3. CHAPTER THREE – AFFECTED ENVIRONMENT/ENVIRONMENTAL EFFECTS

3.2. INTRODUCTION

This section briefly describes the components and scope of the human environment that may be affected by the implementation of the alternatives outlined in Section Two. It then discloses the potential effects (direct, indirect, and cumulative) of implementing each alternative. It presents the scientific and analytic basis for the comparison of alternatives.

Unavoidable adverse impacts, irreversible/irretrievable commitment of resources, and short term use versus long term productivity are also briefly discussed. All discussions will be tiered to the 1990 Umpqua National Forest Final Environmental Impact Statement and the 1994 Final Supplemental Environmental Impact Statement on Management of Habitat for Late-Successional and Old-Growth Forest Related Species within the Range of the Northern Spotted Owl.

3.2. VEGETATION

3.2.1. AFFECTED ENVIRONMENT

MATURE AND OLD GROWTH FOREST

The affected environment for mature and old growth forest, referred to as the late successional stage in forest development, falls within the Lemolo 5th Level Watershed. Forest stands classified as 80-200 years (mature) and 200+ years (old growth) were classified as late successional habitat, as defined in the Northwest Forest Plan (NWFP). Old growth forest is defined in the NWFP ROD on page F-4 as; "a forest usually at least 180-220 years old with moderate to high canopy closure; a multi-layered, multi-species canopy dominated by large over story 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" (Picture 1). Forests 200 years or older were defined as old growth in this analysis. Proposed harvest units 2, 3, 5, 7, 9, 14, 16-24, 27, 30, 32, 33, 36, 37, 40, 41, 68, and helicopter landing 77 meet this definition and have been identified by some publics to be of significant issue.

Approximately 91 percent (69,921 acres) of the Lemolo 5th Level Watershed is currently made up of late successional forest; 31 percent (23,716 acres) old growth forest, 60 percent (46,205 acres) mature forest. Sixty-seven percent (51,752 acres) of the Lemolo Lake Watershed is currently made up of late-successional forest within administratively and congressionally withdrawn lands; 23 percent (18,081 acres) old growth forest, 44 percent (33,671 acres) mature forest. The full detailed analysis is contained in Appendix I – Silviculture, and is entitled "Analysis of Late Successional Forest within the Lemolo Lake Fifth Field Watershed."

Picture 1 – Typical old growth forest within the Lemolo analysis area

PINE HEALTH AND DENSITY MANAGEMENT

The affected environment for pine health falls within all proposed harvest units and prescribed under burn units that have a ponderosa, sugar, western white, or lodge pole pine component. Information from a fire history study completed for the Diamond Lake/Lemolo Watershed Analysis showed that a large portion of the watershed burned in at least three major fire events between 1880 and 1910, with an average fire return interval of 72-years. The absence of fire due to fire suppression efforts since 1910, white pine blister rust, and the mountain pine beetle have been the main causes of the decline in health and vigor of mature and old growth ponderosa pine, sugar pine, western white pine, and lodge pole pine within the Lemolo analysis area. Lack of fire has led to overstocked stand conditions, under story development of shade tolerant species, and mature lodge pole pine stands greater than 80-years of age that are highly susceptible to a mountain pine beetle outbreak.

Pages 198-199 of the Diamond Lake/Lemolo Watershed Analysis made recommendations to improve pine health within the watershed. It stated "If scattered, large, older ponderosa pines and western white pines are to be maintained, competing vegetation of all types should be removed to a distance of approximately ten to 20 feet past the drip line of individual trees" (Picture 2). Units 2, 3, 5, 7, 9, 12, 14, 16, 18-27, 29, 30, 32, 33, 36, 37, 40, 41, 68, and 69-71 are stands where competition around mature and old growth ponderosa, sugar, and western white is affecting pine health and vigor.

Picture 2 – Old growth ponderosa pine – competition from under story fir species

The watershed analysis also states that thinning should be conducted in mature mixed conifer stands to reduce basal areas to below 140 square feet per acre for western white pine and below 120 square feet per acre for ponderosa pine. Units 1, 4, 6, 10, 11, 13, 15, 25, 26, 28, 29, 32, 35, 38, 39 and 67 are stands where basal areas exceed this recommendation and mortality of pine from overstocked conditions is occurring.

The watershed analysis recommended that treatments remove large trees and regenerate lodge pole pine to capture mortality, reduce fire risk, and create a mosaic of age classes at the landscape scale to reduce the risk of a mountain pine beetle epidemic. It defined high risk lodge pole pine stands as greater than 80 years old, greater than 8 inches in diameter, and basal areas greater than 80 square feet per acre (Picture 3). Units 42-56, 60, and 61 meet this high risk definition and are highly susceptible to a mountain pine beetle outbreak. The watershed analysis also recommends that young lodge pole pine stands be commercially thinned to increase vigor in order to delay bark beetle-caused mortality. Units 57-59 and 62-64 are heavily overstocked and in need of thinning.

Picture 3 – Dense Lodgepole pine stand at high risk to Mountain Pine beetle attack

3.2.2 ENVIRONMENTAL EFFECTS

MATURE AND OLD GROWTH FOREST

The guidance outlined in a letter from the Regional Office, dated February 3, 1998, was used to analyze the amount of late successional forest within the Lemolo Lake Fifth Field Watershed, which is synonymous with the Lemolo Watershed Projects Analysis area. The analysis must be conducted in order to meet Standard and Guideline C-44/45 outlined in the 1994 Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl (NWFP). The standard states that if there is 15% or less late successional habitat within a Fifth Field Watershed, any remaining late successional habitat will be retained.

Vegetative age class information from the ump_femat_age GIS coverage and site specific stand age from increment bores, were used for the analysis. The full detailed analysis is contained in Appendix I – Silviculture, and is entitled "Analysis of Late Successional Forest within the Lemolo Lake Fifth Field Watershed".

This analysis showed that all alternatives met the Level 3 Assessment as outlined in the Regional guidance, therefore meeting the Standard and Guideline. The Level 3 Assessment is defined as fifth field watersheds where more than 15 percent of the Federal forest is 80 years or older and there is no potential for late successional stands to be reduced to 15% within the current Forest Service land use planning cycle. Sixty-seven percent (51,752 acres) of the Lemolo Lake Watershed is currently made up of late successional forest within administratively and congressionally withdrawn lands; 23 percent (18,081 acres) old growth forest, 44 percent

(33,671 acres) mature forest. Age class structure within these withdrawn lands will not be affected by any alternative.

The effects of the alternatives on age class structure within the Lemolo Lake Fifth Field Watershed are discussed below. The number of acres of old growth forest harvested under each alternative serves as an evaluation criteria for the old growth issue. A comparison of these evaluation criteria by alternative can be found in Table 7.

3.2.3 ALTERNATIVE 1 (NO ACTION)

DIRECT EFFECTS

Age class structure will not change within the Lemolo Lake Watershed. Table 8 depicts the breakdown of age class structure under this alternative.

Table 1 – Age Class Structure (Alternative 1)

Age Class (years)	Acres	% of Planning Area
0 - 30	3208	4.2
30 - 80	674	0.9
80 - 200	46205	60.4
200+	23716	31.0
Natural and man-made permanent openings	2709	3.5

Ninety one point four percent (69,921 acres) of Lemolo Lake Fifth Field Watershed will remain late successional habitat; 31.0 percent (23,716 acres) old growth forest, 60.4 percent (46,205 acres) mature forest.

INDIRECT EFFECTS

Environmental and biological edge effects will not increase because no harvest will take place. Flora and fauna associated with early successional stages will not benefit from increased edge because no harvest will take place. Habitat favorable to flora and fauna dependent on late successional stages will not be reduced.

CUMULATIVE EFFECTS

Portions of two planned timber sales within the analysis area, Gigawatt units 11, 13, 14 and Bearpaw 17, will convert 20 acres of old growth forest to early successional habitat, therefore reducing the total late successional habitat to 69,901 acres (91.4%).

3.2.4 ALTERNATIVE 2 (PROPOSED ACTION)

DIRECT EFFECTS

Alternative 2 will reduce late successional habitat within the watershed by less than 1% by converting 605 acres of late successional habitat to early successional habitat and 14 acres of late successional habitat to permanent openings (a total of 619 acres). Three hundred acres of

these 619 acres are classified as old growth forest. This will reduce the amount of late successional habitat to 69,302 acres (90.5%) within the analysis area; 30.5% old growth forest, 60% mature forest. Table 9 depicts the mix of age classes under Alternative 2.

Table 2 – Age Class Structure (Alternative 2)

Age Class (years)	Acres	% of Planning Area
0 - 30	3,813	5.0
30 - 80	674	0.9
80 - 200	45,886	60.0
200+	23,416	30.6
Natural and man-made permanent openings	2,723	3.5

Late successional habitat within proposed partial harvest and commercial thinning units will remain late successional habitat.

INDIRECT EFFECTS

Environmental and biological edge effects will increase around regeneration harvest units (shelterwood, seed tree, group harvest prescriptions). Planted and natural early-seral tree species will replace climax tree species in the under story. Flora and fauna associated with early successional stages will benefit from increased edge. Habitat favorable to flora and fauna dependent on late successional stages will be reduced. Minor amounts of existing climax natural regeneration will remain after regeneration harvest. A legacy of the large vertical component of existing vegetation in the form of live culls, seed trees, snags, snag recruitment trees, and shelterwood trees will be left in regeneration harvest areas.

CUMULATIVE EFFECTS

Portions of two planned timber sales within the analysis area, Gigawatt units 11, 13, 14 and Bearpaw 17, will convert 20 acres of old growth forest to early successional habitat, therefore reducing the total late successional habitat to 69,282 acres (90.5%).

3.2.5 ALTERNATIVE 3

DIRECT EFFECTS

Alternative 3 will reduce late successional habitat within the watershed by less than 1% by converting 226 acres of late successional habitat to early successional habitat and 10 acres of late successional habitat to permanent openings (a total of 236 acres). Two acres of these 236 acres are classified as old growth forest. This will reduce the amount of late successional habitat to 69,685 acres (91.1%) within the analysis area; 31.0% old growth forest, 60.1% mature forest. Table 10 depicts the mix of age classes under Alternative 3.

Table 3 – Age Class Structure (Alternative 3)

Age Class (years)	Acres	% of Planning Area
0 - 30	3,434	4.5
30 - 80	674	0.9
80 - 200	45,971	60.1
200+	23,714	31.0
Natural and man-made permanent openings	2,719	3.5

Late successional habitat within proposed partial harvest and commercial thinning units will remain late successional habitat.

INDIRECT EFFECTS

Environmental and biological edge effects will increase around regeneration harvest units (shelterwood, seed tree, group harvest prescriptions). Planted and natural early-seral tree species will replace climax tree species in the under story. Flora and fauna associated with early successional stages will benefit from increased edge. Habitat favorable to flora and fauna dependent on late successional stages will be reduced. Minor amounts of existing climax natural regeneration will remain after regeneration harvest. A legacy of the large vertical component of existing vegetation in the form of live culls, seed trees, snags, snag recruitment trees, and shelterwood trees will be left in regeneration harvest areas.

CUMULATIVE EFFECTS

Portions of two planned timber sales within the analysis area, Gigawatt units 11, 13, 14 and Bearpaw 17, will convert 20 acres of old growth forest to early successional habitat, therefore reducing the total late successional habitat to 69,665 acres (91.1% of the planning area).

3.2.6 ALTERNATIVE 4

DIRECT EFFECTS

Alternative 4 will reduce late successional habitat within the watershed by less than 1% by converting 308 acres of late successional habitat to early successional habitat and 13 acres of late successional habitat to permanent openings (a total of 321 acres). Three acres of these 321 acres are classified as old growth forest. This will reduce the amount of late successional habitat to 69,600 acres (91.0%) within the analysis area; 31.0% old growth forest, 60% mature forest. Table 11 depicts the mix of age classes under Alternative 4.

Table 4 – Age Class Structure (Alternative 4)

Age Class (years)	Acres	% of Planning Area
0 - 30	3,516	4.6
30 - 80	674	0.9
80 - 200	45,887	60.0
200+	23,713	31.0
Natural and man-made permanent openings	2,722	3.5

Late successional habitat within proposed partial harvest and commercial thinning units will remain late successional habitat.

INDIRECT EFFECTS

Environmental and biological edge effects will increase around regeneration harvest units (shelterwood, seed tree, group harvest prescriptions). Planted and natural early-seral tree species will replace climax tree species in the under story. Flora and fauna associated with early successional stages will benefit from increased edge. Habitat favorable to flora and fauna dependent on late successional stages will be reduced. Minor amounts of existing climax natural regeneration will remain after regeneration harvest. A legacy of the large vertical component of existing vegetation in the form of live culls, seed trees, snags, snag recruitment trees, and shelterwood trees will be left in regeneration harvest areas.

CUMULATIVE EFFECTS

Portions of two planned timber sales within the analysis area, Gigawatt units 11, 13, 14 and Bearpaw 17, will convert 20 acres of old growth forest to early successional habitat, therefore reducing the total late successional habitat to 69,580 acres (90.9%).

3.2.7 ALTERNATIVE 5

DIRECT EFFECTS

Alternative 5 will reduce late successional habitat within the watershed by less than 1% by converting 354 acres of late successional habitat to early successional habitat and 13 acres of late successional habitat to permanent openings (a total of 367 acres). One hundred and thirty one acres of these 354 acres are classified as old growth forest. This will reduce the amount of late successional habitat to 69,554 acres (90.9%) within the analysis area; 30.8% old growth forest, 60.1% mature forest. Table 12 depicts the mix of age classes under Alternative 5.

Table 5 – Age Class Structure (Alternative 5)

Age Class (years)	Acreage	% of Planning Area
0 - 30	3562	4.7
30 - 80	674	0.9
80 - 200	45969	60.1
200+	23585	30.8
Natural and man-made permanent openings	2722	3.5

Late successional habitat within proposed partial harvest and commercial thinning units will remain late successional habitat.

INDIRECT EFFECTS

Environmental and biological edge effects will increase around regeneration harvest units (shelterwood, seed tree, group harvest prescriptions). Planted and natural early-seral tree species will replace climax tree species in the under story. Flora and fauna associated with early successional stages will benefit from increased edge. Habitat favorable to flora and fauna dependent on late successional stages will be reduced. Minor amounts of existing climax natural regeneration will remain after regeneration harvest. A legacy of the large vertical component of existing vegetation in the form of live culls, seed trees, snags, snag recruitment trees, and shelterwood trees will be left in regeneration harvest areas.

CUMULATIVE EFFECTS

Portions of two planned timber sales within the analysis area, Gigawatt units 11, 13, 14 and Bearpaw 17, will convert 20 acres of old growth forest to early successional habitat, therefore reducing the total late successional habitat to 69,534 acres (90.9%).

All proposed vegetative manipulation in Alternatives 2, 3, 4 and 5 will be in compliance with the 1988 Final Environmental Impact Statement for Managing Competing and Unwanted Vegetation to which this document is tiered. The Silvicultural Prescription in Appendix I, pages 43-44, specifies the analysis of environmental effects related to vegetative management.

PINE HEALTH AND DENSITY MANAGEMENT

The analysis of pine health and density management revolves around the stands prescribed for harvest or natural fuels treatment to reduce competition and the risk of a mountain pine beetle outbreak, as recommended by the Diamond Lake/Lemolo Watershed Analysis. Existing stand densities were determined using Suppose version 1.13 of the Forest Vegetation Simulator, Western Cascades Variant version 6.21. Data from formal stand exams from the 1980's and 1990's were used for the analysis. Stand densities and prescriptions for each proposed stand can be found in the Silvicultural Prescription in Appendix I, pages 6-38.

The number of acres treated to promote pine health on Bunker Hill and within the entire Lemolo 5th Level Watershed were generated for each alternative and serve as evaluation criteria to compare alternatives. The number of acres commercially thinned to promote stand health and vigor through density management on Bunker Hill and within the entire Lemolo 5th Level Watershed were also generated for each alternative and also serve as evaluation criteria to compare alternatives. A comparison of these evaluation criteria by alternative can be found in Table 7.

3.2.8 ALTERNATIVE 1 (NO ACTION)

DIRECT EFFECTS

Pine health will continue to decline on Bunker Hill (488 acres) and within the Lemolo Watershed (1703 acres), within stands targeted for treatment to promote pine health in the Silvicultural Prescription (units 1-7, 9-16, 18-30, 32, 33, 35-64, and 67-71). This decline is due to overstocked stand conditions, mountain pine beetle, and white pine blister rust. Stand health and vigor will also continue to decline on Bunker Hill (423 acres) and within the Lemolo Watershed (892 acres) within mature forest stands targeted for commercial thinning in the Silvicultural Prescription (units 1, 3, 4, 6, 10, 11, 13, 15, 25, 26, 28, 29, 31, 32, 34, 35, 38, 39, and 67), due to overstocked conditions. These declines will lead to increased mortality in mature and old growth pine, the likelihood of a mountain pine beetle outbreak within mature lodge pole pine stands, and increased susceptibility to insects and disease within stands not undergoing silvicultural treatment.

INDIRECT EFFECTS

Fuels and fire hazard will increase overtime within stands targeted for treatment on Bunker Hill and within the Lemolo Watershed, caused by competition mortality and increased mortality from insects and disease due to overstocked conditions. Ponderosa pine will generally not regenerate due to overstocked stand conditions; therefore younger cohorts will not replace the declining mature and old growth ponderosa pine in the long term.

CUMULATIVE EFFECTS

An increase in fuels within targeted stands for treatment will not move the Lemolo Watershed towards a historical moderate severity fire regime, therefore increasing the risk of a large, high severity fire on Bunker Hill and within the watershed. Maintaining susceptible mature lodge pole pine stands targeted for treatment will increase the risk of a landscape level mountain pine beetle epidemic in the future, according to Whitehead et al. 2001.

3.2.9 ALTERNATIVE 2

DIRECT EFFECTS

Pine health will be promoted on Bunker Hill (488 acres) and within the Lemolo Watershed (1703 acres), within units 1-7, 9-16, 18-30, 32, 33, 35-64, and 67-71, through silvicultural treatment detailed in the Silvicultural Prescription located in Appendix I. Stand health and vigor will also be promoted on Bunker Hill (374 acres) and within the Lemolo Watershed (892 acres) within units 1, 3, 4, 6, 10, 11, 13, 15, 25, 26, 28, 29, 31, 32, 34, 35, 38, 39, and 67, through commercial thinning treatments detailed in the Silvicultural Prescription located in Appendix I. Repeated thinnings on extended rotations can maintain forest cover for long periods while providing current income and employment (Curtis and Carey 1996; Lippke et al. 1996), maintaining tree and stand vigor, promoting stand health and stability, and developing stand structures favorable to certain wildlife species associated with late successional stages (Carey et al. 1996a). All of these treatments combined will lead to decreased mortality in mature and old growth pine, a decreased risk of a mountain pine beetle outbreak within mature lodge pole pine stands, and increased resistance to insects, disease, and white pine blister rust.

Resistance to white pine blister rust will be promoted through planting of tested rust resistant five-needle pine stock and pruning.

INDIRECT EFFECTS

Fuels and fire hazard will decrease within stands targeted for treatment on Bunker Hill and within the Lemolo Watershed, through a decrease in competition mortality and mortality from insects and disease, and slash treatment after harvest that reduces fuels to less than 21 tons per acre. Ponderosa pine will be established through planting and natural regeneration within units 2, 3, 5-9, 12-15, 24-26, 32, and 33. These established younger cohorts will replace the mature and old growth ponderosa pine in the long term.

CUMULATIVE EFFECTS

A decrease in fuels within targeted stands for treatment will move the Lemolo Watershed towards a historical moderate severity fire regime, therefore reducing the risk of a large, high severity fire on Bunker Hill and within the watershed. Reducing the quantity of susceptible mature lodge pole pine stands through silvicultural treatment will decrease the risk of a landscape level mountain pine beetle epidemic in the future, according to Whitehead et al. 2001.

3.2.10 ALTERNATIVE 3

DIRECT EFFECTS

Pine health will be promoted within the Lemolo Watershed (763 acres), within units 6, 10-13, 25, 28, 29, 42-47, 49-52, 57-64, 67, and 69-71, through silvicultural treatment detailed in the Silvicultural Prescription located in Appendix I. Stand health and vigor will be promoted within the Lemolo Watershed (374 acres) within units 6, 10, 11, 13, 25, 28, 29, 31, and 67, through commercial thinning treatments detailed in the Silvicultural Prescription located in Appendix I. Repeated thinnings on extended rotations can maintain forest cover for long periods while providing current income and employment (Curtis and Carey 1996; Lippke et al. 1996), maintaining tree and stand vigor, promoting stand health and stability, and developing stand structures favorable to certain wildlife species associated with late successional stages (Carey et al. 1996a). All of these treatments combined will lead to decreased mortality in mature and old growth pine, a decreased risk of a mountain pine beetle outbreak within mature lodge pole pine stands, and increased resistance to insects, disease, and white pine blister rust. Resistance to white pine blister rust will be promoted through planting of tested rust resistant five-needle pine stock and pruning.

Pine health and stand health and vigor will not be promoted on Bunker Hill. This will lead to increased mortality in mature and old growth pine and increased susceptibility to insects and disease within stands not undergoing silvicultural treatment.

INDIRECT EFFECTS

Fuels and fire hazard will decrease within stands targeted for treatment within the Lemolo Watershed, through a decrease in competition mortality and mortality from insects and disease, and slash treatment after harvest that reduces fuels to less than 21 tons per acre. Ponderosa pine

will be established through planting and natural regeneration within units 6, 12, 13, and 25. These established younger cohorts will replace the mature and old growth ponderosa pine in the long term.

Fuels and fire hazard will increase within stands on Bunker Hill, caused by competition mortality and increased mortality from insects and disease due to overstocked conditions. This will increase the risk of a large, high severity fire on Bunker Hill. Ponderosa pine will generally not regenerate due to overstocked stand conditions; therefore younger cohorts will not replace the declining mature and old growth ponderosa pine on Bunker Hill in the long term.

CUMULATIVE EFFECTS

A decrease in fuels within targeted stands for treatment will move the Lemolo Watershed towards a historical moderate severity fire regime, therefore reducing the risk of a large, high severity within the watershed except for Bunker Hill. Reducing the quantity of susceptible mature lodge pole pine stands through silvicultural treatment will decrease the risk of a landscape level mountain pine beetle epidemic in the future, according to Whitehead et al. 2001.

3.2.11 ALTERNATIVE 4

DIRECT EFFECTS

Pine health will be promoted on Bunker Hill (102 acres) and within the Lemolo Watershed (1032 acres), within units 1, 4, 6, 10-13, 25, 28, 29, 35, 38, 39, 42-64, 67, and 69-71, through silvicultural treatment detailed in the Silvicultural Prescription located in Appendix I. Stand health and vigor will also be promoted on Bunker Hill (102 acres) and within the Lemolo Watershed (553 acres) within units 1, 4, 6, 10, 11, 13, 25, 28, 29, 31, 35, 38, 39, and 67, through commercial thinning treatments detailed in the Silvicultural Prescription located in Appendix I. Repeated thinnings on extended rotations can maintain forest cover for long periods while providing current income and employment (Curtis and Carey 1996; Lippke et al. 1996), maintaining tree and stand vigor, promoting stand health and stability, and developing stand structures favorable to certain wildlife species associated with late successional stages (Carey et al. 1996a). All of these treatments combined will lead to decreased mortality in mature and old growth pine, a decreased risk of a mountain pine beetle outbreak within mature lodge pole pine stands, and increased resistance to insects, disease, and white pine blister rust. Resistance to white pine blister rust will be promoted through planting of tested rust resistant five-needle pine stock and pruning.

INDIRECT EFFECTS

Fuels and fire hazard will decrease within stands targeted for treatment on Bunker Hill and within the Lemolo Watershed, through a decrease in competition mortality and mortality from insects and disease, and slash treatment after harvest that reduces fuels to less than 21 tons per acre. Ponderosa pine will be established through planting and natural regeneration within units 6, 12, 13, and 25. These established younger cohorts will replace the mature and old growth ponderosa pine in the long term.

CUMULATIVE EFFECTS

A decrease in fuels within targeted stands for treatment will move the Lemolo Watershed towards a historical moderate severity fire regime, therefore reducing the risk of a large, high severity fire on Bunker Hill and within the watershed. Reducing the quantity of susceptible mature lodge pole pine stands through silvicultural treatment will decrease the risk of a landscape level mountain pine beetle epidemic in the future, according to Whitehead et al. 2001.

3.2.12 ALTERNATIVE 5

DIRECT EFFECTS

Pine health will be promoted on Bunker Hill (399 acres) and within the Lemolo Watershed (1360 acres), within units 1, 3, 4, 6, 7, 10-13, 16, 25, 28, 29, 33, 35, 38, 39-47, 49-52, 57-64, and 67-71, through silvicultural treatment detailed in the Silvicultural Prescription located in Appendix I. Stand health and vigor will also be promoted on Bunker Hill (384 acres) and within the Lemolo Watershed (835 acres) within units 1, 3, 4, 6, 10, 11, 13, 25, 28, 29, 31, 35, 38, 39, and 67, through commercial thinning treatments detailed in the Silvicultural Prescription located in Appendix I. Repeated thinnings on extended rotations can maintain forest cover for long periods while providing current income and employment (Curtis and Carey 1996; Lippke et al. 1996), maintaining tree and stand vigor, promoting stand health and stability, and developing stand structures favorable to certain wildlife species associated with late successional stages (Carey et al. 1996a). All of these treatments combined will lead to decreased mortality in mature and old growth pine, a decreased risk of a mountain pine beetle outbreak within mature lodge pole pine stands, and increased resistance to insects, disease, and white pine blister rust. Resistance to white pine blister rust will be promoted through planting of tested rust resistant five-needle pine stock and pruning.

INDIRECT EFFECTS

Fuels and fire hazard will decrease within stands targeted for treatment on Bunker Hill and within the Lemolo Watershed, through a decrease in competition mortality and mortality from insects and disease, and slash treatment after harvest that reduces fuels to less than 21 tons per acre. Ponderosa pine will be established through planting and natural regeneration within units 3, 6, 7, 12, 13, 25, and 33. These established younger cohorts will replace the mature and old growth ponderosa pine in the long term.

CUMULATIVE EFFECTS

A decrease in fuels within targeted stands for treatment will move the Lemolo Watershed towards a historical moderate severity fire regime, therefore reducing the risk of a large, high severity fire on Bunker Hill and within the watershed. Reducing the quantity of susceptible mature lodge pole pine stands through silvicultural treatment will decrease the risk of a landscape level mountain pine beetle epidemic in the future, according to Whitehead et al. 2001.

3.3 RECREATIONAL VALUE IN THE LEMOLO LAKE AREA

3.3.2 AFFECTED ENVIRONMENT

The affected environment for recreational value includes the immediate area surrounding Lemolo Lake, which is in Management Area 2 (Concentrated Developed Recreation), Pit Lakes, Kelsay Valley Trail Head, Lake Charlene, Connie Lake, Kelsay Point, Spring River and Thielsen Creek. Proposed harvest units 1, 2, 3, 4, 5, 7, 9, 14-24, 26, 27, 30, 32-41, 48, 53-56, 68 and the east half of unit 25 below the 60 road are located near these areas and have been identified by some publics to be of significant issue. All of these harvest units are located in the MA10/matrix land allocation and are designed to meet LRMP Standards and Guidelines, including direction for the Lemolo Lake Recreation Area.

Currently, many of the forest stand conditions within the affected environment are overstocked. These areas are experiencing extreme fuels build up, primarily due to competition mortality and insect and disease outbreaks (Picture 4). The affected environment is at risk for high intensity fire. Additionally, scattered remnant old growth ponderosa pines are on the decline in the area. Very little natural regeneration of ponderosa pine is taking place. The primary reasons are fire exclusion and competing vegetation.

Picture 4 – Overstocked mixed conifer stand with high levels of down fuel

The Lemolo Lake Recreation Area lies within the Lakeview 6th Level Sub-watershed. Its area is approximately 1,290 acres and is centered on Lemolo Lake. Lemolo Lake is a human made reservoir operated by Scottish Power as a hydroelectric facility. The lake is approximately 419 acres in size at an elevation of 4,230 feet. The recreation area is primarily accessed via Oregon State Highway 138 and Forest Service roads 2610, 60, 2612, and 2614. The Lemolo Lake Recreation Area is identified in the LRMP as a Special Management Area (MA2) and is to be administered for concentrated developed recreation, under prescription A4-1. The USFS operates and maintains five campgrounds in the area with a capacity of 95 sites. Major activities

during the summer include camping, boating, fishing, biking, ATV use, swimming, and sightseeing. The 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.

Pit Lakes is located off of the 2610 road approximately one mile from State highway 138. There are two lakes located in this area, both of which were former gravel pits that eventually filled in with water. Some rehabilitation work has taken place in the area. A trail leads down a closed road (2610-100) to the lakes. Both lakes have been stocked with rainbow and brook trout. Lake Creek is near the lakes and is believed to be the source of water that feeds the lakes. Fishermen are the primary users of this area, with some dispersed camping that takes place mostly during hunting season.

Kelsay Valley trail-head is located east of Lemolo Lake and Forest Road 60. The Kelsay Valley horse camp is located here. The campground has vault toilets and picnic tables. This area is a popular destination for horse recreation. The trail provides access to the Oregon Cascade Recreation Area and Mt Thielsen Wilderness.

Spring River, located approximately 1 ½ miles southwest of the 60 road and the North Umpqua River, receives dispersed recreation use. The primary focus is viewing of the spring that is the source for the river.

Kelsay Point, Lake Charlene, Connie Lake, and Thielsen Creek areas receive considerable dispersed recreation activity and are located near the Oregon Cascades Recreation Area, Thirsty Appendage Road less Area, and other semi primitive areas.

Visual Quality Objectives (VQO's) range from retention to modification within the analysis area, as defined in the LRMP. The area contains many predominant visual features such as Lemolo Lake, Mt. Bailey, Mt. Thielsen, and Bunker Hill.

3.3.3 ENVIRONMENTAL EFFECTS

The effects of the proposed alternatives on recreation and visual quality in the Lemolo Lake area, were evaluated based on public concern, conclusions from the fuels analysis (Appendix E), the Silvicultural Prescription (Appendix I), and Visual Resource Objectives (VQO's) (Appendix L) established in the1990 Umpqua National Forest LRMP, as amended. All proposed harvest and natural fuels units are located in the MA10/matrix land allocation and are designed to meet LRMP Standards and Guidelines, including direction for the Lemolo Lake Recreation Area outlined under Management Area 2.

The number of acres harvested within areas identified as high recreational value through public comment was generated for each alternative and serve as evaluation criteria to compare alternatives. The analysis below generally shows that there are short term adverse impacts to recreation values if harvest activities occur, but long term fire hazard reduction around the Lemolo Lake Recreation Area if silvicultural and fuel treatments are implemented. The fire analysis section of the Lemolo/Diamond Lake Watershed Analysis identified large areas with potential for high intensity fires. Those areas are Bunker Hill, the area north and west of Bradley Creek to its confluence with the North Umpqua River and North of the North Umpqua

River to Bunker Hill. These areas include the stands identified as having high recreation value by some publics.

3.3.4 ALTERNATIVE 1 (NO ACTION)

DIRECT EFFECTS

Harvest and natural fuels treatment will be deferred at this time within the analysis area, therefore adverse direct effects to recreational values caused by vegetative change, logging traffic, smoke, and noise will not occur.

INDIRECT EFFECTS

Without treatment, stands 1-5, 7, 9, 14-24, 26, 27, 30, 32-41, 48, 53-56, 68 and the south portion of unit 25 below the 60 road (total of 945 acres) will continue to experience an increase of down and standing fuels, due to competition mortality and insect and disease activity. These stands already have artificial high fuel loadings due to fire suppression. High fuel loadings will increase the potential of large scale, high intensity fire (Fire Management Report - E) around a highly used recreation area. Large scale, high intensity fire would adversely affect visual quality, the recreation experience of the area, and public safety.

CUMULATIVE EFFECTS

Other projects will occur within the boundary of this analysis area and may contribute to effects on recreation. They are as follows: Lemolo Fire Hazard Reduction, Electric Salvage, and Gigawat and Bearpaw Timber Sales. With the additional operational activity associated with these planned projects, the recreational values will be adversely affected by logging traffic, smoke, and noise for the short-term. However, these projects will help reduce the risk of large scale, high intensity fire and its potential significant adverse effect on visual quality, recreational experience, and public safety.

3.3.5 ALTERNATIVE 2 (PROPOSED ACTION)

DIRECT EFFECTS

This alternative will treat 945 acres in stands 1, 2, 3, 4, 5, 7, 9, 14-24, 26, 27, 30, 32-41, 48, 53-56, 68 and a portion of 25 within the Bunker Hill, Pit Lakes, Kelsay Valley Trail Head, Lake Charlene, Connie Lake, Kelsay Point, Spring River and Thielsen Creek areas that were identified as high recreational value through public comment. The recreation experience for forest visitors will be adversely affected by the noise and traffic that will occur during logging operations. Smoke from burning harvest slash and natural fuels units will adversely affect recreational values. These activities will be mitigated through signing and timing restrictions for scheduled operations. The overall effect will be short-term (approximately 1-3 months in duration).

A visual quality analysis was conducted by Laura Blecker (Forest Landscape Architect), for action alternatives and is located in Appendix L. The analysis shows that there will be no adverse effect to the overall visual quality of the area, generally due to the design of

silvicultural prescriptions for Bunker Hill (Appendix I - Silvicultural Prescription) that meet Forest Plan Standard and Guidelines for visual quality objectives (Appendix L).

There will be no adverse visual effects to the North Umpqua Trail from harvest operations. This is due to a required 200 foot no harvest buffer on either side of the trail.

INDIRECT EFFECTS

Silvicultural and fuel treatments will reduce present and future fire hazard within and around stands with high recreation value. This would help reduce the risk of large scale, high intensity fire and its potential significant adverse affect on visual quality, recreational experience, and public safety.

CUMULATIVE EFFECTS

Other projects will occur within the boundary of this analysis area and may contribute to effects on recreation. They are as follows: Lemolo Fire Hazard Reduction, Electric Salvage, and Gigawat and Bearpaw Timber Sales. Recreational values will be adversely affected by logging traffic, smoke, and noise associated with these planned projects in conjunction with proposed activities in Alternative 2. However, these projects will help reduce the risk of large scale, high intensity fire and its potential significant adverse effect on visual quality, recreational experience, and public safety.

These activities would be mitigated through signing and timing restrictions for scheduled operations. The overall effect would be short term (approximately 1-3 months in duration).

3.3.6 ALTERNATIVE 3

DIRECT EFFECTS

This alternative will not harvest any of the stands identified as high recreational value through public comment within the Bunker Hill, Pit Lakes, Kelsay Valley Trail Head, Lake Charlene, Connie Lake, Kelsay Point, Spring River and Thielsen Creek areas. Adverse direct effects to recreational values caused by vegetative change, logging traffic, smoke, and noise will not occur.

INDIRECT EFFECTS

Without treatment, stands 1-5, 7, 9, 14-24, 26, 27, 30, 32-41, 48, 53-56, 68 and the south portion of unit 25 below the 60 road (total of 945 acres) will continue to experience an increase of down and standing fuels, due to competition mortality and insect and disease activity. These stands already have artificial high fuel loadings due to fire suppression. High fuel loadings will increase the potential of large scale, high intensity fire (Fire Management Report - Appendix E) around a highly used recreation area. Large scale, high intensity fire would adversely affect visual quality, the recreation experience of the area, and public safety.

CUMULATIVE EFFECTS

Other projects will occur within the boundary of this analysis area and may contribute to effects on recreation. They are as follows: Lemolo Fire Hazard Reduction, Electric Salvage, and Gigawat and Bearpaw Timber Sales. Recreational values will be adversely affected by logging traffic, smoke, and noise associated with these planned projects. However, these projects will help reduce the risk of large scale, high intensity fire and its potential significant adverse effect on visual quality, recreational experience, and public safety. These activities will be mitigated through signing and timing restrictions for scheduled operations. The overall effect will be short term (approximately 1-3 months in duration).

3.3.7 ALTERNATIVE 4

DIRECT EFFECTS

This alternative will harvest 271 acres in stands 1, 4, 35, 38, 39, 48, 53, 54, 55 & 56 within the Bunker Hill, Pit Lakes, Kelsay Valley Trail Head, Lake Charlene, Connie Lake, Kelsay Point, Spring River and Thielsen Creek areas identified as high recreational value through public comment. The recreation experience for forest visitors will be adversely affected by the noise and traffic that will occur during logging operations. Smoke from burning harvest slash and natural fuels units will also adversely affect recreational values. These activities will be mitigated through signing and timing restrictions for scheduled operations. The overall effect will be short term (approximately 1-3 months in duration).

A visual quality analysis was conducted by Laura Blecker (Forest Landscape Architect), for action alternatives and is located in Appendix L. The analysis shows that there will be no adverse effect to the overall visual quality of the area, generally due to the design of silvicultural prescriptions for Bunker Hill (Appendix I - Silvicultural Prescription) that meet Forest Plan Standard and Guidelines for visual quality objectives (Appendix L).

There will be no adverse visual effects to the North Umpqua Trail from harvest operations. This is due to a required 200 foot no harvest buffer on either side of the trail.

INDIRECT EFFECTS

Without treatment, stands 2, 3, 7, 9, 14-24, 26, 27, 30, 32-34, 36, 37, 40, 41, 68 and the south portion of unit 25 below the 60 road (total of 674 acres) will continue to experience an increase of down and standing fuels, due to competition mortality and insect and disease activity. These stands already have artificial high fuel loadings due to fire suppression. High fuel loadings will increase the potential of large scale, high intensity fire (Fire Management Report - Appendix E) around a highly used recreation area. Large scale, high intensity fire would adversely affect visual quality, the recreation experience of the area, and public safety.

Silvicultural and fuel treatments will reduce present and future fire hazard over 271 acres within stands with high recreation value. This will help reduce the risk of large scale, high intensity fire and its potential significant adverse affect on visual quality, recreational experience, and public safety.

CUMULATIVE EFFECTS

Other projects will occur within the boundary of this analysis area and may contribute to effects on recreation. They are as follows: Lemolo Fire Hazard Reduction, Electric Salvage, and Gigawat and Bearpaw Timber Sales. Recreational values will be adversely affected by logging traffic, smoke, and noise associated with these planned projects in conjunction with proposed activities in Alternative 4. However, these projects will help reduce the risk of large scale, high intensity fire and its potential significant adverse effect on visual quality, recreational experience, and public safety.

These activities will be mitigated through signing and timing restrictions for scheduled operations. The overall effect will be short term (approximately 1-3 months in duration).

3.3.8 ALTERNATIVE 5

DIRECT EFFECTS

This alternative will harvest 599 acres in stands 1, 3, 4, 7, 16, 17, 33, 35, 38-41 & 68 within the Bunker Hill, Pit Lakes, Kelsay Valley Trail Head, Lake Charlene, Connie Lake, Kelsay Point, Spring River and Thielsen Creek areas identified as high recreational value through public comment. The recreation experience for forest visitors will be adversely affected by the noise and traffic that will occur during logging operations. Smoke from burning harvest slash and natural fuels units will also adversely affect recreational values. These activities will be mitigated through signing and timing restrictions for scheduled operations. The overall effect will be short term (approximately 1-3 months in duration).

A visual quality analysis was conducted by Laura Blecker (Forest Landscape Architect), for action alternatives and is located in Appendix L. The analysis shows that there will be no adverse effect to the overall visual quality of the area, generally due to the design of silvicultural prescriptions for Bunker Hill (Appendix L - Silvicultural Prescription) that meet Forest Plan Standard and Guidelines for visual quality objectives (Appendix L).

There will be no adverse visual effects to the North Umpqua Trail from harvest operations. This is due to a required 200 foot no harvest buffer on either side of the trail.

INDIRECT EFFECTS

Without treatment, stands 2, 5, 9, 14, 15, 18-24, 26, 27, 30, 32, 34, 36, 37, 48, 53-56, and the south portion of unit 25 below the 60 road (total of 346 acres) will continue to experience an increase of down and standing fuels, due to competition mortality and insect and disease activity. These stands already have artificial high fuel loadings due to fire suppression. High fuel loadings will increase the potential of large scale, high intensity fire (Fire Management Report - Appendix E) around a highly used recreation area. Large scale, high intensity fire would adversely affect visual quality, the recreation experience of the area, and public safety.

Silvicultural and fuel treatments will reduce present and future fire hazard over 599 acres within stands with high recreation value. This will help reduce the risk of large scale, high intensity fire and its potential significant adverse affect on visual quality, recreational experience, and public safety.

CUMULATIVE EFFECTS

Other projects will occur within the boundary of this analysis area and may contribute to effects on recreation. They are as follows: Lemolo Fire Hazard Reduction, Electric Salvage, and Gigawat and Bearpaw Timber Sales. Recreational values will be adversely affected by logging traffic, smoke, and noise associated with these planned projects in conjunction with proposed activities in Alternative 5. However, these projects will help reduce the risk of large scale, high intensity fire and its potential significant adverse effect on visual quality, recreational experience, and public safety.

These activities would be mitigated through signing and timing restrictions for scheduled operations. The overall effect would be short term (approximately 1-3 months in duration).

3.4 FUELS AND FIRE MANAGEMENT

3.4.2 AFFECTED ENVIRONMENT

The affected environment are those areas where harvest, road construction, road decommission and prescribed fire activities are proposed, the stands adjacent to the proposed activities, and the Lemolo Analysis Area.

Current fuel loading in the 0 to 8 inch size class in the proposed harvest units range from 5 to 20 tons per acre and in the proposed prescribed fire units 8 to 22 tons per acre.

Umpqua National Forest Hazard Reduction Standards recommends treating activity created slash to reduce fuel amounts to a level between 12 and 21 tons an acre in the 0 to 8 inch size class. It must be emphasized here that only the fine and medium (0 to 8 inch diameter) fuel size classes are addressed in the hazard reduction standard. The large material is usually not a concern from the perspective of fire risk or rate of spread and is not considered in the fire behavior fuel models. For this reason, large material is not addressed in this standard.

Fuel Models are a classification of fuel partially described by the fuel quantity and ratio of surface area to volume for each size class and the depth of the fuel bed. The National Forest Fire Lab has developed fuel models for modeling fire behavior these are called fire behavior fuel models or National Forest Fire Lab (NFFL) fuel models. All fuel models have been expressed as NFFL fuel models in this document.

Resistance to control, fire residence time or duration of intensity, and fire crowning potential are not modeled by the NFFL fuel models; however, some fuel models do have a greater resistance to control and show greater duration of intensity. Efforts are underway to develop a crown fire potential model but at the time this analysis was begun that modeling technique was not available.

Fuel models 8 and 10 (light and heavy timber litter respectively) represent the present condition in the proposed harvest and prescribed fire units. Fuel model 8 has a predicted flame length that would allow for effective suppression using ground crews under most weather conditions. Fuel model 10 has a predicted flame length and resistance to control that is above the effective limit for suppression using ground crews (Picture 5).

The reference time period (pre-1900's) showed that over 75% of the watershed was in fuel model 8 and 15% of the watershed was in fuel model 10. Currently that condition is reversed with approximately 5% of the watershed in fuel model 8 and over 70% of the watershed in fuel model 10 (Diamond Lake / Lemolo Lake Watershed Analysis, Chapter Four, page 137, Figure 2 - Fuel Model Distribution).

Picture 5 – Fuel Model 10 within a mature mixed conifer stand

A fire history survey conducted during the Lemolo and Diamond Lake Watershed Analysis determined that this analysis area currently has a fire regime that most resembles a high-severity fire regime. Much of the affected environment in the planning area had a moderate-severity fire regime until the early 1900's (Diamond Lake/Lemolo Lake Watershed Analysis, Chapter Four, Fire Disturbance, pages 131-141). A moderate-severity fire regime is characterized by infrequent fires (25 to 100 years) and significant areas of high and low severity resulting in partial stand replacement. Fires typically burns weeks to months, and periods of intense behavior are mixed with periods of moderate to low intensity fire behavior. Moderate-severity natural fire regimes produce patchy stands of various sizes mixed with patches of multi-sized stands, (Agee 1990). A high-severity fire regime is characterized by infrequent fires of usually high intensity.

One interesting note is through the fire history study it was discovered that a large portion of the watershed burned in at least three major fire events between 1880 and 1910.

The absence of fire due to fire suppression efforts since the early 1900's, white pine blister rust, and the mountain pine beetle have contributed to the decline in health and vigor of mature and old growth ponderosa pine and sugar pine within the Lemolo planning area. Lack of fire has led to overstocked stand conditions, under story development of shade tolerant species, and mature

lodge pole pine stands greater than 80 years of age that are highly susceptible to a mountain pine beetle outbreak, and an increased risk of large scale, high intensity fire.

3.4.3 ENVIRONMENTAL EFFECTS

The analysis of fire hazard revolves around the stands prescribed for harvest or natural fuels treatment as recommended by the Diamond Lake / Lemolo Lake Watershed Analysis.

Analyses of reference conditions (pre 1900's) involved examination of the fire return interval left as fire scars in tree rings, stand ages and composition, vegetation patterns from older aerial photographs, photos taken in the 1930's from lookouts with a view of the watershed, and anecdotal information from early travelers through the area. The watershed analysis determined that the reference condition for most of the affected areas in the planning area is a mixed-severity fire regime as described by Agee (Agee, 1993). The proposed units north and east of Bunker Hill are in an area of high-severity fire regime.

The current fire regime was also determined during the watershed analysis. The watershed analysis used fire occurrence data, recent fire effects, current fuel models, and current air quality. Data was gathered from the Umpqua National Forest Fire Atlas for fires occurring between 1932 through 1963, fire size was recorded by size class, and cause was recorded as human or lightning. Fire data was retrieved from the National Fire Occurrence Data Library for fires occurring between 1970 and 1996. The current fuel model map on GIS (Geographic Information System) was also used. The fuel model map was developed from PMR data (Pacific Meridian) and UPAD data (Umpqua National Forest Project Activity Database). PMR is based on photo interpretation of the Anderson Land Use / Cover classification scheme, and UPAD is based on current information of managed stands. (Diamond Lake / Lemolo Lake Watershed Analysis, Chapter Four Analysis Procedures, Assumptions, Data Gaps, Page 132, paragraph three)

The current fire regime most resembles a high-severity fire regime.

Two scientific publications were used to validate the effects of silvicultural and fuel treatments on wildfire hazard. They were "The Effects of Thinning and Similar Stand Treatments on Fire Behavior in Western Forests", authored by Graham, Harvey, Jain, and Tonn, and published in September 1999 in General Technical Report PNW-GTR-463; and "The Effect of Fuels Treatment on Wildfire Severity", authored by Omni and Martinson, and published in March 2002 out of the Western Forest Fire Research Center, Colorado State University. Conclusions from these two publications that were utilized in determining effects related to fire hazard include:

"Successful fire exclusion over the past 60 to 70 years has contributed to greater stand densities and an increase in crown fire potential in many forests of the West (Mutch 1994)".

"In addition, forests have changed from fire-adapted species to species more susceptible to fire that tend to form unhealthy stands prone to large-scale wildfires, as well as increased outbreaks of insects and diseases (McCool and others 1997)".

"Crown bulk density, surface fuel, and crown base height are primary stand characteristics that determine crown fire potential".

"Thinning from below, free thinning, and reserve shelterwoods have the greatest opportunity for reducing the risk of crown fire behavior." Thinning from below and shelterwoods are prescribed for many stands in all action alternatives.

"Thinnings in general will lower crown bulk densities and redistribute fuel loads significantly, thus decreasing fire intensities, if the surface fuels are treated (Agee 1993, Alexander 1988, Alexander and Yancik 1977)."

"Fire intensity in thinned stands is greatly reduced if thinning is accompanied by reducing the surface fuels created by the cuttings."

"Depending on intensity, thinning from below and possibly free thinning can most effectively alter fire behavior by reducing crown bulk density, increasing crown base height, and changing species composition to lighter crowned and fire-adapted species. Such intermediate treatments can reduce the severity and intensity of wildfires for a given set of physical and weather variables."

"The best success in modifying fire behavior through the use of thinnings throughout the West is when applied in conjunction with prescribed fire." Both thinning from below combined with prescribed fire are used throughout the action alternatives.

Results from research (Omi 2002) provide strong evidence of fuel treatment efficacy or capacity to achieve the desired reduction in fire intensity.

Crown fire hazard (height to crown, crown bulk density, stand density, and basal area), fire resistance (height and diameter), and fire severity (scorch height, crown volume scorch, stand damage, and depth of ground char) were compared between treated and untreated areas in a recent study conducted at the Western Forest Fire Research Center at Colorado State University. Their results unanimously indicate that thinned stands experience lower fire severity than unthinned stands that burn under similar weather and topographic conditions.

The number of acres treated to reduce fire hazard on Bunker Hill and within the entire Lemolo planning area were generated for each alternative and serve as evaluation criteria to compare alternatives. Fire hazard is considered effectively reduced when fuel treatment following harvest reduced fuel levels to less than 21 tons per acre and when prescribed burning results in fuel model 8 over at least 80 percent of the area. Fire rate of spread and flame length were also used as evaluation criteria for fire hazard on Bunker Hill.

3.4.4 ALTERNATIVE 1 (NO ACTION)

DIRECT EFFECTS

Fuels and fire hazard will increase within stands targeted for silvicultural and fuel treatments in Alternative 2 on Bunker Hill and within the Lemolo Watershed. Increases will be attributed to competition mortality, increased mortality from insects and disease due to overstocked conditions, and crown development.

The no action alternative will not help reduce fuel levels to less than 21 tons / acre. Ladder fuels will continue to increase without management designed to reduce crown layering through silvicultural and fuel treatments. Crown bulk densities and surface fuels will continue to increase, while low crown base heights will be maintained. High levels and continuous large areas of fuel model 10 or 'heavy' fuels will be maintained at the watershed scale.

The no action alternative would not decommission or close roads. Detection and access to fire starts would remain the same. Most of the roads that are proposed for decommissioning are not drivable now due to small trees and logs in the road; however, they could be utilized for foot travel by firefighters, and some could be easily opened for vehicle travel.

INDIRECT EFFECTS

A wildland fire occurring under high fire danger fire weather conditions (90th percentile) on Bunker Hill would lurch along; moving quickly at 6 to 9 feet per minute through most of the area hitting locals of slower spreading conditions of a little over 2 feet per minute. A weighted average of the rate of spread for Bunker Hill is 8.1 feet per minute. Rate of spread does not consider spreading by short or long range spotting or by material rolling down a slope and igniting spots. Rate of spread as compared to size of fire on arrival and rate of fire line construction are used to predict fire size over time and difficulty for containment.

Similarly, flame lengths are predicted of over 5 feet through most of the Bunker Hill area with locals of less fuel predicting slightly over 1 foot flame length. A weighted average of the area is 4.9 feet. Flame lengths are a visual indicator of fire intensity, of BTU's (British Thermal Units- a measure of heat energy) being released by the flaming edge of a fire, and of crowning potential. Suppression by hand crews of fires exhibiting flame lengths of over 4 feet along the flaming front will be unsuccessful without water, dozers and/or aircraft. Crown base heights lower than 10 feet are susceptible to group torching possibly crown fire development. Other ladder fuels in the form of dead tree branches, dead tree boles, and under story trees are present and susceptible to tree torching and possible crown fire development.

Fire behavior predictions using Behave Plus indicate that fires burning under these conditions will have predicted mortality of 9 to 40 percent of the over story on Bunker Hill with a weighted average of 15 percent. Under story mortality has a predicted weighted average of 80 percent. This type of fire will adversely affect the visual quality, the recreation experience of the area, and public safety on and around Bunker Hill.

Currently ponderosa pine will generally not regenerate due to overstocked stand conditions; therefore younger cohorts will not replace the declining mature and old growth ponderosa pine

in the long term. Ponderosa pine is a fire tolerant species and can withstand periodic fire events, creating a more sustainable stand condition in the future. The lack of pine regeneration in these stands and continued encroachment of Douglas-fir and white fir in the under story will add to the risk of high intensity fire.

CUMULATIVE EFFECTS

There will be no change in the fire regime; the current high-severity fire regime will be maintained.

Other projects have occurred in the past or will occur in the foreseeable future that will reduce fuel and fire hazard within the boundary of this planning area. They are Lemolo Fire Hazard Reduction (1432) (Picture 6), Gigawat Timber Sale, and Bear Paw Timber Sale. Silvicultural treatments followed by fuels treatment will reduce resulting slash to meet Umpqua National Forest Hazard Reduction Standards and hazard reduction treatments will reduce threat of fire to Lemolo Resort. Both types of projects total approximately 1437 acres, moving parts of the watershed towards their historical moderate-severity fire regime.

Picture 6 – Lemolo Fire Hazard Reduction Project – hand piles along main road

Projects have occurred in the past or will occur in the foreseeable future that have added fuel and increased fire hazard within the boundary of this planning area. These projects are pre-commercial thinning, power line right-of-way clearing, roadside brushing and hazard tree felling.

The number of acres to be pre-commercial thinned is dependent on funding and could range from zero to 600 acres. Pre-commercial thinning will increase the fuel levels in the watershed and will not meet forest hazard reduction standards but will improve health and vigor of the

stand over the long term. Competition mortality will decrease over the next 50 years after pre-commercial thinning, therefore reducing fuel buildup of 4-8" diameter material within managed stands.

3.4.5 ALTERNATIVE 2

DIRECT EFFECTS

This alternative will treat a total of 1861 acres; 1579 acres through timber harvest and subsequent slash treatment and 282 acres through prescribed fire treatments. Harvest will create slash thus increase the fire hazard, this activity created slash will be treated within 6 months to two years after harvest. The fuel profile after fuel treatments will be reduced to 12-21 tons per acre of 0-8" material. The majority of the treated area will be converted to a fuel model 8, with some fuel model 5 and/or fuel model 11. Crown bulk densities and surface fuels will decrease, while crown base heights will dramatically increase. Ladder fuels will be significantly reduced through silvicultural and fuel treatments, (Picture 7).

Picture 7 – Typical thinning from below that reduces ladder fuel

INDIRECT EFFECTS

A wildland fire occurring under high fire danger fire weather conditions (90th percentile) on Bunker Hill would lurch along; moving slowly at less than a foot per minute to 2 feet per minute through most of the area hitting locals of faster spreading conditions of a little over 5 feet per minute. A weighted average of the rate of spread for Bunker Hill following treatment in this alternative is 2.2 feet per minute. Rate of spread does not consider spreading by short or long range spotting or by material rolling down a slope and igniting spots. Rate of spread as compared to size of fire on arrival and rate of fire line construction are used to predict fire size over time and difficulty of containment.

Flame lengths are predicted to be less than 2 feet through most of the Bunker Hill area, except for locals where greater flame lengths may be expected. Flame lengths are a visual indicator of fire intensity, of BTU's being released by the flaming edge of a fire, and of crowning potential. Suppression by hand crews of fires exhibiting these predicted flame lengths can be successful under all but the most extreme conditions. Individual tree torching may be expected however; due to the high crown base height crown fire development is unlikely. Overall tree mortality under the conditions described above is predicted at 10 percent (Behave Plus).

A buffer of reduced fire hazard will be created along roads 2612 and 60 through silvicultural treatments and prescribed burning. This is north of the Lemolo area, north of the Kelsay Valley area, and west of the Bradley Creek drainage. This reduced fire hazard area improves the likelihood of preventing large fires from spreading west out of the OCRA, east into the OCRA, south into the Lemolo Lake Recreation Composite, or north out of the Lemolo Lake Recreation Composite. Kelsay Valley trailhead and campground will have the fire hazard on the north side of the campground reduced, improving public safety in this area.

Ten and six tenths miles of road decommissioning may have an indirect adverse effect as it relates to detection, access, and response time to wildland fires in the analysis area. Decommissioning roads may increase detection time, increase fire suppression response time, and decrease logistical support ability. Most of the roads that are proposed for decommissioning are not drivable now due to small trees and logs or rocks and berms in the road, however they can be used as walkways for firefighters and some can be easily opened for vehicle access.

Ponderosa pine will be established through planting and natural regeneration within units 2, 3, 5-9, 12-15, 24-26, 32, and 33. These established younger cohorts will replace the mature and old growth ponderosa pine in the long term. Ponderosa pine is a fire tolerant species and can withstand periodic low and moderate severity fire events, creating a more sustainable and resilient stand condition in the future.

CUMULATIVE EFFECTS

silvicultural treatments and prescribed fire treatments will move the Lemolo Watershed towards the historical moderate-severity fire regime on Bunker Hill and decrease the risk of a large, high severity fire on Bunker Hill and within the watershed.

Other projects have also occurred in the past or will occur in the foreseeable future that will reduce fuel and fire hazard within the boundary of this planning area. They are Lemolo Fire Hazard Reduction (935 acres), Gigawat Timber Sale, and Bear Paw Timber Sale. In combination with the actions proposed in this alternative silvicultural treatments followed by fuels treatment will reduce resulting slash to meet Umpqua National Forest Hazard Reduction Standards, prescribe burning treatments in this alternative and hazard reduction treatments will reduce threat of fire to Lemolo Resort. All three types of projects total approximately 2816 acres, moving parts of the watershed towards the historical moderate-severity fire regime.

Projects have occurred in the past or will occur in the foreseeable future that have added fuel and increased fire hazard within the boundary of this planning area. These projects are pre-commercial thinning, power line right-of-way clearing, roadside brushing and hazard tree felling.

The number of acres pre-commercial thinned is dependent on funding and could range from zero to 600 acres. Pre-commercial thinning will increase the fuel levels in the watershed and will not meet forest hazard reduction standards but will improve health and vigor of the stand over the long term. Competition mortality will decrease over the next 50 years after pre-commercial thinning, therefore reducing potential fuel buildup of 4-8"diameter material within managed stands.

3.4.6 ALTERNATIVE 3

DIRECT EFFECTS

This alternative will treat a total of 939 acres; 636 acres through timber harvest and subsequent slash treatment, and 303 acres prescribed fire treatment, silvicultural treatments exclude stands identified as having high recreational value. Harvest will create slash thus increase the fire hazard, this activity created slash will be treated within 6 months to two years after harvest. The fuel profile after fuel treatments will be reduced to 12-21 tons per acre of 0-8" material. The majority of the treated area will be converted to a fuel model 8, with some fuel model 5 and/or fuel model 11. Crown bulk densities and surface fuels will decrease, while crown base heights will increase. Ladder fuels will be significantly reduced through silvicultural and fuel treatments.

No silvicultural or fuel treatments will occur within stands identified as having high recreational value, including Bunker Hill. Fuels and fire hazard will continue to increase (over time) within stands not targeted for silvicultural and fuel treatments on Bunker Hill. Increases will be attributed to competition mortality, increased mortality from insects and disease due to overstocked conditions, and crown development.

INDIRECT EFFECTS

A wildland fire occurring under high fire danger fire weather conditions (the 90th percentile) on Bunker Hill would lurch along; moving quickly at 6 to 8 feet per minute through most of the area hitting locals of slower spreading conditions of a little over 2 feet per minute. A weighted average of the rate of spread for Bunker Hill is 8.1 feet per minute. Rate of spread does not consider spreading by short or long range spotting or by material rolling down a slope and igniting spots. Rate of spread as compared to size of fire on arrival and rate of fire line construction are used to predict fire size over time.

Similarly, flame lengths are predicted of over 4 and over 5 feet through most of the Bunker Hill area with locals of less fuel predicting slightly over 1 foot flame length. A weighted average of the area is 4.9 feet. Flame lengths are a visual indicator of fire intensity, of BTU's (British Thermal Units- a measure of heat energy) being released by the flaming edge of a fire, and of crowning potential. Suppression by hand crews of fires exhibiting flame lengths of over 4 feet along the flaming front will be unsuccessful without water, dozers and/or aircraft. Crown base heights lower than 10 feet are susceptible to group torching possibly crown fire development. Other ladder fuels in the form of dead tree branches, dead tree boles, and under story trees are present and susceptible to tree torching and possible crown fire development.

Fire behavior predictions using Behave Plus indicate that fires burning under these conditions will have predicted mortality of 9 to 40 percent of the over story on Bunker Hill with a weighted average of 15 percent. Under story mortality has a predicted weighted average of 80 percent. This type of fire will adversely affect the visual quality, the recreation experience of the area, and public safety on and around Bunker Hill.

Ponderosa pine will generally not regenerate due to overstocked stand conditions; therefore younger cohorts will not replace the declining mature and old growth Ponderosa pine in the long term on Bunker Hill. The lack of pine regeneration in these stands and continued encroachment of Douglas-fir and white fir in the under story will add to the risk of high intensity fire on Bunker Hill.

A buffer of reduced fire hazard will be created along roads 2612 and 60 through prescribed natural fuels burning. This is north of the Lemolo area, north of the Kelsay Valley area, and west of the Bradley Creek drainage. This reduced fire hazard area improves the likelihood of preventing large fires from spreading west out of the OCRA, east into the OCRA, south into the Lemolo Lake Recreation Composite, or north out of the Lemolo Lake Recreation Composite. Kelsay Valley trailhead and campground will have the fire hazard on the north side of the campground reduced, improving public safety in this area.

Eleven and two tenths miles of road decommissioning may have an indirect adverse effect as it relates to detection, access, and response time to wildland fires in the analysis area. Decommissioning roads may increase detection time, increase fire suppression response time, and decrease logistical support ability. Most of the roads that are proposed for decommissioning are not drivable now due to small trees and logs or rocks and berms in the road, however they can be used as walkways for firefighters and some can be easily opened for vehicle access.

CUMULATIVE EFFECTS

Silvicultural treatments and prescribed fire treatments will move the Lemolo Watershed towards the historical moderate-severity fire regime and decrease the risk of a large fire within the watershed, except for Bunker Hill.

Other projects have also occurred in the past or will occur in the foreseeable future that will reduce fuel and fire hazard within the boundary of this planning area. They are Lemolo Fire Hazard Reduction (1432 acres), Gigawat Timber Sale, and Bear Paw Timber Sale. In combination with the actions proposed in this alternative silvicultural treatments followed by fuels treatment will reduce resulting slash to meet Umpqua National Forest Hazard Reduction Standards, prescribe burning treatments in this alternative and hazard reduction treatments will reduce threat of fire to Lemolo Resort. All three types of projects total approximately 2393 acres, moving parts of the watershed towards the historical moderate-severity fire regime.

Projects have occurred in the past or will occur in the foreseeable future that have added fuel and increased fire hazard within the boundary of this planning area. These projects are pre-commercial thinning, power line right-of-way clearing, roadside brushing and hazard tree felling

The number of acres pre-commercial thinned is dependent on funding and could range from zero to 600 acres. Pre-commercial thinning will increase the fuel levels in the watershed and will not meet forest hazard reduction standards but will improve health and vigor of the stand over the long term. Competition mortality will decrease over the next 50 years after pre-commercial thinning, therefore reducing potential fuel buildup of 4-8"diameter material within managed stands.

3.4.7 ALTERNATIVE 4

DIRECT EFFECTS

This alternative will treat a total of 1208 acres; 905 acres through timber harvest and subsequent slash treatment, and 303 acres of prescribed fire treatment, silvicultural treatments exclude stands identified as having old growth habitat. Harvest will create slash thus increase the fire hazard, this activity created slash will be treated within 6 months to two years after harvest. The fuel profile after fuel treatments will be reduced to 12-21 tons per acre of 0-8" material. The majority of the treated area will be converted to a fuel model 8, with some fuel model 5 and/or fuel model 11. Crown bulk densities and surface fuels will decrease, while crown base heights will increase. Ladder fuels will be significantly reduced through silvicultural and fuel treatments, including 102 acres on Bunker Hill

Approximately 386 acres will not receive harvest or fuel treatments on Bunker Hill. Fuels and fire hazard will continue to increase (over time) within stands not targeted for silvicultural and fuel treatments on Bunker Hill. Increases will be attributed to competition mortality, increased mortality from insects and disease due to overstocked conditions, and crown development.

INDIRECT EFFECTS

A wildland fire occurring under high fire danger fire weather conditions (the 90th percentile) on Bunker Hill would lurch along; moving quickly at 6 to 9 feet per minute in areas and dropping to about a foot a minute in other areas. A weighted average of the rate of spread for Bunker Hill is 6.7 feet per minute. Rate of spread does not consider spreading by short or long range spotting or by material rolling down a slope and igniting spots. Rate of spread as compared to size of fire on arrival and rate of fire line construction are used to predict fire size over time.

Similarly, flame lengths are predicted to vary from 1 to 5 feet in the Bunker Hill area with a weighted average in the area is 4.0 feet. Flame lengths are a visual indicator of fire intensity, of BTU's being released by the flaming edge of a fire, and of crowning potential. Suppression by hand crews of fires exhibiting flame lengths of 4 feet along the flaming front may be successful or may require the use of heavy equipment such as Dozers. Crown base heights lower than 8 feet are susceptible to small group torching, other ladder fuels in the form of dead tree branches, dead tree boles, and under story trees are present and are susceptible to groups of trees torching and possible crown fire development is possible in some locals on Bunker Hill.

Fire behavior predictions using BehavePlus indicate that fires burning under these conditions will have predicted mortality of 7 to 15 percent of the over story on Bunker Hill with a weighted average of 10 percent. This type of fire may adversely affect the visual quality, the recreation experience of the area, and public safety on and around Bunker Hill.

A buffer of reduced fire hazard will be created along roads 2612 and 60, through prescribed burning. This is north of the Lemolo area, north of the Kelsay Valley area, and west of the Bradley Creek drainage. This reduced fire hazard area improves the likelihood of preventing large fires from spreading west out of the OCRA, east into the OCRA, south into the Lemolo Lake Recreation Composite, or north out of the Lemolo Lake Recreation Composite. Kelsay Valley trailhead and campground will have the fire hazard on the north side of the campground reduced, improving public safety in this area.

Eleven and two tenths miles of road decommissioning may have an indirect adverse effect as it relates to detection, access, and response time to wildland fires in the analysis area. Decommissioning roads may increase detection time, increase fire suppression response time, and decrease logistical support ability. Most of the roads that are proposed for decommissioning are not drivable now due to small trees and logs or berms and rocks in the road, however they can be used as walkways for firefighters and some can be easily opened for vehicle access.

Ponderosa pine will be established through planting and natural regeneration within units 6, 12, 13, and 25. These established younger cohorts will replace the mature and old growth ponderosa pine in the long term. Ponderosa pine is a fire tolerant species and can withstand periodic fire events of low and moderate fire intensity, creating a more sustainable and resilient stand condition in the future.

CUMULATIVE EFFECTS

silvicultural treatments and prescribed fire treatments will move the Lemolo Watershed towards the historical moderate-severity fire regime which includes the treatment of 102 acres on Bunker Hill. This alternative will decrease the risk of a large fire within the watershed, including Bunker Hill.

Other projects have also occurred in the past or will occur in the foreseeable future that will reduce fuel and fire hazard within the boundary of this planning area. They are Lemolo Fire Hazard Reduction (1330 acres), Gigawat Timber Sale, and Bear Paw Timber Sale. In combination with the actions proposed in this alternative silvicultural treatments followed by fuels treatment will reduce resulting slash to meet Umpqua National Forest Hazard Reduction Standards, prescribe burning treatments in this alternative and hazard reduction treatments will reduce threat of fire to Lemolo Resort. All three types of projects total approximately 2558 acres, moving parts of the watershed towards the historical moderate-severity fire regime.

Projects have occurred in the past or will occur in the foreseeable future that have added fuel and increased fire hazard within the boundary of this planning area. These projects are pre-commercial thinning, power line right-of-way clearing, roadside brushing and hazard tree felling.

The number of acres pre-commercial thinned is dependent on funding and could range from zero to 600 acres. Pre-commercial thinning will increase the fuel levels in the watershed and will not meet forest hazard reduction standards but will improve health and vigor of the stand over the long term. Competition mortality will decrease over the next 50 years after pre-commercial thinning, therefore reducing potential fuel buildup of 4-8”diameter material within managed stands.

3.4.8 ALTERNATIVE 5

DIRECT EFFECTS

This alternative will treat a total of 1536 acres; 1233 acres through timber harvest and subsequent slash treatment, and 303 acres prescribed fire treatment, silvicultural treatments exclude stands identified as having high recreational value. Harvest will create slash thus increase the fire hazard, this activity created slash will be treated within 6 months to two years after harvest. The fuel profile after fuel treatments will be reduced to 12-21 tons per acre of 0-8" material. The majority of the treated area will be converted to a fuel model 8, with some fuel model 5 and/or fuel model 11. Crown bulk densities and surface fuels will decrease, while crown base heights will increase. Ladder fuels will be significantly reduced through silvicultural and fuel treatments, including 384 acres on Bunker Hill.

Approximately 89 acres will not receive harvest or fuel treatments on Bunker Hill. Fuels and fire hazard will continue to increase (over time) within stands not targeted for silvicultural and fuel treatments on Bunker Hill. Increases will be attributed to competition mortality, increased mortality from insects and disease due to overstocked conditions, and crown development.

INDIRECT EFFECTS

A wildland fire occurring under high fire danger fire weather conditions (the 90th percentile) on Bunker Hill would lurch along; moving 7 to 8 feet per minute in some areas and a little over 2 feet per minute in other areas. A weighted average of the rate of spread for Bunker Hill following treatment in alternative 5 is 2½ feet per minute. Rate of spread does not consider spreading by short or long range spotting or by material rolling down a slope and igniting spots. Rate of spread as compared to size of fire on arrival and rate of fire line construction are used to predict fire size over time.

Predicted flame lengths vary from 1 to almost 5 feet, the weighted average flame length for the Bunker Hill area is 2.1. Flame lengths are a visual indicator of fire intensity, of BTU's being released by the flaming edge of a fire, and are of crowning potential. Suppression by hand crews of fires exhibiting these predicted flame lengths can be successful. Individual tree torching may be expected, due to the high crown base height crown fire development is unlikely except for locals.

Fire behavior predictions using BehavePlus indicate overall tree mortality under the conditions described above averages 10 percent.

A buffer of reduced fire hazard will be created along roads 2612 and 60, through silvicultural treatments and prescribed burning. This is north of the Lemolo area, north of the Kelsay Valley area, and west of the Bradley Creek drainage. This reduced fire hazard area improves the likelihood of preventing large fires from spreading west out of the OCRA, east into the OCRA, south into the Lemolo Lake Recreation Composite, or north out of the Lemolo Lake Recreation Composite. Kelsay Valley trailhead and campground will have the fire hazard on the north side of the campground reduced, improving public safety in this area.

Eleven and two tenths miles of road decommissioning may have an indirect adverse effect as it relates to detection, access, and response time to wildland fires in the analysis area. Decommissioning roads may increase detection time, increase fire suppression response time, and decrease logistical support ability. Most of the roads that are proposed for decommissioning are not drivable now due to small trees and logs or rocks and berms in the road, however they can be used as walkways for firefighters and some can be easily opened for vehicle access.

Ponderosa pine will be established through planting and natural regeneration within units 3, 6, 7, 12, 13, 25, and 33. These established younger cohorts will replace the mature and old growth ponderosa pine in the long term. Ponderosa pine is a fire tolerant species and can withstand periodic fire events, creating a more sustainable and resilient stand condition in the future.

CUMULATIVE EFFECTS

Silvicultural treatments and prescribed fire treatments will move the Lemolo Watershed towards the historical moderate-severity fire regime and decrease the risk of a large, high severity fire on Bunker Hill and within the watershed.

Other projects have also occurred in the past or will occur in the foreseeable future that will reduce fuel and fire hazard within the boundary of this planning area. They are Lemolo Fire Hazard Reduction (1033 acres), Gigawat Timber Sale, and Bear Paw Timber Sale. In combination with the actions proposed in this alternative silvicultural treatments followed by fuels treatment will reduce resulting slash to meet Umpqua National Forest Hazard Reduction Standards, prescribe burning treatments in this alternative and hazard reduction treatments will reduce threat of fire to Lemolo Resort. All three types of projects total approximately 2589 acres, moving parts of the watershed towards the historical moderate-severity fire regime.

Projects have occurred in the past or will occur in the foreseeable future that have added fuel and increased fire hazard within the boundary of this planning area. These projects are pre-commercial thinning, power line right-of-way clearing, roadside brushing and hazard tree felling.

The number of acres pre-commercial thinned is dependent on funding and could range from zero to 600 acres. Pre-commercial thinning will increase the fuel levels in the watershed and will not meet forest hazard reduction standards but will improve health and vigor of the stand over the long term. Competition mortality will decrease over the next 50 years after pre-commercial thinning, therefore reducing potential fuel buildup of 4-8”diameter material within managed stands.

3.5 AIR QUALITY

3.5.2 AFFECTED ENVIRONMENT

The affected environment for the air resource includes Roseburg (closest designated area) which is approximately 70 miles to the west and the following Class I air-sheds: Diamond Peak Wilderness, 9 miles to the northeast; Crater Lake National Park, 10 miles to the southeast.

Air is the mixture of usually invisible, odorless and tasteless gases that comprise the atmosphere surrounding the earth. A variety of natural conditions including sunlight, jet streams, oceans and vegetation influence the atmosphere. Most of the air that passes over the analysis area derives from the Pacific Ocean, crosses the Coast Range, over the Umpqua and southern Willamette Valleys, and finally passes over the Cascade Range. Ocean winds generally push air over the forest, but there are occasions when east winds flow over the Cascade Range and into the western Oregon valleys.

Current Air Quality conditions were analyzed during the Lemolo and Diamond Lake Watershed Analysis. Presently fire management activities influencing air quality include suppression of wildfires and ignition of prescribed fire. Wildfires are managed with an appropriate suppression response and are usually controlled and extinguished within 24 hours. The result of this is negligible concerning visual air quality, with respiratory air quality being only a concern to the firefighter engaged in suppression activities. Prescribed fire activities have included underburning and pile burning of activity created fuels (Diamond Lake / Lemolo Lake Watershed Analysis, Chapter Four, Air Quality, pages 135).

Although the Forest Service does not monitor air resources, it does provide smoke management information to the state of Oregon that assists the state in monitoring air resources. Smoke management information is gathered for each planned prescribed burn.

An in depth discussion of air quality, smoke management, and smoke emissions as it relates to the proposed project and alternatives is located in the Fire and Fuels Analysis Report in Appendix E.

3.5.3 ENVIRONMENTAL EFFECTS

The Forest Service will comply to all aspects of the Clean Air Act by working in conjunction with the Oregon Department of Forestry to follow the Oregon Smoke Management Plan. A "permit" will be acquired by providing a unit description and planning all burning with the Oregon Department of Forestry.

Under burns will be conducted when large fuel and duff moistures are high thus reducing emissions. Pile burning will generally be accomplished during the October to November period. Burning in the fall will generally be accomplished during or after frontal systems that provide favorable smoke dispersal when mixing is good.

Burning during spring and fall will have less impact on developed campsites such as the campgrounds in the Lemolo Composite. Dispersed and undeveloped campsites will receive little impact because they are primarily used during summer months and elk hunting season. Timing of pile burning will be closely monitored to minimize detrimental effect on dispersed camps during elk hunting season.

3.5.4 ALTERNATIVE 1 (NO ACTION)

DIRECT EFFECTS

The no action alternative will have no immediate or active effect on air quality. Wildfires will continue to produce smoke.

INDIRECT EFFECTS

Intrusions on air quality will be greater and last longer if a wildland fire occurred than if a prescribed fire occurred in the same area. In the short term, prescribed fire emissions will increase; however, over the long term as areas are treated wildland fire emissions will decrease. (Snell 2002)

Properly executed prescribed burning is expected to produce fewer total emissions than wildland fire. The reasons for this include: (1) prescribed fires typically burn fewer acres than wildfires, (2) prescribed fires are managed under weather conditions that present a small risk of crowning, (3) prescribed fires are ignited under conditions of higher fuel moisture, which reduces the consumption of large woody material and duff. (A Desk Reference for NEPA Air Quality Analysis, chapter 3.1)

As an example, proposed unit 5 on Bunker Hill has a maximum predicted consumption of 13 tons per acre and will produce less than two tenths of a ton of suspended particulates per acre treated (Fire and Fuels Analysis Report, Appendix E). The maximum size of unit 5 is 43 acres. A wildland fire consumes on average 60 tons per acre (A Desk Reference for NEPA Air Quality Analysis, Ch 3.1) and produces nearly a half of a ton of suspended particulates per acre burned, the overall size of the wildfire is based on the fuel, weather, and topography of where that wildland fire is burning.

CUMULATIVE EFFECTS

There are other activities planned or occurring within the Lemolo Analysis Area boundary that have the potential to impact air quality. They are; Lemolo Fire Hazard Reduction, Electric Salvage, Gigawat Timber Sale, and Bear Paw Timber Sale.

Regional summer wildland fires have an impact in visibility during most summers. The recent fire seasons of 1985, 1987, 1994, 1996, and 2002 have had the greatest impact on the local visibility within and view from the planning area. Regional prescribed fires in the southern and south central Oregon area will continue to be evident during the spring in the form of drift smoke.

3.5.5 ALTERNATIVE 2

DIRECT EFFECTS

Prescribed fire activities associated with this alternative will produce an estimated 369 tons of total suspended particulate and 2355 tons of carbon monoxide over a period of 4 to 6 years.

Road construction or reconstruction and log haul will produce particulates, the effect being dust on roadside vegetation and visible dust from roads of haul routes.

INDIRECT EFFECTS

Smoke from under burns may be visible from the Lemolo Lake recreation area during the day of the burn, and 0 to10 days following burning, smoke may be noticeable in Kelsay Valley Campground, Inlet Campground, East Lemolo Campground and Bunker Hill Campground.

In the short term, prescribed fire emissions will increase. Wildland fire emissions will decrease over the long term as areas are treated. (Snell 2002)

CUMULATIVE EFFECTS

There are other activities planned or occurring within the Lemolo Analysis Area boundary that have the potential to impact air quality. They are; Lemolo Fire Hazard Reduction, Electric Salvage, Gigawat Timber Sale.

Particulate produced from this alternative will be in addition to the estimated 100-200 tons produced from these other projects.

Regional summer wildland fires have an impact in visibility during most summers. The recent fire seasons of 1985, 1987, 1994, 1996, and 2002 have had the greatest impact on the local visibility within and view from the planning area. Regional prescribed fires in the southern and south central Oregon area will continue to be evident during the spring in the form of drift smoke.

3.5.6 ALTERNATIVE 3

DIRECT EFFECTS

Prescribed fire activities associated with this alternative will produce an estimated 260 tons of total suspended particulate and 1651 tons of carbon monoxide over a period of 4 to 6 years.

Road construction or reconstruction and log haul will produce particulates, the effect being dust on roadside vegetation and visible dust from roads of haul routes

INDIRECT EFFECTS

Smoke from under burns may be visible from the Lemolo Lake recreation area during the day of the burn, and 0 to10 days following burning, smoke may be noticeable in Kelsay Valley Campground, Inlet Campground, East Lemolo Campground and Bunker Hill Campground.

In the short term, prescribed fire emissions will increase. Wildland fire emissions will decrease over the long term as areas are treated. (Snell 2002)

CUMULATIVE EFFECTS

There are other activities planned or occurring within the Lemolo Analysis Area boundary that have the potential to impact air quality. They are; Lemolo Fire Hazard Reduction, Electric Salvage, Gigawat Timber Sale.

Particulate produced from this alternative will be in addition to the estimated 100-200 tons produced from these other projects.

Regional summer wildland fires have an impact in visibility during most summers. The recent fire seasons of 1985, 1987, 1994, 1996, and 2002 have had the greatest impact on the local visibility within and view from the planning area. Regional prescribed fires in the southern and south central Oregon area will continue to be evident during the spring in the form of drift smoke.

3.5.7 ALTERNATIVE 4

DIRECT EFFECTS

Prescribed fire activities associated with this alternative would produce an estimated 220 tons of total suspended particulate and 1,421 tons of carbon monoxide over a period of 4 to 6 years.

Road construction or reconstruction and log haul will produce particulates, the effect being dust on roadside vegetation and visible dust from roads of haul routes.

INDIRECT EFFECTS

Smoke from under burns may be visible from the Lemolo Lake recreation area during the day of the burn, and 0 to10 days following burning, smoke may be noticeable in Kelsay Valley Campground, Inlet Campground, East Lemolo Campground and Bunker Hill Campground.

In the short term, prescribed fire emissions will increase. Wildland fire emissions will decrease over the long term as areas are treated. (Snell 2002)

CUMULATIVE EFFECTS

There are other activities planned or occurring within the Lemolo Analysis Area boundary that have the potential to impact air quality. They are; Lemolo Fire Hazard Reduction, Electric Salvage, Gigawat Timber Sale.

Particulate produced from this alternative will be in addition to the estimated 100-200 tons produced from these other projects.

Regional summer wildland fires have an impact in visibility during most summers. The recent fire seasons of 1985, 1987, 1994, 1996, and 2002 have had the greatest impact on the local visibility within and view from the planning area. Regional prescribed fires in the southern and south central Oregon area will continue to be evident during the spring in the form of drift smoke.

3.5.8 ALTERNATIVE 5

DIRECT EFFECTS

Prescribed fire activities associated with this alternative would produce an estimated 281 tons of total suspended particulate and 1785 tons of carbon monoxide over a period of 4 to 6 years.

Road construction or reconstruction and log haul will produce particulates, the effect being dust on roadside vegetation and visible dust from roads of haul routes.

INDIRECT EFFECTS

Smoke from under burns may be visible from the Lemolo Lake recreation area during the day of the burn, and 0 to10 days following burning, smoke may be noticeable in Kelsay Valley Campground, Inlet Campground, East Lemolo Campground and Bunker Hill Campground.

In the short term, prescribed fire emissions will increase. Wildland fire emissions will decrease over the long term as areas are treated. (Snell 2002)

CUMULATIVE EFFECTS

There are other activities planned or occurring within the Lemolo Analysis Area boundary that have the potential to impact air quality. They are; Lemolo Fire Hazard Reduction, Electric Salvage, Gigawat Timber Sale.

Particulate produced from this alternative will be in addition to the estimated 100-200 tons produced from these other projects.

Regional summer wildland fires have an impact in visibility during most summers. The recent fire seasons of 1985, 1987, 1994, 1996, and 2002 have had the greatest impact on the local visibility within and view from the planning area. Regional prescribed fires in the southern and south central Oregon area will continue to be evident during the spring in the form of drift smoke.

3.6 GEOLOGY / SOILS

3.6.2 AFFECTED ENVIRONMENT

The Soil Resource Inventory (SRI) describes the soil types present within the Lemolo 5th Level Watershed. Soil consociations (separate soils), soil complexes, and physical and textural characterizations of the soil resource, which define the soil resource of the LAA, are listed in Appendix J under the heading “Soil Resource Land-types”. This information was incorporated into the cumulative effects analysis.

EROSION PROCESSES FOR THE LAA

The affected environment related to erosion processes evaluated in this DEIS is defined as Bunker Hill and Lemolo Lake, as well as the areas of proposed harvest, fuels treatment, and subsoiling throughout the LAA.

Within the affected environment an erosion risk class was determined for all soils. The factors of soil texture combined with slope and aspect makeup the five erosion risk classes seen in table 13. Risk classes were then tabulated for the soils within the 6th Level Sub-watersheds of Bradley Creek, Calamut Creek, Lake Creek, North Umpqua Headwaters and Thirsty Creek. Of

concern with respect to erosion are risk classes 2-4; these classifications have erosion characteristics such as, earth flow, rotational slumps, turbidity hazard, and high surface erosion.

Table 6 – Soil by Risk Class Within Each Sub-watershed

Erosion Risk Class	Bradley Creek (acres)	Calamut Lake (acres)	Lake Creek (acres)	North Umpqua Headwaters (acres)	Thirsty Creek (acres)	Total Within Lemolo PA (acres)
0	13.3	0.5	13.7	21.4	0	48.9
1	11383.9	11041.2	21825.3	13972.5	15226.9	73449.8
2	122.6	404.5	1325.1	46.4	48.1	1946.8
3	35.3	82.5	246.1	268.2	34.9	666.9
4	0	0	0	0	0	0
Total	11555.1	11528.6	23410.2	14308.6	15309.9	76112.5
Percent of classes 2-4	1.4%	4.2%	6.7%	2.2%	0.5%	

The percent of risk class 2-4 are low for the LAA and as seen in table 13. None of the watersheds exceed 7% elevated risk of earth flow, rotational slumps, turbidity hazard, and high surface erosion.

SOIL PRODUCTIVITY

The affected environment related to soil productivity and soil biotic communities falls within areas of proposed harvest, fuels treatment, roadwork, and subsoiling. Additionally this information was incorporated into the cumulative effects of this proposal and others located within the LAA.

Professional judgment was used to evaluate the productivity of existing and proposed harvest units, or roads within the LAA in relation to soil productivity. Factors for the affected environment which could be altered by the proposed project are: loss of organic matter, increase of soil tilth, soil alteration due to severe burning, soil displacement, and soil compaction. A description of soil productivity concerns and proposed activities to benefit soil productivity is found in Appendix J – Soils.

3.6.3 ENVIRONMENTAL EFFECTS

ANALYSIS OF EROSION AND SEDIMENT ON BUNKER HILL

Forest soils normally have low erosion rates, unless there is an event that accelerates the rate of erosion. Conditions that promote accelerated erosion are, but not limited to; mass wasting, wildfire, roads and timber harvesting operations.

The effect of timber harvest on erosion is proportional to the amount of effective ground cover left on site, slope of the unit, slope of the buffer to riparian, and the amount of compaction left post-harvest. Based on professional observation in other harvest areas, unless excessive soil compaction is present (or created), the erosion from harvest operations tends to last only until vegetation covers exposed ground. The lack of vegetation usually lasts one or two years, except in areas with severe compaction. The same can be assumed for wildfire and prescribed fire operations. Following a burn, the growth of vegetation covers the soil surface with plant and litter, reducing potential erosion. Robichaud and Brown (1999) reported erosion rates dropped

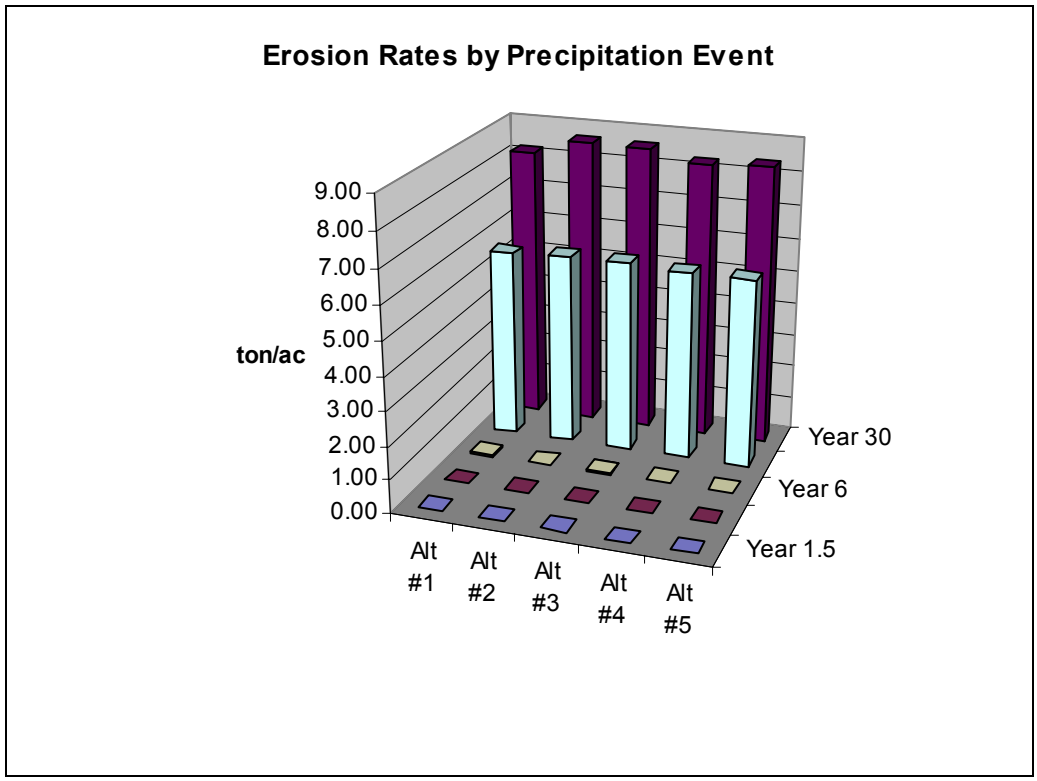
from 40 Mg ha-1 the first year after a fire to 2.3 Mg ha-1 the second year, and 1 Mg ha-1 the third year. These findings indicate that the risk of erosion is greatly reduced over time provided vegetation quickly recovers the site. It is in the window of opportunity for erosion observed by Robichaud and Brown, which has the greatest effect on erosion risk. When this window of opportunity is open, the magnitude of potential erosion depends on the climate. If the year following disturbance is dry, then the likelihood of accelerated erosion is low. If the precipitation during this time is high, then there soil erosion can be greatly increased.

The Water Erosion Prediction Program (WEPP) was used to predict the consequences of each alternative with respect to the soil resource on Bunker Hill for harvest units 1, 2, 3, 4, 5, and 32. The analysis modeled the potential amounts of erosion and subsequent sediment into Lemolo Lake. Given the topography of the area modeled, erosion and sediment did not have different outputs and therefore results displayed in this analysis are for sediment alone.

A detailed description of WEPP, assumptions, constants, and variables used for this analysis are listed in Appendix J, as are outputs for each of the proposed Bunker Hill harvest units. WEPP results were generated from representative transects within each unit. The generation of erosion and sediment is dependent upon the constants of soil texture, percent slope, and the variable of rain intensity. Precipitation or rain was modeled for Bunker Hill using Rock:Clime data from the Toketee Falls weather station to fit the Bunker Hill site (Appendix J).

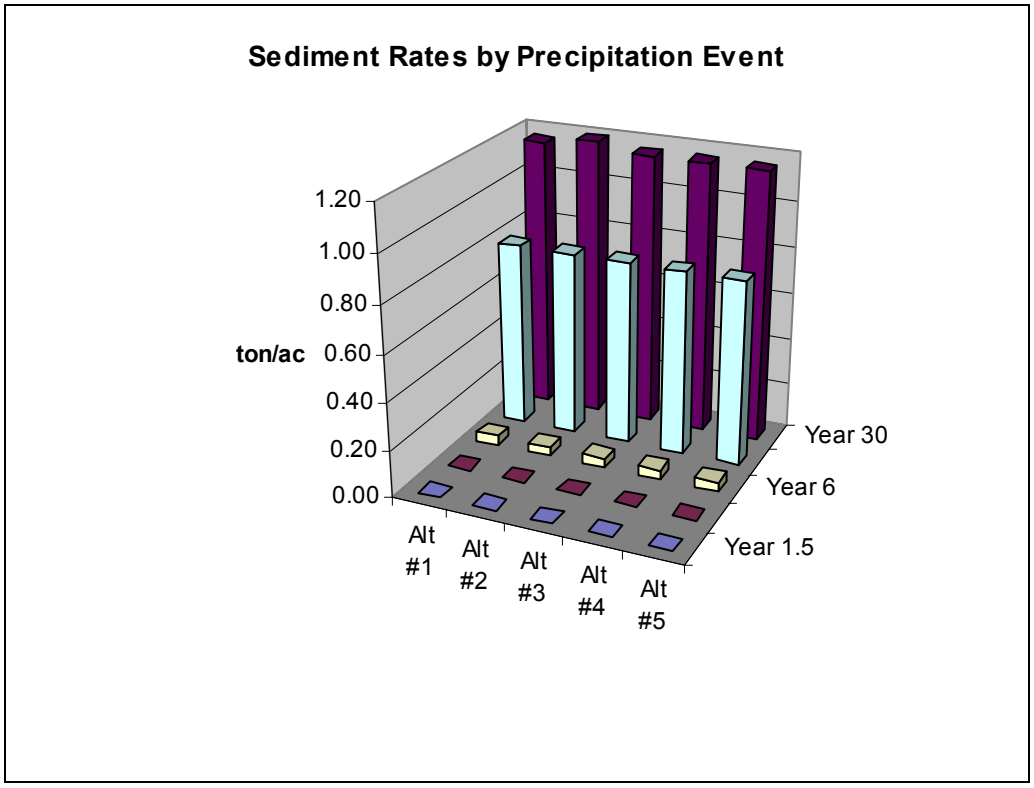
Bunker Hill has four streams associated with the units on that hillside. Three of these streams are related to the proposed units 1, 2, 3 and 4 and are an un-definable variable in this analysis. Identified by Brady Dodd (Hydrologist) in field reconnaissance of this proposal, these streams go subsurface before connecting to Lemolo Lake. Because these streams go subsurface, they are not expected to contribute sediment to the analysis; therefore, soil losses from these units will be considered forth stream, associated with units 5 and 32 can contribute flow to Lemolo Lake during an unknown level of rain. There is no difference in erosion and sediment rates for proposed units 5 and 32, due to topography; therefore outputs from these units were relegated to sediment results.

Figure 1 - Averaged amounts of erosion for each alternative on Units 1, 2, 3, 4, 5 & 32 with regard to precipitation events.



Erosion rates in Figure 8, shows all alternatives producing low erosion rates (<10 t/ac/yr) for a precipitation level of < 15-year (<59.34 inches); with only alternative #2 showing a 2% difference above no action alternatives or a 0.1 t/ac increase over the rest. The increased erosion occurs only with precipitation at a 15-year level. When the precipitation level is > 30-year (>67.91 inches), all alternatives maintain a moderate erosion risk class (10.1-25 t/ac); with alternatives #2, #4 and #5 showing a increases over the no activity alternatives on Bunker Hill. The 30-year precipitation level shows a minor increase for alternative #2 with a 5% difference or 0.4 t/ac over the no activity alternative; alternative ##4 with a 1% difference or 0.1 t/ac over the no activity alternative, #5 with a 2% difference or 0.2 t/ac over the no activity alternative.

Figure 2 - Averaged amounts of sediment for each alternative on Units 1, 2, 3, 4, 5 and 32 with regard to precipitation events.



Sediment rates in Figure 9, shows all alternatives producing moderate sedimentation rates (<0-0.15 t/ac/yr) for a precipitation level of < 15-year (<59.34 inches), with no difference between alternatives. When the precipitation level is > 30-year (>67.91 inches), all alternatives are rated as very high sediment risk class (1.01-3.00 t/ac). At the 30-year precipitation level, only alternative #2 shows an increase; this change is a 3% or 0.03 t/ac increase over the no activity alternative on Bunker Hill.

The potential degradation of the soil resources is caused to a small degree by the proposed harvest and fuel treatment activities on Bunker Hill. These conclusions can be transferred to the rest of the watershed, as the erosion and sediment analysis for Bunker Hill is the worst-case scenario for the planning area. These results are dependent upon the exclusion of wildfire, within the analysis area. Wildfire will elevate erosion and sediment volumes at least ten times for any precipitation level modeled.

SOIL PRODUCTIVITY

The most common types of detrimental disturbances affecting forest soils are compaction, puddling, displacement, erosion, severe burning, and the loss of the surface organic layer. These disturbances can be attributed to the effects of timber harvest activities such as ground skidding of logs, mechanical piling of slash, burning of slash, and construction of roads. These detrimental disturbances can affect long term site productivity by reducing the soils capacity to sustain existing growth of a particular plant or plant community.

Chapter Two of this document outlines best management practices and mitigating measures that minimize direct, indirect, and cumulative soil impacts within activity areas. These practices and measures maintain long-term site productivity within acceptable levels in accordance with current management standards and guidelines. Current management standards and guidelines state that the cumulative combined total amount of unacceptable soil condition within an activity area should not exceed 20%. An unacceptable level of compaction on pumice soil is defined as an increase in bulk density of 20% or more over the natural undisturbed bulk density. An unacceptable level of displacement is defined as the horizontal removal by mechanical means of 50 percent or more of the A1 or AC horizons from 100 square feet and where one dimension is at least 5 feet (an area at least 5 by 20 feet). Unacceptable puddling is defined as the physical change to soil structure that results when traffic ruts and molds a soil to a depth of 6 inches or more. Severe burning, which is defined as unacceptable, occurs when the surface soil has significantly changed color (usually more red) and the next half-inch contains blackened or charred organic matter due to soil heating. Operating within standard and guidelines assures that the effects on the soil resource are not significant within the area of activity. Monitoring of past harvest activity at Diamond Lake Ranger District has shown these practices to be effective in meeting current standards and guidelines.

Table 7 – Direct and Cumulative Detrimental Soil Condition by Alternative

Alternative #	Existing Detrimental Soil Condition within LAA (acres)	Existing Detrimental Soil Condition within LAA (%)	Area of Proposed Activity (acres)	Detrimental Soil Condition within Area of Proposed Activity (acres)	Detrimental Soil Condition within Area of Proposed Activity (%)	Cumulative Detrimental Soil Condition within LAA (%)
1	2212	3	0	0	0	3
2	2337	3	1579	148	8	3
3	2289	3	636	99	12	3
4	2309	3	905	119	11	3
5	2309	3	1233	119	8	3

An evaluation of the effects on the soil resource was predicted for each alternative based on estimated detrimental soil disturbance. The evaluation used the following assumptions: Skyline and helicopter yarding and associated fuels treatment will produce 1-2% unacceptable levels of soil disturbance; loader yarding and associated fuels treatment will produce 10% unacceptable levels of soil disturbance; mechanized yarding and associated fuels treatment will produce 15% unacceptable levels of soil disturbance; and new road and quarry construction will produce 100% disturbance for the acres involved. This analysis showed that all alternatives could meet the regional Standard and Guideline "the combined amount of unacceptable soil condition (detrimental compaction, displacement, puddling or severely burned) within an activity area are less than 20 percent." No alternative exceeds 12 percent cumulative detrimental effects within harvest units or exceeds 3% for the planning area. Table 14 summarizes the direct and cumulative detrimental soil condition under each alternative, adjusted for the benefit of proposed subsoiling treatments.

3.6.4 ALTERNATIVE 1 (NO ACTION)

DIRECT EFFECTS

No new sources of accelerated soil erosion, soil compaction, puddling, displacement, severe burning, or loss of surface organic matter will occur because no activities are proposed. There will be minor occurrences of soil compaction; puddling or displacement caused by falling dead trees, animal wallows, or recreation activities. Low amounts of surface erosion (0-0.15 t/ac/yr) will occur naturally due to the forces of wind, rain, and gravity.

Accelerated erosion in areas of previous activity will continue to occur, though most occurrences are likely to occur with high precipitation or stand replacing fire combined with above average precipitation. An estimated 264 sub-soiling acres remain untreated through this alternative. Soil productivity will continue to be significantly reduced on these acres. These areas will remain in a condition that is unacceptable for use in growing and maintaining healthy trees and for water infiltration.

3.6.5 ALTERNATIVE 2

DIRECT EFFECTS

Accelerated soil erosion, soil compaction, puddling, displacement, severe burning, or loss of surface organic matter will occur through proposed activities and contribute to detrimental soil conditions. The tabulation of soil left in detrimental condition was corrected by subtracting soil restoration (subsoiling) from the total. When combined these activities will create 148 acres or 8% detrimental soil conditions, within the proposed harvest units. The amount of activity area left in detrimental soil conditions (table 14), therefore meets the current standard and guideline of 20% change in the soil resource. However, leaving these detrimental conditions will result in reduced soil productivity for parts of the proposed harvest units, and will contribute to the legacy soil compaction within the watershed. Accelerated erosion will likely not be of a measurable level, as indicated by the WEPP analysis on Units 1, 2, 3, 4, 5 and 32. Low amounts of surface erosion (0-0.15 t/ac/yr) will occur naturally due to the forces of wind, rain, and gravity, and those areas of harvest. Any erosion occurring before vegetative reestablishment will be associated with periods of high precipitation and not driven by harvest activities. Leaving 65%-85% effective ground on areas proposed for harvest activity would minimize surface soil loss from erosion. Accelerated erosion in sub soiled areas may have minor increases dependent upon topography and establishment of vegetative cover soon after treatment.

Soils will be decompacted on an approximately 285 acres through subsoiling operations within old plantations and decommissioned roads. Approximately 21 acres will be decommissioned roads. Subsoiling treatments on 72 of these acres are dependent on appropriated restoration funding.

3.6.6 ALTERNATIVE 3

DIRECT EFFECTS

Accelerated soil erosion, soil compaction, puddling, displacement, severe burning, or loss of surface organic matter will occur through proposed activities and contribute to detrimental soil conditions. The tabulation of soil left in detrimental condition was corrected by subtracting soil restoration (subsoiling) from the total. When combined these activities will create 99 acres or 12% detrimental soil conditions, within the proposed harvest units. The amount of activity area left in detrimental soil conditions (table 14), therefore meets the current standard and guideline of 20% change in the soil resource. However leaving these detrimental conditions will result in reduced soil productivity for parts of the proposed harvest units, and will contribute to the legacy soil compaction within the watershed. Accelerated erosion will likely not be of a measurable level, as indicated by the WEPP analysis on Units 1, 2, 3, 4, 5 and 32. Low amounts of surface erosion (0-0.15 t/ac/yr) will occur naturally due to the forces of wind, rain, and gravity, and those areas of harvest. Any erosion occurring before vegetative reestablishment will be associated with periods of high precipitation and not driven by harvest activities. Leaving 65%-85% effective ground on areas proposed for harvest activity would minimize surface soil loss from erosion. Accelerated erosion in sub soiled areas may have minor increases dependent upon topography and establishment of vegetative cover soon after treatment.

Soils will be decompacted on an approximately 285 acres through subsoiling operations within old plantations and decommissioned roads. Approximately 21 acres will be decommissioned roads. Subsoiling treatments on 243 of these acres are dependent on appropriated restoration funding.

3.6.7 ALTERNATIVE 4

DIRECT EFFECTS

Accelerated soil erosion, soil compaction, puddling, displacement, severe burning, or loss of surface organic matter will occur through proposed activities and contribute to detrimental soil conditions. The tabulation of soil left in detrimental condition was corrected by subtracting soil restoration (subsoiling) from the total. When combined these activities will create 119 acres or 11% detrimental soil conditions, within the proposed harvest units. The amount of activity area left in detrimental soil conditions (table 14), therefore meets the current standard and guideline of 20% change in the soil resource. However leaving these detrimental conditions will result in reduced soil productivity for parts of the proposed harvest units, and will contribute to the legacy soil compaction within the watershed. Accelerated erosion will likely not be of a measurable level, as indicated by the WEPP analysis on Units 1, 2, 3, 4, 5 and 32. Low amounts of surface erosion (0-0.15 t/ac/yr) will occur naturally due to the forces of wind, rain, and gravity, and those areas of harvest. Any erosion occurring before vegetative reestablishment will be associated with periods of high precipitation and not driven by harvest activities. Leaving 65%-85% effective ground on areas proposed for harvest activity would minimize surface soil loss from erosion. Accelerated erosion in sub soiled areas may have minor increases dependent upon topography and establishment of vegetative cover soon after treatment.

Soils will be decompacted on an approximately 285 acres through subsoiling operations within old plantations and decommissioned roads. Approximately 21 acres will be decommissioned roads. Subsoiling treatments on 239 of these acres are dependent on appropriated restoration funding.

3.6.8 ALTERNATIVE 5

DIRECT EFFECTS

Accelerated soil erosion, soil compaction, puddling, displacement, severe burning, or loss of surface organic matter will occur through proposed activities and contribute to detrimental soil conditions. The tabulation of soil left in detrimental condition was corrected by subtracting soil restoration (subsoiling) from the total. When combined these activities will create 119 acres or 8% detrimental soil conditions, within the proposed areas of activity. The amount of activity area left in detrimental soil conditions (table 14), therefore meets the current standard and guideline of 20% change in the soil resource. However leaving these detrimental conditions will result in reduced soil productivity for parts of the proposed harvest units, and will contribute to the legacy soil compaction within the watershed. Accelerated erosion will likely not be of a measurable level, as indicated by the WEPP analysis on Units 1, 2, 3, 4, 5 and 32. Low amounts of surface erosion (0-0.15 t/ac/yr) will occur naturally due to the forces of wind, rain, and gravity, and those areas of harvest. Any erosion occurring before vegetative reestablishment will be associated with periods of high precipitation and not driven by harvest activities. Leaving 65%-85% effective ground on areas proposed for harvest activity would minimize surface soil loss from erosion. Accelerated erosion in sub soiled areas may have minor increases dependent upon topography and establishment of vegetative cover soon after treatment.

Soils will be decompacted on an approximately 285 acres through subsoiling operations within old plantations and decommissioned roads. Approximately 20 acres will be decommissioned roads. Subsoiling treatments on 243 of these acres are dependent on appropriated restoration funding.

3.6.9 ALTERNATIVES 2, 3, 4 AND 5

INDIRECT EFFECTS

Legacy detrimental soil conditions will continue on a slow recovery, aided by tree root growth, the heaving from soil wetting, frost, and erosion of loosened soil from the area of compaction. Subsoiling units that are thirty plus years in detrimental condition illustrate the duration pathways of this process. With little relief to the soil density of previously impacted sites, the losses to surface organic matter will continue on compacted skid trails within plantations. Untreated soils will continue to be considered unacceptable as a growth medium for trees and because of poor water infiltration rates, will not be in an optimum condition to accumulate and decompose organic matter into the soil.

CUMULATIVE EFFECTS

Other projects have also occurred in the past or will occur in the foreseeable futures that will affect erosion, sediment and soil productivity within the LAA. They include the Lemolo Fire

Hazard Reduction Project, Electric Salvage timber sale, and the Gigawatt and Bearpaw timber sales. The mentioned projects are included in the analysis of detrimental soil conditions and will not have a cumulative effect with regard to soil productivity as shown in table 14.

3.7 FISHERIES

3.7.2 AFFECTED ENVIRONMENT

FISH HABITAT

Fish habitat in the analysis area can be divided into four primary units, consisting of two large lakes and two stream systems; Diamond Lake, Lemolo Reservoir, and the North Umpqua River and Lake Creek stream systems.

Lakes

Diamond Lake and Lemolo Lake are by far the two largest fish bearing lakes in the analysis area. Diamond Lake is a large natural lake, approximately 3,200 acres in size. Diamond Lake is shallow for its size, with an average depth of approximately 24 feet. Lake Creek is created by the Diamond Lake outflow. Lemolo Reservoir is created by the Lemolo I diversion dam. At full pool, the reservoir is approximately 435 acres in size, with an average depth of approximately 27 feet. A detailed discussion of Lemolo Reservoir and Diamond Lake is available in the Lemolo/Diamond Lake Watershed Analysis.

Six smaller fish bearing lakes are also present; Pit Lakes #1 and #2, Maidu Lake, and Linda, Connie, and Calamut Lakes. Pit Lakes #1 and #2 are former gravel pits developed as small lakes. Maidu Lake is a natural, spring fed sub-alpine lake, approximately 30 acres in size. The outflow from Maidu Lake is the origin of the North Umpqua River. Linda and Connie Lakes are small, natural sub-alpine lakes. Calamut Lake is a natural sub-alpine lake, approximately 30 acres in size.

Stream Systems

There are approximately 33 miles of fish bearing stream habitat in the analysis area. Streams currently utilized by fish are the North Umpqua River, Spring River, Bradley Creek, Warrior Creek, Tolo Creek, Poole Creek, Lake Creek, Thielsen Creek, and Silent Creek. 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 and Appendix D (Watershed and Fisheries) located in this document.

The Affected Environment streams are in the High Cascade Province. The stream flow characteristics of this province include smaller annual flow fluctuations (i.e.; difference between summer to winter flow) and slow storm runoff response in contrast to the more rapidly responding Western Cascades. The younger volcanic bedrock of the High Cascades has high porosity and permeability because of a common occurrence of joint and fracture patterns that influence this type of flow response. This bedrock condition provides the opportunity for rapid water infiltration and migration both vertically and horizontally and water storage over a wide area in the High Cascades. This underlying geology is the controlling factor in the development

of the High Cascade aquifer (Diamond Lake – Lemolo Lake Watershed Analysis, 1998; Sherrod, 1995; Ingebritsen, 1994). This setting also influences a generally low stream density.

North Umpqua River

The North Umpqua River upstream from Lemolo Lake has a main stem length of approximately 9.8 miles. The river originates as the outflow from Maidu Lake. Stream flow at the Lemolo Lake inlet was measured at 406 cubic feet per second (cfs) on August 10, 1997. 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. However, the upper mile of stream can experience summer water temperatures considerably above this range, with a temperature of 24°C recorded in August, 1997. The warm temperatures in this upper stream segment are most likely a natural result of the river origin as an epilimnetic outflow from Maidu Lake.

Stream channel types range from a low gradient "E" type (Rosgen, 1996) in the lower 3.2 miles of stream, transitioning to a "C" type in the mid reaches, and finally to "B" and "A" types in the upper third of the channel main stem. The occurrence of instream large woody material 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.

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 (to 10.74°C in August, 1997). The Spring River stream channel is classified as a "B" channel type. 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, appropriate water temperature, and other factors.

Bradley Creek

Bradley Creek has a channel length of approximately four miles, and is a tributary to the North Umpqua River. Discharge was measured at 20.5 cfs in late September, 1996. Summer water temperatures are cold, and ranged from 4-9°C during late August/early September, 1996. The lower three miles of stream are classified as an "E" channel. Pool frequency throughout the stream is moderate, with moderate to extensive amounts of glide habitat also present in some, particularly the lower, portions of the stream. Large woody debris levels are high throughout the stream, and, combined with extensive undercut banks, creates good habitat complexity.

Warrior Creek

Warrior Creek has a channel length of over three miles, and is a tributary to Bradley Creek. Discharge was measured at approximately 10 cfs in August, 1997. Summer water temperatures

are cold throughout the stream length, measured at 8-9°C during August, 1997. Pool frequency is low in the lower reach of the stream, increasing to a moderate level in the upper reach. The stream channel is predominately a "B" type, with inclusions of "E" and "C", in the lower reach, transitioning to an "E" type in the upper reach.

Tolo Creek

Tolo Creek has a channel length of approximately two miles, and is a tributary to the North Umpqua River. Discharge was measured at 6.5 cfs in August, 1997. Stream channel morphology is variable, with most stream segments classified as "B" or "C" channel types. Much of the channel profile is stair stepped, with steep channel sections followed by lower gradient sections. Channel was higher in the low gradient sections, and decreased in the high gradient sections. Pool frequency is somewhat low, with large woody debris and boulders being the principal pool creating features.

Poole Creek

Poole Creek has a channel length of approximately 1.2 miles, and is a tributary to Lemolo Reservoir. Discharge was measured at 2.1 cfs in August, 1997. The lower half of the stream is a low gradient, high sinuosity "E" channel. Channel gradient increases to over 10% and sinuosity decreases markedly in the upper half of the channel, with the channel type transitioning to "B", and then "C" channel types. The stream channel is dominated by riffle habitat, with only about 25% of the stream classified as pool habitat. However, much of the channel is narrow and deep, with poorly defined hydraulic controls making delineation of pools difficult during stream survey.

Lake Creek

Lake Creek has a channel length of approximately 11.6 miles. Lake Creek originates as an epilimnetic outflow from Diamond Lake, and empties into Lemolo Reservoir. Due to the origin of Lake Creek as an epilimnetic outflow from Diamond Lake, Lake Creek naturally contains warmer water than is typical of streams in the area. Water temperatures as high as 23°C were measured during August, 1996. Stream habitat is fairly consistent as the stream passes primarily through low gradient topography. Channel types are typically "E" and "C", with some "B" channel present in a canyon dominated reach near Diamond Lake. Pool frequency is low to very low throughout the stream. Large woody debris frequency ranged from marginally adequate to very high for High Cascades stream types. A considerable amount of stable, hydraulically functioning woody debris was present in size classes smaller than what is classified as large woody debris.

Thielsen Creek

Thielsen Creek has a channel length of approximately 12 miles, and is a tributary to Lake Creek. Discharge was measured at 6.6 cfs during August, 1997. Summer stream temperatures are generally cold (5-9°C) with temperatures above 10°C occurring rarely. The lower 7-8 miles of stream are predominantly "E" channel type, with some inclusions of "B" channel type. The upper 2-3 miles of channel are dominated by "B" channel type, with some inclusions of "E" channel near the headwaters. 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 channel length of approximately two miles, and is a tributary to Diamond Lake. Summer water temperatures are cold, typically ranging from 5-8°C. Discharge was measured in August, 1997 at 30 cfs. The stream channel is classified as a "C" channel type, with inclusions of "E" type for the entire length surveyed.

FISH SPECIES

The analysis area contains six species of fish; brown trout (*Salmo trutta*), rainbow trout (*Oncorhynchus mykiss*), brook trout (*Salvelinus fontinalis*), kokanee (*Oncorhynchus nerka kennerlyi*), tui chub (*Gila bicolor*), and golden shiner (*Notemigonus crysoleucas*). Of the six species, five are introduced exotics; brown trout, brook trout, kokanee, tui chub, and golden shiner. Rainbow trout have also been introduced, but a native strain may have been present. It has not yet, and may never be, determined whether any native fish species were present in the analysis area.

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, Lemolo Reservoir, and all of Lake Creek. Brook trout are present in Lemolo Reservoir, Pit Lakes #1 and #2, Calamut Lake, Connie Lake, Linda Lake, Maidu Lake, the North Umpqua River from the origin at Maidu Lake to Lemolo Reservoir, Tolo, Bradley and Warrior Creeks (North Umpqua River tributaries), intermittently in Lake Creek, Thielsen Creek (a Lake Creek tributary), and Poole Creek. Kokanee reside in Lemolo Reservoir only, but do enter the lower reach of the North Umpqua River and Spring River to spawn. Tui chub are present in Diamond Lake, Silent Creek, Lake Creek, Lemolo Reservoir and possibly Pit Lake #2. A small population of golden shiners is present in Diamond Lake.

The general life histories of the species currently present in the analysis area are described below.

Brown Trout

Brown trout are native to Western Europe and have been widely introduced in the United States. Life histories vary from resident, fluvial, adfluvial, to anadromous. In Europe, both anadromous and non-anadromous populations are present. Most populations in North America are non-anadromous. Brown trout are primarily insectivores, but larger fish can become highly piscivorous. Spawning occurs in the fall or early winter, with offspring emerging from the Redd in late winter or spring. Adfluvial fish may live as long as 10 years.

Rainbow Trout

Rainbow trout are native to most Pacific Northwest Rivers and streams, but were not historically as widely distributed as cutthroat trout. Kamloops rainbows are relatively long

lived, piscivorous, grow to a large size, and generally live in lakes. Other non-anadromous strains generally live in streams and feed primarily on terrestrial and aquatic insects their entire lives, and do not grow to a large size. Spawning occurs in the spring, with the timing generally consistent in a given stream, but can vary by a month or more among streams in the same region. Life histories vary from resident, fluvial, adfluvial, to anadromous. Survival in redds is generally directly proportional to the amount of fine sediments present in the gravels.

Brook Trout

Brook trout are native to northeastern North America. Brook trout have a short life span, rarely reaching four years of age. Brook trout spawn in the fall, usually in October, with declining water temperature and day length. Redds are usually built in gravel, but if ground water upwelling is present, spawning may occur on sandy substrate. Brook trout generally do not migrate far, but some anadromy has been reported. In streams, movement is generally minimal. Young migrate from the Redd to shallow water and establish territories, moving into deeper water as they grow. Dominant foods include plankton, terrestrial and aquatic insects, and fish.

Kokanee

Kokanee are a landlocked form of sockeye salmon. Kokanee naturally occur in lakes with and without anadromous sockeye. When found living sympatrically, kokanee populations generally exist independently from anadromous forms, and spawn earlier in the fall. Kokanee typically have a three year life cycle. The secondary sexual characteristics of kokanee are the same as those for sockeye, with bright red coloration at maturity. Spawning may occur along lake shores or in tributary streams. Distinct sub-populations may develop within a single lake. Diet is principally pelagic zooplankton and insects. Average adult length among populations varies from 7-12 inches.

Tui Chub

Tui chub are members of the minnow family and are native to the Owens and Mojave rivers, and several interior basins in Oregon and Nevada. Tui chub typically become sexually mature at three years of age. When in lacustrine systems, tui chub begin entering shallow shoreline area to spawn beginning in late May to early June. Spawning activity generally peaks in July and concludes in August. Nearly the entire population of tui chub may be present in shallow shoreline areas during July. From September through April, adults return to deeper water. In some systems, tui chub are an integral part of the food chain and are heavily preyed upon by piscivorous fish.

Golden Shiner

The golden shiner is a member of the minnow family, is native to the eastern United States, and has been introduced west of the Rocky Mountains. Golden shiners prefer clear, weedy ponds. When found in large lakes, such as Diamond Lake, they tend to remain close to weed beds. Benthic broadcast spawning of adhesive eggs over weed beds occurs over an extended period during mid-summer. Diet consists primarily of planktonic crustaceans, but insects, mollusks, and algae may also be consumed. Adult length is generally 3-7 inches.

3.7.3 ENVIRONMENTAL EFFECTS

Analysis of the environmental consequences of implementation of the Lemolo Watershed Project to fishery resources requires a consideration of the potential effects to the habitat of resident species within the analysis area and potential effects to the habitat of both resident and anadromous species downstream. The potential effects to fishery resources associated with implementation of the action Alternatives (Alternatives 2, 3, 4 & 5) are very similar. Due to this similarity, the potential impacts of the action Alternatives will be discussed as one.

Cumulative effects analyses are complex. Factors such as scale, timing, and type of impacts interact with physical and biological watershed parameters to determine the extent and intensity of effects. Effects can accumulate over time with increases in development, and over space with increases in effects in a downstream direction. Watersheds and biological species have differing abilities to resist or recover from disturbance (Holling, 1973; Yount and Niemi, 1990), further complicating prediction of effects. Not surprisingly, demonstrating the cumulative effects of forest management on stream habitat has been difficult, except in the most severe cases (Bisson et al., 1992). While demonstrating specific linkages between causes and effects is difficult, there is considerable evidence that human alteration of the upper North Umpqua River system has resulted in impacts to fish habitat in many parts of the system. Cumulative impacts to the upper North Umpqua River system can generally be attributed to hydroelectric development and operation, road construction, timber harvest, and the introduction of exotic fish species. The Umpqua National Forest has limited ability to affect the extent of the existing hydroelectric development and operation, and the continued existence of exotic fish species. However, the Umpqua National Forest does have the ability to affect the extent of impacts resulting from road construction and timber harvest.

Specific changes in stream habitat caused by forest management, varies with logging and reforestation practices, watershed geology, regional climate, extent of riparian zone protection, and other factors. In areas where the effects of forest management are studied, it appears that a trend toward simplification of stream channels and a loss of habitat complexity is present (Bisson et al., 1992). Habitat complexity is reduced through loss of hydraulic complexity, loss of connection between stream and flood plain (Naiman et al., 1992), increased dominance of one substrate type, and the loss of sediment and organic matter storage capacity (Sullivan et al, 1987). One component of complexity, connectedness of watershed components, is emerging in the scientific literature as a major component of ecosystem health (Naiman et al, 1992). Processes, which are hypothesized to be key in defining aquatic ecosystem health in the Pacific Northwest coastal ecoregion, are delivery and routing of water, sediment, and woody debris to the stream channel (Naiman et al., 1992), and are dependent on connectedness of ecosystem components.

Chamberlin et al. (1991) describe two types of cumulative effects, type-1 and type-2. Type-1 cumulative effects, incremental changes, are not individually overwhelming, but compounded impacts will result in degraded fish habitat. Recovery from type-1 effects, are possible if the necessary management actions are taken. Type-2 cumulative effects, irreversible changes, result in changes in basic watershed processes. Recovery from these effects is not possible due to the long time requirements involved and/or permanent shifts in social or economic objectives that preclude the required management action.

Forest management goals in matrix land result in an example of type-2 cumulative effects. A permanent social objective is in place that ensures continued fire suppression, timber harvest, and road maintenance and construction. This will result in permanent changes to watershed hydrology. Of relevance is whether these changes cause significant alteration of fish habitat.

3.7.4 ALTERNATIVE 1 (NO ACTION)

DIRECT / INDIRECT / CUMULATIVE EFFECTS

Selection of the No Action alternative would allow current processes to continue, and no changes to the existing direct, indirect, and cumulative effects to fish habitat would occur.

The current impacts to fishery resources within the analysis area, those that would still be present if the "no action" alternative was selected, vary by location. The impacts from ongoing activities are briefly discussed below, and a detailed discussion can be found in the Diamond Lake/Lemolo Lake Watershed Analysis (Umpqua NF, 1998). By far, the two current impacts to fishery resources in the analysis area are the presence and operation of the Lemolo I dam and reservoir, and the presence of tui chub in Diamond Lake. The construction of Lemolo Reservoir permanently converted stream habitat to a reservoir, and the designed style of reservoir management has created some inherent water quality problems. The stocking of rainbow trout in Diamond Lake has indirectly led to the introduction of the tui chub minnow into the lake. The presence of the tui chub has led to substantial changes in the water quality of Diamond Lake, and may be affecting Lemolo Reservoir as well. The ongoing operation of the USFS permitted recreational activities at Diamond Lake also have some effects to water quality and fish habitat within the lake.

Current timber harvest impacts are localized and limited in scope, and primarily affect only Lake Creek and Poole Creek. The Lake Creek and Poole Creek stream systems have also been affected somewhat by road construction and maintenance. Other recreational impacts include campground development and trail use, and can be locally high, but are low/moderate overall. Ongoing prescribed fire projects may be resulting in short duration (1-2 years), limited nutrient introduction with minimal effect.

3.7.5 ALTERNATIVE 2, 3, 4 & 5

DIRECT, INDIRECT AND CUMULATIVE EFFECTS

Under the action alternatives, no timber harvest activity is proposed within riparian reserves, and no direct effects to fish habitat would occur as a result of proposed timber harvest. New road construction will not cross streams, and no direct or indirect effects are expected to occur as a result of new road construction. Road decommissioning and reconstruction are expected to have temporary adverse indirect effects to fish habitat, but result in long term benefits. During and shortly after (1-2 years) the implementation phase of road decommissioning and reconstruction, sediment introduction to project area streams is likely to increase. Once the vegetative recovery process is underway, sediment yield from treated roads should decrease to less than pre-project levels. The net result of project road construction and reconstruction at the 5th field HUC level would be a reduction in road density, a shift in road locations to lower risk sites, and a reduction in road/stream interactions.

Short term indirect adverse effects to water quality in Lemolo Reservoir may occur. The action alternatives may contribute to adverse cumulative effects on water quality. The risk of adverse effects is a result of nutrient inputs to groundwater at timber harvest sites, combined with the possibility that the nutrients could be transported to Lemolo Reservoir in amounts that could contribute to nuisance algae and pH problems present in the reservoir, and are created by the existence and operation of the reservoir. The potential effect of the action alternatives on nutrient input to Lemolo Reservoir is likely to be mitigated to some degree by proposed road decommissioning and soil decompaction, and the effects are expected to be within the range of natural variability of the watershed (as occurred prior to management).

Over the longer term, the indirect effects of the project to fish habitat within the project area is expected to be beneficial. Sediment introduction to project area streams is projected to decrease over time from soil decompaction, and road decommissioning and reconstruction (see discussion in hydrology section). No pathways for indirect effects to fish habitat, other than the previously discussed nutrient and sediment budgets, were identified.

Given that no pathways for direct effects were identified, indirect effects for nutrient input on Lemolo Reservoir are equivocal, and that the indirect effects for sediment input are expected to be beneficial over the long term, cumulative effects to analysis area fish habitat are expected to be minor and clearly within the range of natural variability (as defined by Reeves in Rothstein, 1999).

Downstream Effects

The project area contains much of the North Umpqua River headwaters area located upstream from Lemolo dam. All of the project area drains into Lemolo Reservoir. Between Lemolo Reservoir and Soda Springs Reservoir, a distance of approximately 23 river miles, two other hydropower dams are present. The uppermost, the Lemolo II diversion dam, is located near the mouth of Warm Springs Creek, and has a very small, rapid flow through reservoir pool (perhaps one acre). Toketee dam, located near the mouth of the Clearwater River, has a reservoir pool of approximately 100 acres. Thus, before reaching the point of effect for TES fish species, runoff from the analysis area is influenced by impoundment 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 all bedload sediment, and some of the larger material frequently transported as suspended sediment, is removed from the system before reaching the point of effect for ESA listed and sensitive salmonids. However, the hydropower system adversely affects water temperature, nitrogen loading and processing, and other riverine processes.

Analysis in the Lemolo EIS concludes that the temporary increase in nutrient input to groundwater at timber harvest sites may have a short term adverse effect on water quality in Lemolo Reservoir. Lemolo Reservoir currently does not meet Clean Water Act 303 standards for algae and pH. In context of the nutrient budget for the watershed above Lemolo Reservoir, any increase in nutrient delivery to the stream system is expected to be small, and not significant to water quality in analysis area streams. However, the analysis is equivocal in regards to whether the temporary increase in nutrient delivery to groundwater will result in a significant decrease in water quality in Lemolo Reservoir. Given the much larger drainage area, and the fact that timber harvest and prescribed fire nutrient introductions to groundwater will be

well within levels historically generated by the natural fire regime, the proposed project will not result in a significant effect on water quality in the North Umpqua River at Soda Spring's dam.

3.8 WATERSHED – STREAMFLOW REGIME[1]

ANALYSIS APPROACH

Evaluating the water resource effects involved different approaches. The "Umpqua National Forest Standard and Guideline Procedures for Watershed Cumulative Effects and Water Quality" (Umpqua NF, 1990) was applied where judged applicable to analyze the potential to affect stream flow and impact water quality and beneficial uses. The Hydrologic Recovery Procedure (HRP), recent snow accumulation and melt research on the Diamond Lake Ranger District and on the Gifford Pinchott National Forest, and professional judgment were used to evaluate the potential risk of increased peak stream flow, which will affect channel erosional processes that might result in adverse cumulative effects on water quality and beneficial uses.

The HRP addresses the rain-on-snow susceptibility for the transient snow zone (2,000 – 5,000 feet) at the sub-watershed and/or watershed scale by tracking the loss and recovery of canopy, which affects soil moisture through reduced evapotranspiration and snow accumulation and melt. Rain-on-snow runoff events are generally associated with a 5-year or greater peak flow. A 5-year or greater runoff event has a 20% or less chance of being equaled or exceeded in any one year. Snow accumulation and melt research indicates that a shelterwood canopy can allow about 60% greater snow pack runoff than mature forest (Storck, Kern, and Bolton 1999). HRP analysis assumed a combined 40% canopy recovery condition for proposed shelterwood, partial harvest, and thinning units while proposed seed tree and small group harvest acres were considered to be at zero recovery.

Professional judgment was based on field investigations of existing and proposed harvest units, existing roads, and existing stream conditions within the Lemolo Watershed Projects analysis area. Water quality was evaluated by identifying the existing condition and the influencing processes associated with an impacted water quality parameter.

Direct and indirect effects to stream channels will be analyzed at the site level within the analysis area. Cumulative effects will be analyzed at the sub-watershed (North Umpqua Headwaters, Bradley Creek, Thirsty Creek, Lemolo Reservoir, and Lake Creek) and watershed (Lemolo Lake and Diamond Lake) scales. Below the reservoir it is assumed that if effects from the proposed activities will occur, they will be masked, and ties with potential site disturbance will not be apparent. As a result, the effects analysis only briefly refers to effects downstream of the reservoir.

3.8.2 AFFECTED ENVIRONMENT

The primary analysis area is the Lemolo Lake 5th Level Watershed. A "Watershed" is a division of land that is based on hydrologic drainage and defined by a national hierarchical system, which delineates hydrologic drainage in nested multi-level divisions (FGDC, 2002). A hydrologic division is called a "Hydrologic Unit." There are different Levels of "Hydrologic Units" with the first Level (1st) being the largest area at the national scale (e.g.; Pacific

[1] Watershed Affected Environment and Environmental Effects analysis has been split into the following sections; Streamflow Regime, Water Quality and Stream Morphology for ease of reference and to assist reader clarity.

Northwest) then each 1st Level subdividing to nested smaller levels. The Hydrologic Unit Code (HUC) is a unique numerical identifier under this system that carries the hierarchical nesting by using two digits per level. Therefore, the HUC for the 5th Level "Watershed" has a ten-digit number. The subdivision of the 5th Level is the 6th Level "Sub-watershed." The HUC for the 6th Level Sub-watershed has a twelve-digit number.

The Lemolo 5th Level Watershed Hydrologic Unit Code (HUC) under this system is 1710030102 and nested in the North Umpqua River 4th Level Sub-basin (HUC 17100301). The two major Class II (fish bearing) streams present in the area are the North Umpqua River (major inflow to Lemolo Reservoir) and Lake Creek (from the outlet of Diamond Lake to Lemolo Reservoir).

The Lemolo Lake 5th Level Watershed is subdivided into five 6th Level "Sub-watersheds". These sub-watersheds and HUCs are displayed in Table 15.

Table 8 – 6th Level Sub-watersheds and HUCs

Sub-watershed	Hydrologic Unit Code (HUC)
North Umpqua Headwaters	171003010201
Bradley Creek	171003010202
Lake Creek	171003010203
Thirsty Creek	171003010204
Lemolo Reservoir	171003010205

Upstream of the Lemolo Watershed is the Diamond Lake 5th Level Watershed. The HUC for Diamond Lake is 1710030101. This watershed is the upper most one in the North Umpqua River Sub-basin. Since the Diamond Lake Watershed is located upstream from the primary analysis area, it can potentially contribute to water resource effects and was included in the analysis discussion of cumulative effects for this project. The project area is entirely within public lands administered by the U.S. Forest Service, although the land within the Diamond Lake Watershed extends into Crater Lake National Park.

STREAM FLOW REGIME CHARACTERISTICS

The steam flow regime for the Lemolo Lake Watershed is uniquely influenced by the High Cascade sub-province geology and spring snowmelt (Diamond Lake/Lemolo Lake Watershed Analysis). This underlying geology is the controlling factor in the development of the High Cascade aquifer (Diamond Lake – Lemolo Lake Watershed Analysis, 1998; Sherrod, 1995; Ingebritsen, 1994). The geologic characteristics influence a high volume and storage capacity of groundwater while slowly releasing to channels. The surficial pumice soil allows rapid water infiltration that generally drains to the relatively young, deeply fractured basalt bedrock. The common occurrence of joints and fracture patterns in the bedrock provides the opportunity for rapid infiltration and migration of surface water vertically as well as horizontally over a wide area. Low stream density in this geology is commonly observed and the stream flow regime is spring-dominated.

The resulting stream flow regime is slowly responding but persistent with small annual flow fluctuations i.e. the difference between summer to winter flow. The flow condition provides cool and consistent summer flow while producing less winter responsive runoff in contrast to the warmer and lower summer flow and more responsive winter runoff of downstream Western

Cascade sub-province. Annual river flow in the North Umpqua River below the Lemolo Reservoir is approximately half of the annual precipitation for the watershed. Streams in the Western Cascade sub-province tend to runoff over 70% of the precipitation because of much less storage ability in the older geology.

3.8.3 ENVIRONMENTAL EFFECTS

Stream flow Regime discusses primarily peak flow response but also potential change in water yield and movement.

3.8.4 ALTERNATIVE 1 (NO ACTION)

DIRECT AND INDIRECT EFFECTS

Since the existing hydrograph will not be affected by this alternative, no direct or indirect effects on the stream flow regime are expected from this alternative.

CUMULATIVE EFFECTS

Several other activities are proposed within the analysis area that may affect stream flow regime. These include up to 600 acres of pre-commercial thinning over the next five years, approximately 1432 acres of additional natural fuels treatments under Lemolo Fire Hazard Reduction CE, and 9 acres of the Bear Paw timber sale. Pre-commercial thinning will increase overall stand health and vigor supporting hydrologic recovery. The Hydrologic Recovery within the transient snow zone for the Lemolo Lake 5th Level Watershed is currently high (99%). Hydrologic recovery was historically affected by the harvest of approximately 2,000 acres in the watershed, but those acres now have equivalent recovery acreage of about 1100 acres. The fuels treatment will reduce the fire hazard and risk of losing canopy and reducing hydrologic recovery. Bear Paw timber sale will reduce the hydrologic recovery to zero on 9 acres, but without influence on the watershed or sub-watershed stream flow regime.

PacifiCorp's operations exist within the analysis area that may affect stream flow regime. As identified in the hydropower Settlement Agreement, PacifiCorp's operations will increase minimum instream flow for bypassed reaches in comparison to existing condition. The potential change will increase instream low flows in the North Umpqua River below the Lemolo Dam.

Since implementation of this alternative with the other planned activities will not change the stream flow regime, no adverse cumulative stream flow will occur under this "no action" alternative.

3.8.5 ALTERNATIVE 2

DIRECT AND INDIRECT EFFECTS

The proposed silvicultural treatments will temporarily reduce evapotranspiration and increase potential snow accumulation at the site scale. Canopy recovery in 10 years will diminish these responses for the proposed thinned areas to about 50% to 85% of pre-harvest canopy condition. In addition, annual water yield and summer low flow will show little to no change with these types and areas of proposed treatments (Beschta, 1995).

Compaction within proposed activities will cause localized surface water to route and concentrate. However, it has been observed by a soil scientist that this process only carries water a relative short distance until less compacted ground is reached then the water infiltrates (personal communications with James Archuleta). With the typical low stream density and high infiltration of the High Cascade geology and the proposed Best Management Practices (BMPs) for soil protection, it is very unlikely that routed water will reach a stream channel.

The proposed sub-soiling of previously managed stands and road decommissioning will restore soil productivity and improve water infiltration. The road decommissioning will also eliminate the potential of efficiently routing ditch water to stream channels, which influences channel network extension. All the "action alternatives" will sub-soil 232 acres and decommission 10.74 miles of road.

Therefore, no adverse direct or indirect effects on the stream flow regime are expected from this alternative and.

CUMULATIVE EFFECTS

Results from the HRP analysis indicate that the existing harvest units within the transient snow zone in all the sub-watersheds currently have high recovery levels for the year 2003. Lemolo Reservoir has the lowest at 97% recovery. The recovery at the watershed scale (Lemolo Lake Watersheds) is 99% for 2003. Since the land in Diamond Lake Watershed is above the transient snow zone (>5000 feet), it is outside of the analysis criteria and not included.

At these levels of hydrologic recovery (within High Cascade terrain), the stream flow regime has not likely been modified by forest canopy removal in the transient snow zone from pre-disturbance conditions. Under the historical moderate-severity fire regime, natural wildfires before fire suppression activity likely caused greater canopy reduction and lower hydrologic recovery by infrequent fires (25 to 100 years; Diamond Lake/Lemolo Watershed Analysis). The Umpqua Land Management Plan identifies 75% hydrologic recovery as a level of concern to further evaluate potential peak flow cumulative effects. The existing hydrologic recovery is considerably greater than this level of concern.

The added influence of the existing road network and compacted soils at the sub-watershed or watershed scale has not likely increased stream flow peaks or changed the timing to an earlier rise in the storm hydrograph. The peak flow studies that have evaluated the effect of compaction have founded that the influence was evident when 12% of the area was compacted (Beschta, 1995 and Harr, 1976). The current level of road compaction for the sub-watersheds range from

1% to 3% and Lemolo Lake Watershed is 1%. Total watershed compaction currently is 3% (see Soils effects section).

If compaction from management activities has altered water infiltration and delivery to groundwater, then less water will be available to contribute to low flow. An evaluation of accumulative annual low flow against precipitation for the1931-1982 period for the area above the Lemolo Dam also does not show an obvious compaction affect when comparing reference (1931-1954) and management (1955-1982) periods.

Therefore, no adverse cumulative effects on the stream flow regime have occurred under the existing condition in association with compaction.

The addition of the proposed harvest units on the landscape will result in a slight decrease in hydrologic recovery only for Lemolo Reservoir Sub-watershed, which will be 92% recovered, while the other sub-watersheds will be relatively unchanged in 2003. There will also be a slight decrease in recovery at the Lemolo Lake Watershed scale to 98%. However, the hydrologic recovery remains high and above the level of concern.

Therefore, no adverse cumulative effects on the stream flow regime will occur with the addition of this alternative in association with canopy reduction. Compaction levels in units will not noticeably change at the sub-watershed or watershed scale with the implementation of the soil BMPs. In addition, annual water yield and summer low flow will show little to no change with the proposed type treatments (Beschta, 1995).

New road (3.5 miles) and temporary road (3.9 miles) construction will not affect the stream flow regime. New road construction will compact less than 0.2 % at the sub-watershed level and less than 0.03% at the watershed level. For this alternative, net road reduction at the watershed level will be 5%.

Therefore, no adverse cumulative compaction effects from the addition of the proposed roads on the stream flow regime will occur.

Based on field review, there is not a high likelihood for the interception of groundwater in the development of all road prisms, because of the sufficient depths of permeable surficial deposits and the relatively deep groundwater surface level at these sites. Therefore, initiation of surface flow and channel network extension due to road construction is not likely.

Finally, natural fuels treatment of 282 acres is not planned within riparian reserves, and will not alter soil characteristics due to the low intensity ground heat associated with underburning. Therefore, soil permeability and water runoff will not be affected. The fuels treatment will reduce the fire hazard and risk of losing canopy and reducing hydrologic recovery.

Several other activities are proposed within the analysis area that may affect stream flow regime. These include up to 600 acres of pre-commercial thinning over the next five years, approximately 944 acres of additional natural fuels treatments under Lemolo Fire Hazard Reduction CE, 9 acres of the Bear Paw timber sale, and PacifiCorp's hydropower operation. These activities are discussed under "no action" Alternative.

Since implementation of this alternative with the other proposed and existing activities will not negatively influence the stream flow regime, no adverse cumulative stream flow effects will occur.

3.8.6 ALTERNATIVES 3

DIRECT AND INDIRECT EFFECTS

The direct and indirect effects discussed under Alternative 2 will apply to this alternative. The outcome will be less than Alternative 2 since fewer acres are proposed for harvest and fewer miles of road proposed for new and temporary construction and reconstruction. This alternative also proposes the least acres of harvest and miles of roadwork for all the "action alternatives." Therefore, no adverse direct or indirect effects on the stream flow regime are expected from this alternative.

CUMULATIVE EFFECTS

The addition of the proposed harvest units on the landscape will result in a slight decrease in hydrologic recovery only for Lemolo Reservoir Sub-watershed, which will be 94%, while the other sub-watersheds will be relatively unchanged in recovery for 2003. There will also be a slight decrease in recovery at the watershed scale to 98%. However, the hydrologic recovery remains high and above the level of concern.

Stream flow response relative to compaction, roads, and other existing and planned activities has been discussed under Alternative 2. For this alternative, net road reduction at the watershed level will be 6%. The Lemolo Fire Hazard Reduction CE will include 1432 acres, which is the same as the "no action." The general outcome will be similar to Alternative 2 relative to area of disturbance. Therefore, no adverse cumulative effects on the stream flow regime will occur under this alternative.

3.8.7 ALTERNATIVES 4

DIRECT AND INDIRECT EFFECTS

The direct and indirect effects discussed under Alternative 2 will apply to this alternative. The general outcome will be similar to Alternative 2 and 3 relative to area of disturbance. This alternative also proposes fewer acres of harvest and miles of roadwork than Alternative 2 but slightly more than Alternative 3. Therefore, no adverse direct or indirect effects on the stream flow regime are expected from this alternative.

CUMULATIVE EFFECTS

The addition of the proposed harvest units on the landscape will result in a similar hydrologic recovery as Alternative 3 at the sub-watershed and watershed scale. However, the hydrologic recovery remains high and above the level of concern.

Stream flow response relative to compaction, roads, and other existing and planned activities has been discussed under Alternative 2. For this alternative, net road reduction at the watershed level will be 6%. The Lemolo Fire Hazard Reduction CE will include 1333 acres. The general

outcome will be similar to Alternatives 2 and 3 relative to area of disturbance. Therefore, no adverse cumulative effects on the stream flow regime will occur under this alternative.

3.8.8 ALTERNATIVES 5

DIRECT AND INDIRECT EFFECTS

The direct and indirect effects discussed under Alternative 2 will apply to this alternative. The general outcome will be similar to Alternatives 2, 3 and 4 relative to area of disturbance. This alternative proposes fewer acres of harvest and miles of roadwork than Alternative 2 but more than Alternatives 3 and 4.

Therefore, no adverse direct or indirect effects on the stream flow regime are expected from this alternative.

CUMULATIVE EFFECTS

The addition of the proposed harvest units on the landscape will result in a slight decrease in hydrologic recovery only for Lemolo Reservoir Sub-watershed, which will be 93%, while the other sub-watersheds will be relatively unchanged in recovery for 2003. There will also be a slight decrease in recovery at the watershed scale to 98%. However, the hydrologic recovery remains high and above the level of concern.

Stream flow response relative to compaction, roads, and other existing and planned activities has been discussed under Alternative 2. For this alternative, net road reduction at the watershed level will be 6%. The Lemolo Fire Hazard Reduction CE will include 1033 acres. The general outcome will be similar to Alternatives 2, 3 and 4 relative to area of disturbance. Therefore, no adverse cumulative effects on the stream flow regime will occur under this alternative.

3.9 WATERSHED – WATER QUALITY

3.9.2 AFFECTED ENVIRONMENT

BENEFICIAL USES OF WATER

Beneficial uses designated by the Oregon Department of Environmental Quality (ODEQ) for the North Umpqua River Sub-basin, are inclusive of the following: water-contact recreation, domestic water supply, aesthetics, hydropower, and resident fish and aquatic life. Resident fish and aquatic life are two uses that forest management has influenced by affecting the habitat condition.

WATER QUALITY STATUS

The Oregon 1994 Water Quality Status Assessment Report 305(b) estimated that all beneficial uses of the North Umpqua River Sub-basin are supported, with the exception of both Diamond Lake and Lemolo Reservoir, which are only partially supported. Several water bodies within Lemolo Watershed and above and below the watershed have been identified by ODEQ in the Clean Water Act Section 303(d) list as water quality limited for 2002. These water bodies and the listing parameter are presented in Table 16.

Table 9 - Summary of 303(d) Listed Water Bodies Within and Near the Affected Environment of the Lemolo Watershed

Water body	Location	Listing Parameter
Diamond Lake	Entire lake	Algae, pH
Lake Creek	Diamond Lake outlet to Lemolo Reservoir.	Water temperature during both spawning and rearing periods.
Lemolo Reservoir	Entire reservoir.	pH
North Umpqua River	Several reaches below reservoir	Flow modification, habitat modification, dissolved oxygen, water temperature during spawning and rearing, pH, total dissolved gas.

Within the Lemolo Watershed, both Lake Creek and Lemolo Reservoir are listed as water quality limited. Lake Creek is identified because of temperature exceedance during the spawning period (September 1- July 31) and rearing period (summer) and Lemolo Reservoir is identified because of pH exceedance (>8.5 standard units). Lake Creek temperature is influenced by the surface water outflow from Diamond Lake. The reservoir pH exceedance is limited to the upper 20 feet of the water column. Studies for the relicensing of the North Umpqua Hydroelectric Project have found that the reservoir geometry and the general inherent nature of the impoundment create conditions conducive to increased pH. The reservoir also receives elevated nitrogen levels from Diamond Lake, which is water quality limited for pH, by way of Lake Creek. However, ODEQ has stated that the reservoir "is not a major source or sink of nitrogen" (ODEQ, 2002). This nitrogen inflow through Lake Creek influences algal growth and higher pH through the algal respiration process. ODEQ has recognized the "major influence" that Diamond Lake has on the water quality in Lemolo Reservoir. Future implementation of a Total Maximum Daily Load (TMDL) and water quality management plan that will include Diamond Lake is expected to have "positive water quality effects on Lemolo Reservoir" (ODEQ, 2002) and possibly reduce the algal growth and the associated pH.

ODEQ has evaluated the reservoir pH condition in the water quality certification process for the North Umpqua Hydroelectric Project as defined in Section 401 of the Federal Clean Water Act. 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" that "include each practicable pH control technique know" at the time of certification (DEQ, 2002). When any new information or data or a North Umpqua Basin TMDL and management plan is implemented, reservoir operation will comply with pollutant allocations to protect the water quality and beneficial uses of Lemolo Reservoir.

The fire regime for the Lemolo Watershed has shifted from moderate-severity for the reference condition to high-severity because of the years of fire suppression and fuel accumulation (Diamond Lake/Lemolo Lake Watershed Analysis). This condition has created a higher risk of greater nutrient (nitrogen) release from higher intense fire over a potentially larger area than occurred under the reference condition. This risk has a potential influence on water quality for Lemolo Reservoir because of the current degraded water quality condition (high pH) that is

associated with available nutrients in the surface water from Diamond Lake by way of Lake Creek and reservoir configuration.

3.9.3 ENVIRONMENTAL EFFECTS

Water quality environmental effects relate to the Clean Water Act parameters of concern within the watershed and parameters potentially influenced by the proposed activities.

3.9.4 ALTERNATIVE 1 (NO ACTION)

DIRECT AND INDIRECT EFFECTS

Since the present watershed condition will not be altered by this alternative, no direct or indirect effects or accelerated recovery of water quality are expected from this alternative.

CUMULATIVE EFFECTS

Other projects will occur in the foreseeable future that may affect water quality. The Lemolo Fire Hazard Reduction CE under this alternative proposes 1432 acres of additional natural fuels treatments. Natural fuels treatments have the potential of temporarily releasing nutrient to the groundwater, which will potentially transport to the stream system. However, since burning will not occur during periods of soil saturation or within riparian reserves and fire intensity will be low, much of the additional nutrients will be tied up in the soil pore spaces and taken up by vegetation. The project will help to address the risk of fire under the current high-severity fire regime, which will also reduce the risk of large-scale nutrient release from such an event.

The Bear Paw timber sale will harvest 9 acres within the Lemolo Reservoir Sub-watershed and allow nutrient release to the soil profile. These 9 acres are above Lake Creek on a broad flat ridge. Most nutrient release will likely be tied up near the activity. However, there is some chance of releasing nutrients to the groundwater, which will carry to Lake Creek then Lemolo Reservoir.

Existing effects to water quality that includes sediment from roads, stream temperature increase from loss of riparian shade, and other water quality parameters (e.g.; pH, dissolved oxygen, and chlorophyll a) influenced by hydropower operation will continue. However, riparian shade recovery and the implementation of the hydropower Settlement Agreement will trend water quality toward improvement.

As identified in the hydropower Settlement Agreement, PacifiCorp's operations will increase minimum instream flow for bypassed reaches in comparison to existing condition. These operational changes will affect water quality in the North Umpqua River and numerous tributaries downstream from the analysis area. Potential changes include the release of instream flows sufficient to meet water quality criteria for temperature and dissolved oxygen in all diverted reaches, and maintain stable water levels in the Lemolo Reservoir to reduce periphyton volumes and eutrophic algal species downstream, which will help in the reduction of the algal blooms and pH values in the North Umpqua River.

Since implementation of this alternative will not increase sediment, stream temperature, or change other water quality parameters, no additional influence on cumulative water quality effects from existing will occur under this "no action" alternative.

3.9.5 ALTERNATIVE 2

DIRECT AND INDIRECT EFFECTS

Road reconstruction and maintenance of 43.84 miles of road will produce a source of additional sediment where culverts are replaced, road surfaces are graded, and drainage ditches are cleared. These potential sediment sources will not likely persist beyond the first year and be most evident at the site scale. However, reconstruction and maintenance are projected to reduce chronic sources of sediment in the long term. Furthermore, the proposed road decommissioning and sub-soiling are targeted at roads and areas, which are the main anthropogenic (human-caused) sources of sediment and nutrients. Therefore, these proposed actions will ultimately have a benefiting effect on the beneficial uses downstream.

Timber harvest and road construction are proposed on stable terrain of deep surficial deposits, which are not prone to earth flow or landslide activity. Therefore, there is a low risk of these mass-wasting processes occurring adjacent to and as a result of proposed units and roads. Proposed road construction will occur on stable slopes and ridge tops, without crossing stream channels. Based on field review, there is not a high likelihood for the interception of groundwater in the development of all road prisms, because of the sufficient depths of permeable surficial deposits and the relatively deep groundwater surface level at these sites. Therefore, initiation of surface flow and channel network extension due to road construction is not likely.

Potential sediment from road construction (new and temporary) is not likely to extend down to the current stream network due to extensive distances between roads and existing stream channels, lack of stream crossings, and low risk of road related erosion. Wasnieski (1995) summarized the findings of numerous studies and found the maximum sediment travel distance from new roads, on dry hill slopes, was through a relief culvert and down slope 390 feet, in central Idaho. Burroughs and King (1989) found that there will be a 98 percent probability that sediment will not travel 400 feet from a relief culvert to a stream that is down slope. Our assumption is that where mass wasting is unlikely and the distance to a stream is greater than 400 feet, sediment will not reach the stream. For all alternatives, the maximum distance to live water is greater than 400 feet. Therefore, new roads are not likely to be a source of additional fine sediment to stream channels.

Since the proposed activities will not occur on unstable sites or within riparian reserves, sediment and stream temperature are not likely to be adversely affected by these activities directly or indirectly for all “action” alternatives. A similar beneficial effect for all the “action” alternatives on the sediment regime is likely with the decommissioning of 10.74 miles of road and sub-soiling of 232 acres of previously managed units.

Riparian reserves will be enforced on all proposed units near stream channels, including both harvest and prescribed fire units. Riparian reserves have been found to help “buffer” the stream channel from water quality impacts associated with management. Riparian reserves have been determined to reduce the amount of nutrient loading to a water body following timber harvest and slash burning (Snyder et al., 1975).

Proposed logging operations including fuel treatment will address nutrient loss by implementing Best Management Practices (BMPs), and maximizing the amount of organic debris left within the units, underburning, and minimizing the period of time between harvest and revegetation. By doing so, nutrient losses will be minimized by maintaining the carbon supply, which has been found to regulate microbial uptake of nitrogen (Stark and Hart, 1999). Additionally, proposed road decommissioning and sub-soiling may result in a decrease in nutrient delivery from surface runoff to the stream channel as inorganic sediment nitrogen. An increase in nutrient loading as a result of surface erosion, due to increases in compaction, is not expected. Nutrient loading increases are also not expected to result from instream scour that can be associated with increased runoff. Still, due to the inherently porous nature of the soils in the analysis area and results of referenced studies, it is possible that a small increase in nutrient loading to stream channels may occur as a result of these "action" alternatives.

The fuels and stand treatments for the proposed action alternatives will help to address the current high-severity fire regime by reducing fuels and improving stand health. The risk of large-scale nutrient release under a high-severity fire regime will be reduced over the long-term by all "action" alternatives with the tradeoff of small scale and short-term nutrient release.

CUMULATIVE EFFECTS

Other projects will occur in the foreseeable future that may affect water quality. The Lemolo Fire Hazard Reduction CE (944 acres) and Bear Paw timber sale (9 acres) are planned and/or partially implemented in the watershed and may affect water quality. The effects of these activities have been discussed under the "no action" alternative.

Implementation of any of the "action" alternatives will not increase sediment or water temperature, but may have a temporary effect on indirect nutrient delivery to Lemolo Reservoir. These alternatives together with the existing proposals previously discussed may contribute to the already existing adverse cumulative effect on water quality in Lemolo Reservoir. Nitrogen is already an influence on the pH problems in the upper 20 feet of the reservoir. Studies by PacifiCorp have concluded that the pH exceedances are undoubtedly due to the nitrogen input from Diamond Lake that is routed to Lemolo by Lake Creek and the reservoir creating conditions favorable to algal growth. However, the nitrogen contribution that is of most concern will enter the reservoir and mix in the warm surface water from tributary inflow as Lake Creek. Nitrogen released from proposed harvest and/or fuel treatment and carried by cooler groundwater may enter the reservoir, but will not likely mix with the warmer surface water and contribute to the water quality concern.

The potential nitrogen influence to Lake Creek was used to compare alternatives. The amount of nitrogen lost to streams is related to the amount of disturbance. Therefore, shelterwoods and small group harvest units that will likely drain to Lake Creek will have the most likely effect. This alternative will include 150 acres draining to Lake Creek. This proposed alternative together with other activities in the Watershed may add to the accumulative nutrient response in Lemolo Reservoir. However, nutrient release in response to the alternative will likely be small in scale and short in time compared to the potential outcome of a wildfire under a high-severity fire regime.

3.9.6 ALTERNATIVE 3

DIRECT AND INDIRECT EFFECTS

Road reconstruction and maintenance of 23.98 miles of road will produce a source of additional sediment where culverts are replaced, road surfaces are graded, and drainage ditches are cleared. These potential sediment sources will not likely persist beyond the first year and be most evident at the site scale. However, reconstruction and maintenance are projected to reduce chronic sources of sediment in the long term. Furthermore, the proposed road decommissioning and sub-soiling is targeted at roads and areas, which are the main anthropogenic (man-caused) sources of sediment and nutrients. Therefore, these proposed actions will ultimately have a benefiting effect on the beneficial uses downstream.

The erosional effects of proposed activities, the role of riparian reserves, mitigative measures, and the scope of nutrient response have been discussed under Alternative 2.

CUMULATIVE EFFECTS

The Lemolo Fire Hazard Reduction CE (1432 acres) and Bear Paw timber sale (9 acres) are planned and/or partially implemented in the watershed and may affect water quality. The effects of these activities have been previously discussed under "no action" alternative.

The potential nitrogen influence to Lake Creek was used to compare alternatives. The amount of nitrogen lost to streams is related to the amount of disturbance. Therefore, shelterwoods and small group harvest that will likely drain to Lake Creek have the most probable effect. This alternative will include 55 acres draining to Lake Creek. This proposed alternative together with other activities in the Watershed may add to the accumulative nutrient response in Lemolo Reservoir. However, nutrient release in response to the alternative will likely be small in scale and short in time compared to the potential outcome of a wildfire under a high-severity fire regime.

3.9.7 ALTERNATIVE 4

DIRECT AND INDIRECT EFFECTS

Road reconstruction and maintenance of 24.66 miles of road will produce a source of additional sediment where culverts are replaced, road surfaces are graded, and drainage ditches are cleared. These potential sediment sources will not likely persist beyond the first year and be most evident at the site scale. However, reconstruction and maintenance are projected to reduce chronic sources of sediment in the long term. Furthermore, the proposed road decommissioning and sub-soiling is targeted at roads and areas, which are the main anthropogenic (man-caused) sources of sediment and nutrients, and therefore, will ultimately, have a benefiting effect on the beneficial uses downstream.

The erosional effects of proposed activities, the role of riparian reserves, mitigative measures, and the scope of nutrient response have been discussed under Alternative 2.

CUMULATIVE EFFECTS

The Lemolo Fire Hazard Reduction CE (1333 acres) and Bear Paw timber sale (9 acres) are planned and/or partially implemented in the watershed and may affect water quality. The effects of these activities have been previously discussed under the "no action" alternative.

The potential nitrogen influence to Lake Creek was used to compare alternatives. The amount of nitrogen lost to streams is related to the amount of disturbance. Therefore, shelterwoods and small group harvest that will likely drain to Lake Creek have the most probable effect. This alternative will include 78 acres draining to Lake Creek. This proposed alternative together with other activities in the Watershed may add to the accumulative nutrient response in Lemolo Reservoir. However, nutrient release in response to the alternative will likely be small in scale and short in time compared to the potential outcome of a wildfire under a high-severity fire regime.

3.9.8 ALTERNATIVES 5

DIRECT AND INDIRECT EFFECTS

Road reconstruction and maintenance of 34.22 miles of road will produce a source of additional sediment where culverts are replaced, road surfaces are graded, and drainage ditches are cleared. These potential sediment sources will not likely persist beyond the first year and be most evident at the site scale. However, reconstruction and maintenance are projected to reduce chronic sources of sediment in the long term. Furthermore, the proposed road decommissioning and sub-soiling is targeted at roads and areas, which are the main anthropogenic (man-caused) sources of sediment and nutrients, and therefore, will ultimately, have a benefiting effect on the beneficial uses downstream.

The erosional effects of proposed activities, the role of riparian reserves, mitigative measures, and the scope of nutrient response have been discussed under Alternative 2.

CUMULATIVE EFFECTS

The Lemolo Fire Hazard Reduction CE (1033 acres) and Bear Paw timber sale (9 acres) are planned and/or partially implemented in the watershed and may affect water quality. The effects of the activities have been previously discussed under Alternative 2.

The potential nitrogen influence to Lake Creek was used to compare alternatives. The amount of nitrogen lost to streams is related to the amount of disturbance. Therefore, shelterwoods and small group harvest that will likely drain to Lake Creek have the most probable effect. This alternative will include 81 acres draining to Lake Creek. This proposed alternative together with other activities in the Watershed may add to the accumulative nutrient response in Lemolo Reservoir. However, nutrient release in response to the alternative will likely be small in scale and short in time compared to the potential outcome of a wildfire under a high-severity fire regime.

3.10 WATERSHED – STREAM MORPHOLOGY

3.10.2 AFFECTED ENVIRONMENT

Channel stability and fish habitat inventories have given insight into the erosional and channel morphological processes within headwater streams in the watershed (Diamond Lake/Lemolo Lake Watershed Analysis). Results 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, and minimal amounts of excessive stream bank erosion or deposition of fine sediment. However, 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.

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 (Diamond Lake/Lemolo Lake Watershed Analysis). These channels appear to be inherently stable due to the nature of the stream flow 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.

The pool/riffle ratio appears low (range: 2/98 – 16/84) for the different stream types in the watershed when compared to other streams in different watersheds, which have 2–5 times more pools (Umpqua Level II survey data). The low representation of pools is not likely a result of a deficit in large woody material. Large woody material across the watershed is moderately present with a frequency greater than 41 pieces per mile. 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. Therefore, riffles and glides tend to dominate the channels.

3.10.3 ENVIRONMENTAL EFFECTS

Environmental effects to stream channel morphology discusses the potential to alter channel function, stability, and fish habitat because of stream flow and/or sediment regime changes.

3.10.4 ALTERNATIVE 1 (NO ACTION)

DIRECT AND INDIRECT EFFECTS

No adverse direct or indirect effects or accelerated recovery of channel form are expected from this alternative, because peak flows and sediment delivery to stream channels will not be increased.

CUMULATIVE EFFECTS

PacifiCorp's operations are currently affecting stream channel morphology within and downstream of the watershed because of flow regulation. However, under the recent hydropower Settlement Agreement, PacifiCorp's operations will increase minimum in-stream flow in bypassed reaches in comparison to former operation, which includes the North Umpqua

River below Lemolo Reservoir. The increased minimum in-stream flow will improve summer rearing space.

No adverse cumulative impacts to channel morphology are expected from the combination of other projects planned in the Lemolo Lake Watershed because implementation of this alternative will not change the stream flow or sediment regime.

3.10.5 ALTERNATIVES 2, 3, 4, AND 5

DIRECT AND INDIRECT EFFECTS

The proposed reconstruction will temporarily produce a source of additional sediment for about one year. However, over the longer period chronic sediment sources will be reduced, which will provide improvement to the current sediment regime.

The sub-soiling of previously managed stands and road decommissioning that is equally proposed in all alternatives will help to restore soil productivity and improve water infiltration. These activities will reduce the amount of ditch flow, which could provide channel network extension and influence on stream flow response. Therefore, the proposed activities will help to trend toward improvement or maintain the stream flow and sediment regimes by reducing compacted surfaces, water concentration, ditch routing to channels, and associated fluvial erosion.

No adverse direct or indirect effects to channel form are expected because stream flow and sediment regimes will not be increased and Riparian Reserves will not be altered by these "action" alternatives.

CUMULATIVE EFFECTS

PacifiCorp's operations are currently affecting stream channel morphology within and downstream of the watershed because of flow regulation. However, under a recent hydropower Settlement Agreement, PacifiCorp's operations will increase minimum in-stream flow in bypassed reaches in comparison to former operation, which includes the North Umpqua River below Lemolo Reservoir. The increased minimum in-stream flow will improve summer rearing space.

No adverse impacts to channel morphology are expected in combination with other projects planned in the Lemolo Lake Watershed because implementation of the "action" alternatives will not change the stream flow or sediment regimes.

3.10.6 CONSISTENCY WITH AQUATIC CONSERVATION STRATEGY - ALL ALTERNATIVES

The evaluation of the 9-objectives for the Aquatic Conservation Strategy using the Matrix of Pathway and Indicators found that the effects of all the action alternatives will maintain all the aquatic indicators of measurement at current condition for the environmental baseline ("Analysis of Aquatic Conservation Strategy Objectives for the Lemolo Watershed Projects Environmental Impact Statement;" Appendix D). Habitat Access was the only indicator maintained at a "not properly functioning" condition. However, this evaluation is based on the Lemolo Dam preventing fish movement. Those indicators that will maintain an "at risk"

condition are sediment, nutrient/chemical contamination, pool frequency, pool quality, and stream bank condition. The sediment, pool frequency, pool quality, and stream bank condition indicators are noticeably influenced by the High Cascade geology and soils that define sensitive condition. The environmental baseline for nutrient/chemical contamination is influenced by the water quality listing of Lemolo Reservoir for pH and the porous nature of the project area soils that allow nutrient movement to the groundwater then surface water.

3.11 WILDLIFE - MANAGEMENT INDICATOR SPECIES

As part of the project planning process, the National Forest Management Act (NFMA) directs each forest to identify management indicator species (MIS), and to evaluate the project in terms of the effects it will have on the selected indicator species. The goal of project planning is to ensure the maintenance or improvement of habitat for these indicator species, while remaining consistent with the multiple-use objectives established by the Umpqua Forest Land and Resource Plan, as amended. Indicator species are selected as representatives of a particular habitat type. Indicator species may include threatened and endangered species, game species, or non-game species of special interest. The following MIS inhabit the Lemolo Analysis Area.

3.11.2 AFFECTED ENVIRONMENT - ROOSEVELT ELK (*Cervus elaphus*) AND BLACK- TAILED DEER (*Odocoileus emionus columbianus*)

Due to their high recreational value, elk and black-tailed deer are included as Forest Management Indicator Species. Although there are some differences in their habitat requirements, it is often accepted that meeting the habitat needs of elk will adequately meet the needs of deer. As noted in the Watershed Analysis conducted for the Diamond Lake/Lemolo Lake area, elk in this area are considered to be migratory. Due to the elevation of the analysis area it is considered to be summer range, with important migratory routes and calving areas. The migratory route to winter range within the analysis area appears to be from Windigo Pass into Kelsay Valley and then northward out of the analysis area to the Warm Springs basin. The affected environment for Roosevelt elk and black-tailed deer is the 62,330 acres in the Bradley Creek, Lemolo Reservoir, Thirsty Creek and Lake Creek 6th field sub watersheds.

Elk calving areas must have adequate amounts of forage, water and security to meet cow and calf needs. Wet meadow complexes and riparian zones are often such places. Within the analysis area, the riparian zones and meadows in Kelsay Valley, Lake Creek and wetlands associated with Lemolo Lake appear to be good calving habitat. Based on information contained in a GIS size class map, current Cover:Forage ratio for the affected environment is 81:9. This lumps both hiding and thermal stands as "cover," and reflects the large amount of the analysis area in which timber harvest is precluded (Oregon Cascades Recreation Area and Thielsen Wilderness) along with the naturally low amounts of open meadows.

3.11.3 ENVIRONMENTAL EFFECTS - ROOSEVELT ELK (*Cervus elaphus*) AND BLACK-TAILED DEER (*Odocoileus hemionus columbianus*) - ALTERNATIVE 1

DIRECT, INDIRECT AND CUMULATIVE EFFECTS

Alternative 1 retains all habitats in its current conditions, with no change to Cover: Forage ratios, identified migratory corridors or calving areas.

3.11.4 ALTERNATIVE 2

DIRECT AND INDIRECT EFFECTS

Shelterwood and seed tree harvest prescriptions will convert 448 acres of cover stands to forage stands. This increase in forage stands is not of a large enough scale to alter the Cover:Forage ratio, which remains at 91:9. Alternative 2 also contains shelterwood harvest units 7, 9, 12, 14 and 24 within the area described as the travel corridor. These units will remove some thermal and hiding cover, but as the Cover:Forage ratio displays, neither of these habitat components is in short supply. Even with these regeneration harvest units, the functionality of the travel corridor will remain intact. Alternative 2 has units 25, 29 and 30, which lie close to potential calving areas. Human disturbance may move cow bands to other available calving locations during periods of harvest activity. This is especially true at unit 25, which is located next to the Oregon Cascade Recreation Area. Unit 30 is planned for shelterwood harvest. Unit 30 will remove much of a thermal cover stand closest to a meadow area to the northwest, but also add a valuable foraging site. Unit 29 is planned as a commercial thinning. This will have less of an effect, but will also reduce the amount of thermal cover in a potential calving area. As the Cover:Forage ratio indicates, cover within the analysis area is not in short supply. This alternative also proposes 3.2 miles of new road construction and 11.0 miles of road decommissioning; a net decrease of 7.9 miles. It also includes 282 acres of prescribed burning and 264 acres of subsoiling. This decrease in road density, prescribed burning and subsoiling will also result in small improvements to Roosevelt elk habitat quality.

3.11.5 ALTERNATIVE 3

DIRECT AND INDIRECT EFFECTS

Shelterwood and seed tree harvest prescriptions will convert 172 acres of cover stands to forage stands. The increase in foraging areas, however, is not large enough to result in a change in the Cover:Forage ratio for the analysis area. As with Alternative 2, some thermal and hiding cover may be lost in the travel corridor but its functionality will remain intact. Calving habitat impacts are similar to those described in Alternative 2, with the sole exception that Alternative 3 does not include unit 30. This alternative also proposes 2.5 miles of new road construction and 11.0 miles of road decommissioning; a net decrease of 8.5 miles. It also includes 303 acres of prescribed burning and 264 acres of subsoiling. This decrease in road density, prescribed burning and subsoiling will also result in small improvements to Roosevelt elk habitat quality.

3.11.6 ALTERNATIVE 4

DIRECT AND INDIRECT EFFECTS

Shelterwood and seed tree harvest prescriptions will convert 254 acres of cover stands to forage stands. This increase in foraging area is not large enough to alter the existing Cover:Forage ratio. Only unit 12 is within the identified travel corridor. There is abundant cover along this route, and proposed shelterwood and seed tree harvest will have little impact to the functionality of the travel corridor. The impacts to identified calving habitat are the same as in Alternative 3. This alternative also proposes 3.0 miles of new road construction and 11.0 miles of road decommissioning; a net decrease of 8.0 miles. It also includes 303 acres of prescribed burning

and 264 acres of subsoiling. This decrease in road density, prescribed burning and subsoiling will also result in small improvements to Roosevelt elk habitat quality.

3.11.7 ALTERNATIVE 5

DIRECT AND INDIRECT EFFECTS

Shelterwood and seed tree harvest prescriptions will convert 245 acres of cover stands to forage stands. This will not alter the Cover:Forage ratio. It also contains units 7 and 12 that are within the identified travel corridor, but treatments of these units will not eliminate the functionality of the travel way. The impacts to identified calving habitat are the same as in Alternative 3. This alternative also proposes 3.0 miles of new road construction and 11.0 miles of road decommissioning; a net decrease of 8.0 miles. It also includes 303 acres of prescribed burning and 264 acres of subsoiling. This decrease in road density, prescribed burning and subsoiling will also result in small improvements to Roosevelt elk habitat quality.

3.11.8 ALTERNATIVES 1, 2, 3, 4 & 5

CUMULATIVE EFFECTS

Other ongoing or planned activities that could affect Cover:Forage ratios, travel corridor and calving habitat within the analysis area include Lemolo Fire Hazard Reduction activities, Gigawatt Timber Sale, Bearpaw Timber Sale, and pre-commercial thinning units. The ongoing Lemolo Fire Hazard Reduction activities and pre-commercial thinning units have the potential to reduce the amount of hiding cover stands. Gigawatt and Bearpaw Timber Sales will reduce the amount of thermal cover and increase forage habitat. These changes are not enough o alter the Cover: Forge ratio across the analysis area. None of these planned and ongoing projects, in combination with effects of these alternatives produce substantial impacts to elk and deer habitat elements.

3.11.9 AFFECTED ENVIRONMENT - PINE MARTEN (*Martes americana*)

The Forest Plan identifies pine marten as inhabitants of lodge pole pine and mountain hemlock forests. Currently within the analysis area 58,189 acres are classed within lodge pole pine and mountain hemlock forest series. Of this, 53,470 acres (92%) is considered to be mature forest that qualifies as suitable pine marten habitat. This mature forest defines the affected environment for this analysis.

3.11.10 ENVIRONMENTAL EFFECTS - PINE MARTEN (*Martes americana*) - ALTERNATIVES 1, 2, 3, 4&5

DIRECT AND INDIRECT EFFECTS

Alternative 1 will maintain all 53,470 acres of existing suitable pine marten habitat within the watershed.

Alternative 2 includes units 19, 29, 30 and 31 within large saw timber classed stands in lodge pole or mountain hemlock forests. Of these, only units 19 and 30 are planned for shelterwood harvest. Although shelterwood harvest will reduce the amount of available marten habitat by 27

acres, the net effect from these units is not great enough to alter the percentage of suitable marten habitat within the analysis area. Units 29 and 31 are group selection or thinnings that will reduce the quality of available habitat on an additional 71 acres.

Alternatives 3, 4 and 5 do not have any shelterwood or seed tree harvest in identified marten habitat, but all include units 29 and 31. These thinnings will reduce marten habitat quality immediately following treatment.

CUMULATIVE EFFECTS

Other ongoing and planned activities that may impact the amount of suitable marten habitat include the Lemolo Fire Hazard Reduction activities and Bearpaw Timber Sale. The Lemolo Fire Hazard Reduction activities are expected to result in a reduction of down wood material on 1432 acres. The Bearpaw Timber Sale has only a minor inclusion in the analysis area, resulting in the loss of 10 acres of suitable habitat. When combined with proposed activities in Alternatives 2 and 3, these activities result in 37 acres of lost habitat and 1,503 acres of degraded habitat quality within the analysis area. These effects would impact approximately 2% of the available habitat within the project area.

3.11.11 AFFECTED ENVIRONMENT - CAVITY NESTERS

Primary cavity-nesters are defined as an indicator species representing the snag and down log components of conifer forest habitat because they require snags for nesting, roosting and foraging. Primary cavity-nesters identified in Forest Plan Appendix B that may occur in the Lemolo Watershed Projects Analysis Area include the northern flicker (*Colaptes auratus*), red-breasted sapsucker (*Sphyrapicus ruber*), hairy woodpecker (*Picoides villosus*), downy woodpecker (*Picoides pubescens*), and pileated woodpecker (*Dryocopus pileatus*). For this assessment, the affected environment for cavity nesters is the set of sub watersheds where timber harvest, road construction, and fuels treatment activities are proposed. This includes the Bradley Creek, Lemolo Reservoir, Thirsty Creek and Lake Creek 6th field sub watersheds, encompassing 62,330 acres. Project activities may have potential impacts to cavity nesting populations both within treatment units and in adjacent forested environments.

Based on a limited number of snag surveys within the analysis area, managed stands have an average of 13 small snags (6-16 inches in diameter) per acre and 0.3 large snags (greater than 16 inches diameter) per acre. Unmanaged stands had an average of 18 small and 16 large snags per acre.[2]

3.11.12 ENVIRONMENTAL EFFECTS - CAVITY NESTERS

The LRMP, as amended has specific direction for managing down wood and snag habitat. In addition to this direction, past consultations with Fish and Wildlife Service have resulted in a list of "Project Design Features." One such feature is the retention of coarse woody debris in activity areas. This design feature calls for retention of 120' of down wood per acre in pieces at least 16 inches in diameter and at least 16 feet long.

[2] More detailed information on these species can be found in document entitled “Lemolo Watershed Projects Effects to Terrestrial Wildlife Species of Interest” in Appendix M.

Effects on pileated woodpeckers and primary cavity-nesters are based on implementation of management requirements and mitigation measures related to snags and down wood outlined in Chapter 2 under the "Soil" and "Wildlife and Botany" subheadings.

3.11.13 ALTERNATIVE 1 (NO ACTION)

Direct Effects

Alternative 1, the No Action alternative does not have any activities that will alter the availability of snags available as foraging and nesting sites.

3.11.14 ALTERNATIVE 2, 3, 4 & 5

Direct Effects

Alternatives 2, 3, 4, and 5 each contain timber harvest, road construction, and fuels reduction activities that are expected to impact short and long term snag and down wood levels. Inventories of previously treated units indicate that these activities result in the loss of total snag levels, with a higher percentage of impact to large diameter snags. The exact amount of snag habitat loss is hard to predict, but based on limited snag monitoring conducted in the analysis area, managed stands had a 74% reduction in large snags and a 27% reduction in small snags when compared to unmanaged stands. Although some loss of standing snags is expected in timber harvest units, project design features for all action alternatives include minimum snag levels that will retain snag levels sufficient to support 60% of potential populations. This potential loss of snag habitat can be expected across the 1,579 acres of timber harvest in Alternative 2, 636 acres in Alternative 3, 905 acres in Alternative 4 and 1,233 acres in Alternative 5. The natural fuels treatments units may also produce some changes to standing snag numbers. However, the treatment prescriptions are for relatively low intensity burning, so any loss of standing snags or recruitment of new snags from burn mortality is expected to be very low.

Cumulative Effects

Other ongoing or planned activities that may impact the amount of snags and down wood within the Lemolo Analysis Area are firewood collection, natural fuels reduction activities, and timber harvest operations. Firewood collection on the Umpqua National Forest requires a permit, and is generally restricted to certain areas. One of these designated firewood cutting areas is located along the Windigo Pass road. This policy offers some control over removal of snags and down wood by limiting firewood cutting to standing dead or down lodge pole pine. Changes to the existing firewood policy are not expected in the immediate future and past trends are expected to continue. These firewood cutting activities result in decreased snag and down wood levels along open roads. However, this designated firewood cutting area is located in a lodge pole pine area with abundant and ongoing tree mortality. Snag and down wood levels are high in most of this habitat. Natural fuels reduction activities can alter cavity nester habitat by reducing snag and down wood levels through piling and burning of brushpiles, or through underburning. Underburning may also result in the creation of future snag habitat when burning operations result in new tree mortality. The Lemolo Fire Hazard Reduction project is expected to result in fuel reductions on 1432 acres within the analysis area. Planned timber harvest in the area is limited to 20 acres of Gigawatt and Bearpaw units. When combined with proposed treatments in

action alternatives, these impacts to standing snag availability will occur on approximately 2% of the analysis area. Given the large amount of area with natural snag levels nearby (Oregon Cascades Recreational Area), this level of impact will not produce any substantial impact to overall snag habitat conditions throughout the watershed.

3.12 FEDERALLY LISTED ANIMAL SPECIES

3.12.2 AFFECTED ENVIRONMENT - NORTHERN BALD EAGLE (*Haliaeetus leucocephalus*)

The bald eagle is a raptor which preys largely upon fish and is most often associated with rivers or lakes. Primary habitat components include clean water with abundant populations of fish and large wolf perch trees and roost sites located nearby. Nest and roost trees are often the biggest trees available with stout limbs capable of supporting large nesting structures. Nest trees must also have suitable flight paths into the nest and offer good visibility of the surrounding terrain. On the Diamond Lake District bald eagles have been verified as occurring around Diamond Lake, Lemolo Lake and Toketee Lake. Proposed activities have the potential to affect only the Lemolo Lake bald eagles, so the affected environment for this analysis is defined as the area within ¼ mile of Lemolo Lake, the Lemolo Lake water body and the southerly aspects of Bunker Hill.

3.12.3 ENVIRONMENTAL EFFECTS- NORTHERN BALD EAGLE (*Haliaeetus leucocephalus*)

Bald eagles are summer residents of the Lemolo Lake area and both an active and alternate nest have been located in the Bunker Hill area north of Lemolo Lake. A site specific nest management plan for this nest has not yet been developed, so land management activities are guided by Land Management Prescription C3-II (Bald Eagle, Maintained) prepared for the Umpqua National Forest Land and Resource Management Plan, as amended. This Prescription directs that a 330 foot radius primary zone be established around both active and alternate nest trees. No harvest is permitted within this primary zone. A secondary zone extending from 330 feet to 660 feet from the nest tree is also established. Within this secondary zone harvest is restricted to no more than 10% of the area per decade. All mechanized activity in each zone is prohibited from January 1 through August 31 to allow an undisturbed nest site.

3.12.4 ALTERNATIVE 1 (NO ACTION)

Direct and Indirect Effects

Alternative 1 is the No Action alternative and will retain both the primary and secondary zones in their current condition. Alternative 1 will have "No Effect" to bald eagles or their habitat.

3.12.5 ALTERNATIVES 2, 3, 4 AND 5

Direct, Indirect and Cumulative Effects

Alternatives 2, 3, 4 and 5 all propose timber harvest, natural fuels treatments, road decommissioning, and subsoiling. All natural fuels treatments, road decommissioning and subsoiling would be located over 1 mile from the nest location. Given the eagle's acceptance of ongoing boating, camping, hiking, hunting and trail/road maintenance in the Lemolo Lake area

and the distance to the active eagle nest; the natural fuels, road decommissioning and subsoil activities are not expected to produce any adverse disturbance to nesting bald eagles.

Potential impacts of action alternatives are limited to disturbance associated with proposed timber harvest, yarding operations and post sale fuels treatments in proposed units 1-6 and unit 32. Alternative 2 includes all of these units, while Alternative 3 includes just unit 6. Alternative 4 includes units 1, 4 and 6 and Alternative 5 includes units 1, 3, 4 and 6. To address this potential impact, seasonal restrictions that prohibit helicopter logging operations and fuels treatment activities in units 1-6 and unit 32 from January 1 through August 31 each year have been incorporated into the management requirements for all action alternatives. Typically, when eagle nests at Lemolo Lake or Diamond Lake have been successful, the young have fledged well before the end of August. With this timing restriction in place, there are no anticipated effects to bald eagles from disturbance. This timing restriction may be lifted if monitoring indicates no nesting activity or a documented failure earlier in the season.

In all alternatives, no harvest will occur within the primary zone of either active or alternate nests and harvest will be limited in the secondary zone to 10% of the area per decade as directed in Forest Plan Prescription C3-II. Proposed harvest prescriptions on Bunker Hill around the nest locations include commercial thinning and group selections. No shelterwood or seed tree type harvests will occur within 2 miles of the nests. Proposed thinnings and group selections are intended to address the concerns for overstocked stands, stressed ponderosa pine over story trees, and increased risk for stand replacement fire or insect/disease events. Proposed harvest prescriptions will help maintain a healthy forest stand around the nest site and enhance long term sustainability of the site, as well as promote ponderosa pine, a species preferred as a nesting site. All action alternatives meet the Forest plan direction for managing bald eagle nest sites.

Proposed harvest and fuel treatment activities in Alternatives 2, 3, 4 and 5 “May Effect”, but are “Not Likely to Adversely Affect” bald eagle populations or recovery efforts. This reflects the analysis process as dictated by ESA Section 7 consultation guidelines.

3.12.6 AFFECTED ENVIRONMENT - NORTHERN SPOTTED OWL (*Strix occidentalis caurina*)

The northern spotted owl utilizes mature forests for both nesting and foraging and is considered to be an old growth obligate species. Land management activities to maintain adequate habitat for this species are guided by the Draft Recovery Plan for the Spotted Owl (USDI 1992) and the Northwest Forest Plan (NFP). Key elements in these conservation strategies are Late Successional Reserves (LSRs), designated Critical Habitat Units (CHUs) and buffer areas around spotted owl activity centers.

The following definitions were used to prepare this analysis:

Suitable Habitat - Nesting/roosting/foraging (NRF) habitat that is capable of supporting a reproductive pair of spotted owls. The location and extent of existing suitable habitat comes from Forest GIS mapping.

Dispersal Habitat - Forested areas which can support individuals as they disperse across the landscape, but lack the large diameter trees needed as nesting sites. These stands may provide for some foraging as well as roosting and protection from predators. Under 4,500 feet in elevation, stands with over stories averaging at least 11 inches in diameter and 40% canopy

closure qualify as dispersal habitat. Over 4,500 feet, stands with average over story sizes above 9 inches are considered dispersal habitat.

Unsuitable Habitat - Those areas which are capable of developing into either suitable or dispersal habitat but which do not currently meet the definition of either.

Proposed management activities may impact resident spotted owls through habitat modifications or disturbance. For this assessment, the affected environment is all of the 6,682 acres of suitable habitat and 4,936 acres of dispersal habitat within the Bradley Creek, Lemolo Reservoir, North Umpqua Headwaters, Thirsty Creek and Lake Creek 6th field sub watersheds.

More detailed information on these species can be found in Biological Assessment located in Appendix M.

3.12.7 ENVIRONMENTAL EFFECTS - NORTHERN SPOTTED OWL (*Strix occidentalis caurina*)

The northern spotted owl utilizes mature forests for both nesting and foraging and is considered to be an old growth obligate species. Land management activities to maintain adequate habitat for this species are guided by the Draft Recovery Plan for the Spotted Owl (USDI 1992) and the Northwest Forest Plan (NWFP). Key elements in these conservation strategies are Late Successional Reserves (LSRs), designated Critical Habitat Units (CHUs), and buffer areas around spotted owl activity centers. The proposed Alternatives were analyzed in relation to their effects on suitable nesting/roosting/foraging habitat, dispersal habitat, and disturbance. Habitat definitions can be found in Chapter 3, under the Affected Environment for the Northern Spotted Owl. These habitat types can be impacted in the following ways:

Habitat Removal - When a stand of suitable or dispersal habitat is converted to unsuitable habitat.

Habitat Degradation - When components of suitable or dispersal habitat are removed from a stand, but the stand is expected to continue to function in the same habitat classification.

Habitat Downgraded - When suitable habitat is altered sufficiently such that it is expected to function as dispersal habitat after treatment.[3]

DIRECT, INDIRECT, AND CUMULATIVE EFFECTS

Alternative 1 is the No Action alternative and retains spotted owl habitat. It also has no activities that would result in disturbance to suitable but un-surveyed habitat. Alternative 1 will have "No Effect" to CHU, suitable spotted owl habitat outside of CHU, and will have “No Effect” resulting from disturbance.

Action alternatives each have impacts to spotted owl habitat parameters. These are summarized in the tables below:

Table 10 - Alternative Effects to Spotted Owl Habitat From Proposed Timber Harvest

[3] More detailed information on these species can be found in Biological Assessment located in Appendix M.

Alternative	NRF* Removed (acres)	NRF Downgraded (acres)	NRF Degraded (acres)	Dispersal Removed (acres)	Dispersal Degraded (acres)
1	0	0	0	0	0
2	80	0	670	114	6
3	58	0	190	56	6
4	23	0	290	86	6
5	23	0	587	84	6

*NRF = suitable nesting/roosting/foraging habitat

Table 11 - Alternative Effects to Spotted Owls From Proposed Natural Fuels treatments

Alternative	NRF Removed (acres)	NRF Downgraded (acres)	NRF Degraded (acres)	Dispersal Removed (acres)	Dispersal Degraded (acres)
1	0	0	0	0	0
2	0	0	56	0	17
3	0	0	58	0	17
4	0	0	58	0	17
5	0	0	58	0	17

Table 12 - Combined Harvest and Natural Fuels Impacts to Spotted Owl Habitat

Alternative	NRF Removed (acres)	NRF Downgraded (acres)	NRF Degraded (acres)	Dispersal Removed (acres)	Dispersal Degraded (acres)
1	0	0	0	0	0
2	80	0	726	114	23
3	58	0	248	56	23
4	23	0	348	86	23
5	23	0	645	84	23

Alternatives 2, 3, 4 and 5 all propose timber harvest and natural fuels treatments that "May Effect" the amount and quality of spotted owl habitat outside of CHU. These alternatives all result in decreases to available spotted owl habitat and are "Likely to Adversely Affect" spotted owl habitat outside of designated recovery habitat.

Alternatives 2, 3, 4 and 5 all propose management activities with the potential of producing noise disturbance (chainsaws, loaders, helicopter yarding, bulldozers, etc.) to spotted owls. Each alternative incorporates prescribed project design criteria (Appendix M) for roadwork, subsoiling and harvest operations to minimize the impact of these activities upon nesting spotted owls. This seasonal restriction is not applied to prescribed burning operations because fuel moisture conditions needed to achieve the treatment objectives are most prevalent in the spring. Those disturbance activities conducted after July 15th "May Effect" spotted owls. When prescribed burning operations occur during the early reproductive season (March 1 through July 15) these disturbance activities are "Likely to Adversely Affect" spotted owls.

In the official Biological Opinion issued for the project, the US Fish and Wildlife Service concluded that although the project had adverse impacts to spotted owls, it will not jeopardize the long-term viability of the spotted owl population.

CUMULATIVE EFFECTS

Other ongoing and planned activities that could impact spotted owl habitat in the analysis area include timber sales, prescribed burning, and cinder pit use. Bearpaw, Gigawatt, and Electric Salvage Sale are located within the watershed and have been through consultation procedures with the U.S. Fish and Wildlife Service. The ongoing prescribed burning project near the North Umpqua Trail was determined to have no effect to spotted owl habitat. The Kelsay Point cinder pit is adjacent to a designated spotted owl core. Consultation for the Kelsay Point project was concluded with the Fish and Wildlife conclusion that the project was "Not Likely to Adversely Affect" spotted owls. The latest Biological Opinion from the U.S. Fish and Wildlife Service incorporated all of these activities within the project area and concluded that they would not jeopardize the long-term viability of the northern spotted owl.

3.13 FOREST SERVICE SENSITIVE WILDLIFE SPECIES

Of the 14 Sensitive wildlife species known or suspected to occur on the Diamond Lake District, the Lemolo analysis area has potential habitat for the nine species listed below.[4]

3.13.2 AFFECTED ENVIRONMENT - OREGON SPOTTED FROG (*Rana pretiosa*)

Although not verified as occurring within the analysis area, the area does contain riparian zones, wetlands and other bodies of water that provide suitable habitat for this species. The affected environment for this analysis includes riparian habitat in 6th level watersheds with proposed activities (Bradley Creek, Lemolo Reservoir, Thirsty Creek and Lake Creek).

3.13.3 ENVIRONMENTAL EFFECTS - OREGON SPOTTED FROG (*Rana pretiosa*)

The analysis area contains streams and riparian areas that are suitable habitat, although the species has never been documented on the Diamond Lake District. All alternatives include riparian zone buffers that are expected to maintain the primary habitat and reproductive areas of this species. Alternatives 1, 2, 3, 4 and 5 have no identified direct, indirect or cumulative effects and are all expected to have "no effect" to this species.

3.13.4 AFFECTED ENVIRONMENT - COMMON KINGSNAKE (*Lampropeltis getulus*)

The analysis area is at the upper elevation limit for this species. Riparian areas with thick vegetation are considered suitable habitat. The affected environment for this analysis includes riparian habitat in 6th level watersheds with proposed activities (Bradley Creek, Lemolo Reservoir, Thirsty Creek and Lake Creek).

[4] More detailed information on these species can be found in Biological Evaluation located in Appendix M.

3.13.5 ENVIRONMENTAL EFFECTS - COMMON KINGSNAKE (*Lampropeltis getulus*)

Portions of the analysis area fall within the elevational zone reported for this species, so the area is considered to be marginal, but potential habitat. The riparian areas reported as being favored habitat are protected by riparian buffers with each of the alternatives. Alternatives 1, 2, 3, 4 and 5 have no identified direct, indirect or cumulative effects and will have "no effect" to this species.

3.13.6 AFFECTED ENVIRONMENT - BUFFLEHEAD (*Bucephala albeola*)

Lemolo Reservoir is suitable habitat and is the affected environment. Use of this body of water is expected to be limited to times outside of the breeding season.

3.13.7 ENVIRONMENTAL EFFECTS - BUFFLEHEAD (*Bucephala albeola*)

Lemolo Reservoir is suitable habitat that is likely utilized during the non-breeding seasons. None of the proposed actions will alter the suitability of Lemolo Lake for this purpose. Alternatives 1, 2, 3, 4 and 5 have no identified direct, indirect or cumulative effects and will have "no effect" to this species.

3.13.8 AFFECTED ENVIRONMENT- PEREGRINE FALCON (*Falco peregrinus*)

Suitable nesting and foraging areas occur within the analysis area, but there are no records of nesting activity. Habitat use is expected to be limited to foraging from birds nesting in nearby locations. Peregrines potentially forage over all habitat types within the analysis area, so the entire Lemolo Analysis Area is considered to be the affected environment.

3.13.9 ENVIRONMENTAL EFFECTS - PEREGRINE FALCON (*Falco peregrinus*)

Cliffs suitable for peregrine falcon nesting are located in the higher elevations along the Cascade Crest, but no high potential sites are known to occur near proposed activity areas. None of the alternatives will preclude use by foraging peregrine falcons. Alternatives 1, 2, 3, 4, and 5 have no identified direct, indirect or cumulative effects and will have "no effect" to peregrine falcons.

3.13.10 AFFECTED ENVIRONMENT - HARLEQUIN DUCK (*Histronicus histronicus*)

Although not documented within the analysis area, the Oregon Department of Fish and Wildlife lists the North Umpqua River Basin above Roseburg as one of the main potential habitat areas within the state. This species prefers turbulent mountain streams and Lake Creek and the North Umpqua River in the analysis area are considered to be potential habitat. This potential habitat within the analysis area boundary is considered to be the affected environment.

3.13.11 ENVIRONMENTAL EFFECTS - HARLEQUIN DUCK (*Histronicus histronicus*)

The North Umpqua River in the project area is considered to be suitable habitat for harlequin ducks. However, all proposed projects are located far enough away from this area that no effects are anticipated. Alternatives 1, 2, 3, 4 and 5 have no identified direct, indirect or cumulative effects and will have "no effect" to this species.

3.13.12 AFFECTED ENVIRONMENT - PACIFIC SHREW (*Sorex pacificus cascadensis*)

This species has not been verified within the analysis area, although it has been recorded for the District on two of the experimental Demonstration of Ecosystem Management Options sites (DEMO). Suitable habitat is described as moist forests with down wood. Much of the analysis area meets this general description. For this analysis the affected environment includes moist forest habitat in 6th level watersheds with timber harvest and prescribed natural fuels reduction activities (Bradley Creek, Lemolo Reservoir, Thirsty Creek and Lake Creek).

3.13.13 ENVIRONMENTAL EFFECTS - PACIFIC SHREW (Sorex *pacificus cascadensis*)

The analysis area contains an abundance of moist wooded areas and is considered to be suitable habitat. The No Action alternative will retain all current habitat features. This alternative has no direct, indirect or cumulative impacts and will have "no effect" to the Pacific shrew.

DIRECT AND INDIRECT EFFECTS

Alternatives 2, 3, 4 and 5 each include activities that will result in some alterations in suitable habitat. Proposed timber harvest and natural fuels reduction activities are expected to reduce the quality of available habitat in treated areas. A summary of treated acreage for these project types is included below in Table 20.

Table 13 - Alternative Impacts to Potential Pacific Shrew Habitat

Alternative	Timber Harvest (acres)	Natural Fuels Treatment (acres)	Total Impacted (acres)
1	0	0	0
2	1,577	282	1859
3	636	303	939
4	903	303	1206
5	1,231	303	1534

These activities will result in decreases in down wood and degraded habitat conditions in treated areas. All action alternatives incorporate standards for retention of down wood. Although there may be some loss of down wood material, these retention levels are expected to provide enough down wood substrate for continuation of a viable population of pacific shrews within the project area. These direct negative impacts will be localized in timber harvest and prescribed burning units. Suitable habitat will still remain throughout much of the analysis area. Proposed treatment areas would result in some loss of down wood material on 1,534 acres or approximately 3% of the total acreage within the affected environment.

CUMULATIVE EFFECTS

Other ongoing and planned activities that could impact pacific shrew habitat in the analysis area include other planned and active timber sales, natural fuels reduction activities, and firewood collection. The Gigawatt, Bearpaw, and Electric Salvage Timber Sales are within the watershed. These timber sale areas total 144 acres within the watershed. Planned and occurring natural fuels reduction projects total an estimated 1432 acres. Identified firewood cutting areas in the analysis area total another 2,666 acres, although actual firewood collection is expected to occur

on much less than this acreage. These timber sales, natural fuels reduction activities and firewood collection areas total 4242 acres and will cause a loss of down wood material that produces good small mammal habitat.

These localized reductions in available habitat "may impact individuals but are not likely to cause a trend to federal listing or a loss of viability" for the Pacific shrew.

3.13.14 AFFECTED ENVIRONMENT PACIFIC - FRINGE-TAILED BAT (*Myotis thysanodes vespertinus*)

This bat species is a resident of caves and abandoned human structures. Although there are no known caves in the analysis area, there are some human structures that have limited potential as suitable habitat. These bats have been reported to occupy and forage in a diversity of habitats, so the entire analysis area is considered to be the affected environment.

3.13.15 ENVIRONMENTAL EFFECTS PACIFIC - FRINGE-TAILED BAT (*Myotis thysanodes vespertinus*)

The analysis area does not contain any known caves suitable for this species. The human structures that may provide roosting locations are not expected to be altered by any of the proposed actions. All alternatives have no identified direct indirect or cumulative impacts and will have "no effect" to the pacific fringe-tailed bat.

3.13.16 AFFECTED ENVIRONMENTAL - WOLVERINE (*Gulo gulo*)

This large carnivore can inhabit a wide variety of habitats, but large undisturbed areas free from human disturbance are preferred. The entire analysis area is considered to be potential habitat, with areas around the Oregon Cascade Recreation Area providing the highest quality secluded habitats. Although not verified, recent aerial surveys for wolverines have located potential tracks and denning sites in the Mount Thielsen area. Wolverines may use a variety of habitat types, and the entire analysis area is considered the affected environment.

3.13.17 ENVIRONMENTAL EFFECTS - WOLVERINE (*Gulo gulo*)

Alternative 1 is the No Action alternative and retains secluded areas and the forage base in their current conditions. Alternative 1 has no direct, indirect or cumulative impacts and will have "No effect" to wolverine.

DIRECT AND INDIRECT EFFECTS

Alternative 2, 3, 4 and 5 each have vegetative treatments, but none are of the extent where they are considered to affect the availability of a forage base. Alternative impacts are expected to be limited to changes in seclusion habitat availability. Each of the action alternatives proposes both additional road construction and road decommissioning. These are summarized below in Table 21.

Table 14 - Alternative Impacts to Wolverine Seclusion Habitat

Alternative	New Road (miles)	New Road Impacts to Seclusion Habitat (acres)	Road Decommissioning (miles)	Decommissioning impacts to Seclusion Habitat (increased acres)
1	0	0	0	0
2	3.5	0	10.7	1,124
3	2.8	0	10.7	1,124
4	3.3	0	10.7	1,124
5	3.3	0	10.7	1,124

All new road construction occurs within the area already influenced by existing roads, so the new construction in Alternatives 2, 3, 4 and 5 do not alter the amount of seclusion habitat available for wolverines. These same alternatives include 10.7 miles of road decommissioning. The only segment that will alter the amount of existing seclusion habitat is the decommissioning of the 4793-100 section at Wit's End. Decommissioning this segment will indirectly result in an increase of 1,124 acres of seclusion habitat.

Alternatives 2, 3, 4 & 5 maintain the wolverine forage base and result in improvements to the seclusion area. These alternatives are expected to have a "beneficial impact" to wolverine habitat conditions.

CUMULATIVE EFFECTS

Other planned or ongoing activities that can cumulatively influence the availability of a large ungulate forage base and seclusion habitat include prescribed burning, other road developments or decommissioning, and recreational use of back-country areas. Prescribed burning in the analysis area is expected to improve large ungulate habitat by improving grass and browse availability and palatability. Prescribed burn units, though, comprise a very small portion of the analysis area. The only other road development that is being planned in the area is a potential improvement to the Diamond Drive. While this is not expected to result in the loss of any seclusion area, it would likely mean an increase in annual traffic rates. Recreational use of backcountry areas has shown an increasing rate of use. This trend is expected to continue. Cumulatively, these projects and project alternatives do not produce habitat impacts of a scale that conflict with the objective of maintaining wolverine viability.

3.13.18 AFFECTED ENVIRONMENT - PACIFIC FISHER (*Martes pennanti*)

Fishers have been verified as occurring in the analysis area as recently as the winter of 1999-2000. Home ranges for fishers are approximately 5,000 acres, or about the average size of a 6th level watershed. The affected environment for this analysis is the 6th level watersheds (Bradley Creek, Lemolo Reservoir, Thirsty Creek and Lake Creek) with timber harvest and prescribed natural fuels activities. Forest structure mapping indicates there are currently 55,782 acres of mature forests (over 80 years of age) providing suitable habitat in these sub watersheds.

3.13.19 ENVIRONMENTAL EFFECTS - PACIFIC FISHER (*Martes pennanti*)

Alternative 1 is the No Action alternative and retains current habitat conditions. This alternative has no direct, indirect, or cumulative impacts and will have "no effect" to fishers.

DIRECT AND INDIRECT EFFECTS

Alternatives 2, 3, 4 and 5 each propose some changes in the availability of mature forest stands. These impacts are summarized in Table 22 below.

Table 15 - Alternative Impacts to Suitable Fisher Habitat

Alternative Number	Removed By Timber Harvest (acres)	Degraded by Timber Harvest (acres)	Degraded by Natural Fuels Treatment (acres)	Habitat Remaining (acres)	Percentage Impacted (%)
1	0	0	0	55,782	0
2	531	76	225	55,251	1
3	182	44	284	55,600	1
4	266	44	284	55,516	1
5	297	59	284	55,485	1

Shelterwood, group, and seed tree harvest prescriptions are considered to remove suitable fisher habitat, while commercial thinning and partial harvest are considered to degrade habitat conditions. Only habitat removed was deleted from the existing acreage when calculating the habitat remaining. Both removal and degraded habitat were summed to evaluate the percentage of habitat impacted. Alternatives 2, 3, 4, and 5 all have direct adverse impacts to the amount and quality of available fisher habitat. The scale of these impacts is minor in comparison to the amount of available habitat within the analysis area.

CUMULATIVE EFFECTS

Other identified ongoing activities that can influence the availability of mature forest suitable as fisher habitat include other timber sales and natural fuels treatment projects. The Gigawatt and Bearpaw Timber Sales propose 20 acres of harvest in the area. The Electric Salvage Sale occurs along major roadways and is not considered to impact potential fisher habitat. The ongoing Lemolo Fuels Reduction project may result in some loss of habitat quality on 1432 acres in the watershed. Cumulatively, these activities together with proposed alternative activities do not produce habitat impacts of a scale that conflict with the objective of maintaining Pacific fisher viability.

Alternatives 2, 3, 4 and 5 "may impact individuals but are not likely to cause a trend to federal listing or a loss of viability" for the Pacific fisher.

3.14 SURVEY AND MANAGE SPECIES

The ROD recently amended (Feb 2001) by the Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines, implements surveys and various management of known

sites for late-successional and old-growth forest related species. Surveys were conducted in the Lemolo Analysis Area for lichens, bryophytes (moss and liverworts), and fungi that are listed Survey and Manage species and have a pre-disturbance survey requirement.

3.14.1 AFFECTED ENVIRONMENT - CRATER LAKE TIGHTCOIL (*Pristiloma articum crateris*)

The survey protocol for this species in place prior to 2003 described suitable habitat for Pristiloma articum crateris as being coniferous forests above 2000 feet in elevation, east of Interstate 5. Key habitat features were identified as mosses and other vegetation near wetlands springs and seeps. There are a great many acres of coniferous forests meeting these requirements in the analysis area. Surveys according to this protocol were conducted in all suitable habitat activity areas during 1999, 2000 and 2001. These surveys found no *Pristiloma articum* crateris in any of the proposed activity areas; however other survey efforts did locate a single population within the project area. This population occurs within a very small seep area (less than 1 acre) located near proposed fuels unit 70. This occupied Pristiloma habitat is the affected environment.

3.14.2 ENVIRONMENTAL EFFECTS - CRATER LAKE TIGHTCOIL (*Pristiloma articum crateris*) - ALTERNATIVE 1, 2, 3, 4 & 5

DIRECT AND INDIRECT EFFECTS

Alternatives 1, 2, 3, 4 and 5 propose no activities within occupied Pristiloma articum crateris habitat and therefore will have no direct effects. Natural Fuels Unit 70 is located a short distance from a known Pristiloma articum crateris population located near Crystal Spring. The only identified potential indirect effect would be vegetation modification large enough to substantially modify water discharge at Crystal Springs. The proposed management activities in all 5 alternatives were reviewed with a hydrologist, and none of the alternatives were considered as likely to produce such significant hydrologic or habitat impacts.

CUMULATIVE EFFECTS

Other ongoing and planned activities which may cumulatively impact the occupied Pristiloma articum crateris habitat are dispersed camping, road maintenance activities and the Diamond Drive Reconstruction project. Access barricades have recently been installed at a nearby dispersed camping site, which is believed to produce beneficial impacts to the occupied habitat. Road maintenance activities are expected to continue as in the past, so no adverse cumulative impacts are expected fro these kinds of activities. The Diamond Drive Reconstruction project has identified the need for site protection of the area, and has been altered to meet the needs of continued species persistence on the site. None of these activities are expected to have adverse cumulative impact to the site.

3.14.3 AFFECTED ENVIRONMENT - GREAT GREY OWL (*Strix nebulosa*)

Great gray owls are large raptors most often associated with edges of meadows, riparian zones and openings. They have also been documented to forage in created openings including clear cuts and heavily thinned forest stands. Suitable habitat within the analysis area occurs near the riparian and meadow areas associated with the North Umpqua, Spring River, and Lemolo Reservoir. Owl calling, using established protocol (1996, 1997 &1998), has resulted in positive

responses from great gray owls within the analysis area, but no documented nest sites have yet been determined. Great gray owls are considered to be resident and reproducing in the project area. The lack of documented nest locations is considered to be related to this species' secretive nature and unreliability in responding to calling techniques. Land management direction which is applicable to these areas include Forest wide Wildlife/TES standard #8 (p.IV-37) which directs that active raptor nests be protected until fledging or nesting is complete, Land Management Prescriptions C5-1& 3 relating to Wildlife Unique Habitats, and riparian zone management direction contained in the Northwest Forest Plan. In Flammulated, Boreal, and Great Gray Owls in the United States: A Technical Conservation Assessment (1994), Duncan and Hayward cite the two principle factors which appear to limit great gray owl populations as the availability of suitable nest sites and suitable abundance of small mammals as a forage base. The affected environments are the 6th field sub-watersheds with suitable habitat and proposed timber harvest, subsoiling or fuels activities (Bradley Creek, Lemolo Reservoir, Thirsty Creek and Lake Creek).

3.14.4 ENVIRONMENTAL EFFECTS- GREAT GREY OWL (*Strix nebulosa*) - ALTERNATIVE 1 (NO ACTION)

DIRECT AND INDIRECT EFFECTS

Alternative 1, the No Action alternative, has no effect to the availability of nesting sites or the small mammal forage base. This alternative retains great gray owl habitat in its current status.

3.14.5 ALTERNATIVE 2, 3, 4 & 5

DIRECT AND INDIRECT EFFECTS

Great gray owls forage primarily within natural and created openings, and prefer to nest nearby these foraging areas. Suitable foraging sites are located throughout the lower elevations of the analysis area, but are concentrated in the riparian areas around Lake Creek, Kelsay Valley and the North Umpqua River. Other suitable foraging areas were created by recent shelterwood and clear-cut harvests. Great gray owls prefer to nest within 500 meters of these foraging sites. Almost all of the proposed activities fall within the 500 meter distance to these potential foraging areas. Proposed shelterwood, seed tree, and group harvests within mature (over 80 year old) stands would remove potential nesting habitat stand canopy closures below the 60% desired by great gray owls. These units would result in the conversion of potential nesting habitat into potential foraging habitat. For Alternative 2 this conversion would total 504 acres, for Alternative 3 it would total 161 acres, for Alternative 4 it would total 245 acres and for Alternative 5 it would total 276 acres. Sufficient potential nesting sites will still be retained with each of these action alternatives and none of these alternatives are expected to have an adverse impact to great gray owls within the analysis area.

Alternatives 2, 3, 4, and 5 also include natural fuels reduction and subsoiling treatments. Each of these has some potential to reduce down wood or ground level vegetation that may influence small mammal populations. The natural fuels treatments are expected to reduce down wood material. Such an impact is expected to have an adverse impact to total small mammal populations, but would also make treatment areas more available for foraging great gray owls. 282 acres are proposed for fuels treatments in Alternative 2, and 303 acres are proposed for treatment in Alternatives 3, 4, and 5. Subsoiling treatments are expected to result in an

immediate reduction in ground cover. Following subsoiling, increased tree stocking rates will likely reduce the quality of these areas as foraging sites for great gray owls in the long term. Alternatives 2, 3, 4, and 5 all propose 264 acres of subsoiling treatments.

CUMULATIVE EFFECTS

Other ongoing or planned activities that could affect great gray foraging or nesting habitat within the analysis area include other timber sales and fuels reduction projects. Other planned or ongoing timber sales in the area include Gigawatt, Bearpaw and Electric Salvage. Gigawatt and Bearpaw total 20 acres within the analysis area, and would also convert potential nesting habitat to foraging habitat. Electric Salvage is not considered to be suitable great gray owl habitat. The Lemolo Natural Fuels Reduction project is also expected to impact an additional 1432 acres of habitat with some reduction to down wood material. When combined, these activities still represent less than 7% of the total area within 500 meters of potential foraging habitat.

3.14.6 AFFECTED ENVIRONMENT - WHITE-HEADED WOODPECKER (*Picoides albolarvatus*), BLACK-BACKED WOODPECKER (*Picoides tridactylus*), PYGMY NUTHATCH (*Sitta pygmaea*)

These 3 species of cavity excavators were included in the Northwest Forest Plan ROD with snag retention guidelines designed to enhance viability. For ponderosa pine and Douglas-fir habitat, inhabited by white-headed woodpeckers and pygmy nuthatches, 0.6 snags per acre will be retained with the minimum size being 15 inches dbh. Both white-headed and black-backed woodpeckers have been documented to occur on the Diamond Lake District.

Black-backed woodpeckers are residents of lodge pole pine forests or mixed conifer forests with a lodge pole pine component at elevations at or above 4,500 feet. Some information indicates black-backed woodpeckers respond favorably after large-scale catastrophic events (such as wildfires or large-scale insect epidemics) which create large amounts of down wood or dying trees. The Northwest Forest Plan directs that land management activities retain sufficient down wood and snag habitat to retain 100% of potential populations. This level is established in the Northwest Forest Plan ROD to be .12 snags per acre of trees at least 17 inches in diameter (or largest available if 17 inch trees are not available).

The affected environment for this analysis are those 6th level sub watersheds (Bradley Creek, Lemolo Reservoir, Thirsty Creek and Lake Creek) with potential habitat for white-headed woodpeckers, black-backed woodpeckers or pygmy nuthatch, where potential snag habitat altering activities (timber harvest, natural fuels treatments, road closures) are proposed. Information on snag habitat availability within the analysis area is sparse, but the information available indicates that within managed stands, snags between 6 and 16 inches average 13 per acre and snags greater than 16 inches average 0.3 per acre. In unmanaged stands, snags 6-16 inches average 18 per acre and snags greater than 16 inches average 1.0 per acre.

3.14.7 AFFECTED ENVIRONMENT - FLAMMULATED OWL (*Otus flammeolus*)

Flammulated owls usually inhabit forests of large ponderosa pine stands. The Northwest Forest Plan ROD concluded that snag retention guidelines established for woodpeckers (white-headed) would adequately provide nesting habitat for Flammulated owls, a secondary cavity nester.

Although open stands of large ponderosa pines favored by this species are not abundant on the Diamond Lake District, these birds have been documented within the immediate vicinity of the analysis area in high elevation lodge pole pine and mixed conifer forest. Much of the analysis area fits this description. The 55,782 acres of mature (80 plus years old) forest within 6th field sub watersheds with timber harvest or fuels treatments (Bradley Creek, Lemolo Reservoir, Thirsty Creek and Lake Creek) are considered to be the affected environment.

3.14.8 ENVIRONMENTAL EFFECTS - ALTERNATIVE 1, 2, 3, 4 & 5

DIRECT, INDIRECT, AND CUMULATIVE EFFECTS

These species were included as Survey and Manage species in the Northwest Forest Plan to ensure retention of adequate snag habitat to provide nesting sites for 100% of potential populations. One hundred percent potential population translates to 0.12 snags/acre for Black-backed woodpeckers and 0.6 snags/acre for white-headed woodpeckers. All alternatives will meet Forest Plan Standards and Guidelines for retention of snag habitat for these two woodpecker species and maintain 100% of potential populations within harvest and fuel treatment units. This is based on the management requirements and mitigating measures that deal with snag retention and recruitment, outlined in Chapter 2. There are no published snag per acre guidelines for Flammulated owls or pygmy nuthatches. The Forest Plan assumes that the Standards and Guidelines for cavity nesters, black-backed woodpeckers, and white-headed woodpeckers will provide for the needs of Flammulated owls and pygmy nuthatches. The effect to these cavity-nesting species is the same as described earlier in the document for "cavity nesters".

3.14.9 AFFECTED ENVIRONMENT - RED TREE VOLE (*Arborimus longicaudus*)

Red tree voles are small mammals, which spend almost all of their time within tree canopies of Douglas-fir stands. Although they have been documented as occurring within sapling stands, the highest densities are in large limbed old growth. The Biology and Interim Survey Protocol for the species suggests it was included as a survey and manage species owing to its low dispersal distance and a concern for its ability to travel between late successional reserves. Potential habitat is defined by survey protocol to be coniferous forests with Douglas-fir below 6,000 feet of elevation. The 51,033 acres of over 80 year old stands below 6,000 feet in elevation are considered to be the affected environment.

As part of the project planning process, the National Forest Management Act (NFMA) directs each forest to identify management indicator species, and to evaluate the project in terms of the effects it will have on the selected indicator species. The goal of project planning is to ensure the maintenance or improvement of habitat for these indicator species, while remaining consistent with the multiple-use objectives established by the Umpqua Forest Land and Resource Plan, as amended. Indicator species are selected as representatives of a particular habitat type. Indicator species may include threatened and endangered species, game species, or non-game species of special interest.

3.14.10 ENVIRONMENTAL EFFECTS - RED TREE VOLE (*Arborimus longicaudus*)

Surveys for red tree voles were conducted according to protocol during 2000 and 2001. These surveys did not locate any active red tree vole nests within proposed habitat disturbing areas.

3.14.11 ALTERNATIVE 1, 2, 3, 4 & 5

DIRECT AND INDIRECT EFFECTS

Alternatives 1, 2, 3, 4 and 5 are expected to have no direct, indirect or cumulative effects to red tree voles.

CUMULATIVE EFFECTS

There are no other known red tree vole populations in the analysis area, and no cumulative effects with other ongoing or planned projects in the area are anticipated.

3.14.12 AFFECTED ENVIRONMENT - TRITOMARIA EXSECTIFORMIS

This is a species of liverwort currently listed as a category B species. This category considers rare species and calls for management of all known sites and strategic surveys. This is a very rare species with only 14 known sites on forest service lands within the Pacific Northwest. Most sites are known from around the crest of the Cascades on the Deschutes and Umpqua forests, while a few new sites have been located on the Wenatchee National Forest. Three sites were found within the Lemolo Analysis Area near springs, including Battery spring, Crystal springs and Spring River. The species occurs on moist rotting logs and hummocks on the edge of these clear cold springs. The affected environment for this species is defined as the area within or adjacent to known sites including timber sale unit 40 and fuel reduction unit 75. A scale encompassing the range of the Northern Spotted Owl is also considered.

3.14.13 ENVIRONMENTAL EFFECTS - TRITOMARIA EXSECTIFORMIS

ALTERNATIVE 1 (NO ACTION)

This alternative does not propose harvesting unit 40 or treating unit 75 for fuel reduction, therefore there will not be any negative direct, indirect, or cumulative effects to this species under this alternative.

3.14.14 ALTERNATIVE 2, 3, 4 AND 5

DIRECT EFFECTS

No direct effects will occur to this species due to the implementation of the mitigation measures stated for this species in Chapter Two. Alternatives 2 through 5 will implement these mitigation measures for unit 75. Mitigation measures include a 300 foot no entry riparian buffer on the spring where this species was found during surveys. However, there is a low risk of prescribed burning getting out of control and running through the riparian areas where this species is found. If this happens, it is likely that negative direct effects will occur to this species through the loss of populations by fire consumption and/or burning snags and trees falling on the liverwort population.

INDIRECT EFFECTS

Alternatives 2 and 5, but not 3 and 4, include harvest unit 40, proposed for shelterwood harvest. There may be indirect effects to this species under alternative 2 or 5 within Battery Springs from increased infiltration and possibly erosion processes caused by the harvest of unit 40. At this point it is uncertain to say whether negative indirect affects will occur, but they may occur due to increased water volume in Battery Springs from reduced transpiration in unit 40.

Under alternatives 2, 3, 4 and 5 there is a potential for indirect effects from prescribed burning if the burn encroaches on the 300 foot buffer. Alterations in canopy cover and microclimatic conditions from fire burning live trees or hummocks in the riparian would impact this species. The assumption is that this will not occur due to the mitigation measures being implemented.

CUMULATIVE EFFECTS

Cumulative effects to Survey and Manage species should be looked at based on the NWFP and its guidelines for maintaining persistence of a given species across the range of the Northern Spotted Owl. There are currently 14 known sites of this species within the NWFP area according to the ISMS database. The Standard and Guideline mitigation measures of the ROD were put in place to minimize cumulative effects to Survey and Manage species, given that administrative units follow the guidelines. In addition this species receives protection under the Aquatic Conservation Strategy through riparian buffers. Following these guidelines allows us to protect the known sites in Battery Springs, Crystal Springs and Spring River and maintains persistence of the species. This in turn with the other known protected sites across the NWFP area mitigates' against cumulative effects to this species.

3.14.15 AFFECTED ENVIRONMENT – CLADONIA NORVEGICA

This is a species of lichen currently listed as a category B species. This category considers rare species and calls for management of all known sites and strategic surveys. This lichen is considered quite rare at this point but is assumed to be under collected due to its difficulty in field identification. Little is known about its habitat parameters or distribution. It was discovered in a montaine mixed coniferous forest in proposed timber harvest unit number 22. The scale of the affected environment for this species is the harvest unit in which it was found. A larger scale encompassing the range of the Northern Spotted Owl is also considered.

3.14.16 ENVIRONMENTAL EFFECTS – CLADONIA NORVEGICA - ALTERNATIVE 1 (NO ACTION), 3, 4, AND 5

DIRECT, INDIRECT AND CUMULATIVE EFFECTS

These alternatives do not propose unit 22 for harvest or fuel treatment, therefore there will not be any negative direct, indirect, or cumulative effects to this species.

3.14.17 ALTERNATIVE 2

DIRECT AND INDIRECT EFFECTS

No direct or indirect effects will occur to this species due to the implementation of the mitigation measures stated for this species in Chapter Two. Alternative 2 will implement these mitigation measures within unit 22. Mitigation measures include a 100 foot radius buffer adjacent to primary forest suitable for species dispersal and retention of class 3-5 downed woody material. Indirect effects such as micro-climatic change, substrate loss, and other environmental negative effects are not expected due to mitigation. This assumption is based upon information from papers by Chen, Franklin and Spies on the effects forest edge has on vegetation,(Chen, Franklin, Spies, 1992 & 1993)

CUMULATIVE EFFECTS

Cumulative effects to Survey and Manage species should be looked at based on the NWFP and its guidelines for maintaining persistence of a given species across the range of the Northern Spotted Owl. There are currently 26 known sites of this species within the NWFP area according to the ISMS database. The Standard and Guideline mitigation measures of the ROD were put in place to minimize cumulative effects to Survey and Manage species given that administrative units follow the guidelines. Following the guidelines allows us to protect the known site in unit 22 and maintains persistence of the species. This in turn with the other known protected sites across the NWFP area mitigates' against cumulative effects to this species.

3.14.18 AFFECTED ENVIRONMENT – RAMARIA RUBRIEVANESCENS

This is a species of fungus currently listed as a category B species. This category considers rare species and calls for management of all known sites and strategic surveys. This is a corral fungus, which has been collected from numerous sites on our district since beginning fungi surveys in fall 1999. Two sites were found incidentally while surveying for lichens and bryophytes. One in proposed timber harvest unit 25 and one in unit 11. This is a mycorrhizal forming species occurring in drier Douglas Fir (Psuedotsuga menziesii), Mt. Hemlock (Tsuga mertensiana), Western White Pine (Pinus monticola) and Shasta Red Fir (Abies magnifica var. shastensis) coniferous forest types. The scale at which this species is analyzed for affected environment is site specific within the harvest units it was found in. A scale encompassing the range of the Northern Spotted Owl is also considered.

3.14.19 ENVIRONMENTAL EFFECTS - ALTERNATIVE 1 (NO ACTION)

DIRECT, INDIRECT AND CUMULATIVE EFFECTS

This alternative does not propose units 11 or 25 for harvest or fuel treatment, therefore there will not be any negative direct, indirect, or cumulative effects to this species.

3.14.20 ALTERNATIVE 2, 3, 4 AND 5

DIRECT AND INDIRECT EFFECTS

No direct or indirect effects will occur to this species due to the implementation of the mitigation measures stated for this species in Chapter Two. Alternatives 2, 3, 4, and 5 will implement these mitigation measures within units 11 and 25. Mitigation measures include a 100 foot radius buffer adjacent to primary forest suitable for species dispersal and retention of class 3-5 downed woody material. Indirect effects such as micro-climatic change, substrate loss, and other environmental negative effects are not expected due to mitigation. This assumption is based upon information from papers by Chen, Franklin and Spies on the effects forest edge has on vegetation, (Chen, Franklin, Spies, 1992 & 1993).

CUMULATIVE EFFECTS

Cumulative effects to Survey and Manage species should be looked at based on the NWFP and its guidelines for maintaining persistence of a given species across the range of the Northern Spotted Owl. There are currently 50 known sites of this species within the NWFP area according to the ISMS database. The Standard and Guideline mitigation measures of the ROD were put in place to minimize cumulative effects to Survey and Manage species, given that administrative units follow the guidelines. Following the guidelines allows us to protect the known site in units 11 and 25 and maintains persistence of the species. This in turn with the other known protected sites across the NWFP area mitigates' against cumulative effects to this species.

3.15 THREATENED, ENDANGERED, AND SENSITIVE PLANT SPECIES

3.15.1 AFFECTED ENVIRONMENT

There are no Endangered and one Threatened plant species on the Umpqua National Forest, *Lupinus sulphureus ssp. kincaidii* or Kincaids Lupine. Kincaids Lupine is a Willamette Valley endemic of low elevation Oak Savannah ecotypes, disjunct on the Tiller Ranger District. No suitable habitat exists within this analysis area for this species. Sensitive plants were surveyed for within the entire Lemolo Analysis Area and none were located. For more information see the attached Biological Evaluation (BE) in Appendix A.

3.15.2 ENVIRONMENTAL EFFECTS

Since there are not any known Threatened, Endangered or Sensitive plant sites within the analysis area a determination of "No Effect" can be made.[5]

3.16 RARE PLANT SPECIES

The National Forest Management Act (NFMA) makes reference to the need to conserve native species diversity based on an analysis area scale. The analysis area is considered the area covered by the Umpqua National Forest Land and Resource Management Plan (LRMP). Three botanical species occur within the Lemolo Analysis Area that are considered rare on lands

[5] A detailed description can be found in the Biological Evaluation in Appendix A.

managed by the Umpqua National Forest. Persistence of these species is analyzed at the site-specific scale because so little information is known or documented about their habitat across the landscape.

3.16.1 AFFECTED ENVIRONMENT - BUXBAUMIA APHYLLA

This moss is being reported for the first time on the Umpqua Forest and was found within proposed timber harvest unit 28. This species is currently listed in the Oregon Natural Heritage Program (ONHP) as a category 3, which states there is inadequate information at the current time to consider it locally endangered or imperiled. The species appears to be restricted to upper elevation dry montane forests along the crest of the Cascades. This species was analyzed at the site-specific scale only. Proposed timber harvest unit 28 defines the affected environment.

3.16.2 ENVIRONMENTAL EFFECTS - BUXBAUMIA APHYLLA - ALTERNATIVE 1 (NO ACTION)

There would be "no direct, indirect or cumulative impact" to any rare plant species under this alternative.

3.16.3 ALTERNATIVES 2, 3, 4 AND 5

DIRECT EFFECTS

No direct effects are expected to this species because of the mitigation measures that are being implemented as stated in the Best Management Practices in chapter 2. Mitigation measures include protecting the site with a 100 ft. radius no entry buffer.

INDIRECT EFFECTS

No indirect effects will occur to this species since the buffers should provide for persistence.

CUMULATIVE EFFECTS

A site specific scale is considered to gage cumulative effects to this species. This is because so little information exists about this organism's biology and ecology. Currently only 5 known sites of this moss occur on the Umpqua National Forest. Past and present projects in this watershed have had no impacts on the current sites. The site in unit 28 of LPA will be protected as stated earlier. This site represents the affected environment of this species and will not see cumulative effects as it is anticipated it will persist after the harvest is completed.

3.16.4 AFFECTED ENVIRONMENT - PELTIGERA HYDROTHYRIA (SYN.=*Hydrothyria venosa*) (GREEN PHOTOMORPH)

This aquatic lichen was discovered growing in a perennial stream within the riparian buffer adjacent to natural fuels reduction unit number 74. This species was once considered rare and listed in the original ROD as a category 1 & 3 species. It has since been removed due to numerous new localities and its obligation to perennial streams, leaving it protected by riparian buffers. The reason for listing it here is because the specimen found is unique from typical specimens in thallus and vein color. The specimen collected was at first thought to be a new species or variety to science. After in depth genetic analysis and opinions from experts in the

field, the specimen has been considered a photomorph of the typical species. It is not considered a separate species at this time. This species was analyzed at the site-specific scale. The affected environment is the 300 foot riparian area adjacent to natural fuels reduction unit number 74.

3.16.5 ENVIRONMENTAL EFFECTS - PELTIGERA HYDROTHYRIA (SYN.=*Hydrothyria venosa*) (*Green Photomorph*)

DIRECT AND INDIRECT EFFECTS

No direct effects will occur to this species due to the implementation of the mitigation measures for unit 74, stated for this species in Chapter Two. Mitigation measures include a 300 foot riparian buffer on the spring where this species was found during surveys and no prescribed burning within the buffer. However, there is a low risk of prescribed burning getting out of control and running through the riparian areas where this species is found. If this happens, it is likely that negative direct effects will occur to this species through the loss of populations by fire consumption and/or burning snags and trees falling on the lichen population. It is unknown if the population would persist and re-colonize the area after burning.

CUMULATIVE EFFECTS

The scale used to determine cumulative effects to this lichen species are based on the affected environment, which is the 300 foot riparian buffer. Due to the fact that very little information is available about this species habitat and biology it is difficult to gage cumulative effects to the species across the landscape. Culminations of past and present projects in this watershed have not thus far affected this site. Therefore affects from past disturbance coupled with the proposed treatment are not expected to lead to cumulative effects, as the mitigation stated in chapter 2 will adequately protect this site.

3.16.6 AFFECTED ENVIRONMENT - *Asarum wagneri* (GREEN FLOWERED GINGER)

This vascular plant was found in units 50, 53, 63 and 64 within the Pumice Flats area of the analysis area. This species was recently removed in the latest update of the Region 6 Threatened, Endangered and Sensitive species list. However as it stands right now there are only a dozen or so known sites on the Umpqua National forest and it is still considered a rare aspect of the Umpquas flora. This species occupies open forested areas often consisting of Lodge pole Pine (*Pinus contorta var. latifolia*) but can also be found in moist meadow areas where Lodge pole Pine is the dominant tree species. Proposed units 50, 53, 63 and 64 define the affected environment.

3.16.7 ENVIRONMENTAL EFFECTS - *Asarum wagneri* (GREEN FLOWERED GINGER)

DIRECT EFFECTS

Although mitigation measures will be implemented, some direct effects will still occur to this species. This is due to the fact that the units it occurs in will be seed tree harvested. Because the plant is growing throughout the units not all sites will be covered by the leave group mitigation measure stated in chapter 2. Direct effects to this species include trampling, covering with slash, and other impacts associated with routine logging operations. Units 50, 53, 63 and 64 are

involved. These populations of Green Flowered Ginger may persist after harvest, as this species is known to be associated with disturbance regimes such as frequent fire.

INDIRECT EFFECTS

Indirect effects may occur to some parts of these populations through changes in habitat conditions from increased light and humidity levels. Although this species can tolerate certain levels of disturbance there is a threshold. Extreme changes in canopy cover will lead to drier conditions allowing direct sunlight to burn or scorch plants especially from mid July through August. The sites in units 50, 53, 63 and 64 will see loss of individuals but it is probable that the populations as a whole will survive especially with the implementation of the mitigation measures.

CUMULATIVE EFFECTS

Currently there are about a dozen or more known sites of this species on the Umpqua National Forest. These sites are protected from extirpation and are only susceptible to loss through natural wildland fire. Past and present projects have not and will not affect these sites. The sites within units 50, 53, 63 and 64 will be impacted but not to the extent that the species, as it stands on the UNF, will see significant cumulative effects to its populations.

3.17 NOXIOUS WEEDS

3.17.1 AFFECTED ENVIRONMENT

The scope of analysis considered for noxious weeds is the area known as the Lemolo Analysis area (LAA). Four noxious weed species have been documented within the LAA. St. Johnswort (Hypericum perforatum) is a perennial non-native from Europe that is well established on the Diamond Lake Ranger District. It occupies many roadsides, landings and other bare ground areas within the analysis area. Only limited treatment through manual means is occurring at this time on the Diamond Lake Ranger District. Spotted Knapweed (*Centaurea maculosa*), an Eurasian introduced plant, is perennial and very aggressive. Currently this plant is in very limited numbers within Douglas County and is a high priority for extirpation from the county. Only one site has been documented in the analysis area. Herbicide treatment for this species is currently being analyzed through a separate NEPA process. Scotch Broom (*Cystisus scoparius*) is a perennial native to Western Europe, which has established itself very well in lower valleys of Oregon. This analysis area is not optimum for Scotch Broom to disperse because of the high elevation, porous soils and low temperatures for much of the year. Medusa head Rye (*Taeinatherum caput-medusae*) has been found sporadically across the planning area. This grass species has invaded large areas of land in the Great Basin east of the Cascades but has not yet firmly established itself here in the west Cascades. In general the harsh edaphic factors keep the number of any non-native plants to a minimum within this analysis area when compared to other watersheds on the Diamond Lake Ranger District.

3.17.2 ENVIRONMENTAL EFFECTS - NOXIOUS WEEDS

As stated in the Affected Environment chapter it is difficult for noxious weed's to establish in this particular physiographic region. This is due to harsh climatic variation, porous pumice soils and a heavy persistent snow-pack. As evidenced by the lack of weeds found during surveys, this

area even though a recreational hot spot, is not considered an area at risk from noxious weeds. The exception however is Spotted Knapweed, which has established itself very well in Northern Idaho and Northwestern Montana in similar type conditions as the Lemolo Analysis Area.

3.17.3 ALTERNATIVE 1 (NO ACTION)

Under Alternative 1 (No Action), there will be no direct, indirect or cumulative impacts from this project to the spread of noxious weeds within the analysis area. Noxious weeds would continue to spread at the current rate.

3.17.4 ALTERNATIVE 2, 3, 4 & 5

DIRECT EFFECTS

Direct effects to the spread of the noxious weeds listed in the affected environment chapter are minimal to none with the exception of St. Johnswort and Medusahead Rye. Known populations of St. Johnswort and Medusahead Rye have been found within areas proposed for mechanical activity. There is high likelihood that actions relating to this project will contribute to the spread of these two species in the immediate areas of disturbance. Most of these areas are along road corridors and old landings and other fallow ground areas. No sites were found within proposed harvest or fuel treatment units. However it is likely that these species will spread into harvest and fuel units after the canopy is more open and bare ground is available for colonization. Mitigation will include noxious weed treatment post activity for up to five years.

INDIRECT EFFECTS

Indirect affects such as catalyzing seed dispersal, opening new fallow ground, and disturbing existing seedbeds are likely. This project may cause indirect effects, which may lead to increased noxious weeds in the analysis area, especially of Medusahead Rye and St. Johnswort. It is likely that these two species will colonize and, over time, replace existing native plant communities. However mitigation measures in the BMP sections of each alternative will be implemented in order to alleviate as much noxious weed spread as possible.

CUMULATIVE EFFECTS

At the analysis area scale this project is not expected to increase noxious weeds to a level where a cumulative impact would be detrimental to the watershed. There is potential if Spotted Knapweed were further dispersed through this project to cause negative cumulative affects within the entire watershed but sufficient measures will be in place to hold this possibility to a minimum.

Other actions within this watershed include Lemolo Fire Hazard Reduction, Electric Salvage timber sale, pre-commercial thinning, Bearpaw timber sale and Gigawatt timber sale. All these actions have potential to spread noxious weeds however it is difficult to assess the outcome and affects of potential weed spread. Cumulatively these projects in conjunction with the Lemolo PA will see increased noxious weed infestation and spread. However, none of the high priority species are expected to increase in population size from these actions.

3.18 TRANSPORTATION

ROAD USERS

Current users of the 136.45 miles of system roads within the analysis area are primarily grouped into three categories, administrative, commercial and recreation as denoted in the Road Management Objectives (RMOs). Administrative users are typically Forest Service employees acting in and official capacity, such as contract inspectors, timber sale administrators, law enforcement officers, etc., conducting day-to-day work activities. Commercial users are usually thought of as other than government employees conducting daily commerce activities (delivering goods and services) in, adjacent to, or out of the National Forests. Forest transportation systems can be thought of as a link in the over-all chain of existing transportation systems available to the public within the State of Oregon. Recreation users are typically people who use the Forest transportation system to access and use trails, trailheads, campsites, interpretive sites, heritage sites, waterways, dams, docks, boat ramps etc.

ROADS ANALYSIS PROCESS

In January 2002, the Forest Service outlined details of the agency's final Road management Policy. The policy relies upon scientific analysis and public involvement at the local level. It is designed to help the Forest Service determine how best to manage at the local level. It is designed to help the Forest Service determine how to best manage the more than 380,000 miles of roads in the National Forest roads system. A six-step analysis process was developed and documented in August 1999 (Miscellaneous Report FS-643).

The six-step Roads Analysis process is outlined in the 1999 USDA publication titled Roads Analysis: Informing Decisions about Managing the National Forest Transportation System. (Misc. Report FS-643, Everest, et.al.) The Watershed-Level Roads Analysis for the Lemolo Lake 5th filed watershed is located in Appendix K of this document. The chapters in this report follow the six steps for ease of understanding.

3.18.1 AFFECTED ENVIRONMENT

The Lemolo Analysis Area contains 136 miles of roads and 67 miles of summer trails. Roads by maintenance level and road numbers within the LAA are displayed in Table 24, under the no action alternative, and represent the current condition. The affected environment for Transportation is the entire Lemolo 5th level watershed.

3.18.2 AFFECTED ENVIRONMENT - ROAD DENSITY AND ROAD DECOMMISSIONING

Roads can have numerous impacts to other natural resource values. The density of roads is often used as an indicator and expressed in terms of miles (of road) per square mile of area; miles/sq. mile.

Road density was analyzed using GIS road data and software. Road density is displayed as average miles per square mile of road. Road density is calculated by taking the total analysis area road miles, divided by sub-watershed area acres, and converted into miles per square mile.

Road decommissioning/obliteration; means to un-build, deactivate, or dismantle a road; the denial of use; elimination of travelway functionality, and removal of the road from the Forest development Road system; return of the road corridor to resource production by natural or

designed means ('Guide for Road Closure and Obliteration In The Forest Service', Technology and Development Program, 7700 Engineering, June 1996).

The goals of road decommissioning are to improve watershed health by closing roads to vehicular traffic and reducing impacts to wildlife. "Improving watershed health is accomplished by improving road drainage through re-establishing drainage patterns thus reducing the long-term damage to soil, water and wildlife, and by stabilizing roadway cut and fill slopes by planting with native vegetation.' (FY 2000 budget Justification Paper, USDA-Forest Service, pages 232-233).

3.18.3 Environmental Effects - Impacts to Transportation Systems, Road Density

The Forest Plan sets an upper limit on inventoried aquifer lands of 5 percent of the land area in roads, or 5.3 miles of road per square mile. There are 136.45 miles of road in the Lemolo Watershed Projects analysis area. This equates to a density of 1.14 miles per square mile in the entire 5th Level Watershed. Excluding the wilderness and OCRA land allocations within the watershed, the density is 3.03 miles per square mile. This density is lower than the surrounding watersheds.

Table 23 lists the road densities by 6th Level Sub-watershed within the Lemolo 5th Level Watershed.

Table 16 - Road Density by 6th Level Sub-watershed

6th Level Sub-watershed	Acres	Square Miles	Road Miles	Road Density Mi/Sq Mi
Bradley Creek	11,600	18.13	19.36	1.07
Calamut Lake	11,960	18.68	55.70	2.98
Lake Creek	23,610	36.89	43.25	1.17
N. Umpqua Hdwtrs	14,370	22.45	0	0
Thirsty Creek	15,360	24.00	18.14	0.76
Totals	76,900	120.16	136.45	1.14

3.18.4 Alternative 1 (No Action)

This alternative proposes no new road construction, no decommissioning, and therefore does not change the current road density.

3.18.5 Alternatives 2, 3, 4 and 5

Alternative 2 will construct 3.17 miles of new road. There will be 6.73 miles of road decommissioning using KV funds and 3.84 miles of decommissioning with other funds when they become available. A total of 51.29 miles of road reconstruction/maintenance will occur. Road density within the analysis area (Lemolo 5th Level Watershed) will be reduced from a current road density of 1.14 miles of road per square mile to 1.05 miles of road per square mile.

Alternative 3 will construct 2.46 miles of new road. There will be 0.28 miles of road decommissioning using KV funds and 9.76 miles of decommissioning with other funds when they become available. A total of 19.55 miles of road reconstruction/maintenance will occur.

Road density within the analysis area (Lemolo 5th Level Watershed) will be reduced from a current road density of 1.14 miles of road per square mile to 1.05 miles of road per square mile.

Alternative 4 will construct 2.97 miles of new road. There will be 2.14 miles of road decommissioning using KV funds and 7.96 miles of decommissioning with other funds when they become available. A total of 19.37 miles of road reconstruction/maintenance will occur. Road density within the analysis area (Lemolo 5th Level Watershed) will be reduced from a current road density of 1.14 miles of road per square mile to 1.08 miles of road per square mile.

Alternative 5 will construct 2.95 miles of new road. There will be 2.29 miles of road decommissioning using KV funds and 7.96 miles of decommissioning with other funds when the become available. A total of 38.10 miles of road reconstruction/maintenance will occur. Road density within the analysis area (Lemolo 5th Level Watershed) will be reduced from a current road density of 1.14 miles of road per square mile to 1.08 miles of road per square mile.

3.18.6 AFFECTED ENVIRONMENT - ROAD MAINTENANCE LEVELS

Maintenance Levels (ML) defines the level of service provided by, and maintenance required for a specific road, consistent with road management objectives and maintenance criteria (FSF 7709.58, Forest transportation Systems Maintenance Handbook, and 6-95). Briefly stated:

- Maintenance Level 1 is assigned to intermittent service roads during the time they are closed to vehicular traffic, the closure period is typically one year or longer. Basic custodial maintenance is performed.

- Maintenance Level 2 is assigned to roads open for use by high clearance vehicles. Passenger car traffic is not a consideration

- Maintenance Level 3 is assigned to roads open and maintained for travel by a prudent driver, in a standard passenger car. User comfort and convenience are not considered to be priorities.

- Maintenance Level 4 is assigned to roads that provide a moderate degree of user comfort and convenience at moderate travel speeds.

- Maintenance Level 5 is assigned to roads that provide a high degree of user comfort and convenience at moderate travel speeds.

Within the Lemolo Analysis Area there are 136 miles of roads comprised of the following maintenance levels:

- Maintenance level 1 roads, totaling 55.92 miles (41%)

- Maintenance level 2 roads, totaling 34.03 miles (25%)

- Maintenance level 3 roads, totaling 22.56 miles (16.5%)

- Maintenance level 4 roads, totaling 1.38 miles (1%)

- Maintenance level 5 roads, totaling 22.56 miles (16.5%)

3.18.7 ENVIRONMENTAL EFFECTS – ROAD MAINTENANCE

Prior to 1990, road maintenance in the watershed was accomplished using several sources of funds and people. Timber sale purchasers performed most of the maintenance on level 1, 2 and 3 roads, while contributing funds towards maintaining the paved and high use roads. PacifiCorp, then known as Pacific Power and Light, contributed towards the maintenance of joint-use roads and performed the maintenance on their exclusive use roads. The Forest Service funded a road maintenance crew through appropriations and collections to perform the maintenance on multiple use roads.

When timber harvest declined in the 1990's, purchaser road maintenance and contributed funds also declined sharply. At the same time, appropriated road maintenance funds declined, forcing shrinkage of the district road crew size and capability. Currently, the District shares one road grader with two other Districts, alternating months of availability. Annual road maintenance is limited primarily to level 3, 4, and 5 roads, which are part of the primary road system identified in the Forest's Access and Travel Management Plan.

3.18.8 ALTERNATIVES 1 (NO ACTION)

While alternative 1 proposes no additional new road construction, it also does not propose to decommission any existing system roads. The current condition will therefore persist. Currently, it is estimated that 73 miles of maintenance Level 1 and 2 roads are not being fully maintained within the analysis area and are in an accumulated deferred maintenance status. When comparing maintenance costs of roads with the same groups of road maintenance activities (roadway and surfacing, vegetation, drainage, structures, and signs and traffic control) typically, maintenance costs are greater as the maintenance level number increases; ML roads more costly than ML 3. Table 24 shows total miles of road maintenance by maintenance level that would occur in each alternative. Alternative 1lists total miles of maintenance level roads that exist in the analysis area.

Table 17 - Resultant Road Maintenance Levels by Alternative (Total Miles)

	Alternative 1 (Current Condition)	Alternative 2	Alternative 3	Alternative 4	Alternative 5
ML 1	55.92	15.63	6.44	7.05	8.91
ML 2	34.03	14.97	6.24	8.88	9.23
ML 3	22.56	21.14	6.65	7.86	16.94
ML 4	1.38	-0-	-0-	-0-	-0-
ML 5	22.56	-0-	-0-	-0-	-0-
TOTAL	136.45	51.74	19.33	23.79	35.08

3.18.9 ALTERNATIVES 2, 3, 4, AND 5

Alternatives with the greatest increase in new system road construction would cause a slight increase in overall maintenance activities over the long term. Alternative 2, 3, 4 and 5 would increase system road miles only with ML 1 roads. The miles of ML 2, ML 3, ML 4 and ML 5 would not change under these alternatives.

ML 1 roads typically are closed, and have the least maintenance costs of all roads, since only basic custodial maintenance is performed on these roads when in a closed status. Closed status occurs when entrance closures are installed and no vehicular traffic is allowed. When open, these roads accommodate high-clearance vehicles with a single purpose, typically commercial haul of forest products. When ML 1 roads are operational, their ML status goes to a ML 2, requiring the user to perform appropriate maintenance work prior to use, commensurate to a ML 2 rating.

Overall, the miles of road to be maintained, for Alternatives 2, 3, 4 and 5, would decrease from the current condition, due to road decommissioning. The difference between alternatives is the ML 1 roads being proposed for new construction (and subsequently part of the permanent road system requiring maintenance).

3.18.10 AFFECTED ENVIRONMENT - APPENDIX "C" ROAD LESS AREAS

Road less area management became a national issue in 1972 when the Forest Service initiated a review of certain areas of National Forest System Lands (NFSL) greater than 5,000 acres to determine their suitability for inclusion in the National Wilderness Preservation System. This planning process was called Road less Area Review and Evaluation (RARE). This initial process (sometimes referred to as RARE I) identified lands meeting certain criteria for wilderness lands. The affected environment for Appendix "C" Road less Areas is the 2,644 acre Mt. Bailey and 2,301 acre Thirsty Appendage Road less Areas.

3.18.11 ENVIRONMENTAL EFFECTS - APPENDIX "C" ROAD LESS AREAS

Two Road less Areas (Thirsty Appendage and Mt Bailey) located in or partially in the Lemolo analysis area, were identified during the 1980 RARE II review process. Thirsty Appendage is located entirely within the Lemolo Lake analysis area and Mt Bailey is partially located within the analysis area. There are no activities proposed in these Road less Areas. Therefore, there is no effect to Inventoried Road less Areas in all alternatives, as defined by Appendix C of the Forest Plan, as amended.

3.19 HERITAGE RESOURCES

3.19.1 AFFECTED ENVIRONMENT

The affected environment for the heritage resource falls within the areas of proposed ground disturbing activities (timber harvest and associated activities; road construction, reconstruction, and decommissioning; subsoiling; natural fuels treatment; and helicopter landing construction). Heritage resources include pre-historic and historic sites and features. Appropriate heritage resource surveys were conducted within the Lemolo Watershed Projects analysis area. No properties potentially eligible for the National Register of Historic Places are within the areas of ground disturbing activities.

Previous cultural studies completed on the Diamond Lake Ranger District included portions of the Lemolo Analysis area. These studies included consultation with the Confederated Tribes of the Grand Ronde Community, Confederated Tribes of Siletz and Cow Creek Band of the Umpqua Tribe of Indians regarding traditional cultural properties. No traditional cultural properties were identified through consultation with the tribes.

3.19.2 ENVIRONMENTAL EFFECTS - ALTERNATIVES 1 (NO ACTION)

DIRECT EFFECTS

There would be no direct effect on heritage resources.

INDIRECT AND CUMULATIVE EFFECTS

The no action alternative may lead to damage to historic properties due to the risk of high intensity fire occurrence under the current fire regime.

3.19.3 ALTERNATIVES 2, 3, 4, & 5

DIRECT EFFECTS

Proposed ground disturbing activities will have little potential to affect heritage resources. Standard contract provisions will provide for protection of heritage resources discovered during project implementation.

INDIRECT EFFECTS

Proposed ground disturbing activities will have little potential to affect heritage resources outside of the area of the proposed project impact or implementation time frame. Project implementation may reduce the potential of damage to historic properties due to the reduced risk of high intensity fire occurrence.

CUMULATIVE EFFECTS

There are other activities planned or occurring within the Lemolo Analysis Area boundary that have the potential to impact heritage resources; they are the Gigawatt Timber Sale, Electric Salvage, Bearpaw Timber Sale, and Lemolo Fuels Reduction. These projects received review for heritage resources as part of the NEPA process and it was determined the ground disturbing activity had little potential to effect heritage resources.

Potential effects from ongoing operation and maintenance of Lemolo Lake Lodge and/or PacifiCorp's hydroelectric facilities, and ongoing recreation uses will not create cumulative effects on heritage resources with the additional activity associated with Lemolo Analysis area's proposed projects.

3.20 LOCAL COMMUNITIES AND ECONOMICS

3.20.1 AFFECTED ENVIRONMENT

Most timber sales from the Umpqua National Forest and Diamond Lake District are purchased and operated by individuals and companies based in Douglas County. Therefore, the affected environment for this analysis is Douglas County, Oregon.

Timber and wood products businesses employ a large percentage of Douglas County's workforce. The Oregon Labor Market Information System (OLMIS) displays forestry and wood products manufacturing as 17.7% of the county's employment in 2000. During the past 25 years more economic diversification has occurred, and employment in the wood products and logging sectors has declined (Stevenson 2001). The average wage paid in these sectors, however, is much less than the timber and wood products average wage (see Table 26). Average earnings per job has dropped from $31,080 in 1970 to $25,724 in 2000 in Douglas County (Sonoran 2003).

Total mill capacity in Douglas County stands at 760 mmbf/year (Ragon 2003). Recently, local mills have increased imports from Canada and travel further for raw log supply. In addition, two mills have closed within the last 3 years with a capacity of 283,000 cubic meters, or about 18.3 mmbf (Spelter 2002). Reduction in timber available from Federal land is given as one factor for these actions.

Despite the trend of declining timber production, Douglas County continues to rely on the lumber and wood products industry as a major component of its economic health. About a third of the overall industrial output in 1999 was related to the timber and wood products sectors, according to the economic impact analysis data in Appendix C.

Recreation in the watershed is concentrated around Lemolo Lake and the developed campgrounds. Four developed campgrounds with 94 campsites around Lemolo Lake average $31,000 in direct revenue per year. The total use is estimated at about 1/3 of capacity and these sites are filled to capacity about two days per year. Information from surveys done in the 1990's show about 25% of recreation visitors to the Lemolo Lake area are from Douglas County, with another 40% from southwest Oregon (Evans 1998).

A 2000-2001 study of recreation on the Umpqua National Forest by Robert Burns of the University of Florida asked questions about spending in relation to recreation on the Forest. According to the study, people spend the most for private lodging, transportation and food. For respondents to the survey who reported spending some money on recreation during a typical year, the average was $2,055 (in 2001 dollars). Diamond Lake visitors spent significantly more on average than visitors to the rest of the Forest: $2,385 per year (Burns 2002).

Natural resource economists have, in recent years, have begun to focus on another aspect of resource management, which sees ecosystems as essential components of the planetary life support system and have attempted to quantify these functions under the general term "ecosystem services." Direct relationships and clear principles of accounting for such things are only beginning to be developed. The goal, however, is to understand the true value of the standing timber as a form of "natural capital", the biological structures that provide these critical services (Hawken et al. 1999). Ecosystem services in the Lemolo watershed may include:

- Purification of air and water

- Mitigation of droughts and floods
- Generation and preservation of soils and renewal of their fertility
- Detoxification and decomposition of wastes
- Pollination of natural vegetation
- Cycling and movement of nutrients
- Maintenance of some level of biodiversity
- Protection of stream channels and banks from erosion during high water
- Protection from the sun's harmful ultraviolet rays
- Moderation of local weather patterns and their impacts
- Provision of aesthetic beauty and intellectual stimulation that lift the human spirit

(Adapted from G. Daily et al., Ecosystem Services: Benefits Supplied to Human Societies by Natural Ecosystems, ESA: Issues in Ecology)

Many of these are global sorts of concerns, such that changes that might occur in the overall picture from actions at this scale would be of marginal value, sometimes approaching zero. At the same time, some are clearly location dependent - e.g., timber stands that maintain stream channel integrity. This complicates the choice of scale for analysis. The watershed scale is the smallest that would be meaningful for most of these resources. Where the scale is different, it is described in Chapter 4.

3.20.2 ENVIRONMENTAL EFFECTS

Activities associated with the Proposed Action and alternatives would generate various economic costs and benefits. The economic analysis in Appendix C describes the methods, sources of data and results of cost/benefit and economic impact analysis.

DIRECT, INDIRECT, AND CUMULATIVE EFFECTS

Cost/Benefit Analysis

Table 26 contains a summary and comparison of the costs and benefits associated directly with the timber harvest and sale area improvements proposed by each alternative.[6]

Following the columns for Alternatives 3, 4, and 5 in Table 25, are columns that give the percentage change from the corresponding value for Alternative 2, for ease of comparison. For

[6] The complete table with specific costs is in Appendix C.

example, the total volume for Alternative 3 is 68.7% less than in Alternative 2. Alternatives 4 and 5 show a 54.2 % and 25.9% reduction in volume from Alternative 2, respectively.

The standard criterion for deciding whether a government program can be justified on economic principles is net present value (NPV) – the discounted monetary value of expected net benefits (OMB A-94). The results of the analysis show that NPV is correlated positively and proportionally with the amount of timber volume harvested. Alternative 2 has the highest NPV and Alternative 3 the lowest. A sensitivity analysis for discount rate in the Economic Analysis Report in Appendix C shows very little change in NPV due to changes in the discount rate used.

Table 18 – Value Change Between Alternatives

	Alt 2	**Alt 3**	**Percent Change From Alt 2**	**Alt 4**	**Percent Change From Alt 2**	**Alt 5**	**Percent Change From Alt 2**
Timber Volume (MBF)	27,735	8,670	-68.7	12,697	-54.2	20,550	-25.9
Acres Harvested	1,577	636	-59.7	905	-42.6	1,231	-21.9
Volume (MBF)/Acre	17.6	13.6		14.0		16.7	
Total NP Benefits							
Gross Benefit	$11,480,371	$3,469,179	-69.8	$5,116,438	-55.4	$8,532,548	-25.7
Value/MBF	$414	$400	-3.4	$403	-2.6	$415	+0.3
Value/Acre	$7,280	$5,395	-25.9	$5,814	-20.1	$6,931	-4.8
Total NP Costs							
Total Cost	$6,442,032	$1,700,642	-73.6	$2,691,567	-58.2	$4,856,507	-24.6
Cost/MBF	$232	$196	-15.5	$212	-8.9	$236	+1.4
Cost/Acre	$4,085	$2,6,45	-35.2	$3,059	-25.1	$3,945	-3.4
Net Present Value	$5,038,339	$1,768,537	-64.9	$2,424,871	-51.9	$3,676,041	-27.1
NPV/MBF	$182	$204	+12.7	$191	+5.4	$179	-1.2
NPV/Acre	$3,195	$2,750	-14.0	$2,755	-13.8	$2,986	-6.6
Stumpage	$6,873,433	$2,352,785	-65.8	$3,154,923	-54.1	$4,912,380	-28.6
Return to the Treasury	$5,683,524	$1,986,775	-65.1	$2,732,495	-52.0	$4,152,031	-27.0
B/C Ratio	1.78	2.04	+14.6	1.90	+6.7	1.76	-1.1

Cost/benefit ratio is not correlated with total volume harvested, but is positively correlated with NPV per thousand board feet (MBF). This means that C/B is dependant on the relative differences in value/MBF and cost/MBF by alternative. The primary components of value are species and diameter (grade) of timber. These alternatives show average non-discounted delivered log values that range from $482.17 to $500.33, less than 4% difference. Logging systems are the largest cost center and clearly dominate the cost differences, with helicopter

logging by far the most expensive. Alternatives 2 and 5 have substantial amounts of helicopter logging (31% and 32%, respectively), and show the lowest C/B ratios.

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.

Economic Impact Analysis

An economic impact analysis was done to describe the effects of each alternative on employment and income in the affected environment. In past periods of non-declining, even-flow of timber from federal land, an individual timber sale may not have significantly changed the overall economic activity of the county, since the total assigned sale quantity (ASQ) would be sold each year. The conditions today and into the foreseeable future are not the same. The Umpqua has not sold a consistent level of volume, or levels approaching the potential sale quantity (PSQ) in the Forest Plan since 1990. Therefore, new timber sales can be treated as an actual increase in the raw material available for local industry, allowing an increase in production up to the full level of mill capacity.

Table 26 displays the results of the economic impact analysis by alternative. In general, the increase in saw log volume to the local economy would result in increased employment in the logging and wood products manufacturing sectors, indirect increases in forestry (slash treatment, planting, etc.) and induced increases in many other sectors. The taxes paid to Federal, State, and local governments would also increase.

Other direct, indirect, and induced benefits derive from road construction, reconstruction, decommissioning and other sale area improvement work funded by KV. These work activities are treated as costs in the benefit/cost analysis since they reduce the revenue to the 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 26.

The numbers in Table 26 are not intended to be absolute. The analysis should be used to compare the relative differences of the 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 2002). The percentage of value assigned to saw log and veneer production is 75% and 25%, respectively, based on the 1998 data.

Table 19 - Economic Impact Analysis

	Alt 2	**Alt 3**	**Alt 4**	**Alt 5**
% of County Mill Capacity	3.7%	1.1%	1.7%	2.7%

Change in Total Output	+$15,537,700	+$4,659,200	+$7,000,700	+$11,623,300
Change in Employment	+166	+52	+75	+123
Change in Labor Income	+$4,363,200	+$1,326,200	+$1,974,900	+$3,262,100
Change in Proprietor Income	+$895,200	+$298,400	+$407,300	+$649,900
Change in Other Property Income	+$2,048,500	+$591,200	+$918,800	+$1,529,600
Change in Indirect Business Taxes	+$372,900	+$113,200	+$167,900	+$277,100
Change in Value Added	+$7,679,700	+$2,329,000	+$3,469,000	+$5,718,700

No-Action Alternative 1 is not shown in the table since by definition; it does not change the conditions or level of economic activity in the county. This alternative would, however, contribute to the decline in the local timber industry, since it would keep federal timber from the market. No attempt was made to quantify the impact.

All values displayed in Table 26 are positively correlated with NPV and the total amount of volume harvested. Alternative 2 would provide the most positive impact to the local economy, and Alternative 3 would provide the least positive impact, except for Alternative 1.

Impacts to the local economy from changes in recreation due to each alternative are difficult to quantify. Negative economic impacts from logging, slash disposal, and sale area improvement projects on these activities would occur if the noise, dust, smoke, and road congestion cause people to leave the area or stay home and not recreate. Burns reported that 55% of the visitors to the Umpqua would have gone somewhere else to pursue their recreational activity if, for some reason, it was not available on the Umpqua and 11% would have stayed home (Burns 2002). This indicates there would be some shift in use during logging and other activities, probably proportional to the proximity of the nuisance to camping, hiking, and viewing areas.

Recreation that involves solitude, such as backpacking in wilderness areas, may be negatively impacted in the short run by noise, dust, etc., and in the long run by visual changes. The Umpqua study shows 33% of the recreationists engage in wilderness area recreation (Burns 2002). Since harvest activity does not occur in wilderness, any effects are peripheral and in the background. Without surveying users before, during and after logging activities, no real estimate of the impact in the Lemolo area is possible.

Other recreational activities such as hunting and berry picking would increase as logging occurs, due to the increase in early seral vegetation that provides suitable conditions. Helicopter logging is often a novelty in a particular area as well, providing an interesting opportunity to watch logs flying.

Due to the high uncertainty of effects, the impacts of all recreation changes must be estimated and bracketed by a sensitivity analysis. The following assumptions are made:

11% reduction in direct recreation during the time of sale operations close to Lemolo developed campgrounds. This assumption is based on the Burns study indicating some people would stay home and not recreate on the Umpqua. This does not indicate a reduction in Lemolo Lake Resort use.

<u>Proportional Decrease in Yearly Recreation Spending in Douglas County.</u>

25% of Lemolo Lake area recreationists are from Douglas County.

Potential increases in spending due to hunting and berry picking would be estimated by the lower bound of sensitivity analysis: 50% of the effect, or 5.5% reduction in total use. This means that reductions in camping fees and other spending would be partially offset by increases in hunting and berry picking.

Decreases due to loss of scenic value and solitude are estimated by the upper bound of sensitivity analysis: 150% of the effect, or 16.5% reduction in use. This represents a worst-case scenario.

Table 27 displays the results of the analysis of recreational economic effects due to reductions in use by alternative. The numbers shown are combined direct loss of revenue (camping fees) and reduced yearly spending on recreation. These are total yearly numbers and would be felt during the years of sale operation.

Table 20 - Recreation Spending Impacts

	Alt 2	Alt 3	Alt 4	Alt 5
5.5% Reduction	$1,594	$692	$810	$928
11% Reduction	$6,017	$2,611	$3,057	$3,504
16.5% Reduction	$8,847	$3,838	$4,495	$5,152

These numbers represent a very small percentage of the total value added by each alternative: 0.08%, 0.11%, 0.09%, and 0.06%, respectively. This indicates that overall impacts to the Douglas County economy from reductions in recreation would probably not be detectable.

Impacts to Ecosystem Services

Benefit/cost and economic impact analyses are presented from the point of view of resource utilization, which sees wood fiber and recreation as market commodities, and weighs the direct benefits and costs of producing the commodity and making it available to the local economy. The economic principles are fairly well understood and are an important consideration in overall project design and resulting consequences.

Other costs and benefits would accrue in each alternative but are not easily quantified monetarily. These include values associated with the transportation system, the opportunity and existence values of undisturbed areas and large trees, and the future growth benefits of reduced competition in thinned stands. These relationships, including applicable mitigation measures, are discussed throughout the DEIS. As described in the Affected Environment, benefits accrue associated with standing timber as natural ecosystems, termed “ecosystem services”.

Direct, Indirect, and Cumulative Effects

Of the ecosystem services listed above, those which are most applicable to the analysis of effects include: water quality, flood control, soil productivity, maintenance of biodiversity and,

under the general topic of "the provision of aesthetic beauty and intellectual stimulation that lift the human spirit," recreational opportunities, scenic quality, heritage resources and the protection of semi-primitive unroaded areas. Impacts to the ability of the watershed to provide these services are discussed, both qualitatively and quantitatively, in the appropriate sections of this DEIS, in relation to each of these individual resources.

A complete list of services could also include the harvest of sustainable commodities in a non-damaging manner, such as those practiced by indigenous pre-technological societies, as well as special forest products, like mushrooms, fence posts, firewood, managed berry stands, fish, and big game.

It is also important to note that stand-replacement fires can reduce ecosystem services in the short-term, and some catastrophic fire events, when they burn exceptionally hot, would alter soil chemistry and physical properties in ways that limit future productivity for many centuries. Thus, steps that are taken in Alternatives 2- 5 to prevent or ameliorate such occurrences would tend to maintain and maximize the provision of ecosystem services over time.

3.21 WETLANDS, PARKLANDS, FARMLANDS, WILD AND SCENIC RIVERS, ECOLOGICALLY CRITICAL AREAS AND FLOODPLAINS

No parklands, farmlands, ecological critical areas, wetlands, or wild and scenic rivers are within or adjacent to the Lemolo 5th Level Watershed and the proposed activities. Units are adjacent to the floodplains of various Class III and IV streams. Their floodplains are protected by riparian reserves.

3.22 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Irreversible commitment of resources results from decisions to use or modify resources that are reversible only over a long period of time. The harvest of mature stands and the loss of soil productivity would be irreversible in the short term for Alternative 2, 3, 4 & 5.

Irretrievable commitment of resources refers to the use of a renewable resource that is lost because of land allocations or scheduling decisions. The timber volume lost to stand deterioration because of deferred harvest would be irretrievable for Alternative 1 (no action). Land taken out of the sustainable timber harvest base in Alternative 2, 3, 4 & 5 due to system road and permanent helicopter landing construction would be irretrievable for growing trees.

3.23 SHORT TERM USES AND LONG TERM PRODUCTIVITY

Short-term uses are those that generally occur in less than ten years. Long term refers to a period of more than ten years. The relationship between short-term uses (primarily timber harvest) and long-term productivity (generally effects on soil and water) has been addressed in this chapter under the headings.

3.24 CONSUMERS, CIVIL RIGHTS, MINORITY GROUPS AND WOMEN

None of the alternatives would affect the civil rights of women, Native Americans, or any other minority group. The Forest Service supports affirmative action hiring practices. Timber sale

contracts and service contracts for connected actions contain equal employment clauses that would protect the right of all employees. The action alternatives would provide raw wood materials that would be manufactured into products for consumers. Impact to consumers is primarily associated with the effect on timber supply.