supervisor's Office, Soil Scientist. B.S. Soil Science, California Polytechnic State University, San Luis Obispo, 1991. A.S. Forest and Parks Recreation Management, Kings River Community College Forest Resources, 1978. Nineteen years experience in Timber Planning. Thirty-two years of experience in forestry, recreation, and management.

The following people also helped in preparation of this project:

Rick Abbott	Zone Silviculturist
Jim Archuleta	Soil Scientist
Barnes & Associates	Transportation Planning Assistance and Silviculture assistance
Bryan Benz	Botanist/Field Reconnaissance
Jeff Bohler	District Wildlife Biologist
Larry Broeker	Forest Geologist
Joel Detlef	Logging Systems Input
Derek Ibarguen	Zone Recreation Manager
Greg Lesch	Products and Planning Staff
Gary Loffler	Landscape Architect
Donna Mattson	Landscape Architect
John Ouimet	Former District Ranger
Angie Snyder	Cultural Resource Technician
Stephanie Wessell	Botanist/Field Reconnaissance
Pat Williams	Logging Systems Input

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CHAPTER 5

LIST OF PARTICIPANTS AND PUBLIC INVOLVEMENT

Public Involvement Process

Initial contacts with the public for the D-Bug project began in August of 2007, when the IDT started field reconnaissance to develop a proposed action. At that time, the need to collaborate was identified. Numerous contacts were made with interested individuals, homeowners, special use permittees, conservation groups, industry representatives, and other agencies over a 6 month period of time, with the goal of collaborating on the development of the proposed action. This collaboration also included newspaper articles, an advertised public meeting at the Douglas County library and a follow-up field trip. The feedback received during the development of the proposed action is summarized in notes, conversation records, and in a 'pre-scoping summary' document. The project was also listed in the October 2007 Schedule of Proposed Actions (SOPA), which let interested people know the project was in development.

Formal scoping began in January of 2008, when a scoping packet was sent to over 350 individuals and groups (Table 68), including maps and details of the proposed action. People were invited to document their concerns regarding the proposal. In addition, a Notice of Intent to prepare an Environmental Impact Statement was published in the January 22, 2008 Federal Register, and a front-page story describing the details of the proposed action was published on February 8, 2008 in The Roseburg New Review.

The regulatory agency (US Fish and Wildlife Service) charged with overseeing the Endangered Species Act, was consulted extensively throughout the planning process. Consultation with this agency will be finalized before the Record of Decision is signed.

The Tribal governments (Cow Creek Band of Umpqua Indians, Confederated Tribe of the Grand Ronde Indians, and the Confederated Tribe of the Siletz Indians) have been sent a letter describing the project, with a request for further information. To date, no responses have been received. The Tribes were also consulted under the National Historic Preservation Act.

During the scoping period, letters, face-to-face discussions, e-mails, and phone calls regarding the D-Bug Hazard Reduction Timber Sale Project Proposed Action were received from 37 individuals or groups. The D-Bug analysis file contains a detailed scoping summary of all comments received during scoping.

TRIBES THAT WERE CONSULTED

Cow Creek Band of Umpqua Tribe of Indians

Confederated Tribe of Grand Ronde of Indians

Confederated Tribe of Siletz Indians

INDIVIDUALS, GROUPS, AND AGENCIES INVOLVED IN THE PLANNING PROCESS

An extensive mail list was developed for the D-Bug project. The following list was used to inform the public of the opportunity for early involvement, public meetings, field trips and the start of the formal scoping process (Table 68).

Table 68. Individuals/groups who received outreach and scoping information.

Participant		Affiliation
		Representative Susan Morgan
		Congressman Peter DeFazio
		McReynolds Family 2002 Trust
		Bruce Stanley Construction
		Sun Studs
		North Umpqua Business Association
		Umpqua Watersheds
Kenneth Adams		Diamond Lake Homeowner
		Klamath-Siskiyou Wildland Center
		Douglas County Library
		Douglas County Commissioners
		Rocky Mountain Elk Foundation
		Sullivan & Company Inc.
		Columbia Helicopter Inc.
Betty & Don	Adams	
Frank	Adams	
Richard Browne	and Lisa Bailey	Diamond Lake Homeowner
James	Anderson	Cross Country Riders
Butch	Anderson	
Jerry	Anderson	
Darrol	Anderson	
John	Armes	Edelweiss Ski Club
Beth	Ayer	PNW 4-Wheel Drive Association
Buck and Linda	Baker	Diamond Lake Homeowner
Tim	Ballard	
Larry	Barlow	
Rick	Barnes	Barnes Forestry Consultants
Diane	Barr	
Richard	Barrett	
Bob	Bastian	Rocky Mountain Elk Foundation
Rayma	Bateman	Diamond Lake Homeowner
Dick	Bauer	
Brad	Bebeau	
Paul	Beck	Herbert Lumber
Bruce	Benson	Diamond Lake Homeowner
Fred	Bertsche	Oregon Hunters Association
Julie	Bonney	Diamond Lake Homeowner
Kent	Bonney	Diamond Lake Homeowner

Participant		Affiliation
Mike	Bormuth	
Becky	Bosley	Diamond Lake Homeowner
Terry	Bounds	
Milford	Bowers	
Gene	Bowling	Rogue Snowmobilers
Mark	Boyer	
Wayne & Susan	Brace	Diamond Lake Homeowner
Ruben	Brenhaug	
Mac	Brock,	Crater Lake National Park, Chief of Resources
Nancy	Bruce-Ceccanese	
Tom	Bryant	
Rodney	Burgardner	
Gary and Barbara	Burke	Diamond Lake Homeowner
Robert	Burns, Jr.	Diamond Lake Homeowner
Robert	Burson	
Robert	Butler	Diamond Lake Homeowner
Steve	Callaway	
Douglas and Gayle	Carl	Diamond Lake Homeowner
Ken	Carloni	
Steve	Carter	Northwest Hardwoods (DTO)
Patrick and Carol	Cavanaugh	Diamond Lake Homeowner
Scott	Center	US Fish & Wildlife
Jim	Chapman	Diamond Lake Homeowner
Jerry	Cochran	
Kathy and Michael	Collier	Diamond Lake Homeowner
Chris	Conroy	Congressman Peter Defazio's Roseburg Office
Brian	Cowan	
Gordon	Culbertson	Swanson Group -Manufacturing, L.L.C.
Bruce	Curtis	
George	Daley	
Leon Douglas	Dense	Diamond Lake Homeowner
Arnold	Depner	Diamond Lake Homeowner
Diana	Donovan	
Larry	Doyle	Diamond Lake Homeowner
Robert	Dunn	Diamond Lake Homeowner
Gary	Dunn	
Francis	Eatherington	Umpqua Watersheds, Inc.
Ronnie	Egger	
Chuck	Ehlers	Diamond Lake Homeowner
Wes & Bev	Ellis	

Participant		Affiliation
Dave	Erickson	
Mike	Eshleman	
Wayne	Estes	
Samuel	Fagone Sr	
Patricia	Fagone-Colfax	Diamond Lake Homeowner
Matt	Fairchild	
Joseph	Federico	UFA
Joe	Ferguson	Steamboaters
Forrest	Fleischman	Forest Service Employees for Environmental Ethics
Brian	Fletcher	
Tom	Foote	
Jeanne & George	Forrest	
John & Lynn	Forsyth	Diamond Lake Homeowner
Swede	French	Rocky Mountain Elk Foundation
Randy	Garrison	
Jeff	Gillette	
Javier	Goirigolzarri	Resource Management Services
Dr. Augustine	Gombart	Diamond Lake Homeowner
Allen	Goodwin	Diamond Lake Homeowner
Sarah	Grafenstein	
Janice	Green	Recreational Fishing Alliance
Gerald	Griffeth	Diamond Lake Homeowner
Bill	Griffin	
Larry & Darelyn	Griffin	Diamond Lake Homeowner
Fred & Helen	Gross	Diamond Lake Homeowner
Steve & Sandra	Gross-Hunt	Diamond Lake Homeowner
Rich	Grost	PacifiCorp
Jake	Groves	American Forest Resource Council
Larry & Roberta	Hall	Diamond Lake Homeowner
Bob	Hall	BLM - Public Affairs
Don	Hamann	
Tom	Hanke	
Don	Harmon	
Robin	Hartmann	North Umpqua Foundation
Don	Harwick	Swanson Group -Manufacturing, L.L.C.
Tom	Hatfield	Farm Bureau
Emmett	Havemann	
Doug	Heiken	Oregon WILD
Bert & Anne	Henderson	Diamond Lake Homeowner
Ken	Hendrick	

Participant		Affiliation
Scott	Henselman	Diamond Lake Homeowner
Paul	Herberling	Oregon Department Of Environmental Quality
Leonard	Herzstein	
Paul	Hess	
Redge	Heth	
Bill	Hicky	
Cari	Hinesly	Pacific Sled Dog & Skijor Association
Sandra	Hislop	Diamond Lake Homeowner
Robert	Hoedel	Diamond Lake Homeowner
Bob	Hoehne	
Bruce	Hoevet	
Dan	Hoffman	
Lewis & Elizabeth	Hogan	Diamond Lake Homeowner
Chris & Hugh	Hohe	
Janet	Holland	
Dave & Denyse	Horsburgh	Diamond Lake Homeowner
M	Houde	
Steve	Houde	
Ben	Hoyle	
Ralph	Huffman	Diamond Lake Homeowner
Donald	Isakson	
Matt	Jackson	
David	Jackson	
Gunnar	Johnson	
Stanley & Gina	Johnson	Diamond Lake Homeowner
Ray	Jones	Roseburg Forest Products
Dale	Josh	
Ken	Joslen	c/o Cheryl Hibbs, Diamond Lake Homeowner
Bob	Kamph	
Sharon	Karr	Diamond Lake Homeowner
Phil & Jo	Kaser	Diamond Lake Homeowner
Paul	Kay	"Ursa"
Scott	Keep	Seneca Sawmill Co
Jerry	Kerk	DR Johnson Lumber
Linda	Kesling	
Roger	King	
Ray	Kinney	SWCD
Bob	Kinyon	Partnership for the Umpqua Rivers
Chad	Kirstein	
Steve	Koch	Diamond Lake Resort

Participant		Affiliation
Karl	Konecny	North Umpqua Foundation
Bernie & Ruby	Kosola	Diamond Lake Homeowner
Art	Kramert	
Garry P.	Krause	
Dick	Kreger	
Berdine	Krennek	Diamond Lake Homeowner
Teresa	Kubo	EPA Region 10 - NEPA Review Unit
Dick	Kyker	Diamond Lake Homeowner
Klaus	Labuhn	Diamond Lake Homeowner
Tom	Laden	Grants Pass Nordic Club
Cecil	Lake	
Scott & Dianna	Lamb	Lemolo Lake Resort
Stan	Larson	Diamond Lake Homeowner
Josh	Laughlin	Cascadia Wildlands Project
Joe	Laurance	Douglas County Commissioner
Donald & Marlene	Lawless	Diamond Lake Homeowner
Larry	Layton	Umpqua Regional Council of Governments
William & Carol	Leaverton	Diamond Lake RV Park
Charles & Judith	Leipold	Diamond Lake Homeowner
John & Penny	Lind	
Richard	Little	Diamond Lake Homeowner
Bill	Logan	
Jim	Long	
David & Laura	Loomis	Diamond Lake Homeowner
David B.	Lowry	Diamond Lake Homeowner
Tod	Lum	Oregon Department of Fish and Wildlife
Mike	Lund	
Chuck	Lundy, Superintendent	Crater Lake National Park
Cynthia	Maples	Diamond Lake Homeowner
Chris	Marchand	
Suzanne	Marchant	
Roy	Marshall	
Frank	Massingale	
Jeremiah	Mattos	
Charlotte	Mattson-Payne	Diamond Lake Homeowner
Russ	McCurdy	Weyerhaeuser Pole Facility
James	McMeen	
Tom	McReynolds	Diamond Lake Homeowner
Stephen	McReynolds	
Pat	Mehlhoff	Beardsley Cabin Trust, Diamond Lake Homeowner

Participant		Affiliation
G.	Meiling	
Suzanne	Merchant	Diamond Lake Homeowner
Chris	Mercier	Confederated Tribes of the Grande Ronde
N. T.	Merrill	
Gerald	Meyer	Douglas County Health Depart.
Dick	Meyer	
Ross	Mickey	Northwest Forestry Association
Sharon Karr and	Mike Macon	Diamond Lake Homeowner
Mary	Miller	Diamond Lake Homeowner
Rick	Minear	
Robert	Minear	Diamond Lake Homeowner
Marv & Libby	Mizell	
Bob	Moffett	
Rick	Moffitt	
Frank & Jeanie	Moore	
Sam	Moore	
Sam	Moore	
Tom & Nancy	Moore	
Bill	Moore	Seneca Timber Company
Lyle	Morrison	
Dick & Vella	Munn	Diamond Lake Homeowner
Ken	Nagao	
Evelyn	Nores	
Bob	Olds	Diamond Lake Homeowner
Norman	Olson	Diamond Lake Homeowner
Michael	O'Mara	
Stephan & Bethany	Overhoff	Diamond Lake Homeowner
Ed	Padilla	
Tim	Palm	
Ed	Parker	
John	Passmore	
Dan	Patterson	
Jack	Patterson	
Ray	Patterson	
John	Paulson	
Alan	Paulson	
Donald & Sally	Pearce	Diamond Lake Homeowner
Adam	Pearson	The News-Review

Participant		Affiliation
Harold	Pedergen	
Everett	Peterson	
Charles C.	Peterson	Diamond Lake Homeowner
Stan	Petrowski	
Rick & Diane	Phillips	
Mike	Piehl	
Delores	Pigsley	Confederated Tribes of the Siletz
Culley	Polehn	Southern Oregon Nordic Club
Elaine	Porter	
John	Punches	OSU Extension Service
Bob & Jan	Purkepile	Diamond Lake Homeowner
Bob	Ragon	DTO
Brad	Reed	Crater Lake National Park
Betty	Rice	Diamond Lake Homeowner
Bill	Roady	Diamond Lake Homeowner
James & Woodra	Roberts	Diamond Lake Homeowner
Sharon	Roberts	
Ross & Suzanne	Roberts	Diamond Lake Homeowner
Rick	Rockholt	Diamond Lake Resort
Steve & Kristi	Roe	Diamond Lake Homeowner
Steven	Rondeau	Dir Natural Res.- Cow Creek Band of Umpqua Indians
Tom	Rondeau	
Cindy	Rooney	Oregon Hunters Association
Don	Rooper	Interfor Pacific
George	Roth	
Erich and Alice	Rother	Diamond Lake Homeowner
Tina	Roy	
Rolf E.	Ruf	
Sue	Rummer	
B.	Sachau	
Steve	Sand	
Buck	Sarves	
Kenneth	Scgeudegger	Diamond Lake Homeowner
Doug & Tina	Schattenkerk	
Edward	Schattenkerk	
Kenneth & Elvera	Scheidegger	
Gary	Schroeder	C & D Lumber
Sue	Scott	
Richard	Secord, Jr.	

Participant		Affiliation
Richard	Secord, Sr.	
Rick & Jenny	Seidemann	
Suma	Shaazmunda	
Sue	Shaffer	Cow Creek Band of Umpqua Indians
Doug & Tina	Shattenkerk	Diamond Lake Homeowner
Dave	Sheman	
Glenn	Shirek	
Gary & Peggy	Shontz	Diamond Lake Homeowner
Ron & Rachel	Shubin	Diamond Lake Homeowner
Philip	Simon	
Cory	Sipher	
Anna	Slemmer	
Wendell	Smith	Diamond Lake Homeowner
Sean	Smith	Starfire Lumber Co.
Lee & Hazeldean	Smith	c/o Brenda Riggs - Diamond Lake Homeowner
Maryjane	Snockers	
Jack	Snyder	Diamond Lake Homeowner
Rick	Sohn	Lone Rock Timber
Phil	Southern	
Stephen	Speer	Diamond Lake Homeowner
Larry	Spielbusch	
Charles	Spooner	Steamboaters
Tom	Staley	
James	Stancliff	
Patrick	Starnes	
Karl & Rosan	Staubach	Diamond Lake Homeowner
Phil	Stenbeck	Douglas County Planning Department
Nancy	Stern	
Rachel	Stevenson	Diamond Lake Homeowner
Bruce	Stewart	Bohemia Mine Owner Assn.
Joe	Strahl	
John & Ann	Studer	Diamond Lake Homeowner
Joel & Kathleen	Sullivan	Diamond Lake Homeowner
Christina	Swanson	Diamond Lake Homeowner
James	Talburt	
Barbara	Taylor	
Kenneth & Nancy	Tedder	Diamond Lake Homeowner
Connie	Thomas	Diamond Lake Homeowner
James & Mary	Thompson	Diamond Lake Homeowner
Dan	Thomsen	PacifiCorp

Participant		Affiliation
Robert	Thornton	Diamond Lake Homeowner
Bernadette	Tobar	
Peter	Tronquet	
Craig	Tuss	US Fish & Wildlife
Paul	Utz	
Olis & Jean	Van Meter	
David	VanDermark	
Eileen	Vaughn	Diamond Lake Homeowner
Stan & Kathy	Vejtasa	Umpqua Valley Audubon Society
Leonard	Vollard	
Jeff	Waddington	
Susan	Waddle	
Rick	Waddle	
Dave	Wagner	
Diana	Wales	Umpqua Valley Audubon Society
Malinda	Walls	
Frank	Walter	
Cindy	Walters	
Charles	Wamack	
Jonathan	Warren	Diamond Lake Homeowner
Joe & Jackie	Watson	Diamond Lake Homeowner
Joe	Watson	Diamond Lake Homeowner
Viven	Weaver	
Avann	Weber	
Katie	Weidman	
Jim	Wells	Umpqua Fishermen
Francis	Welty	
Rick	Werner	
LaVerne R.	West	
Clifford	Wheeler	Diamond Lake Homeowner
Don	Whitaker	Don Whitaker Logging & Hauling
MaryAnn	Wilcox	
Dennis	Williams	Paradise Northwest
Carey	Williams	Southern Oregon Fly Fishers
Don	Wilson	Oregon Hunters Association
Levi & Kendra	Wilson	
Amy	Wilson	Southwest Oregon RC&D
William	Wood	Alla Mage Ski Club
Norman	Woods	

Participant		Affiliation
Donna	Woolley	Diamond Lake Homeowner
Fred	Worsley	
Ken	Wostenberg	
Ron	Yockim	
John	Yoder	
Curtis & Susan	Young	Diamond Lake Homeowner
Albert	Young	
Marion	Young	

AGENCIES NOTIFIED OF THE AVAILABILITY OF THE DEIS

The following Federal and State agencies were notified of the availability of the DEIS at the beginning of the 45-day comment period (Tables 69 and 70).

Table 69. Federal Agencies notified.

Federal Agencies Notified
Advisory Council on Historic Preservation
USDA, APHIS PPD/EAD
USDA, Natural Resource Conservation Serv.
National Marine Fisheries Service
U.S. Army Corps of Engineers - NW Division
U.S. Environmental Protection Agency
USDA, National Agricultural Library
U.S. Environmental Protection Agency, R-10
U.S. Department of Interior
Northwest Power Planning Council
U.S. Coast Guard
Federal Aviation Administration
Federal Highway Administration
U.S. Department of Energy

Table 70. State Agencies Notified

State Agencies
Department of Fish and Wildlife
Oregon Parks and Recreation Department
Water Resources Department
Division of State Lands
Department of Geology and Mineral Industries
Department of Environmental Quality
Department of Land Conservation and Development
Economic and Community Development
Department of Administrative Services
Oregon Department of Forestry
Governor's Natural Resources Office

INDIVIDUALS NOTIFIED OF THE AVAILABILITY OF THE DEIS

The following individuals were notified by mail regarding the availability of the DEIS at the beginning of the 45-day comment period (Tables 71).

Table 71. Individuals notified.

Participant	
Donald & Marlene	Lawless
Doug & Tina	Shattenkerk
Erich and Alice	Rother
Dr. Augustine	Gombart
Doug & Tina	Schattenkerk
Kenneth & Nancy	Tedder
Michael and Kathy	Collier
John & Lynn	Forsyth
John	Studer
James & Woodra	Roberts
Fred & Helen	Gross
Elgan	Amidon
Douglas and Gayle	Carl
Donald & Sally	Pearce
Kenneth	Adams, Trust
Susan	Morgan
Bernie & Ruby	Kosola
James & Mary	Thompson
Pat	Mehlhoff
Bert & Anne	Henderson
Charles C.	Peterson
Charles & Judith	Leipold
Wayne & Susan	Brace
David & Laura	Loomis
Dennis & Mary	Miller
Pat	Colfax
Becky	Bosley
Curtis & Susan	Young
Stephan & Bethany	Overhoff

Participant	
Larry & Roberta	Hall
David B.	Lowry
Robert	Thornton
Kenneth	Scgeudegger
Robert & Zelna	Minear
Suzanne	Merchant
Leon Douglas	Dense
Viven	Weaver
Steve & Sandra	Gross-Hunt
Stanley & Gina	Johnson
Christina	Swanson
Steve & Kristi	Roe
Robert	Butler
Robert	Burns, Jr.
Richard	Browne
Lisa	Bailey
Rachel	Stevenson
Joe & Jackie	Watson
Gary	Shontz
Bruce	Benson
Gary and Barbara	Burke
Lewis & Elizabeth	Hogan
Joel & Kathleen	Sullivan
Karl & Rosan	Staubach
Patrick and Carol	Cavanaugh
Norman	Olson
Sharon Karr and	Mike Macon
Robert & Joan	Hoedel
Ron & Rachel	Shubin
Sandra	Hislop

Participant	
Patricia	Fagone-Colfax
Rayma	Bateman
Samuel	Fagone, Sr.
Larry & Darelyn	Griffin
Allen	Goodwin
Jack	Snyder
William	Roady
Charlotte	Mattson-Payne
Michael	O'Mara
Tom & Barbara	McReynolds
Richard	Little
John & Penny	Lind
Stan	Larson
Klaus	Labuhn
Jeri	Krenek
Don	Hamann
Ralph	Huffman
Scott	Henselman
Bob	Olds
Kent	Bonney
Roger	Doyle
Mark & Karen	Mihaljevich
Stan	Martindale
Doug & Mary Ann	Glover
Ron	Swenson
Gerald	Griffeth
Richard	Barrett
Janice	Green
Arnold	Depner
Rick	Rockholt

Participant	
Larry	Doyle
Joe	Ferguson
Javier	Goirigolzarri
Joe	Watson
Buck and Linda	Baker
Linda	Kesling
Larry	Spielbusch
Jonathan	Warren
Chuck	Ehlers
Steve	Koch
Ronnie	Egger
John	Patterson
Frank & Jeanie	Moore
N. T.	Merrill
G.	Meiling
Dan	Patterson
George	Roth
Wes & Bev	Ellis
Dick	Kyker
Betty Rice	Rice
Guy	Kennerly
Stan & Kathy	Vejtasa
Gerald	Meyer
Rick	Minear
Clifford	Wheeler
Donna	Woolley
Dick & Vella	Munn
Cinthia	Maples
Robert	Dunn
Jim	Chapman

Participant	
Tom	Staley
Craig	Tuss
Phil & Jo	Kaser
Dave & Denyse	Horsburgh
Ross & Suzanne	Roberts
Bob & Jan	Purkeypile
Hugh	Hohe
Doug	Heiken
Jacob	Groves
Karl	Konecny
Mac	Brock
Cari	Hinesly
Bruce	Stanley
Sharon	Karr
William & Carol	Leaverton
Scott & Dianna	Lamb
Ron	Yockim
Michael	Sullivan
Don	Hardwick
Stanley	Petrowski
Bob	Bastian
Charles	Spooner
Mark	Boyer
Steve	Denney
Wendell	Smith
Connie	Thomas
Tim	Ballard
Jim	Long
Joe	Laurance
Bob	Ragon

Participant	
Steven	Rondeau
Darrol	Anderson
Stephen	Speer
Ken	Hendrick
Julie	Bonney
Gary	Schroeder

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ACRONYMS, GLOSSARY OF TERMS, AND INDEX

ACRONYMS

ACS	Aquatic Conservation Strategy
BBWO	Black-Backed Woodpecker
BE	Biological Evaluation
BLM	Bureau of Land Management
BMP	Best Management Practice
BS	Bachelor of Science Degree
BTU	British Thermal Unit (measure of heat)
CAA	Clean Air Act
CE	Categorical Exclusion
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cfs	cubic feet per second
CHU	Critical Habitat Unit (for the Northern Spotted Owl)
CI	Crowning Index
CO ₂ eq	Carbon Dioxide warming equivalents
CWD	Coarse Woody Debris
CWPP	Community Wildfire Protection Plan
dbh	[Tree] Diameter at Breast Height
DEIS	Draft Environmental Impact Statement
DEQ	Department of Environmental Quality
DO	Dissolved Oxygen (in water)
EGC	Effective Ground Cover
EIS	Environmental Impact Statement
ESA	Endangered Species Act
FEMAT	Forest Ecosystem Management Assessment Team
FOFEM	First Order Fire Effects Model
FS	Forest Service
FVS	Forest Vegetation Simulator
FY	Fiscal Year
GIS	Geographic Information System

GP	Grapple pile
GSE	Ground Skidding Equipment
HFRA	Healthy Forest Restoration Act
HE	Habitat Effectiveness (a measure used to quantify habitat for big game)
HP	Handpile
HRP	Hydrologic Recovery Percentage
HUC	Hydrological Unit Code
IDT	Interdisciplinary Team
IRA	Inventoried Roadless Area
LRMP	1990 Umpqua National Forest Land and Resource Management Plan
LSR	Late Successional Reserve
MA	Management Area
MOCA	Managed Owl Conservation Areas
MBF	Thousand Board Feet
MEC	Mechanical Logging
ML	(Road) Maintenance Level
NEPA	National Environmental Policy Act of 1969
NF	National Forest
NFMA	National Forest Management Act of 1976
NFP	Northwest Forest Plan
NOI	Notice of Intent
NRF	Nesting, Roosting, and Foraging Habitat
NSOOM	Northern Spotted Owl Occupancy Map
OCRA	Oregon Cascades Recreation Area
ODEQ	Oregon Department Environmental Quality
ODFW	Oregon Department of Fish and Wildlife
ODOT	Oregon Department of Transportation
OHV	Off Highway Vehicle
ONHP	Oregon Natural Heritage Program
OSHA	Oregon Safety and Health Administration
PA	Proposed Action
PCT	Precommercial Thinning
pH	power of Hydrogen
RMO	Road Management Objectives
ROD	Record of Decision (for the Northwest Forest Plan)

ROS	Recreational Opportunity Spectrum
RVD	Recreational Visitor Day
S&G	Standards and Guidelines (from Forest Plans)
SMS	Scenery Management System
SKY	Skyline
TI	Torching Index
TPA	Trees Per Acre
TMDL	Total Maximum Daily Load
UB	Underburn
UNF	Umpqua National Forest
USFWS	US Fish and Wildlife Service
USDA	United States Department of Agriculture
USDI	United States Department of Interior
WMU	Wildlife Management Unit
USFS	United States Forest Service
VQO	Visual Quality Objective
WA	Watershed Analysis
WEPP	Water Erosion Prediction Program
WUI	Wildland-Urban Interface
VLSB	Volcanic Legacy Scenic Byway

GLOSSARY

A

Activity center: A term used in northern spotted owl management to denote regular use of an area by owls. It may be a nest site, repeated presence of pairs, or territorial behavior by individuals.

Activity fuels: Fuels generated by management activity (slash).

Administratively withdrawn: Areas removed from the suitable timber base through agency direction and land management plans.

Airshed: A geographic area delineated using similar atmospheric characteristics.

Air Pollutant: Any substance in the air that could, if in high enough concentration, harm humans, animals, vegetation, or material. Air pollutants may include almost any natural or artificial matter capable of being airborne in the form of solid particles, liquid droplets, gases, or a combination of these.

Air Quality: The composition of air with respect to quantities of pollution therein; used most frequently in connection with “standards” of maximum acceptable pollutant concentrations.

Administratively withdrawn: Areas removed from the suitable timber base through agency direction and land management plans.

Allelopathic: Refers to plants that naturally have pesticide characteristics with abilities to keep other plants from growing near them.

Alluvial: Material deposited by creeks and rivers, including gravel, sand, silt and clay.

Ameliorate: To improve or become more satisfactory.

Anadromous: Those species of fish that mature in the ocean and migrate into fresh water rivers and streams to spawn (e.g., salmon and steelhead).

Analysis Area: Areas that are described in the EIS where appropriate to define the area of potential impact at the appropriate scale. These scales are not always the same between resource areas and may be a portion of the Study Area, or a larger scale that extends beyond the Study Area; examples include hydrology (sub-watersheds), wildlife (habitat blocks), or social-economic areas (where people are), etc.

Animal damage: Physical damage to forest tree seed, seedlings, and young trees through seed foraging, browsing, cutting, rubbing, or trampling, by mammals and birds.

Anthropogenic: Of, relating to, or resulting from the influence of humans on nature.

Aquatic habitat: Habitat that occurs in free water.

Aquifer: A geologic formation or structure that transmits water in sufficient quantity to supply the needs for a water development; usually saturated sands, gravel, fractures, pumice, or cavernous and vesicular rock.

Aspect: The direction a slope faces with respect to the cardinal compass points.

B

Bark slippage: When trees are susceptible to damage because of sap flow and accelerated growth in the spring of the year, which makes bark easily damaged and or removed from the bole of the tree.

Bedrock: Solid rock underlying soils.

Best Management Practices (BMPs): Management practices developed by the Forest Service designed to protect, maintain, or improve water quality by preventative rather than corrective means. Developed in compliance with the Clean water Act and coordinated with the United States Environmental Protection Agency and the State of Oregon.

Biological control: Deployment of host specific organisms to eliminate or control noxious weeds.

Biological diversity: The variety of life forms and processes, including a complexity of species, communities, gene pools, and ecological functions.

Biological Evaluation (BE): An evaluation of the effects on Threatened, Endangered, or Sensitive plant or wildlife species required by the Forest Service for the Proposed Action and each alternative.

Biological Opinion (BO): The document resulting from formal consultation that states the opinion of the US Fish and Wildlife Service or National Marine Fisheries Service as to whether or not a Federal action is likely to jeopardize the continued existence of listed species.

Blowdown: Trees felled by high winds (see windthrow).

Bryophytes: Plants of the phylum Bryophyta, including mosses, liverworts and hornworts, characterized by the lack of true roots, stems and leaves.

Bucked: To cut a length of log with a chainsaw.

C

Canopy closure: The degree to which the canopy blocks sunlight or obscures the sky.

Carbon Dioxide warming equivalents: The warming effect of CO₂ is assigned a value of 1, and the warming effects of other gases are calculated as multiples of this value in order to assess effects of the project on global warming.

Cavity nester: Wildlife species, most frequently birds, that require cavities (holes) in trees for nesting and reproduction.

Class I area: A CAA classification that protects the air quality in national parks greater than 6,000 acres and Wilderness areas greater than 5,000 acres that existed on August 7, 1977.

Classified roads: A road constructed or maintained for long-term use. May include public, private, or forest system roads. May include roads that are maintained to remain open year-round or roads that are closed.

Clearcut harvest: A timber harvest method in which all trees are removed in a single entry from a designated area, with the exception of retention trees or snags. The objective is to create an even-aged stand.

Climax vegetation: The final vegetative community which emerges after a series of successive vegetation stages and perpetuates itself indefinitely unless disturbed by outside forces.

Coarse fragments: Rock or mineral particles greater than 2.0 mm in diameter. Gravel is rock less than 7.6 cm (3 in), cobbles are diameters 7.6 to 25 cm (3 to 10 in), stones are 25 to 61 cm (10 to 24 in), and boulders are greater than 61 cm (24 in).

Coarse woody debris: Standing dead trees and large down woody material.

Co-dominant trees: Trees with crowns forming the general level of the main canopy in even-aged stands or, in uneven aged stands, the main canopy of the tree's immediate neighbors, receiving full light from above and comparatively little from the sides.

Cohort: A distinct aggregation of trees originating from a single natural event or regeneration activity, or a grouping of trees (e.g., 10-year age class) as used in inventory or management.

Commercial thinning: The harvest of generally merchantable trees from a stand usually to encourage growth of the remaining leave trees (see density management).

Commodity value: The economic value of outputs from the forest that are commercially sold to private operators.

Compaction (soil): An increase in bulk density and a decrease in soil porosity resulting from applied loads, vibration, or pressure.

Conformity Provisions: Provisions in the Clean Air Act (Section 176(c)) that prohibit federal agencies from taking any action within a non-attainment area that causes or contributes to a new violation in standards of, increases the frequency or severity of an existing violation, or delays the timely attainment of a standard as defined in the area plan.

Congressionally Reserved areas: Areas that require Congressional enactment for their establishment, such as Wilderness Areas and the Oregon Cascades Recreation Area.

Connectivity: A measure of the extent to which conditions among late-successional forest areas or within stream and river systems that provide habitat for important ecological functions such as species breeding, feeding, and dispersal of young.

Contiguous habitat: Habitat suitable to support the life needs of species that is distributed continuously or nearly continuously across an area of the landscape.

Core area: An area of late successional habitat surrounding a nesting area.

Cost efficiency: The usefulness of specified inputs (costs) to produce specified outputs (benefits). In measuring cost efficiency, some outputs including environmental, economic, or social impacts, are not assigned monetary values but are achieved at specified levels in the least costly manner. Cost efficiency is usually measured using present net value, although use of benefit-cost ratios and rates-of-return may be appropriate.

Cost: The negative (adverse) effects. Costs may be monetary, social, physical or environmental in nature.

Critical habitat: Under the Endangered Species Act, critical habitat is defined as (1) the specific areas within the geographic area occupied by a Federally listed species on which are found physical and biological features essential to the conservation of the species, and that may require special management considerations or protection; and (2)

specific areas outside the geographic area occupied by a listed species, when it is determined that such areas are essential for the conservation of the species.

Crown: The upper part of a tree or other woody plant that makes up the branches and the foliage.

Crowning Index (CI): The 20' wind speed necessary to result in a crown fire once it has started. CI is a function of canopy bulk density, slope, and fuel moisture content (a higher CI number indicates lower hazard).

Flame length - The length of a flame from the top of the fuels being consumed. A good benchmark is to keep flame lengths below 4 feet under hot and dry conditions,

Cultural (heritage) resource: Any definite location of past human activity identifiable through field survey, historical documentation, or oral evidence. This includes archaeological sites, structures, or places, and places of traditional cultural or religious importance to specified groups whether or not represented by physical remains.

Cumulative effects: Those effects on the environment that result from the incremental effect of the action when added to the past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions.

D

Decommissioning: To permanently terminate the function of a road and mitigate any adverse impacts to forest resources. May include blocking the entrance, assuring natural or artificial re-vegetation, removal of drainage structures, and re-establishing natural drainage patterns; and for system roads, removal from the Forest road inventory.

Density management: Cutting (and removal) of trees for the primary purpose of widening their spacing so that growth of remaining leave trees can be accelerated.

Developed recreation: A site or area developed with permanent facilities designed to accommodate recreation users.

Discount factor: A factor applied to future monetary costs and benefits to convert them to 'present value', thus reflecting society's time preference for money. A four percent discount factor is required for Federal projects.

Dispersal habitat: Habitat that allows safe movement of young or displaced animals in search of a new territory. For spotted owls, dispersal habitat is mature to old-growth forest that has a closed canopy.

Dispersed recreation: Outdoor recreation in which visitors are diffused over relatively large areas. Where facilities or developments are provided, they are primarily for protection of the environment rather than comfort or convenience of the user.

Displacement (soil): The removal and horizontal movement of soil from one place to another by mechanical forces such as a tractor.

Dominant trees: Trees with crowns extending above the general level of the main canopy of even aged stands or, in uneven-aged stands, above the crowns of the tree's immediate neighbors, and receiving full light from above and partly from the sides.

Duff: The layer of loosely accumulated debris underlying the litter layer on the forest floor.

E

Ecosystem: A unit comprising interacting organisms considered together with their environment (e.g., marsh, watershed, and lake ecosystems).

Endangered Species: Any species of plant or animal identified through the Endangered Species Act as being in danger of extinction throughout all or a significant portion of its range, and published in the Federal Register.

Endemic: Species that are only known from a geographic area. Endemism can be narrow (one drainage) or regional (Pacific Northwest) or continental (North America).

Environmental safety standards: Design standards developed to protect the environment during road construction and reconstruction.

Epidemic: When a natural population of insects suddenly and greatly enlarges. Used interchangeably with the term outbreak.

Ephemeral streams: Streams that contain running water only sporadically, such as during and following storm events. Ephemeral streams with a definable channel are considered "intermittent" when they show evidence of annual scour or deposition.

Erosion: The wearing away of the land surface by running water, wind, ice, or other geological agents, including such processes as gravitational creep. There are different types of erosion; including gullies, sheets, and rills.

Evapotranspiration: The removal of water from the soil by plant roots and the use of that water in the growth process (transpiration) plus the evaporation of any excess water from the surface of leaves. When trees are harvested in a clearcut, little to no evapotranspiration takes place until the regenerating stand of trees and shrubs reestablishes.

Existence value: The value placed on a resource based on simply knowing that it exists in a certain state, irrespective of direct experience through visiting the site.

F

Fen: A wetland ecosystem in which the main source of water is usually nutrient rich groundwater

Fire hazard: A physical condition that describes how the area would burn if a fire started.

Fire intensity: A function of fire behavior. Specifically, for D-Bug, it refers to the amount of impact to the dominant overstory, described in terms of mortality, which is directly related to fire behavior. Therefore, a "high intensity" fire is one that replaces the overstory (i.e., crown fire). A low intensity fire burns the understory, leaving the overstory trees with green crowns.

Fire regime: The characteristic frequency, extent, intensity, severity and seasonality of fires in an ecosystem.

Fire risk: The probability that a fire will occur. It does not relate to the likelihood of a fire becoming large.

Fire severity: Generally applies to the post-fire condition (i.e., what is left after the fire). Fire severity is a function of fire intensity in combination with residence time; thus it is a product of temperature and duration (duration of burn at a specific location). For the D-

Bug project, fire severity applies to the impact of fire to the soil. Therefore, a high surface fuel loading (particularly large fuels) will produce a high severity fire.

Fluvial: Refers to creek and rivers. For instance, fluvial erosion of streambanks is caused by the forces of water during a flood.

Fragmentation: The process that divides a habitat into separate blocks and isolates the blocks through loss of connective habitat.

Fuelbreak: Fuelbreaks in this document refer to “shaded” fuelbreaks, defined as those “created by altering surface fuels, increasing the height to the base of live crown, and opening the canopy by removing trees” (Agee et al. 2000) to alter fire behavior within the treated area.

Fuel loading: The weight of fuel at a given site; usually expressed in tons per acre. This value generally refers to the fuel that would be available for consumption by a fire.

Fuel model: An identifiable association of fuel elements of distinctive species, form, size, arrangement or other characteristics that will cause a predictable rate of fire spread and intensity under specific weather and topographic conditions.

G

Geomorphic: Pertaining to the form or shape of those processes that affect the surface of the earth.

Geographic Information System (GIS): A computer system capable of storing and manipulating spatial (i.e., mapped) data.

Gradient: The degree of inclination or rate of descent.

Green tree retention (GTR): A Standard and Guideline from the Northwest Forest Plan that requires the retention of live trees as well as snags in dispersed and aggregate fashion within harvest units in order to provide for a biological legacy and to provide for habitat components through the next management cycle.

Groundwater: That portion of the water below the surface of the ground.

Group harvest: Method of regenerating uneven-aged stands in which trees are removed, and new age classes are established in small groups.

H

Habitat: A place where a plant or animal naturally or normally lives, grows, and reproduces.

Hand piling: Piling of limbs and branches from trees that have been cut during a logging operation in order to reduce the potential for a fire.

Hard snags: Trees that have been dead for a short period of time and have only slightly decayed.

Harvest unit: An area where timber cutting and logging operations take place.

Harvester-forwarder: A logging system where two separate pieces of equipment are used to fell the trees and then transport them to the landing. The harvester cuts the tree and then lays it next to the trail. The forwarder then loads the cut log onto a bunk where it is transported, fully suspended above the ground, to the landing.

Hazardous fuels: A fuel complex defined by kind, arrangement, volume, condition and location that form a special threat of ignition or suppression difficulty.

Hazard tree: A tree that has been identified as a potential risk for structural failure that could cause injury to a person or property.

Helicopter logging: Use of helicopters to transport logs from where they are felled to a landing.

Hiding cover: Generally refers to any vegetation used by wildlife for security or to escape from danger. More specifically for elk, it is any vegetation capable of providing concealment (e.g., hiding 90% of an animal from human view at a distance of 200 feet).

Home range: The land area used by an animal throughout the year, providing food, shelter, and breeding opportunity. For migratory animals, home range includes summer range, winter range, and any migratory lands in between.

Hydrologic recovery procedure: An analysis tool used to estimate the recovery and health of a stream.

I

Indirect effect: Caused by the action and are later in time or farther removed in the distance, but are still reasonably foreseeable.

Inorganic: Chemical substances which are derived from the external physical environment, and which are not organic.

Insect epidemic: When a natural population of insects suddenly and greatly enlarges. Used interchangeably with the term insect outbreak.

Interdisciplinary Team (IDT): A group of individuals with different training or knowledge in different resource areas assembled to perform a task or to solve a problem. The group works together to integrate the various disciplines while developing solutions.

Infiltration: Downward entry of water into the soil.

Interior forest habitat: That portion of a mature forest stand that receives little edge effect. For the purpose of this analysis, it is any portion of the stand more than 300 feet away from the edge bordering an opening.

Invasive plant species: Invasive plant species are alien plants whose introduction do or are likely to cause economic or environmental harm, or harm to human health

Inventoried Roadless Area: Areas that were inventoried prior to the development of the 1990 Umpqua LRMP and described in Appendix C of the Forest Plan.

Irretrievable: Applies primarily to the use of nonrenewable resources. For example, some or all of the timber production from an area is irretrievably lost during the time an area is used as a road. If the road is decommissioned, timber production can be resumed. The production lost is irretrievable, but the action is not irreversible.

Irreversible: Applies primarily to the use of nonrenewable resources, such as minerals or cultural resources, or to those factors such as soil productivity that are renewable only over long time periods. Irreversible also includes loss of future options.

Issue: As defined by the National Environmental Policy Act, an issue is an unresolved conflict over the use of available resources. Issues are points of debate, dispute, or disagreement over the effects of a proposed action.

J

Jackpot burning: prescribed ignition and burning of concentrations of slash or fuel as a result of harvest or post-harvest activities. Used where concentrations of slash are not continuous.

L

Ladder fuels: Midstory vegetation that provides vertical movement of fire burning on the ground into the crowns of trees. Removing or limiting ladder fuels lowers the risk of stand-replacing crown fires

Land Allocation: Specific land areas usually with a set of management prescriptions or standards and guidelines established (in a FEIS for a Forest Plan) to achieve particular goals for the allocation.

LandFire: A dataset of vegetation types derived from Satellite images for the lower 48 states. It describes forest and fuels conditions appropriate for landscape-level analysis. It is available at LandFire.gov.

Large woody debris / material: Pieces of wood larger than 10 feet long and 6 inches in diameter, in a stream channel.

Late-successional forest: A forest in its mature and / or old-growth successional stage. The Northwest Forest Plan defines late successional forests as those 80 years of age or older.

Late successional reserves: Land allocation under the Northwest Forest Plan with the objective to protect and enhance conditions of late-successional and old-growth forest ecosystems that serve as habitat for late-successional and old-growth forest related species, including the northern spotted owl. Limited stand management is permitted, subject to review by the Regional Ecosystem Office (USDA, USDI 1994b).

Late seral stand: See late-successional forest.

Leave trees: Trees, pole-sized or larger, retained in either a dispersed or aggregated manner.

Legacy compaction: Soil compaction from past management actions that carries over to the present.

Lithic scatter: A cultural resource, specifically an archaeological site, consisting largely of the debris (flakes, cores, and broken tools) left behind from the making or sharpening of prehistoric chipped-stone artifacts.

Loamy: Intermediate in texture and properties between fine-textured and coarse-textured soils.

Logging systems: The use of specific logging equipment to achieve prescribed management objectives for an area planned for harvest.

Lop and scatter: A method of slash reduction where accumulations and concentrations are broken up (usually with chain saws) and dispersed from dense locations.

M

Maintenance level: See road maintenance levels.

Management Area (MA): Areas that have been allocated by the Land and Resource Management Plan. Each area has different resource goals and activity Standards and Guidelines.

Management Indicator Species (MIS): Animal species identified within the LRMP to represent specific habitats whose population changes are believed to indicate the effects of management activities.

Mastication: The grinding of woody fuel into small pieces using a grinding head mounted on an excavator or other hydraulic equipment.

Matrix: Lands identifies within the Northwest Forest Plan that are outside of Late-Successional Reserves, Administratively Withdrawn areas, and Riparian Reserves.

Merchantable: Refers to a product that is marketable.

Microclimate: Suite of climatic conditions measured in localized areas near the earth's surface. Microclimate variables important to habitat may include temperature, light, wind speed and moisture.

Mitigation: Modification of actions that: (1) avoid impacts by not taking a certain action or part of an action; (2) minimize impacts by limiting the degree or magnitude of the action and its implementation; (3) rectify impacts by repairing, rehabilitating, or restoring the affected environment; (4) reduce or eliminate impacts over time by preservation and maintenance operations during the life of the action; or (5) compensate for impacts by replacing or providing substitute resources or environments.

Model: An idealized representation of reality developed to describe, analyze, or understand the behavior of some aspect of it; often a mathematical representation of the relationships under study.

Modification: A Visual Quality Objective where land management activities may visually dominate the natural surrounding landscape but must borrow from naturally established form, line, color, and texture.

Mollusk: Invertebrate animals (such as slugs, snails, clams, or squids) that have a soft unsegmented body usually enclosed in a calcareous shell.

Multistoried/multilayered forest stands: Forest stands that contain trees of various heights and diameter classes and therefore support foliage at various heights in the vertical profile of a stand.

Mycorrhizal: The symbiotic association between certain fungi and plant roots which enhances the uptake of water and nutrients.

N

National Environmental Policy Act (NEPA): Federal Legislation related to actions on Federal land that encourages informed decision making. NEPA requires Federal agencies to: (a) use a systematic interdisciplinary approach in planning and decision making; (b) consider the environmental impact of proposed actions; (c) identify adverse environmental effects which cannot be avoided should the proposal be implemented; (d) consider alternatives to the proposed action; (e) consider the relationship between local short-term uses of the human environment and the maintenance and enhancement of long-term productivity; and (f) identify any irreversible and irretrievable commitments of

resources which would be involved in the proposed action should it be implemented. Established a Council on Environmental Quality (CEQ).

National Register of Historic Places: A Federal list of those cultural resource sites and structures that are found to be of national, regional, or local significance and worthy of special consideration during the planning of Federal or Federally approved undertakings.

Net Public Benefits (NPB): A conceptual comparison of all costs and benefits, whether or not they can be monetarily quantified.

Nitrogen: Nitrogen is an important component of all proteins and is required for most biochemical reactions. All living cells require nitrogen in relatively high amounts compared to other nutrients.

Notice of intent: A notice that an environmental impact statement will be prepared and considered.

Noxious weeds: Plant species designated as such by the Secretary of Agriculture or by the responsible State official, that generally possess one or more of the following characteristics: aggressive and difficult to manage, poisonous, toxic, parasitic, a carrier or host of serious insects or disease, and being new to or not common to the United States.

O

Old-growth forest: An old forest stand usually at least 180-220 years old with moderate to high canopy closure; a multi-layered, multi-species canopy dominated by large overstory trees; high incidence of large trees, some with broken tops and other indications of old and decaying wood (decadence); numerous large snags; and heavy accumulations of wood, including large logs on the ground (Definition from the 1992 Northwest Forest Plan).

Opportunity cost: The value of the foregone opportunities for alternative uses of a resource that are eliminated through the Proposed Action.

Optimal thermal cover: Stands of coniferous trees with a multi-layered canopy where greater than 70 percent of the canopy is from trees over 40 feet in height. Stands are generally between 30-60 acres in size and the dominant trees are of relatively large size.

Option Value: The value placed on a resource from knowing that the resource will be available for one's use in the future.

Overstory: Trees that provide the uppermost layer of foliage in a forest with more than one roughly horizontal layer of foliage.

Overstory removal: The cutting of trees comprising an upper canopy layer in order to release trees or other vegetation in an understory. In the case of D-Bug, overstory removal refers to the harvest of the lodgepole pine overstory.

P

Partial Retention: A Visual Quality Objective where land management activities may be evident to the viewer but must remain visually subordinate to the surrounding landscape.

Particulates: Small airborne dust and debris particles.

Patch: Often refers to a small (20-60 acre) part of the forest. A patch is often equivalent to management units in even-age plantations (5 to 100 acres). In unmanaged forest

areas, a patch would correspond to seral stages for each forest type. This term is used to describe the pattern of seral stages by forest type at the landscape scale. In the science of forest landscape ecology, the predominant seral stage in a forested landscape at any one time in forest succession is considered the forest "matrix", and the matrix vegetation that is surrounded by a pattern of seral-stage "patches". Patch is often used in forest management to indicate a type of clear-cutting (patch cut) associated with the "staggered setting" approach to distributing harvest units across the landscape.

Peak flow: The highest amount of stream or river flow occurring in a year or from a single storm event.

Perennial stream: A stream or portion of a stream that flows throughout the year.

Physiographic region: A geographic area having a similar set of biological and physical characteristics and processes because of the effects of climate and geology that result in patterns of soils and broad-scale plant communities. Habitat patterns, wildlife distributions, and historical land-use patterns may differ significantly from those of adjacent regions.

Plant association: A plant community type based on land site potential, successional patterns, and species composition.

Plantation: A forest stand raised as a crop, either by seeding or planting.

Plant series: A level of vegetation classification that is identified by the most common species found in the plant community.

Pole: A tree between the size of a sapling and a mature tree.

Porosity: Volume of pores in a soil sample (non-solid volume) divided by the bulk volume of the sample.

Post and pole harvest: An area designated for cutting of posts and poles.

Pre-commercial thinning: The practice of removing some of the trees less than merchantable size (less than 5 inches in diameter) from a stand so that remaining trees will grow faster.

Prescribed fire: Controlled application of fire to wild-land fuels in either their natural or modified state. It is accomplished under specified environmental conditions which allow the fire to be confined to a predetermined area while also producing the intensity of heat and spread required to attain fuel reduction objectives.

Probable Sale Quantity (PSQ): An estimate of scheduled timber yields from Matrix lands.

Pumice: An excessively, cellular, glassy lava; a sort of volcanic froth.

R

Range of natural variability: An assessment of the long-term variation in natural conditions including the natural disturbance regime.

Record of decision: Document signed by a responsible official recording a decision that was preceded by the preparation of an environmental impact statement.

Recreational Opportunity Spectrum (ROS): An array of recreational activities, settings, and experiences used as a basic framework in planning and managing the recreation

resource, and divided into the following classes: primitive; semiprimitive non-motorized; semiprimitive motorized; roaded modified; roaded natural; rural; and urban.

Reforestation: The natural or artificial restocking of an area with forest trees; most commonly used in reference to artificial stocking.

Regeneration: Seedlings or saplings existing in a stand; or the act of establishing young trees naturally or artificially.

Regeneration harvest: Timber harvest conducted with the partial objective of opening a forest stand to the point where favored tree species will be reestablished.

Region 6: Forest Service Pacific Northwest Region, including the National Forests of Washington and Oregon.

Regional Guide: The guide developed to meet the requirements of the Forest and Rangeland Renewable Resources Planning Act of 1974, as amended by the National Forest Management Act. Regional guides provide Standards and Guidelines for addressing major issues and management concerns that need to be considered to facilitate National Forest planning.

Release: Freeing a tree or group of trees from immediate competition by eliminating overtopping or closely surrounding vegetation.

Relief culvert: A culvert designed to drain ditches on forest roads.

Resilience (to stand replacement fire): A stand's ability to resist the mortality of overstory trees being killed by a fire. A resilient stand is one that is less likely to experience a crown fire and thus less likely to be killed by a stand-replacement fire.

Restoration: Activities designed to enhance or repair resources that were impacted from past management activities, fire exclusion, or natural events.

Retention: A Visual Quality Objective where land management activities are not visually evident. Management activities are permitted, but the results of those activities on the natural landscape must not be evident to the average viewer.

Riparian: That which is related to, living, or located in conjunction with, a wetland, the bank of a river or stream, or the edge of a lake or tidewater.

Road Maintenance Levels: Defines the level of service provided by, and maintenance required for a specific road. There are five Maintenance Levels (1-5). Maintenance level 1 roads are closed while maintenance level 5 roads are open and maintained to the highest level to allow use by low clearance vehicles. For example, Road 4795 around Diamond Lake, is a maintenance level 5 road.

Road prisms: Defined as the area from the top of the cut to the bottom of the fill of a road.

Roaded natural ROS: An area characterized by predominantly natural-appearing environments with moderate evidence of the sights and sounds of people. Such evidences usually harmonize with the natural environment

Runoff: Portion of precipitation on an area that is discharged from the area through stream channels. Precipitation which is lost without entering the soil is called surface runoff.

Rural ROS: An area characterized by substantially modified natural environment, with sights and sounds of humans readily evident and interaction between users often moderate to high.

S

Sale area map: A map that identifies individual harvest unit locations within a timber sale.

Salvage harvest: Harvesting primarily to utilize dead or dying trees that would not be merchantable if left in the stand until the next harvest entry.

Scale: Refers to the geographic area of consideration for analysis of a particular resource. Examples include small scale (stream reach) or large scale (river basin).

Scenic Integrity: Scenic integrity is very similar to visual quality, measuring visual impacts to scenery in terms of contrast of color, and distracting elements of unnatural form, line, and texture. Under the scenery management system (SMS), high scenic integrity is equivalent to retention; moderate scenic integrity is equivalent to partial retention; low scenic integrity is equivalent to modification; and very low scenic integrity is equivalent to maximum modification.

Scenic Stability: The degree to which the valued scenic character and its scenery attributes can be sustained through time and ecological progression.

Scenic Quality: Scenic quality refers to the degree to which the appearance of a place, landscape or feature can elicit psychological and physiological benefits to individuals and, therefore, to society in general.

Scoping: As defined by the National Environmental Policy Act, scoping is an early and important process for determining the scope of issues to be addressed and for identifying the significant issues related to the proposed action.

Section 106: The "Section 106 compliance process" is the process mandated by the National Historic Preservation Act of 1966, as amended, whereby a Federal agency considers the potential effect of a proposed agency undertaking on significant cultural resources. The process typically involves field survey of a project area; documentation and evaluation of cultural resources that may be found within the project's area of potential effect; agency determination of the effect (or lack thereof) of the proposed undertaking on those resources; and consultation with and review by the appropriate State Historic Preservation Office. The Section 106 process is implemented under the terms of Federal regulations 36 CFR 800.

Sediment: Transported and deposited particles derived from rocks, soil, or biological material.

Sediment potential: Rating system which measures the transport and deposition of particles or aggregates derived from rock, soil, or biological material.

Semi-primitive motorized recreation ROS: An area characterized by predominantly unmodified natural environment of a size or location that provides a good-to-moderate opportunity for isolation from sights and sounds of people except for facilities essential for the use of motorized equipment.

Sensitive species: Those plant and animal species identified by a regional forester for which population viability is a concern, as evidenced by either a significant current or

predicted downward trends in population numbers or density or a significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution. (FSM 2670.5)

Seral stages: The series of relatively transitory plant communities that develop during ecological succession from bare ground to the climax stage. Stages include early, mid, and late.

Silviculture: The art and science of managing forest ecosystems to ensure environmental, social, and economic sustainability. This involves the knowledge of the nature of forested ecosystems and vegetation; how they grow, reproduce, and respond to environmental changes, and how vegetation interacts with other components of the ecosystem.

Site potential trees: A tree that has attained the maximum height possible given site conditions where it occurs.

Site preparation: Manipulation of the vegetation or soil of an area prior to planting or seeding. The manipulation follows harvest, wildfire or construction in order to encourage the growth of favored species.

Site productivity: The ability of a geographic area to produce biomass (such as wood fiber), as determined by conditions in that area.

Skid trail: A path created by dragging logs to a landing or gathering spot.

Skeletal soils: Having little productivity and substance; shallow, rocky soils.

Skyline logging: A system for transporting felled logs to a landing where they are loaded on trucks. This method transports logs using a wire rope suspended between two high points. The wire rope serves as an overhead track for a load-carrying carriage. A skyline system uses vertical lift to suspend at least one end of the log free of the ground during inhaul.

Snag: Any standing dead, partially dead, or defective tree.

Snowdown: A term used to describe trees that were knocked down during a winter storm.

Socioeconomic: Pertaining to, or signifying the combination or interaction of social and economic factors.

Soil compaction: Compression of the soil layers through mechanical pressure that increases the soil density and decreases the soil aeration.

Soil displacement: Soil particles moved from the soil surface by water, gravity or mechanical disturbance.

Soil moisture regime: Condition of the soil in relation to moisture; dry, moist, or wet.

Soil productivity: Capacity or suitability of a soil for establishment and growth of a specified crop or plant species, primarily through nutrient availability.

Special use permit: Permits issued by the Forest Service to the private sector when a business is established on, or revenues are generated from, public Forest Service managed lands. A percentage of the revenue generated from the business is paid to the federal government.

Stand: An aggregation of trees occupying a specific area and sufficiently uniform in composition, age, arrangement, and condition so that it is distinguishable from the forest in adjoining areas.

Standards and Guidelines: The primary instructions for land managers, and the principles specifying the environmental conditions or levels to be achieved and maintained (e.g., USDA and USDI 1994, 2001). Standards address mandatory actions, whereas Guidelines are recommended actions based on a land-management decision.

Stand replacement fire: A fire that is severe enough over a large enough area (for example, 10 acres) to kill the existing stand of trees and initiate a new stand.

Stocking: An indication of growing space occupancy relative to a pre-established standard. Usually expressed in number of trees per acre.

Subsoil: Soil horizon layer below the surface or surface layer.

Subsoiling: A treatment to loosen compacted soil at the compacted layer without inversion and with a minimum of mixing with the tilled zone.

Succession: A series of dynamic changes by which one group of organisms succeeds another through stages leading to potential natural community or climax.

Surficial deposits: Pumice soils that flowed into the area when Mt Mazama erupted.

System road: Also referred to as Forest development roads. Defined as a road wholly or partially within or adjacent to a National Forest boundary and necessary for protecting, administering, and using National Forest System Lands, which the Forest Service has authorized, and over which the agency maintains jurisdiction.

T

Terrestrial: Referring to species that are associated with the upland, non-aquatic portion of the ecosystem.

Thermal cover: Cover used by animals against weather. For elk, thermal cover can be found in a stand of coniferous trees at least 40 feet tall with a crown closure of at least 70%.

Threatened species: Those plant or animal species likely to become endangered species throughout all or a significant portion of their range within the foreseeable future.

Timber stand improvement (TSI): Measures such as thinning, pruning, release cutting, fertilization, prescribed fire, or girdling of unwanted trees aimed at improving growing conditions for the remaining trees.

Torching Index (TI): The 20' windspeed necessary to take a fire from the ground into the crowns (a higher number indicates lower hazard). TI is a function of surface fuel loading, fuel moisture, canopy base height, slope, and wind reduction factor (canopy closure).

Total Maximum Daily Load: The calculated amount of pollutant a water body can receive and still meet Oregon water quality standards

Topography: Hills, slopes, and valleys in a landform.

U

Uncharacteristic fire: A fire that is burning in a way that does not emulate historical (reference) fire behavior. This may include fire intensity, severity, size, and landscape patterns. Unless otherwise indicated, this term refers to fires burning with greater intensity, severity, and size and with less variability across the landscape compared to historical effects.

Uncharacteristic wildfire effects: Effects of an uncharacteristic fire (see uncharacteristic fire).

Unclassified roads: A road that is not constructed, maintained, or intended for long-term highway vehicle use, such as roads built for temporary access for timber harvest that were never obliterated following use.

Underburning: Prescribed burning with a low intensity, under a tree canopy.

Unique habitat: Non-forested openings such as talus slopes, meadows, hardwood stands, caves, cliffs, and wetlands.

Upland: The portion of the landscape above the valley floor or stream.

V

Vascular plants: Plants that contain conducting or vascular tissue. They include seed-bearing plant (flowering plants and trees) and spore bearing plants (ferns, horsetails, and club-mosses).

Vertical structure: Refers to the appearance of vegetation from the forest floor to the tallest plants or trees defined by a limited area. Stands or areas that have many different heights are thought to have good vertical structure.

Visual Quality Objectives: The levels of visual quality that have been adopted by management through the Forest land management planning process.

W

Waterbar: An erosion control device usually constructed by digging a small ditch or piling dirt or other debris to interrupt the flow of over-the-surface water. Usually constructed on steeper ground in skid trails where the mineral soil is exposed.

Watershed analysis: A systematic procedure for characterizing watershed and ecological processes to meet specific management and social objectives. Watershed analysis is a stratum of ecosystem management planning applied to Watersheds of about 20-200 square miles.

Wetlands: Areas that are inundated by surface water or groundwater with a frequency sufficient to support, and under normal circumstances do or would support, a prevalence of vegetative or aquatic life that require saturated or seasonally saturated soil conditions for growth and reproduction.

White pine blister rust: A fungus (*Cronartium ribicola*) that causes damage and can lead to eventual death of five needle pine trees the Pacific Northwest.

Wilderness: Areas designated by congressional action under the 1964 Wilderness Act. Wilderness is defined as undeveloped Federal Land retaining its primeval character and influence without permanent improvements or human habitation. Wilderness areas are protected and managed to preserve their natural condition, which generally appear to

have been affected primarily by the forces of nature with the imprint of human activity substantially unnoticeable; have outstanding opportunities for solitude, or for a primitive and confined type of recreation; include at least 5,000 acres or are of sufficient size to make practical their preservation, enjoyment, and use in an unimpaired condition; and may contain features of scientific, educational, scenic, or historical value as well as ecological and geological interest (USDA, USDI 1994a).

Wildfire: Any wildland fire that is not a prescribed fire.

Windthrow: A tree or trees uprooted or broken off along the bole and toppled by the wind.

Y

Yarding: The moving of logs from the stump to a central concentration area.

Young stands: Forest stands not yet mature (generally less than 50-80 years old); typically 20-40 years old).

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