

Vegetation Management Plan
for the
The Unroaded Recreation Area West of Diamond Lake (Management Area 1)
and the
Diamond Lake and Lemolo Lake Recreation Composite Areas (Management Area 2)

Plus

Watershed Analysis Iteration
Updating recommendations made in the 1998
Diamond Lake / Lemolo Lake Watershed Analysis

Approved By:

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5/6/08

Date



Mt. Thielsen from the west shore of Diamond Lake.



Beetle-killed trees on the east shore of Diamond Lake.

I. Introduction

Plan Objectives

The 1990 Umpqua National Forest Land and Resource Management Plan requires the preparation of vegetative management plans within Management Areas 1 and 2 where timber stands are susceptible to catastrophic insect and disease situations. An on-going mountain pine beetle outbreak coupled with uncharacteristically dense timber stands has triggered a need to prepare a vegetative management plan to guide vegetation management in these two Management Areas. Management Area 1 (Figure 1) has the focus of unroaded recreation primarily in a semi-primitive environment. Though this management area is mapped in several locations scattered across the Forest, this management plan only applies to the area located west of Diamond Lake. Management area 2 has the focus of concentrated developed recreation immediately around Diamond and Lemolo Lakes. This management plan applies to the complete area of Management Area 2.

The Diamond Lake/Lemolo Watershed Analysis also recommended that a vegetation management plan be developed for the Diamond Lake/Lemolo Recreation Areas to address bark beetle-caused mortality, white pine blister rust resistance, density management in young lodgepole pine stands, basal area reduction around ponderosa and western white pine, hazard trees, noxious weeds, and fire risk in the wildland urban interface.

Finally this document includes an iteration of the 1998 Watershed Analysis for the Diamond Lake/Lemolo Watersheds which updates recommendations since the onset of the mountain pine beetle outbreak and the completion of Community Wildfire Protection Plans.

The specific objectives of this vegetation management plan are to:

1. Identify safety hazards associated with the on-going mountain pine beetle outbreak to the recreating public and recommend vegetation management approaches to provide safe conditions.
2. Identify high priority areas for fuel hazard reduction and prescribe methods to reduce the risk of catastrophic fire in the short and long-term in order to implement the Community Wildfire Protection Plans for both the Diamond Lake and Lemolo Lake communities.
3. Identify where fire or silviculture can be used to improve, restore, or maintain plant and wildlife habitats and prescribe methods.
4. Identify important wildlife habitats and prescribe vegetation management activities to sustain the long-term capabilities of these habitats.
5. Identify unique plant communities and any threats to these communities and recommend vegetation restoration activities that would maintain or improve them.
6. Identify scenery management objectives in light of both the mountain pine beetle outbreak and the uncharacteristically dense stand conditions in the area and recommend vegetative treatments that will achieve the long-term desired condition of the characteristic landscape.

Overview

Diamond Lake Recreation Area

The Diamond Lake Recreation Area is approximately 8,100 acres and is centered around Diamond Lake with Mt. Bailey on the western side (8,363 feet in elevation), Mt. Thielsen to the east (9,182 feet in elevation), and Crater Lake National Park to the south. Diamond Lake is at an elevation of 5,182 feet, over 3,000 acres in size, and is approximately 3.5 miles long and 1.5 miles wide. Road 4795 surrounds the lake and is the main access route to recreation facilities. The area is easily accessible via Oregon State Highways 138, 230 and 97 and fairly equidistant (about 90 miles) from the major communities of Bend, Klamath Falls, Medford and Roseburg in central and southern Oregon (Figure 1).

Diamond Lake is identified in the Umpqua National Forest Land and Resource Management Plan (LRMP) as a special management area (MA2) to be administered for concentrated developed recreation under prescription A4-1 and has a Recreation Opportunity Spectrum (ROS) class of Rural. Silvicultural activities are permitted for hazard removal, safety consideration, and insect and disease control measures. Vegetation management plans must be prepared for sites where forest stands are susceptible to catastrophic insect and disease events.

To meet the recreational demand of about 700,000 Recreation Visitor Days (RVD's) per year), the Diamond Lake Recreation Area contains extensive USFS and private developments:

- 3 developed campgrounds (Diamond Lake, Broken Arrow and Thielsen View) with a capacity of 446 sites
- Two Day Use areas (South Shore and Noble Fir)
- Hiker/biker camp (six sites)
- Three group reservation areas
- Five boat ramps and docks
- Overflow camping area
- Visitor Information Center
- Administrative work center
- Sewer and water systems
- Paved bike path around the lake

Diamond Lake has traditionally been recognized as a regionally and nationally renowned trout fishery with an average of over 100,000 angler days annually. This angling use declined sharply in the late 1990s until 2007 due to an infestation of tui chub, a small fish native to the Klamath basin, that was inadvertently introduced into Diamond Lake. The tui chub over-populated Diamond Lake causing a decline in the trout fishery and water pollution. In 2006 the water level of Diamond Lake was drawn down by eight feet in order to eradicate the tui chub with rotenone

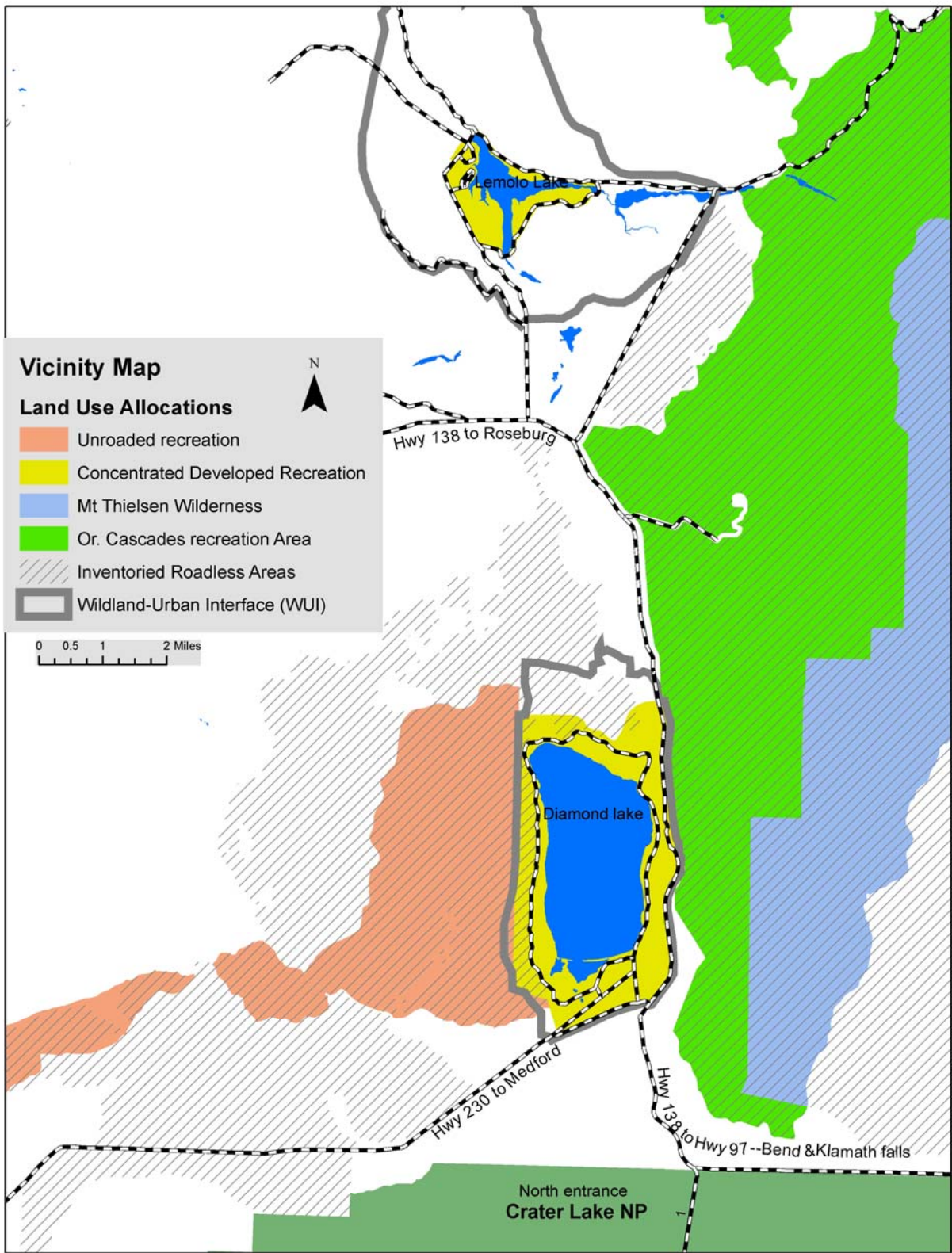


Figure 1. Vicinity Map

to kill all the fish. In 2007 the lake was re-stocked with rainbow trout and the fishery has rebounded.

Major use activities are fishing, camping, sightseeing, and biking. Normal operating season for the USFS facilities is mid-April through October coinciding with the fishing season. During the winter months the campgrounds are closed and used for cross-country skiing and other winter sport activities. Diamond Lake Campground (238 sites) is located along the eastern shore of Diamond Lake between the lake and road 4795. Broken Arrow Campground (148 sites) is located south of road 4795 approximately ¼ to ½ mile from Diamond Lake. The South Shore Picnic Area is located along the southern end of Diamond Lake. Thielsen View Campground (60 sites) is located along the northwest shoreline of Diamond Lake between the lake shore and road 4795. All of the campgrounds and the South Shore Picnic Area have paved roads and spurs with hardened sites.

Other developments in the area are the Diamond Lake Resort (Diamond Lake Improvement Company), Diamond Lake RV Park, Recreation Residences, and Oregon Department of Fish and Wildlife (ODF&W) cabin. These developments operate under special use permits and are privately owned facilities.

The Diamond Lake Resort, located primarily at the northeast corner of Diamond Lake, is a full service resort with 92 lodging units with a pillow count of 500. There are four restaurants with a combined seating capacity of 665, two grocery stores, two marinas with a capacity for 186 boats, a gas station, 46 employee-housing units and miscellaneous support buildings. The resort has a total permit area of 75 acres. Diamond Lake Resort operates year round.

Diamond Lake RV Park is located at the southeast end of Diamond Lake on the east side of road 4795. The park has 140 spaces with full hook-ups (water, sewer, and electric), shower and laundry facilities and living quarters and maintenance building. The permit area is 22.9 acres and is operated seasonally from mid-May through mid-October and closed during the winter months.

Diamond Lake recreation residences are located along the west side of Diamond Lake between the lake shore and road 4795. There are 102 privately owned residences in the tract with 81 residences possessing separate special use permits for boat docks along the west shoreline of Diamond Lake. Home lot sizes average approximately ½ acre with total permit acreage in the tract of 52 acres. The residences are accessed by a series of unimproved roads off of road 4795. Full time occupancy of the residences is not allowed and many are used only occasionally while others are used off-and-on, year-round. Access to the tract is closed by snow during the winter months with access by snowmobile or skiing only.

ODF&W owns a cabin and manages a lake level control structure on the northwest corner of Diamond Lake at the outflow of Diamond Lake into Lake Creek. The special use permit covers 3 acres. Use is primarily during the fishing season by Oregon State employees engaged in the management and monitoring of the put and take fishery.

Recreational Visitor-Use Surveys

In 2001, a survey of user characteristics, behaviors and attitudes was conducted of recreationists on the Umpqua National Forest. Specific questions were asked to address reasons for visitation to Diamond Lake, the primary activities of participation and satisfactions levels of their trip, as well as future intentions to revisit.

Following are the highlights of the survey results:

Regarding the trip characteristics, there was a tendency to have repeat visitors, 74% of Diamond Lake visitors came 1 to 10 times in a typical year and over half of the respondents stayed at the lake 3-5 days. Two-thirds of the visitors said the lake was their primary destination and of the remaining third, 43% of those reported that Crater Lake was their primary destination (Burns et al., 2002).

Generally, there was participation at Diamond Lake in many different activities. Most likely participation was in relaxing/hanging out (46%), viewing natural features (40%), camping (37%) and hiking/walking (36%). About one-fifth used resorts, cabins or other accommodations on national forest lands and one-third (33%) reported participating in fishing. Other popular activities included picnicking (29%) and bicycling (26%) (Burns et al., 2002).

When asked about primary activity undertaken, while at Diamond Lake, the top three were (1) camping in developed sites (23%), general relaxing/hanging out (21%) and fishing (18%) (Burns et al., 2002). Overall, there was a high level of satisfaction among Diamond Lake visitors about their trip with 86% of visitors rating their experience 8 or higher on a 10-point satisfaction scale.

Sense of Place

Surrounding the Diamond Lake Area is a range of outdoor recreation opportunities that occurs in outdoor recreation settings that encompass “rural” to “primitive” types of experiences. These opportunities allow a person “to participate in a particular recreational activity in a specific setting to realize a preferred type of experience and subsequent benefits”.

A recreation experience is “a composite of multiple experiential dimensions (e.g. challenge, freedom, physical exercise, escapement from everyday stresses) that involve multiple senses (e.g. sight, sound, smell).”

The concept of “Sense of Place” is predicated on a connectedness between (1) recreation activities, (2) settings, (3) experiences and (4) benefits. When one or more of these elements change, it can have a direct effect on a person’s perception of “sense of place.”

Sense of Place (SOP) units have been defined by their place in the Recreation Opportunity Spectrum from Urban to Primitive in the type of setting that is provided, and the visual quality objectives identified for the physical environment from “ecological changes only” to a “heavily modified” condition (Figure 2 and Table 1).

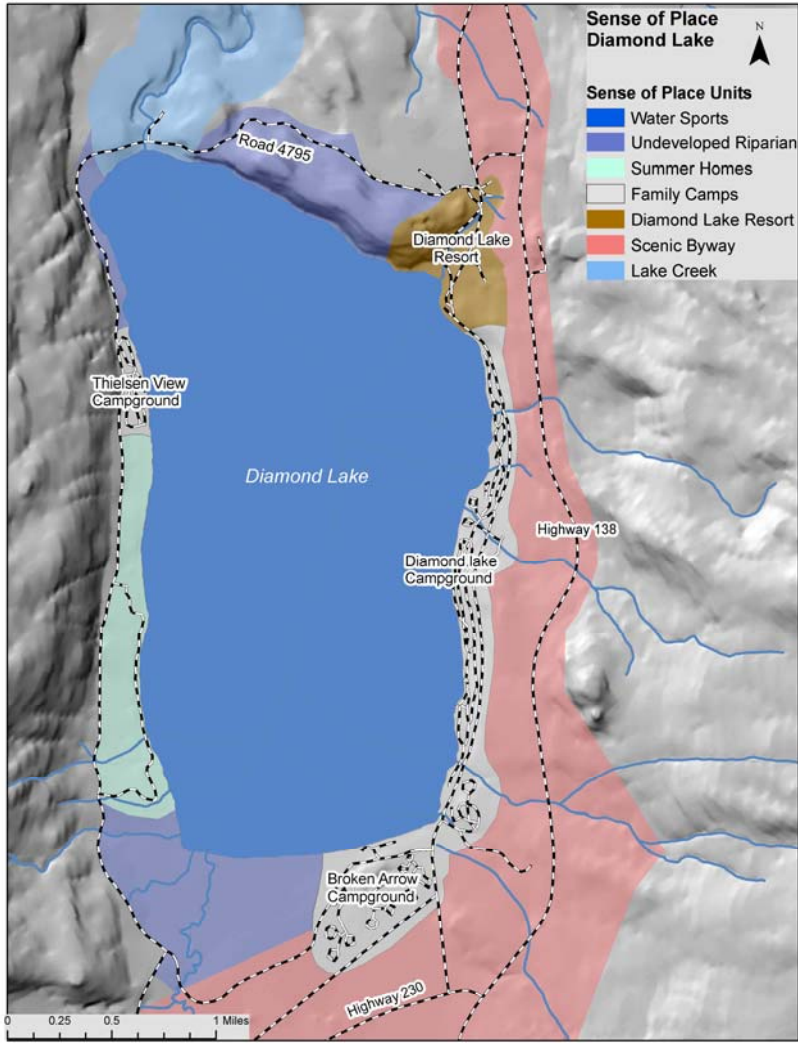


Figure 2. Sense of Place Units around Diamond Lake

Table 1 -- Summary of SOP units within the Diamond Lake Recreation Composite.

SOP Unit	Summary Description	ROS Classification	Visual Quality Objectives
Water Sports	A 3,031 acre water magnet, in an intact mountain setting that supports outdoor recreation use for passive and active water-based pursuits in a remote, but social environment which contributes substantially to the local economy.	Rural Rural (existing developed recreation)	Foreground Retention
Family Camps	High-capacity, highly developed day-use, camping and boating facilities on a mountain lake in a High Cascade forest, anchored by volcanic peaks, that supports multi-generational families and groups during summer and fall seasons.	Rural Rural (existing developed recreation) Rural (potential developed site)	Foreground Retention Foreground Partial Retention

SOP Unit	Summary Description	ROS Classification	Visual Quality Objectives
Diamond Lake Resort	A year-round, high mountain destination with a full service, lakeside resort serving “Joe and Jane” citizen and multi-generational families. Located close to many outdoor recreation opportunities. Diamond Lake Resort also has options for extensive social experiences, including major events and festivals.	Rural	Foreground Retention
Summer Homes	Multi-generational, single-family recreation residences, under special-use permit for seasonal use along the shoreline of Diamond Lake. Area includes 102 summer residences.	Rural Rural (existing developed recreation)	Foreground Retention
Undeveloped Riparian	A lush, vegetated area with standing or sub-grade water levels that support wildlife habitat areas attractive to dispersed recreationists such as birdwatchers and photographers.	Rural Rural (existing developed recreation) Rural (potential developed site)	Foreground Retention Foreground Partial Retention
Lake Creek	This meandering, linear, riparian feature contains the Lake Creek waterway and provides dispersed recreation opportunities, fish and wildlife habitat, as well as downstream water supplies.	Roaded natural (sensitivity level 1) Roaded natural (sensitivity level 2) Rural Rural (potential developed site)	Foreground Retention Foreground Partial Retention Modification

Visual Quality Objectives¹

Retention - Management activities are not visually evident.

Partial Retention - Management activities remain visually subordinate to the characteristic landscape.

Modification - Management activities may visually dominate the original characteristic landscape.

Maximum Modification - Management activates of vegetative and landform alterations may dominate the characteristic landscape.

Distance Zones

Foreground - The limit of the zone is based upon the distances at which details can be perceived. Normally, in foreground views the individual boughs of trees form texture. It will usually be limited to areas within ¼ to ½ mile of the observer, but is determined on a case-by-case basis.

Middleground - This zone extends from the foreground zone to 3 to 5 miles from the observer. Texture normally is characterized by the masses of trees in the stands of uniform tree cover. Individual tree forms are usually only discernable in very open or sparse stands.

Background - This zone extends from the middle ground to infinity. Texture in stands of uniform tree cover is generally very weak or non-existent. In very open or sparse timber stands, texture is seen as groups or patterns of trees.

¹ Umpqua National Forest Land and Resource Management Plan

Sensitivity Levels

Highest sensitivity - sensitivity level 1 includes all seen areas from primary travel routes, use areas and water bodies where, as a minimum, at least one-fourth of the Forest visitors have a major concern for scenic qualities.

Average sensitivity - sensitivity level 2 includes all seen areas from primary travel routes, use areas, and water bodies where less than one-fourth of the Forest visitors have a major concern for scenic qualities.

Lowest sensitivity - sensitivity level 3 includes all seen areas from secondary travel routes, use areas, and water bodies where less than one-fourth of the Forest visitors have a major concern for scenic qualities.

Recreation Opportunity Spectrum (ROS)

Roaded Natural – Area characterized by predominantly natural-appearing environments with moderate evidence of the sights and sounds of people. Such evidences usually harmonize with the natural environment. Rural – Area characterized by substantially modified natural environment, with sights and sounds of humans readily evident and interaction between users often moderate to high.

Rural – Area characterized by substantially modified natural environment, with sights and sounds of humans readily evident and interaction between users often moderate to high.

Lemolo Lake Recreation Area

The Lemolo Lake Recreation Area is approximately 1,290 acres and is centered around Lemolo Lake. Lemolo Lake is a man-made reservoir operated 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 roads 60, 2612, and 2614. The ROS class is roaded natural (RN).

Similar to Diamond Lake, Lemolo Lake has both Forest Service and private permittee facilities to meet the recreational demand of 70,000 RUDs. The USFS operates and maintains five campgrounds in the area with a combined capacity of 95 sites. Major activities during the summer include camping, boating, fishing, biking, ATV use, swimming, and sightseeing. The main winter activities are cross-country skiing and snowmobiling. The campgrounds usually operate from mid-May (once snow-free) until the end of October or November. Because of the high popularity of the area for fall elk hunting, the campgrounds will often remain open until the end of November, weather permitting.

The largest and most developed of the campgrounds is Poole Creek (60 sites). It is located in the southwest corner of Lemolo Lake and is accessed from roads 2610. The campground has paved roads and spurs, water, vault toilets, group reservation camping areas, boat ramp and dock, and swimming area. The remaining 4 campgrounds are less developed and have gravel or unimproved roads and spurs, vault toilets, and no water. East Lemolo Campground (15 sites) is located in the southeastern sector of Lemolo Lake along the North Umpqua River. It is accessed from road 2614. Crystal Springs Campground (1 site) is located farther east of Inlet Campground (14 sites). Both campgrounds are accessed from roads 2612 or 2614. Bunker Hill Campground (5 sites) is located along the northern shore of Lemolo Lake and is accessed from road 2612. There are also approximately 20 dispersed unimproved campsites throughout the area.

Lemolo Lake Resort is a privately owned facility operating under a USFS special use permit. It is located along the north shore of Lemolo Lake. It is a full service facility having 10 lodging

units with a pillow count of 32, and a restaurant and bar with seating capacity of 48. It has a trailer park with 36 spaces with full hook-ups and shower and laundry facilities, gas station, grocery store, boat ramp and docks, employee housing, and shop buildings. Major summer activities and services include fishing, boat rentals, water skiing, swimming, sightseeing, bicycling, ATV riding, and hiking. During the fall, the primary activities are fishing and hunting. During the winter, snowmobiling and cross-country skiing dominate the activities in the area.

Sense of Place

The sense of place units defined for the Lemolo area have some similar attribute as those around Diamond Lake (Figure 3 and Table 2).

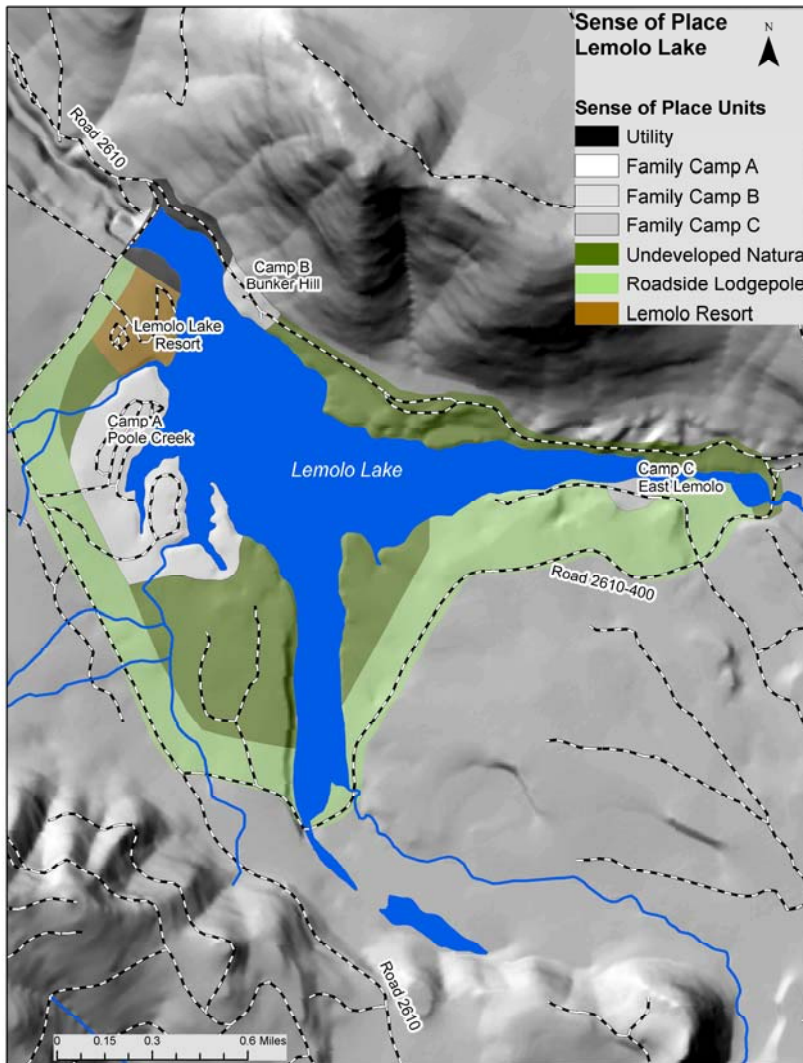


Figure 3. Sense of Place Units around Lemolo lake

Table 2. -- Summary information for SOP units within the Lemolo Lake Recreation Area

SOP Unit	Summary Description	ROS Classification	Visual Quality Objectives
Family Camp A	High-capacity, highly developed day-use, camping and boating facilities on a mountain lake in a High Cascade forest, anchored by volcanic peaks, that supports families and groups during summer and fall seasons.	Roaded Natural	Foreground Retention Foreground Partial Retention
Family Camp B	A year-round, high mountain destination lakeside resort serving families. Located close to many outdoor recreation opportunities.	Roaded Natural	Foreground Retention
Family Camp C	Semi-remote family campground in the forest with limited facilities adjacent to a high mountain lake.	Roaded Natural	Foreground Retention
Lemolo Lake	This water feature, created by a dam, provides spacious fishing, swimming and boating opportunities with extensive, meandering shoreline.	Roaded Natural	Foreground Retention Foreground Partial Retention
Lemolo Resort	A mountain lake resort providing lodging, food and RV camping opportunities with limited supplies for purchase.	Roaded Natural	Foreground Retention Foreground Partial Retention
Roadside LP	Lodgepole forest adjacent to Roads 2610 and 2614 that provides a buffer around nearly ¾ of Lemolo Lake in flat to gentle terrain.	Roaded Natural	Foreground Partial Retention
Undeveloped Natural	A natural-appearing, vegetated area of forest and riparian area in close proximity to Lemolo Lake which may contain standing or sub-grade water levels that support wildlife habitat attractive to dispersed recreationists such as birdwatchers and photographers.		
Utility	A forested area along the reservoir edge, adjacent to Lemolo Lake Dam, which serves as a transition from natural lake setting to built environment.		

II. CURRENT CONDITIONS

Wildland Urban Interface (WUI)

The areas around both Lemolo and Diamond Lakes are designated as at-risk communities located in the wildland urban interface (Figure 1). The Healthy Forest Restoration Act (HFRA) of 2003 was designed to expedite hazardous fuels reduction and forest restoration projects on specific types of Federal lands that are at risk of wildland fire or insect epidemics. This law encourages the development of Community Wildfire Protection Plans under which communities designate their wildland-urban interface areas where expedited projects under HFRA may take place. In 2006, the Umpqua National Forest collaborated with Douglas County and other entities to finalize the Douglas County Community Wildfire Protection Plans. These plans addressed the Diamond Lake and Lemolo Lake WUIs. The protection plans for Diamond and Lemolo Lake list hazardous fuel reduction treatments and methods to protect these at-risk communities including:

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

Scenery Management

The 1990 LRMP contains standards and guideline for scenery management. Due to the high level of natural beauty, the significant recreation use in the area, and the predominant use of clearcutting as a harvest method at that time, visual quality objectives of retention (where management activities are not visually evident) and partial retention (where activities remain subordinate to the characteristic landscape) were assigned. Over the last 20 years, the scenic quality² of the area around Lemolo and Diamond Lakes has remained very high. The lodgepole pine clearcuts of the 1970s and 1980s have grown back to dense young lodgepole pine stands. Some recent partial harvest of mixed conifer stands along the road into Lemolo Lake has had a limited impact on the overall scenic quality of the area. The recreating public has been exposed to very limited, small-scale changes to the scenery such as expansion of recreation facilities including the creation of the bike trail, expansion of the south shore boat launch and picnic area, additions of fish cleaning stations, addition of snow parks, hazard tree removal around campgrounds and the recreation residences, and the construction of the new Diamond Lake scenic overlook off of Highway 138.

The progressive development of dense forest stands due to fire exclusion is a process that goes unnoticed by most visitors. Many visitors perceive the dense forest conditions that are visible from the primary travel routes and trails as being natural, while others are aware of, and concerned about fuel build-up and the increasing fire hazard.

² Scenic quality refers to the degree to which the appearance of a place, landscape or feature can elicit psychological and physiological benefits to individuals and, therefore, to society in general.

The uncharacteristically dense stand conditions and the abundance of mature lodgepole pine forest in the area and surrounding landscapes is eroding the ability of the landscape to sustain the existing scenic quality. Scenic stability³ is diminishing because the existing scenic character can not be sustained in light of the pine beetle outbreak and the need to provide safe conditions in the concentrated developed recreation land allocation.

The quality of the scenery has recently dropped around Diamond Lake but has essentially remained unchanged in the vicinity of Lemolo Lake. The biggest impacts have occurred where dead hazard trees have been felled and removed around the Diamond Lake Resort and the Diamond Lake campground. Many stumps are now obvious and some of the cut stumps are high and not yet masked by vegetative re-growth. Though the pine beetle outbreak has not yet had an impact on the Lemolo area, there are mature stands of lodgepole susceptible to beetle mortality near Lemolo and the uncharacteristically dense mixed conifer and young lodgepole forests are posing hazards in the wildland urban interface that must be addressed in both WUIs. These existing conditions pose challenges to meeting the visual quality standards and guidelines from the 1990 LRMP that requires retention and partial retention and that restrict opening size to ½ acre.

The need for exceptions to these scenery standards and guidelines was recognized in the LRMP (pg. IV-23) where catastrophic loss is imminent or has occurred. This is particularly true in landscapes where the existing scenic conditions are not sustainable over time because vegetative conditions are outside the natural range of variability due to fire exclusion. Exceptions to meeting the scenery standards require environmental analysis and amendment procedures. Mitigation in the form of visual rehabilitation is necessary where LRMP standards are not met.

Current Forest Stand Conditions

Methods

The Common Stand Exam program was used to collect data on forest conditions in 2001. Stands were delineated within the Lemolo and Diamond Lake management areas using 1998 aerial photos. These stand polygons were then entered into GIS for analysis. The current vegetative condition is based on formal stand exam information and field reconnaissance by the District silviculturist. Detailed field reconnaissance notes and stand exam summaries generated by the Forest Vegetation Simulator are also available in District files.

Stand Types & Structure

Stands within the Lemolo and Diamond Lake management areas consist of three major vegetation types: pure lodgepole pine (*Pinus contorta*), lodgepole pine/mixed conifer, and mixed conifer (Figure 4 & 5). These stands, in turn, consist of three structural stages of forest development (Figures 6 & 7): stem exclusion, understory reinitiation, and old-growth (Oliver and Larson 1996).

³ Scenic Stability is the degree to which the valued scenic character and its scenery attributes can be sustained through time and ecological progression.

Pure Lodgepole Pine

This vegetation type includes both wildfire-generated stands in the lodgepole pine plant series (Atzet et al. 1996), and clearcuts that naturally regenerated to lodgepole pine following harvest. These harvested stands may not necessarily be in the lodgepole pine series since lodgepole is the principle pioneer species in other plant series. Managed stands originated from the Spring Timber Sale (1982-1984) and the Poole Lodgepole Timber Sale (1978-1980). Managed stands are in the stem exclusion stage and in most cases have high stocking levels, sometimes greater than 10,000 trees per acre.

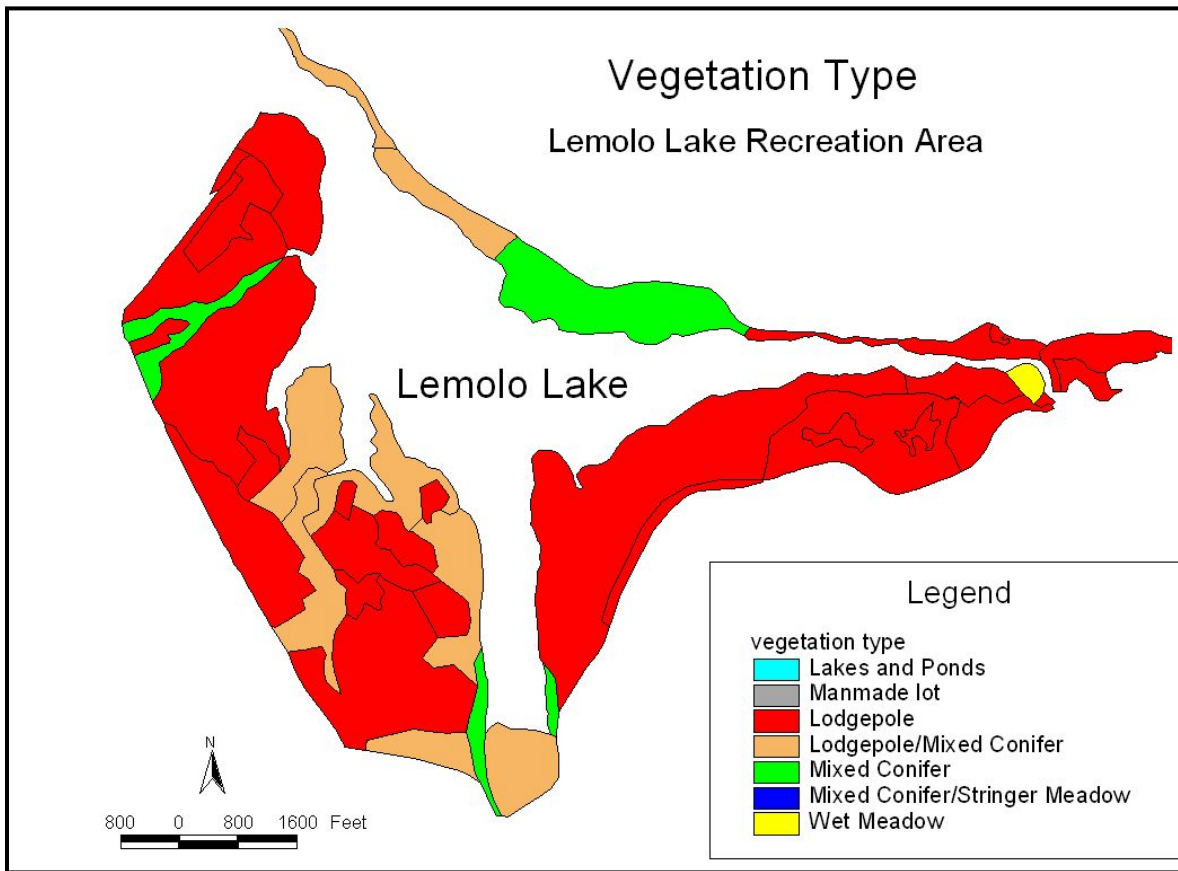


Figure 4. Vegetation types within the Lemolo Lake Recreation Composite (Management Area 2)

Vegetation Type

Diamond Lake Recreation Area

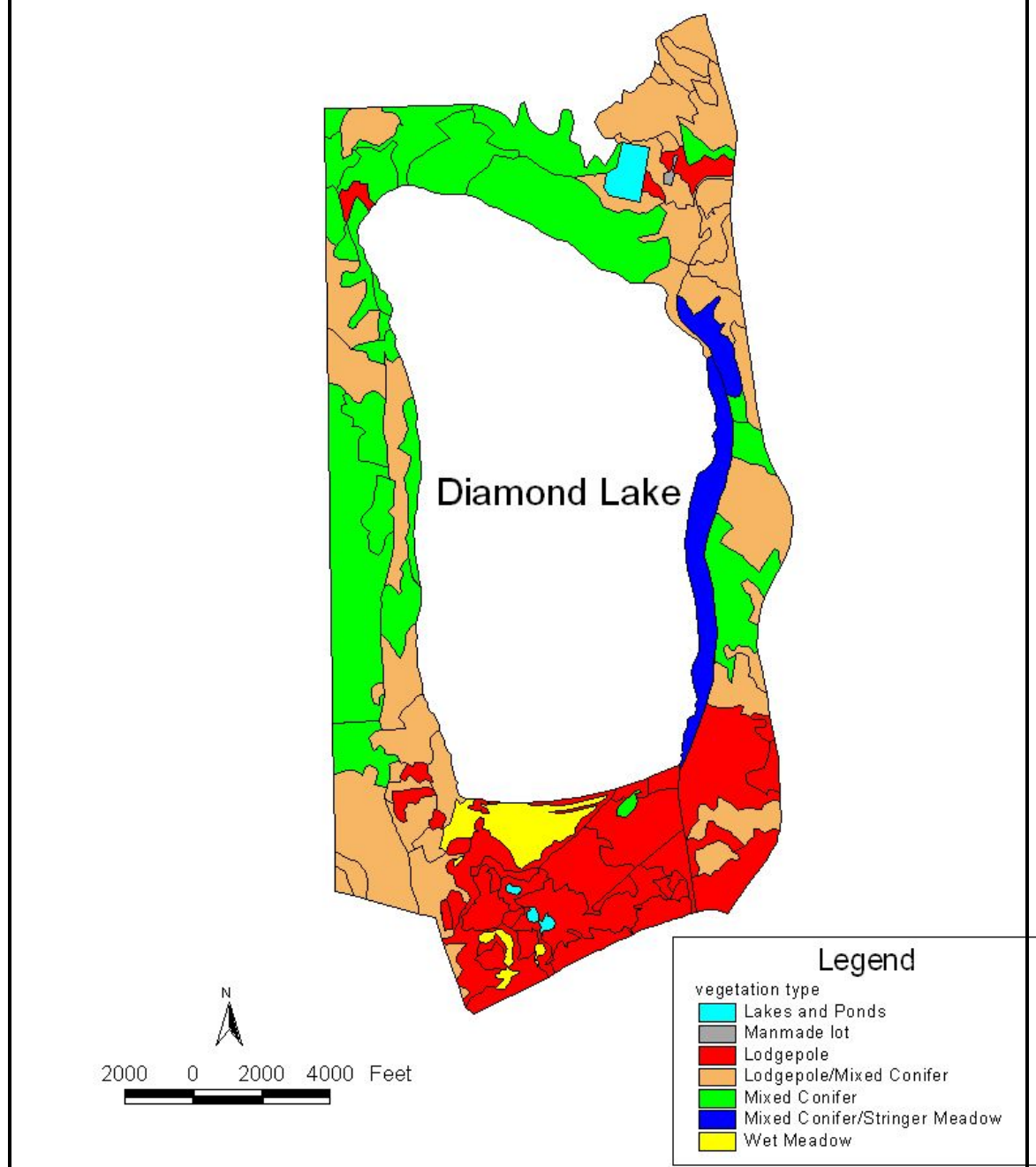


Figure 5. Vegetation types within the Diamond Lake Recreation Composite (management Area 2).

Unmanaged stands range from 60-120 years of age and are characterized by both the stem exclusion and understory reinitiation structural stage of forest development. Mistletoe (*Arceuthobium americanum*), western gall rust (*Endocronartium harnessii*), and mountain pine beetle are common in these natural stands to varying degrees. Natural stands in the understory reinitiation stage are usually characterized by high levels of dead wood (standing and down) and ladder fuels created by multi-storied canopies.

Lodgepole Pine/Mixed Conifer

This vegetation type includes natural stands within the mountain hemlock (*Tsuga mertensiana*), white fir (*Abies concolor*), Pacific silver fir (*A. amabilis*), or Shasta fir (*A. shastensis*) plant series (Atzet et al. 1996) in the stem exclusion/understory reinitiation stage. The overstory is dominated by mature lodgepole pine, which acts as frost protection for the natural regenerating understory. The understory is diverse and consists of combinations of western white pine (*Pinus monticola*), ponderosa pine (*P. ponderosa*), Shasta fir, Douglas-fir (*Pseudotsuga menziesii*), mountain hemlock, incense-cedar (*Calocedrus decurrens*), lodgepole pine, Pacific silver fir, Engelmann spruce (*Picea engelmannii*), and white fir. Understory heights can range from 2-40 feet, depending on the length of understory development. The overstory lodgepole pine is already rapidly dying off due to mountain pine beetle attack in many areas. This results in high levels of ground fuels and safety hazards within recreation areas. The understory species eventually overtop the lodgepole pine to develop into healthy mixed conifer stands in the stem exclusion stage with high levels of canopy closure and low levels of ladder fuels. These stands can remain in this stable condition for 60 to 150 years, depending on natural disturbance processes.

Mixed Conifer

This vegetation type includes diverse natural stands within the mountain hemlock, white fir, Pacific silver fir, or Shasta fir plant series in the stem exclusion/understory reinitiation or old-growth stage. Stands within the stem exclusion stage are 40-100 years old and are characterized by high canopy closures, high densities, and high levels of down wood (usually lodgepole pine). Tree species diversity is also high and similar to the understories described in the lodgepole pine/mixed conifer vegetation type. Stands within the understory reinitiation and old-growth stages are 150+ years of age, have multi-storied canopies that create ladder fuels and scattered old-growth remnants, and high species diversity. The overstory is usually a mix of Shasta fir, western white pine, Douglas-fir, mountain hemlock, and sometimes ponderosa pine; the understory is usually a mix of white pine, Shasta fir, mountain hemlock, white fir, and Pacific silver fir. Lodgepole pine is usually absent. Pockets of down woody material are typically centered around areas of armillaria (*Armillaria ostoyae*) root disease. Mistletoe (*Arceuthobium tsugense*) in mountain hemlock and Indian paint fungus (*Echinodontium tinctorium*) in true fir and hemlock is typical within these older stands. White pine blister rust (*Cronartium ribicola*) is an introduced pathogen that is usually the responsible agent for dead top western white pine.

Forest Structure

Diamond Lake Recreation Area

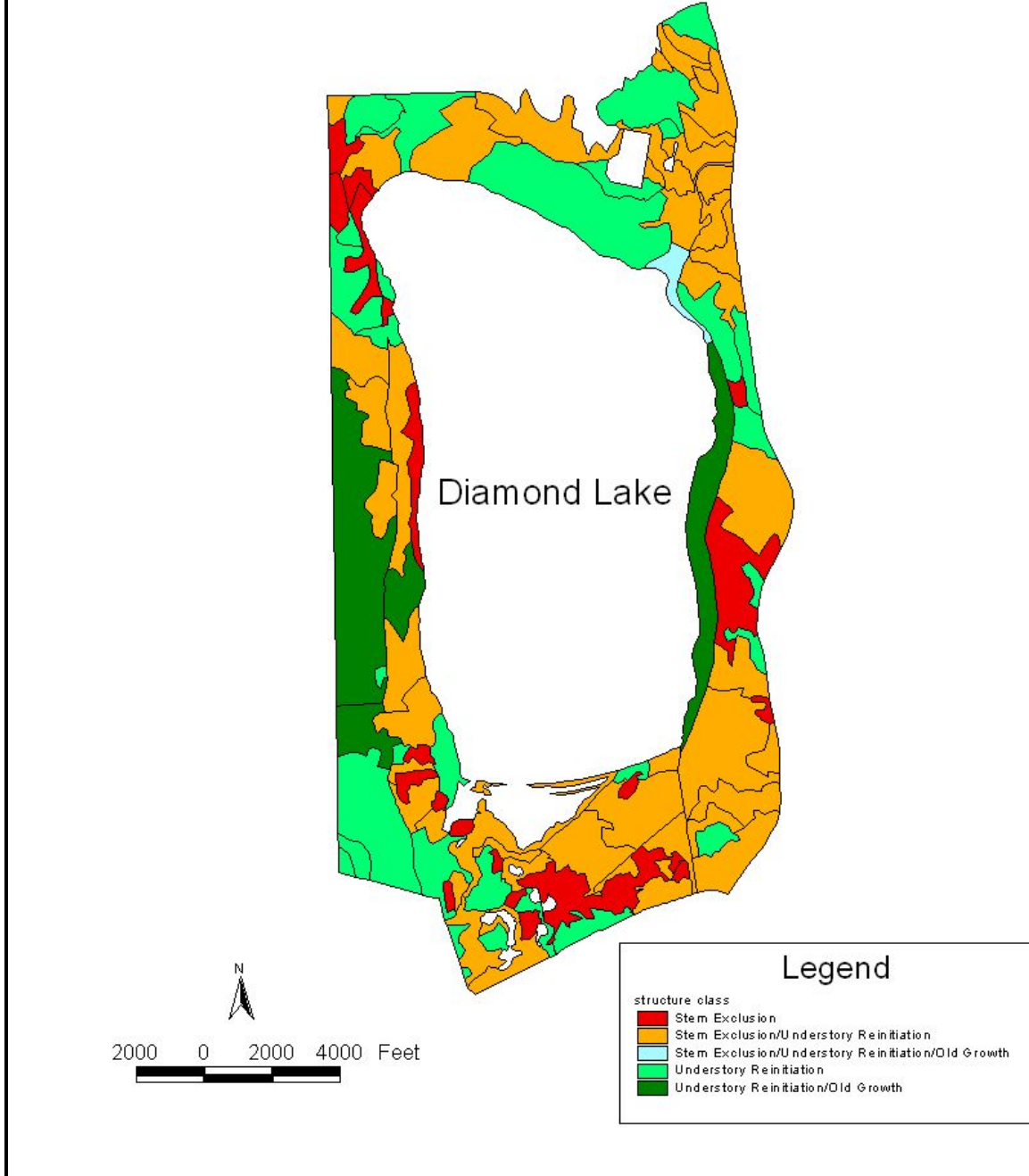


Figure 6. Forest structure within the Diamond Lake Recreation Composite

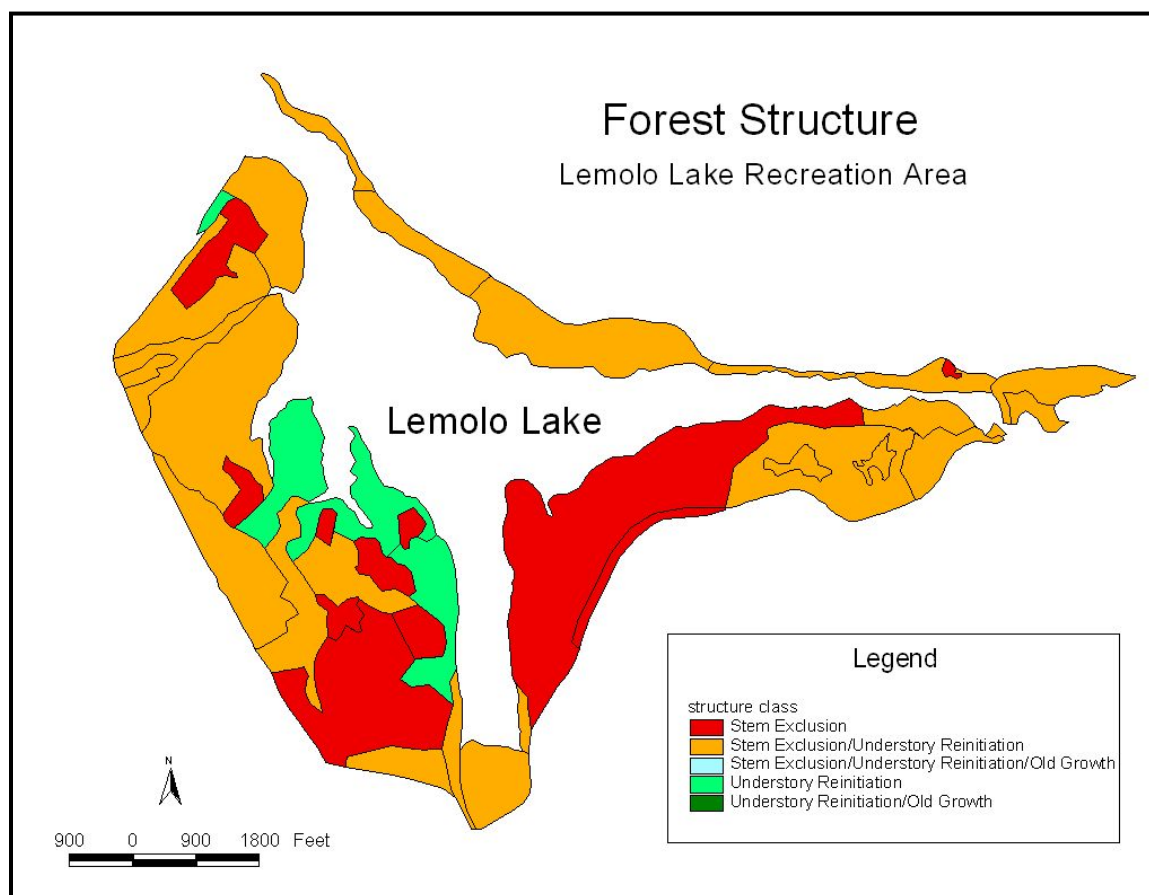


Figure 7. Forest structure within the Lemolo Lake Recreation Composite.

Disturbance Processes

Fire History

Mature natural lodgepole pine stands on the landscape today are the result of the large fires in the late 19th and early 20th century. At least three different large conflagrations can be documented between 1880 and 1910 in the Diamond Lake and Lemolo Lake watersheds. One historic account described a number of fires spreading over the area started by an electrical storm on July 5, 1910; most were not extinguished until fall rains in September (Perkins, 1938). Diary accounts during the late 1800s included many references to fire and thick smoky conditions that often obscured views of Mt. Thielsen from Diamond Lake (Waldo, 1885). Fire history is difficult to reconstruct in lodgepole pine forests because lodgepole pine are relatively short-lived and their thin bark tends to result in mortality from fire rather than generate fire scars that could be counted along with the growth rings. However, there is anecdotal evidence that the high incidence of fire during this period may be partly the result of stockmen set fires intended to replace fire cleared area during this period. Lodgepole pine is the pioneer species that subsequently reseeded into the burned areas resulting in the vast acreage of mature stands today. Since then, the Forest Service policy to suppress fires has resulted in artificially small fires that have done little to break up the homogeneous stands in the area (USDA, Umpqua National Forest, 1998).

Mountain Pine Beetle

The dominant feature of the Diamond Lake/Lemolo Lake area is the vast, contiguous stands of lodgepole pine, 80 to 150 years of age. These stands carpet the pumice flat area by Lemolo Lake, sweep up the flanks of Mt. Thielsen and extend seamlessly south into Crater Lake National Park. Dense stands of lodgepole pine (either in pure lodgepole stands or in mixed conifer stands) that are at least 80 years of age with trees 8 inches in diameter are highly susceptible to mountain pine beetle (*Dendroctonus ponderosae*) attack. The life history of lodgepole pine lends itself particularly well to mountain pine beetle attack but all pines including, ponderosa pine, western white pine, and whitebark pine are susceptible to attack during an outbreak. Younger stands, particularly of trees less than 4 inches in diameter, are seldom attacked. Because of the very large amount of the area having mature pine, the risk of a landscape scale outbreak is considered high (Goheen and Bridgwater 2007).

A mountain pine beetle outbreak has been on-going since 2004 (Figure 8). Focal points for the outbreak include the east shore of Diamond Lake and areas just north of the lake. Since then, beetles have begun killing lodgepole near the south shore and all along the west shore of Diamond Lake. Forest Service entomologists predict that the present infestation on the north and west shores of Diamond Lake will spread to other areas, and that this could happen quickly. Their assessment is based on how rapidly mountain pine beetle populations build and spread when epidemics occur, on historic mountain pine beetle outbreaks in Oregon and especially the outbreak in the area during the 1920s, and the level of landscape risk due to the presence of continuous mature lodgepole pine that exists in the area today. “It is very probable that a high proportion of the lodgepole pine stands in the area will be infested within the next few years. Infested stands will likely suffer as much as 90 percent mortality of the overstory lodgepole pines and may also lose large proportions of any ponderosa, western white, or white bark pines that they contain” (Goheen and Bridgwater, 2007). Previous to the on-going epidemic, a pine beetle outbreak occurred at the south end of Diamond Lake during the late 1970’s and early 1980’s.

Mountain pine beetle outbreaks can create landscape level mortality that increases the fire hazard (Parker et al. 2006, Lynch et al. 2006). In pure lodgepole stands, fire hazard is typically high during the first few years following an outbreak before dead needles fall. During this period, fire can spread through the abundant aerial fine fuels (Stuart et al. 1998). In pure stands, the hazard typically subsides a few years after the outbreak in the period after the red needles have fallen and before snags begin to fall. During this period, the threat of crown fire is often very low as there are less fine fuels in the canopy. Fire hazard again begins to increase as snags fall and branchwood accumulate on the forest floor. This increase can be rapid and drastic when blowdown results in “jack-strawed” conditions in which dead and downed trees

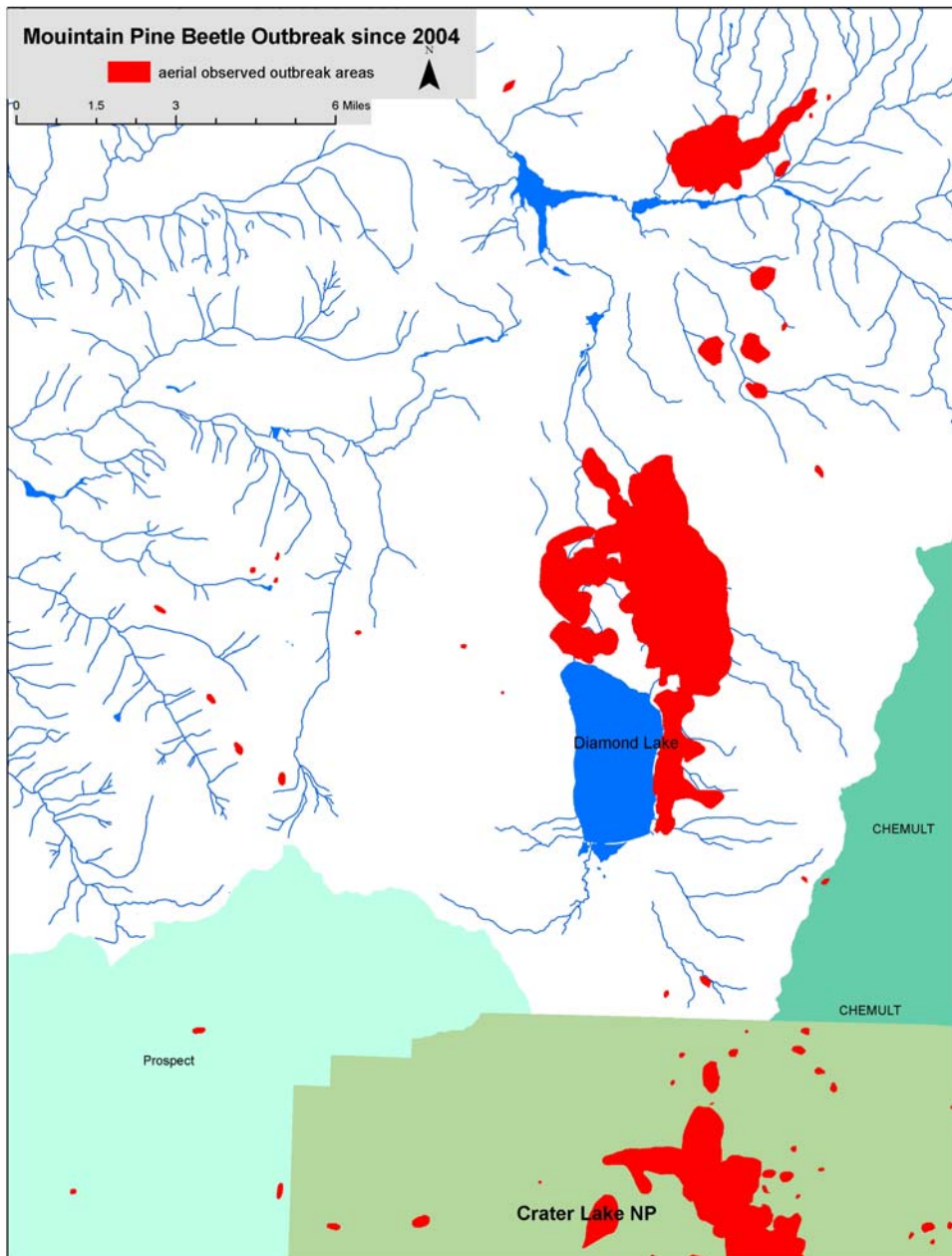


Figure 8. Concentrated areas of recent mortality from mountain pine beetle.

loosely pile atop one another, carpeting the forest floor in a continuous jumble of logs many feet high. Jack-strawed conditions can create very high intensity and severity fires (Page and Jenkins 2007), that are very difficult and dangerous for firefighters to suppress and can damage natural resources.

Fire hazard also increases in mixed conifer stands, where lodgepole and other pines are killed amongst live hemlock, true firs, and Douglas-fir. The threat of crown fire continues in these stands even after needles have fallen from the beetle-killed trees because a live overstory

remains. The beetle-killed trees contribute to surface fuel loadings and ladder fuels, increasing the intensity and severity of fire when it occurs.

The mountain pine beetle – wildfire cycle in lodgepole pine forests is a natural process that has undoubtedly been repeated continuously for centuries. However, decades of fire suppression following what appears to be an unnaturally high occurrence of fire in the late 19th and early 20th century has resulted in an unusually homogenous occurrence of mature lodgepole forest. This condition leaves the landscape at a very high risk of extensive wildfire that could be difficult and dangerous to manage in the heavily used recreation sites around Diamond and Lemolo Lakes.

Fire Exclusion

Stands classified as understory reinitiation and old growth mixed conifer (Figures 6 & 7) were not stand replaced by the fires of the late 19th and early 20th century that resulted in today's mature lodgepole pine stands. Older stands in the white fire series in particular, are exhibiting a change from their historic composition and structure due to fire exclusion. These stands currently consist primarily of an overstory of very large Douglas-fir, ponderosa pine, and white fir with substantial in-growth of white fir developing underneath. Much of the white fir is already mature and forms a subcanopy below the Douglas-fir and ponderosa pine and occupies gaps generated by the dying overstory trees. Under reference conditions, these areas typically experienced fire more frequently, so fire exclusion has had a greater ecological impact here than other mixed conifer stands. Ponderosa pine is not able to withstand as much vegetative competition than white fir and will eventually be lost in the absence of disturbance. Stand replacement fire in mixed conifer stands is now more probable due to the uncharacteristic buildup of live and dead vegetation in most mixed conifer forest types.

The effects of fire exclusion are less pronounced in older mixed conifer stands dominated by mountain hemlock and Shasta fir stands because the fire return interval is longer than in the white fir/mixed conifer sites.

Stand and Fuel Conditions in High Use Areas

Recreation Residences (west shore of Diamond Lake)

The 102 recreation residents under special use permit are located in both the mixed conifer and lodgepole/mixed conifer stands (Figure 5) on the west shore of Diamond Lake (Figure 2). The mixed conifer stands surrounding these homes are extremely dense. The lodgepole pine in both these forest types is beginning to die from mountain pine beetles. The lodgepole in this area is particularly tall, and the hazard to people and homes is expected to increase as the outbreak progresses with more and more pine dying each year. There are numerous, old-growth Shasta red fir trees in the mixed conifer stands surrounding homes. Many have heart rot, which is also posing a toppling hazard to the homes and occupants. The added fuel from the beetle-kill is expected to increase the surface fuels exacerbating the existing fire hazard posed by the dense mixed conifer. The lodgepole/mixed conifer stands along the southern areas of recreation residences pose similar safety hazards from toppling, but less fire hazard since the tree densities are not as uncharacteristically dense as observed in the mixed conifer stands.

Diamond Lake Resort (northeast shore of Diamond Lake-Figure 2)

The Diamond Lake resort is mostly surrounded by dense lodgepole/mixed conifer that is beginning to experiencing a wave of beetle mortality. Dying lodgepole are posing safety hazards especially during windy conditions along the lakeshore. In addition, the uncharacteristically dense understory in these stands surrounding the resort, the residences, and other facilities are posing a fire hazard. The horse rental facility is located in lodgepole/mixed conifer which is very dense. A trail network emanates from the corral and heavy mortality and subsequent down logs are expected as the outbreak expands.

Visitor Information Center and Administrative Site (east shore of Diamond Lake)

This area is in a lodgepole pine/mixed conifer forest that has recently been lightly thinned and hand piled. Though ladder fuels have been reduced, the level of thinning is not expected to adequately resist the pine beetle infestation.

RV Park (southeast shore of Diamond Lake-Figure 14)

The RV Park is surrounded by pure lodgepole pine stands. Much of the areas around this site was clearcut in the late 1970s, so the near term susceptibility to the beetle outbreak along the east shore is presently low. However, an uncut leave area directly east of this recreation facility is composed of highly susceptible lodgepole pine that is beginning to die from mountain pine beetles. As such, toppling hazards will worsen at this site.

Diamond Lake Campground (east shore of Diamond lake-Figure 2)

The Diamond Lake campground along the east shore of Diamond Lake is one of the focal points for the mountain pine beetle outbreak. In 2006 and 2007 more than a thousand dead hazard trees were cut in this campground at a cost of nearly \$100,000, in order to provide safe conditions for campers. Bark beetle hot spots now exist on the east and north sides of Diamond Lake. Since 2004, these areas have experienced increasing annual mortality. In some stands, most of the lodgepole host trees are dead and have been removed. Portions of the Diamond Lake campground were not safe enough to open in 2007 because hazard tree felling could not keep up with the rapid and progressive mortality. Some very dense stands of mixed conifer are also present, and some are experiencing competitive stresses where and increased mortality. The campground's location at the edge increases the windthrow hazard to campground facilities. The risk to people and facilities is greatest during the winter when the campground is typically closed, however high winds during the fall of 2007 toppled some live conifers while the campground was still occupied.

Thielsen View Campground (west shore of Diamond Lake-Figure 2)

The lodgepole pine growing in the overstory of the Thielsen View Campground on the west side of Diamond lake is beginning to die from mountain pine beetles. Due to the amount of large susceptible lodgepole growing in the overstory, it is likely that the outbreak will result in substantial amounts of mortality and hazardous conditions for campers and other users of this site (bike trail and boat dock/launch).

Broken Arrow Campground and vicinity (south shore of Diamond Lake)

The Broken Arrow Campground and the South Shore Boat Launch and Day Use Area are mostly surrounded by pure lodgepole pine stands. Much of the area around these sites was clearcut in the late 1970s, so the near term susceptibility to the beetle outbreak is presently low. The old clearcuts have developed into dense stem exclusion stands that have the potential to carry a crown fire and increase fire intensity compared to older less densely stocked lodgepole stands.

North shore forest stand

The north shore of Diamond Lake has a mature and old-growth mixed conifer forest that was recognized in the 1998 WA as an area with potential for uncharacteristically-high intensity fire. Moreover, the area contains large ponderosa pine trees that are now at risk of mortality associated with the development of dense understory conditions. This stand is highly visible from the lake and from numerous high-use developed recreation sites including the bike trail that parallels the lake edge at the base of the stand. A bald eagle nest stand is located within this stand. Some limited fuel reduction activity has occurred in this stand where trees less than 6 inches have been cut, piled and burned, but the fire hazard still remains uncharacteristically high and pines are still susceptible to beetle mortality due to overly dense stand conditions.

Lemolo Lake Resort (west shore of Lemolo Lake-Figure 3)

This facility is almost completely surrounded by young lodgepole pine that is regenerating after clearcutting in the late 1970s. The old clearcuts have developed into extremely dense stem exclusion stands that have the potential to carry a crown fire and increase fire intensity compared to older less densely stocked lodgepole stands. Because these smaller trees lack the size needed for pine beetle nesting, susceptibility to the beetle outbreak is presently low.

Poole Creek Campground (southwest shore of Lemolo Lake-Figure 3)

This campground is surrounded by young lodgepole pine that is regenerating after clearcutting in the late 1970s that are now dense stem exclusion stands. As such there is a high potential to carry a crown fire, but the susceptibility to the beetle outbreak is presently low. Screening vegetation between individual campsites is presently very good in terms of camper privacy, but lake views are limited by thick stands of lodgepole between the lake and the campsites.

Bunker Hill Campground (North shore of Lemolo Lake-Figure 3)

This campground is located in a stand of mixed conifer at the base of Bunker hill immediately on the lake's edge.

Unique Plant Communities/Meadow Habitat (Figures 10 and 14)

Within the Diamond Lake and Lemolo Lake Management Area, protection of unique habitats is assigned on "overlapping habitats" (LRMP IV-110). Unique habitats include "natural meadows, rock outcrops, talus slopes, or other natural openings with high wildlife values" (LRMP IV-200). Although unique habitats comprise only a small percentage of the land base, they provide habitat for an exceptionally high percentage of the biological diversity on the Forest. Hickman (1976) estimated that non-forested habitats provided for approximately 85% of the plant species diversity of the Western Cascades. Vegetation manipulation or structural improvement within

150 ft. of inventoried openings is permitted only for the enhancement of wildlife (LRMP IV 200-201).

Lemolo Lake

Lemolo Lake reservoir was formed by flooding the valley where Lake Creek joins the North Umpqua River. Much of what is now open water was formerly an extensive series of wetlands particularly along Lake Creek. Wetlands still persist at both inlets to the Lake. Although situated on the shores of the lake, these wetlands would be considered fens rather than simply shoreline wetlands because they are fed by the mineral-rich ground water. Because of this, they are vegetatively distinct from most of the shoreline communities along Lake Creek and the North Umpqua River that are formed on alluvial sediments (Figure 9). These fens at both inlets include at least five major plant community types: dwarf birch (*Betula nana*) wetland; bog blueberry (*Vaccinium uliginosum*)/kalmia (*Kalmia microphylla*) hummocks, sedge (*Carex* spp.) wetlands, spikerush (*Eleocharis quinqueflora*) hollows, and a bogbean (*Menyanthes trifoliata*) pond.

Much of the character of these fen communities owes to the presence of peat mosses (*Sphagnum* spp.). The exceptional cation-exchange capacity of sphagnum, together with the effects of anaerobic decomposition, creates a highly acidic environment that few plants are adapted to. Several species of sphagnum are present which are roughly distributed along a gradient between the hollows and hummocks (Figure 9). Species include: *Sphagnum angustifolium*, *S. teres*, *S. squarrosum*, *S. capillifolium*, and *S. fuscum*. Brown and red tinged species of sphagnum tend to occur on the hummocks. The darker colors absorb heat and assist with capillary absorption of water up the stems on the hummocks which lie above the water table. Members of the heath family, including bog huckleberry and kalmia prefer acidic habitats while other species have unique modifications for these specialized environments.

The insectivorous roundleaf sundew (*Drosera rotundifolia*) occurs on and around the perimeter of the hummocks while bladderwort (*Utricularia minor*) fills shallow areas of standing water with its finely dissected, submerged leaves. Bladderwort also produces leaves that are modified into tiny helmet-shaped bladders for trapping microscopic aquatic animals. The carnivorous modifications of these two species are adaptations to the anaerobic environment from which nutrients are not readily extracted.

The wetlands at the North Umpqua arm of Lemolo Lake have only a narrow wetland ecotone within the management area boundary although Kelsay Valley at Inlet Campground and upriver is characterized by an extensive mosaic of swampy forest and diverse meadows. The wetlands at the Lake Creek arm have a broader wetland-influenced interface in some areas characterized by open lodgepole pine with a tall grass and forb understory. Lake Creek meanders from Diamond Lake and Lemolo Lake mostly through a low-gradient, open floodplain within a broad stream terrace that is dominated by old to mature Englemann spruce (*Picea englemannii*) and Douglas-fir along with a mix of hemlocks and true firs.



Figure 9. Dense thickets of dwarf birch, bog blueberry, kalmia, and willow line the sedge openings in this photograph from the Lake Creek inlet to Lemolo Lake.

The shoreline of Lemolo Lake is otherwise represented by an unvegetated drawdown zone and the associated steep, unvegetated banks above full pool. The lack of vegetation on the exposed banks is a result of the excessive steepness, the lack of nutrients and organic matter, and lack of summer soil moisture. The drawdown zone remains unvegetated because the water is maintained at full pool during the summer for recreation and dropped in the autumn leaving the banks exposed to winter freezing. This cycle is the reverse of what would naturally occur in a lake (i.e. the lake would fill during the winter and slowly drop during the summer months) so few plants are adapted to survive such a hydrologic condition.

In order to mitigate, in part, for the wetlands lost to the various water impoundments associated with the hydroelectric project, some wetlands are being created or restored. This includes one small wetland near the east shore of the Lake Creek arm of Lemolo Lake. This area was planted in 2007 to sedges and grasses that occur in other nearby wetlands along with aspen.

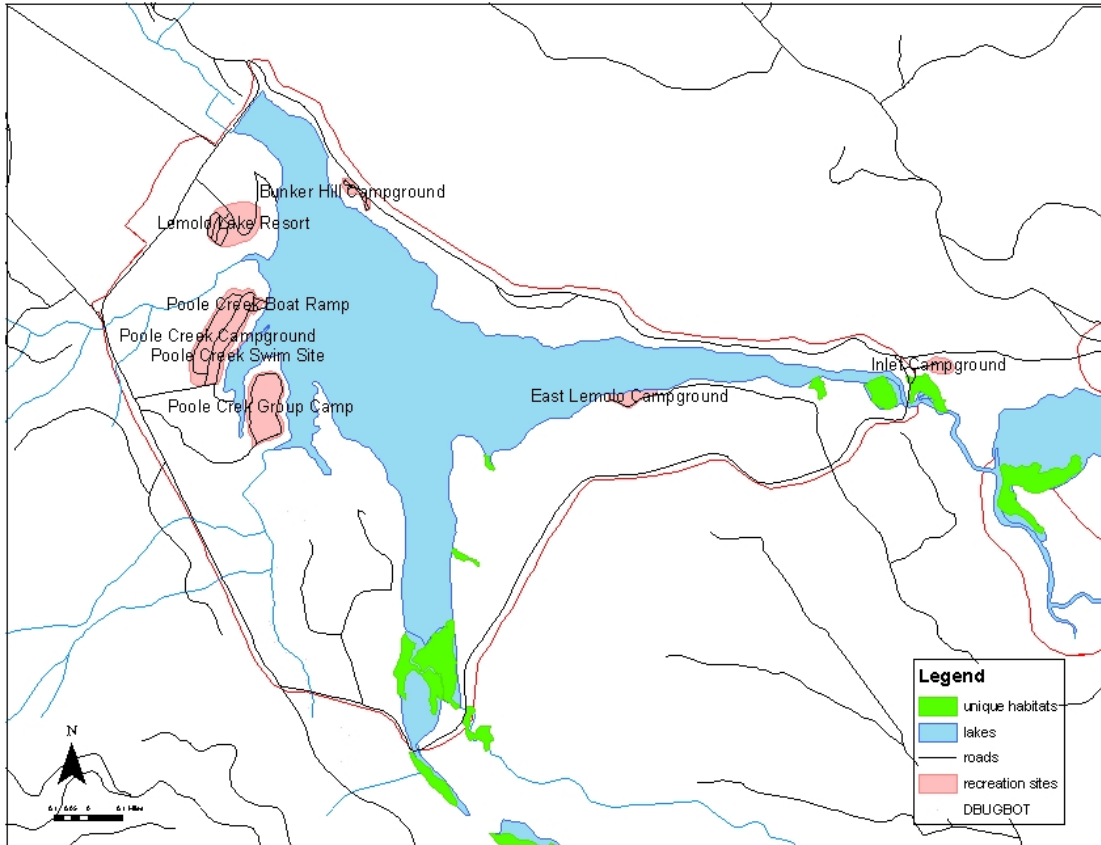


Figure 10. Unique habitats and recreation sites at Lemolo Lake.

Diamond Lake

Extensive wetlands extend over about 156 acres at the south end of Diamond Lake. The largest wetland at the south end of Diamond Lake is dominated by numerous sedges and other grasses with relatively little shrub or sphagnum development. Aquatic Sedge (*Carex aquatilis*) and beaked sedge (*C. utriculata*) are the most abundant sedges. While these species form near monocultures over large acres there are also small patches of other species including slender cottongrass (*Eriphorum gracile*), few-flowered spikerush, and other sedges. There are small patches of *Sphagnum mendocinum* scattered through the larger meadows and limited hummock development occupied by bog blueberry and Geyer's willow (*Salix geyeriana*). In these meadows English sundew (*Drosera anglica*) replaces roundleaf sundew.

Within this large sedge meadow there are shallow ponds of pond lilies (*Nuphar lutea*) and swaying bulrush (*Schoenoplectus subterminalis*) that grade, without defined banks, into the wet sedge meadow. Swaying bulrush is rare sedge-like species with flaccid leaves that float on the water's surface. Bladderwort is also common in these areas of ponded water and bogbean occurs sporadically in shallower water. Yellow pond lily and swaying bulrush also occur at Horse and Teal Lakes.

The large wetland, along with Horse and Teal Lakes, are hydrologically connected with the water level in Diamond Lake. These meadows drained during the summer of 2006 when the lake was drawn down for treatment of the invasive Tui chub with Rotonone. Since the lake level is artificially maintained at full pool throughout the summer, this also keeps the wetlands at the south end of the lake from gradually drying through the summer as well. It is unknown precisely what affect this has had on the plant composition of these meadows, but may explain why so much of the wetlands are occupied by only a couple of highly competitive, rhizomatous sedges.

The large wetland also exhibits past management in the form of an old roadbed that dissects the wetland just south of the lake shoreline and drainage ditches that no longer function (if they ever did) because the lake level is managed at the same level as the wetlands. These features have resulted in slightly increased topographic diversity of the wetland. The road is acting like a large, linear hummock while the ditches are mimicking “E” channels that are typical of large wetlands in the Cascades. Vegetation associated with both the former road and the ditches is entirely native and comprised of typical wetland species for the Cascades.



Figure 11. Star sedge forms yellow-green clumps in the foreground of this photograph. The white in the background is the fluffy, white heads of cottongrass. The red patches are spike-rush. Mt. Thielsen is in the background.

Drier meadows are largely dominated by tufted hairgrass (*Deschampsia cespitosa*). Some areas that are only vernal moist are sparsely vegetated with silverweed cinquefoil (*Potentilla anserina*), aster and grapefern (*Botrychium multifidum*). The most diverse communities are associated with the upper reaches of Silent Creek and some of the smaller wetlands near Highway 230. These meadows contain a diverse assemblage of sedge wetlands and rich fen communities that are similar to the previously described communities at Lemolo Lake. Road 6592-100 bisects two of these wetlands effectively damming the meadows such that there is a persistently wet meadow above the road and a drier meadow below.

The meadow openings are largely surrounded by a broad ecotone of Lodgepole pine with an understory of dwarf blueberry (*Vaccinium caespitosum*) or grasses, particularly bluejoint reedgrass (*Calamagrostis canadensis*), and sedges. There is often a subordinate mix of mountain hemlock and true firs intermingled with the lodgepole pine. Western gall rust is locally abundant on the lodgepole pines in much of this area (Figure 12). It forms large galls on the stems and branches and is very evident along the bike path in the vicinity. This is a common disease of lodgepole pine in humid areas but does not appear to spread very rapidly or represent a significant threat to adjacent stands.



Figure 12. Western gall rust on the stems of lodgepole pine along the edge of a wetland south of Diamond Lake.

A rare and unusual species of moss, *Schistostega pennata*, occurs in the wet lodgepole pine habitats adjacent to Diamond Lake. It is largely confined to the shaded, moist soil of uprooted trees although it has also been found in one hole in the ground along Silent Creek. Because it occurs in shaded areas, the new growth of germinating spores (called protonema) glows yellow-green from reflected light. This luminescence is the product of lens-shaped cells that concentrate light on the chloroplasts. Because it glows from darkened crannies in the forest, it is sometimes known as goblin's gold. It also is unusual in having sticky spores that are transported to fresh substrates on insects and other animals. The wet pits where *S. pennata* can be found are always filled with a cloud of gnats and mosquitoes. This adaptation is important because the upturned trees which *S. pennata* depend upon only provide habitat for so many years before they decay into a mound of soil. Because the insects and moss share the same habitat preference, the insects appear to facilitate transport of spores. The lodgepole pine surrounding Diamond Lake is currently at a late-mature stage and is subject to blowdown and breakage. This has created a flush of suitable habitat for *S. pennata* that should last into the near future.

Another rare species that is related to fallen trees in the wetland forest interface (Figure 13) is the liverwort, *Tritomaria exsectiformis*. It grows on well-decayed logs and organic streambanks that

are in immediate proximity to water. Maintaining a continual source of large logs is critical to the persistence of this and many other more common log-dwelling mosses and liverworts.



Figure 13. Many plants, particularly mosses and liverworts, depend upon decaying logs in and along the streams and wetlands for habitat.

There is an aspen (*Populus tremuloides*) community adjacent to the lake in the G-loop of Diamond Lake campground. The understory is dominated by large, native forbs: cow parsnip (*Heracleum lanatum*), Alice Eastwood's fleabane (*Erigeron aliciae*), western coneflower (*Rudbeckia occidentalis*), northern bluebells (*Mertensia paniculata*), and Canada goldenrod (*Solidago canadensis*). It is difficult to know whether this is a planted or natural population.

Diamond Lake, itself, supports an extensive aquatic plant community along with emergent plant communities along the western shoreline. Emergent plants are plants that have their bases submerged in water but aerial stems, leaves and flowers. The most extensive emergent community occurs north of Thielsen View Campground where an extensive patch of cattail (*Typha latifolia*), yellow pond-lily and hardstem bulrush (*Scirpus acutus*) occurs. The eastern shoreline is mostly too steep and rocky to support wetland or aquatic plants and much of the shoreline is occupied by reed canarygrass (*Phalaris arundinaceae*). This is generally considered to be an undesirable species today because it aggressively replaces native shoreline species but was probably intentionally planted for shoreline stabilization.

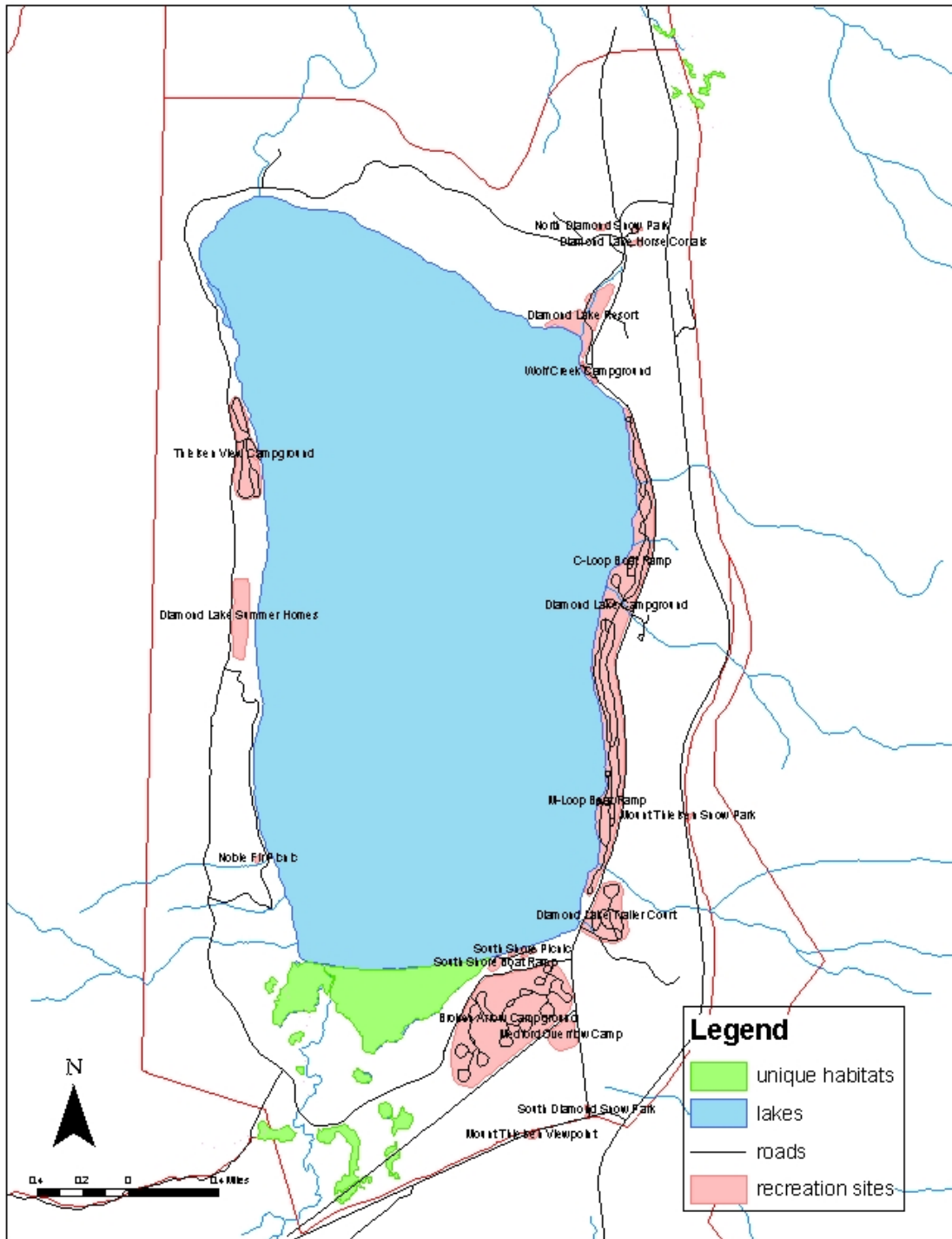


Figure 14. Unique habitats and recreation sites at Diamond Lake.

Wildlife Habitat

Coniferous forest types and the wetland habitats described previously provide suitable habitat for a variety of wildlife species. Vegetation management activities to maintain or augment coniferous forest wildlife species are not a priority for vegetation management in the area. However, there are several priority wildlife habitat elements that can be managed to contribute and enhance the experience of the concentrated developed recreation emphasis. These are: bald eagle nesting and foraging habitats, open water lakes and wetlands, wet meadows, and watchable wildlife habitat.

Bald Eagle Nesting and Foraging Habitat

There are two known active bald eagle nests located within the Diamond Lake Recreational Composite area. A third is located just outside the Lemolo Lake Recreational Composite. Together these nests comprise 3/4ths of the bald eagle nests on the Umpqua National Forest. Annual monitoring over the past 10 years indicates that each of the Diamond Lake nests have been active for 9 of the 10 years, while the Lemolo Lake nest has been active for all 10 years. Cumulatively these nests have fledged 26 young during this time period. Both nest locations at Diamond Lake are within the Composite boundary, along with portions of the designated nest management zones. The nest and nest management zone for the Lemolo nest fall outside the Management Area 2 boundary, but the primary foraging area for this pair is Lemolo Lake.

Open Water Lakes and Wetlands

The dominant landscape features within both recreational areas are the large lakes. In addition to Lemolo and Diamond Lakes, the recreational management area also includes the smaller Horse and Teal Lakes. Although not a natural body of water, the Diamond Lake sewage lagoons also provide open water habitat that is utilized by a large variety of wildlife species. Cooperative monitoring by the Audubon Society has documented the following species which are only associated with such large water bodies: common loon, western and Clark's grebes, goldeneye, bufflehead, greater and lesser scaup, ring-necked duck, double crested cormorant, bald eagle, osprey, California gull, Caspian tern, arctic tern and Foster's tern. Common loons require secluded nesting areas immediately adjacent to large rearing lakes. Suitable nest locations include grassy areas or sedge meadows with few disturbances and very gentle terrain. Suitable nesting habitat can be found in the large sedge wetland on the south end of Diamond Lake and in the wetland on northwest corner of the lake.

Sedge Wetland

The sedge wetlands are potential habitat for the Forest Service Sensitive yellow rail. This species has not yet been verified in the area, but this habitat provides some of the best potential for this rare species on the Umpqua National Forest. These wetlands are also habitat for several unique wildlife species including: spotted sandpiper, solitary sandpiper, western sandpiper, short and long-billed dowitcher, Wilson and red-necked phalarope, sandhill crane and greater yellowlegs. In addition, these wetlands are also habitat for other wildlife species. Of particular note is the healthy breeding population of western toads in the Horse Lake area. This species has had dramatic population declines in other areas of the west and is a federally listed species in some areas.

Watchable Wildlife Habitats

The recreational facilities at both Diamond and Lemolo Lakes have the highest visitor use on the Umpqua National Forest. Along with this high recreational use comes an excellent opportunity to provide wildlife viewing and interpretation. The chance to interact and experience even common wildlife species, like gray jays, chipmunks, flickers, gulls, mallards, and chickadees, can add to the satisfaction of the recreational visit. The composite areas also offer the chance to view less conspicuous species such as the bald eagle, beaver, common loon, wading birds, pine marten, elk, and black bear.

Noxious Weeds and Other Invasive Plants

The Umpqua National Forest adopted an integrated weed management strategy with Land and Resource Management Plan Amendment Number 4 (2003). This strategy is consistent with: the Federal Noxious Weed Act of 1974, as amended (7 U.S.C. 2801 et seq.), the Pacific Northwest Region's Final Environmental Impact Statement (FEIS) for Preventing and Managing Invasive Plants (2005), Executive Order (February 3, 1999) and the USDA National Strategy for Invasive Species Management (USDA Forest Service 2001). An integrated weed management strategy evaluates economic or environmental thresholds for managing weeds and utilizes a broad array of management techniques. Noxious weeds are designated by both the Federal and State governments. Noxious weeds are generally aggressive, non-native species that can cause economic or environmental harm or harm to human health.

State-listed noxious weeds are relatively sparse within both the Lemolo Lake and Diamond Lake recreation composite areas. Most of the weeds are associated with roads, campgrounds and other areas where the soils and vegetation have been disturbed. St. Johnswort (*Hypericum perforatum*) occurs in small patches throughout both areas. Isolated plants of bull thistle (*Cirsium vulgare*), Canada thistle (*C. arvense*), and Scotch broom (*Cytisus scoparius*) are also scattered about. Of these weeds only Scotch broom has been subject to active management in the lakes area. There are currently no extant known sites of Scotch broom in the area and any new sites would be subject to eradication.

Spotted knapweed (*Centaurea maculosa*) and diffuse knapweed (*C. diffusa*) have been the highest priority weeds for treatment in the immediate area. Several infestations of spotted knapweed had become established along Highways 138 and 230, including by the sign at the north entrance to Diamond Lake and the junction at the south entrance. These infestations have been sprayed with herbicide since 2003 and are now nearly eradicated. Another small site on the Lemolo Lake road was sprayed in 2004 and may be gone. There are small infestations of diffuse knapweed along the road near the Lemolo Lake dam which have also been sprayed and are currently nearly eradicated.

Reed canarygrass (*Phalaris arundinaceae*) is perhaps the most significant of the many other non-native species that occur within the area. This is a very tall, rhizomatous grass that was probably intentionally planted around the lake shores to stabilize the banks. It lines much of the shoreline of Diamond Lake. It also occurs in patches along the Lake Creek inlet to Lemolo Lake and

perhaps in other places as well, however the banks around Lemolo Lake are largely barren of vegetation. This very aggressive species is very difficult to eradicate once established.

Recreation use can provide both a vector for spread of weed seed and provides a favorable seed bed by disturbing the soil and vegetation. Although wind, water and animals all contribute to movement of weeds, vehicles appear to be the most effective vector for weed seed distribution. When vehicles are traveling from distant locations, this increases the potential for bringing in new invasive species to the Forest. The horse corrals at Diamond Lake provide another potential vector for weed movement. Straw and hay brought in for use as feed or bedding is of particular concern because of the potential for it to be contaminated with weed seed.

II. Desired Conditions and Recommendations

Community Wildfire Protection

Implement the recommendations in the Douglas County Community Wildfire Protection Plans for the Lemolo and Diamond Lake at risk communities. These include:

- a) Thinning 300 feet around structures and critical infrastructure.
- b) Clearing and thinning evacuation routes for homes and areas of recreation. The evacuation routes include State Highways 230 and 138; FS road 2610 into Lemolo Lake from Highway 138 and 2610-400 surrounding Lemolo Lake; FS Road 4795 surrounding Diamond Lake; and FS road 6592 exiting Diamond Lake to the south.
- c) Implementing fuel reduction treatments include mechanical clearing and thinning in the WUIs including harvesting, thinning, mowing, mastication, chipping, cutting and piling.
- d) Using prescribed burning where appropriate as a method of fuels reduction.

Scenery Management

Apply the applicable concepts of the Pacific Northwest Scenery Management System (Appendix J) to highlight conditions and locations where exceptions to the standards and guidelines for scenery management are needed. Site-specific forest plan amendments should be pursued where necessary to achieve a desired scenic character⁴ that is compatible with desired conditions for vegetation and fuel management in order to lower the fire hazard in the WUIs and along evacuation routes. Opportunities to highlight and showcase views of legacy old-growth trees that are now obscured by dense understory ingrowth should be identified during NEPA analysis for vegetation management. Mitigation measures should be developed to lower the short-term

⁴ The desired scenic character under the Scenery Management system is defined as “The most complete, attractive and sustainable expression of the valued scenic character which is compatible with that landscape’s fully integrated set of Desired Future Conditions.” Desired Scenic Character represents the most “ideal” and attractive scenic identity that is possible, given the limitations of the ecosystem and achievement of other resource objectives as defined in the LMP or project-level Desired Future Conditions.

impacts to scenery in campgrounds, the foreground of primary access roads, and other high use areas where vegetation management is planned.

The LRMP suggests opening sizes of 0.25 acre to 1.5 acres in the foreground areas of retention and 0.5 to 1.5 acres in the foreground areas of partial retention (Tables 1 and 2). Larger openings are suggested in middle ground areas of retention and partial retention areas. Where lodgepole stands are susceptible to beetle mortality, the opening size limitations should be amended during site-specific NEPA analysis to meet the overarching objectives of hazard management in high use recreation areas and WUIs.

Management Areas 1 and 2

The LRMP places a size limitation on timber harvest openings (units) that can be created within Management Area 2, the Lemolo Lake and Diamond Lake Recreation Composites. In order to allow for removal of beetle killed trees and to allow for the lodgepole pine to be removed, the LRMP should be amended during site-specific NEPA to allow for timber harvest units greater than ½ acre in size.

The LRMP does not permit timber harvest in Management Areas 1, except in the event of catastrophic damage. In order to lower the effects of the on-going mountain pine beetle outbreak and reduce fuels in the vicinity of the Wildland Urban Interface Area, the LRMP should be amended during site-specific NEPA to allow timber harvest to help reduce the fire risk within and adjacent to MA 1, west of Diamond Lake.

General Fuel and Forest Structure

The desired vegetative condition for fuels and stand vigor are lodgepole stands structures that are more resilient to infestation from pine beetle and thus represent a lower wildfire threat to important high use recreation areas and homes both in and outside WUIs and along designated evacuation routes. The desired mixed conifer stand structure would generally be more open posing less threat to old-growth legacy trees from fire, insects, and disease.

Pure Lodgepole pine

In mature stands (80 years old or older) that are susceptible to infestation from mountain pine beetle (dense stands with lodgepole 8 inches and greater), commercial timber harvest should be employed to remove the host trees before the beetles infest an area. Where healthy lodgepole exists with adequate crowns, either heavy thinning (with trees spaced 25-30 feet apart ranging from 50-70 leave trees/ac) or an overstory removal (with leave trees to meet standards and guidelines), or a mosaic of these prescriptions resulting in variable density thinning is recommended. This approach allows landscape level treatments. These prescriptions would meet Forest Plan tree retention standards when interspersed with uncut leave groups. With fewer host trees, and increased sunny micro-climate, beetle-caused mortality of remaining host trees can be decreased (Fettig et al. 2007). Where healthy lodgepole are not present, the overstory removal prescription is recommended since unhealthy, failing lodgepole leave trees would

eventually add to the fuel accumulation. The overall objective in mature lodgepole is to diversify stand structure and to decrease the future accumulation of fuel and dangerous hazard trees in the recreation areas and the WUIs.

The LRMP excluded most of the lodgepole pine ecosystem from the timber harvest base because of poor site conditions and low growing capacity. A recent analysis (Blackburn 2007) of stand conditions shows that these sites are growing at a rate that exceeds plan expectations. The 1990 LRMP should be amended during site-specific NEPA to allow for timber harvest in the lodgepole pine ecosystem to lower hazards to recreation areas.

In younger stem exclusion lodgepole pine, apply cost-effective density management techniques such as mastication in order to accomplish a maximum amount of acreage in a cost-effective manner to lower the potential fire intensity in the WUIs.

Mixed conifer and lodgepole/mixed conifer

In older mixed conifer timber stands, thinning from below would reduce stand density to the approximate conditions that would occur under the nature fire regime. The objective is to improve the resiliency of stands to withstand the effects of fire, insect outbreaks and other uncharacteristic conditions that occur under excessive tree densities. In the older lodgepole/mixed conifer stands not yet affected by the beetle infestation, thinning should remove or lower the density of susceptible pines from the overstory and release understories. In such stands where the older, large lodgepole pine have mostly all died, remove some of the dead and dying trees as economically feasible during the thinning operation. Seek funding sources to burn or otherwise dispose of excessive fuel loads determined to be sub-merchantable.

Stands containing ponderosa and western white pine would particularly benefit from reduction in competition through thinning of subordinate trees. These pines are also susceptible to mortality from mountain pine beetle especially under dense conditions created by fire exclusion. Western white pine is more susceptible to white pine blister rust under unnaturally dense conditions and ponderosa pine is also weakened by other diseases under excessively dense conditions increasing the likelihood of beetle mortality. Underburning is recommended where feasible in the stands containing ponderosa pine as long as duff mounds are pulled away from the base of the legacy pines two years in advance of the under burn. Underburning is not recommended in the stands containing western white pine.

Vegetation Management in High Use Areas

Tree toppling hazards

Use timber sale or stewardship contracts to remove existing and anticipated future hazard trees within a zone of one tree height around structures and developments including certain high-use Forest Service roads. For the 102 recreation residents on the west shore of Diamond Lake, this recommendation applies to the area *beyond* the individual lots (The lots average about ½ acre each). For the other facilities under special use permit that do not have surveyed areas, this recommendation applies to the immediate area surrounding developed structures and homes for a

distance of at least one tree height. This recommendation is made to reduce the toppling hazard while maintaining a reasonable and practical expectation of timber sale purchasers.

Hazard trees should be assessed by knowledgeable Forest Service representatives with input from permittee holders. The objective is to lower the immediate and future safety hazards from tree toppling or branch fall from either dead or live trees of all species. Designation of hazard trees should be based on existing tree condition and the characteristics of the particular tree species. Hazard should also consider stand conditions including present and anticipated trends related to insects, disease, competition, age, fire exclusion, and seral stage. Slash should be cleared to lower fire hazard and improve defensible space around permittee developments.

Wildfire protection

Overly dense forest stands near special use permit sites should be thinned to lower fire hazard following the recommendations above in collaboration with permittee holders.

Forest Service Managed Sites

In all Forest Service administered recreation sites at both Diamond and Lemolo Lakes where susceptible lodgepole and other pines exist, tree densities should be managed to avoid the level of tree mortality, public safety hazard, scenic impact, loss of use, and economic impact that occurred from 2005-2008 at the Diamond Lake campground. Thinning prescriptions for the recreation sites should be developed to lower the susceptibility of lodgepole pine beetle mortality, while applying visual mitigation and visual rehabilitation techniques. Prescriptions should generally focus on leaving the large, healthiest trees that are least susceptible to disease, rot and blowdown. Where feasible, stewardship or timber sale contracts should be used to remove commercial wood products from the recreation facilities to lower the economic impact to the recreation budget.

Visual mitigation techniques such as stump grinding, stump flush cutting, stump coverage with slash and duff, and appropriate tree and shrub plantings should be utilized in the Diamond Lake Campground, as funding allows.

Unique Plant Communities and Wetland Habitats

New developed recreation should be discouraged in unique and wetland habitats. The integrity of the forest ecotone around wetland and meadow habitats should generally be maintained to provide screening for wildlife, recruitment of wood and snags and maintenance of shade and humid microsite conditions around the perimeter of these meadows. Minor exceptions may be made for incursions into unique habitat buffers to provide wildlife viewing areas as appropriate to the site. Mature and old-growth stand conditions around the meadows should be encouraged. Thinning to promote such conditions may be appropriate in young stands.

The large nesting and roosting trees used by eagles, osprey, and double crested cormorants would be maintained in vigorous conditions for long-term use by these species. This may also extend to more distant locations for eagle and osprey nesting and perching habitat.

It would be desirable to remove the section of the 6592-100 road that is bisecting two wetlands. With removal of the road and the associated fill material, the natural hydrology and plant communities should rapidly recover on their own.

Remnants of a long abandoned road and three drainage canals remain within the largest wetland along the south shore of Diamond Lake. Although a lower priority because features due not appear to be causing any resource damage under current management of the lake, it could be useful to break up the linear road bed into more natural shapes and plug the canals near their exit points at the lake. It is not clear that the canals function at all while the lake is maintained at full pool but the canals blew out when the lake level was dropped in 2006 facilitating drainage of the wetlands. Plugging the canals would moderate wetland hydrology from any future or ongoing manipulation of the lake level.

Bald Eagle Nesting and Foraging Habitat

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

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

Watchable Wildlife Habitats

The desired condition is the maintenance of vegetative conditions in and around developed recreational sites (campgrounds, the RV Park, trails, and day use areas) that enable frequent opportunities for visitors to have close contact with watchable wildlife. To maximize these opportunities plant communities within these areas should contain a diversity of tree, shrub and ground layer species, along with a variety of age classes. In areas where tree species or shrub cover are not at desired levels, plant species such as aspen, serviceberry, willow, snowberry, huckleberry to improve species and structural diversity. Another desirable habitat component is down wood and debris. Hazard trees should be left on-site where possible; otherwise they should be placed in small aggregations in more suitable locations around the recreational site.

Invasive Plants

Forest Service policy emphasizes an integrated weed management approach to treatment of invasive species. This includes prevention of the introduction and establishment of invasive plant species and containment and suppression of existing weed infestations. Pertinent prevention measures in the Diamond Lake and Lemolo Lake composite areas include: restricting the amount of disturbed area around recreation sites and facilities, restricting vehicle use outside of roads and developed recreation sites, rapidly revegetating areas following soil disturbance and using only certified weed-free straw, hay and seed.

High priority noxious weed infestations, particularly of spotted and diffuse knapweed, should continue to be monitored and treated using methods that have a reasonable expectation of success. Lower priority weeds, such as reed canarygrass, may be managed on a site-specific basis in conjunction with other site restoration or recovery efforts.

Literature Cited

Atzet, T.D., D.E. White, P.A. Martinez, O.L.A. McCrimmon. 1996. Field Guide to the forest plant associations of SW Oregon. USDA, PNW Region, Technical Report R6-NR-_ECOL-TP-17-96. 334 pages.

Blackburn, Lori. 2007. Lodgepole Suitability and Forest Plan Amendment. Unpublished Memo by the Umpqua NF Silviculturist.

Burns, R.C., A.R. Graefe and K. Robinson. 2002. Recreationists on the Umpqua National Forest: A Survey of User Characteristics, Behaviors and Attitudes, University of Florida and Pennsylvania State University. Unpublished.

Fettig, C.J., K.D. Klepzig, R.F. Billings, A.S. Munson, T.E. Nebeker, J.F. Negron, J.T. Nowak. 2007. Forest Ecology and Management, 238: 24-53.

Douglas County Community Wildfire Protection Plans. 2005-2006. Douglas County Planning.

Goheen, Don and Dave Bridgwater, 2007. Forest Service entomologists, field trip to the D-bug project, personal communications,

Stuart, J.D., J.K. Agee, and R.I. Gara 1989. Lodgepole pine regeneration in an old, self sustaining forest in south central Oregon. Canadian Journal For. Resources Vol 19 (1096-1104).

Oliver, C.D. and B.C. Larson 1996. Forest Stand Dynamics. Biological Resource Management Series. McGraw-Hill. 467 pages.

Perkins, J.W. 1938. Reminiscences of Southern Oregon pioneers; a personal interview of George A. Bonebrake (December 3, 1938). Unpublished.

Page, W.G. and M.J. Jenkins. 2007. Mountain pine beetle-induced changes to selected lodgepole pine fuel complexes within the Intermountain Region. Forest Science, 53(4) 507-518.

Parker, T.J., K.M. Clancy, and R.L. Mathiasen. 2006. Agricultural and Forest Entomology. 8, 167-189.

USDA, Umpqua NF. 1998. Diamond Lake-Lemolo Lake Watershed Analysis. Unpublished.

USDA Forest Service, Pacific Northwest Region, Final Environmental Impact Statement (FEIS) for Preventing and Managing Invasive Plants (2005), Executive Order (February 3, 1999) and the USDA National Strategy for Invasive Species Management (USDA Forest Service 2001).

J.B. Waldo. 1880-1909. Diaries and Letters from the High Cascades. Unpublished.