ODELL PILOT WATERSHED ANALYSIS

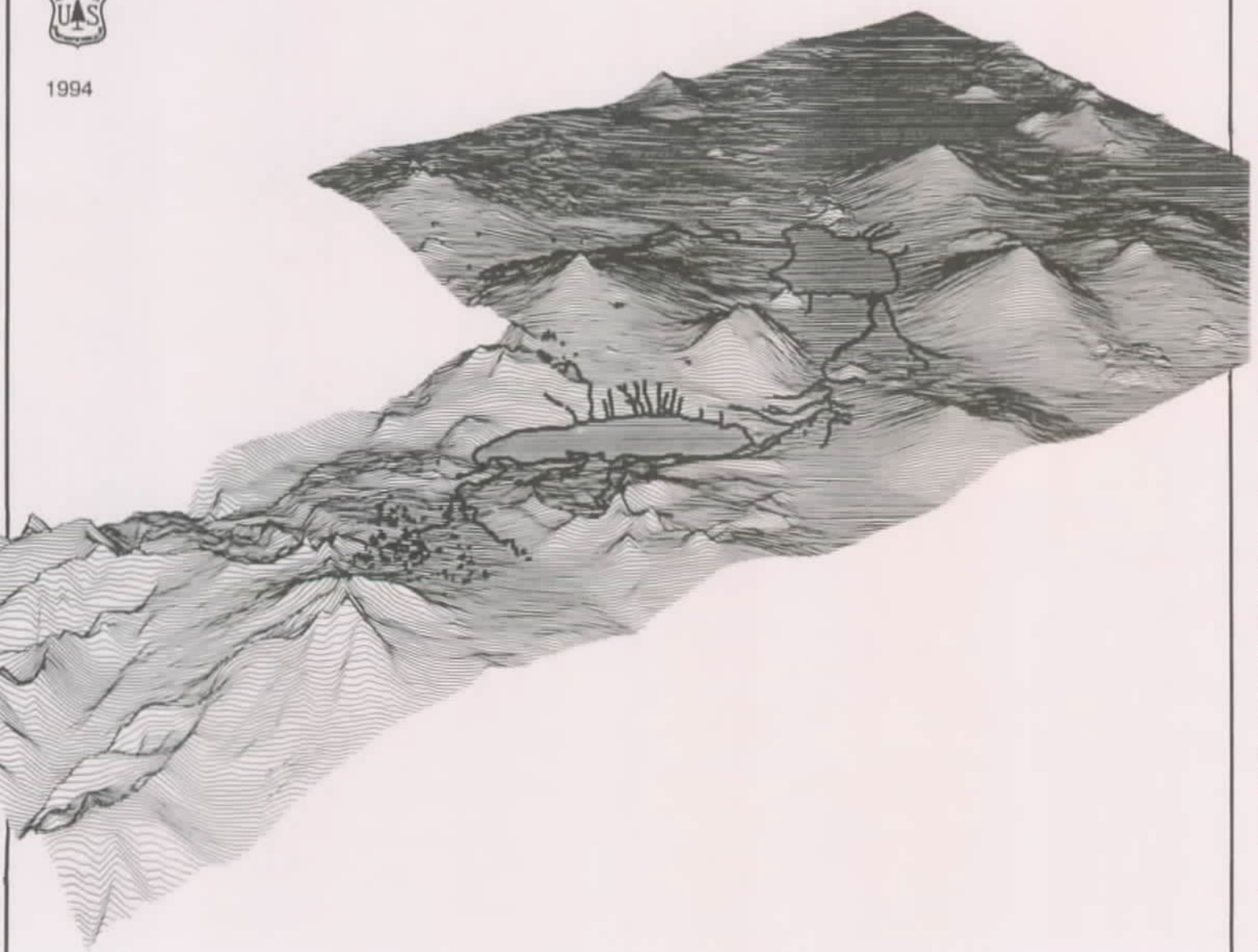
DESCHUTES NATIONAL FOREST
CRESCENT RANGER DISTRICT

United States
Department of
Agriculture

Forest Service

**Pacific
Northwest
Region**

1994



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EXECUTIVE SUMMARY

ODELL PILOT WATERSHED ANALYSIS

DESCHUTES NATIONAL FOREST

NOVEMBER, 1994

The Odell Pilot Watershed Analysis is written to help guide provincial and project planning on the Crescent Ranger District of the Deschutes National Forest. The analysis area includes three subwatersheds: Moore Creek, Odell Lake, and Odell Creek which is a Key Watershed. The Odell Watershed is one of 15 Pilot Watersheds selected by the interagency committee assigned the task of implementing the President's Forest Plan.

The purpose of the analysis was to develop conceptual strategies to sustain viable ecosystems. Analysis was completed using the *Watershed Evaluation & Analysis for Viable Ecosystems* (WEAVE) process developed in November, 1993 on the Deschutes National Forest to help clarify and implement the *Federal Agency Guide for Pilot Watershed Analysis*. The WEAVE process melds social values, biological capabilities, and physical characteristics of the landscape at a watershed scale. This scale is physically and ecologically relevant and socially meaningful for analysis. The WEAVE process includes five phases which are as follows: A) Orientation and context setting, B) Data gathering and analysis, C) Information sharing (also called team teaching), D) Synthesis and integration, and E) Landscape goals and opportunities.

Analysis was completed for three basic areas called domains: Physical, Biological, and Social. The physical domain includes climate, air quality, geology, soil resources, soil quality, and water resources. The biological domain includes historic, current, and potential vegetation, riparian resources, and wildlife. The social domain includes historic, current, and potential human interactions within the context of the watershed.

Key issues were identified and were concentrated within four general topical categories: 1) Viability of indigenous fish, 2) Recreational use, 3) Soil quality, and 4) Vegetative structure. Key questions pertaining to these issues were generated and used to focus and drive the watershed analysis.

Phase D, synthesis and integration, analysis identified trends which relate to the key issues and questions. These trends result from factors which, over time, influence change on a given element or portion of the ecosystem. The trends were categorized as either red, yellow, or green. Red implied a "red flag" signifying urgency for intervention to prevent further deterioration of a resource, endangered species, or to ensure species viability. Yellow indicated something must be done soon to prevent the resource from becoming a red trend. Green indicated the urgency is not great or the trend maintains or enhances ecosystem sustainability and should continue.

Red flag trends include reduction of large tree dominated stands, loss of western white pine as an invader of root rot pockets, and questionable viability of bull trout populations. Yellow flag trends include increased soil compaction, forest stands increasing in risk to catastrophe as they approach later seral stages, increased human use, and non-native fish populations. Green flag trends include reduction in viability of meadows, riparian areas in sustainable condition, stable water quality, and fluctuation of the water level in Davis Lake.

Development of landscape goals and opportunities, or Phase E of the WEAVE process, was completed by landscape area. The landscape areas were designed to encompass locations where the physical, biological, and social domains had relatively similar stratifications. Goals, objectives, and opportunities were developed for each of the six landscape areas. Opportunities include a variety of potential activities ranging from restoration to maintenance to monitoring of particular resources within the watershed.

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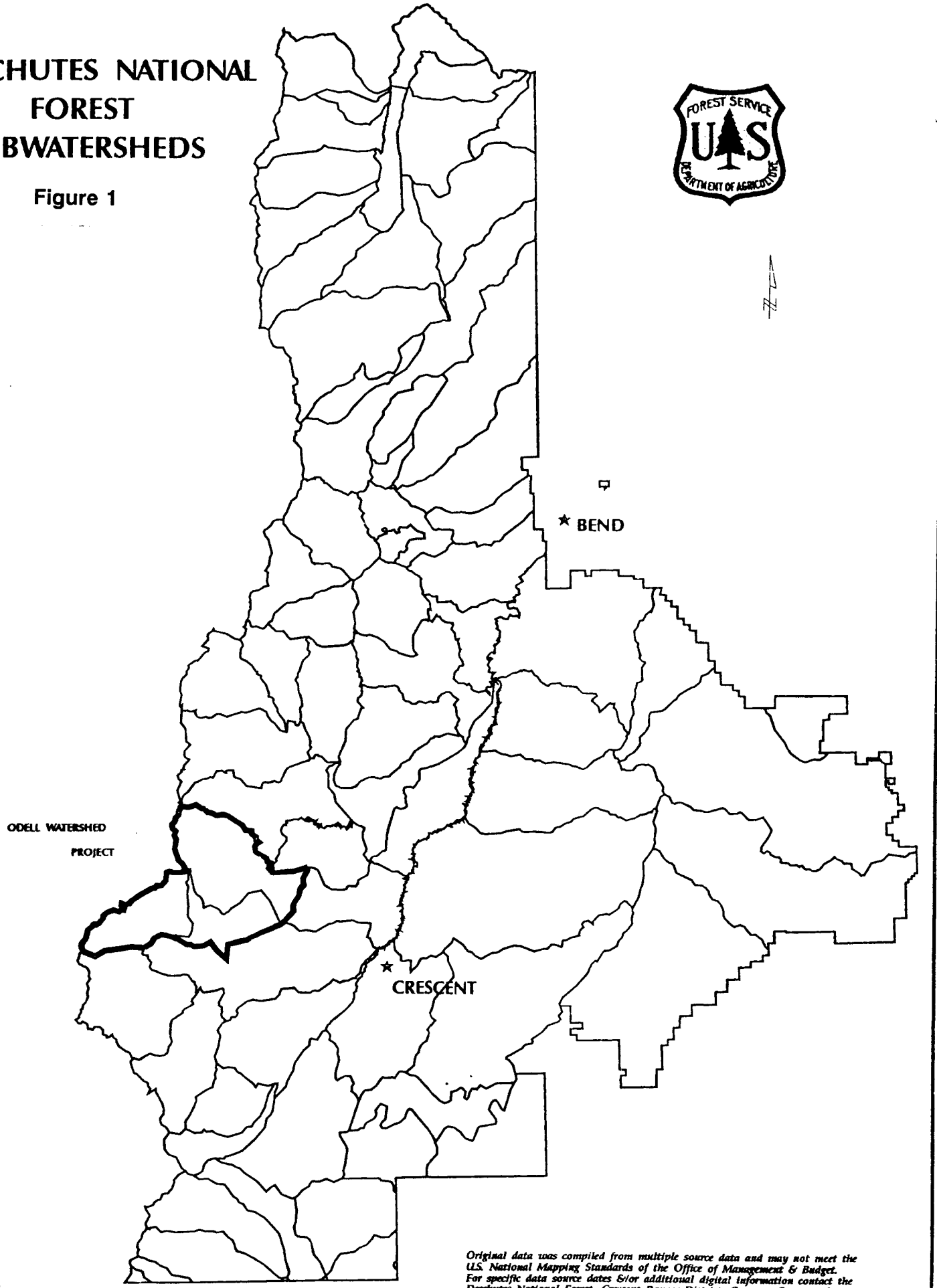

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CHAPTER 1

BACKGROUND INFORMATION

BACKGROUND INFORMATION

ROD AND PILOT WATERSHEDS

On April 13, 1994 the Record of Decision was signed which amended the Deschutes Land and Resource Management Plan to include Standards and Guidelines based on the *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.* The Record of Decision (ROD) requires that watershed analysis be completed in Key Watersheds prior to the occurrence of new management activities. The ultimate goal is to complete watershed analyses in all watersheds to guide provincial planning as well as project planning. Key Watersheds were identified by building on work completed by the Scientific Panel on Late-Successional Forest Ecosystems and the Scientific Analysis Team. Seven Key Watersheds were identified on the Deschutes National Forest. "Watershed analysis is required only in Key Watersheds prior to land management. Ultimately however, Watershed Analysis should be conducted in all watersheds on federal lands as a basis for ecosystem planning and management" (DSEIS, p. B-80).

Fifteen Pilot Watersheds were selected by the interagency committee assigned the task of implementing the President's Forest Plan. These pilot watershed analyses are an important component of the interagency watershed analysis implementation program. The program is designed to provide a systematic and rigorous approach that tests and further develops the Federal Guide to Watershed Analysis, to explore mechanisms for interagency and intergovernmental cooperation, and to demonstrate that ecosystem-based management can produce commodities while minimizing environmental risks. A primary goal for analysis in Pilot Watersheds is to develop new models of regulatory involvement. By focusing on a small number of watersheds, these agencies will best be able to participate in the process of defining Watershed Analysis for use on Federal lands.

Pilot program objectives:

* Advance the concept of cooperative approaches for watershed analysis and ecosystem management.
* Build credibility through early and open participation in fast-track (6 months or less) pilots
* Develop a cadre of experienced analysts
* Clarify the hierarchical relationships between watershed analysis and province/basin analysis
* Field test the existing procedural guide and identify areas for improvement
* Obtain information about logistical needs (e.g. time, costs, personnel, and equipment)
* Develop techniques to improve the tie between watershed analysis and the decision-making process
* Continue interaction between research and management
* Develop model watershed analyses that would serve as quality standards
* Demonstrate how ecosystem management can support commodity production while minimizing environmental risks

A range of characteristics were used to select the 15 Pilots to be studied within the range of the Northern Spotted Owl for 1994. The Pilots were chosen to:

-- Represent different geographic conditions
-- Include state and tribal interests
-- Reflect an array of significant issues
-- Cover multi-ownership patterns
-- Studies to represent different scales

- -- Data poor to data rich
- -- Address restoration activities
- -- Identify management opportunities

Watershed Analysis is not a decision process; rather, it is a synthesis of information on ecological functions, environmental processes, and human interactions. It will reduce the time needed for subsequent project-level planning, and it provides strategies for making the best use of existing data and limited budgets. Watershed Analysis is an iterative process, not an endpoint. The analyses will be updated and revised if and when substantial new issues come forth, when important new information becomes available, or when significant changes in watershed condition occur. The analyses are intended to feed both upward to provide guidance on cumulative effects at larger scale, and downward for project-level planning. Conversely, information collected at provincial and project-level scales will be incorporated into watershed analyses.

WEAVE

Watershed Evaluation and Analysis for Viable Ecosystems (WEAVE) is the process developed on the Deschutes National Forest in November 1993, and is consistent with the "Federal Agency Guide for Pilot Watershed Analysis". WEAVE is a broad-based, ecosystem analysis which incorporates the original requirements of watershed analysis with landscape ecology concepts in a comprehensive holistic process. It melds social values, biological capabilities, and physical characteristics of the landscape at a watershed scale -- a physically and ecologically relevant and socially meaningful scale. The process provides: an efficient strategy for carrying out the analysis, checklists to ensure that relevant topics are not overlooked, suggested analytical techniques, strategies for synthesis, and recommended products. It is a five step process which begins by looking at the context of the watershed and its key issues (Phase A), then moves into in-depth data analysis in the physical, biological, and social realms (Phase B), provides for team teaching so each team member has a basic understanding of all dimensions of the landscape (Phase C), using this knowledge, ecological relationships are explored and integrated trends, causes, and factors at risk in the watershed are identified (Phase D), and finishes by stratifying the landscape, setting goals, and making appropriate recommendations (Phase E). See Appendix A for additional information on the WEAVE process.

The WEAVE process provides the framework necessary to begin Watershed Analysis on the Deschutes National Forest. The intent is to provide consistency and guidance while allowing enough flexibility for each analysis to be tailored to the relevant questions in a particular watershed. The process is dynamic. It was designed to incorporate feedback to allow for updates and modification as new information and technology become available. Pilot team members have documented what did and did not work for future updates of this "working" document. These changes, as well as suggestions from other Deschutes NF watershed analyses and Pilots on other National Forests, will be incorporated to update the WEAVE process for 1995.

The purpose of Pilot Watershed Analysis was to develop conceptual strategies to sustain viable ecosystems. The focus of the Pilot team was to mutually understand, identify, and document **key** trends, their causes, their associated risks, and where they fit within the historic range of variability. The Pilot team outlined strategies to meet human needs while sustaining viable ecosystems and biodiversity. Broad landscape goals, objectives, and opportunities were recommended, as well as means to meet aquatic conservation objectives and appropriate riparian boundaries. However, the scope of watershed analysis does not include project planning or decisions.

The goals of the Pilot watershed analysis were to:

- -- Begin to understand ecological components and interactions on the landscape.
- -- Establish the historic range of variability.

- -- Facilitate understanding of the mechanisms of landscape change.
- -- Address social values, expectations, and effects.
- -- Provide interagency and large-scale context.
- -- Provide guidance for project-level planning.
- -- Provide guidance to meet Aquatic Conservation Strategy
- -- Recommend Riparian Reserve boundaries.
- -- Provide a basis for developing monitoring strategies.

Upon review, the Pilot Team confirmed that the 8-Step procedure from the "Federal Guide" was completed through this Pilot Watershed Analysis effort.

ODELL WATERSHED

The Odell Watershed was chosen based on the presence of a species at risk, bull trout; it encompassed a Key Watershed; and exhibited an array of uses, values, and diversity of forested systems. In addition, GIS layers and data bases were more complete for this watershed than for other areas of the Deschutes National Forest.

The ROD allocations for the Odell Watershed and the acreage that they encompass are listed in the chart below:

Table 1 - 1, ROD Allocations

ROD Allocation	ROD Acres Within Watershed
Congressionally Withdrawn lands	12,212
Administratively Withdrawn lands	19,715
Late-Successional Reserves	35,222
Matrix	7,784
Total Acres	74,933

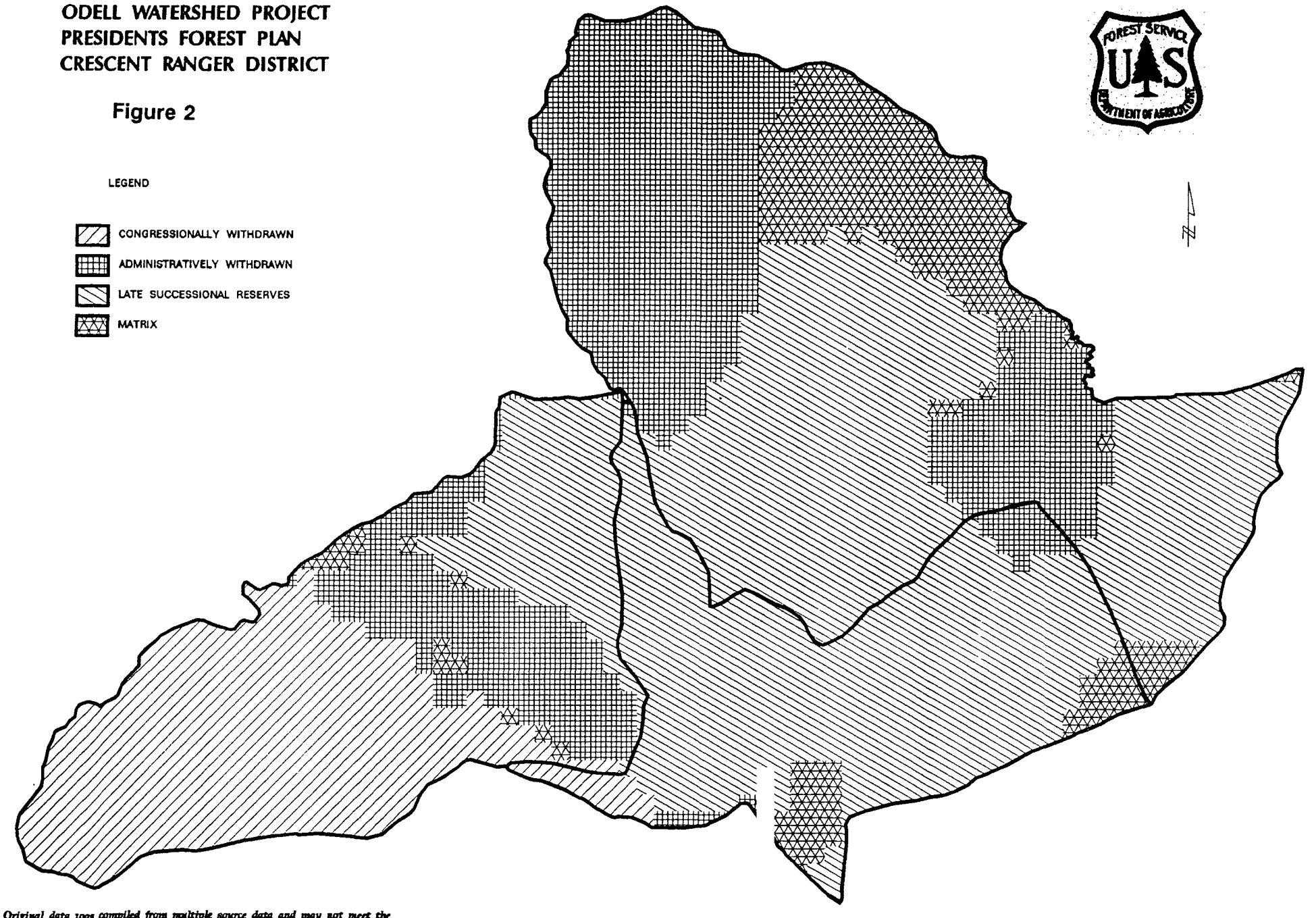
See Figure 2 for a map of the allocations.

PARTICIPATION WITH OTHERS

The Provincial Interagency Executive Committee (PIEC) is an interagency committee established to implement the President's Forest Plan by providing a coordinated strategy and guidelines for federal lands within the province. Issues at a broad scale will be addressed at this level. Currently, the land management agencies involved with the Deschutes Province are the Deschutes, Mount Hood, Ochoco, and Winema National Forests and the Prineville Resource Area. Many other Federal Regulatory Agencies are also involved including the EPA, US Fish & Wildlife Service, National Fisheries Marine Service, and Soil Conservation Service among others. State and local agencies as well as Tribal Governments are in the process of being included under a charter for the Federal Advisory Committee Act. When the PIEC Federal Advisory Committee is established, the Local Interagency Interdisciplinary Team (LIIT) will become fully functional, and will be patterned after the PIEC.

ODELL WATERSHED PROJECT
PRESIDENTS FOREST PLAN
CRESCENT RANGER DISTRICT

Figure 2



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Early involvement of the PIEC occurred during preparation of the Odell Preliminary Watershed Restoration Assessment. The Deschutes PIEC provided advice on issues and strategies, and reviewed restoration projects. Local Interagency Interdisciplinary Team review of the Odell Preliminary Assessment was also completed. Federal agencies involved with completion of the Odell Pilot Watershed Analysis included US Fish & Wildlife Service, EPA, Soil Conservation Service, and BLM. Input from state and local agencies and Tribal Governments was received during the open process described below.

Due to the Pilot nature of this analysis, public participation for the Odell Watershed Analysis was limited. Participation with other Federal, State, and Local agencies was frequent. The Confederated Tribes of the Warm Springs and the Klamath Tribe requested that they be informed of the progress of the analysis. A Liaison from each Tribe was able to attend at least one public meeting. Contact was made with individuals, special interest organizations, local business organizations, and permittees.

Several meetings were held to review the findings from the Preliminary Watershed Restoration Assessment. Notification of these meetings was published in the Bend Bulletin and, in addition, known interested parties were contacted. Review by Ranger District personnel throughout the process helped to ensure that the local viewpoint was represented. Comments were received at the meetings from individuals and a special interest group. Other organizations, permittees, and individuals provided comments but did not attend the meetings.

Team members worked with colleagues from other Federal, State, and local agencies on a regular basis. Non-Federal agencies and governments participated in the open meetings while Federal agencies participated in both the open meetings as well as Team meetings. The US Fish & Wildlife Service sent a full-time representative to serve on the Pilot Team. The Environmental Protection Agency, Soil Conservation Service, and Bureau of Land Management were also involved on several occasions also. See Appendix I for additional information on the open meetings and comments.

LINK TO LATE-SUCCESSIONAL RESERVE ASSESSMENT

It was recognized by the Pilot Team that a Late-Successional Reserve Assessment (LSR) is needed for this area in order to meet the Standards and Guidelines of the President's Forest Plan before many opportunities can be undertaken in the Odell Watershed area. While much of the information needed to complete the assessment was analyzed by the Pilot Team, completion of the LSR Assessment was outside the scope (time & funding) of the Pilot Team. The Pilot Team recommends that an LSR Assessment is undertaken in 1995 using the data and findings of the Pilot Team so that ecosystem restoration and other opportunities may be explored, studied under NEPA, and implemented as appropriate in the near future.

CHAPTER 2

ORIENTATION AND CONTEXT SETTING

(PHASE A)

KEY WATERSHEDS

The Odell Pilot Watershed extends from Diamond Peak north to Davis Lake, and from Davis Lake west to the crest of the Cascade Mountains. The watershed covers roughly 75,000 acres and consists of three subwatersheds, Odell Lake, Moore Creek (including the Davis Lake area), and Odell Creek which is designated as a key watershed. Refer to Figure 1 for the general location of the Odell Watershed and Figure 3 for the water features. The Middle Deschutes Watershed is comprised of a total of five subwatersheds, three of which are listed above and included in this analysis. Only three of the subwatershed were addressed in the Pilot Watershed Analysis due to their unique hydrologic character. The lava flow which created Davis Lake prevents surface water exchange with the two remaining subwatersheds of the Middle Deschutes Watershed, which results in a closed system for surface water, nutrient cycling, and fish populations within the Pilot analysis area. There is some ground water correlation between the two portions of the Middle Deschutes Watershed, but it was decided that from a landscape analysis perspective (physical, biological, and social), the two areas were distinct enough that they could stand on their own for watershed analysis.

In the President's Forest Plan Key Watersheds were selected which provide high quality habitat for at-risk stocks of resident fish species. They are to serve as refugia for maintaining and recovering habitat for these at-risk species. These refugia include areas of high quality habitat as well as areas of degraded habitat.

Odell Creek Subwatershed contains a stream with high quality habitat conditions which serves as an anchor for the potential recovery of depressed fish populations. Odell Creek subwatershed was designated as a Tier 1 (Aquatic Conservation Emphasis) Key Watershed which contributes directly to conservation of at-risk bull trout and resident fish populations. This subwatershed is part of a network of 143 Tier 1 Watersheds which are designated to ensure that refugia are widely distributed across the landscape. This subwatershed was chosen for the Pilot analysis due to its unique intrinsic value to fish, wildlife and humans.

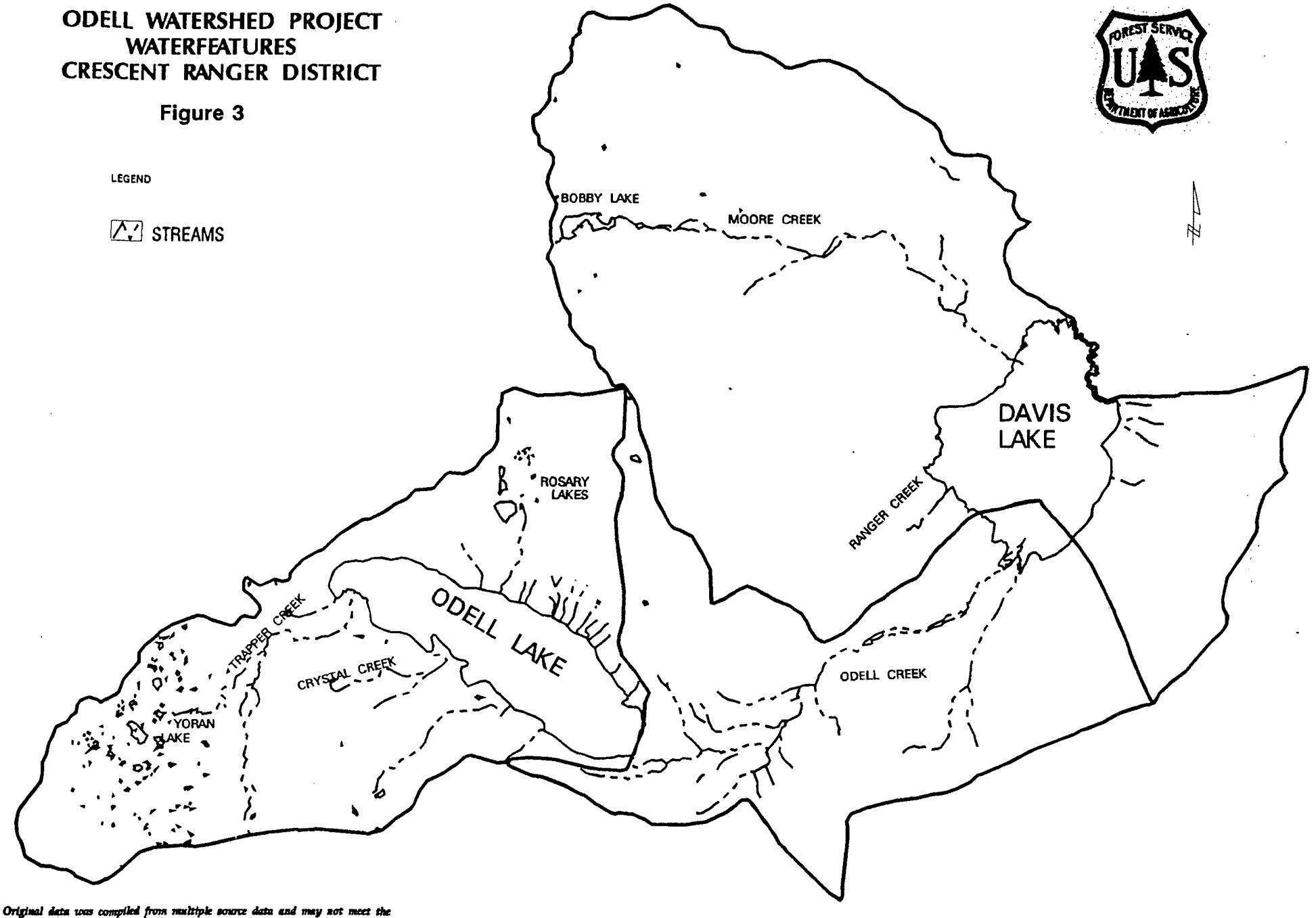
Moore Creek Subwatershed, which includes Davis Lake, has a unique hydrology (lake level fluctuation). The lake was created when a lava flow dammed Odell Creek. The lake is shallow in nature, and its outflow is controlled by "leaks" in the lava along the northeast shoreline and bottom of the lake. Due to these factors, the water level fluctuates dramatically, in fact, the lake can vary in size from 40 to 3,000 acres.

This lake is extremely important to migrating waterfowl. Tens of thousands of migrating birds make an annual stop to rest and forage in the waters of the lake and along the shoreline. Bald eagles and osprey nest and rear their young at both Davis and Odell Lakes. When the water level is high, Davis Lake also supports an excellent fishery. The lake is open to flyfishing only.

The third subwatershed includes Odell Lake which is 3,600 surface acres in size and is recognized as one of the largest lakes in the Oregon Cascades. The water in the lake remains very cold due to its depth and elevation. Odell Lake contains the only remaining natural adfluvial population of bull trout in Oregon. Odell Lake is a popular fishing and boating lake and has been a major recreational draw for nearly three quarters of a century.

ODELL WATERSHED PROJECT
WATERFEATURES
CRESCENT RANGER DISTRICT

Figure 3



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Throughout Phases A and B the discussions will address each of the domains, physical, biological, and social. See Appendix A for a discussion on the domains outlined in the WEAVE.

PHYSICAL DOMAIN

CLIMATE

The character of the Odell Basin has been influenced by changes in climate. Climate has changed from cold air masses that supported the formation of glaciers to more temperate, dry air masses. The changes in climate can be attributed to changes in temperature, the amount of precipitation, or, most likely, a combination of both. It is impossible to predict any changes in climatic pattern that might influence the landscape and associated resources.

Most of the precipitation results from low-pressure systems that approach from the Pacific Ocean on the dominant westerly winds. A large amount of moisture is accumulated by these air masses as they pass over the Pacific Ocean. Before reaching the Odell Basin, they must cross two mountain ranges, and in doing so, lose much of their accumulated moisture as precipitation. Thus, air reaching the basin is much drier than the original marine air. This results in a modified continental-type climate.

A winter precipitation regime occurs within the Odell Watershed. Approximately 55 to 65 percent of the total annual precipitation occurs between November and March, while only 8 to 12 percent occurs between June and August. Yearly totals rise sharply as elevation increases and decline dramatically with increased distance east of the Cascade Crest. For example, average annual precipitation totals range from 60 to 80 inches on the upper slopes of Diamond Peak to 22 to 26 inches on the surface of Davis Lake (a distance of less than 6 air miles east of the Cascade Crest). (See Figure 4 for locations of the mountains and buttes within the watershed) Snowfall generally amounts to 120 to 150 inches per year on the upper slopes of the basin and approximately 30 inches annually at the lower elevations. Normal weather patterns consist of wet and dry cycles. As an example, the Fremont station a few miles southeast of Crescent, has a mean annual precipitation of 10.50 inches (n=66) with a standard deviation of 3.46 inches. The maximum recorded annual precipitation which occurred in 1956 was 22 inches; the minimum recorded annual precipitation which occurred in 1955 was 4 inches.

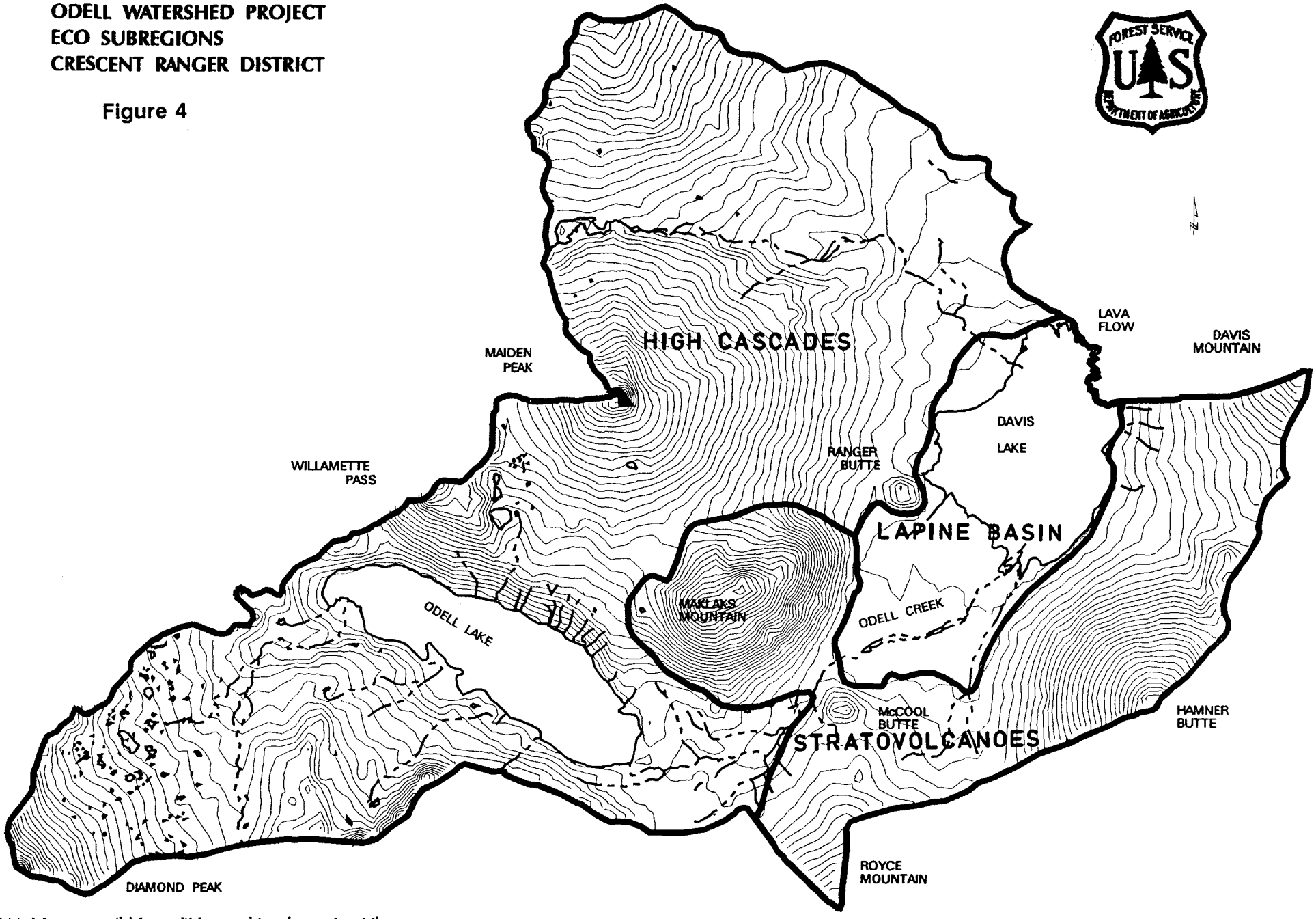
There is cloud cover in the Odell Basin approximately 50 percent of the time. Since the clouds are generally patchy, sunshine is provided on most days. Temperatures are characterized by moderate days and cool nights. Elevation has a primary effect on local climate. Precipitation and snowfall increase and temperatures decrease rapidly as elevation increases on the mountainous areas. (Franklin and Dyrness 1973) Summers are characterized by high-pressure systems which bring fair, dry weather for extended periods of time. Daytime temperatures rarely exceed 90° F in summer and typically do not drop below -20° F in winter. Daytime humidities in the summer average between 30 to 40 percent, although it is not unusual to have humidities of 10 and 20 percent during the day. Estimated lake evaporation ranges between 28 to 34 inches per year, and potential evapotranspiration varies from 20 to 30 inches. Winds are common on Odell Lake, since it is located adjacent to a low pass in the Cascade Mountains.

AIR QUALITY

The air quality within the basin is excellent, since there are no major source polluters in the area, and the population base is small. The chemical composition of wilderness and backcountry lakes has been monitored, and no indicators of declining air quality have been found.

ODELL WATERSHED PROJECT
ECO SUBREGIONS
CRESCENT RANGER DISTRICT

Figure 4



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Many lichen species are considered to be sensitive air quality receptors. Lichen and moss communities can be found throughout the entire watershed in some form or another. These communities can be found in each of the plant association groups (PAG's), with significant overlap occurring between the PAG's. The presence of lichens and mosses is more a function of moisture and other environmental conditions than a function of vegetation types. Mosses appear to be limited in extent on the east side of the Cascades due to lack of moisture.

GEOLOGY

The Odell Watershed Analysis area is part of three ecoregions at the subsection scale (1:250,000; see ecological unit classification April 1994). These ecoregions are the High Cascades, Stratovolcanoes, and LaPine Basin. (Figure 4)

The western portion of the Odell Watershed which is included within the High Cascades Ecoregion consists of basaltic andesite and basaltic eruptive complexes that form large, overlapping shield volcanoes. Large fields of lava are found around the bases of these eruptive complexes. Shield volcanoes include The Twins and Maiden Peak, estimated to be 100,000 to 200,000 years old, and Diamond and Lakeview Mountains, estimated to be 300,000 to 400,000 years old. These peaks and much of the lava around them have been eroded by glaciers. Since major ice ages come and go approximately every 100,000 years, the degree of glacial erosion aids in estimating the relative ages of these volcanic landforms. At lower elevations moraines have buried the volcanic landscape. Glacial landforms abound and include erosional features such as cirques, basins, valleys, and depositional features such as terminal, lateral, recessional, and ground moraines. Glacial deposits include angular to subrounded pebbles, cobbles, and boulders in a sandy to silty matrix.

The portion of the Odell Watershed included in the Stratovolcanoes Ecoregion includes Maklaks Mountain, Royce Mountain, Hamner Butte, and Davis Butte. These older, isolated stratovolcanoes are stratified with layers of ash, cinders, scoria, and lava of basalt and basaltic andesite. Minor erosion has created small valleys and ridges on some of the slopes. Small cirques on Royce and Maklaks Mountains indicate that they have been glaciated on their upper, northern slopes. The ages of these volcanoes are not well-known but probably range from 0.5 to 2 million years old. Some of these volcanoes are magnetically reversed, and the most recent reversal of the earth's magnetic field took place 780,000 years ago.

The LaPine Basin Ecoregion is part of a graben filled with up to 2,500 feet (760 m) of sediment. In the Odell Watershed, older fine-grained sediments have been overlaid by a large fan of stratified glacial outwash that is greater than 40 feet (12 m) thick, which extends from its apex at McCool Butte to Davis Lake. Gravel sizes become progressively finer as the distance from the apex increases. Along Moore Creek immediately above Davis Lake, a fan of glacial outwash overlies lava.

The Davis Lake Lava Flow erupted approximately 5,500 years ago. The blocky, permeable flow dammed Odell Creek and created Davis Lake. The lake has no surface outlet, but instead drains through openings in the lava at about the rate of inflow from Odell Creek. Evaporation and local precipitation rates approximately cancel each other in the lake's water budget. Thick lake sediments at the bottom of the shallow lake consist almost entirely of diatoms and organic material. Odell Creek has brought very little sediment into the lake.

Around 7,600 years ago, the catastrophic eruption of Mount Mazama (Crater Lake) left a blanket of rhyolitic ash and pumice over the entire landscape of the Odell Watershed.

SOIL RESOURCES

The parent materials for the dominant soil types in this watershed are the airfall pumice and ash from the Mount Mazama eruption. The original thickness of this airfall deposit within the watershed ranged from about 16 inches (0.4 m) at the west edge (Cascade Crest) to about 60 inches (1.5 m) along the southeast edge (Royce Mountain and Hamner Butte). Particle sizes range from fine to medium sand sizes in the west, to coarse sand to small gravel sizes in the east. Since the eruption, the Mazama ash has moved considerable distances down the steeper slopes and formed thick wedges and aprons. Mazama ash has been stripped from many ridges and tops of buttes by erosion. On younger lava flows such as those north and northwest of Davis Lake, the ash has eroded off of projections and ridges of lava and accumulated in local depressions. The effect of this erosion is a more subdued, less hummocky landscape. Because the Davis Lake Lava Flow erupted after Mount Mazama, no ash is found on the lava or in the sediments of Davis Lake.

The glaciated portions of the watershed have fine sandy loam textured soils over compacted ground moraines. Here the older glacial material dominates water transport and plant growth in the area.

Soil moisture regimes are Xeric in the basin and on the eastern edges of the watershed and Ustic in the more moist sections of the watershed. Soil temperature regimes range from frigid to cryic.

SOIL QUALITY

Parent material, climate, topography, organisms (both macro and micro flora and fauna) and time have worked together to establish the soil conditions found throughout the watershed. In the WEAVE, high soil quality was defined as the ability to support sustained, vigorous and diverse ecosystems. This includes:

- Sufficient vegetative cover to inhibit surface soil erosion
- Soil organic carbon levels that have evolved over time due to natural processes
- Soil physical properties that allow water and air movement into and through the soil profile and that facilitate biological activity

Other researchers (Doran 1994) have defined soil quality as a combination of physical, chemical, and biological properties. Soil quality describes how effectively soils:

- Accept, hold, and release nutrients and other chemical constituents
- Accept, hold, and release water to plants, streams, and groundwater
- Promote and sustain root growth
- Maintain suitable soil biotic habitat
- Respond to management and resist degradation

The above are the functions of soils. Maintenance or enhancement of soil quality will protect or improve the soils ability to carry out these functions.

In addition, there are many soil processes that control the ability of a soil to function adequately. These include among others:

Erosion
Nutrient Cycling
Water Cycling
Soil Formation

There are many components involved in the above processes. It was felt that these are the dominant processes that affect changes in the ecosystem. By accelerating, decelerating, or truncating any one of these processes, an impact on the ability of the soil to function adequately can be assessed.

WATER RESOURCES

The Davis/Odell Lake watershed drains approximately 75,075 acres, contains sixteen named lakes, as well as numerous other water bodies less than five acres in size, and seven fish bearing streams. (Figures 3 and 5) The water resources within the Odell Watershed include an abundance of small lakes in the headwater area above Odell Lake, springs and small streams that flow into Odell Lake, Odell Lake itself as the main water supply source for Odell Creek, several small tributaries to Odell Creek along its traverse to Davis Lake, and two creeks and several small intermittent drainages feeding Davis Lake. Davis Lake may provide the water source for the springs located in the Davis arm of Wickiup Reservoir. This hypothesis cannot be tested until the routing times through the fractures in the lava are known or measured.

Due to both the porosity of the glacial outwash and the Mazama ash that blanketed the area, surface creeks and/or any expression of surface runoff are rare to nonexistent over much of the lower basin. The volcanic cones are also comprised of very porous materials which exhibit little to no drainage pattern, and, consequently, no streams flow over this landscape. As a result, over two-thirds of the Odell Basin acts like a sponge, absorbing water, from precipitation and releasing its water throughout the year in the form of springs. This hydrologic generalization is applicable throughout the area with the exception of the glacial till zone which includes the portions of the wilderness that drain into Odell Lake.

Bobby, Yoran, and the three Rosary Lakes are headwater lakes having drainage basins less than 5,000 acres in size. These lakes have little effect on the routing time of rainfall or snowmelt within the basin.

Odell Lake, fed from headwater lakes, springs and small streams, is 3,600 surface acres in size and is recognized as one of the largest lakes in the Oregon Cascades. Odell Lake has a deep, elongate lake basin with steep sides that was formed by glaciation. A terminal moraine blocks the lake outlet on the eastern border. Odell Lake has a maximum depth of 282 feet and average of 132 feet, with only a small percentage of the lake having a depth less than 10 feet. Little growth of aquatic macrophytes occurs in the lake, since there is a limited amount of rocky shoreline and shallow water. The deep water in the lake remains very cold (39° F) throughout the year due to the depth of the lake and its elevation (4,787 feet). The lake occasionally freezes over during the winter. The water column in summer develops a pronounced thermal stratification.

Trapper Creek drains the glacial till zone and is the lone tributary into Odell Lake that responds directly to runoff generating events.

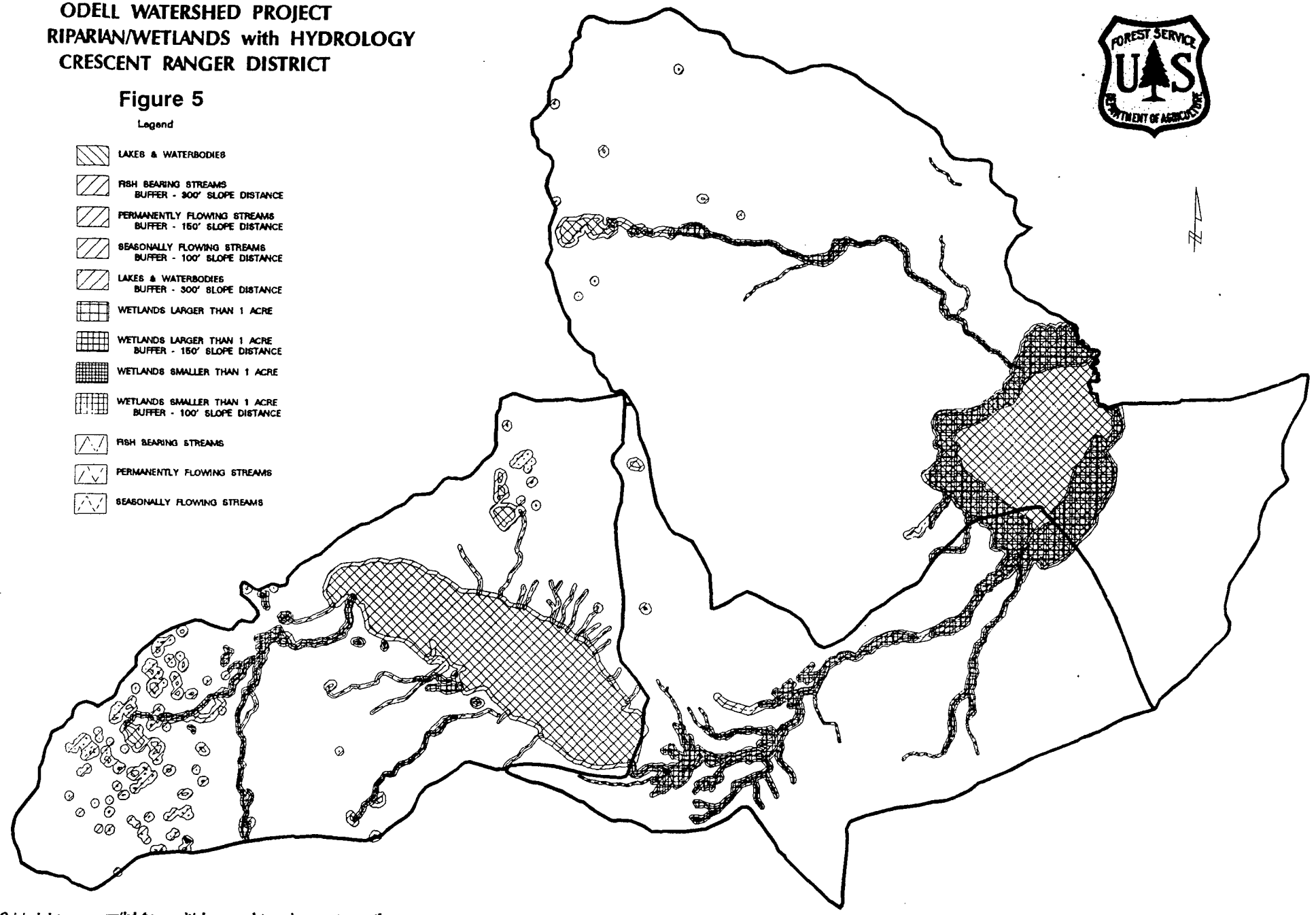
Odell Creek which is approximately seven miles in length, collects several small tributaries before reaching Davis Lake. The creek is confined for nearly half of its length by recessional moraine features, while the remainder lies in a glacial outwash plain. Odell Creek historically flowed directly into the Deschutes River prior to being dammed by the Davis Lake Lava Flow. The creek's discharge is determined, for the most part, by the outflow of Odell Lake.

ODELL WATERSHED PROJECT
RIPARIAN/WETLANDS with HYDROLOGY
CRESCENT RANGER DISTRICT

Figure 5

Legend

- LAKES & WATERBODIES
- FISH BEARING STREAMS BUFFER - 300' SLOPE DISTANCE
- PERMANENTLY FLOWING STREAMS BUFFER - 150' SLOPE DISTANCE
- SEASONALLY FLOWING STREAMS BUFFER - 100' SLOPE DISTANCE
- LAKES & WATERBODIES BUFFER - 300' SLOPE DISTANCE
- WETLANDS LARGER THAN 1 ACRE
- WETLANDS LARGER THAN 1 ACRE BUFFER - 150' SLOPE DISTANCE
- WETLANDS SMALLER THAN 1 ACRE
- WETLANDS SMALLER THAN 1 ACRE BUFFER - 100' SLOPE DISTANCE
- FISH BEARING STREAMS
- PERMANENTLY FLOWING STREAMS
- SEASONALLY FLOWING STREAMS



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Maklaks Creek, the perennial tributary to Odell Creek provides an important cold water source. This cold water reduces the temperature of Odell Creek downstream of its confluence with Maklaks Creek. Above the confluence, the water temperatures are warmer, since the flow of Odell Creek is derived from the warmer surface water temperatures of Odell Lake. Odell Lake's surface water temperatures can exceed 65° F, which is above the desirable temperatures for salmonids. The range and frequency of Odell Creek's discharge have been well documented. Flows range from 9 cubic feet per second (cfs) to 1,100 cfs. Approximately 50% of Odell Creek's runoff occurs during two peak periods, December to January and May to June. The low flow period takes place during August and September, when less than 10% of the runoff occurs.

Groundwater in the McCool-Davis outwash fan lies more than 30 feet (9 m) below Odell Creek in the upper part of the fan. In the lower part, the level of Davis Lake approximates the level of groundwater. Water from Odell Creek percolates into the sand and gravel of the fan. Thin, nearly impervious silt layers within the fan apparently act to perch infiltrating surface water. Along Odell Creek these layers are essentially non-existent at the head of the fan but increase toward Davis Lake and probably account for the increasing downstream amount of riparian vegetation.

Davis Lake, whose size ranges from 40 to 3,000 acres, is the terminus of the water supply in the Odell Basin. It receives its water supply from two creeks and several small intermittent drainages. Water levels fluctuate greatly on an annual basis. Davis Lake can be reduced to approximately 40 surface acres in size during the fall of the year. Its outflow is controlled by "leaks" in the lava along the northeast shoreline and bottom of the lake. Due to its shallow nature, 10 to 20 feet in depth, temperatures in Davis Lake can rise above 70° F over much of the lake body during mid to late summer.

In addition to the major lakes and fish bearing streams, there are numerous other water bodies (seasonal and perennial) within the watershed that support macroinvertebrates, phytoplankton and zooplankton species, crustaceans, and provide habitat for amphibians. Information on the aquatic organisms inhabiting the smaller seasonal water bodies is limited to anecdotal information.

The beneficial uses of water identified by the Oregon's Water Quality Standards for the Odell Watershed are resident fish, aquatic life, domestic water supply, water contact recreation, and aesthetic quality. Beneficial uses most sensitive to activities associated with forest management are those related to aquatic biota and human use. Water temperature, dissolved oxygen, turbidity, sedimentation of bed materials, channel and pool parameters, large woody material, and biological criteria are factors used to determine the health of this watershed.

BIOLOGICAL DOMAIN

VEGETATIVE STRUCTURE

INTRODUCTION

Vegetative structure is a critical factor in evaluating the physical, biological, and social processes taking place in the Odell Pilot Watershed. The functioning of most of the processes can be directly correlated to the vegetative structures in which those processes take place. Restoration, maintenance and/or enhancement of the vegetative structure is critical to the quality and effectiveness of those processes in the future.

DISCUSSION

One of the key issues identified by the Odell Pilot Watershed Interdisciplinary Team (IDT) is the importance and the role of the vegetative structure. The vegetative structure includes the presence, species, size, and density of vegetation at any given point on the landscape, any given point in time, and in the combination of landscape and time.

Vegetative structure results as a function of, among other things, the processes associated with climate, topography, disturbance events, succession, seed supplies, and time. Climate and topography remain fairly constant over time compared with the other processes mentioned. Disturbance events include insect attacks, disease infestations, wind storms, fire, and management activities of humans. Successional processes are usually typified by invasion of seral species, followed by vertical structure development to the point where mid and late seral species increase and, in some cases, replace the earlier seral species. Seed supplies are, in part, the result of previous disturbance events and the relative proximity of seed-bearing plants to suitable seed beds. It appears that over time a given point in the landscape will cycle through disturbance events, followed by invasion of seral species and development of vertical stand structures which, if left somewhat undisturbed, will result in the establishment of mid to late seral species until another disturbance occurs and sets the process back to an earlier successional stage.

Factors of importance discussed in this document relating to vegetative structure include impacts of landscape disturbance events, processes of vegetative succession, and fragmented vegetative structure and management direction toward late successional reserve. Each of these factors will be discussed in the context of plant association groups (PAG's). Wildlife habitat/structure needs and providing scenic quality for each PAG are discussed in separate documents. Table 2 - 1 shows the relative areas each of the PAG's occupies within the watershed.

PAG's are comprised of the grouping together of the various plant associations as described in Appendix C of the WEAVE document. The notable exceptions are that the lodgepole (LP) high elevation was included as part of the LP dry with mountain hemlock PAG. The LP dry PAG was then subdivided into those plant associations with a considerable amount of mountain hemlock. These associations were classified as LP dry/hemlock, while all the remaining LP dry plant associations were classified as LP dry. All ponderosa pine associations were grouped for this watershed. Lastly, the mixed conifer dry plant associations, CWC2-13 and CWS1-15, were included in the mixed conifer wet PAG. The rest of the mixed conifer dry associations were designated as the mixed conifer dry PAG (having a ponderosa pine fire climax).

TABLE 2 - 1. Proportional areas in acres by plant association groups (PAG's)

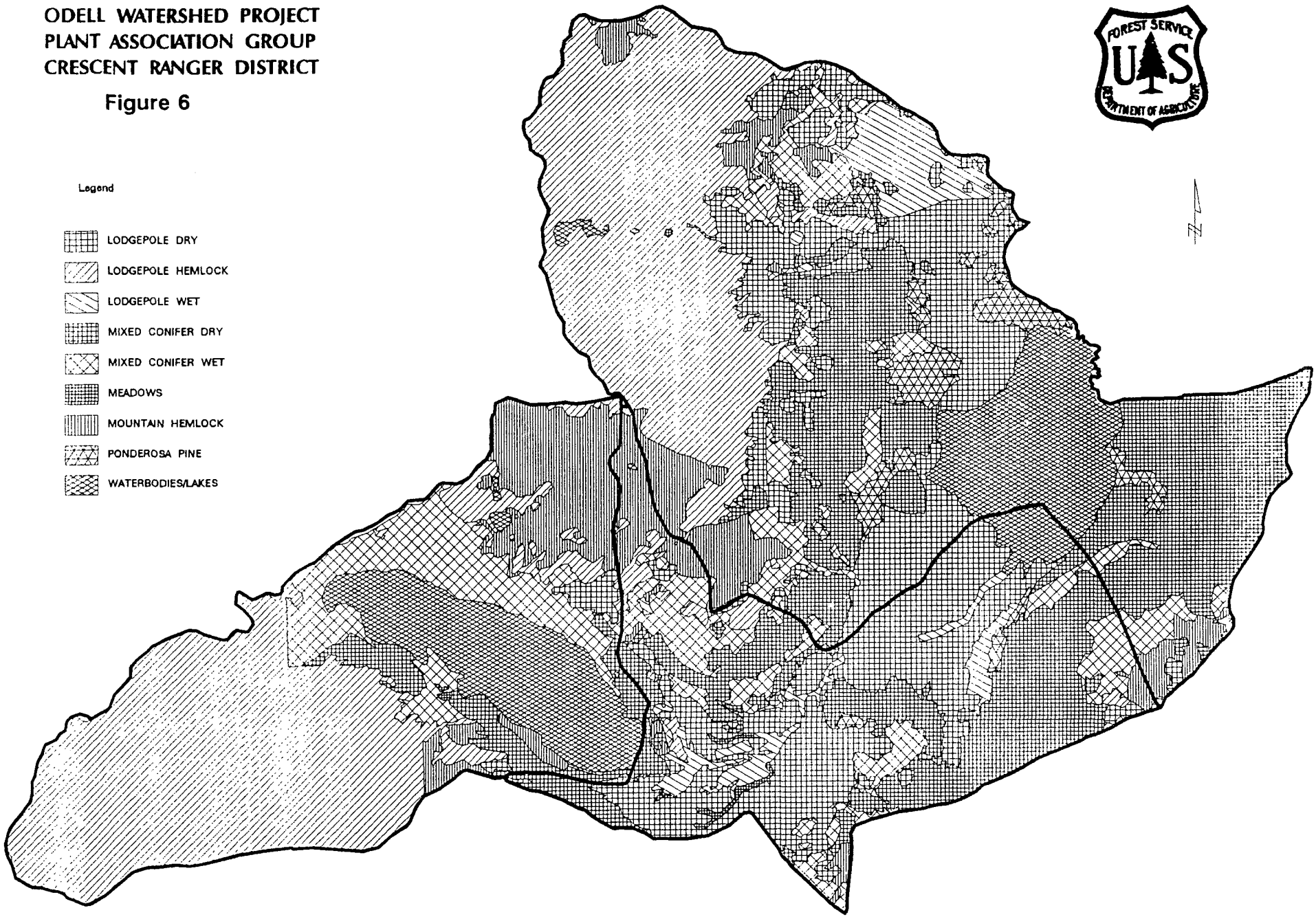
Percent	Plant Association Group (PAG)	Area
2%	Ponderosa Pine	1,653 acres
33%	Lodgepole Pine with Mountain Hemlock	22,117 acres
9%	Mountain Hemlock	5,930 acres
18%	Lodgepole Pine - Dry	12,196 acres
3%	Lodgepole Pine - Wet	2,186 acres
12%	Mixed Conifer - Wet	7,858 acres
23%	Mixed Conifer - Dry with fire climax	15,454 acres
0.20%	Meadows (See Note Below)	138 acres
--	Lakes (Acres not included in totals) 7,206 acres	--
100%	TOTAL	67,532 acres

NOTE: Acreage for meadows varies upwards by several hundred acres with water fluctuations in Davis Lake.

See Figure 6 for a map of the distribution of the PAG's .

ODELL WATERSHED PROJECT
PLANT ASSOCIATION GROUP
CRESCENT RANGER DISTRICT

Figure 6



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Species of special interest that may have been present in the past. In the mountain hemlock and lodgepole pine with hemlock PAG's, one of the primary invasion species of hemlock root rot pockets was western white pine (*Pinus monticola* Dougl.). Presently, the root rot pockets in this watershed are still being invaded by western white pine, however, a disease introduced from Europe, the white pine blister rust (*Cronartium ribicola* Fisch), has seriously impacted the ability of the white pine trees to effectively reach maturity and reproduce. Due to the blister rust, there is a higher proportion of lodgepole pine invading and maturing within the root rot pockets than historically did. (Maffei 1994) For further discussion, see the trends discussion for the mountain hemlock PAG's in Phase B.

Indigenous peoples used fire on the east side of the Cascade Mountains. This use is well documented and most likely was for maintaining food supplies. (Williams 1994)

European influence was not common until the late 1800s when some influx of sheep and cattle grazing began. In addition, development of the railroad over Willamette Pass and the subsequent fire suppression efforts, in conjunction with the interruption of indigenous use of fire, are believed to have had an effect on the structure of the ponderosa and mixed conifer dry PAGs.

Grazing occurred primarily in the Davis Lake area from the late 1800s until about 1970. A more detailed discussion is included in the social domain write-up.

Federal management activities have primarily consisted of the harvesting of timber using a variety of intensive regeneration cutting methods. These timber harvests have resulted in the current pattern of vegetative patches and fragmentation of the LP dry, LP wet, ponderosa, mixed conifer wet, and mixed conifer dry PAG's. There has been little to no impact of Federal management activity in the mountain hemlock and LP dry/mountain hemlock, and meadows PAG's.

Fire is analyzed by frequency and intensity in this analysis. It is discussed by PAG in general terms.

Flood. There is little or no evidence of significant flooding events in the watershed riparian systems.

Blowdown disturbance events are relatively infrequent as evidenced by the isolated and infrequent existence of windthrown trees across the watershed. As would be expected, frequencies go up with the amount of exposure and with topographic features associated with wind acceleration. (Harris 1989)

Disturbance factors primarily consist of the historic elements of insect and disease infestations, fire, and wind. In addition, harvest of timber has influenced significant portions of the lodgepole, ponderosa, and mixed conifer PAG's.

Decay processes continue in stands where fire and harvest activities are excluded. In the areas of insect activity, fuels accumulate much faster than decomposition rates. In green, healthy stands small fuel accumulation exceeds the decay somewhat, especially in duff development, but the overall fuels accumulation remains fairly stable until a disturbance agent changes the balance.

Productivity, especially on fire-excluded sites of ponderosa pine and mixed conifer, is steadily increasing as decay processes make nutrients available to green plants which occupy the site. This site productivity increase is thought to be unique to those stands which had high frequencies of low intensity (underburn) fires prior to fire suppression activities (Hopkins 1994). In general, productivity on other sites remains fairly constant except where soil composition or tree density have been modified with harvest or facilities activities.

Resource utilization has caused patches and fragmentation on those PAG's and portions of the landscape where timber harvest activities have occurred. Objectives of such past harvest activities have been to

convert overmature, decadent stands of trees to young, thrifty, healthy stands of regeneration, and to provide plenty of edge habitat for wildlife, as well as forage for big game species. These objectives have also resulted in saw timber and revenues for local economies.

In most of the lodgepole pine cuts, harvest activities have utilized beetle-killed overstory trees as well as some of the green residual overstory. Within the past few years, harvesting has focused primarily on dead trees, since firewood collection has become the predominant harvest activity within the watershed.

Physical processes related to the vegetation are primarily restricted to the effects of harvest activities and their impacts on soil quality. In particular, soil compaction and displacement through erosion, where they are present, may be hindering conifer tree establishment and growth.

RIPARIAN RESOURCES

Riparian/Wetlands/Floodplain vegetation occupies in excess of 1,100 acres within the watershed. The various vegetative types associated with these areas include the following: open meadows which are either grasslands or willow/grasslands; intermittent stream channels are comprised of a combination of open meadows and meadows intermixed with conifer; and stream channels are occupied by mixed conifer as the overstory, mountain alder as the shrub component, and grasslands as the ground cover. (Figure 5)

WILDLIFE

There are 268 species of wildlife that are known or suspected to utilize habitat within the Odell Watershed at some point throughout the year. The species may utilize the watershed for breeding, foraging, and/or resting habitat. Riparian areas are used by 177 of those species.

Species habitats include foraging, reproduction, roosting, perching, and any other habitat necessary to the species through its life cycle. Not only does habitat quantity and quality affect species, but disturbance may also influence the ability to forage, reproduce, or disperse. Past logging, suppression of wildfire, and increased disturbance from recreational uses has lowered the quality of habitat for many species.

The following is a chart of the PETS or selected species known or suspected to occur within the watershed.

Table 2 - 2, PETS or Selected Wildlife Species

Species	Status
Peregrine Falcon	E
Bald Eagle	T
Northern Spotted Owl	T
Western Snowy Plover	T
Fisher	C2
Preble's Shrew	C2

Table 2 - 2, PETS or Selected Wildlife Species (continued)

Species	Status
Wolverine	C2
Northern Goshawk	C2
Long-billed Curlew	C3
Marten	SS
American White Pelican	SS
Black-backed Woodpecker	SS
Flammulated Owl	SS
Great Gray Owl	SS
Greater Sandhill Crane	SS
Pileated Woodpecker	SS
White-headed Woodpecker	SS

E - Federally Endangered, T - Federally Threatened, C2 - Federal Candidate, Category 2, C3- Federal Candidate, Category 3, SS - State of Oregon Sensitive

Several pairs of spotted owls are currently located within the Odell Watershed. The habitat in the area that the species historically used has been heavily fragmented by timber harvest activities. The populations on the eastside of the Cascade Crest and within the Odell Watershed are low in comparison to the population densities in the remainder of the owl range. The watershed contains 16,556 acres of suitable owl nesting, roosting, and/or foraging habitat, which equates to 22% of the total watershed acreage.

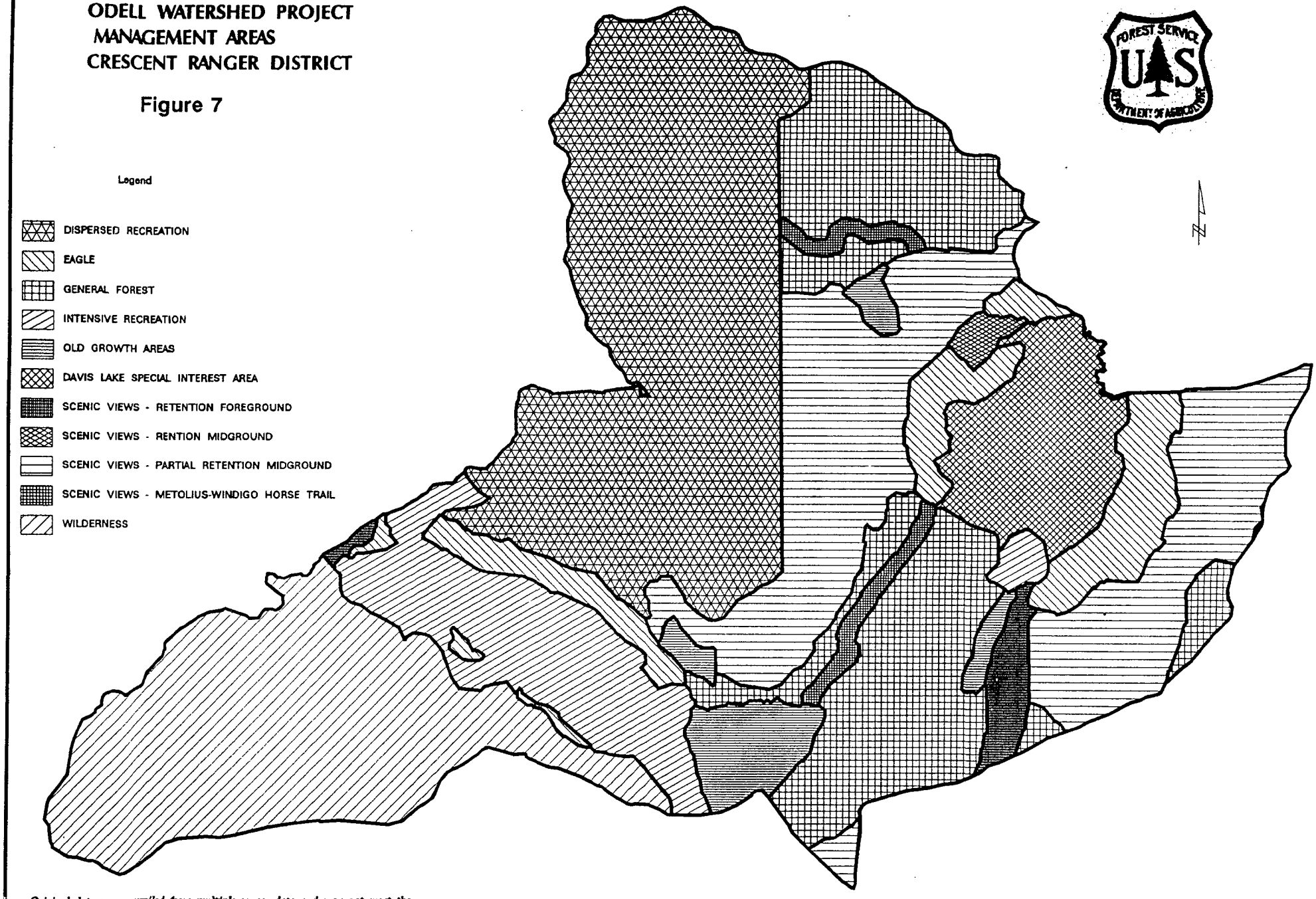
Bald eagles historically nested and foraged in and around Odell and Davis Lakes. Currently, both lakes continue provide nesting and foraging habitat for several pairs of eagles. In mild winters year-round habitat may be provided within the watershed. Bald Eagle Management Areas (BEMA) are located adjacent to both Davis and Odell Lakes. (Figure 7)

FISH

Three indigenous (native) game fish species, bull trout, redband trout and whitefish, were historically distributed in the Odell/Davis Lake and Odell Creek drainage. These populations were isolated from the Deschutes River population approximately 5,500 years agp by the lava flow that created Davis Lake.

ODELL WATERSHED PROJECT
MANAGEMENT AREAS
CRESCENT RANGER DISTRICT

Figure 7



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The bull trout (*Salvelinus confluentus)* is currently listed on the Region 6 Regional Forester's Sensitive Species List and classified as a Category 1 (C1) Candidate Species by the US Fish and Wildlife Service. The bull trout currently can be found only within Odell Lake, although historically it was found in Davis Lake and the stream systems associated with these water bodies. The bull trout population in the Odell Lake system is the only remaining natural adfluvial population, and one of two existing adfluvial populations in Oregon. The only other adfluvial population is located in Lake Billy Chinook, a human created reservoir. The Metolius River bull trout population contains a mixture of both fluvial and adfluvial fish.

As early as 1913, the Oregon Fish and Game Commission (now called Oregon Department of Fish and Wildlife, ODFW) authorized construction and operation of a fish hatchery on Odell Creek which cultured rainbow trout and non-indigenous brook trout. The Odell Creek hatchery supplied fish for many other waters. Increased demands for recreational fishing in Central Oregon spurred introductions of other fish species as well. Kokanee salmon (*Oncorhychus nerka*, landlocked sockeye salmon) and lake trout (*Salvelinus namaycush*, also called mackinaw) were successfully introduced in the 1910s through 1920s to provide a fishery in Odell Lake. In addition, chubs used by anglers as baitfish were illegally introduced into Odell and Davis Lakes in the 1920s.

The genetic purity of the existing redband rainbow trout population is questionable, because numerous strains of rainbow trout have been released by the Oregon Department of Fish and Wildlife (ODFW) in the central Oregon waters since the early 1900s. The ODFW is currently conducting genetic tests on the redband population in the Odell Basin to determine its genetic status.

SOCIAL DOMAIN

Throughout history many people have utilized the resources within the Odell Watershed to accommodate their specific needs and desires which range from gathering food to recreation. For this social analysis, these various social needs and desires have been represented by seven types of communities. Each of these communities have their own expectations for the use and management of the Odell Watershed based on their unique culture, history, economy, and geographic location. These communities include:

Native Americans: Klamath Tribe
Communities west of the Cascades: Eugene, Oakridge
Local, rural industrial communities: Crescent, Gilchrist
Local, rural recreation/residential communities: Crescent Lake Junction, LaPine
Central Oregon urban area: Bend
Transient commercial mushroom pickers
National community of Forest users: United States of America.

(Figure 8)

To illustrate how the Odell Watershed functions from the social perspective, geographic areas within the watershed that share similar social expectations were spatially delineated on a map (Figure 9). These areas include:

Willamette Pass-Odell Lake area
High Cascade Crest
Stratovolcanoes and similar conical, volcanic features
Davis Lake
Odell Creek
LaPine Basin

Willamette Pass-Odell Lake Area

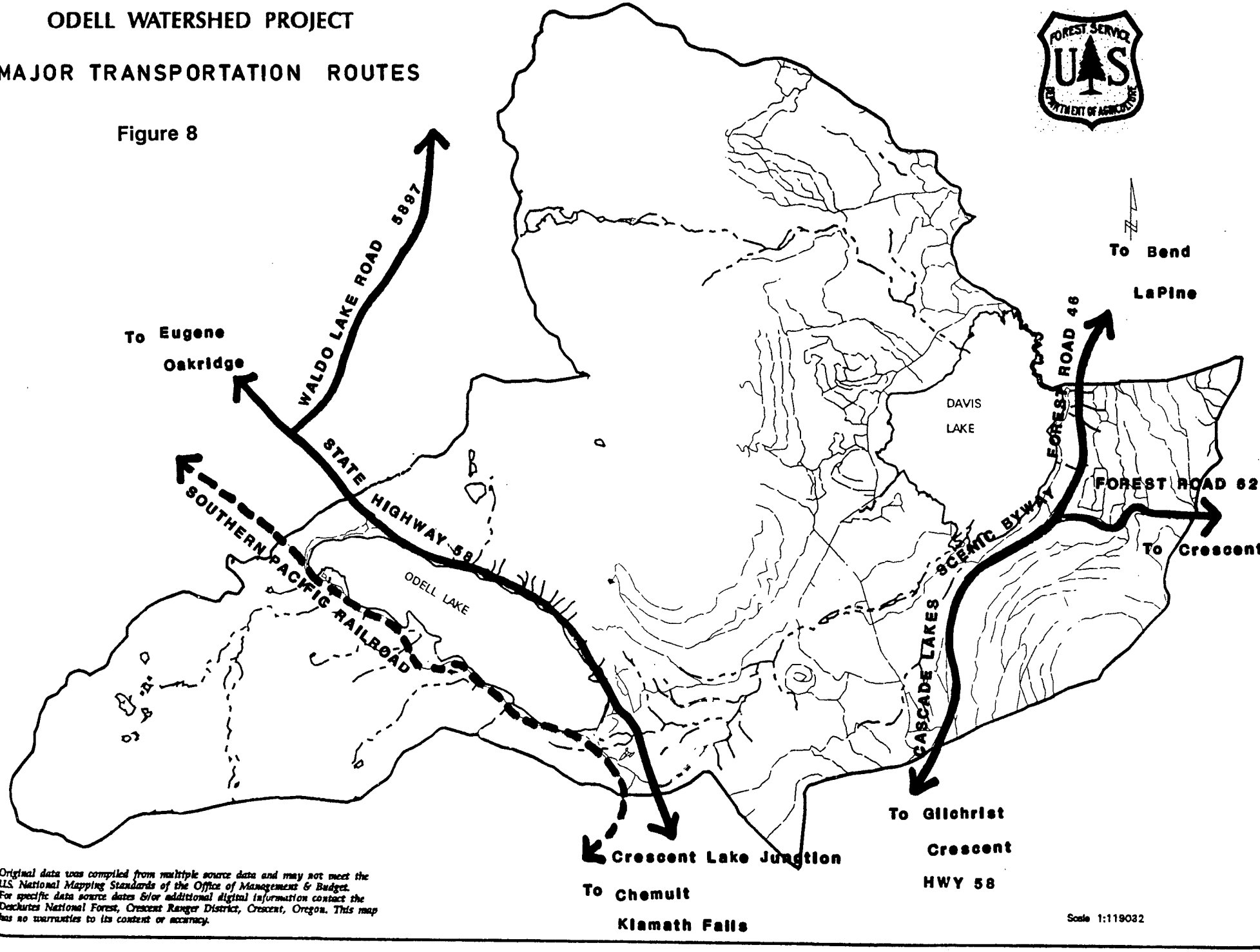
During the late 1800s when the means of human transportation was transformed from foot and horse to wagons, trains, and automobiles, the flat terrain around Odell Lake and the low elevation of Willamette Pass were utilized to route railroads and highways through the Cascades to the Willamette Valley. This new, direct link to the Willamette Valley opened up commercial traffic through the area, and brought visitors to recreate in the High Cascades. By the late 1920s, railroad stations, two resorts, and several summer homes were built around Odell Lake. In 1939 Willamette Pass Ski Area was developed. These developments established the foundation for the current social context of this area - recreation and transportation.

The 1990 Deschutes National Forest Land and Resource Management Plan (LRMP) has continued to support this intensive recreational use and commercial traffic (Figure 7). Communities at local, regional, and national scales expect these uses to continue into the future. Crescent Lake Junction, a small service community, depends on these travelers and recreationists to support its businesses. The Klamath Tribe values this area for its wealth of heritage resources and advocates protecting these resources from further degradation resulting from development around Odell Lake.

ODELL WATERSHED PROJECT

MAJOR TRANSPORTATION ROUTES

Figure 8



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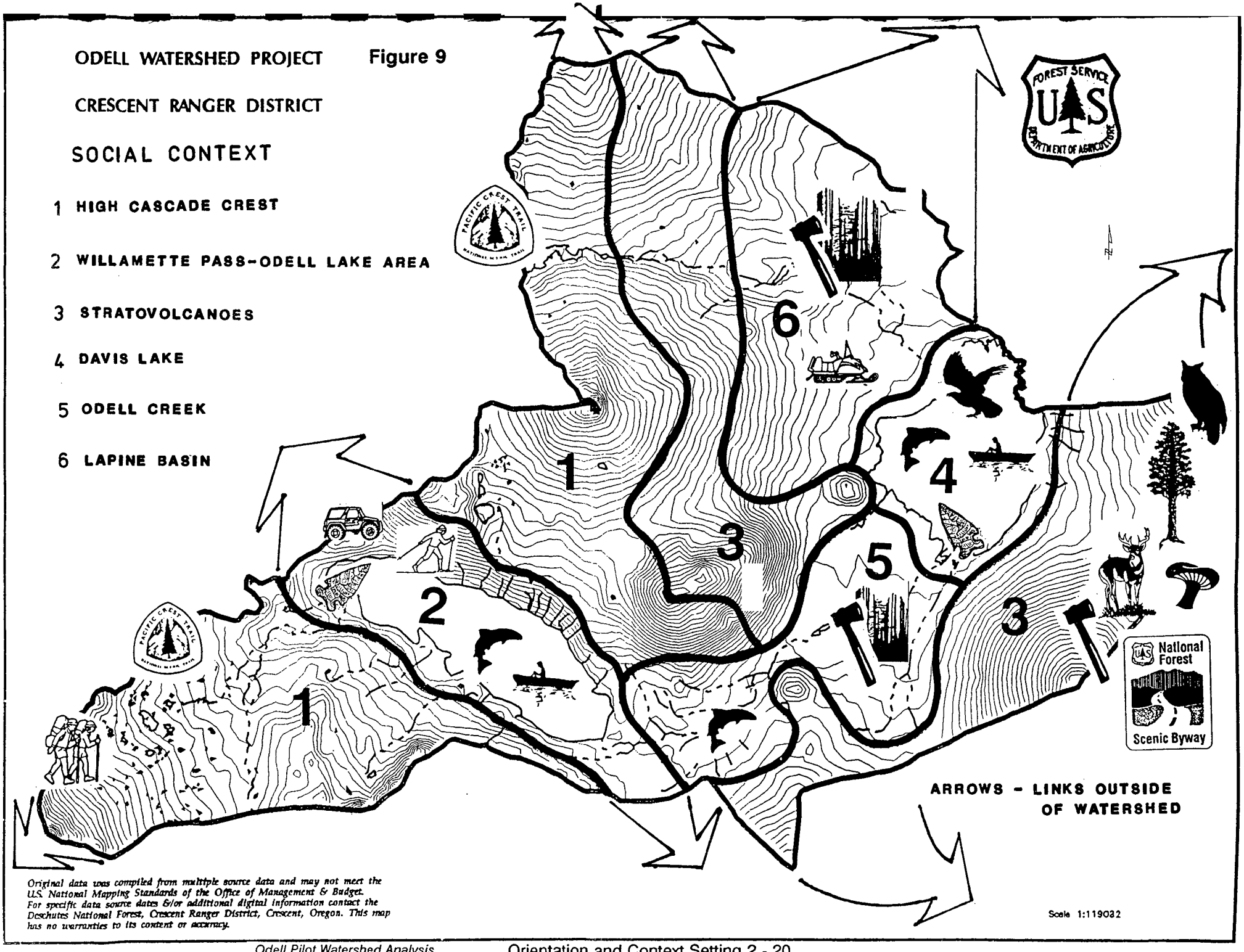
ODELL WATERSHED PROJECT
Figure 9
CRESCENT RANGER DISTRICT
SOCIAL CONTEXT
1 HIGH CASCADE CREST
2 WILLAMETTE PASS-ODELL LAKE AREA
3 STRATOVOLCANOES
4 DAVIS LAKE
5 ODELL CREEK
6 LAPINE BASIN
FOREST SERVICE
U.S.
DEPARTMENT OF AGRICULTURE
PACIFIC CREST TRAIL
National Forest
Scenic Byway
ARROWS - LINKS OUTSIDE OF WATERSHED
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High Cascade Crest

The High Cascade Crest within the Odell Watershed is also valued by communities at the local, regional, and national scales. This rugged, glaciated terrain which includes Diamond Peak (8,744 feet in elevation), Mount Yoran, and Maiden Peak, discouraged the building of roads and remains roadless today. The value of this wild area has been recognized at the national level through legislative acts of Congress. The Diamond Peak area was added to the National Wilderness Preservation System in 1965 (Figure 7), and the Oregon Skyline Trail was designated as part of the Pacific Crest National Scenic Trail (Figure 10). The remainder of the Cascade Crest has been allocated to provide dispersed recreation in an undeveloped environment by the LRMP (Figure 7). These designations have prevented development, timber harvesting, and other environmentally altering activities from occurring and recognize the value of retaining some areas where the presence of humans remains subordinate to the wild environment.

Stratovolcanoes

The social expectations for recreation, transportation, and wilderness that dominate the use and management of the Willamette Pass-Odell Lake area and the High Cascade Crest are now being expanded to the rest of the watershed. Within the last decade, the social expectations for management of the Odell Watershed stratovolcanoes such as Davis Mountain, Hamner Butte, and Ranger Butte, have increased and diversified. Historically, these mountains and buttes were utilized for their valuable timber which supported the economy of local, rural industrial communities and, more recently, industries on the westside of the Cascades. Access to the area was limited to primitive roads built to facilitate timber harvesting.

Today, a national scenic byway has been designated through this area which highlights the scenic value of these mountains and buttes. The Cascade Lakes Scenic Byway (Figure 8) brings new users to the area with expectations of viewing forested landscapes without evidence of timber harvesting. Since 1988 another community, transient commercial mushroom pickers, have discovered the wealth of matsutake mushrooms growing on these buttes. Mushroom collecting occurs annually during the permitted fall season which coincides with the area's big game hunting season.

In April 1994 *The Record of Decision for Amendments to Forest Service and Bureau of land Management Planning Documents Within the Range of the Northern Spotted Owl* (ROD) allocated this area to provide habitat for a variety of wildlife species. This amendment to the LRMP highlights a national expectation to conserve the remaining old growth trees in the National Forests and the associated ecosystems. Native Americans also value this area because of the potential prehistoric use of these volcanic mountains for vision quest and burial sites.

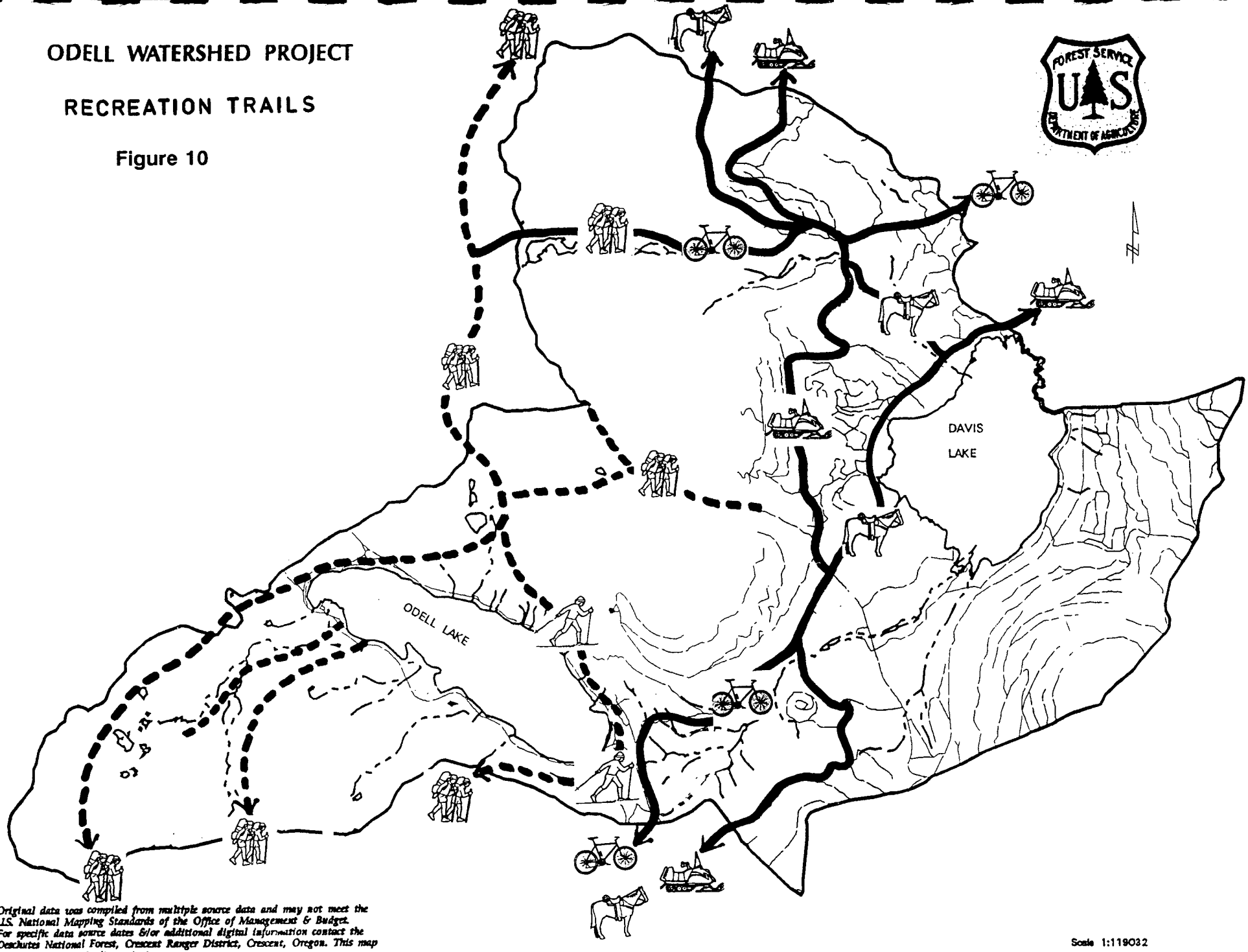
Davis Lake

Davis Lake is another area within the Odell Watershed that has a complex range of social expectations for use and management. Through the years, human use of the lake has changed due to the extreme fluctuations of the water level which cause the lake to range in size from 40 to 3,000 surface acres. During high water years, recreational use of the lake is also high due to the productive fishery and boating opportunities. During low water years, this use decreases. Because of this fluctuation in recreational demand, the area has not been highly developed with facilities as Odell Lake has.

ODELL WATERSHED PROJECT

RECREATION TRAILS

Figure 10



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Today, with growing populations in Central Oregon, and additional access being provided by the scenic byway, recreational use of Davis Lake is increasing. Even during low water years, people come to watch wildlife, including a wide variety of migratory birds, and enjoy the primitive character of the area. The current water level of Davis Lake is low, and there are people in every community that value this natural fluctuation in the water level. However, there are also people that expect the water level to be retained at a minimal level to sustain populations of fish and enhance specific waterfowl habitat. Other social expectations include the national expectation to provide habitat for the bald eagle which impacts opportunities for recreation during nesting periods. The area also contains a wealth of heritage resources that are highly valued and expected to be preserved. The management of Davis Lake currently accommodates these diverse social expectations, but as human use increases, this will become more difficult to achieve.

Odell Creek

The social expectations for Odell Creek and the remainder of the Odell Watershed are less complex. Historically, the Odell Creek area has received minimal use by the surrounding communities. Presently, human uses include dispersed camping, fishing, and hunting. (Figure 11) Commodities in this area include dead and dying lodgepole pine which is collected as firewood, especially by people from the westside of the Cascades. Gravel is also mined from this area for road construction on National Forest lands. In 1994 the ROD recognized the regional value of this area for wildlife habitat. This document amended the Forest Plan and directed that this area be managed for those specific values.

LaPine Basin

The LaPine Basin reaches far beyond the boundaries of the Odell Watershed, but within the watershed, this area is relatively flat and dominated by lodgepole pine and to some extent ponderosa pine. The social context of this area has not changed significantly over the years. Timber harvest continues to be the expected use of this area. There are only a few recreation trails that pass through the LaPine Basin (Figure 10), and it is not highly visible from the Cascade Lakes Scenic Byway. Currently, dead and dying lodgepole pine is being salvage harvested from the area in order to provide timber to the wood products industry.

ODELL WATERSHED PROJECT

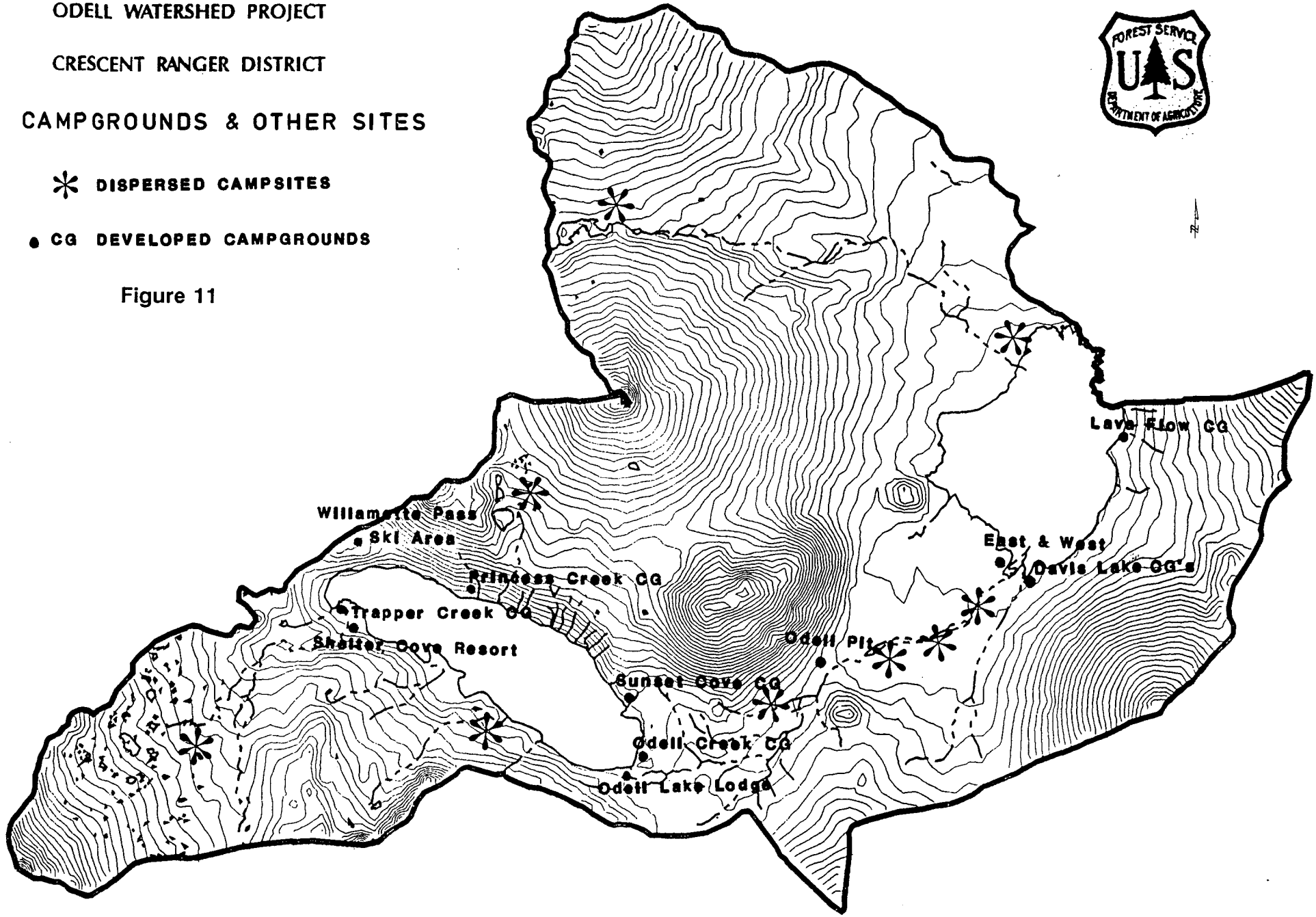
CRESCENT RANGER DISTRICT

CAMPGROUNDS & OTHER SITES

* DISPERSED CAMPSITES

● CG DEVELOPED CAMPGROUNDS

Figure 11



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KEY ISSUES FOR THE ODELL WATERSHED

The following issues were obtained from the Odell Pre-WEAVE analysis and from environmental analyses within the Odell Watershed. Refer to Appendix A for a copy of the Pre-WEAVE.

1) VIABILITY OF INDIGENOUS FISH - Bull trout, Redband trout, Whitefish.

Factors:

- Competitive rearing habitat.
- Competitive spawning habitat.
- High recreational use around spawning habitat.
- Poaching.
- Angling.
- Low water level/high water temperature.
- Disease.
- Thriving non-native species.

2) RECREATIONAL USE.

Factors:

- Impact to heritage resources.
- Harassment of bald eagles and other aviary habitat.
- Impact to prime fishery habitat including bull trout.
- Easily accessible wilderness area with increasing use.
- Impact to water quality.
- Impact to riparian vegetation and soils.
- Economic benefit.
- Diverse, high quality recreational opportunities.
- User group conflicts.

3) SOIL QUALITY.

Factors:

- High road density.
- Roads through wet areas.
- Soil compaction and erosion in high use recreation areas.
- Compaction from mechanized equipment.
- Loss of organic material from skidding, piling, and machine planting.

4) VEGETATIVE STRUCTURE.

Factors:

- Impacts of landscape disturbance events.
- Processes of vegetative succession.
- Wildlife habitat/structure needs including:
  - Habitat for the black-backed three-toed woodpecker, marten, and goshawk, management indicator species (MIS).

- Thermal cover.
- Fawning and calving areas.

Fragmented vegetative structure and direction toward late successional reserve.
Mushroom harvesting.
Retention of large, diameter trees.
Providing scenic quality.

The issues listed above aided in the generation of the key questions for the watershed. These key questions were then used to focus and drive the watershed analysis.

KEY QUESTIONS

PHYSICAL DOMAIN

- What is the status of water quality within the watershed, and what activities threaten or benefit its quality?
- What actions need to be taken to protect/restore the water quality?
- What is the condition of the riparian zones and what activities threaten or enhance their quality/condition?
- What restoration actions are needed within the Riparian Reserves and what widths are needed for protection?
- What are the appropriate activities within the reserves that maintain and protect the riparian area integrity?
- What was the historic condition of the aquatic resources?
- What natural and human events have created the existing conditions and how have the aquatic resources responded to the events?
- What are the limiting factors that control fish species populations?
- Where are the sensitive and resilient soils located within the watershed?
- What was the historic soil quality within the watershed and how does it compare to existing soil quality? What human and natural disturbances have impacted soil quality?

BIOLOGICAL DOMAIN

- What are the natural and human caused disturbances within the landscape which have shaped the existing landscape/watershed condition?
- What is the existing distribution and abundance of habitats, seral stages, plant community types or ecosystems within this watershed?

- What was the historic distribution and abundance of wildlife habitats (pre-settlement), or natural range of variability?

- Is the current condition within the natural range of variability or are there some aspects (functions, processes, interactions, structural or spatial elements) outside of this range of natural variability?

- If the watershed is outside of its natural range of variability what techniques or tools can be used to modify the existing condition to bring it within its natural range of variability?

- What is this Watershed's role within the larger landscape?

- Are there any unique or sensitive habitats? What are their current conditions?

- What are the historic and existing wildlife habitat relationships?

- What non-native plant and animal species (including insects, fungi, bacteria, etc.) are present within the Watershed?

- What are the other, various desired human elements within the Watershed such as big game hunting and fishing, recreation (campgrounds, dispersed rec sites, picnic areas, OHV use, hiking, etc.), wilderness, and forest products (commercial timber, mushrooms, native vegetation collection, poles, Christmas trees, bear grass, etc.)? How do these commodities currently affect and are expected to affect wildlife habitats and wildlife in the future?

- What are the existing agency priorities for the management of wildlife resources within the landscape/watershed?

- Are there management activities which could maintain or enhance ecosystem sustainability?

- How do the existing vegetative trends affect ecosystem sustainability?

- Historically, what were the key processes involved in creating the vegetative composition?

- How has human activity changed the historic vegetative composition?

SOCIAL DOMAIN

- What communities utilize the resources within the Odell Watershed? Which resources are most important to each community and why? How does each community influence the management of valued resources within the watershed?

- What are the physiographic features and inherent ecological processes within the Odell Watershed that have influenced people's desire and ability to utilize the watershed's resources?

- What past land management decisions by the Forest Service have influenced the existing physical, biological, and social condition of the Odell Watershed?

- What are the unique characteristics within the Odell Watershed in terms of scenery, recreation, access, commodities, and heritage resources?

CHAPTER 3

DATA GATHERING AND ANALYSIS

(PHASE B)

PHYSICAL DOMAIN

AIR QUALITY

Baseline information has been collected on the lichen population within the Odell Basin. Through surveys and population monitoring it has been shown that a diverse lichen population exists within the watershed (18 species). Numerous lichen species are present that are considered to be sensitive air quality receptors. No moss surveys have been completed.

The lichen and moss communities in the watershed are believed to be comparable to what they were prior to the 1850s. Changes in population numbers and species diversity may have occurred in areas where fire historically played an active role in creating open patches in the landscape, which resulted in a greater percentage of vegetation in early structural stages. Lichen population density and diversity increase in later structural stages of vegetative development, since they tend to be slow growing. Due to fire suppression, lichen and moss abundance may have increased in late successional areas. Land designations and continued fire suppression which favor late structural stages of vegetation will allow for a high level of lichen and moss community habitat in those areas.

The two primary threats to air quality within the watershed are from smoke which is produced when wood is used to heat the recreation residences and lodges, and from vehicle emissions which are produced by the vehicles on Highway 58.

Air quality trends indicate that due to continued population growth in and around the area and increased traffic on all roads, air quality will slightly deteriorate over time. The primary cause will be from accelerated population growth. As Crescent Lake Junction increases in size and Oakridge continues to grow, more locally generated and imported pollutants are anticipated to reach the Odell Basin. The net effect may be a slight decrease in both diversity and abundance of lichens and mosses. The areas within the watershed managed to later structural stages of vegetation will provide improved habitat for these species, but may not be able to counteract fully the impacts of air pollution within the next century.

MINERAL AND ENERGY RESOURCES

One gravel and three cinder pits are located within the watershed (Figure 11). The cinder pits are used locally for road surfacing. The gravel pit is an extremely valuable resource. It is the only source of high quality gravel suitable for crushing and road surfacing in the proximity of the watershed. The restoration plan for this gravel source development includes respreading of topsoil and grass seeding the area.

An abandoned gravel pit was also found on the bank of Odell Creek. Its history is not documented and no restoration has occurred.

No other mineral or energy resources are known to exist in the Odell Watershed.

HISTORIC SOIL QUALITY

A map of inherent (or historical) soil quality was created utilizing the plant association groupings for potential natural plant communities that were developed by the assessment team. The delineation of soil quality was based on the assumption that the most productive sites result from a variety of soil forming factors; in addition, the quality of the soil can be expressed by the plants that have the potential to grow on a

site. The accompanying map indicates historic soil quality (Figure 12). The delineation of high, moderate and low soil quality is based on the following groupings of plant associations:

TABLE 3 - 1, SOIL QUALITY AND ASSOCIATED PAG'S

SOIL QUALITY	POTENTIAL NATURAL PLANT COMMUNITY
HIGH =	Mixed Conifer - wet
MODERATE =	Mixed Conifer - dry Mountain Hemlock Lodgepole with Mountain Hemlock High Elevation Lodgepole Lodgepole - moist/wet
LOW =	Lodgepole - dry Ponderosa Meadows

This assessment shows that the majority of the analysis area (67%) is of moderate soil quality. 21% of the watershed area is in a low soil quality class, while only 12% of the area is considered to be of a high soil quality class. (These definitions of soil quality are on a relative basis. East of the Cascade Range, productivity classes 3 and 4 are considered good, and, thus, are given a high soil quality rating.)

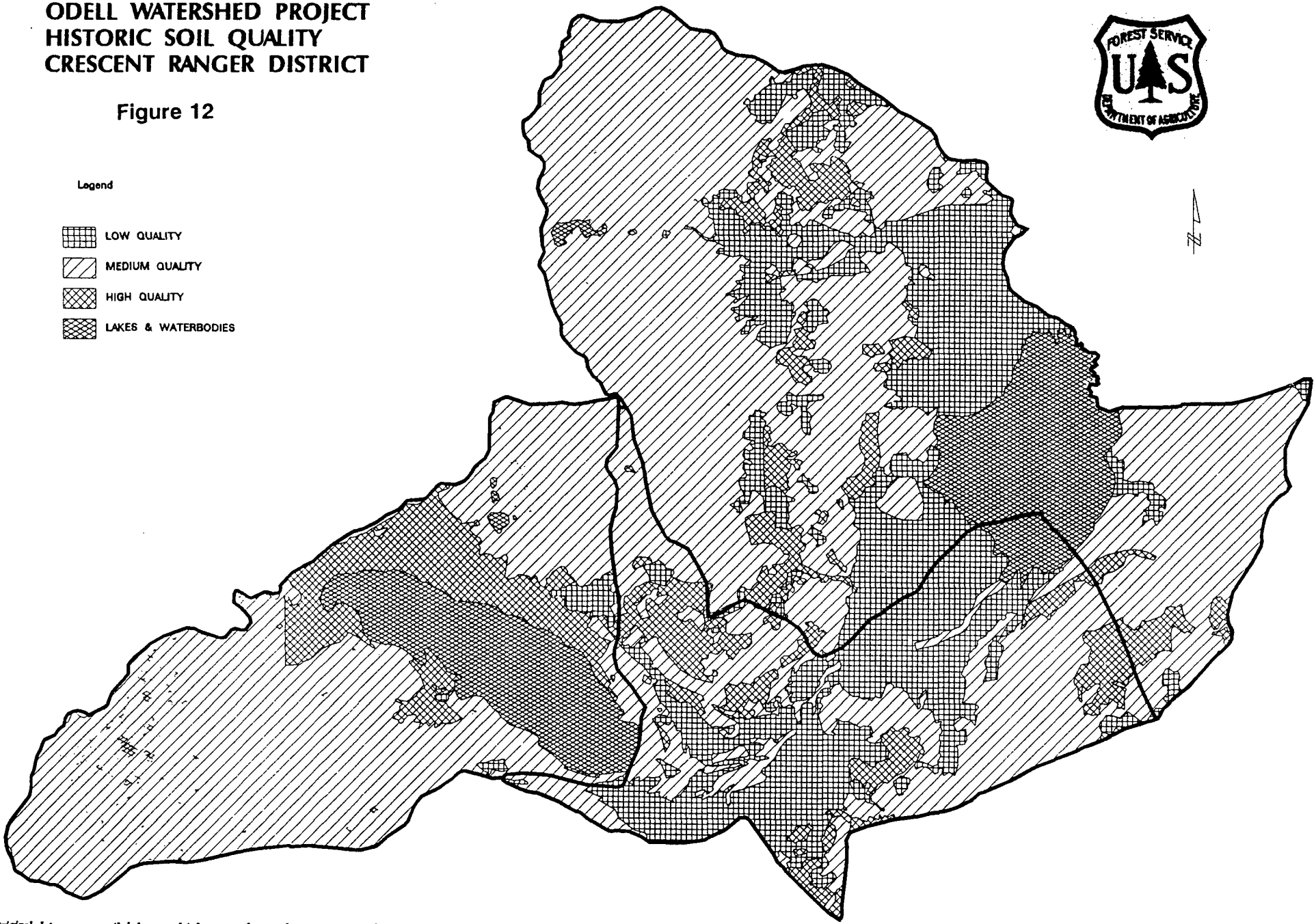
In addition to an assessment of the historic soil quality, an assessment of the sensitivity of each soil mapping unit to erosion, nutrient loss, and compaction was made. The sensitivity rating was based on inherent soil properties. The Soil Resource Inventory (SRI) for the Deschutes National Forest completed in 1976 was the source of most of the basic soil property information utilized in this assessment. For the most part, the inventory is usable information. The most accurate information applies to the eastern portion of the watershed which had been designated "General Forest" area by the Deschutes Land and Resource Management Plan (LRMP). The intensity of and, therefore, the reliability of the inventory decreases in areas designated as "Wilderness" or "Dispersed Recreation". See Figure 7 for a map of the LRMP designations. The only area that was determined to be not accurately depicted, even in a general sort of way, is north of Davis Lake where the SRI shows the area of glaciation and glacial outwash (SRI Landtype 25). Lava appears to be the dominate force in this area.

Data from the SRI were incorporated into a database to facilitate an evaluation of the susceptibility, resiliency, and overall sensitivity of each soil mapping unit delineation to the forces of erosion, nutrient loss, and compaction. (See Appendix B - Soils, Tables 1-6 for factors used to make this determination.) From that assessment, a map of overall sensitivity of the soils in the watershed was created (Figure 13). Soil mapping units were grouped into low, moderate, or high sensitivity (See Appendix B - Soils, Tables 7-9 for classification of each mapping unit). Some mapping units are complexes of several mapping units and those sensitivities are reflected by the individual values for each separate mapping unit component i.e. low/high or low/moderate designations.

The sensitivities of various portions of the watershed are depicted spatially in Figure 13. The watershed has 46% of its area with highly sensitive soil properties, 29% has a moderate sensitivity, and 25% has a low sensitivity. These sensitivities are assessed by examining the impacts that activities have on soil quality.

ODELL WATERSHED PROJECT
HISTORIC SOIL QUALITY
CRESCENT RANGER DISTRICT

Figure 12



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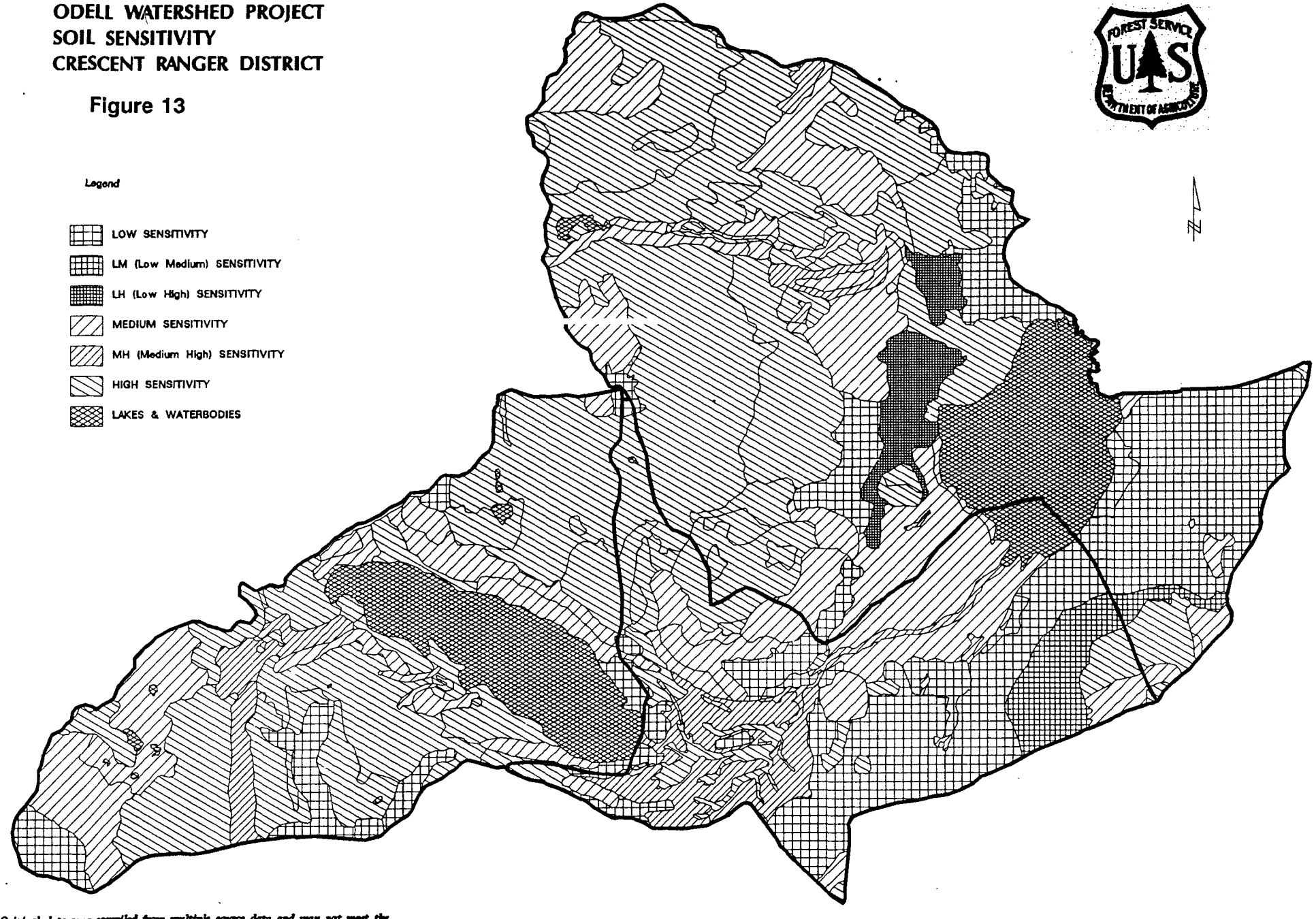
ODELL WATERSHED PROJECT
SOIL SENSITIVITY
CRESCENT RANGER DISTRICT

Figure 13



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Most of the areas that are highly sensitive include places where there are harsh climatic conditions and the period of biological activity is short. Higher sensitivity ratings also can be found in areas of the watershed where there are finer soil textures and few coarse fragments to resist the impacts. In the glaciated portion of the watershed, the depth to a restrictive layer, either rock or compacted till, restricts rooting depth and results in less resilience and, therefore, higher sensitivity ratings.

Due to the coarse textures and high infiltration rates of the soils and the gentle to moderately steep slopes throughout the watershed, the sensitivity to erosive forces are low to moderate.

The soils in the watershed are highly susceptible to the loss of nutrients. This is due to the ease of soil displacement, which results from the lack of soil structure. The surface textures are coarse and occur as individual particles. Organic debris and litter on the surface of the soil decrease the susceptibility to nutrient loss. Carbon concentrations in the top 30 centimeters, depth of rooting, and soil texture all help to determine a soil's resiliency to nutrient loss. In this watershed most of the soils have little ability to restore soil conditions once nutrient loss has occurred.

The soils in this watershed are highly to moderately susceptible to compaction depending predominantly on the soil texture, the amount of cobbles and stones, and the amount of carbon in the top 30 cm of soil. Due to frost heaving of the top 4-6 inches of soil, compaction can be alleviated on the surface. Below that depth, however, these soils have a low to moderate ability to restore infiltration and aeration features of the soil profile once detrimental damage has occurred.

EXISTING SOIL QUALITY

A determination of the detrimental impact that has occurred due to past management activities in the watershed was made. Definitions of a detrimental soil condition come from the Forest Service Manual 2520.13. An aerial photo analysis, as described in the WEAVE document, was undertaken. Through that analysis, with some ground verification of results, it was determined that on the portion of the watershed where the majority of management activities have occurred (ie. watershed acres minus large water bodies, dispersed recreation, and wilderness), the following percentages of detrimental soil condition were found:

46% in Condition Class A = < 11% detrimentally impacted
19% in Condition Class B = 11-20% detrimentally impacted
18% in Condition Class C = 21-40% detrimentally impacted
17% in Condition Class D = > 40% detrimentally impacted

The assessment of detrimental soil condition in the area where management activities have occurred is depicted spatially in Figure 14.

When the detrimental soil condition analysis is determined over the entire watershed acreage, including lakes, wilderness and dispersed recreation areas, the following percentages of detrimental soil condition were found.

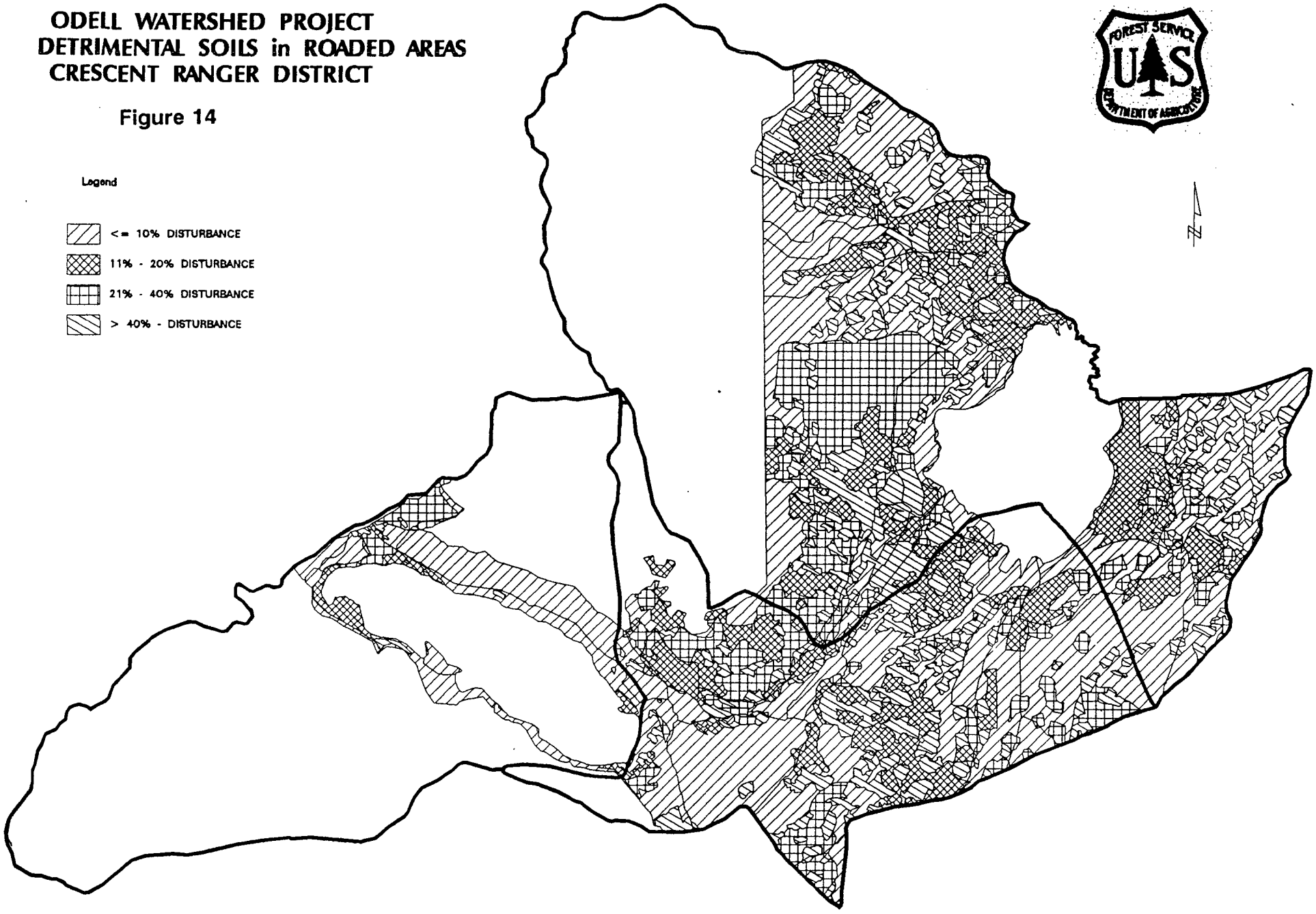
69% in Condition Class A = < 11% detrimentally impacted
11% in Condition Class B = 11-20% detrimentally impacted
10% in Condition Class C = 21-40% detrimentally impacted
10% in Condition Class D = > 40% detrimentally impacted

The assessment of detrimental soil condition throughout the watershed is depicted spatially in Figure 15.

The quality of the soil resource has been decreased on 7,267 acres, 11% of the watershed, by activities that detrimentally impact the soils.

ODELL WATERSHED PROJECT
DETRIMENTAL SOILS in ROADED AREAS
CRESCENT RANGER DISTRICT

Figure 14



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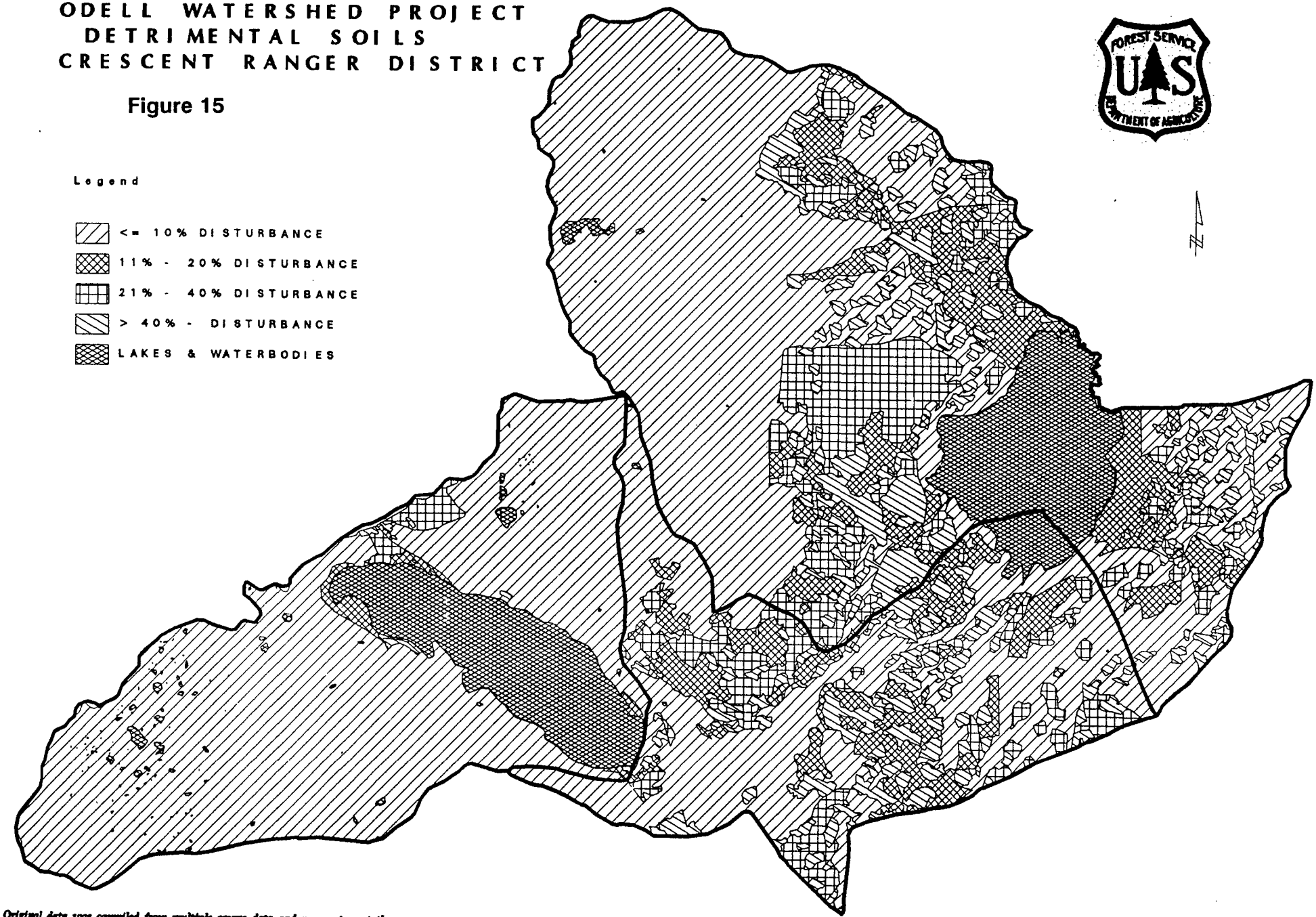
ODELL WATERSHED PROJECT
DETRIMENTAL SOILS
CRESCENT RANGER DISTRICT

Figure 15



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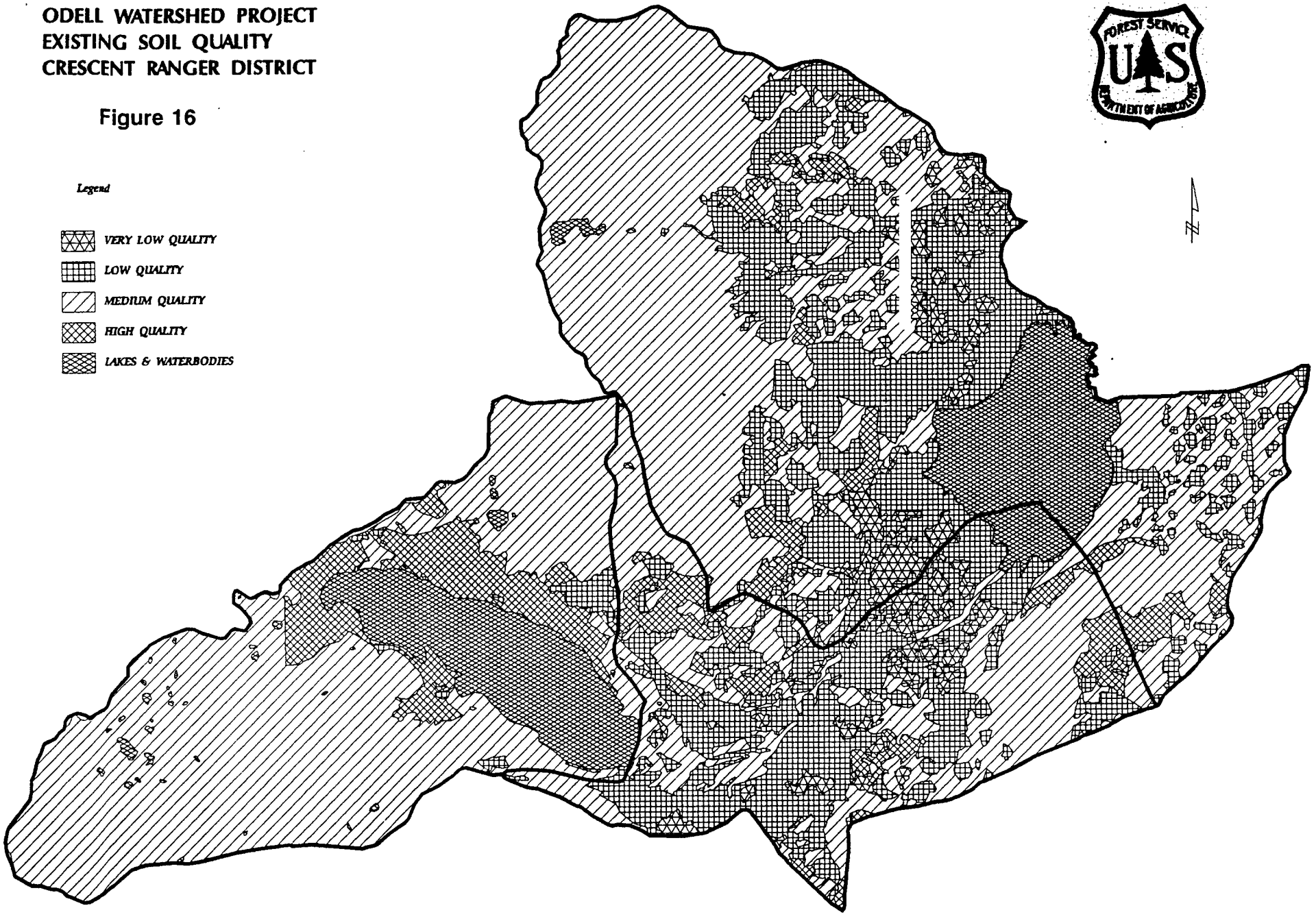
ODELL WATERSHED PROJECT
EXISTING SOIL QUALITY
CRESCENT RANGER DISTRICT

Figure 16



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The existing soil quality is a combination of the historic soil quality, the sensitivity of the site (ability to resist change combined with the ability to self-restore), and the degree of detrimental impact imposed on that site by human activities. A spatial depiction of the existing soil quality is in Figure 16. The following chart was used to assess changes in soil quality:

TABLE 3 - 2, CHANGES IN SOIL QUALITY

HISTORIC SOIL QUALITY	SENSITIVE *	DETRIMENTAL CONDITION CLASS +	EXISTING SOIL QUALITY
High	No	A, B, C	High
		D	Moderate
High	Yes	A,B	High
		C	Moderate
		D	Low
Moderate	No	A, B, C	Moderate
		D	Low
Moderate	Yes	A,B	Moderate
		C,D	Low
Low	No	A, B, C	Low
		D	Very Low
Low	Yes	A, B	Low
		C,D	Very Low

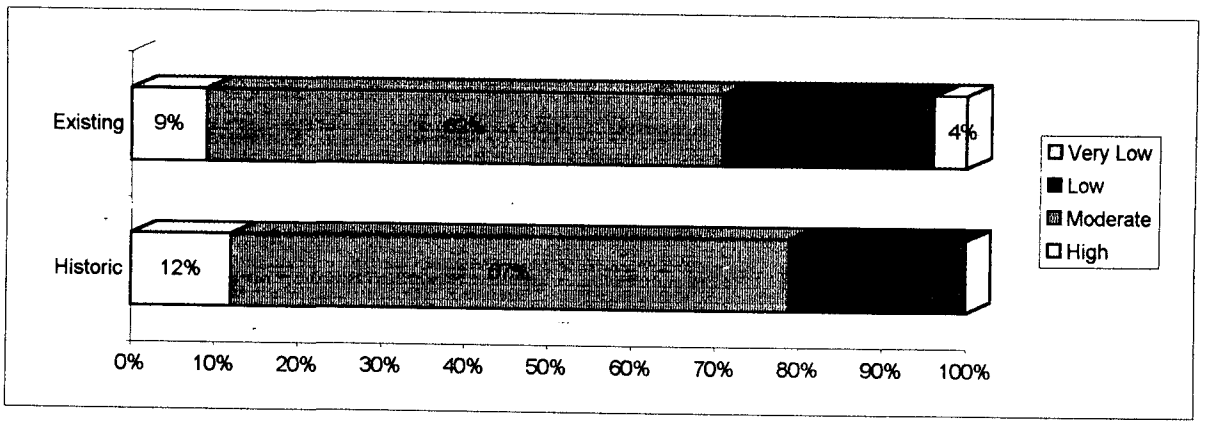
* Sensitive ratings are as follows:
Yes - if the individual sensitivity was low-high, medium, medium-high, or high.
No - if the individual sensitivity was low or low-moderate.

+ Detrimental Condition Class implies the percentage of soils detrimentally impacted.
A = ≤ 10%, B = 11 - 20%, C = 21 - 40%, D = > 40%

The table and chart below show the changes between historic and existing soil quality.

TABLE 3 - 3, SOIL QUALITY

	High	Moderate	Low	Very Low
Historic	12%	67%	21%	0%
Existing	9%	62%	25%	4%



Soil carbon status (Appendix B - Soils, Table 10) was determined on an area of lodgepole pine in the LaPine Basin just west of Davis Lake. The harvested area had been machine harvested, piled, and planted. The amount of litter on the soil surface in the activity area was considerably less than that on the forest floor in the natural forest area. A portion of the organic material that was on the surface was removed during the machine activity and a portion was mixed with the surface soil horizons. This has resulted in a lower organic carbon component for the long-term, but in the short-term, a larger amount of carbon is in contact with the soil, where it may be more easily decomposed by microorganisms. There is some debate among research scientists about the ability of microorganisms to break down this organic litter into usable forms. In these dry cold areas of the west, the length of time that microorganisms are active in the soil is short. This is a result of either cold temperatures and/or dry soil conditions. Some scientists have determined that fire is an essential component of these systems. Fire provides the initial breakdown of organic material into components that are more easily utilized by microorganisms.

Soil nutrient status (Appendix B - Soils, Table 11) was also determined for the lodgepole pine area discussed above. Nutrient analysis of nitrogen, phosphorous, and potassium was completed. The analysis results indicate that a slight increase in the total nitrogen content of the surface soils within the activity area which can be explained by the above discussion. All other nutrient levels were reduced in the harvested area as compared to the levels found in the adjacent forested area. The nutrient ranges on the harvested unit are on the low end, but within acceptable ranges for sufficient growth of lodgepole pine.

Roads in the watershed are in good shape for the most part. System roads occupy 0.83% of the total watershed and 1.27% of the portion of the watershed that has had the majority of management activity. 30% of this road network has been closed by blocking entry or allowing natural succession processes to proceed on these compacted surfaces. No road obliteration (defined as restoring the hydrologic function of the area) has occurred in the area.

It was found during this analysis that the skid trail systems from past harvest activities are acting as ephemeral stream channels and conducting water to the system roads. Evidence of this occurs in areas where sideslopes exceed 15%. This results in erosion on the road prism and displacement of sediment from the road to the forest below where it is deposited. In many cases the erosion is deposited in stream channels that only flow during extreme storm events. Nevertheless, conditions are being established where those landscape altering events could transport a substantial accumulation of material that is unconsolidated and readily moved with those storm flows.

Erosion from old logging skid trails on the slopes of Maklaks and Royce Mountains and Ranger and McCool Buttes is still evident and actively occurring several decades after the initial impact.

Skid trails have caused the majority of the detrimental soil condition by displacing organic material, litter, and the nutrient rich surface soil horizons and by compacting the soil. As mechanized harvesting was introduced in the 1980s, more soil was compacted by heavy equipment operation, since equipment made several passes over the same ground to access timber.

Compaction disrupts several soil processes. Most directly it impacts water cycling by inhibiting the infiltration of water, however, it also increases the runoff potential, thereby accelerating the processes of erosion. Compaction and erosion both can change the soil moisture storage capacity of the soil.

Compaction restricts root growth which reduces the physical ability of roots and associated mycorrhizae to penetrate the soil profile in order to uptake water and transport it to the tree where it is transpired into the atmosphere. Competition also influences nutrient cycling by creating an environment that has a reduced ability to support soil biotic communities due to increased water stress, reduced aeration, and physical barriers.

The process of soil formation is set back by compaction until the properties that facilitate it, including decomposition, aeration, and porosity, are restored either naturally over a long period of time, or by mechanical restoration, ie. subsoiling.

Harvest activities can change the distribution of moisture and solar energy, thereby, altering soil and air temperatures and evapotranspiration rates at the soil surface.

Increased utilization of wood fiber and machine piling woody debris to reduce fuel loads resulted in the compaction of additional ground. These activities result in large woody material, fine litter, and duff either being removed from the site or incorporated into the surface soil, both of which alter the rate of nutrient cycling. The removal of material from the site truncates nutrient cycling by eliminating the major source of carbon and nitrogen; incorporating material into the soil accelerates nutrient cycling by bringing the source in more direct contact with moist soil where the soil organisms are active.

Machine planting operations also degraded soil quality by removing large and fine organics and surface soil horizons during the planting operations.

Prescribed fire, which has been utilized as a management tool in the northeast portion of the watershed, was not considered to cause detrimental soil conditions. The burns left behind surface litter and covered the area in mosaic patterns. Fire plays a natural role in this watershed. The role includes recycling stored carbon and nutrients back into the soil which, in turn, regulates the moisture storage capacity. Soil organic material losses should be kept at a minimum whenever fire is introduced to the system. Burning of slash piles, however, significantly reduced the soil organic matter component immediately under the slash piles.

SOIL OPPORTUNITIES

Fertilization

Displacement or removal of topsoil reduces the ability of the soil to accept, hold, and release nutrients to plants. Fertilization can restore the capacity of the soil to provide this function.

Many sites will respond to Nitrogen (N) fertilization since it and soil moisture are likely to be limiting factors. Using N fertilizer offers excellent opportunities to enhance growth especially on good sites. However, application of N to many tree species is likely to induce major changes in the distribution of Carbon (C) between tops and roots, generally favoring the production of tops at the expense of roots. Generating forest stands with high ratios of tops to roots in ecosystems with periodic drought and soils of limited moisture and nutrient storage capacity could be risky. Nitrogen can also reduce mycorrhizal activity which

can reduce the ability of plants to acquire nutrients, particularly if large root to shoot ratios and intense mycorrhizal inputs are required on low productivity or harsh sites.

Roads

Many roads are acting like extensions of the ephemeral stream channel. These roads and the adjacent skid trails that are contributing runoff and sediment should be obliterated.

1st Priority - roads with adjacent sideslopes >60%
2nd Priority - roads with adjacent sideslopes >30%
3rd Priority - roads with adjacent sideslopes >15%

Figure 17 spatially depicts the open and closed roads within the watershed.

Subsoiling

Subsoiling is currently the best technology available to restore the ability of soil to:

- accept, hold, and release water to plants, streams, and groundwater,
- promote and sustain root growth,
- and to maintain suitable soil biotic habitat

Under a purely economic assessment, areas to subsoil would be prioritized by the following classification:

1st Priority - high soil quality degraded to low soil quality
2nd Priority - high soil quality degraded to moderate soil quality
3rd Priority - moderate soil quality degraded to low soil quality
4th Priority - low soil quality degraded to very low soil quality

Figure 18 is a map of the restoration priorities.

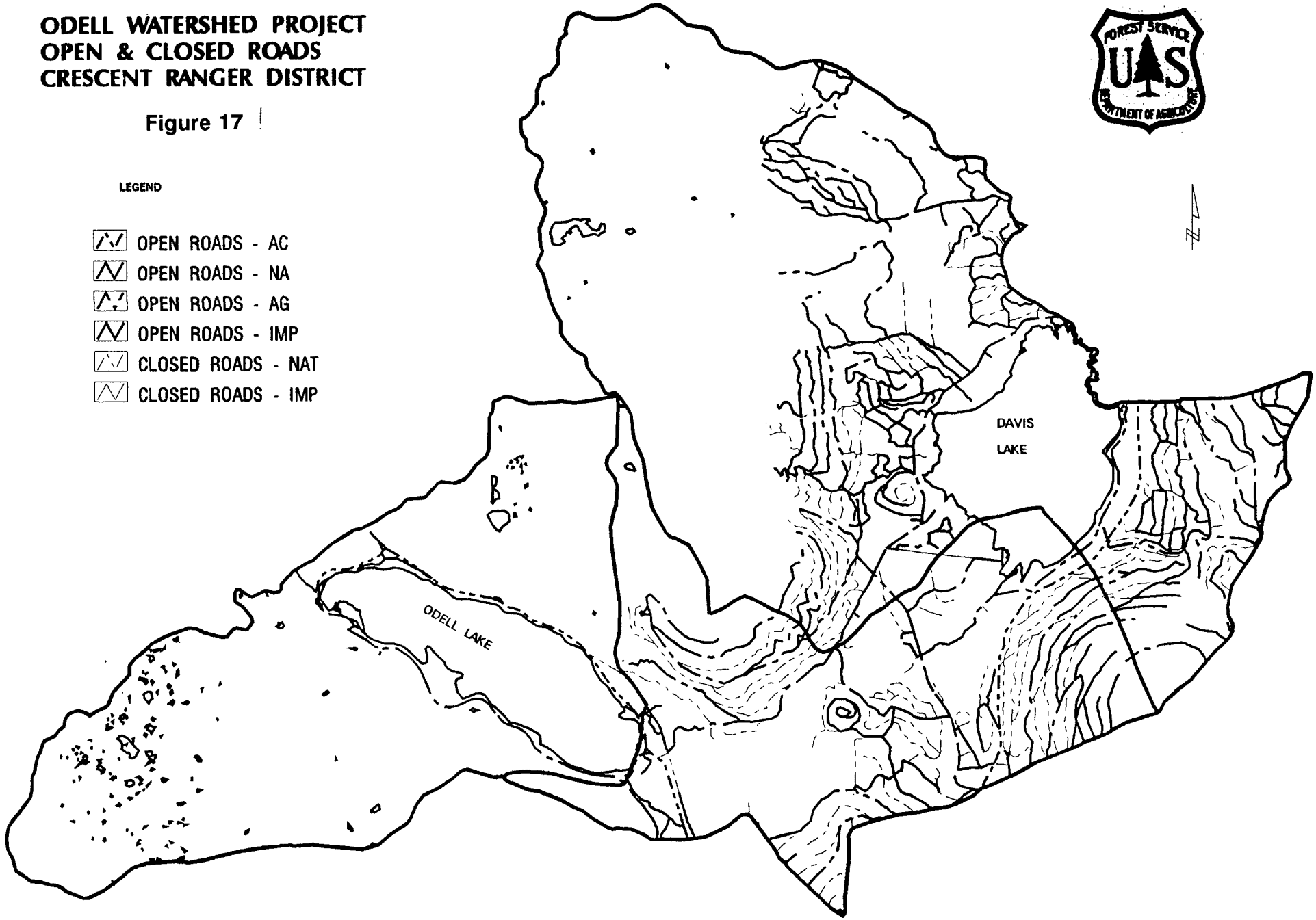
However, these priorities must be integrated with other important resource objectives to determine where and in what priority restoration activities should occur.

WATER QUALITY

Floodplain function and the quality of the riparian vegetation has been maintained in over 99% of the watershed. The basin is in excellent shape, except in localized recreation sites where human influences have altered both form and function of riparian and floodplain areas. Vegetation in these areas has either been destroyed or trampled, and the moist soils have been compacted. Riparian vegetation has also been adversely altered or destroyed in the high concentration use zones (resorts and campgrounds). (Figures 3 and 11) The streambanks and lakeshores in these areas have been trampled and protective vegetation has been eliminated. This is particularly apparent along Trapper Creek near the campground. A few trails (hiking, OHV, and snowmobile) traverse or parallel riparian zones and have detrimentally impacted some wet meadows. There are several sites adjacent to Davis Lake where four-wheel drive networks have been developed in riparian zones causing vegetation damage and concentrating water flow through the meadow which disrupts hydrologic function. The impacts associated with the concentration of people in riparian zones include: trampled vegetation; slight increase in runoff, erosion, and sediment delivery to the water body; and damage to the streambanks.

ODELL WATERSHED PROJECT
OPEN & CLOSED ROADS
CRESCENT RANGER DISTRICT

Figure 17



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15-OCT-94
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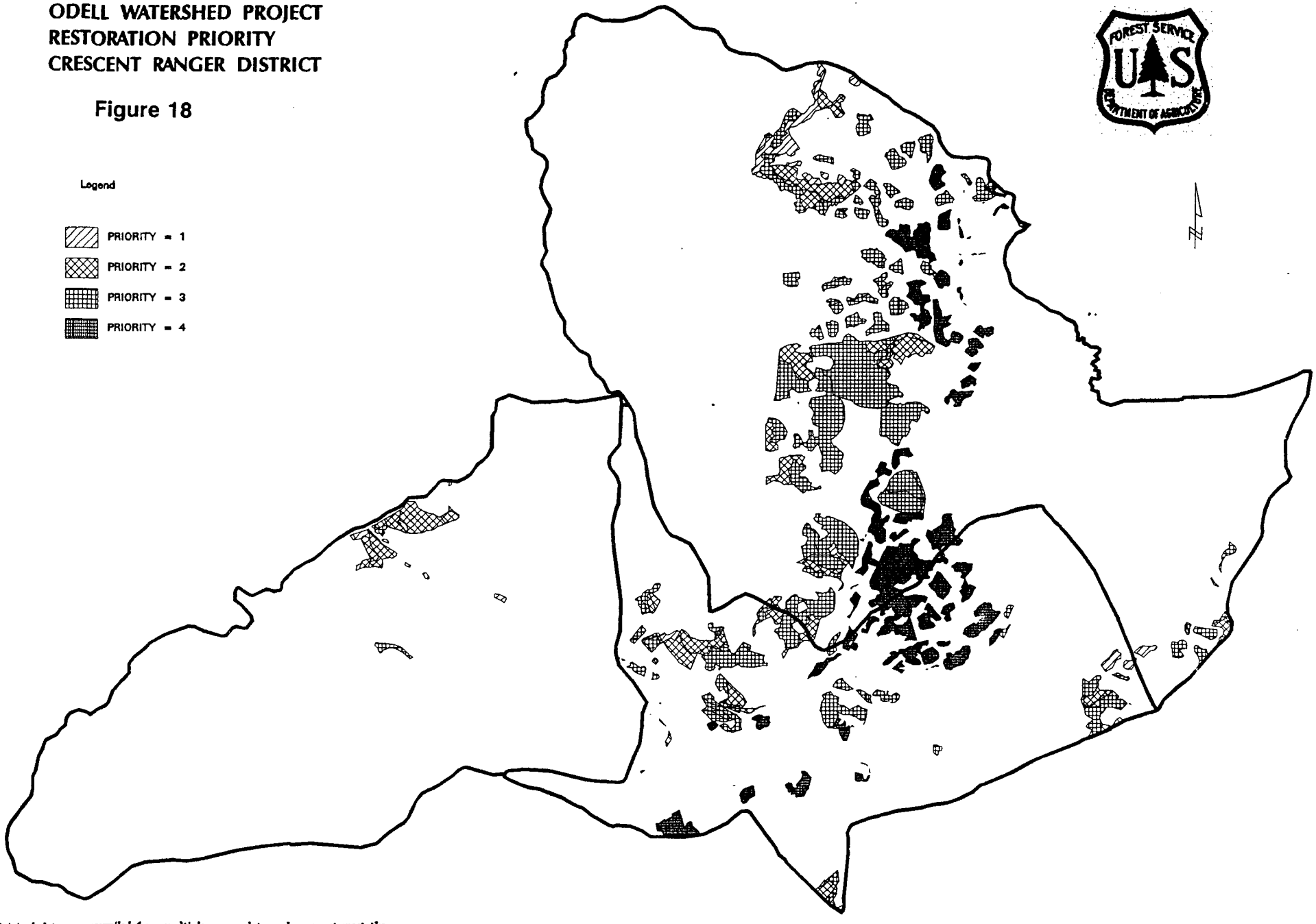
ODELL WATERSHED PROJECT
RESTORATION PRIORITY
CRESCENT RANGER DISTRICT

Figure 18



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The riparian conditions within the watershed are believed to be similar to what they were prior to the 1850s. One possible exception is in the lodgepole and mixed conifer plant association groups where fire played an active role in creating open patches (open meadows in this plant association intermixed with the lodgepole and mixed conifer) in the landscape. (Figure 6) Historically, a greater percentage of open meadows was present in the watershed. Within these areas where fire has been suppressed, fuel loading (both live and dead) is higher than the perceived natural range of variability. The addition of fire to these areas would produce a mosaic of vegetative types and seral stages.

Continued fire suppression will allow additional buildup of fuels in the riparian/wetlands/floodplains, which will result in increased susceptibility to fire and a decline in the species dependent on herb/shrub meadows. As the human population in Oregon and the neighboring states increases, a greater number of people will be recreating in the Odell Watershed at established and dispersed sites. The resulting effects from this trend is increased pressure on the existing riparian zones including trampled vegetation, compacted soils, and damaged streambanks.

Vegetation treatments within the riparian zone have taken place along the two miles of Odell Creek immediately upstream of Davis Lake. These treatments included the removal of lodgepole pine killed by the mountain pine beetle. This overstory removal altered small segments of the forest adjacent to the creek. Removal of the lodgepole pine has occurred on approximately 500 feet of the streambank which has caused the loss of stream shade.

Forest management activities have caused localized effects on channels, pools, and the amount of large woody material in the watershed. Trapper Creek is six miles in length and management activities have impacted approximately 1/8 of a mile of the creek. These management activities include the removal of large woody material (LWM) from the stream at and above the Trapper Creek Campground following the 1969 flood and the placement of gabion structures on 200+ feet of the creek bank to reduce erosion and contain storm flow runoff. Restoration efforts in the 1990s consisted of the addition of LWM to the stream and the planting of willow along the streambank.Continued degradation/suppression of the riparian vegetation in Trapper Creek is occurring due to the proximity of the campsites to the creek.

The channel, cover, and LWM components are providing excellent aquatic habitat in Odell, Ranger, Maklaks, Crystal, and the remainder of Trapper Creek.

LWM was removed from Odell and Davis Lakes to accommodate small watercraft. This activity caused negligible impacts to the aquatic resources in Odell Lake, but significantly impacted the fisheries population in Davis Lake. Odell Lake has a very small percentage of littoral zone with a high level of cobble and boulder size substrate. Davis Lake is within the glacial outwash zone and contains an extensive littoral area with substrate that is dominated by fine sediments. When Davis Lake experiences low lake level periods, fish are forced to swim through a half mile of extremely shallow riffle and glide habitat in order to reach cooler stream water of adequate depth to provide protection from predators. Restoration activities in the 1990's will include the addition of LWM to the lake and planting of willow trees along the banks for cover. Continued degradation/suppression of the riparian vegetation is occurring due to the proximity of East and West Davis Lake Campgrounds to the confluence of Davis Lake and Odell Creek.

The water quality standards determined to meet biological criteria for aquatic life are adequate within the watershed. These standards include water temperature, turbidity, fine sediments in the substrates, other parameters for resident fish, as well as habitat for aquatic organisms. Measured adverse water quality effects have been reported for Odell Lake. Using information collected from other lakes in the area, the conclusion has been drawn that Odell Lake was oligotrophic (nutrient poor) prior to the development of the two resorts, five campgrounds and sixty-six summer homes along its shore. From data collected on Odell Lake including sechi disc, lake sediment, and plankton analysis, a trend towards an eutrophic condition (high in nutrients) was observed and documented in the late 1960s. Increased nutrients stimulated an

increase in the growth of phytoplankton, including an initial appearance of blue green algae and a subsequent decrease in water clarity. This trend was reversed in the 1970s when the two resorts significantly improved their waste water treatments (leach lines). In addition, the Forest Service campground facilities have been converted to sealed vaults, and several summer homes have upgraded their septic systems. Data clearly shows that the enrichment trend within Odell Lake has been reversed. The lake is currently classified as mesotrophic (moderate levels of nutrients). Consultation with various agencies resulted in a concurrence that the lake is in an acceptable state of nutrient balance.

Water quality (decrease in introduced nutrients) should improve slightly in the future as the summer homes improve/upgrade their septic systems. A continued threat to Odell Creek and Lake is as the population increases, the risk of hazardous material spills along Highway 58 increases. (Figure 8) There have been numerous spills in the watershed, but none have contaminated the water bodies.

BIOLOGICAL DOMAIN

VEGETATION

METHODS AND SPECIFICS OF ANALYSIS PROCESS

Historic Range of Variability

Vegetation was analyzed using the concept of "Historic Range of Variability" (HRV) of successional states. A pivotal assumption in the use of HRV is that an element or process that is outside the range or natural variability cannot be sustained naturally (Caraher et al. 1992). Native species have adapted to the natural disturbance events of the Holocene (the past 10,000 years) environment and require those conditions for their survival (Swanson et al. 1993).

In determining the historic ranges of variation, two approaches were integrated: 1) the notion of "natural states", as described by Swanson et al. (1993), and 2) the natural disturbance regimes associated with each plant association group.

The first approach assumes that the landscape is composed of definable vegetative "states" or conditions which change through time as they are altered by succession and by the specific disturbance regimes which pertain to them. This approach for characterizing range of variation has been widely used in describing the historical conditions throughout the western United States (Swanson et al. 1993). In this approach, the length of time required to pass through each of these "states" is critical in determining how much of the landscape will be characterized by a state at any point in time. Also important is the total length of time required to progress from bare ground to the climax vegetative state. For instance, in lodgepole pine, the "climax state" could be reached in 120 years, whereas this condition in mountain hemlock associations may require 300 years to attain.

The disturbance regimes are distinct for each group of plant associations, and vary in terms of the agents involved, their periodicity, intensity, and magnitude of the area affected. Low intensity, high frequency disturbances modify the natural state much less dramatically than high intensity, low frequency disturbances such as stand replacement fires. Where high intensity disturbances affecting a large area are likely to occur, the range of variation must necessarily be broad in order to encompass the entire array of natural states that could occur through time.

As the progression through natural states was integrated with the disturbance regime for each PAG, estimates were made as to how much of each condition would exist on the ground at any point in time. (It is a requisite that each state is represented to some degree at all times, in order that the next state can be reached through natural succession). These numbers were adjusted to include consideration of the stability of each state and the length of time required to pass to the next state. The **ranges** of numbers reflect the natural variation through time, and take into consideration the dynamic nature of the system where succession and disturbances are continually operating.

Some of the numbers for range of historical variation for Odell Watershed were extracted from the Ochoco Viable Ecosystems Guide. Specifically, the numbers developed for the ponderosa pine and mixed conifer PAG's on the Ochoco NF were used, given that the plant associations in Odell Watershed were similar and, therefore, most likely subject to similar disturbance regimes and natural succession patterns.

The numbers for the lodgepole pine PAGs were developed using the concepts of succession and disturbance described above.

The mountain hemlock associations were assumed to be within their historic range of variation, since there is an extremely long interval between fire disturbances and lack of human intervention in those high-altitude areas.

The following discussion on seral/structural classification is modified from the Draft Viable Ecosystem Management Guide from the Ochoco National Forest. Modifications were made to best fit the information available for this analysis and for clarity in communicating within the analysis team.

This concept of HRV of seral states resulting from natural disturbance regimes was analyzed by displaying the vegetation (both present and HRV) information in a matrix. The matrix grouped the information into progressive "seral or disturbance categories" based on the structural and species composition characteristics. The matrix is progressive and assumes that development of vegetation on a site proceeds in stages, beginning with a disturbance. The type and intensity of disturbance determines the condition of the site. The composition of species which remains or immediately establishes on a site following a disturbance determines the future successional development for the area.

TABLE 3 - 4, SUCCESSIONAL MATRIX BY PAG

	Seral Stage		
Structure Class	**Pioneer Species Composition (P)**	**Mixed Species Composition (M)**	**Climax Species Composition (C)**
Grass/Forb/Shrub (1)	P1	N/A	N/A
Seed/Sapling (2) ≤ 4.9" dbh	P2	M2	C2
Pole (3) 5.0 - 8.9" dbh	P3	M3	C3
Small (4) 9.0 - 20.9" dbh	P4	M4	C4
Medium/Large (5) 21.0 - 47.9" dbh	P5	M5	C5

Refer to Appendix C - Vegetation for additional information on the successional matrix and assumptions.

Once the initial species composition is set, growth and reproductive success of individual species become drivers of succession. Growth in the tree layer causes an individual stand to develop from a grass/forb/shrub stage (P1) to seed/sapling (P2, M2, C2) to poles (P3, M3, C3) to small trees (P4, M4, C4) and finally to medium/large trees (P5, M5, C5) (See SERAL/STRUCTURAL MATRIX TABLE, above).

Tree species' shade tolerance, longevity, moisture requirements, and fire adaptations may determine broad shifts in their composition on a site through time. This regulates the successional advance of a stand, i.e. movement of a stand from Pioneer (P) (Early Seral) to Mixed (M) (Mid Seral) and finally to Climax (C) (Late Seral) stages. Some growing seasons only maintain the existing community. Because growing seasons vary, years or seasons were not used as a measure of succession; instead, relative stages of plant community development were used. Specifically for this watershed, relative stages of conifer community development were used for analysis due to the type of electronic information available. Succession depends

on relatively unpredictable occurrences, such as seed production on or near the disturbance site, abundance of seed predators, annual weather patterns, existing species composition, and combinations of these factors.

The analysts used the following formula for clarity in this analysis:

Structural Stages + Seral Stages = Successional Stages

Where Structural stages consist of the grass/forb/shrub, seedling/sapling, poles, small, and medium/large size categories.

AND

Where Seral stages consist of the pioneer, mixed, and climax composition of conifer species categories.

The information used to develop these structural/seral stages included canopy cover and size structure information from the Landsat satellite imagery, which was combined with the existing geographic information system (GIS) information, and clipped (separated) by PAG. The information was then converted to Paradox data tables in the PC environment for further summary and analysis.

In this analysis, four of the PAG's were analyzed by both structural and seral stages. These PAG's include the mixed conifer dry, mixed conifer wet, mountain hemlock, and lodgepole dry with mountain hemlock. Stands included in these PAG's had conifer species compositions which could be analyzed electronically using the existing data. There was no discernible way to analyze seral stage data for the ponderosa pine, lodgepole dry, and lodgepole wet PAG's, so the information for these associations is presented in the pioneer structural stages only.

Each seral/structural stage is not a uniform condition across the landscape, but varies by species composition, number of canopy layers, and density (stocking levels). The limits of each seral/structural stage are arbitrarily determined while considering the canopy structure and vegetative composition. The boundaries between these seral/structural stages are often imperceptible on the ground, and are primarily used for data analysis. Even so, these stages are valuable for assessing the successional progress of a stand, predicting the next plant community to occupy the site, and evaluating the mix of wildlife species likely to use the site.

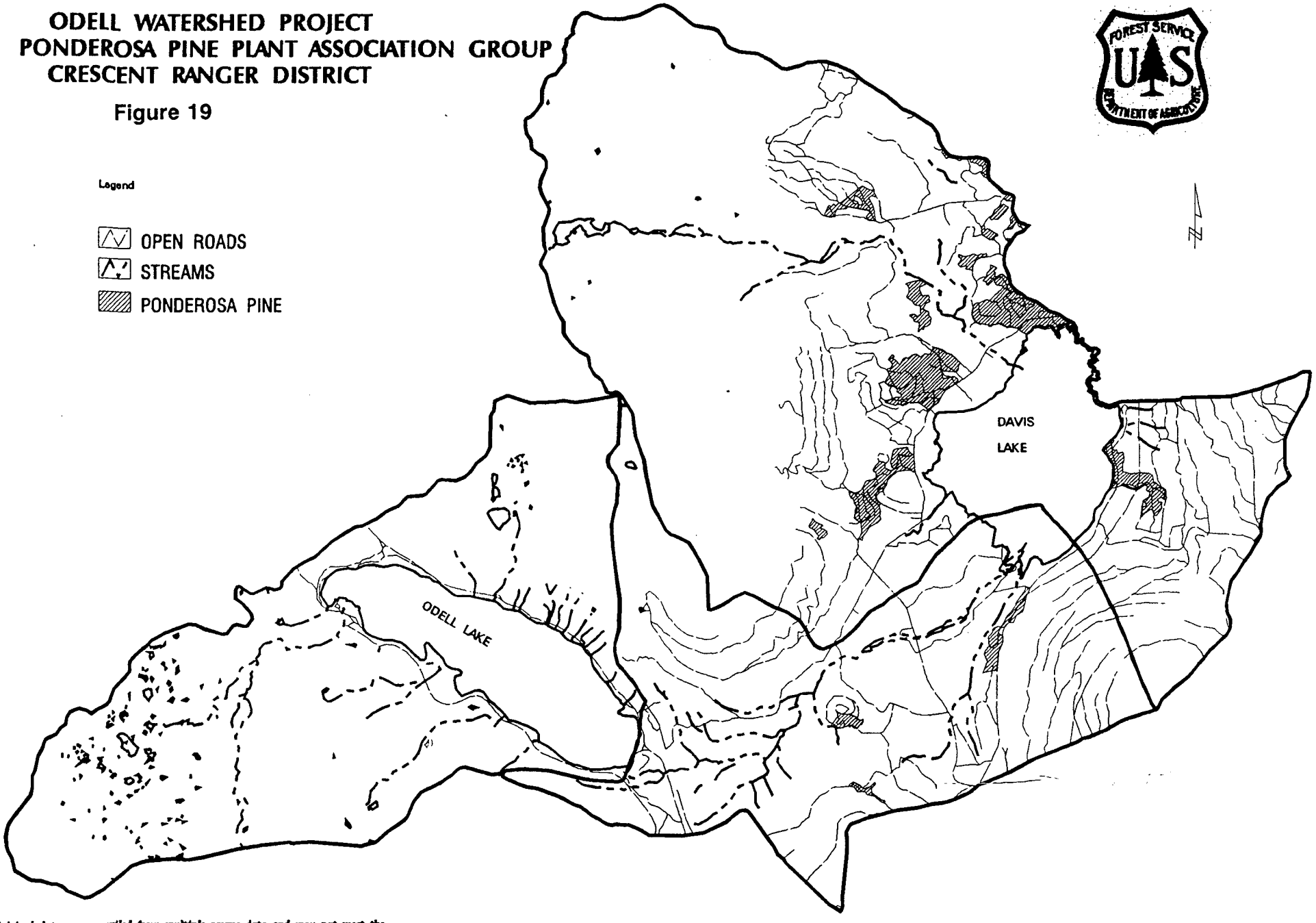
Patch size and edge density were not analyzed with this project due to the initial difficulties and the time needed to assemble the existing GIS data and the contracted Landsat remote sensing data into the necessary formats needed for project analysis. This information is now loaded and ready for patch analysis, but the time needed to complete the process exceeded the time available for this project.

Historic condition, as used in this document, describes vegetative and animal conditions prior to being notably influenced by direct and indirect affects of European settlement. Historic records, fire-scarred stumps, tree ages, and other documented studies were used to gather information to estimate historic conditions.

In using historic conditions as a basis for comparison, the assumption is made that vegetative and wildlife populations were viable and sustainable across the landscape. While such an approach and assumptions may not be perfect, the team chose this approach to approximate past conditions, to compare historic and present conditions, and to estimate the desired conditions that might reasonably be expected to maintain a sustainable, viable ecosystem.

ODELL WATERSHED PROJECT
PONDEROSA PINE PLANT ASSOCIATION GROUP
CRESCENT RANGER DISTRICT

Figure 19



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The following describes by PAG, the Pilot Team's analysis of the Historic Range of Variability:

PONDEROSA PINE PAG

TABLE 3 - 5, HISTORIC RANGE OF VARIABILITY FOR PONDEROSA PINE

	Ponderosa Pine Total Acres = 1,653					
Size/Structure Class	**Pioneer (P)**		**Mixed (M)**		**Climax (C)**	
	Acres	**Percent**	**Acres**	**Percent**	**Acres**	**Percent**
Grass/Forb/Shrub (1)	51 83-496 -(32-445)	3% 5-30% -(2-27%)	N/A		N/A	
Seed/Sapling (2)	417 83-496	25% 5-30%	N/A		N/A	
Pole (3)	541 49-347 +(194-492)	33% 3-21% +(12-30%)	N/A		N/A	
Small (4)	545 331-827	33% 20-50%	N/A		N/A	
Medium/Large (5)	99 331-827 -(232-728)	6% 20-50% -(14-44%)	N/A		N/A	

CHART LEGEND:
Current Values
Historic Range of Values
Differences if Outside HRV

Refer to Figure for the overall PAG map and Figure 19 for the ponderosa pine PAG map.

INTERPRETIVE COMMENTS FOR PONDEROSA PINE PAG HRV TABLE

This PAG is within the historic range of variability (HRV) for two successional stages: Seed/Sapling and Small. The Grass/Forb/Shrub stage is just slightly below historic levels. The difference is probably due to the modeling assumption used to update the Landsat data where regeneration harvest units occurred since 1988 (the date the Landsat image was taken). These harvest units were updated with the Seed/Sapling code. This designation may not always fit younger plantations, since the information obtained from Landsat data does not move stands out of the Grass/Forb/Shrub stage until at least 10% of the area is in conifer canopy cover.

The excess of medium/large structural stages seems appropriate in this PAG. Many of the existing stands of ponderosa pine have been excluded from fire for several decades. The exclusion of fire has allowed significant ingrowth of the ponderosa and lodgepole pine seedlings, which are currently all pole sized or larger. The definition of Pole stage includes stands having multiple canopy layers, but which primarily consist of pole trees, with some small, medium, and/or large trees in the overstory above them. Other stands which fall under the pole stage, include those that have had an overstory removal and ingrowth of smaller trees. Most of the stands that have had little or no vegetation management within this PAG are classified as pole stands.

The lack of sufficient acres of Medium/Large stands is due to regeneration and overstory removal harvest activities. These harvest activities caused the stands to move from the Medium/Large stage to an earlier stage. In addition, as discussed with the Pole stage, there may be some of the Pole stage stands that actually still have their historic small and medium sized overstory relatively intact. There may be more acres in the Medium/Large stage than shown here, but this is not distinguishable with the electronic data available at this time.

Existing vegetative condition and how it relates to future disturbances by insects and diseases:

All structural stages except the seedling/sapling stage are currently outside the HRV. Stages which are under-represented include the grass/forb/shrub and Medium/Large tree size. Pole-sized structure is over-represented, and occupies one-third of the acres in the PAG. These pole-sized stands, especially where they occur in high densities, are likely to be altered in the immediate future by the mountain pine beetle. Stand densities are also important to consider within the medium/large tree structural stage, because this stage could be driven further out of balance if large trees are lost in dense stands to the western pine beetle. Opportunities do exist in the watershed to cultivate replacements for the presently under-represented medium/large tree structure, since the acres of small trees are well within the HRV at the present time. In all cases, it must be considered that dense stands will invariably be altered, predominantly by bark beetles, if no vegetative management occurs.

FACTORS PERTAINING TO TRENDS IN THE PONDEROSA PINE PAG

Disturbance Events

The majority of the disturbance that has occurred within the ponderosa pine areas over the past 80 to 100 years or more has resulted from timber harvesting and its associated activities. Virtually all of the disturbance activity has taken place within the past 45 years. The purpose of the first entries into the ponderosa pine stands was to reduce potential tree mortality from bark beetles (*Dendroctonus* species), which flourish in overstocked ponderosa pine stands (USDA 1990). Keen's tree classification was used to identify and remove trees considered to be of high risk to bark beetle invasion, usually during a 30-year cutting cycle (Smith 1962). Based on field observations for this analysis, these entries removed scattered trees throughout the stands, but probably did not impact the canopy cover or structure by opening it more than 10%.

In the 1960s, 70s, and 80s silviculturists determined that even-aged management with conversion of overmature stands into young, thrifty, fast growing stands was the best way to manage ponderosa pine. In addition, biologists at the time desired considerable edge or contrast for big game and a few other wildlife species. Most of the fragmentation of the late and old structured stands resulted from these entries. It will take several decades to return these even-aged stands of regeneration back to complex structured stands even with vegetation management activities. In addition, the soils in some or all of these stands have been compacted to the point that tree survival and growth are detrimentally affected.

Vegetative Succession

The portions of the ponderosa pine stands which have not had regeneration harvest activities currently have structures which consist of late and old structural components. The exclusion of fire from these stands over the past 80 years or more has contributed to the development of complex fuel beds as tree and brush mortality increased. In addition, development of dense brush in some areas has resulted in a situation known as needle drape. Pine trees shed their oldest needles, usually those 4 or 5 years old, every summer as the new growth develops. These shed needles "drape" over the existing brush and cause a considerable increase in the susceptibility to fire due to their "aerial" nature.

Fire exclusion has also allowed less fire resistant species such as lodgepole pine to become established in these ponderosa pine stands. At present, most disturbances which do not remove the lodgepole pine seed source should expect a predominance of lodgepole pine regeneration in response. Areas where lodgepole pine regeneration has become established are more susceptible to stand replacement fires, since the lodgepole pine creates an effective fuel ladder.

Fragmentation and LSR

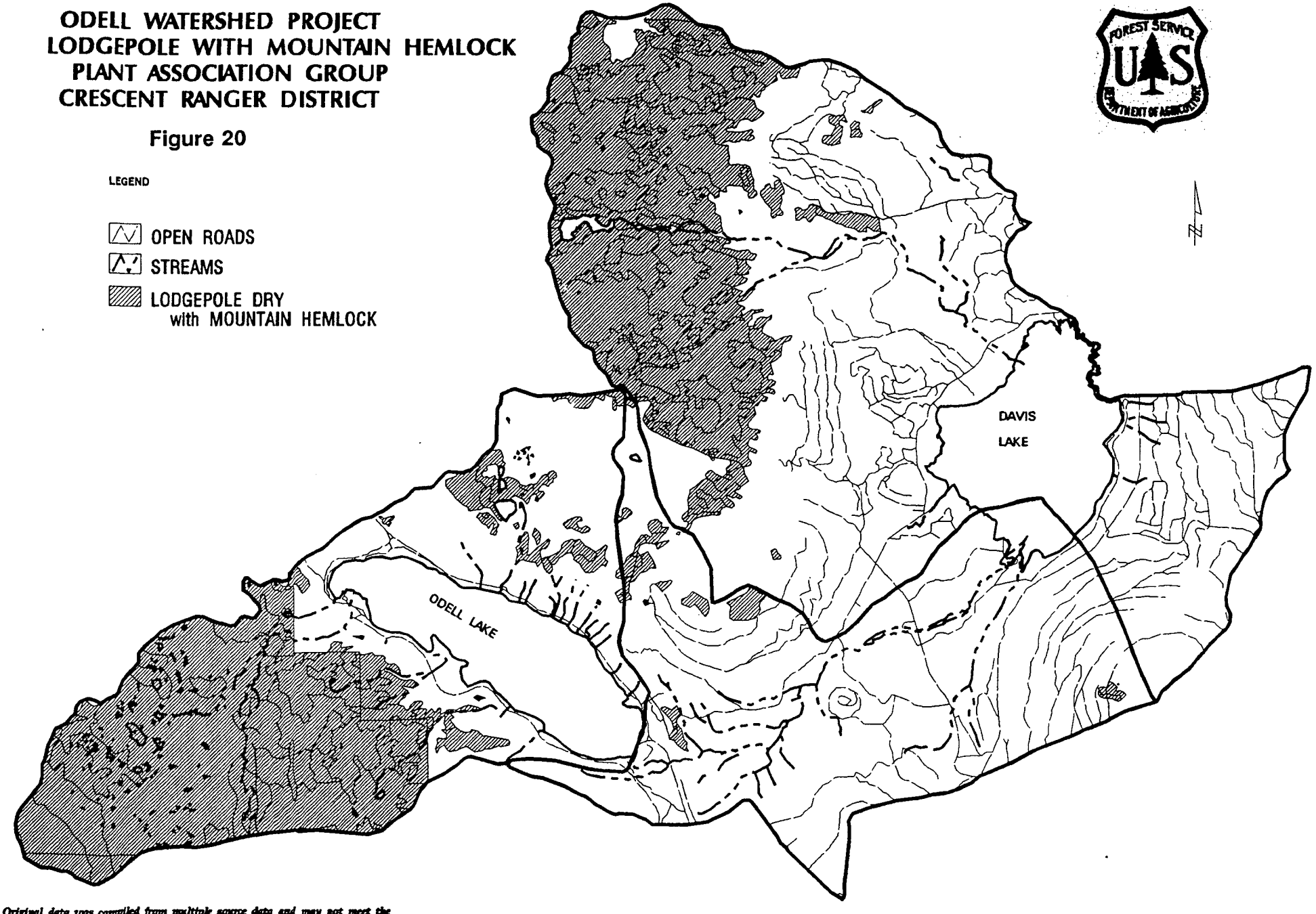
Most of the ponderosa pine stands in the watershed fall under the LSR designation in the Record of Decision (ROD) and Standards and Guidelines. (USDA 1994) Currently, the majority of these stands are fragmented. Several decades are needed in order for these stands to begin to naturally move towards late-successional vegetative structures. This process could be accelerated through vegetative manipulation such as thinnings, prunings, fertilization, etc., which would enhance the rates and types of structures which develop in these stands.

In the portions of these stands which have not been fragmented, many options remain for vegetative manipulation to enhance desired characteristics within these forested stands.

Large diameter, yellow-barked trees are very important scenic elements within Central Oregon forests. This desired aesthetic feature of the landscape is provided primarily by ponderosa pine trees. Past timber harvest activities such as shelterwood harvests removed the majority of the ponderosa pine trees and left sparsely vegetated stands that are highly visible from major travel ways and recreation areas. Within the past few years the trend seems to have moved away from such major vegetative modifications. Most recent harvests planned in scenic viewsheds have been designed with the objective(s) of retaining visual qualities by leaving a sufficient canopy and/or designing the size and shape of the harvest units to fit the landscape in a less visible and/or more natural context.

ODELL WATERSHED PROJECT
LODGEPOLE WITH MOUNTAIN HEMLOCK
PLANT ASSOCIATION GROUP
CRESCENT RANGER DISTRICT

Figure 20



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LODGEPOLE DRY/MOUNTAIN HEMLOCK PAG

TABLE 3 - 6, HISTORIC RANGE OF VARIABILITY FOR LODGEPOLE/HEMLOCK

	Lodgepole Dry/Hemlock Total Acres = 22,117					
Size/Structure Class	**Pioneer (P)**		**Mixed (M)**		**Climax (C)**	
	Acres	**Percent**	**Acres**	**Percent**	**Acres**	**Percent**
Grass/Forb/Shrub (1)	35	0%	N/A		N/A	
Seed/Sapling (2)	11	0%	0	0%	0	0%
Pole (3)	2277	10%	187	1%	5674	39%
Small (4)	381	2%	759	5%	6052	42%
***Medium/Large (5)**	0	0%	0	0%	0	0%

CHART LEGEND:
Current Values
Historic Range of Values
Differences if Outside HRV

NOTE: The Lodgepole Dry/Hemlock PAG is within the historic range of variability. Studies have shown that the range of variability on these sites is very broad and cycles over periods of 600 to 1,200 years or more.

* The analysis tools used did not show any stands categorized as medium/large, but some stands are suspected of being in that category. Stands may appear in that category using more precise data or later in the development of the small category stands.

(Figures 6 and 20)

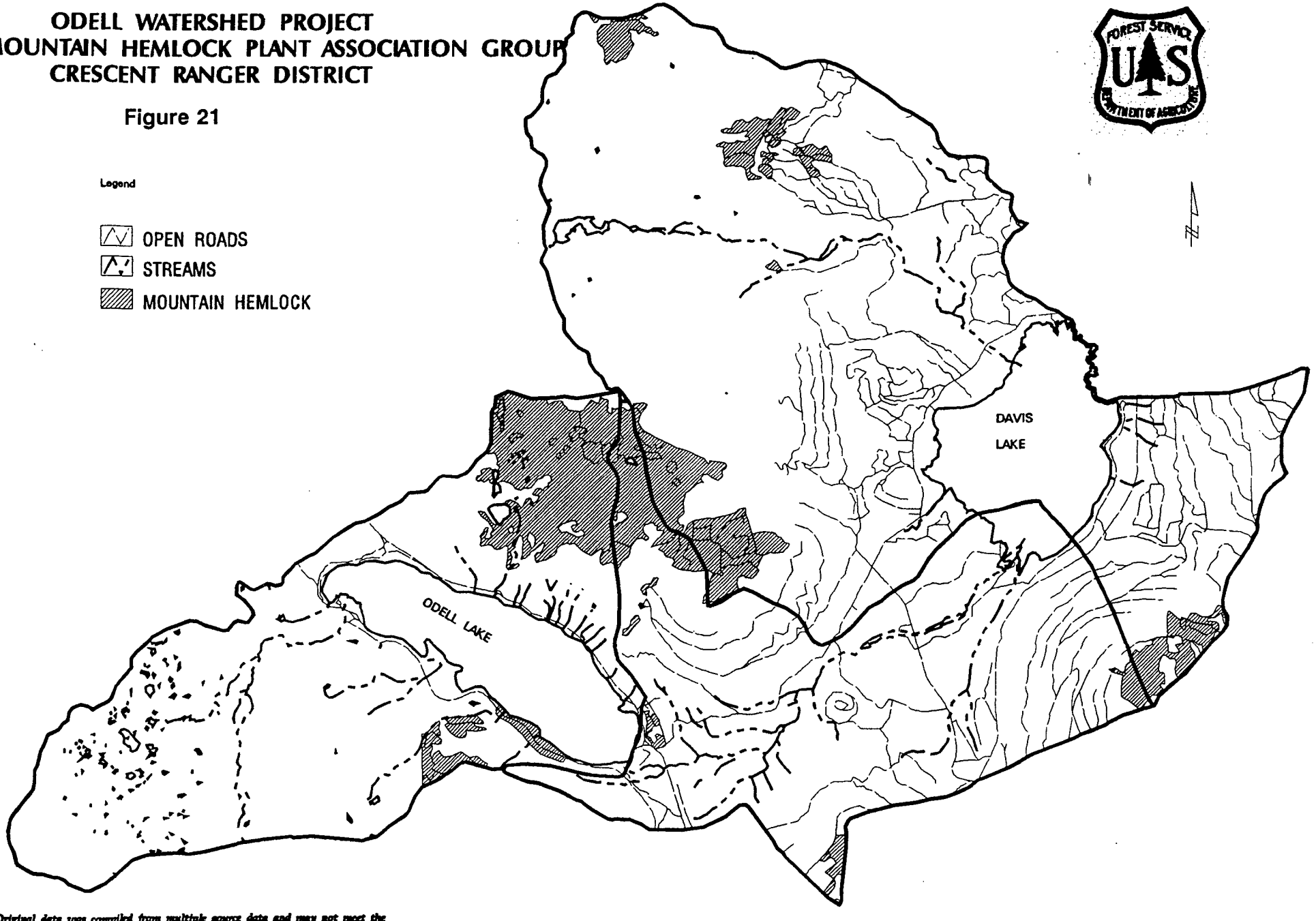
INTERPRETIVE COMMENTS FOR LODGEPOLE PINE DRY/HEMLOCK HRV TABLE

The disturbance processes discussed with the trend write-up for this PAG cause patterns of structure, density, and species composition in the vegetation to slowly develop over many hundreds of years. These patterns occur so slowly, in fact, that they develop along with overall changes in climate and geologic events. In fact Dickman and Cook, 1988, propose that the system is still reestablishing its equilibrium following the transition from the warm dry conditions of the hypsithermal (little ice age) and the Mazama ash, which took place approximately 3,500 years ago, to the cooler climatic conditions. The hypsithermal favors pines both directly and indirectly by promoting fires, and the Mazama ash also favors pine growth. The cooler climatic conditions favor a more abundant, broader distribution of mountain hemlock and, therefore, laminated root disease. In light of the significant role these long-term processes seem to have in shaping the hemlock plant association, the watershed team felt it was inappropriate to view the hemlock PAG's in terms of "historic range of variability", since subsequent cycles may not follow the same pattern due to future climatic changes or geologic events.

In this century it was assumed that the trend in hemlock plant associations within the watershed shifted towards more "climax" or hemlock forests (over the more seral lodgepole), and an associated increase in the abundance and size of laminated root disease mortality centers resulted. These assumptions were based on the fact that recorded disturbances (or lack thereof) have been those which favor proliferation of the hemlock forest and the root disease i.e. there have been no recorded fires of significant size, and there have been two significant bark beetle epidemics (one in the early 1900s and one in the 1980s). Up to this point in time, human fire suppression has probably had little or no observable influence on these stands (Dickman and Cook 1988), and, in addition, there has been little management within the hemlock forest.

ODELL WATERSHED PROJECT
MOUNTAIN HEMLOCK PLANT ASSOCIATION GROUP
CRESCENT RANGER DISTRICT

Figure 21



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MOUNTAIN HEMLOCK PAG

TABLE 3 - 7, HISTORIC RANGE OF VARIABILITY FOR MOUNTAIN HEMLOCK

	Mountain Hemlock Total Acres = 5,930					
Size/Structure Class	**Pioneer (P)**		**Mixed (M)**		**Climax (C)**	
	Acres	**Percent**	**Acres**	**Percent**	**Acres**	**Percent**
Grass/Forb/Shrub (1)	6	0%	N/A		N/A	
Seed/Sapling (2)	62	1%	0	0%	0	0%
Pole (3)	180	3%	121	2%	2929	49%
Small (4)	124	2%	127	2%	2334	39%
Medium/Large (5)	41	1%	0	0%	6	0%

CHART LEGEND:
Current Values
Historic Range of Values
Differences if Outside HRV

NOTE: The Mountain Hemlock PAG is within the historic range of variability. Studies have shown that the range of variability on these sites is very broad and cycles over periods of 600 to 1,200 years or more.

(Figures 6 and 21)

INTERPRETIVE COMMENTS FOR MOUNTAIN HEMLOCK PAG HRV TABLE

As with the lodgepole pine dry/hemlock PAG, the disturbance processes discussed with the trend write-up for this PAG cause patterns of structure, density, and species composition in the vegetation to slowly develop over many hundreds of years. These patterns occur so slowly, in fact, that they develop along with overall changes in climate and geologic events. In fact Dickman and Cook 1988, propose that the system is still reestablishing its equilibrium following the transition from the warm dry conditions of the hypsithermal and the Mazama ash, which took place approximately 3,500 years ago, to the cooler climatic conditions. The hypsithermal favors pines both directly and indirectly by promoting fires, and the Mazama ash also favors pine growth. The cooler climatic conditions favor a more abundant, broader distribution of mountain hemlock and, therefore, laminated root disease. In light of the significant role these long-term processes seem to have in shaping the hemlock plant association, the watershed team felt it was inappropriate to view the hemlock PAG's in terms of "historic range of variability", since subsequent cycles may not follow the same pattern due to future climatic changes or geologic events.

In this century it was assumed the trend in hemlock plant associations within the watershed shifted towards more "climax" or hemlock forests (over the more seral lodgepole), and an associated increase in the abundance and size of laminated root disease mortality centers resulted. These assumptions were based on the fact that recorded disturbances (or lack thereof) have been those which favor proliferation of the hemlock forest and the root disease i.e. there have been no recorded fires of significant size, and there have been two significant bark beetle epidemics (one in the early 1900s and one in the 1980s). Up to this point in time, human fire suppression has probably had little or no observable influence on these stands (Dickman and Cook 1988), and, in addition, there has been little management within the hemlock forest.

Existing vegetative condition and how it relates to future disturbances by insects and diseases: (For both the lodgepole pine dry/hemlock and the mountain hemlock PAG's)

These PAG's are dominated by the later successional species and the pole and small tree structure classes. The abundance of mountain hemlock-dominated stands implies that a large-scale disturbance such as fire or extensive windthrow has not occurred for a long time. As such, the disturbance agents of lodgepole pine (mountain pine beetle and lodgepole pine dwarf mistletoe) are exerting minimal influence at this time due to limited presence of their host tree. The most significant disturbance agent in these stands would be laminated root rot which is creating and expanding patches within the stands dominated by mountain hemlock.

FACTORS PERTAINING TO TRENDS IN LODGEPOLE PINE DRY WITH MOUNTAIN HEMLOCK AND MOUNTAIN HEMLOCK PAG'S

Disturbance Events

Most of the acreage in these PAG's are in management areas without a historic cut component. Harvest activities within these PAG's have only occurred in approximately 2% of the area (424 acres) on the Hamner and Maklaks buttes. Most of the PAG's lie within the Undeveloped Recreation portion from the LRMP, and the Diamond Peak Wilderness. Disturbance events consist primarily of historic stand replacement fires, with an estimated frequency of 600 to 1,200 or more years, and root rot pockets caused by laminated root rot (*Phellinus weirii*) (Dickman and Cook 1988).

Stand replacement fires have been measured at up to 8,000 acres in one study (Dickman and Cook 1988). In the same study, it was noted that stand replacement fires occurred on half of the 45,000 acre study area within the last 500 years. Such large disturbances appear to have played a role in this watershed in that there are very large, contiguous, even-aged stands almost exclusively across these PAG's, except where root rot centers are located.

The root rot centers range from very small (< 1 acre) pockets to nearly 300 acres in size based on photo measurements taken as part of this analysis. These centers differ greatly from harvested units since they expand at the rate of only about one foot per year (Dickman and Cook 1988). The pockets then fill in with vegetation which is more tolerant or immune to the root rot. Hence, several feet into the root rot centers there is well established vegetation providing cover for wildlife, diversity in stand structure, and soil stability.

Vegetative Succession

Historic vegetative successional processes are continuing relatively undisturbed by human activities except for the western white pine. Fire suppression within this century seems to have had very little affect on the successional processes in these PAG's since lightning fires often smoulder around on the ground, sometimes for days or weeks, before being detected and suppressed. These fires are low intensity and are not stand replacement events.

Fragmentation and LSR

As discussed under disturbance events, above, only a small portion of these PAG's has been impacted with harvest or other management activities. Most of the current fragmentation of the late and old stands is a result of the root rot pockets. Fragmentation is expected to continue to increase as the root rot pockets grow in size. In time, perhaps several hundred years when the fuel beds become complex, these stands may experience large stand replacement fires, but existing fuel bed structure is such that large fire disturbance events are quite unlikely.

Insect/disease activity and stand structural patterns in the Hemlock PAG'S

In both of these hemlock plant association groups, a significant portion of the later successional hemlock dominated portion of the PAG is comprised of laminated root disease mortality pockets. These pockets are structurally composed of an outer edge of mortality as the root disease progressively spreads radially through root contacts to adjacent mountain hemlocks, colonizes, and kills them. In the older parts of the mortality center, tree reproduction has become reestablished (although with a higher proportion of resistant species like lodgepole pine and western white pine). Structurally, the infection centers are more open than the characteristically dense uninfected hemlock forest; and the progressive mortality and regeneration associated with these centers have created a variety of gap patterns across the landscape. Centers also have larger numbers of snags and a higher volume of down woody debris. Although they are not affected by the laminated root disease, the western white pine is experiencing mortality rates as a result of white pine blister rust (*Cronartium ribicola* Fisch).

The lodgepole pine dominated component to the hemlock PAG has recently experienced significant mortality from mountain pine beetle attack. It is estimated that over 20 percent of the canopy has been removed from these stands which releases the hemlock understory in many instances (or in the case of the lodgepole/hemlock PAG, the lodgepole and hemlock understory).

Disturbance processes and succession

The interaction between fire, mountain pine beetle (*Dendroctonus ponderosae* Hopkins), and the root rotting fungus (*Phellinus weirii*) creates large-scale patterns in the mountain hemlock forests of subalpine Central Oregon Cascade Mountains (Dickman and Cook 1988). In brief, fire restricts the distribution of laminated root rot by replacing the susceptible hemlock forest with the resistant seral lodgepole pine. While the lodgepole pine probably harbors the fungus without showing outward signs of infection, discernable mortality centers are not apparent until the stand is once again dominated by hemlock (about 175 years into post fire succession). Lodgepole pine stands usually give way and release the hemlock in the understory as a result of mountain pine beetle attack (Dickman and Cook 1988).

In this century it is assumed the trend in hemlock plant associations within the watershed constitutes a shift towards more "climax" or hemlock forests (over the more seral lodgepole) and an associated increase in the abundance and size of laminated root disease mortality centers. Our assumptions are based on the fact that recorded disturbances (or lack thereof) have been those which favor proliferation of the hemlock forest and the root disease. In other words, there have been no recorded fires of significant size, and there have been two significant bark beetle epidemics (one in the early 1900s and one in the 1980s). Human fire suppression has probably had little or no observable influence on these stands so far (Dickman and Cook 1988), and, in addition, there has been little management within the hemlock forest.

In summary, overall vegetative patterns are moving towards a larger proportion of hemlock and the abundance of root disease is increasing. It is believed that these changes are not a result of human intervention, rather, they are a result of variability in climatic conditions, and possibility, long-term climatic changes.

White Pine Blister Rust

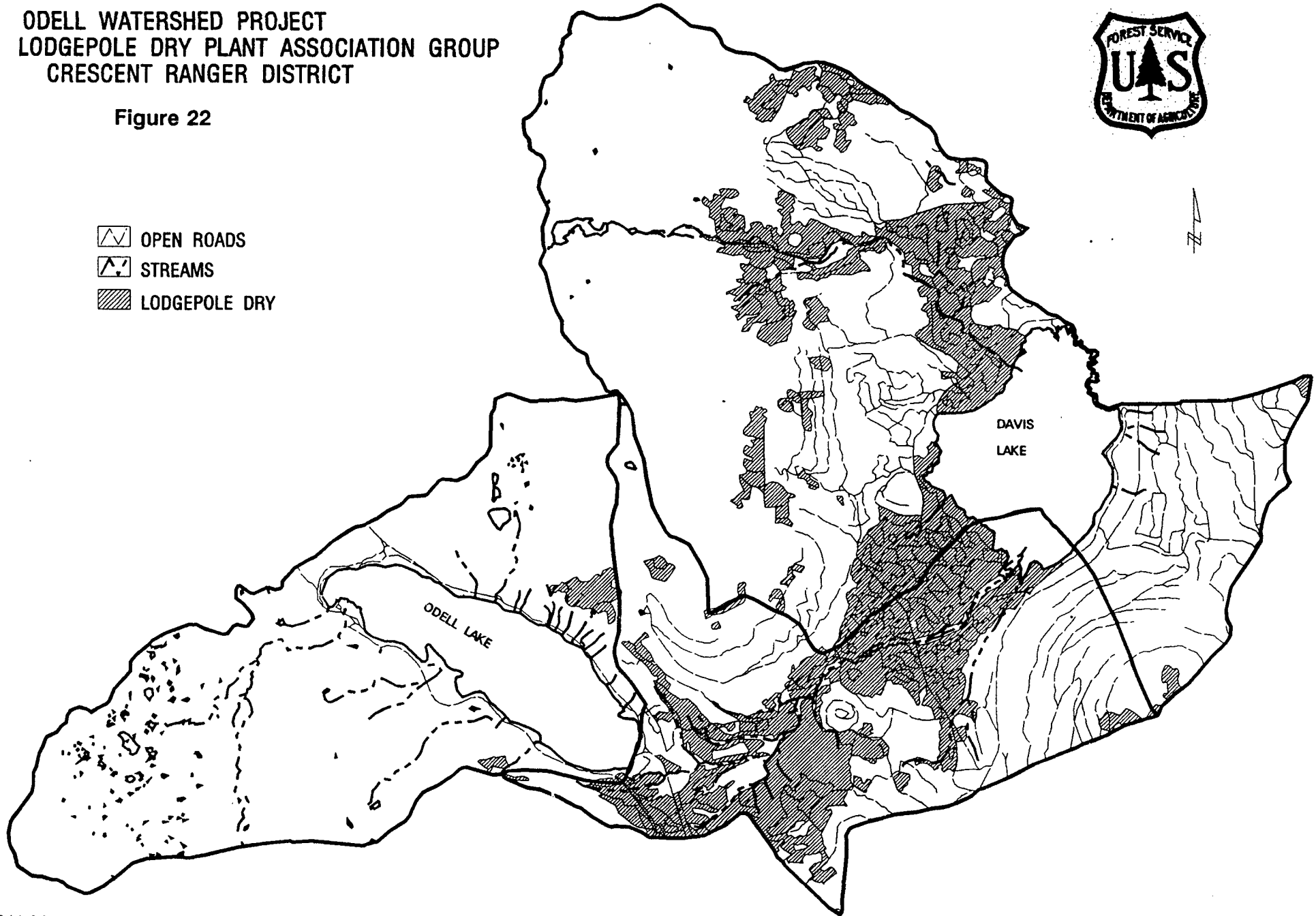
Western white pine is an important component of diversity in the laminated root rot pockets. Studies by McCauley and Cook, 1980 near Waldo Lake found that ponderosa pine and true fir comprise 50 percent of the survivors in infection centers but only about 5 percent of the trees in the uninfected hemlock forest. In the laminated root rot pockets of Odell Watershed, one of the primary invading species is western white pine. Presently however, these trees are experiencing severe mortality and damage as a result of an introduced disease organism (*Cronartium ribicola* Fisch) which causes the disease white pine blister rust. On a field reconnaissance through the area, it was observed that 90-95 percent of the western white

pine was either dead or top-killed to the extent that reproductive capacity had been lost. Mortality was higher among the white pine regeneration. All of the seedlings found on the reconnaissance were infected. It should be noted that this disease is causing similar problems across the entire range of western white pine.

This situation is the cause of considerable concern. White pine blister rust is almost completely eliminating western white pine as a component of the hemlock forest on the watershed. Because of the diseased condition of the reproduction, future trends in western white pine populations are projected to decline further; removing from the root rot pockets (which are apparently increasing in size) an important component of diversity, as well as one of the few species which can survive and grow in the pockets. Future restoration efforts could include planting of blister rust resistant western white pine into the root rot pockets to restore the level of diversity in these centers to presettlement levels.

ODELL WATERSHED PROJECT
LODGEPOLE DRY PLANT ASSOCIATION GROUP
CRESCENT RANGER DISTRICT

Figure 22



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B. Hexby
30-AUG-94
Scale 1:119032

LODGEPOLE DRY PAG

TABLE 3 - 8, HISTORIC RANGE OF VARIABILITY FOR LODGEPOLE DRY

	Lodgepole Dry Total Acres = 12,196					
Size/Structure Class	**Pioneer (P)**		**Mixed (M)**		**Climax (C)**	
	Acres	**Percent**	**Acres**	**Percent**	**Acres**	**Percent**
Grass/Forb/Shrub (1)	155 0+-6098	1% 0+-50%	N/A		N/A	
Seed/Sapling (2)	1729 0+-6098	14% 0+-50%	0 0	0% 0%	N/A	
Pole (3)	8241 0+-9757	68% 0+-80%	0 0	0% 0+	N/A	
Small (4)	2039 0+-3659	17% 0+-30%	0 0+	0% 0+	0 0+	0% 0+
Medium/Large (5)	32 0+-1220	0% 0+-10%	0 0+	0% 0+%	0 0+	0% 0+%

CHART LEGEND:
Current Values
Historic Range of Values
Differences if Outside HRV

NOTE: Historic processes are continuing in portions of these stands, which result in the continued conversion of stands from late and old structured to middle and early structured. This conversion is due to current bark beetle activity (mountain pine beetle, *Dendroctonus ponderosae*), and occurs most notably in the area south of Maklaks Butte.

(Figures 6 and 22)

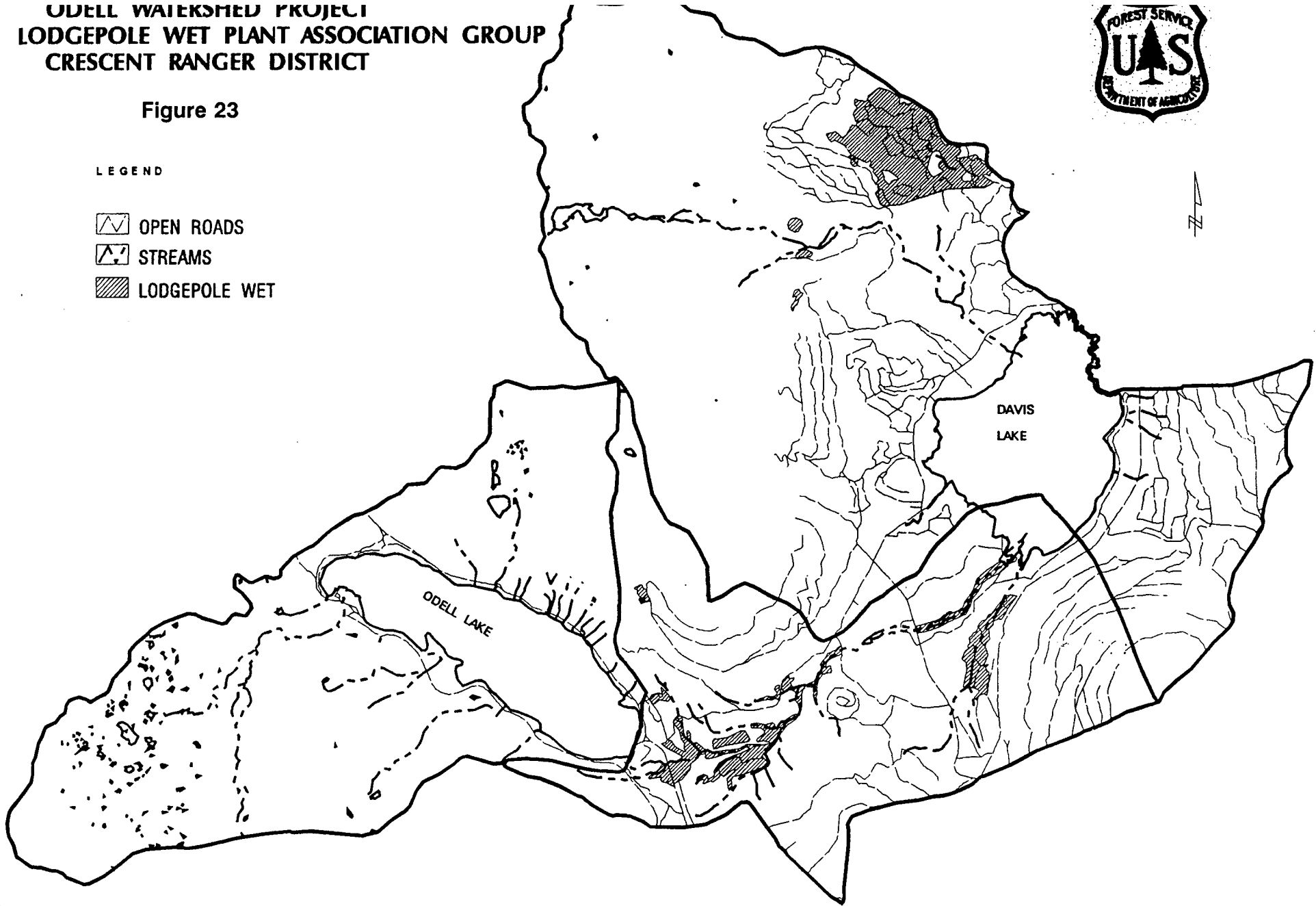
INTERPRETIVE COMMENTS FOR LODGEPOLE DRY PAG HRV TABLE

This PAG is within the historic range of variability for all successional stages. This PAG has a very wide range of variability due to the historic disturbance cycle of insect attack, fire, regeneration, maturity, and insect attack again. These events seemed to occur on large, contiguous acres.

The lack of medium/large structural stages seems appropriate in these stands. Hopkins' discussion in the WEAVE book indicates the historic beetle infestations occurred in these stands either before or soon after they become large enough for this stage.

ODELL WATERSHED PROJECT
LODGEPOLE WET PLANT ASSOCIATION GROUP
CRESCENT RANGER DISTRICT

Figure 23



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LODGEPOLE WET PAG

TABLE 3 - 9, HISTORIC RANGE OF VARIABILITY FOR LODGEPOLE WET

	Lodgepole Wet Total Acres = 2,186					
Size/Structure Class	**Pioneer (P)**		**Mixed (M)**		**Climax (C)**	
	Acres	**Percent**	**Acres**	**Percent**	**Acres**	**Percent**
Grass/Forb/Shrub (1)	47 0-1312	2% 0-60%	N/A		N/A	
Seed/Sapling (2)	158 0-1312	7% 0-60%	N/A		N/A	
Pole (3)	1490 219-1749	68% 10-80%	0 0-437	0% 0+-20%	0 0+	0% 0+%
Small (4)	491 0+-656	22% 0+-30%	0 0+-656	0% 0+-30%	0 0+-1749	0% 0+-80%
Medium/Large (5)	0 0+	0% 0+%	0 0+	0% 0+%	0 0+	0% 0+%

CHART LEGEND:
Current Values
Historic Range of Values
Differences if Outside HRV

(Figures 6 and 23)

INTERPRETIVE COMMENTS FOR LODGEPOLE WET PAG HRV TABLE

As with lodgepole dry, this PAG is fully within the historic range of variability for all successional stages. This PAG has a very wide range of variability due to the historic disturbance cycle of insect attack, fire, regeneration, maturity, and insect attack again. These events seemed to occur on large, contiguous acres.

The lack of medium/large structural stages seems appropriate in these stands. Hopkins discussion in the WEAVE book indicates the beetle infestations occur in these stands either before or soon after they become large enough for this stage.

Existing vegetative condition and how it relates to future disturbances by insects and diseases:

Current condition is within the HRV for all size classes, but there is a predominance of the pole-sized structure within this PAG. Over two-thirds of the wet lodgepole acres are dominated by this structural condition. As these stands continue to develop toward the large end of the pole-sized tree scale, their susceptibility to infestation by the mountain pine beetle increases, which would cause dramatic alterations to the stands. This disturbance event is probably several decades away, but will affect a substantial portion of the PAG simultaneously when it does occur. The likelihood of insect-related disturbance in the immediate future is fairly low, given that less that one-fourth of the PAG currently contains the most susceptible structural stage (dominance of small diamater [9-20"] trees).

FACTORS PERTAINING TO TRENDS IN LODGEPOLE PINE DRY AND WET PAG'S
(AREAS NOT ASSOCIATED WITH RIPARIAN AREAS)

Disturbance Events

These areas have had some modification of the historic disturbance systems through human utilization of beetle-killed trees, the conversion of such stands to managed stands, and the suppression of fires. The primary impact of the harvest activities has been to remove most of the residual stand structure following beetle attacks and to move the stands to single-storied, even-aged stands. In addition, microclimate modifications are suspected and result from the removal of the woody biomass from cold sites which causes them to become even harsher. Suppression of fires may have allowed forest litter and duff to accumulate to the point where there may be an increase in forest productivity due to increasing nutrient reserves.

The beetle-killed lodgepole pine has provided considerable opportunity to gather fuelwood. The utilization of the dead lodgepole pine, whether as fuel or pulp, has changed the amount of down woody material on the site. This reduces fire hazard, but also reduces the amount and effectiveness of the habitat for species which can utilize fallen dead trees as hiding/foraging habitat.

Harvesting of the green trees following beetle-kill may cause the biggest impacts to the sites other than soil compaction. Harvesting the residual green trees leaves little or no structural diversity to the canopy. Leaving those trees on a site provides some vertical structure which, combined with the regeneration, provides habitat for a wider variety of wildlife species than just the regeneration alone.

Harvesting has also impacted soils with detrimental compaction of skid trails and landings. This could affect survival and growth of the residual and establishing stands over time. Detrimental compaction typically occurs on 10 - 40% of the area.

Vegetative Succession

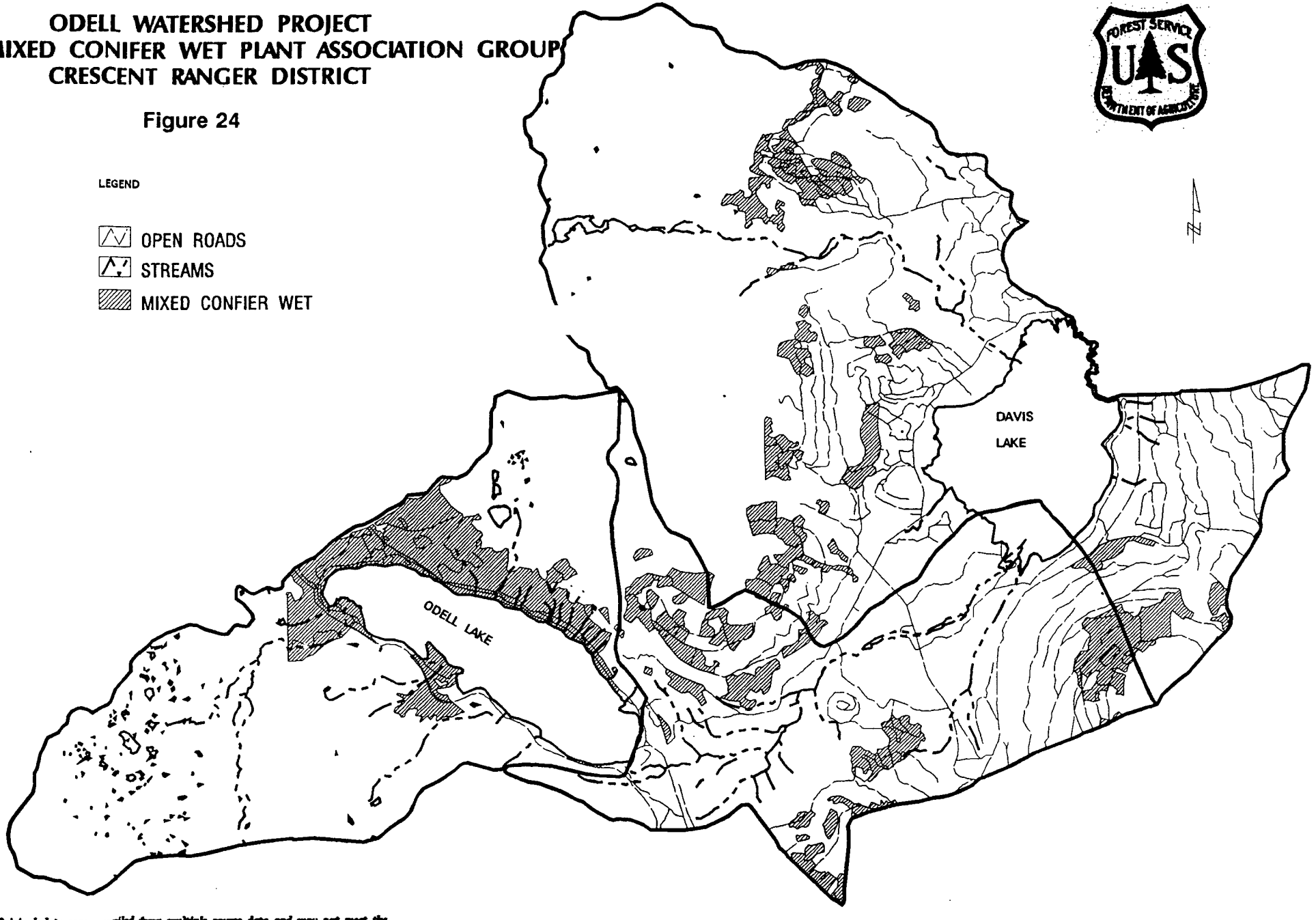
The cycle for the lodgepole wet and dry PAG's is generally beetle kill of mature lodgepole, fire, regeneration, periodic low intensity fires in small areas, maturation of the overstory, and back to beetle kill. The stands are presently in the post-epidemic portion of the cycle which is typical for lodgepole pine. This means that the beetle-killed stands have generally moved from late or old successional stages towards earlier stages in large portions of the PAG's.

Fragmentation and LSR

The beetles have impacted large areas and effectively set them back from late or old successional stages to earlier successional stages. The largest effects of fragmentation have been in the residual green trees harvested in association with dead trees and in the discontinuity of the large woody debris as habitat for wildlife. In these PAG's, fragmentation may actually be beneficial from a fuels management perspective, since there is a variety of fuel structures which would lessen fire intensity where fuels have been removed.

ODELL WATERSHED PROJECT
MIXED CONIFER WET PLANT ASSOCIATION GROUP
CRESCENT RANGER DISTRICT

Figure 24



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B. Hexby
30-AUG-94
Scale 1:119032

MIXED CONIFER WET PAG

TABLE 3 - 10, HISTORIC RANGE OF VARIABILITY FOR MIXED CONIFER WET

	Mixed Conifer Wet Total Acres = 2,186					
Size/Structure Class	**Pioneer (P)**		**Mixed (M)**		**Climax (C)**	
	Acres	**Percent**	**Acres**	**Percent**	**Acres**	**Percent**
Grass/Forb/Shrub (1)	166 0-437	8% 0-20%	N/A		N/A	
Seed/Sapling (2)	2 66-437 -(64-435)	0% 3-20% -(3-20%)	0 0-547 -(0-547)	0% 0-25% -(1-10%)	0 <197	0% <9%
Pole (3)	199 22-240	9% 1-11%	199 109-656	9% 5-30%	243 22-219 +(24-221)	11% 1-10% +(1-10%)
Small (4)	225 22-240	10% 1-11%	312 219-700	14% 10-32%	541 235-306 +(235-497)	25% 2-14% +(11-23%)
Medium/Large (5)	33 22-66	2% 1-3%	52 175-612 -(123-560)	2% 8-28% -(6-26%)	214 44-306	10% 2-14%

CHART LEGEND:
Current Values
Historic Range of Values
Differences if Outside HRV

(Figures 6 and 24)

INTERPRETIVE COMMENTS FOR MIXED CONIFER WET PAG HRV TABLE

This PAG has four stages outside of the historic range of variability. The Seed/Sapling stage is below historic levels in the Pioneer seral stage. The difference between the HRV and current acreages is probably due to the low proportion of area within this PAG that has been regeneration harvested, which converts stands from later stages to these earlier stages. Fire exclusion may also have played a role.

The excess of Pole and Small climax stages seems appropriate in this PAG. Many of the existing stands have had fire excluded from them for several decades. The exclusion of fire has allowed significant ingrowth of the true firs and shade tolerant seedlings which are all pole sized or larger. The definition of Pole stage includes stands having multiple canopy layers, which mostly consist of pole trees, with some small, medium, and/or large trees in the overstory above them. Other stands which fall within the pole stage are those that have had an overstory removal and ingrowth of smaller trees. Most of the stands that have had little or no vegetation management within this PAG are classified as pole stands.

The lack of sufficient acres of Medium/Large stands in the Mixed stage is due to regeneration and overstory removal harvest activities. These harvest activities caused the stands to move from the Medium/Large stage to an earlier stage. In addition, as discussed with the Pole stage, there may be some of the Pole stage stands that actually still have their historic small and medium sized overstory relatively intact. There

may be more acres in the Medium/Large stage than shown here, but this is not distinguishable with the electronic data available at this time.

Existing vegetative condition and how it relates to future disturbances by insects and diseases:

Within this PAG the size/species/structure stages which are in greatest overabundance include the pole-sized and small-tree stages of white fir. Given that the climax fir species is highly susceptible to many insects and diseases, it is likely that stands dominated by this species experience changes in structure. Most of the disturbances such as root diseases and bark beetles do not produce profound changes in species composition; rather, they are more apt to cause these stands to be dominated by firs of smaller sizes as these recolonize the openings created in the stands.

Where stand densities are high, there is also the likelihood that seral species (lodgepole pine and ponderosa pine) may be removed either through competition with white fir or through the selective bark beetles which prey on the pine species (mountain pine beetle and western pine beetle). The result would be a shift in succession toward the later stages, which are dominated by fir.

FACTORS PERTAINING TO TRENDS IN THE MIXED CONIFER WET PAG

Disturbance Events

The majority of the disturbance that has occurred within the mixed conifer wet areas over the past 80 to 100 years or more has resulted from timber harvesting and its associated activities. Virtually all of the disturbance activity has taken place within the past 45 years. The purpose of the first entries into the mixed conifer stands was to reduce potential tree mortality from bark beetles (*Dendroctonus* species) in the ponderosa pine, which flourish in the overstocked stands (USDA 1990). Keen's tree classification was used to identify and remove trees considered to be of high risk to bark beetle invasion, usually during a 30-year cutting cycle (Smith 1962). Based on field observations for this analysis, these entries removed scattered trees throughout the stands, but probably did not impact the canopy cover or structure to any great extent.

As in the previously discussed stands, in the 1960s, 70s, and 80s silviculturists determined that even-aged management with conversion of overmature stands into young, thrifty, fast growing stands was the best way to manage mixed conifer. Most of the fragmentation of the late and old structured stands resulted from these entries. It will take several decades to return these even-aged stands of regeneration back to complex structured stands even with vegetation management activities, and it will also take several decades of fire exclusion before significant late-seral species components appear. It should be noted that the soils in some or all of these stands have been compacted to the point that tree survival and growth are detrimentally affected.

Vegetative Succession

The portions of the mixed conifer stands which have not had regeneration harvest activities currently have structures which consist of late and old structural components, many of which are in the mixed or climax seral stages. The exclusion of fire from these stands over the past 80 years or more has contributed both to the increase of later seral species encroachment and in the development of complex fuel beds as tree and brush mortality increased. In addition, development of dense brush in some areas has resulted in a situation where abundant ladder fuel conditions exist.

Fire exclusion has also allowed less fire resistant species such as lodgepole pine and true firs to become established in these mixed conifer stands. At present, most disturbances which do not remove the lodgepole pine seed source should expect a predominance of lodgepole pine regeneration in response. Areas where

lodgepole pine regeneration has become established are more susceptible to stand replacement fires, since the lodgepole pine creates an effective fuel ladder, especially as its rate of mortality increases with increased competition or insect activity.

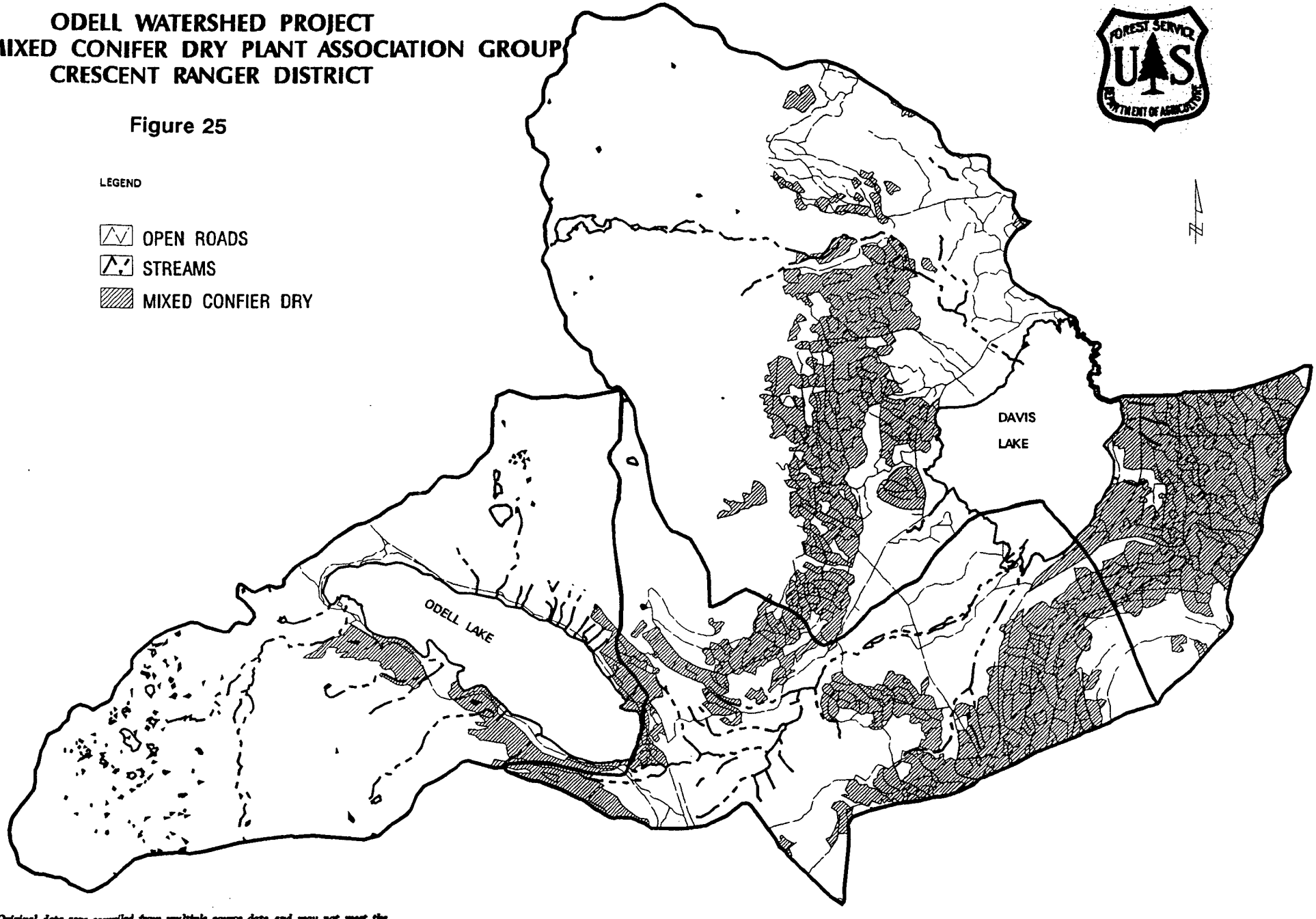
Fragmentation and LSR

Most of the mixed conifer wet stands in the watershed fall under the LSR designation in the ROD. Currently the majority of these stands are fragmented. Several decades are needed in order for these stands to begin to naturally move towards late successional vegetative stages. This process may be enhanced in many situations through vegetative manipulation such as thinnings, prunings, fertilization, etc., which would enhance the rates and types of structures which develop in these stands.

In the portions of these stands which have not been fragmented, some options remain for vegetative manipulation to enhance desired characteristics within these forested stands. This could also help maintain areas without vegetative manipulation by buffering insect, disease, and fire disturbance events.

ODELL WATERSHED PROJECT
MIXED CONIFER DRY PLANT ASSOCIATION GROUP
CRESCENT RANGER DISTRICT

Figure 25



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B. Hardy
30-AUG-94
Scale 1:119032

MIXED CONIFER DRY PAG

TABLE 3 - 11, HISTORIC RANGE OF VARIABILITY FOR MIXED CONIFER DRY

	Mixed Conifer Dry Total Acres = 15,454					
Size/Structure Class	**Pioneer (P)**		**Mixed (M)**		**Climax (C)**	
	Acres	**Percent**	**Acres**	**Percent**	**Acres**	**Percent**
Grass/Forb/Shrub (1)	548 155-1082	4% 1-7%	N/A		N/A	
Seed/Sapling (2)	4 309-2164 -(305-2160)	0% 2-14% -(2-14%)	0 155-1082 -(155-1082)	0% 1-10% -(1-10%)	0 <155	0% <1%
Pole (3)	1650 773-3245	11% 5-21%	700 309-2318	5% 2-15%	1050 155-618 +(432-895)	7% 1-4% +(3-6%)
Small (4)	3008 1855-6182	19% 12-40%	2955 927-4637	19% 6-30%	4157 464-773 +(3455-3693)	27% 3-5% +(22-24%)
Medium/Large (5)	203 2318-6491 -(2115-6288)	1% 15-42% -(14-41%)	774 702-4327	5% 5-28%	405 464-773 -(59-368)	3% 3-5% -(0+-2%)

CHART LEGEND:
Current Values
Historic Range of Values
Differences if Outside HRV

(Figures 6 and 25)

INTERPRETIVE COMMENTS

This PAG has six stages outside of the historic range of variability. The Seed/Sapling stage is just slightly below historic levels in Pioneer and Mixed seral stages. The difference between the HRV and current acreages is probably due to the low proportion of area within this PAG that has been regeneration harvested, which converts stands from later stages to these stages. Fire exclusion may also have played a role.

The excess of Pole and Small climax stages seems appropriate in this PAG. Many of the existing stands have had fire excluded in them for several decades. The exclusion of fire has allowed significant ingrowth of the true firs and shade tolerant seedlings which are all pole sized or larger. The definition of Pole stage includes stands having multiple canopy layers, which mostly consist of pole trees, with some small, medium, and/or large trees in the overstory above them. Other stands which fall within the pole stage are those that have had an overstory removal and ingrowth of smaller trees. Most of the stands that have had little or no vegetation management within this PAG are classified as pole stands.

The lack of sufficient acres of Medium/Large acreage in the Pioneer stage is due to regeneration and overstory removal harvest activities. These stands were moved from the Medium/Large stage to an earlier stage. In addition, as discussed with the Pole stage, there may be some of the Pole stage stands that actually still have their historic small and medium sized overstory relatively intact. There may be more

acres in the Medium/Large stage than shown here, but this is not distinguishable with the electronic data available at this time.

The lack of sufficient acres of Medium/Large stands in the Climax stage is due to the relative frequency of historic fire entries. These fires were of low intensity and favored the early seral species while maintaining the less fire tolerant species at very low levels. The several decades which have passed since fire exclusion began have not been sufficient to allow medium and large shade tolerant species to dominate these sites.

Existing vegetative condition and how it relates to future disturbances by insects and diseases:

Fire exclusion efforts have probably had the most profound effects within this PAG (Agee 1993, Everett Report Vol. 3), and, therefore, it is probably the most likely to experience large-scale and dramatic changes in size, structure, and species composition due to disturbance from insects and diseases.

Severe imbalances exist within this PAG with respect to the HRV. The greatest shortages between historic and current acreages occur in the open park-like ponderosa pine stands. Currently, less than 1% of the acres are in this size class. The pine and true fir seedling/sapling stages are also underrepresented and collectively comprise less than 1% of the acres within the PAG. To a lesser extent, there is also a shortage of acres dominated by late-successional large white firs. The stages which are dominant on the landscape and occur above the HRV include the pole-sized and small-tree components of the climax species. These abundances and shortages clearly reflect the influence of fire exclusion and also suggest that stand densities are very high. Due to high stand densities of the true fir in the understory, disturbance agents which thrive on true fir (including the fir engraver, defoliating insects, and Armillaria root disease) could have immediate and continuing effects on the fir component. In addition, extreme competition between the true firs and the ponderosa pine trees will also place the ponderosa pines at risk and will greatly increase the rate at which the pathogens and insects of pine are likely to express themselves. All of these effects are apt to be observed where the fir component is largest and most abundant, that is, on those acres dominated by pole-sized and small-tree white firs.

FACTORS PERTAINING TO TRENDS IN THE MIXED CONIFER DRY PAG

Disturbance Events

As with the mixed conifer wet PAG, the majority of the disturbance that has occurred within the mixed conifer dry areas over the past 80 to 100 years or more has resulted from timber harvesting and its associated activities. Similar to the ponderosa pine stands, virtually all of the disturbance activity has taken place within the past 45 years. The purpose of the first entries into the mixed conifer stands was to reduce potential ponderosa pine tree mortality from bark beetles (*Dendroctonus* species), which flourish in the overstocked stands (USDA 1990). Keen's tree classification was used to identify and remove trees considered to be of high risk to bark beetle invasion, usually during a 30-year cutting cycle (Smith 1962). Based on field observations for this analysis, these entries removed scattered trees throughout the stands, but probably did not impact the canopy cover or structure to any great extent.

As in the ponderosa pine stands, in the 1960s, 70s, and 80s silviculturists determined that even-aged management with conversion of overmature stands into young, thrifty, fast growing stands was the best way to manage mixed conifer. Most of the fragmentation of the late and old structured stands resulted from these entries. It will take several decades to return these even-aged stands of regeneration back to complex structured stands even with vegetation management activities. and it will also take several decades of fire exclusion before significant late-seral species components appear. It should also be noted that the soils in some or all of these stands have been compacted to the point that tree survival and growth are detrimentally affected.

Vegetative Succession

The portions of the mixed conifer stands which have not had regeneration harvest activities currently have structures which consist of late and old structural components, many of which are in the mixed or climax seral stages. The exclusion of fire from these stands over the past 80 years or more has contributed both to the increase of later seral species encroachment and in the development of complex fuel beds as tree and brush mortality increased. In addition, development of dense brush in some areas has resulted in a situation known as needle drape. Pine trees shed their oldest needles, usually those 4 or 5 years old, every summer as the new growth develops. These shed needles "drape" over the existing brush and cause considerable increase in the susceptibility to fire due to their "aerial" nature.

Fire exclusion has also allowed less fire resistant species such as lodgepole pine and true firs to become established in these mixed conifer stands. At present, most disturbances which do not remove the lodgepole pine seed source should expect a predominance of lodgepole pine regeneration in response. Areas where lodgepole pine regeneration has become established are more susceptible to stand replacement fires, since the lodgepole pine create an effective fuel ladder, especially as its rate of mortality increases with vegetative suppression or insect activity.

Fragmentation and LSR

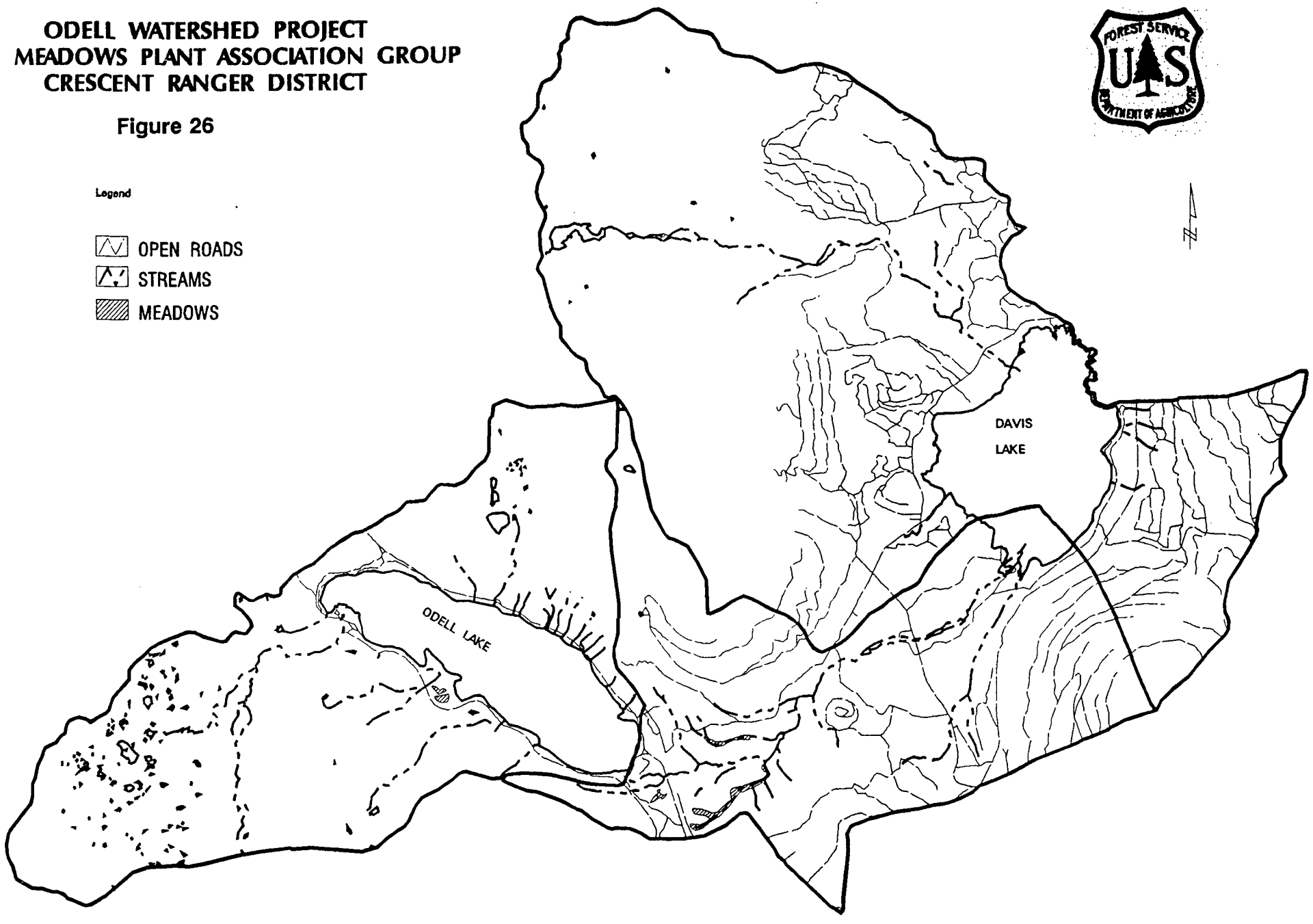
Most of the mixed conifer dry stands in the watershed fall under the LSR designation in the President's Plan, and currently the majority of these stands are fragmented. Several decades are needed in order for these stands to begin to naturally move towards late successional vegetative stages. This process may be accelerated in many situations through vegetative manipulation such as thinnings, prunings, fertilization, etc., which would enhance the rates and types of structures which develop in these stands.

In the portions of these stands which have not been fragmented, many options remain for vegetative manipulation to enhance desired characteristics within these forested stands. This could also help maintain areas without vegetative manipulation by buffering insect, disease, and fire disturbance events.

As mentioned previously, large diameter, yellow-barked trees are very important visual quality elements within Central Oregon forests. This desired aesthetic feature of the landscape is provided primarily by ponderosa pine trees in the mixed conifer dry PAG as well as in the ponderosa pine PAG. Past timber harvest activities such as overstory removal harvests eliminated the majority of the ponderosa pine trees and left sparsely vegetated stands that are highly visible from major travel ways and recreation areas. Within the past few years the trend seems to have moved away from such major vegetative modifications. Most recent harvests planned in scenic viewsheds have been designed with the objective(s) of retaining visual qualities by leaving a sufficient canopy and/or designing the size and shape of harvest units to fit the landscape in a less visible and/or more natural context.

ODELL WATERSHED PROJECT
MEADOWS PLANT ASSOCIATION GROUP
CRESCENT RANGER DISTRICT

Figure 26



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B. Haxby
20-AUG-94
Scale 1:119032

MEADOWS PAG

FACTORS PERTAINING TO TRENDS IN THE MEADOWS PAG

This discussion primarily refers to the meadows which are not associated with the fluctuating water levels of Davis Lake, although some comments may be relevant to all meadow areas. (Figures 6 and 26)

Disturbance Events

Little or no management activity has occurred within meadows. There is a snowmobile trail through one meadow, and a powerline and Highway 58 pass through another. These developments do not constitute a significant portion of the meadow acreages.

Vegetative Succession

In general, the meadows are moving towards later successional stages as a result of the reduction in grass/forb/shrub components and an associated increase in the amount of conifer establishment. This trend is historic during fire-free periods and is actually the result of successional processes.

Fragmentation and LSR

Vegetation in the meadows is relatively pristine with the bulk of the impacts resulting from deer and elk traffic and browsing. Since these areas have historically been meadows, they contribute to historic fragmentation of the conifer stands. However, they are excluded from the need to manage towards Late-Successional Reserves of conifer timber according to the ROD (p. C-9) since the objective of LSR is,"...to protect and enhance conditions of late-successional and old-growth forest ecosystems." These meadows are not, nor have they been in the measurable past, forest ecosystems.

ALL PAG'S

STAND STRUCTURE AND FACTORS RELEVANT TO ALL PAG's (Figure 6)

Impacts of landscape disturbance events.

Timbered stands of vegetation which have not been disturbed in the past few decades or longer are moving towards later **successional stages** in their development, which often implies an increase in forest structure complexity. The exclusion of fire through fire suppression efforts has allowed fuels to increase in both amount and distribution throughout the vegetative canopy structure. Tree density, measured in number of trees per acre, has increased to the point where mortality is frequent in many stands. This mortality results, in part, from the suppressed and intermediate-sized trees that are unable to compete for the light and moisture necessary for their survival. In other cases, mortality occurs in dense stands of trees due to their susceptibility to insect and disease infestations.

Such complex structured stands can be found to some extent in every forested PAG within the watershed. These complex stands provide necessary habitat for a wide variety of wildlife species. The increasing fuel amounts and complexities within the stands cause protection from stand replacement fire to be increasingly difficult as time goes by. In addition, virtually all insect and disease organisms are regulated by the amount of food (host trees) available to them. When a particular set of conditions, such as species mixture, age class, or stocking density occurs widely over a landscape, insect and disease agents will eventually be present to exploit that condition (USDA 1994). Insect and disease outbreaks also contribute to the amount and complexity of the fuel beds.

As these conditions continue, especially in the absence of vegetative manipulation by harvest or fire, the risk of stand replacement events increases in at least two ways. First, the larger the area of homogeneous stand conditions, the more food is available to support epidemic levels of insect and/or disease activities. Second, as fuel beds become heavier and more complex, their resistance to fire control increases, especially during extreme fire behavior conditions.

The result is that both the risk and the scale of landscape disturbance events will continue to increase as the trend towards contiguous late seral structured stands continues. Prior to acceptance of this risk for large-scale disturbance events, seed reserve considerations should take place. Seed reserves for conifer and other native plant species assist in the rapid recovery of vegetative components following stand replacement disturbance events.

Processes of vegetative succession.

The discussion above typifies a primarily natural succession process. The exception that must be noted is the conspicuous absence of fire, especially in the ponderosa and mixed conifer dry PAG's in recent decades. The other forested PAG's, even though they have also had fire suppression, may be minimally impacted by the fire suppression of humans. This is due to longer fire frequency intervals and/or the portion of the disturbance cycle that the stand is presently in. Additional information is available by PAG.

Wildlife habitat/structure needs.

Discussion of the wildlife needs is best done in the context of the PAG's (Refer to Biological Domain/Wildlife). It should be noted here, however, that human influence has modified wildlife habitat/structure availability within the watershed. These modifications are mostly in the form of harvest activities and fire exclusion. They may include, among others, artificially high acreages available of stands that have had fire excluded and a large proportion of patches of early seral structures which provide opportunities for big game foraging and other species which like contrast and early successional habitat.

Fragmented vegetative structure and direction toward late successional reserve.

Most of the Odell Pilot Watershed lies within the designations from the ROD which call for minimal to no vegetative management activities. These include Congressionally Withdrawn Areas (wilderness), Administratively Withdrawn Areas (lakes, undeveloped recreation, special management areas), and Designated Late Successional Reserve Areas (LSR's). Only a small area on the south side of Odell Lake, small areas on Davis Mountain and Hamner Butte, and a few thousand acres in the northern most portion of the analysis area are within the lands designated as Matrix in the PFP. (Figure 2)

Fragmentation of the timbered stands has resulted in a pattern which is easily observed from an aerial perspective. The vegetative structures of these fragmented stands have been modified by human activity, fire, insect, and/or disease activity. These disturbances have had the greatest effects on the landscape when they resulted in very simple structures which often contain a smaller diversity of plant and animal species than would be found in later successional stages of stand development.

Wildlife species which depend on later successional stands of large acreages for their reproductive and/or foraging habitat, may experience significant reductions in their population viability due to fragmentation of those stands. In addition, the extensive fragmentation resulting from human activities in certain portions of the landscape exceeds the current scientific and political guidelines. Hence polity, as it stands presently, would indicate the trend of increasing fragmentation resulting from human activity is undesirable. In order to ensure the recovery of large stands of later successional stands, fragmentation needs to be curtailed.

FIRE

HISTORY AND PRESENT RISK

Because of the importance of fire in shaping vegetation structure, density, and species composition, it was felt that an overall description of the fire history and present risk in the watershed was an appropriate and important part of the analysis of the biological domain.

The information in this document is based on what is known about the fire history of the Odell Watershed. Currently, the likelihood of fires that are primarily stand replacement events is not very high. Replacement fires in the modern era are significantly less frequent and smaller than they were between the years 1680 through 1918. This century, fire suppression activities have also repressed low intensity fires. Natural underburns, which are fairly easy to control, have been virtually eliminated.

As compared to Eastern Oregon as a whole, the Odell Watershed has a relatively low risk of significant fire, since this area typically receives a greater amount of moisture, which decreases the likelihood of significant fires. The above statement has been verified by recent fire history. Since 1908 there are only eight known fires which were larger than 80 acres in size within the watershed (Figure 27). The total number of acres burned by those fires was approximately 2,600 acres, with only 500 acres of those acres having burned since 1915.

Between 1970 and 1992 there were 180 fires and the largest of these was only 80 acres in size. Of those fires 109 or 61% were human caused which resulted in an ignition rate of 0.070 ignitions/1,000 acres/year. The 71 lightning caused ignitions result in a slightly lower ignition rate of 0.046 ignitions/1,000 acres/year. These numbers apply to the watershed as a whole, and demonstrate the relative "success" of fire suppression.

Of course, this information does not imply that 1,000+ acre stand replacement events will no longer occur, it is just a matter of time. The fuel loading levels that wildland fire suppression has created are their own paradox. Fire suppression adds fuel to the next fire.

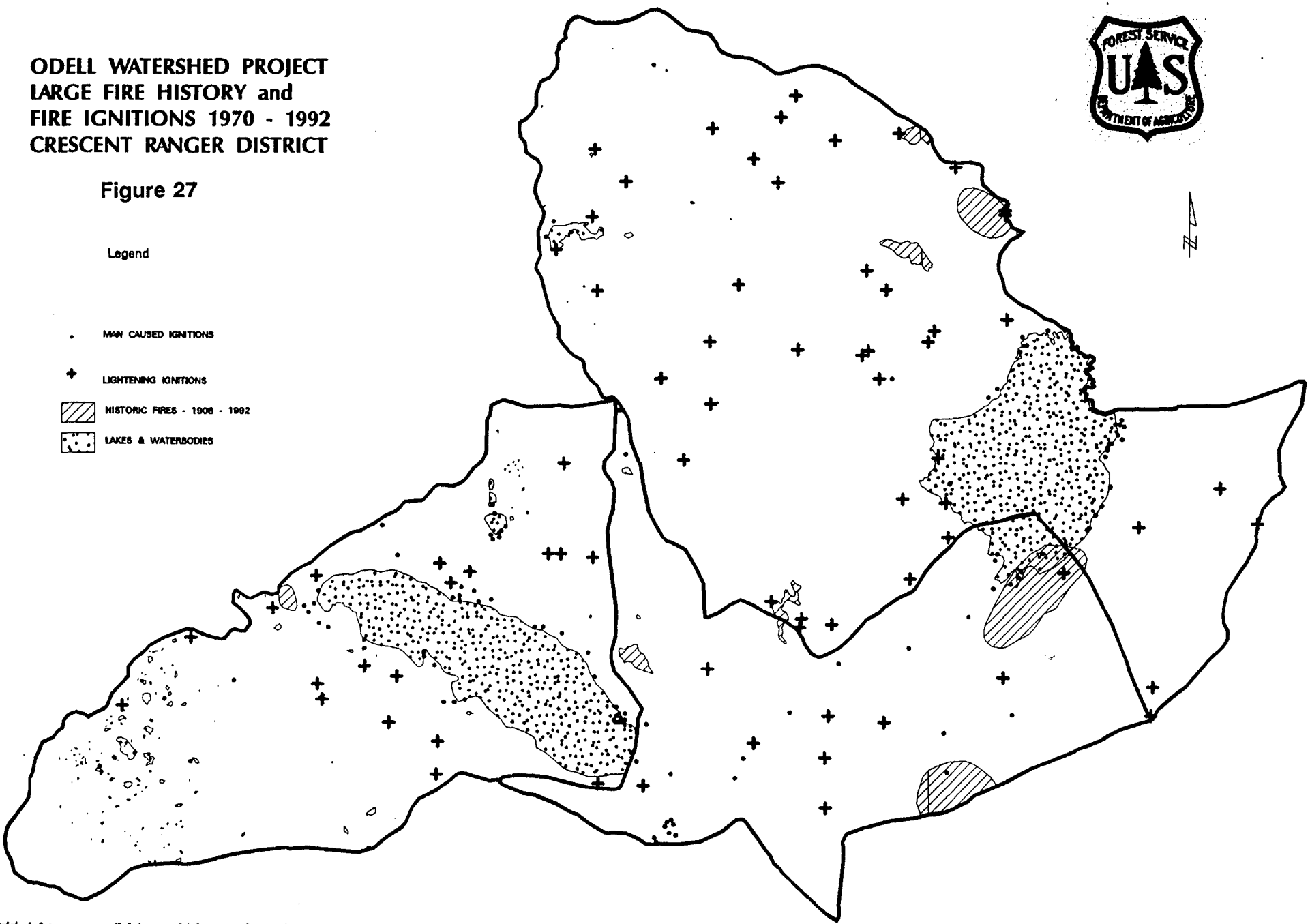
Continued fire suppression will result in increased mortality, species conversion to plants less resistant to fire, and further accumulation of both horizontal and vertical fuels. Without the reintroduction of fire or other treatments that mimic fire, the likelihood of stand replacement fires will continue to increase, and overall forest health will decline.

A critical concern is the location and amount of human caused fires. Of the ignitions that occurred in the watershed between 1970 and 1992, 25% (46 fires) were located within 3/8ths of a mile of Odell Lake, and 38 of those 46 fires or 83% were human caused. (Figure 27) The increased likelihood of fire in an area that contains diverse recreational and scenic values should result in Odell Lake being given priority status for the reintroduction of low intensity underburns. Davis Lake, and to a lesser extent Rosary Lakes and Bobby Lake, share these statistics.

Using maps provided by the Bureau of Land Management (BLM), it was determined that an average of approximately 75 lightning ground strikes were recorded per fire season in the Odell Watershed between 1985-1993. The number of strikes ranged from a low of 6 strikes in 1985 to a high of 152 in 1991. Using the average from 1970-1992 of 3.1 lightning fires per year, it could be reasonably inferred that approximately 4% of the lightning strikes cause wildfires. It should be noted that the two time periods listed above do not precisely overlap (lightning data is only available since 1985), and the lightning detection system is admittedly flawed. The disclaimer letter that accompanied the lightning data stated that a 15% error was possible.

ODELL WATERSHED PROJECT
LARGE FIRE HISTORY and
FIRE IGNITIONS 1970 - 1992
CRESCENT RANGER DISTRICT

Figure 27



Original data was compiled from multiple source data and may not meet the U.S. National Mapping Standards of the Office of Management & Budget. For specific data source dates &/or additional digital information contact the Deschutes National Forest, Crescent Ranger District, Crescent, Oregon. This map has no warranties to its content or accuracy.

B.Hasby
19-SEPT-94
Scale 1:119032

Since 1993 the Odell Watershed has experienced an increased number of fires; these fires resulted from the carelessness of mushroom hunters and a particularly prolific lightning storm that crossed Maiden Peak in July, 1994. The data from these fires occurrences were not incorporated in the figures above but do have a tendency to reflect it. One trend is apparent, though, from a fire protection standpoint, natural ignitions are declining in importance as compared to human caused ignitions within accessible areas.

Determining the fire history in the watershed is difficult because of a lack of data. Many fire records were lost or are incomplete. Assembly of the Deschutes NF fire history was initiated only recently and is not complete. This fire history project is utilizing information obtained from the oldest Deschutes fire atlas which dates back to 1908.

Notes by Pat McCauley, (1993) suggest that 1918 is the reasonable year to begin referencing from as the modern fire era with respect to suppression. Beginning in 1918, the number of large fires on the forest dropped dramatically, which demonstrates the relative effectiveness of the emerging fire organizations.

The difference between natural fire disturbance events and Native American management is unknown. Even if escaped campfires started by Native Americans and early white settlers are the only human caused fire starts prior to 1908, they undoubtedly had their effect. There would probably have been the tendency for this type of ignition to occur primarily in areas bordering larger water bodies. This hypothesis has not been proven, since evidence of these fires cannot be obtained.

The only known account of a human caused fire within the watershed prior to this century is a record of one which occurred on the shores of Odell Lake in 1896 and was documented by Judge John Breckenridge Waldo in his journal (Williams 1985). His accounts of the "unaltered wilderness" include only one reference of an encounter with Native Americans and discuss two "Warm Springs Indian Trails" that had been recently created in the Odell and Davis Lake areas.

Judge Waldo visited Davis and/or Odell Lake in fourteen of the years between 1880-1896. He regularly mentions smoke obscuring views and occasionally fires restricting travel. His journals record the locations of the fires, and it seems unlikely that he would have failed to observe and document fires that had occurred in the area he considered to be his favorite, Davis Lake. Judge Waldo only documents the accidental fire that occurred near Odell Lake in 1896.

Native American ignitions would, of course, alter the natural range of variability for fires. "There are at least 13 documented reasons for American Indians ecosystem burning." (Williams 1994). The emerging evidence of extensive burning in the Northwest reinforces the belief that the Native American attitude towards the role of fire in the ecosystem is nearly opposite of the views today. Unfortunately, there is no documentation that specifically records the use of fire by Native Americans within the Odell Watershed.

Determining the extent and severity of the current fuel loading problem within the watershed is somewhat subjective. The increases in down woody material from the time of stand replacement can be quantified as was done for the Mount Jefferson Wilderness (Simon 1991). The information within the Odell Watershed is too incomplete at this time to provide a picture of what the forest floor would look like if low intensity underburns had been allowed to occur naturally. These fires are the primary natural method for controlling fuel loading.

Some work has been completed that uses early aerial photos to attempt to understand the approximate fuel loading levels in the 1930s and 40s. However, this work did not include the Odell Watershed. Known historical accounts of fuel loading are limited to statements such as the following in regards to the Davis Lake area. [This area] "may be explored quite thoroughly through here, as a horse can be ridden anywhere." (Williams 1985). This account would tend to show that the legendary park-like stands, with their low thicket and ground fuel accumulations were prevalent here.

The fuel accumulation in the Odell Watershed is the product of both fire suppression efforts that have occurred since 1915, and the relatively limited number of low and high intensity burns that took place between the years 1881 and 1909. This generalization is corroborated by the accounts of Judge Waldo, the Deschutes Fire History, and stand examination data. The six largest fires that occurred between 1910 and 1914 burned a total of only 2,200 acres. Basically, the Odell Watershed has had a lack of significant fire activity for the past 113 years, if not longer; and the current fuel loading levels are a direct result of that.

Tree ring data has been collected during some of the stand examinations and can be used to determine basically when a stand originated. Disease and insects usually initiate stand replacement events which are finalized by fire. A series of stands that originated at the same time can demonstrate when the last stand replacement fire occurred and can give a very rough idea of the perimeter of the fire. Stand exam data has not been collected in some portions of the watershed, and where it has occurred, the year of origin information was often not collected. Combine these factors with the overlapping nature of replacement events, and we revert to a "best guess" as to when stand replacement events occurred in some areas.

Stand exam data does show that "major" fires occurred in approximately the years 1680, 1735, 1780, 1785, 1805, 1810, 1818, 1828, 1835, 1840 and 1855. Even without field verification these stands are spaced widely enough apart to indicate that each of these fires was over 2,000 acres in size. This incomplete data also indicates that in at least 79 of the years between 1680 and 1918, some type of replacement event occurred in the watershed, in other words, one every three years. Between 1918 and 1994 there have been just two relatively large fires. They occurred in 1930 and 1991 and totaled 400 acres with only 200 acres of that being of an intensity to cause stand replacement. This is a dramatic contrast to the period between 1730 and 1918, where the longest gap between "large" fires was 11 years. Within the past several hundred years, there has not been a period that correlates with the modern era. It is difficult to say precisely, since we are working with yearly figures and not more desirable acreages for analysis, but the Odell Watershed, excluding the high country, is clearly outside the HRV for replacement fires.

The following is a discussion on the fire history and present risk within each of the plant association groups.

Lodgepole Dry with Mountain Hemlock, (LPH) and Mountain Hemlock,(MH) PAG's: (Figures 20 and 21)

Stand exams have not been completed within most of these "high country" areas. A study completed by the University of Oregon (Dickman and Cook 1988) included the area north of Maiden Peak, Bobby Lake and The Twins. It showed that major fires occurred within this portion of the watershed circa 1528, 1618, 1813, 1868, and 1873. Data collected on this study area, which also included the west slopes of the Cascades down to Waldo Lake, showed that at least half of the 45,000 acres had stand replacement events within the last 500 years.

The fire scars from the 1813, 1868, and 1873 burns are visible on the oriented panoramic photographs taken from Maiden Peak by Osborne on July 2, 1933, due to the snow showing through the reduced timber canopies. These photos appear to show that the root rot pockets burned with much greater intensity than the surrounding areas.

The Osborne photos taken toward and beyond Odell Lake indicate only one significant fire scar, that of a 1914 fire west of Odell Lake that burned westerly onto the Willamette NF. It appears that no replacement fires of any size have occurred in the Diamond Peak Wilderness portions of the Odell Watershed for over 100 years.

Most of these lands that are either Congressionally or Administratively Withdrawn do not pose a significant fire risk, from the perspective of fire management personnel or the historic range. These wilderness or wilderness type areas have essentially 500+ year stand replacement fire occurrence rates. Even with

effective suppression efforts being undertaken in these areas within the last century, no fire is known to have exceeded one acre in size since 1928. The area has not moved outside the historic range of variability.

Time moves slower within these stands, so perhaps it is appropriate to allow some monitored fires to ensure that the stands do remain within the HRV, including some control of root rot infestations by high intensity fires (Dickman & Cook 1988). Aerial photos for Dickman and Cook's fire occurrence study (1988) show a high correlation between stand replacement perimeters and significantly lower levels of root rot infection.

In order to allow lightning fires to burn in a monitored status within this area, safeguards would have to be set up that would take into consideration fuel moistures, drought conditions, specific locations, neighboring resources, and time of year, etc. Should a fire exceed its prescription, it could be placed in a suppression mode. The major limiting factors with this opportunity are smoke management concerns and public acceptance.

The mountain hemlock stands located on the south slope of Maiden Peak and the north slopes of Hamner Butte, Maklaks and Royce Mountains may have greater fire occurrence rates due to the length of the slopes located there. Stand exams for 706 acres of mountain hemlock on Maklaks Mountain show that replacement event(s) last occurred there between 1780-1784. This area probably also burned in 1680. The mountain hemlock stands located on Hamner Butte and Maklaks Mountain show advanced root rot infection and may indicate stand replacement fires may occur in these locations as a result of fuel loading. Such a high intensity replacement fire would place the surrounding east, west, and southerly exposures at great risk. These exposures would have to be "fire proofed" by underburns before a replacement fire prescription for the north slopes could be written.

Lodgepole Wet, (LPW) and Dry, (LPD) PAG's: (Figures 22 and 23)

Lodgepole lives, dies, falls down and usually burns with such rapidity that it is difficult to manage it as Late Successional Reserve. Historically, approximately one-third of the lodgepole pine stands in the vicinity of Odell Creek probably burned every 60 years. The drier the site, the more complete the replacement. Information from a USGS map of the Forest Conditions in 1903 for the Cascade Range Forest Reserve shows two burned areas just southwest of Davis Lake. These two burns combined are nearly as large as Davis Lake at full pool, or approximately 3,000 acres.

These maps are slightly flawed when compared with the precision mapping that is available today. The maps show rounded perimeters for fire, forest, grazing and other areas, which typically did not occur. The maps appear to be accurate enough to indicate that substantial fire activities need to be reintroduced in the lodgepole PAG's, particularly with respect to meadow encroachment in riparian areas and the adjacent habitat.

The burning of lodgepole stands near riparian areas should be considered to restore meadow size. The riparian areas themselves could serve as portions of the necessary fire breaks. The other "fire line" needed could be made by setting up portable pump sprinkler operations which would reduce the need for ground disturbance. This type of prescribed fire would be best used in the West Odell Creek area in 5 to 50 acre parcels.

The drier lodgepole stands found in the eastern half of the Odell Creek drainage would best be served by duplicating the larger fires shown on the USGS report. This would avoid the fragmentation that has occurred in the recent past that is detrimental to numerous wildlife species.

Mixed Conifer Wet,(MCW) & Dry, (MCD) PAGs: (Figures 24 and 25)

Of the MCW and MCD stands, 52% have had stand examinations completed on them. Information collected from these stands shows that the average year of the last stand replacement event weighted by acreage was 1814 for the MCW and 1820 for the MCD. The number of years since the last stand replacement event ranges from 97-314 years ago. The fires that occurred in 1910, 1914 and 1930 also included some mixed conifer acreage. A few of the mixed conifer stands located on the southerly slopes were replaced as often as 1680, 1780, 1840 and 1860; while others have not been replaced since 1680. The 60-300 year frequency suggested here for southerly aspects is somewhat wider than the 75-150 year frequency listed in the Deschutes NF WEAVE. The WEAVE document states that the more northerly aspects of MCW have a 50-300 year replacement fire rate. The stand exams on these slopes indicate events within this range.

Stands at the base of south slopes are typically older than those located farther up the slope. This information was obtained from a fire history study that took place on the eastside of the Mount Jefferson Wilderness (Simon 1991). The mid and upper slopes receive more ignitions than the lower slopes, and on the southerly aspect typically result in backing fires that burn with less intensity, which insulates the lower stands from replacement fires. Both the mixed conifer wet and dry PAG's at the base of Maklaks Mountain date primarily from 1680. These are some of the oldest stands in the Odell Watershed. While their stand replacement occurrence rates are very low, 160-314+ for MCW on Maklaks, the low intensity underburn frequency is probably high, 10-75 years.

The lessons that can be learned from the south slopes are clear. If maintaining old growth or moving a stand towards it is the objective, two things are necessary, first, silvicultural treatments to reduce density and fire risk together with an aggressive prescribed fire program and, second, continued fire suppression until the former is achieved. Eventually, both management practices could be reduced if the underburns are maintained at the same frequency as the historic rate found on the lower south slope stands. The initial burns are the expensive, labor intensive efforts. Once the first round of underburns is completed, both fire suppression needs and expense for the next round of burns decreases.

Returning to fire resistant old growth stands will require layered removal of fuels in most areas. One type of layered removal would require a late fall burn after a soaking rain where the underside of the large diameter logs would be lighted and reduced. The next spring, after the snow melts and a two plus week drying occurs, the smaller diameter ground fuels could also be reduced. The partial removal of one fuel layer at a time lowers the intensity of each burn and increases green tree survivability. In those mixed conifer stands with high true fir ladder fuel configurations, a mechanical thinning from below of the firs would first be necessary. Following this, the burning of landings and then ground fuel reduction burns should occur. The heavy fuel loadings of these stands require labor intensive efforts to prevent significant damage to these LSR stands. Oftentimes, a single burn window small enough to reasonably protect the big trees cannot be written. Ultimately, the costs of fire suppression are high.

Ponderosa Pine (PP) PAG: (Figure 19)

Stand exam data for the Odell Watershed shows a variety of age and dbh ranges for the ponderosa PAG indicating the somewhat random effects of historic natural underburning and bark beetle activity.

Stand replacement events occurred every 75-300+ years in this PAG. These stands are adjacent to and intermixed with both of the mixed conifer PAG's. The frequency rates for both stand replacement and underburns are very similar for ponderosa pine and mixed conifer stands and vary more by aspect and slope than by PAG. As with the mixed conifer, it is fairly important that the southerly ponderosa stands receive first priority for prescribed fire and other treatments for fire proofing in order to prevent large stand replacement fires.

The accumulation of ladder fuels, primarily from competition mortality and lodgepole pine ingrowth, has endangered the overstory. A series of treatments such as thinning from below followed by low intensity burning should be undertaken to restore the remaining stands to a more reasonable fire resistant level.

FIRE AS A DISTURBANCE FACTOR

The transition from historic fire frequency, intensity, size, timing, and duration to fire as a present disturbance factor within the watershed will take additional work. While this is an important step in analyzing future outcomes of management scenarios, the modeling done with this watershed analysis proved to be inadequate. Appendix D contains additional fire information.

PLANTS AND FUNGI

NOXIOUS WEEDS AND NON-NATIVE PLANT SPECIES

Historic Condition

Noxious weeds have been introduced from other countries through shipping and other means of international trade. The weeds entered through shipping ports in the holds of ships containing shipping ballast and plant goods. Others arrived with the import of domestic livestock and their feed. Numerous opportunities existed for the introduction of these species. Natural biological controls that exist in the weed's native country were not present in the United States, thereby allowing the weed populations to explode due to mild temperatures and disturbed soils. Once introduced to the United States, the weeds were further spread by cattle drives, plant transport, and wagon trails, among others.

Within the watershed livestock grazing centered around Davis Lake until the mid 1970s. Non-native grasses were introduced with the grazing and farming of the homestead at the lake. Within riparian areas Kentucky bluegrass (*Poa pratensis*) has been introduced through historic livestock grazing. Overgrazing enhances the spread of bluegrass and decreases the ability of native grass species to compete.

Current Condition

Noxious weeds that have been inventoried include knapweeds (*Centaurea* spp.), tansy ragwort (*Senecio jacobaea*), St. Johnswort (*Hypericum perforatum*), Dalmatian toadflax (*Linaria dalmatica*), yellow toadflax (*Linaria vulgaris*), and cheatgrass (*Bromus tectorum*). Thistle species such as Canada thistle (*Cirsium arvense*) may also pose a problem within riparian areas. No surveys have been conducted to verify its presence or absence. These species have become established as a result of management practices which have caused disturbed areas to be susceptible to invasion by non-native species.

Knapweed and tansy ragwort are introduced through seeds being brought in on livestock (riding horses and cattle) and vehicles. Establishment has been along travelways and in harvest units. As harvest units re-establish with tree canopy closure the plants will decline, but the seed source may survive for numerous years. As long as travelways are infested with noxious weeds and disturbances occur adjacent to the travelways, these species will continue to prosper. Infestation can also occur following catastrophic events such as windthrow or wildfire.

St. Johnswort and possibly Canada thistle, if it is present, are located in riparian areas. These locations provide easy transportation downstream throughout the watershed drainage and basin, which increases the potential for riparian habitats downstream to become infested.

Non-native plant species were purposely introduced for erosion control and forage for wildlife, such as big game and birds. These non-native grasses are declining in abundance. Most do very poorly in their non-native environments. In addition, use of non-native plants for management purposes is decreasing.

PETS PLANTS

Historic Condition

The historical distribution and abundance of species that are currently threatened, endangered, or sensitive is unknown. Historic survey information is not available.

Current Condition

Surveys that have been conducted within the watershed have located several sites of Jepson's monkey-flower scattered throughout the lodgepole dry, lodgepole wet, ponderosa pine, and mixed conifer dry PAG'S. Surveys have also located Bolander's hawkweed within the alpine sites in the Diamond Peak Wilderness. The majority of the watershed has not been surveyed for threatened, endangered, and sensitive plants, except within project areas since 1990. The opportunity to destroy or damage sensitive plant sites increases as public usage of the watershed increases. Habitats for sensitive plants may be undergoing successional changes that do not favor the sensitive plant species. Fire, historically, may have maintained the desirable habitat conditions for some of these plant species, therefore, fire suppression may be reducing the desired conditions.

Refer to Appendix C - Vegetation for plant habitat needs information.

FUNGI

Currently, there is minimal information available on the fungi populations within the watershed. No formal surveys or monitoring have occurred. Appendix C - Vegetation contains a listing of the fungi species known or suspected exist within the watershed.

The limited information that is available applies primarily to commercially valuable species such as the matsutake mushroom, chanterelles, and morels. The matsutake currently is the most valuable mushroom species within the watershed and is highly sought after by mushroom pickers.

Information is needed on the species existing within the watershed, mycorrhizal relationships between fungi and associated plant species, and the effects of mushroom harvesting on the fungi population viability.

WILDLIFE

INTRODUCTION

A total of 268 wildlife species are known or suspected to use the Odell Watershed during the year. Appendix E - Wildlife, Table 1 contains a listing of the species with their scientific names that are known or suspected to use the Odell Watershed, Table 2 contains a list of those species and the habitat(s) (PAG's) that they are associated with. Appendix E - Wildlife, Tables 3 - 8 contain lists of the species found in the Plant Association Groups and the structural stage(s) that they utilize for breeding, foraging, and/or resting habitat. See Appendix E - Wildlife for information on the habitat needs for the species addressed throughout the wildlife section.

RIPARIAN AREAS (Figure 5)

Of the 268 wildlife species known or suspected to utilize the Odell Watershed throughout the year, 177 species use the riparian areas as their primary or secondary habitat for breeding, feeding, and/or resting. Several other species use the riparian areas for some purpose other than breeding. In addition to a diversity of vegetative species, riparian areas also contain a wide array of small mammals, amphibians, fungi, mollusks, reptiles, insects, and fish. Snags, down logs, large trees, willows, alder, spruce, grass, and grass-like species create the vegetative structure of riparian areas that, in turn, provides highly desirable habitat for numerous species.

Of the plant association groups within the Odell Creek Watershed, the dry lodgepole PAG has the least diverse riparian vegetation. In fact, there is little change in vegetative species composition within the riparian zone, but it is still important for many wildlife species. The predominant riparian areas for the lodgepole dry PAG are the intermittent lower portion of Moore Creek, the south and western shores of Davis Lake, and essentially all of Odell Creek. (Figure 22)

Wet lodgepole pine PAG's contain a substantially more diverse riparian area, and include species such as white fir, Douglas-fir, ponderosa pine, spruce, alder, willow, spirea and many herbaceous species. Wet lodgepole pine riparian areas occur sporadically along Odell Creek. (Figure 23)

Mixed conifer PAG riparian areas are also highly diverse. Mixed conifer dry and wet PAG riparian areas occur predominately around Odell Lake and the east side of Davis Lake. (Figures 24 and 25)

Both the mountain hemlock and lodgepole dry with mountain hemlock PAG's contain diverse riparian areas. The mountain hemlock PAG within this watershed provides limited riparian areas around the Rosary Lakes and southern shore of Odell Lake. For the dry lodgepole with mountain hemlock PAG the predominate riparian areas within the watershed are the high elevation lakes within the wilderness, around the Rosary Lakes and Bobby Lake, as well as the headwater streams which drain these lakes. (Figures 20 and 21)

Ponderosa pine PAG riparian areas are similar to those found in the lodgepole dry riparian areas, but may include patches of alder or willow which often provide for increased species diversity. Ponderosa pine PAG riparian areas are also limited to small areas around the north and eastern shore of Davis Lake. (Figure 19)

Specific structural aspects of riparian areas provide habitat for wildlife species such as the associated aquatic habitat of streams, wet marshes/bogs, small ponds, and lakes which play a key role for amphibians, songbirds, and waterfowl. Twenty-three species including the woodduck, Barrow's and common goldeneye, downy woodpecker, mountain chickadee, long-eared owl, and long-legged myotis use cavities in association with riparian areas. Down logs along riparian areas are utilized by the golden-mantled ground squirrel,

long-tailed vole, long-tailed weasel, Townsend's chipmunk, and yellow-pine chipmunk. Large trees near or along the riparian areas are used by the bald eagle, common raven, Douglas' squirrel, golden eagle, great blue heron, northern flying squirrel, northern saw-whet owl, osprey, purple martin, red-breasted sapsucker, and western gray squirrel. The loose bark on ponderosa pine and mixed conifer trees provides nesting habitat for the brown creeper and several species of bats. Willows and alder patches provide nesting and foraging habitat for the mourning dove, olive-sided flycatcher, ruffed grouse, white-breasted nuthatch, hummingbird, and various warbler species.

Riparian vegetation is used as nest lining material by birds and small mammals. The vegetation provides abundant foliage for hiding, grazing, browsing, and preying on insects, amphibians, and small mammals. The riparian area provides a cool microclimate for breeding and resting wildlife. Maintaining a constant body temperature is critical for the survival of most wildlife species. If body temperature drops or rises too much, animals are forced to burn calories to warm or cool the body. Expenditure of calories reduces the animal's reserves that are needed to survive seasons of low food and/or harsh weather conditions. Riparian areas provide travel corridors within the watershed for numerous species and also serve as a central location for mating species.

The following is a list of riparian habitats and the number of species associated with that habitat within the Odell Watershed:

Headwaters (springs and seeps) - 9 species; including belted kingfisher, long-toed salamander, northwestern salamander, Pacific treefrog, red-winged blackbird, river otter, rough-skinned newt, tailed frog, and western toad. Tailed frogs focus on cold, fast running water associated with springs.

Marsh and bog - 114 species; including common garter snake, chipping sparrow, hermit thrush, killdeer, mallard, Pacific treefrog, redhead, ruffed grouse, and winter wren.

Streams (streams and creeks) - Fast and slow moving- 11 species; including American wigeon, belted kingfisher, blue-winged teal, Caspian tern, cinnamon teal, Forster's tern, green-winged teal, mallard, river otter, rough-skinned newt, and spotted sandpiper. Slow moving only - long-toed salamander, northwestern salamander, spotted frog, and western toad. Fast moving only - tailed frog.

Lakes (Lakes, ponds, reservoirs) - 83 species; including sandhill crane, gadwall, Canada goose, cinnamon teal, common garter snake, killdeer, long-billed curlew, and northern pintail.

Aspen - 52 species; including downy woodpecker, American kestrel, black-throated gray warbler, Calliope hummingbird, chipping sparrow, MacGillivray's warbler, mountain chickadee, Nashville warbler, olive-sided flycatcher, western flycatcher, Wilson's warbler, yellow warbler, and yellow-rumped warbler.

Mesic/wet Shrublands - 40 species; including Anna's hummingbird, American robin, Brewer's blackbird, deer mouse, elk, fox sparrow, heather vole, house finch, montane vole, mountain quail, red-eyed vireo, rufous hummingbird, rufous-sided towhee, song sparrow, warbling vireo, willow flycatcher, Wilson's warbler, and yellow warbler.

Alpine Shrublands - 28 species; including badger, bobcat, broad-footed mole, bushy-tailed woodrat, Calliope hummingbird, Cascades frog, Cassin's finch, coast mole, common raven, coyote, golden-mantled ground squirrel, heather vole, long-tailed vole, MacGillivray's warbler, merlin, northern pocket gopher, pine siskin, porcupine, red fox, rock wren, rufous hummingbird, Steller's jay, Swainson's hawk, western jumping mouse, western pocket gopher, western red-backed vole, white-crowned sparrow, and yellow-pine chipmunk.

Subalpine/Alpine Meadows - 30 species; including Calliope hummingbird, Cascades frog, ermine, fox sparrow, horned lark, Nashville warbler, pine siskin, red fox, and western red-backed vole.

Historic Condition

Judge John Breckenridge Waldo: *Diaries and letters from the high Cascades of Oregon 1880-1907* (Williams 1985):

Davis Lake, August 14, 1883. 9:40 a.m.

"I saw a flock of wild geese on this river when I visited it the other day, and Mr. Johnson, of the other party, told me that he saw a goose with about 20 goslings at the lower end of the Lake. I had not known before that wild geese bred in Oregon. Water fowl of all kinds are numerous, and fish hawks and white-headed eagles are seen screaming over head."

Davis Lake, August 14, 1883. 7:15 p.m.

"The noise of water fowl is heard from our camp. But a little while ago we heard the gutteral voices of sandhill cranes. All have their representatives in this lake. Late in the evening the blue crane make wing overheard 'to the rocky wood.'"

Davis Lake, September 18, 1889.

"What was once Davis Lake lying to the northeast-is now nearly a dry plain of white mud, apparently; for there seems to be no more water in it than what O'dell stream makes as it flows through it."

Current Condition

Overall the riparian habitats are in good condition, a small percentage of localized habitats have been degraded and wildlife species displaced. With increasing use by humans on water bodies and within the riparian areas, habitat effectiveness is being degraded and will continue to do so. Approximately 30% of the riparian area around Odell Lake has been degraded, 10% around Odell Creek, 5% within the wilderness and dispersed recreation areas, and 20% around Davis Lake. The degradation not only includes the loss of habitat to developed recreational facilities (campsites, hiking, and OHV trails), dispersed recreation sites, firewood cutting, roads, timber harvest, and winter recreation, but, in addition, human movement through a species territory increases disturbance to wildlife, which adds a stress factor. Disturbance to wildlife increases the amount of calories that they burn to produce adrenaline which may affect the animal's ability to reproduce, care for young, or survive extreme temperatures if disturbance is continual and/or prolonged.

The following riparian species demonstrate a sensitivity to human activity, in other words, they tolerate low levels of human activity but react to high levels: American pipit, American white pelican, American wigeon, Arctic loon, bank swallow, Barrow's goldeneye, Bonaparte's gull, bufflehead, Canada goose, canvasback, cinnamon teal, common loon, common merganser, Franklin's gull, great blue heron, great egret, great white-footed goose, green-winged teal, Harlequin duck, hooded merganser, lesser scaup, long-billed curlew, mallard, northern pintail, northern shoveler, redhead, ring-necked duck, sandhill crane, semipalmated plover, snowy egret, tundra swan, and woodduck. Trumpeter swans demonstrate a high sensitivity to human activity, i.e. they react to both low and high levels of human activity. Both Odell and Davis Lakes are utilized by the above species for either feeding or resting as they travel north to breeding grounds or south to winter migration areas. Other species such as the bank swallow utilize this habitat at Davis Lake for primary breeding habitat. With increasing human activity around the lakes many of the species may be displaced from using them as a stop-over location or breeding habitat.

Davis Lake, because of its extreme fluctuation in water level, is a unique lake which provides abundant feeding grounds for shorebirds and waterfowl. Most of the lakes east of the Cascade Mountains provide very little shoreline habitat or shallow water. The design of Davis Lake provides a rich source of aquatic

insects compared to other natural lakes or reservoirs on the eastside. During bird migration this lake probably has one of the largest number of birds per acre of any lake within Central Oregon. The shallow water provides excellent foraging for egrets, herons, pelicans, dabbler ducks, phalaropes, geese, cranes, and shorebirds. Sandhill cranes, osprey, and bald eagles also nest adjacent to the lake, relying on the lake's resources to provide food. Amphibians and reptiles are closely tied to the lake habitats. Rushes provide a unique habitat for the marsh wren, yellow-headed blackbird, red-winged blackbird, and others. The lava flow provides safe rearing habitat for otters, yellow-bellied marmots, and pikas.

The water in Davis Lake is supplied through Odell Creek, occasionally Moore Creek, and runoff, but the lake has no surface outflow. The drainage system is unique. Water exits through the lava flow. What influence this has on providing additional foodbases or moderating the lava flows microenvironment is unknown. Questions that have arisen in regards to the water which flows through the lava flow include: Where does it go? Does it contribute to the LaPine Basin underground water system? Does it feed downstream springs or does it directly resurface at Wickiup Reservoir? These questions need to be answered in order to understand the system and how it functions within the entire ecosystem.

PETS OR SELECTED WILDLIFE SPECIES

Northern Spotted Owl

Historic Condition

The historic range of the spotted owl was probably much as it is today but without the extensive fragmentation that currently exists. South-facing slopes of Hamner Butte and Davis Mountain may have had a larger component of ponderosa pine with a slightly more open canopy. Openings would have been created by natural disturbances (fire, wind, and insects), but within mixed conifer they would have been larger in scale and fewer in number versus current patch openings created by timber harvest. Historic density levels for the spotted owl are not known. However, it is highly likely that densities of spotted owls were greater prior to human settlement of the area, given the recent loss and fragmentation of suitable habitat and its status as a threatened species.

Current Condition

Location Within Range:

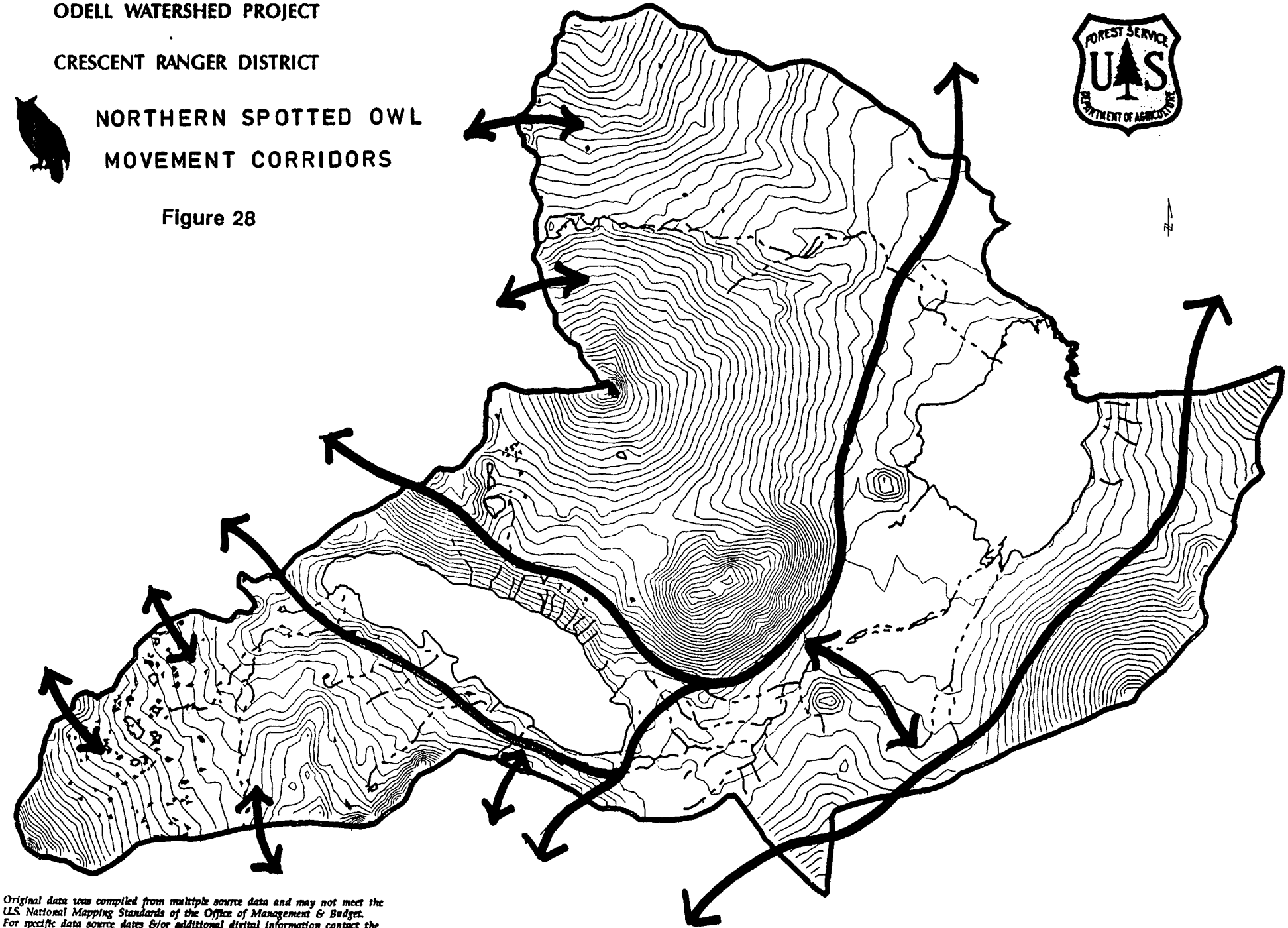
The watershed is located along the eastern edge of the northern spotted owl range. Spotted owl pairs are generally located within the mature/old growth mixed conifer PAG's associated with the buttes. There are five pairs of owls and one resident single owl within the watershed. Three additional pairs of owls occur within 1/4 mile, 1 mile, and 2 miles of the watershed boundary, respectively. The closest owl pair south of Odell Lake is 52 miles away and is located on the Chemult Ranger District. Three other documented spotted owl activity centers occur within the Crescent Ranger District to the south and southeast of the watershed. To the north five pairs of spotted owls are adjacent to Cultus Mountain (12+ miles north of Davis Lake) on the Bend Ranger District. On the Willamette National Forest the closest known spotted owl pair is 2 1/4 miles northwest of Willamette Pass and a single response occurred 1 1/2 miles west of the Pass. Other documented pairs occur west of Waldo Lake. (Figure 28)

ODELL WATERSHED PROJECT

CRESCENT RANGER DISTRICT

NORTHERN SPOTTED OWL MOVEMENT CORRIDORS

Figure 28



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Scale 1:119032

Relative Population/Habitat Within Range:

The spotted owl is federally listed as a threatened species. Eastside owl populations and Odell Watershed densities are low in comparison with population densities in the remainder of the owl range. The eastside population is at the fringe of the owl range and the birds have adapted to somewhat different habitat types than westside owls. Eastside owls may provide genetic diversity that will enhance overall species adaptability. Species adaptability has become important as optimal habitat declined throughout the range of the owl.

The habitats that the eastside spotted owls utilize are not always the same as those typically associated with the westside spotted owls. Owls on the east side of the Cascades have adapted to areas containing a slightly different stand structure, vegetative species composition, and prey base. For example, owls in the Odell Watershed utilize more xeric ponderosa pine/mixed conifer stands dominated by ponderosa pine, Shasta red fir, silver fir, grand fir, white fir, and a limited Douglas-fir component, while westside owls utilize the mesic Douglas-fir/western hemlock stands. Average stand diameter size may be slightly smaller than those typically used on the westside. Eastside habitat has scattered larger diameter trees and overall stands have a canopy cover that is slightly more open than on the westside. The dominant prey species for the westside spotted owls is the northern flying squirrel. In the Odell Watershed, dusky-footed or bushy-tailed woodrats are probably equally as important as flying squirrels in the diet of the owl. Woodrats often predominate in diet samples collected within drier mixed conifer forests. (ISC report). Although not documented, spotted owls may also utilize lodgepole pine stands as dispersal and foraging habitat given the availability, abundance, and proximity of this habitat type within owl pair home ranges.

Critical spotted owl habitat unit OR-7 is encompassed by a Late-Successional Reserve (LSR) that overlaps the watershed. The Late-Successional Reserve within the watershed is adjacent to both Congressionally and Administratively Withdrawn Areas that tie together other LSR's up and down the eastside of the Cascade Range. (Figure 7) Dispersal habitat throughout the LSR and watershed is in fair condition even though areas have been fragmented. The heaviest fragmentation occurs west of Davis Lake in the mixed conifer dry PAG. Spotted owls likely travel through the fragmented areas to the unfragmented upper slopes and disperse through the lodgepole pine and mountain hemlock PAG's. (Figure 6) However, optimal dispersal habitat would occur throughout the mixed conifer zone if it were not so heavily fragmented. The watershed contains 16,556 acres of suitable owl habitat (nesting, roosting, and foraging) which represents 22% of the total watershed acreage.

Table 3 - 12, Spotted Owl Habitat

ROD Allocation	ROD Acres Within Watershed	Suitable Owl Acres
Congressionally Withdrawn lands	12,212	4,267
Administratively Withdrawn lands	19,715	1,473
Late-Successional Reserves	35,222	10,097
Matrix	7,784	719
Total Acres	74,933	16,556

Past timber harvest activities have reduced and fragmented suitable spotted owl habitat within the watershed. Habitat loss and fragmentation within the mixed conifer plant association groups have detrimentally affected the owl in several ways. These effects include: a reduction in the available habitat for spotted owl territories; increase in the amount of energy needed to successfully reproduce, thus reducing individual fitness and reproductive potential; reduction in dispersal capabilities; and increase in competition and predation amongst other raptors such as the great horned owl and goshawk. In addition, barred owls have recently extended their range from the east coast to the west coast of the United States. Barred owls have successfully adapted to fragmented habitats and are known to compete with the spotted owl for habitat (space) and prey; and may potentially consume spotted owls as prey. Habitat fragmentation in the mixed conifer zone has reduced north to south dispersal corridors for the spotted owl, whereas the east to west corridors that occur within the mountain hemlock zone are stable.

In the ponderosa pine plant association group and mixed conifer dry PAG, historic harvest of ponderosa pine stands and fire suppression activities have resulted in the growth of a dense understory of white fir. These activities have created better quality spotted owl habitat in the ponderosa pine and mixed conifer dry plant association groups. This habitat, however, is generally not stable over time, due to the fire history of the area, prolonged drought, and insect and disease infestations. When fire occurs in these areas, it will most likely be a large scale stand replacing fire. Prior to fire suppression, the fire cycle would typically have been comprised of short duration, small scale, ground fires that would have maintained the overstory ponderosa pine trees and thinned the understory white fir.

Fire historically acted as a controlling agent for epidemics of disease and insects which currently are infesting the stands as a result of fire suppression efforts.

Increasing demand for public and commercial mushroom harvesting may create a decline in the prey base for spotted owls. Many mushroom species are utilized by small mammals, such as the Douglas' squirrel. Loss of this important fall forage component may lead to reduced fitness or population decreases among small mammal species, which could cause a reduction in the spotted owl prey base.

Bald Eagle

Historic Condition

Bald eagles historically nested and foraged on Davis and Odell Lakes and fed on bull trout, rainbow trout, whitefish, and waterfowl.

Current Condition

The bald eagle is federally listed as a threatened species. The watershed provides nesting habitat for six known pairs of bald eagles around both Odell and Davis Lakes, and in mild winters the eagles may reside year-round. During colder winters, the eagles may migrate to Klamath Marsh or other areas having an abundance of waterfowl. Bald Eagle Management Areas are located around Davis and Odell Lakes (Figure 7).

In the fall Odell Lake and its tributaries provide an opportunistic food source since the introduction of kokanee salmon. Kokanee spawn along the lake edges and in Trapper and Crystal Creeks and provide an easy prey base for bald eagles and osprey.

At Davis Lake the food base has changed from bull trout, rainbow trout, whitefish, and waterfowl to chubs, whitefish, rainbow trout, and waterfowl. The change in prey base resulted from the poisoning of Odell Creek and Davis Lake in 1959 and the introduction of non-native fish species and their associated diseases.

The change in prey species has caused the eagle to expend a greater amount of energy for the same amount of fish. Where, historically, one successful foraging trip would lead to the capture of one large bull trout, rainbow trout, or whitefish, presently, several trips may have to be made in order to acquire the same poundage of chubs and smaller fish. Since additional trips are required, the eagle expends more energy and, therefore, has to increase the poundage of fish consumed in order to maintain the same fitness level. In addition to the increased energy expenditure, a rise in the amount of recreational activity on both Odell and Davis Lakes has also occurred, which causes added disturbance during active foraging periods. This disturbance causes an increase in the amount of time and energy spent feeding.

Peregrine Falcon

Historic Condition

Limited suitable habitat historically was available within the watershed (potentially Lakeview Mountain, Maiden Peak and Diamond Peak). It is unknown what the population densities may have been. Use of toxic pesticides (2-4-5-T and DDT) reduced populations of many raptors, including bald eagle, osprey, golden eagle, and peregrine falcon, that fed on prey that had consumed pesticides. The pesticides reduced egg shell strength and during incubation many eggs were inadvertently crushed. Nestlings that did hatch were typically weak and had low survival rates.

Current Condition

The peregrine falcon is federally listed as an endangered species. To date peregrine falcons have only been observed migrating through the Odell Watershed. Limited habitat does exist within the watershed, but there are no known or suspected nest sites. However, available habitat may become important as the peregrine falcon recovers and new nesting territories are established. The species is not now known to occur on the Deschutes National Forest except as a seasonal migrant. If these sites become Occupied by nesting peregrine falcons in the future, conflicts with recreational use (especially rock climbers) may occur, since peregrine falcons are not tolerable of human disturbance. In addition, geothermal and mining development would need to be assessed as to the potential impacts to the species.

A ban on the use of toxic pesticides was established in the United States, but these pesticides are still legally being used in Central and South America. For species such as the peregrine falcon that migrate to Central and South America, pesticides still pose a threat to populations and breeding capabilities.

Western Snowy Plover

Historic Condition

Western snowy plover habitat historically existed at Davis Lake and its associated wet meadows. The lake's dramatic water fluctuations provide excellent shorebird habitat, including that for western snowy plovers.

Current Condition

There are no documented sightings of western snowy plovers within the watershed, however, foraging and nesting habitat does exist at Davis Lake. The fluctuations at Davis Lake continue to provide exceptional foraging opportunities for the western snowy plover. The western snowy plover is currently a federally listed threatened species.

Northern Goshawk

Historic Condition

Historically, the abundance of habitat that was available for the northern goshawk was greater than that which is currently present. Suitable habitat has decreased as a result of timber harvest activities that have fragmented the habitat and removed appropriate nest sites. It is probable that goshawk numbers within the watershed were also greater.

Current Condition

The goshawk is listed as a state sensitive species due to conversion of suitable habitats to younger, even-aged stands without appropriate nest sites and open foraging areas under the canopy. The goshawk is also listed as a federal category 2 species (C2) and is proposed for listing on the Region 6 Regional Foresters Sensitive Species List in 1995.

Goshawk habitat has been fragmented by past timber harvest activities and firewood collection. Some areas of intact lodgepole pine stands still provide primary and secondary habitat along Odell Creek. The lodgepole/mountain hemlock and mountain hemlock PAG's provide unfragmented primary and secondary habitats. Within the ponderosa and mixed conifer PAG's appropriate habitat has been reduced and fragmented, however, some areas of primary habitat still exist within the mixed conifer PAG's, but at a lower density level than was historically present.

Epidemic levels of beetles have killed many of the mature trees in the lodgepole dry PAG. Currently, these stands still provide primary habitat for the goshawk and will continue to as long as the standing dead and live tree component comprises a canopy cover of 70% or above. As these stands begin to fall apart in the next 5-15 years, these acres will change from primary habitat to secondary or foraging habitat. The number of acres that will be converted will depend on how many large trees survive the beetle epidemic. These acres will cycle back into desirable habitat within 40-50 years. During the cycling period, goshawks may relocate to adjacent suitable mixed conifer or lightly infected lodgepole pine stands.

Wolverine, Fisher and Marten

Historic Condition

Historically, wolverine, fisher, and marten were more abundant than they are today. Many of the furbearing mammals were trapped heavily in the 1920s and 1930s which reduced local and Cascade populations. In addition, these species may have been inadvertently killed during bait poisoning aimed at coyotes and wolves. Wolverine and marten habitats were likely similar to current conditions since few management activities have occurred in the high elevations of this watershed. However, fisher habitat has been subsequently reduced and fragmented by timber harvest activities which continue to contribute to depressed populations even though the use of bait and trapping have dramatically declined.

Current Condition

The wolverine and fisher are federal candidate species (category 2), and the marten is a state listed sensitive species.

Wolverine, fisher, and marten are solitary and territorial species. Little information is available on the occurrence and distribution of these species within the watershed and within Central Oregon.

Habitat for fisher, and to some extent marten, has been heavily fragmented in the Odell Watershed due to timber harvesting. Openings, decreasing amounts of mature timber, and removal of dead and down trees for firewood have detrimentally impacted the suitability of the habitat for these two species. Areas within the watershed may be fragmented to the point that they can no longer meet the habitat needs of the fisher and marten. Fragmentation may have led to isolation of small populations of these species that are too small for long-term viability. Overall population levels have most likely declined due to fragmentation.

Another rising conflict within the watershed is the increasing amount of winter disturbance from snowmobile users which causes the animals to react in adverse terrain conditions (movement through snow). This conflict may reduce the suitability of foraging areas within heavily travelled recreation areas during the winter months.

The preferred habitats of the wolverine and marten are located at higher elevations and contain a dense, continuous canopy cover. Both species prefer remote areas that lack human disturbance. Wolverine and marten corridors likely occur (north to south) through the wilderness and (east to west) along areas of high elevation through the country surrounding Bobby Lake. (Figure 29) These corridors are relatively stable and healthy and are minimally impacted by humans.

Marten use a variety of travel corridors, since the animal can use various habitats (lodgepole pine, ponderosa pine and mixed conifers). Travel corridors are not likely a limiting factor for this species.

Marten and wolverine are known to exist within the Odell Watershed, but population density information is not available.

Fisher travel corridors occur along the mixed conifer belt, similar to the spotted owl. This mixed conifer habitat occurs primarily along the southeast side of Odell Lake and in the area to the northwest of Davis Lake. (Figure 28) This corridor is highly fragmented due to timber harvest and road construction activities which limit its value as a fisher movement corridor. The fisher may be extirpated from the Odell Watershed and Deschutes National Forest. The last documented sighting within the watershed occurred in 1986.

Preble's Shrew

Historic Condition

Potential Preble's shrew habitat likely existed along Odell Creek, some portions adjacent to Davis Lake, and other small meadows and wet areas throughout the lodgepole dry/mountain hemlock and mixed conifer wet PAG's. The historic distribution and abundance of Preble's shrews are unknown.

Current Condition

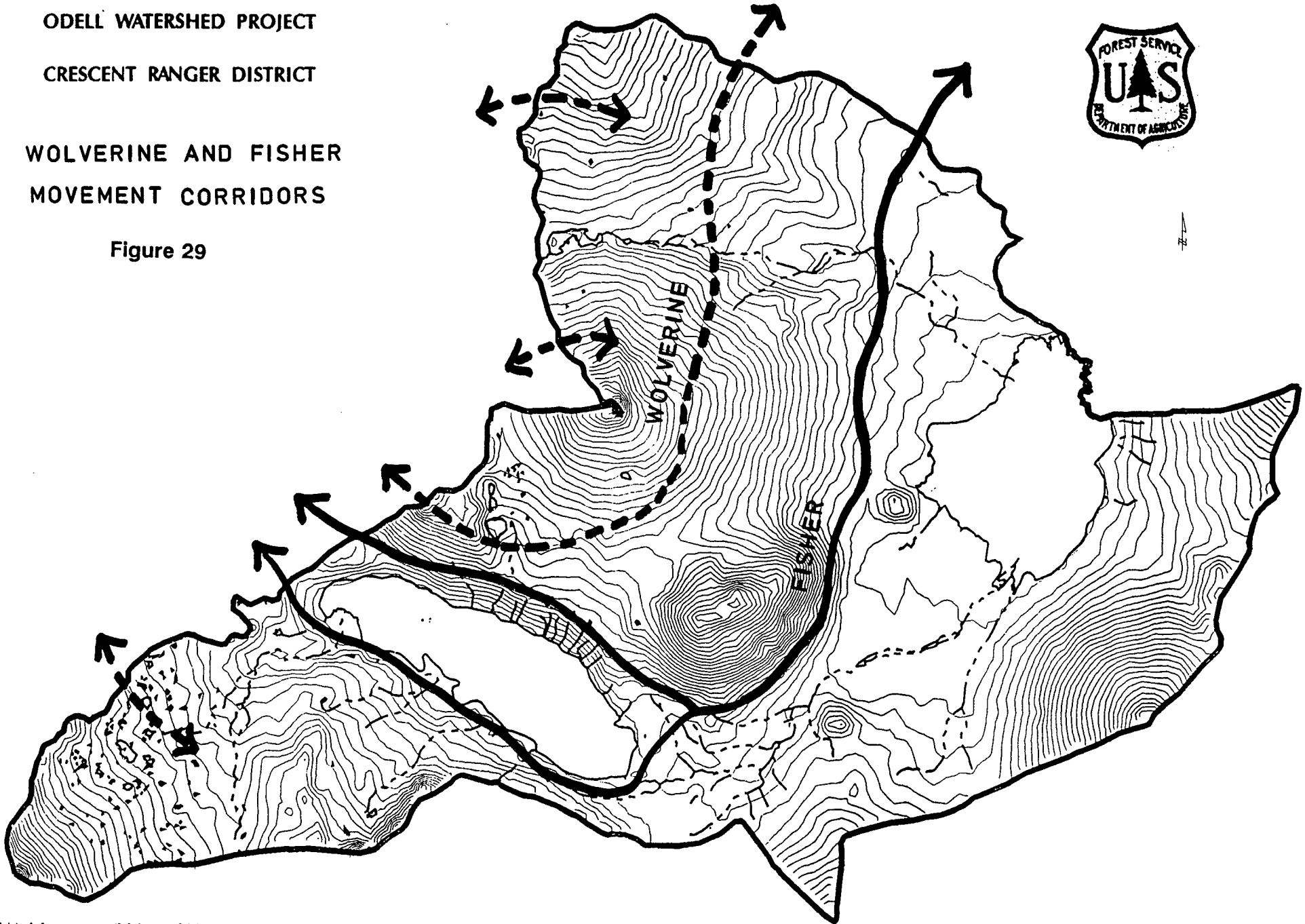
The Preble's shrew is a federal candidate species (category 2). The species is suspected to occur on the Deschutes National Forest, but no surveys have been conducted within the watershed. Conifer encroachment may be reducing primary habitats in some locations along Odell Creek and its tributaries.

ODELL WATERSHED PROJECT

CRESCENT RANGER DISTRICT

WOLVERINE AND FISHER MOVEMENT CORRIDORS

Figure 29



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B. Haxby
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Long-billed Curlew

Historic Condition

Habitat for the long-billed curlew has existed since the creation of Davis Lake and the associated wet meadows which occurred 5,500 years ago when a lava flow blocked Odell Creek.

Current Condition

The long-billed curlew is a federal candidate species (category 3). The bird has not been documented within the watershed, however, foraging and nesting habitat exist at Davis Lake. The dramatic fluctuation at Davis Lake provides exceptional foraging for the long-billed curlew and many other shorebirds.

Black-backed Woodpecker

Historic Condition

The historic abundance of habitat for the black-backed woodpecker was most likely greater than the amount currently available, and, therefore, the number of woodpeckers was also probably greater. Humans have utilized these beetle-killed trees that provide the necessary habitat for the black-backed, as a source of fuel and pulpwood. These harvesting activities have led to fragmentation of the habitat and removal of a food source.

Current Condition

The black-backed woodpecker is considered a sensitive species in the critical category by the Oregon Department of Fish and Wildlife due to loss of snags and conversion of mature lodgepole stands to young, fast-growing stands that are free of heart rot and bark beetles (Marshall 1992a). The woodpecker is also identified in analysis and mitigation in Appendix J2, *Results of Additional Species Analysis from the 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, April 13, 1994*. This species is proposed for listing on the Region 6 Regional Forester's Sensitive Species List in 1995.

Abundant habitat currently exists along Odell Creek in the lodgepole wet and dry and lodgepole dry/mountain hemlock plant association groups. Limited habitat exists in the mixed conifer plant association groups due to extensive fragmentation. The birds are currently located within the watershed and utilizing the existing habitat. Population densities are unknown. Epidemic levels of beetles have killed much of the lodgepole dry PAG, thereby creating large areas of primary habitat. As these stands start falling apart in the next 5-15 years, these acres will probably become secondary or foraging habitat rather than primary habitat. The amount of acres that will be converted will depend on how many large trees survive the beetle epidemic. These acres will cycle back into desirable habitat within 40-50 years. During the cycling period black-backed woodpeckers may relocate to adjacent suitable mixed conifer or lightly infected lodgepole stands.

Great Gray Owl

Historic Condition

Habitat historically existed within the Odell Watershed for the great gray owl, but population density information is unavailable.

Current Condition

The great gray owl is considered a sensitive species in the vulnerable category by the Oregon Department of Fish and Wildlife. Its status is due to the loss or elimination of nest and roost sites by logging, including salvage harvesting of lodgepole pine for mountain pine beetle control. Another reason for the owl's sensitive status is the urban sprawl in prime habitat in the LaPine, Bend and Sisters areas (Marshall 1992a). The species is also proposed for listing on the Region 6 Regional Forester's Sensitive Species List in 1995. Currently, no great gray owls are known to exist within the watershed. Habitat does exist and the potential for their occupation of it is high.

Flammulated Owl

Historic Condition

Historically, the amount of habitat available for the flammulated owl was greater than that which is present currently. The birds were known to exist within the watershed, but population density information is not known.

Current Condition

The flammulated owl is considered to be a sensitive species in the critical category by the Oregon Department of Fish and Wildlife due to loss of habitat. This habitat loss includes the conversion of uneven-aged, multi-layered forests to even-aged single-layered forests, reduction in size and numbers of mature and old-growth ponderosa pines which are used as nesting sites, and loss of snags (Marshall 1992a). The species is also proposed for listing on the Region 6 Regional Forester's Sensitive Species List in 1995.

The lack of low intensity fires due to aggressive fire suppression has reduced most of the suitable habitat for the flammulated owl within the ponderosa pine and mixed conifer PAG's and has caused the development of a more closed canopy primarily in the ponderosa pine stands. There is no documentation of flammulated owls occurring within the watershed, but it is strongly suspected that they are present, especially around Davis Lake.

Greater Sandhill Crane

Historic Condition

Habitat for the sandhill crane has existed within the watershed since the creation of Davis Lake and development of the associated wet meadows, which occurred 5,500 years ago when a lava flow blocked Odell Creek.

Judge John Breckenridge Waldo: *Diaries and letters from the high Cascades of Oregon 1880-1907* (Williams 1985):

> Davis Lake, August 14, 1883. 7:15 p.m.
>
> "The noise of water fowl is heard from our camp. But a little while ago we heard the gutteral voices of sandhill cranes. All have their representatives in this lake. Late in the evening the blue crane make wing overheard 'to the rocky wood.'"

Historic conditions for the greater sandhill cranes were likely to be similar to the conditions today since few habitat modifications have occurred around Davis Lake. However, the number of sandhill cranes

using Davis Lake were likely higher historically than they are today, since species-wide population declines have occurred due to overharvesting and habitat degradation.

Current Condition

The greater sandhill crane is considered to be a sensitive species in the vulnerable category by the Oregon Department of Fish and Wildlife. Its status is due to low reproductive success caused by predation and the rising waters of Malheur Lake which is destroying habitat. Predation rates by ravens and coyotes upon chicks and nests are high. Each nesting pair requires a large area; in addition, the birds are highly sensitive to human disturbance and land use practices (Marshall 1992a). The species is also proposed for listing on the Region 6 Regional Forester's Sensitive Species List in 1995.

Davis Lake provides nesting and foraging habitat in those areas not frequented by recreationists. During the spring and summer sandhill cranes can be heard and/or observed at Davis Lake.

Sandhill crane nests and young are susceptible to coyote, raven, raccoon, and skunk predation as well as to predation by uncontrolled domestic dogs, which accompany recreational users to the area.

American White Pelican

Historic Condition

Since the creation of Davis Lake, with its shallow depth and dramatic water fluctuations, it has provided an abundance of fish and excellent habitat for white pelicans. The birds have been documented using this lake since the earlier settlers arrived, however, there are no recorded population estimates.

Current Condition

The pelican is considered a sensitive species in the vulnerable category by the Oregon Department of Fish and Wildlife due to a shortage of suitable breeding areas (stable islands, nesting space availability, security, and sufficient forage base) (Marshall 1992a). This species is also proposed for listing on the Region 6 Regional Forester's Sensitive Species List in 1995.

Pelicans are often observed foraging on Davis Lake as they migrate north and south in the spring and fall months. There is no known nesting on Davis Lake.

White-headed Woodpecker

Historic Condition

Documented provincial declines following the selective harvesting of ponderosa pine would indicate historical potential populations were greater than currently exist.

Current Condition

White-headed woodpecker is considered a sensitive species in the critical category by the Oregon Department of Fish and Wildlife. The woodpecker has been given this status due to a sparse natural population and the loss of large ponderosa pine structure and snag trees which resulted from timber harvest activities (Marshall 1992a). This species is also proposed for listing on the Region 6 Regional Forester's Sensitive Species List in 1995.

There are no documented white-headed woodpecker observations within the watershed. A documented sighting was recorded adjacent to the watershed on Davis Mountain in 1987. Habitat does exist around the Davis Lake area throughout the ponderosa pine and mixed conifer dry PAG's. Loss of many of the large ponderosa pines may have reduced existing populations. Another factor within the mixed conifer dry and ponderosa pine PAG's is that active fire suppression has occurred since the early 1900s, which has reduced the number and size of low intensity fires. The two PAG's may still be within the range of variability for fire frequency, but are moving towards going outside the range. Within the mixed conifer dry PAG this has resulted in the development of an understory of white fir, with ponderosa pine and Douglas-fir still being the primary large tree component but not the dominant stand component. Therefore, there is a risk of losing additional ponderosa pine habitat through direct competition with white fir and due to a high habitat susceptibility for stand replacement fires.

Pileated Woodpecker

Historic Condition

Prior to timber harvest activities, the historic abundance of habitat for the pileated woodpecker was greater. Timber harvest activities led to the reduction of large diameter trees and also caused increased fragmentation. It is probable that the number of pileated woodpeckers was also greater historically, but population density information is not available.

Current Condition

The pileated woodpecker is considered a sensitive species in the critical category by the Oregon Department of Fish and Wildlife, because it is sensitive to timber harvest treatments that result in the removal of large live and dead trees which are necessary for foraging, nesting and roosting (Marshall 1992a). The species is also proposed for listing on the Region 6 Regional Forester's Sensitive Species List in 1995.

Pileated woodpeckers are known to occur within the watershed. Currently, habitat is limited to the highly fragmented mid-elevational mixed conifer forests and the sparse distribution of large diameter white fir within the watershed. Previous timber harvest activities caused the reduction of large diameter trees including white fir, eliminated patches of large diameter trees, and created fragmentation. In addition, roads were constructed to access the harvested trees, but these same roads also enabled access to the area for increasing demands of personal and commercial firewood and fiber. Fuelwood collection added to the impacts to the area due to the removal of snags and down logs, thus reducing nesting and foraging habitat.

Aquatic Species

Long-toed salamander (*Ambystoma macrodactylum*)
Northwestern salamander (*Ambystoma gracile*)
Pacific giant salamander (*Dicamptodon tenebrosus*)
Rough-skinned newt (*Taricha granulosa*)
Pacific tree frog (*Pseudacris regilla*)
Tailed frog (*Ascaphus truei*)
Red-legged frog (*Rana aurora*)
Western toad (*Bufo boreas*)

Cascades frog (*Rana cascadae*)
Spotted frog (*Rana pretiosa*)

Historic Condition

No historic documentation of aquatic populations has been identified, however, human impacts have likely reduced the distribution and survival of amphibians in some locations within the watershed. Given the recent introduction of non-native fish, poisoning of Odell Creek, and loss of riparian habitats in localized disturbance areas, it is likely that the Cascades and spotted frogs were more widely distributed throughout the watershed. The designation of these two species as federal candidate species (category 2) reflects geographic concerns.

Historically, Odell Creek and Davis Lake were poisoned in an attempt to eradicate the illegally introduced tui chub. Rotenone poisoning likely reduced the number of amphibians as well as their prey base for several years. Documented response or results of this poisoning on amphibians and other aquatic organisms is not known.

Current Condition

A factor that most likely influenced amphibian populations is the introduction and continued stocking of fish in many of the lakes that historically did not contain a fishery. Non-native fish are competing for food and cover, as well as directly preying upon endemic amphibians. A local survey documented that a stocked trout had consumed ten long-toed salamanders. Roland Knapp, a University of California Research Biologist, has documented dramatic declines in amphibian and endemic fauna in historically fishless lakes that had been stocked.

Declines in endemic population levels and distribution of amphibians have occurred where continued non-native fish stocking occurs and where extensive recreational use adversely affects riparian habitats. These factors may pose migration barriers within and between watersheds that may adversely affect gene pool exchange and ability to colonize depopulated areas. Recreational use in riparian areas has probably also reduced or detrimentally impacted amphibian breeding habitat in localized areas, predominately around Odell Lake, Bobby Lake, the lower portion of Odell Creek, and some of the wilderness lakes. (Figure 30) However, riparian impacts may affect less than 30% of the lakeshores and less than 20% of stream riparian areas. Loss or significant reduction in native amphibian populations is likely to disrupt local food webs, i.e. disturbance of the aquatic and to a lesser degree the terrestrial ecosystems. If this occurs, these systems will not be within their range of natural variability.

In addition, increased recreational use and development along lakes and streams is degrading riparian habitats that are critical to amphibian populations. It is expected that recreational pressure will continue to center around aquatic areas and degrade adjacent riparian habitats, thus reducing amphibian habitats and dispersal capabilities. Along with increased recreational use, comes the increased risk of contamination spills, recreational dumping, bank erosion, and removal of riparian vegetation.

Drought and possible climatic changes may be affecting the quantity and quality of amphibian habitat within the watershed, however, this change is likely to be within the natural range of variability.

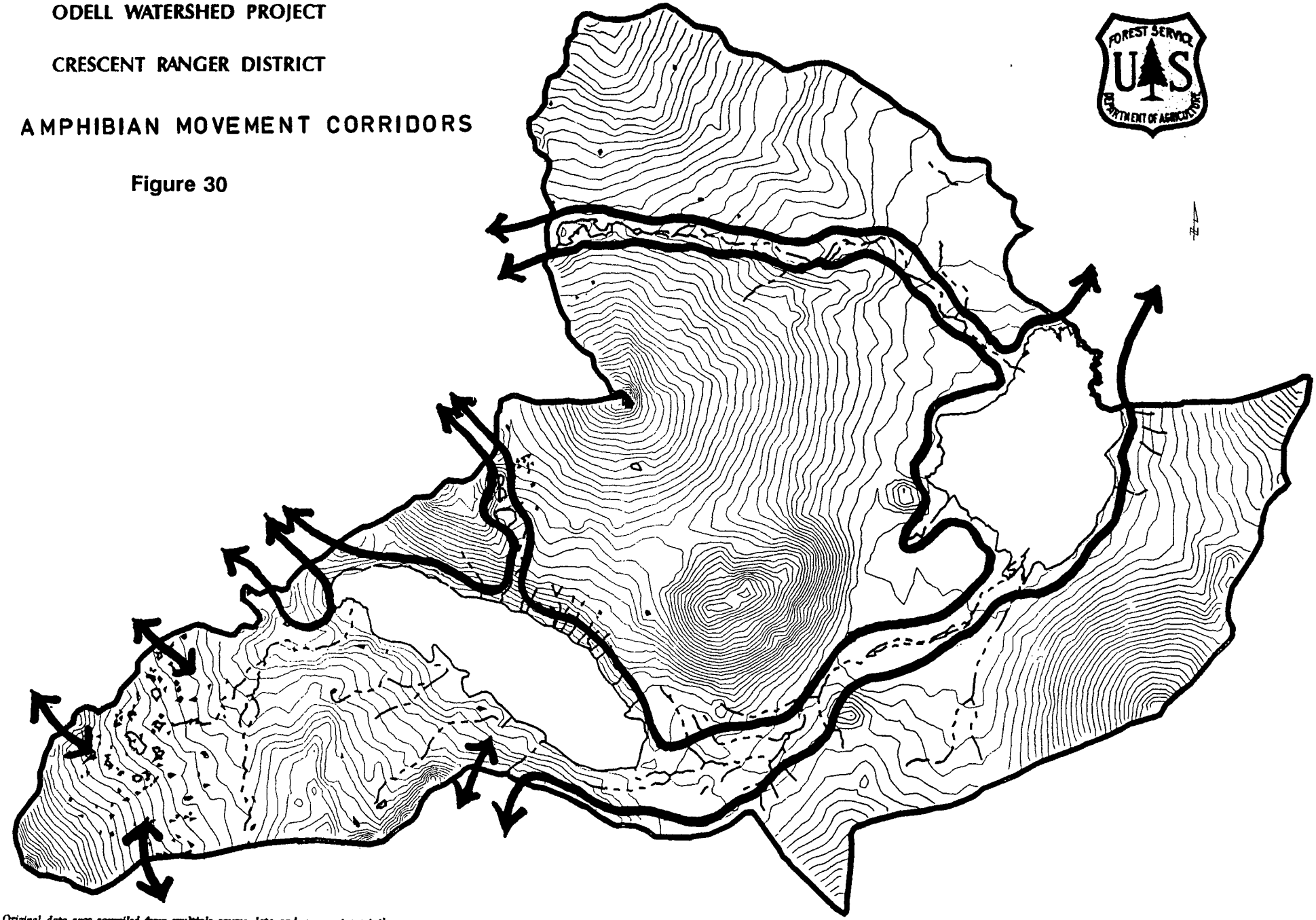
Traffic along Highway 58 may pose a migration barrier to amphibians.

ODELL WATERSHED PROJECT

CRESCENT RANGER DISTRICT

AMPHIBIAN MOVEMENT CORRIDORS

Figure 30



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Scale 1:119032

TERRESTRIAL AND AVIAN SPECIES ASSOCIATED WITH THE PLANT ASSOCIATION GROUPS

Lodgepole Pine (Dry & Wet)
Ponderosa Pine
Mixed Conifer (Dry & Wet)
Lodgepole Pine Dry/Mountain Hemlock
Mountain Hemlock
Meadows (Includes Wet Meadows, Moist (hairgrass) Meadows, and Dry Meadows)

See Appendix E - Wildlife, Tables 3 - 8 for lists of the species associated with the PAG's and the structural stages that they utilize for breeding, foraging, and/or resting habitat.

Historic Condition

Elk and deer numbers were fairly low until timber harvest activities created a greater forage base.

Historically, merlin were most likely rare in Oregon and Washington.

Early furtrapping reduced the populations of many species between 1820 and 1830. The beaver population was significantly impacted, while trapping of mink, marten, weasel, ermine, fisher, and wolverine also affected population densities of these species. Hunts to kill large numbers of wolves, coyotes, mountain lions, and other species classified as "predators" were commonplace in the early and mid 1900s. The gray wolf is thought to be extirpated from Oregon. Mountain lion populations have been reduced from historic levels. In recent history, coyote numbers may be increasing due to reduced levels of hunting and poisoning.

Current Condition

Increased disturbance to wildlife by forest users (mushroom pickers, other forest product gatherers, recreationists, recreational vehicle traffic, and hunters) affects an animal's fitness depending on how it responds to human disturbance. Species that demonstrate a sensitivity to human activity, i.e. they tolerate low levels of activity but react to high levels include: bald eagle, boreal owl, Cooper's hawk, elk, golden eagle, marten, merlin, mountain lion, northern goshawk, red-tailed hawk, rough-legged hawk, sharp-shinned hawk, Trowbridge's shrew, and white-winged crossbill. Species that demonstrate a high sensitivity to human activity, i.e. react to both low and high levels of human activity include: big brown bat, California myotis, little brown myotis, long-eared myotis, long-legged myotis, peregrine falcon, silver-haired bat, wolverine, and Yuma myotis. Depending on the extent, frequency, and duration of disturbance, it may affect the animal's ability to survive during stressful periods, cause abandonment of young, and/or abandonment of habitats. Vehicular traffic on roads, whether it be cars, trucks, motorcycles, ATV's, snowmobiles, or mountain bikes all contribute to the disturbance of wildlife. The road density, excluding the Diamond Peak Wilderness, the Dispersed Recreation Management Areas, and Odell and Davis Lake water bodies, is 3.5 miles/sq mile of open roads and 1.5 miles/sq mile of closed roads. Not all road closures are effective in eliminating access to motorcycles, ATV's, mountain bikes, and/or snowmobiles. This analysis does not include skid trails created during timber harvest activities or recreationally created (non-forest) roads. (Figure 17)

Not only do roads provide an avenue for disturbance, but they create a fragmented habitat along with timber harvest units. Fragmentation, the breaking up and eliminating of large continuous stands of habitat, is prevalent within all PAG's except the lodgepole/mountain hemlock and mountain hemlock PAG's. Fragmentation reduces habitat for species that require large home ranges with continuous habitats and species that use interior, non-edge influenced, habitats. Some of the species that are detrimentally affected by fragmentation include black-backed woodpecker, northern goshawk, spotted owl, Barrow's goldeneye,

Anna's hummingbird, and wolverine. However, fragmentation favors edge and contrast species such as elk, deer, European starling, brown-headed cowbird, great horned owl, and red-tailed hawk.

Species that have an extremely low to low/moderate degree of habitat versatility are species which tend to have very specific habitat requirements. Some of these species include: American dipper, Anna's hummingbird, ash-throated flycatcher, bald eagle, bank swallow, barn owl, Barrow's goldeneye, belted kingfisher, black rosy finch, black-backed woodpecker, black-chinned hummingbird, bufflehead, Cascades frog, Clark's nutcracker, common goldeneye, common merganser, common poorwill, double-crested cormorant, Douglas' squirrel, fisher, flammulated owl, golden eagle, golden-crowned kinglet, golden-crowned sparrow, great blue heron, great gray owl, heather vole, hooded merganser, horned lark, house wren, killdeer, Lewis' woodpecker, long-toed salamander, MacGillivray's warbler, marsh wren, marten, merlin, mountain bluebird, northern goshawk, northern harrier, northern pocket gopher, northern saw-whet owl, northern salamander, osprey, pika, pygmy nuthatch, red-breasted sapsucker, red-winged blackbird, rock wren, rough-skinned newt, rubber boa, ruby-crowned kinglet, sandhill crane, spotted frog, spotted owl, tailed frog, three-toed woodpecker, Townsend's chipmunk, tree swallow, Trowbridge's shrew, vagrant shrew, varied thrush, water shrew, western flycatcher, western gray squirrel, western jumping mouse, western kingbird, western red-backed vole, western toad, white-breasted nuthatch, white-headed woodpecker, white-throated swift, white-winged crossbill, Williamson's sapsucker, winter wren, wolverine, yellow warbler, yellow-bellied marmot, yellow-breasted chat, and yellow-rumped warbler. Because these species have low versatility, they are adversely affected by the removal or degradation of their associated habitat.

Increasing demand for mushrooms by the public may create a decline in this food source for small mammals including squirrels, chipmunks, voles, and other species such as deer. Loss of this important fall forage component may stress the animals listed above during harsh weather periods, or may cause mortality.

In addition to habitat conditions, wildlife populations are being affected by illegal poaching including species such as elk, deer, bear, hawks, and eagles. The demand for black market body parts for aphrodisiacs, cure-alls, illegal trophy hunts, and meat is creating a large profit for those people willing to violate the law.

Deer and elk populations within the watershed have increased over time as a result of past timber harvest activities which created forage (harvest units) in close proximity to cover. In addition, there has been an increase in amount of effective deer and elk cover where fire suppression has resulted in dense understories of white fir. Stands infected with insects have provided additional security habitat in areas of abundant downed logs. Increased human use of riparian areas (preferred breeding habitat for deer and elk) has displaced some animals from historic breeding sites. If the Cascade Lakes Highway (Road 46) is improved, there would likely be an increase in motor vehicle collisions with deer and elk. Future land management activities with an emphasis on restoring and conserving late-successional forests in the watershed will most likely within twenty years reduce the amount of forage for deer and elk to quantities more consistent with historic levels. (Figure 31)

There has been a loss of large trees due to timber harvesting. Large trees are an important habitat component for breeding and roosting wildlife. Species such as the brown creeper create nests under the large loose bark, while several species of bats (myotis) utilize this bark for roosting. Bald eagles, golden eagles, and great blue herons depend on large trees to create their nests in. Cavities in large trees are used by various species such as marten, fisher, bear, and squirrels for denning, nesting, or resting.

The loss of large snags to firewood cutting, timber harvesting, and safety hazard reduction has eliminated much of the habitat needed by primary and secondary cavity users. Areas that typically lack snags are recreational use areas adjacent to water bodies and streams, in the lodgepole forests (firewood collection), and mixed conifer PAG's (timber harvest). Many waterfowl species including the woodduck, Barrow's goldeneye, bufflehead, common goldeneye, and common merganser, have shown a decline, possibly due to the loss of snags and disturbance by recreationists.

ODELL WATERSHED PROJECT

CRESCENT RANGER DISTRICT

DEER AND ELK MOVEMENT CORRIDORS

Figure 31

Original data was compiled from multiple source data and may not meet the U.S. National Mapping Standards of the Office of Management & Budget. For specific data source dates &/or additional digital information contact the Deschutes National Forest, Crescent Ranger District, Crescent, Oregon. This map has no warranties to its content or accuracy.

Scale 1:119032

Increases in the number of forest users have favored some wildlife species. Species that show a positive correlation to human activity are the American crow, barn owl, European starling, golden-mantled ground squirrel, gray jay, Townsend's chipmunk, and yellow-pine chipmunk.

Those species that are known or suspected to occur within the watershed that are on the decline are listed in Appendix E, Table 9.

NON-NATIVE WILDLIFE SPECIES

Aquatic Species

Bullfrog (*Rana catesbeiana*)

Historic Condition

Bullfrogs are native to the eastern and midwestern United States and southeastern Canada. Due to human introductions, they are now well established throughout most of the western United States and southwestern Canada (Leonard 1993).

Current Condition

Bullfrogs are currently not known to exist within the watershed. The closest known sightings have occurred in Bend. Since the Odell Watershed drains into the Deschutes River system, there is a high potential for colonization by this species.

Terrestrial or Avian Species

House sparrow (*Passer domesticus*)
Brown-headed cowbird (*Molothrus ater*)
European starling (*Sturnus vulgaris*)
Barred owl (*Strix varia*)

Historic Condition

The house sparrow was introduced from Europe and became established in the United States between 1850 and 1867.

The brown-headed cowbird was introduced through the cattle drives from the eastern and midwestern states. Artificial green belts along east-west irrigation canals have also aided in the invasion of the cowbird.

The European starling is native to Eurasia and North Africa, and it is not known how the bird became established in North America.

Barred owls are endemic to the eastern United States and Canada. The fragmentation of the northwest forests have provided suitable habitat for entry of the barred owl from Canada.

Current Condition

The house sparrow aggressively appropriates nests, especially those of bluebirds and swallows, often destroying the eggs and nestlings.

The cowbird can be found in many of the habitats within the watershed. The cowbird parasitizes many species of birds thus reducing their reproductive fitness, refer to Appendix E, Table 10. Of the 44 bird species listed as parasitism hosts, 30 of those species are known or suspected to occur within the watershed. The cowbird may also affect the insect population. The bird's diet includes spiders, snails, grass, and forb seeds. The predominate diet of the cowbird host species consists almost entirely of insects and a few berries (Ehrlich 1988). Therefore, reductions in the population density of the host species may result in greater numbers of insects.

The starling can be found throughout the watershed. It is not known how this species may interact or compete with other native wildlife species in the watershed.

Records to date have found only one response from a barred owl within the watershed. Due to the fragmented habitat, the barred owl is able to adapt/use these habitats and thus compete for food and space with the spotted owl, and may potentially prey upon the spotted owl.

FISH (Figures 3 and 5)

DAVIS LAKE

In the 1960s the Oregon State Game Commission considered Davis Lake to be one of the best fish producing lakes in the state. For a number of reasons there have been several unsuccessful attempts to maintain a rainbow trout fishery in Davis Lake. Water quantity and quality have been identified as the most probable limiting factors for rainbow trout production. A series of drought years, causing increased lake water temperatures during summer months and drastically reducing the amount of habitat, are directly associated with decreased trout populations. Due to coho salmon and hatchery rainbow trout introductions, the sporazoa parasite *Ceratomyxa shasta* (C.shasta) became saturated in the lake. C.shasta is capable of causing increased mortality to endemic populations of rainbow trout and reduces the probability of reestablishing and maintaining rainbow trout in Davis Lake.

Rainbow trout can become prolific in Davis Lake again, if a series of wet water years occurs that maintains a large amount of habitat year round (up to 4000 acres). When several low water years occur, the rainbow trout population has a tendency to crash. This is due to both a lack of habitat and infestation by C.shasta which is aggravated by high water temperatures and confined space.

The bull trout population in Davis Lake is nonexistent at this time. It is speculated that a combination of factors has prevented the bull trout population from reestablishment. Reasons suspected are:

1. Competition with other fish species for food, space, and spawning habitat
2. Hybridization with brook trout
3. Toxaphene treatment eliminated most fish in this adfluvial population
4. Historic Poaching
5. Parasite *Ceratomyxa shasta*

Chubs flourished after their introduction into Odell and Davis Lakes. ODFW treated Davis Lake and Odell Creek with toxafene in 1959 to reduce or eliminate the chub and whitefish populations.

Large, woody material (LWM), which provides habitat and cover for fish, was removed from the confluence of Odell Creek with Davis Lake to reduce the navigational hazards. Efforts have been made in the last few years to return LWM to this area as well as to Davis Lake itself.

There is a desire by some to retain additional water in Davis Lake to improve the temperature regime for the aquatic biota. Due to the shallow nature of the lake, it heats up each summer, and exceeds the comfort level for the trout. Increasing the late summer lake level would improve the aquatic biota condition.

ODELL LAKE

The primary recreational activity on Odell Lake is fishing for kokanee salmon, however, anglers fish for mackinaw and rainbow trout as well.

Currently all of the native and introduced fish species are self-sustaining, with the possible exception of the bull trout, whose population status is unknown at this time but is considered by ODFW to be extremely depressed. Reasons suspected for the depressed low bull trout population levels are:

1. Angling mortality
2. Competition with other fish species for food, space, and spawning habitat
3. Hybridization with brook trout
4. Limited spawning and rearing habitat in the tributaries of Odell Lake (naturally high % fines in Crystal Creek, and low gravel and LWM levels in Trapper Creek)
5. Partial barriers created at the railroad crossings of the spawning tributaries, limiting access to upstream habitat
6. Historic poaching in tributaries
7. Kokanee superimposing redds on the bull trout redds

The bull trout population at Odell Lake is considered to be the last natural remaining adfluvial population of bull trout in Oregon. Recently, during surveys, only a small number of bull trout adults were captured and released near Odell Creek. Currently, there is insufficient information available to determine a reliable estimate for the bull trout population in Odell Lake and its tributaries, but it is known that the population is extremely small. Because of the severity of the situation, Odell Lake and its tributaries have been closed to fishing for bull trout since 1992. All bull trout must be released unharmed if caught in the lake. Trapper Creek is closed to all fishing.

When the railroad was built along the south shore of the lake, the hydrologic functions of the streams were disrupted. The railroad crossing on Trapper Creek created a fish barrier which eliminated access to a quarter mile of bull trout spawning and rearing habitat (half of the accessible habitat within the creek). The barrier was removed in the summer of 1994.

Crystal Creek was reported in the 1950s to have bull trout spawning and rearing in the lower half mile of the stream, but, in recent history, no bull trout have been found to be using the creek. Ideal spawning gravels in Crystal Creek are lacking, because of the source material in the watershed and the gradient alteration created by the culvert at the railroad. The spawning gravels and the jump and rest pool at the culvert crossing were improved in the summer of 1994.

Currently, the lake outlet of Odell Lake is partially controlled by a low rock weir which maintains that water level at a depth one foot higher than its normal water level. This held over water increases the low flows to Davis Lake in mid to late summer. The net affect on the Davis Lake fishery is negligible, because the increased volume released at that time of the year is insignificant as compared to the volume lost to the holes in the lava. The loss to the lava averages 150 cfs annually, but during mid to late summer the losses exceed the input.

ODELL CREEK

Odell Creek is dominated by riffle habitat, while pool habitat makes up the other significant portion of the stream. The substrates are primarily cobble and the primary pool and side channel forming factor is the abundant supply of large woody material (LWM) in the stream. Rainbow and whitefish are common throughout, but are concentrated in areas where velocity barriers are located. Stream temperatures range from 10-18° C in the summer. Shade from vegetative cover, which is mostly supplied by conifers and mountain alder, averages 35%. LWM is deficient in the lower half mile of Odell Creek, from the East and West Davis Lake Campgrounds to the lake itself. Historically, this material was removed to provide access for anglers from the campgrounds to the lake. In the past few years, restoration efforts have been made to increase the level of LWM in this portion of the creek. The continued supplementation of this segment of the creek with additional LWM would provide additional benefits. This segment of Odell Creek functions as a stream when the water levels in Davis Lake are low, and is considered to be part of Davis Lake during high water periods.

TRAPPER CREEK

Trapper Creek is the only tributary to Odell Lake with a known resident fish population. There is a natural fish barrier located approximately 7/8 mile upstream from the mouth of the creek. Above and below that barrier, brook trout are found. Seasonally, kokanee salmon and bull trout spawn below the barrier. Trapper Creek has approximately four miles of fish-bearing waters.

CRYSTAL CREEK

Crystal Creek is a spring-driven system containing approximately one mile of low gradient fish habitat. Historically, bull trout used Crystal Creek, but today it is used extensively by kokanee salmon during the spawning season. The lower half mile of stream contains excellent rearing habitat for fish, since it is low gradient, has extensive pool formation, and an abundant LWM supply.

HIGH COUNTRY LAKES

Within the Odell Watershed there are fourteen high country lakes that support fish populations. These lakes contain brook trout, char, and a few contain rainbow trout. These fish populations are restocked biennially by ODFW and are utilized by backcountry users. There are 30+ lakes in the backcountry that exceed one acre in size and a substantially larger number that are less than one acre or are intermittent. Most of these water bodies support native aquatic flora and fauna, but some have been altered in various degrees by attempts in the past to establish fish populations.

SOCIAL DOMAIN

HUMAN SETTLEMENTS INFLUENCING THE ODELL WATERSHED

The social context of the Odell Watershed is partially explained by the history of human settlement in and around the watershed. Each community has evolved utilizing different resources within the Odell Watershed primarily due to the differences in time and location of each settlement. Most of the different uses are still valued by the respective communities and are part of their culture. By understanding these uses and the culture of each affected community, the social context of the Odell Watershed can be better understood. Refer to Figures 8 - 11 for information on major transportation routes, recreation trails, campgrounds and other sites, and social context.

The following is a brief history of the various human settlements and their cultures which have influenced the Odell Watershed in some capacity over time. All of these communities continue to influence forest management within the Odell Watershed through various forums with the Forest Service, some of which are identified below.

Native Americans

History - During prehistoric times before the eruption of Mount Mazama (Crater Lake), the Odell Watershed was considered to be a small part of a vast territory shared by several nomadic tribes of Native Americans. A broad boundary located near the present town of Bend, Oregon signified the southern reach of the Warm Springs Tribe and the northern reach of the Klamath Tribe. Other territorial boundaries were designated from mountain top to mountain top and encompassed the associated valleys and water drainages. These people probably hunted, fished, and gathered roots and berries within the Odell Watershed as they traveled toward the Columbia River Gorge. Near the Dalles, they traded their products crafted from the obsidian lava beds near Tulelake, northern California (Coburn 1994).

As the early pioneers migrated to this area during the late 1800s, these vast Native American territories were mapped to inform settlers of their location. Using compasses and straight lines, the mapped boundaries constricted the original physiographic boundaries used by the Native Americans. By 1865 the United States Government had delineated a reservation for the Klamath Tribe south of the Odell Watershed. During 1958-1960, this reservation was sold to the United States Government by the Klamath Tribe for approximately $120,000,000. The area is now designated as part of the Winema and Fremont National Forests (Coburn 1994).

Today - The Klamath Tribe has remained informed and involved with the Deschutes National Forest during forest land and resource management planning. Most of this involvement is formalized through a planning process outlined in the National Environmental Policy Act (NEPA). The Forest currently employs a member of the Klamath Tribe to serve as a liaison between itself and the Warm Springs and Klamath Tribes. Consequently, forest managers are better informed of opportunities to conserve and enhance those forest resources valued by Native Americans.

These resources may include the physical evidence of their ancestors from prehistoric times and a variety of berries, roots, plants, fish, and big game which were traditionally gathered and hunted throughout the Odell Watershed. The Native Americans have concern involves the retention of the integrity of special places such as Odell Lake, Davis Lake, and the high mountain tops, which may have been used as burial and vision quest sites.

Westside of the Cascades

History - In the early 1850s, white settlers explored the Odell Watershed for a potential route through the Cascade Mountains to the Willamette Valley. The route was to be an alternative to the Columbia River section of the Oregon Trail. The first surveyors in the area were William Macy and John Diamond. They climbed the highest peak in the Odell Watershed, 8,744 feet in elevation, and discovered a pass south of where they stood. John Diamond later named this peak "Diamond Peak" for himself (History Papers).

In 1865 another pair of surveyors, Byron J. Pengra and William G. Odell, visited the area. They discovered a large lake, which Pengra named for Odell, and a low mountain pass located near present day Willamette Pass. These early surveying trips led to the construction of the Oregon Central Military Wagon Road which crossed the Cascade summit south of the Odell Watershed (History Papers).

The first automobile to cross the military road occurred in 1911. The car was a 1910 Buick, and the trip took over a month to complete. Roads were soon built to access the east and west ends of Odell Lake with ferry service connecting the two roads. The military road remained the basic transportation route through the area until the Central Pacific Railroad was completed in 1926 (Williams 1983).

This railroad was built parallel to Odell Lake along its southwest side and tunneled under the Cascade Crest. This direct link brought people from the westside of the Cascades to the Odell Watershed for recreation. It also created a route to transport industrial products through the Cascades. By 1927 two railroad stations, two resorts, and several summer homes had been constructed around Odell Lake to accommodate the increased recreational and commercial uses (Williams 1983).

By 1940 the use of automobiles was more popular than riding the train, so State Highway 58 was constructed. The highway was also built parallel to Odell Lake, but along its northeast side. The highway eventually joined State Highway 97, the California-Dalles Highway, several miles south of the Odell Watershed (Williams 1983).

Since then, additional recreation facilities and summer homes have been constructed around Odell Lake. Several utility corridors and road maintenance facilities have been strung along Highway 58, and more and more people have been routed through the Odell Watershed.

Today - Opportunities for recreation within the Odell Watershed remain an important asset to many residents of the Willamette Valley. A majority of the users of campgrounds within the Odell Watershed and owners of summer homes around Odell Lake are permanent residents of the Willamette Valley (Virgin 1994). Most of these users have established a long tradition of recreating within the Odell Watershed. In the last few years, the use of the Odell Watershed for wood products has also increased due to a recent decline in areas available for timber harvesting and fuelwood collection west of the Cascades.

Residents of the Willamette Valley remain involved and informed with current land management decisions that affect their special interests through several forums. The National Environmental Policy Act (NEPA) encourages public involvement in project scoping. Information about potential projects and current forest management decisions are mailed to a variety of people. The majority of people, however, are informed of current issues through westside television and newspaper reports such as the recent article "Dreams of Lake Going Down Drain" about Davis Lake which appeared in the Eugene *Register Guard* (Register Guard 1994).

Many special interest groups such as sport clubs and homeowner associations are comprised of Willamette Valley residents. These associations have been involved with the Forest Service to promote their special interests within the Odell Watershed. For example, mountain bike clubs have worked with the Deschutes and Willamette National Forests to increase mountain biking opportunities in the area. Other special interest groups lobby for fishing, snowmobiling, nordic skiing, wildlife watching, and windsurfing within the watershed.

Rural Recreation and Residential Communities (USDA Forest Service 1990a)

History - Since the Odell Watershed area attracts a high volume of recreational use, service-oriented communities have established themselves around the area. The closest community of this type is Crescent Lake Junction which is located less than a mile from the watershed boundary. This small business community has grown along both sides of State Highway 58 near the junction with the 60 Road which accesses Crescent Lake.

In addition to being informed and involved through the NEPA planning process, Crescent Lake Junction has developed a business type relationship with the Forest Service. Forest managers actively participate in monthly meetings of the Oregon Cascade Recreation Association which is the chartered community association. These meetings provide frequent opportunities to discuss the management of resources that provide an economic base for the community. These resources include a diversity of quality recreational opportunities, permitted special uses, commercial mushroom collecting, facilities, roaded access, infrastructure, law enforcement, and scenic quality.

Currently, this community is working in partnership with the Deschutes National Forest and the Klamath County Economic Development Association to develop a Community Action Plan. This plan will help guide the expansion of the community within its recreational and environmental capacity by developing an integrated vision for the community's future and its use of the resources within the Odell Watershed.

This vision has helped the community to identify appropriate recreation and infrastructure improvement opportunities including a new sno-park, trails, emergency services, sewer, water, and transportation needs. The plan has developed a short and long list of potential projects to move the community toward this new vision for the future (Community Action Team 1994).

Another community that utilizes the Odell Watershed as a recreational resource is LaPine which is located 17 miles north of Crescent, Oregon on Highway 97. LaPine is a residential community that accommodates people who enjoy the rural lifestyle and convenient access to the Deschutes National Forest and its numerous amenities.

Members of the community are involved with forest management planning through the NEPA process and special interest groups. The diversity of recreational opportunities and quality of scenery are their primary interests within the Odell Watershed. This community is not directly dependent on the use of resources within the Odell Watershed for its ecomomic stability as is the community of Crescent Lake Junction.

Rural Industrial Communities (USDA Forest Service 1990a)

History - As the timber industry grew throughout the Pacific Northwest, timber industrial communities were established on the eastside of the Cascade Mountains. In 1938 the Gilchrist mill was constructed approximately 12 miles from the Odell Watershed. This operation established the community of Gilchrist and provided a new economic base for the community of Crescent, Oregon located just one mile south of Gilchrist on Highway 97 (History Papers).

Prior to the Gilchrist mill, Crescent's economy was based on servicing traffic which used the California-Dalles Highway (97) and the railroad which passed through town. Since the headquarters for the Paulina National Forest was located at Crescent in 1906, the Forest Service has also provided employment opportunities in the area. (History Papers).

The Odell Watershed has historically been considered as an extended "backyard" for residents of Crescent and Gilchrist. In the past, few visitors utilized the area outside of the Odell Lake-Willamette Pass area, so the remainder of the watershed was essentially theirs for hunting, fishing, mushroom collecting, and fuelwood

gathering. These activities were done for enjoyment as well as for subsistence. Timber was also readily available to support the local industry (USDA Forest Service 1990a).

Today - Many of the local uses such as hunting and mushroom collecting have been displaced by either new management policy or the influx of new users. As human use increases and diversifies within the Odell Watershed, the historic backyard for Gilchrist and Crescent are decreasing in size. It is a scenario similar to the one that faced Native Americans.

The communities are now forced to share the Odell Watershed with a variety of users with diverse values and needs such as commercial mushroom pickers and travelers of the Cascade Lakes Scenic Byway. Meanwhile, national issues surrounding the conservation of wildlife and riparian habitats have also changed the historic use of the watershed for timber and recreation by imposing new management strategies.

Currently, residents of Crescent and Gilchrist involve themselves in forest management planning through the NEPA process and special interest groups. Their concerns primarily reflect their declining freedom to utilize the area as they have grown accustom to using it. During the summer of 1994, the community began preparations to charter an association similar to the Oregon Cascade Recreation Association with guidance from the Forest Service. This group may provide a forum for addressing issues and developing a unified vision for the community's future including its future relationship with the Odell Watershed.

Central Oregon Urban Center (USDA Forest Service 1990a)

Bend, Oregon originated as a rural industrial community similar to Gilchrist, but has since grown into the urban center of Central Oregon. Located about 45 miles north of Gilchrist and Crescent, Bend has attracted a population of over 25,000 people with diverse backgrounds and values. In 1994 the local saw mill was sold, and is currently being modified into a riverfront development that combines both commercial and residential use (Bulletin 1994). Bend's economy is growing toward light industry, large retail franchises, and service-oriented businesses such as resorts and restaurants.

In contrast to rural industrial communities, the high quality scenery and recreational opportunities within the Odell Watershed are the highest valued resources. The quality of life that this environment provides has attracted people to Bend from urban places all across the United States.

Recently, on "Eye on America," a national television news magazine, Bend was highlighted as a destination for people that have given up high paying urban jobs to find a better living environment and quality lifestyle. To these people, the quality of life that Central Oregon provides is more valuable than a secure income. The area is also popular for people who have earned a comfortable living and can now move to an area where they desire to live (Video 1994).

In addition to routine NEPA involvement, local newspapers and television stations keep the Bend area informed of management issues that may concern them and their lifestyle in Central Oregon. In context to the entire Deschutes National Forest, the Odell Watershed receives less attention and use from Bend residents than the Three Sisters area which is in Bend's backyard. Issues such as commercial mushroom harvesting and the natural draining of Davis Lake are of interest to the Bend residents and have been highlighted by local newspapers, radio, and television (Bulletin 1994).

Transient Commercial Mushroom Pickers

Since 1988 commercial harvesting of the matsutake mushrooms in this area has increased exponentially. It has been a gold rush type phenomenon as mushroom collection has evolved from a subsistence, recreational, or educational activity to a multimillion-dollar industry (Molina 1992). This increase is primarily attributed to the influx of Southeast Asians who roam the Pacific Northwest for commercial mushrooms.

Southeast Asians have found that mushrooms in the Pacific Northwest are similar to those in their homeland. They can pick them within the Odell Watershed and sell them to buyers at Crescent Lake Junction without having to speak fluent English or own much more than a car for transportation (Molina 1992). The majority of pickers within the Odell Watershed are transient, and are only in the area during the regulated fall mushroom season. Most of the pickers stay in designated industrial campsites. Only one industrial site is located within the watershed.

Concerns about managing this growing commercial use has led to the initiation of a planning effort involving the Deschutes, Winema, Umpqua, and Willamette National Forests. Most of the use is concentrated on the Crescent District of the Deschutes, and the Chemult District of the Winema National Forest. An Environmental Assessment is currently being prepared with appropriate public involvement to address the social and biological effects of continued commercial mushroom harvesting in the area (Bisbee 1994).

USDA Forest Service

Judge John Breckenridge Waldo from Eugene was one of the first Willamette Valley settlers to visit the Odell Watershed for recreation. Beginning in 1872, Judge Waldo and several friends spent their summers exploring the area in and around the Odell Watershed. The group would often camp and fish at Odell Lake and then follow Odell Creek from the lake's outlet for seven miles to rediscover Davis Lake (Williams 1985).

From these visits, Waldo developed a great appreciation for the beauty and wildness of the Odell Watershed. Inspired, he pleaded to Congress in 1889 that this area be designated as part of the National Forest Reserves. Due in part to Judge Waldo's efforts, President Grover Cleveland withdrew this land from the Public Domain on September 28, 1893 (History Papers).

Since that time, the Forest Service has managed the watershed for the use and benefit of all American citizens. This means that the Odell Watershed has standards for management that not only reflect the values of Oregonians and residents of the Pacific Northwest, but also the values of all Americans including Tennesseans. Most of these values are articulated in environmental policy such as the Clean Water Act, Wilderness Act, National Environmental Policy Act, and the Endangered Species Act.

On April 13, 1994 a *Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl* (ROD) was signed to amend the current Deschutes National Forest Land and Resource Management Plan 1990 (LRMP). This is the most recent change in forest management direction, and it will affect the use of the Odell Watershed by all communities mentioned thus far.

HISTORY OF FOREST SERVICE MANAGEMENT WITHIN THE ODELL WATERSHED

The history of Forest Service management within the Odell Watershed aids in documenting how humans have influenced this landscape since the late 1800s and the reasoning behind their actions. Most of the reasons are related to the unique physiographic features and the inherent ecological processes within the Odell Watershed that have influenced people's desire and ability to utilize the various resources throughout time.

Moreover, this historical overview nurtures an important perspective, that there have been many land managers deciding the fate of the Odell Watershed prior to today, and the greatest number of people who will be affected by today's decisions have yet to be born.

Odell Lake-Willamette Pass

The historical management of the Odell Lake and Willamette Pass area has centered around transportation routes through the Cascades (refer to the previous "Human Settlement" section for a description), accommodating recreational use, and the fishery at Odell Lake. The following poem which is presumed to be written by Cy Bingham, a Ranger during the early 1900s, describes Odell Lake:

> "In this grand old State in which we dwell,
> There's a spot called Lake Odell,
> No prettier lake, was ever seen,
> Where the hunters killed the spotted fawn,
> And speared the dollys as the spawned." (History Papers).

In the early 1900s, a fish hatchery was established at Odell Creek near the Odell Lake outlet. Non-native fish were soon introduced to the lake and the populations thrived. Currently, the Oregon Department of Fish and Wildlife maintains a large fishery including kokanee salmon and lake trout. Odell Lake, with an average depth of 282 feet, is now considered to be one of the best deep water, recreational fisheries in the state of Oregon.

Recreational use of the area evolved along with transportation. During the 1920s resorts and summer homes were built around Odell Lake to accommodate anglers and overnight users. Today, there are sixty-six summer homes concentrated along the northeastern and northwestern shores of the lake and several campgrounds and boat ramps.

In 1939 the Willamette Pass Ski Area was developed adjacent to Odell Lake as the first operating ski area in the central Cascades. Only the Timberline Lodge on Mt. Hood has a longer operating history in the state of Oregon (Dept. of Planning 1984). This ski development initiated the establishment of Willamette Pass as a winter destination area.

In 1974 a snowmobile racetrack was built at the southern boundary of the Odell Watershed immediately north of the Crescent Lake Airstrip. The permit for the racetrack was the first issued for this type of use in Region 6. The track area, which originally operated as a solid waste disposal site for upper Klamath County, is no longer used for racing (History Papers). In 1984 the ski lodge at Willamette Pass Ski Area was constructed. Since then, accommodations for other winter activities including cross-country skiing have also been developed throughout the area.

The 1990 Deschutes National Forest Land and Resource Management Plan (LRMP) allocates the majority of the Odell Lake-Willamette Pass area for intensive summer and winter recreational use. The goal of this allocation is to provide a wide variety of quality outdoor recreation opportunities in a forested environment that range from modified to undeveloped (Figure 7).

Wildlife emphasis in this area is focused on habitat improvements for watchable wildlife and maintaining or improving fish habitat. Two areas located around Odell Lake provide the necessary habitat for wildlife species such as the northern spotted owl and bald eagle and are designated specifically to conserve the integrity of that habitat. Within these small areas, human use is to remain subordinate to wildlife needs.

For fisheries, Trapper and Crystal Creeks and area around near their inlet to Odell Lake, provide the most critical habitat for fish spawning and rearing. The bull trout, which historically utilized these areas to spawn and rear, is now a category 1, candidate species for listing as a federally threatened or endangered species. This may effect future management of the non-native fishery, which includes, kokanee salmon and recreational use of Trapper Creek riparian area. Currently, all bull trout must be released if caught by anglers.

In 1994 the Record of Decision (ROD) amended the LRMP and designated this area to three allocations: Administratively Withdrawn Areas, Late-Successional Reserves, and Riparian Reserves. This amendment shifts the priority in this area from providing recreational use sites in riparian areas to their protection from degradation (Figure 2).

High Cascades

The rugged, glaciated terrain of the High Cascades including Diamond Peak, Mount Yoran, and Maiden Peak discouraged roading during the late 1800s. Instead, routes were established at present day Willamette Pass which is lower in elevation. In the 1930s, the Oregon Skyline Trail was blazed along the Cascade Crest crossing the base of Diamond Peak over Willamette Pass and past Maiden Peak (History Papers).

The value of the wilderness experience that could be obtained from this trail was widely recognized. This section of trail grew in popularity and uniqueness as other areas in the Cascade Mountains were soon roaded. In 1957 the USDA Forest Service established the Diamond Peak Wilderness which was eventually added to the National Wilderness Preservation System in 1965. In 1968, the Oregon Skyline Trail became part of the Pacific Crest National Scenic Trail. (History Papers).

These acts of legislation prevented the continuation of development in the Willamette Pass area for winter recreation including the denial of building permits for two additional ski resorts. The first proposal was for a Diamond Peak resort in the 1940s. This development was envisioned to be larger than the Timberline Lodge on Mount Hood (History Display). The second proposal was made in 1970 to develop Maiden Peak for downhill skiing with a base area located near Bobby Lake (USDA Forest Service 1970).

The LRMP allocates the area south of Willamette Pass as the Diamond Peak Wilderness. The ROD classified this area as Congressionally Withdrawn which does not change current management direction. Likewise, the area to the north, which is allocated as Dispersed Recreation in the Forest Plan, is now allocated to Administratively Withdrawn (Figures 2 and 7).

Stratovolcanoes

Stratovolcanoes and other similar volcanic features within the Odell Watershed include the following landmarks: Davis, Royce, and Maklaks Mountains, and Hamner, Ranger, and McCool Buttes. These volcanic features were not glaciated into scenic monuments like Diamond Peak and Mount Yoran, but are mostly vegetated, conical in shape, and stand alone as prominent landmarks (Figure 4). This conical shape and high vegetative productivity have influenced their history of human use.

Forest Service managers first utilized the vistas afforded by the conical landmarks by building two fire lookouts within the watershed. The first was built on Maiden Peak in 1923, was abandoned in 1942, and burned in 1955. Later, a lookout was built atop Davis Mountain which was destroyed in the 1970s. In 1971, the first official helispot on the Crescent Ranger District was built on Hamner Butte. Historical maps indicate that a majority of the Odell Watershed was accessible within several hours by foot from these lookouts, which probably kept historically frequent ground fires within the watershed suppressed to a minimal size (History Papers).

The stratovolcanoes have also served as a source for valuable timber. The combination of having highly productive growing sites for mixed conifers and ease of accessibility created feasible timber operations. Today, a majority of the stratovolcanoes are roaded with low maintenance level roads (native surface) and have been logged in some capacity.

The LRMP has allocated these volcanic features for various uses. Because of their high visibility from the Cascade Lakes Scenic Byway and recreation sites, most of them have been allocated to Scenic Views. Other visible areas have been designated as northern spotted owl habitat. Both of these management

areas emphasize the conservation of large trees to benefit either scenery or wildlife habitats. Consequently, in areas of past timber harvesting, more large trees have been retained in these management areas versus those allocated to General Forest which emphasizes timber production while providing for other uses such as commercial mushroom collection and hunting (Figure 7).

The ROD amended the LRMP and designates a majority of the stratovolcanoes to Late-Successional Reserves which greatly changes management direction within General Forest from timber production to managing for the retention and growth of large trees. The ROD has also allocated part of this area as Matrix which defers to the current Forest Plan for management standards and guidelines (Figure 2).

LaPine Basin

The flat area between the high Cascade Crest and the stratovolcanoes is considered part of the LaPine Basin. Lodgepole pine is the dominant tree type in the basin due to the low productivity of pumice and ash which cover the area up to a meter in depth. This pumice and ash deposition resulted from the eruption of Mount Mazama (Crater Lake). Because of the low commercial value of lodgepole pine and limited recreational opportunities in the basin, the Forest Service did not manage this area for any particular use until the 1960s.

At that time, a mountain pine beetle epidemic caused a large component of the lodgepole pine to die. The timber industry created a market for the dead and dying lodgepole, which resulted in a majority of it being salvage harvested. The accessible dead and dying lodgepole was also used for commercial and personal firewood.

The LRMP allocates most of the LaPine Basin to General Forest which emphasizes timber production and some additional uses. The ROD amends this allocation to Late-Successional Reserve which allows for fuelwood collection and salvage operations if those activities are intended to prevent effects on late-successional habitat, while permitting some commercial wood volume removal (Figures 2 and 7).

Odell Creek

Odell Creek begins at the outlet of Odell Lake and flows approximately seven miles to the inlet of Davis Lake. Throughout history, people, fish, and wildlife have used this riparian corridor to travel between the two lakes. From its outlet at Odell Lake east to McCool Butte, the glacial moraine which created Odell Lake also created a wide riparian area with a perched water table. The resulting marshy area has discouraged roading and development.

The historic road to Davis Lake, one of the few roads in this area, is a good example of a route which has avoided this wet area. The road was routed from State Highway 58 near the crossing of Odell Creek to north above the creek along the base of Maklaks Mountain. This route was considered as an alternative route for the Cascade Lakes Scenic Byway but was not selected for various reasons, including safety and avoiding riparian disturbance. The existing route along the base of Hamner Butte was selected for the byway instead (Putman 1994).

Under the LRMP the interior of this area was designated as Old Growth surrounded by General Forest. Timber harvesting in this area has been minimal due to the low value of lodgepole pine the wetlands. The ROD designates this area as Late-Successional and Riparian Reserve which varies from the management objectives set for General Forest, but does not differ from the historic "on-the-ground" management of this area (Figures 2 and 7).

From the east of McCool Butte to Davis Lake, the soil is more porous and the riparian area is limited to the stream channel. This area is more conducive to roading, and a road currently parallels Odell Creek. The LRMP manages this lodgepole area as General Forest. Salvage and firewood operations have removed

most of the dead and dying lodgepole in this area. As stated above, the ROD designates the entire Odell Creek area as Late-Successional and Riparian Reserves. These designations will affect salvaging and fuelwood activities and possibly dispersed recreation opportunities in this eastern section of Odell Creek.

Davis Lake

Nearly 5,500 years ago, a lava flow blocked Odell Creek and flooded approximately 3,000 acres of the LaPine Basin, thereby creating Davis Lake which has a maximum depth of 10 feet. At certain times of the year the porous nature of the lava flow allows water to drain from Davis Lake at a greater rate than Odell Creek and other water sources can replenish. Consequently, the water surface of Davis Lake can fluctuate between 40 and 3,000 acres. This natural process has greatly influenced the use and management of the lake for agriculture, recreation, and wildlife.

During low water years, the Davis Lake area appears as a large prairie. In the late 1800s and early 1900s, several settlers attempted to homestead the area under the Homestead Act of June 11, 1906. To homestead the area, the government had to be convinced that the land was suitable for agriculture. Several arguments were made supporting the area for agriculture during low water years, but testimony of high water years made the idea of homesteading questionable (Settlement Papers 1908-1915).

Finally, the Secretary of Agriculture requested a formal examination of the Davis Lake area. It was named the Davis Lake Classification Project, and on September 11, 1914, the Secretary of Agriculture issued the following statement:

> "It is my opinion after a complete review of the evidence, that this land has no positive value for agriculture, that it is needed for the use, utilization, protection, administration and enjoyment by the public of the resources of the surrounding forest area, and that the only higher use to which it might be put would be water storage purposes, which is also a proper National Forest use of land" (Settlement Papers 1908-1915).

Consequently, the area was never officially homesteaded, but grazing was permitted in the area. Judge John Breckenridge Waldo noted in his diary on August 14, 1888:

> "...We have fared well at Davis Lake, but a band of sheep have been about the Lake since before we came, and have taken much of the charm from the place. For taking the aroma out of the wilderness this animal can hardly be excelled by a company of 'business' men or clodhoppers" (Williams 1985).

The Stearn Cattle Company received a grazing permit for the Davis Lake area after Crane Prairie reservoir was flooded. Permitted grazing continued in the area until the early 1970s when it was phased out due to increased conflicts with recreational and wildlife needs. These needs were identified as part of the Charlton-Davis Lake Land Use Study which was conducted in the late 1960s when the lake's water level was high (History Papers).

During high water years, populations of fish and wildlife flourish at Davis Lake, and human use increases due to the prime hunting and fishing opportunities. The desire to maintain these opportunities has led to several attempts to artificially retain water in Davis Lake. In the 1940s there were unsuccessful attempts to plug noticeable holes in the lava. Attempts were again repeated between 1966-1967. Fishery improvements were also attempted throughout the years, including the introduction of non-native fish and the poisoning of chubs (History Papers).

During low water years, the use of Davis Lake by fish and anglers drops considerably, but high densities of wildlife and waterfowl continue to use the area. This resource has attracted people who enjoy watching wildlife, especially the impressive variety of migratory birds. This use was emphasized in the current LRMP

where a majority of the area was allocated to conserve bald eagle habitat along the lakeshore. Another allocation includes proposed Special Interest Areas to preserve and provide areas of unique geological, biological, and cultural features for recreation, research, and educational opportunities (Figure 7).

Only two sites located near the Odell Creek inlet were designated for intensive recreation. The other campground located near the lava flow has retained its undeveloped character. In the 1970s, there were plans to develop this campground, however, the plans were abandoned during the proceeding low water years which lowered the recreational demand (Vroman 1994). In 1994 the Lava Flow Campground was temporarily closed due to a pair of nesting bald eagles. This action illustrates the emphasis on wildlife management at Davis Lake in contrast to Odell Lake and several lakes along the Cascade Lakes Scenic Byway which are managed almost entirely for intensive recreation.

The Record of Decision amends the LRMP allocations to include Administratively Withdrawn Areas, Late-Successional Reserve, and Riparian Reserves. This amendment will further shift the priority from providing recreation in the riparian areas to protecting their integrity for fish and wildlife habitat (Figure 2).

ACCESS AND TRAVEL

Odell Lake-Willamette Pass

The earliest roads in the Odell Watershed were built in the Odell Lake and Willamette Pass area to provide access to the southern Willamette Valley through the High Cascades (refer to "Human Settlement" section for additional history). Since the construction of State Highway 58 and the Southern Pacific Railroad, roading has been limited to providing the necessary access to facilities. The roads are kept at a high maintenance level and receive heavy commercial and interstate traffic (Figure 8).

High Cascades

Because of the rugged terrain of the High Cascades and the early establishment of travel routes at Willamette Pass, no roads have been built in the High Cascades within the Odell Watershed. Access is limited to foot and horseback within the Diamond Peak Wilderness. The adjacent dispersed recreation area north of Willamette Pass, does allow bicycle and motorized winter use such as snowmobiles on designated trails only.

State Highway 58 provides access to the Willamette Pass-Pacific Crest Trailhead which spans both the Diamond Peak Wilderness and the dispersed recreation area (Figure 8). From Highway 58, roads around Odell Lake access trailheads to Yoran and other high cascade lakes. The Waldo Lake Road (#5897) which spurs off of Highway 58 on the west side of the Cascade Crest, provides roaded access parallel to the Cascade Crest on the backside of Maiden Peak. This road is paved to Waldo Lake and turns to native surface near Charlton Lake.

From Charlton Lake, the 5897 Road connects to the Cascade Lakes Scenic Byway at the 42 Road junction north of the Odell Watershed. The low maintenance of this section of road has discouraged through traffic from the Cascade Lakes Highway. If the level of maintenance is improved to accommodate standard cars, the use of this road and the undeveloped recreation area would greatly increase by residents of Central Oregon and the Willamette Valley.

Stratovolcanoes

The majority of the existing roads on the stratovolcanoes are associated with timber harvesting. The conical shape of these mountains and buttes were historically more conducive to roading than the High Cascades.

A single road could either be spiraled to the top or switch back up one side, from there, timber harvest equipment developed a network of skid roads and corridors which facilitated the removal of the timber.

Most of these roads were constructed with a native surface and receive low maintenance (Figure 17). Many have been closed either by road barricades, natural revegetation, or obliteration. These roads are still used by hunters, mushroom collectors, and curious drivers. The area is currently open to all motorized use, but this may change due to the recent Late-Successional Reserve designation in the ROD (USDA Forest Service 1994).

LaPine Basin

Most of the LaPine Basin was roaded within the last 30 years to access the dead and dying lodgepole for salvage. The flat topography of the basin has allowed people to travel basically wherever they desire. This includes fuelwood collectors, timber harvest equipment, hunters, OHV operators, and mushroom pickers. The area is currently designated for open motorized use, but may change due to its recent designation as Late-Successional Reserve in the ROD (USDA Forest Service 1994).

Odell Creek

The western half of Odell Creek from Odell Lake to McCool Butte has minimal roading (refer to the previous "Forest Service Management" section for more information). Most traffic, including recreation trails, is routed south around McCool Butte and away from this sensitive riparian area. The road near the Maklaks Creek inlet is identified as a mountain bike route, and is the only route in this area designated for recreational use. (Figure 10)

An underpass for Highway 58 is proposed in this area for snowmobile traffic. If constructed, this may attract other users through the west Odell Creek area such as horseback and bike riders who want to cross Highway 58. These trails will need to be routed similar to the existing snowmobile route which crosses a bridge near McCool Butte and goes around the sensitive riparian area.

The remainder of Odell Creek, east of McCool Butte toward Davis Lake, is more accessible by road. The 600 road was built parallel to the creek which has encouraged some dispersed camping along the creek. Some of the sites have an excessive amount of entry routes which have been created over the years.

Davis Lake

Historically, access around Davis Lake was much closer to the lakeshore. People can remember many times when the historic road to Davis Lake from Highway 58 was flooded along the western lakeshore (Putman 1994). This road is no longer used by vehicles, but some people do use it as a trail. The 4660 Road now provides access nearly a half mile from the lakeshore.

Access along the eastern lakeshore used to be confined to the 850 and 855 Roads which were once part of the Cascade Lakes Scenic Byway, however, the byway was reconstructed and moved above the lakeshore about a half mile. Today, an intersection on the byway leads travelers to the 850 and 855 Roads to access Lava Flow Campground and East and West Davis Campgrounds. These roads pass through critical habitat for the bald eagle and prompt people to create their own routes to the lakeshore. Consequently, several alternatives to access Davis Lake have been discussed and planned over the years. Rock barriers were placed along the 850 and 855 Roads in 1994 to limit direct access to Davis Lake.

SCENERY

Odell Lake-Willamette Pass

The Odell Lake-Willamette Pass area has maintained most of its natural scenic character which includes a foreground dominated by large trees and picturesque scenes of Odell Lake with snow-capped Diamond Peak in the background. The uniform texture of the mixed conifers in the middleground has been modified in localized areas such as the Willamette Pass Ski area which is viewed from the southwestern lakeshore. Other areas of modification include gravel pits and highway widening.

Scenic management within this area has emphasized the retention of the large tree dominated forest and blending developments into the High Cascades setting. Most of the recreation sites have been developed with large logs and steeply pitched roofs which are commonly associated with structures built during the CCC era.

The high visibility of this area has prevented active vegetation management including timber harvest and understory thinnings. Consequently, an understory of white and grand fir has been established under the large tree overstory. This may later threaten the health of the desired large tree dominated forest and understory vegetation including huckleberry, willow, and other shrubs.

High Cascades

The natural scenic character within the High Cascade Crest has been retained throughout the years. Management for wilderness and dispersed recreation has maintained and protected its natural scenic character. Even the suppression of wildfire has not significantly affected the character of this forest. Only root rot pockets larger than 40 acres are noticeable on the landscape. These pockets provide visual variety in an otherwise uniformly textured forest.

This area is highly visible from distances ranging from a 1/2 - 10 miles from Highway 58, the Cascade Lakes Scenic Byway, and several recreation sites including Davis Lake. The area is is most closely viewed from the Pacific Crest Trail and several other high mountain trails (Figure 10).

Stratovolcanoes

Timber harvest activities have caused the greatest impact to scenic quality within the Odell Watershed on the stratovolcanoes. Most of these visible volcanic landmarks have partially retained their inherent scenic characteristics when viewed as middle and background or at a distance greater than a half mile. Some of the past regeneration harvest units including clearcuts, however, appear as geometric, unnatural openings. Royce, Maklaks, Davis, and Hamner Mountains display the most recent modifications. Other buttes such as Ranger and McCool are mostly impacted by visible roads and skyline corridors.

The Cascade Lakes Scenic Byway, which is routed along the base of Davis Mountain and Hamner Butte, provides travelers with the closest view of vegetative diversity growing on the stratovolcanoes. Over the years, timber harvest activities have reduced the amount of large ponderosa pine and fir trees, which historically dominated this foreground view, to the point that large trees are now considered to be unique scenic features. Currently, these views are dominated by pole-sized trees and the remaining large trees are screened behind thickets of lodgepole pine which have invaded the disturbed highway right-of-ways.

LaPine Basin

Most of the LaPine Basin cannot be viewed from travel routes within the Odell Watershed, however, a view from the top of any of the high mountains and buttes reveals a patchwork of clearcuts. A majority of

the lodgepole stands were salvage harvested within the last 30 years with some form of clearcut to help control the mountain pine beetle epidemic.

From a foreground view or within a half mile, the flat topography limits scenic views. Along a single road a visitor may see one or all of the following: a foreground dominated by a thickets of young lodgepole pine, a 40 acre clearing dominated by lodgepole seedlings with views of the surrounding mountains, a decadent lodgepole forest with large amounts of standing and fallen dead trees, or areas where firewood collection has left a green forest with tire tracks throughout. Scenic management of the area has been challenging due to its susceptibility to insect epidemics and the consequent mortality.

The most scenic vegetation in the LaPine Basin within the Odell Watershed is along the forested lavas where old, large ponderosa pines are elevated on the lava ridges. Currently, no designated trails or recreational use occur in this area.

Odell Creek

The riparian area surrounding Odell Creek, especially west of McCool Butte, creates a unique scenic character within the Odell Watershed. This corridor includes a variety of riparian shrubs, spruce trees, and meadows with an abundance of wildflowers. Modifications to the scenery have only occurred in localized areas where timber has been harvested within 50 feet of the creek. Dispersed campsites along the creek have changed the character in areas only where excessive access routes have been created by users. The area is highly resilient and can restore itself if given adequate protection from use.

Davis Lake

The unique scenic character around Davis Lake has been retained over the years. The lakeshore is still dominated by large open park-like stands of ponderosa pine. Areas of lodgepole appear natural with large amounts of standing and fallen dead trees. Historically, willows may have been more noticeable on the landscape before grazing. Several hundred native willows were planted in 1994 as a restoration effort.

Recreation facilities around the lake appear subordinate to the surrounding landscape. Of all the developed campgrounds, Lava Flow Campground is the most primitive in appearance with an entry road and campsites situated among large ponderosa pines. In some areas an understory of grand fir has become established, and endemic insect and disease infestations are evident, both factors may threaten the longevity of the big pines.

East and West Davis Lake Campgrounds are situated in areas dominated by lodgepole pine. The mountain pine beetles have caused tree mortality in the area resulting in the removal of numerous hazard trees. Ponderosa pine seedlings were planted in 1994 throughout the campgrounds.

The water level fluctuation of Davis Lake also changes the scenic character of the area from a wide open space, which a person can wander through by foot, to a large lake reflecting the adjacent land features and sky. During low water years there are usually tire tracks throughout the exposed lake bottom which detracts from the natural scenic quality.

RECREATION

Odell Lake-Willamette Pass

The Odell Lake-Willamette Pass area provides a unique setting for recreation within a larger context. Odell Lake is situated in a recreation area that spans from Oakridge, Oregon located 37 miles west of Willamette

Pass to Crescent Lake located 4 miles southwest of Crescent Lake Junction. Within this area a large spectrum of outdoor experiences are possible (Figure 9).

Waldo Lake, a large, high elevation lake, provides recreationists with an environment that is primarily undeveloped where people can canoe, hike, and bike in a quiet, serene setting. On the other end of the spectrum, Crescent Lake is warm enough to attract water skiers, jet skiers, and swimmers. During the summer, this lake is active with motorized watercraft, and the beaches are shared by several groups of recreationists.

Odell Lake provides a recreational experience somewhere between Waldo and Crescent Lakes. The cold, deep water and strong winds discourage swimming and water skiing. The excellent fishery attracts motorized boating, but boaters usually limit their motor use to travel between fishing spots. This creates an outdoor setting that is scenic and somewhat quiet.

A range of facilities around the lake add to this outdoor experience. Anglers or other visitors can stay in summer homes, developed campgrounds, lodges, and nearby accommodations in Crescent Lake Junction. There are also campgrounds accessible only by boat which offer a unique outdoor experience not available at lakes that provide access around their entire perimeter.

The Willamette Pass-Odell Lake area also provides opportunities for recreation during the winter. A combination of consistent snowfall and the winter maintenance of Highway 58 invites winter recreational use to this area. A full range of experiences are possible ranging from day and night downhill skiing to groomed and ungroomed cross-country skiing. The Willamette Pass Ski Area and the East Odell Lake Lodge rent equipment and groom a variety of ski trails. Recreational snowmobiling is minimal around Odell Lake which enhances the quiet, winter setting for nordic skiers.

The Odell Lake-Willamette Pass area is a highly solicited area for summer and winter recreation. Within a larger context, it illustrates a balanced spectrum of outdoor experiences ranging from primitive to developed settings. The continued increase of use within this area highlights an opportunity to expand and develop new facilities to accommodate the influx of visitors. Although the area can physically support more activities, people, and development, the spectrum of outdoor experiences can quickly become imbalanced which eliminates the opportunities for undeveloped, quiet recreation and habitat for a variety of wildlife species.

High Cascades

The High Cascades within the Odell Watershed provide recreationists with a convenient, but pristine environment to enjoy solitude and wildness. From State Highway 58 and the Waldo Lake Road, high alpine lakes such as Yoran and Rosary Lakes are accessible by hiking only a few miles. From the Waldo Lake Road, most trails are flat or downhill which is attractive to hikers and bikers that want a high elevation or downhill experience without much uphill effort. Because of this convenient access, the use of these areas will probably increase as visitor traffic rises and populations grow. As use increases, the opportunities for solitude and a pristine setting will decrease.

The Pacific Crest Trail (PCT) is also routed through this part of the Odell Watershed and is designated as a national scenic trail. This trail affords the opportunity to hike from the Mexican to Canadian borders in a mostly undeveloped, wild environment which is very unique and rare within the United States. Currently, Highway 58 is the only major development within the Odell Watershed that cannot be avoided by PCT hikers (Figures 8 and 10).

Stratovolcanoes

Most of the stratovolcanoes are enjoyed by recreationists from a distance. These volcanic landmarks are scenic features in the landscape as viewed from various trails, lakes, campgrounds, and the Cascade

Lakes Scenic Byway. There is only one designated recreational trail on these buttes, a snowmobile route on Royce Mountain. There are many low maintenance roads that provide rough access for curious back road drivers, hunters, campers, and commercial mushroom pickers.

LaPine Basin

The flat, vegetated area within the LaPine Basin is not heavily used for recreation. Most users pass through the area on trails which extend far outside the Odell Watershed such as the Border-to-border snowmobile trail, Metolius-Windigo horse trail, and mountain bike trails. Most of these trails use existing roads which are also used by hunters and mushroom collectors (Figure 10).

There are a few trailheads for hikers, but none of them specifically accommodate winter or horse use. Currently, there is a need to officially designate the southern section of the Metolius-Windigo horse trail through this area and assess the need for horse camp facilities.

Odell Creek

The recreational use of Odell Creek is minimal compared to other creeks in the vicinity of the Odell Watershed. Dispersed hunting, fishing, and camping occur at a few spots along the creek where roaded access is provided. Most of these users are repeat visitors with a tradition of using Odell Creek for recreation. Other creeks such as Crescent Creek which is a Wild and Scenic River may provide a better setting for creek-side hiking and more convenient access. Refer to the previous section on "Access" for recreation trails in this area.

Davis Lake

The recreational setting of Davis Lake changes with the fluctuating water level. The area accommodates different recreational uses and users during high versus low water years. During high water years Davis Lake is shared by a variety of users including fly fishermen, low speed boaters, canoeists, campers, and wildlife watchers. During low water years, use of the area by anglers, campers, and boaters declines.

This natural fluctuation of human use has helped maintain the area's undeveloped, wild condition. The low water/low use years, have allowed the campgrounds, riparian areas, and wildlife that were disturbed during the high water/high use years to restore themselves. If projects for facilities were demanded in high water years, the demand faded during low water years. Consequently, developments rarely were completed including Lava Flow Campground which still provides dispersed camping opportunities.

The use of Davis Lake will probably increase over the years, even if the water level does not return to a high level. This is due to the designation of the Cascade Lakes Scenic Byway. Tentatively, three areas around Davis Lake are proposed as stopping points along the byway including the lava flow, East Davis Lake campground (for day use), and a viewing area at the entrance road. If these stops are implemented, use of the lake area will greatly increase (Simpson 1994).

The 62 Road also directly links the Crescent/Gilchrist area to Davis Lake. Currently, three miles of this road are not paved, if this link is ever improved or solicited, the use of Davis Lake would increase substantially. As more and more use occurs at Davis Lake, the need for more development will emerge and threaten the existing undeveloped character of this lake which is unique to the southern portion of the Cascade Lakes Scenic Byway (Figure 8).

COMMERCIAL USES AND COMMODITIES

Odell Lake-Willamette Pass

Commercial use of the Odell Lake-Willamette Pass area is centered around State Highway 58, the Southern Pacific Railroad, and the summer and winter recreation opportunities. Highway 58 is often used as an alternative route for commercial truckers who want to avoid the Interstate 5 route through the Siskiyou Mountains. Trucks constitute approximately 40 percent of the traffic (Community Action Team 1994).

Currently, the closest Amtrak stops near the Odell Watershed are located at Oakridge and Chemult. The Amtrak stop at Crescent Lake was discontinued in 1977, but there is interest in reestablishing this stop to draw more business to the area (Community Action Team 1994). This type of traffic plus commercial and interstate traffic, support small businesses in the area of Crescent Lake Junction and a maintenance facility for the Oregon Department of Transportation. These routes also serve as right-of-ways for utilities such as Midstate Electric.

The inherent opportunities for summer and winter recreation with supportive facilities makes this area a destination for many people. This type of use provides the most stable flow of income for resorts, businesses in Crescent Lake Junction, campground concessionaires, and the Willamette Pass Ski Area. The quality of the outdoor setting including the facilities, fishery, wildlife, access, and scenery must be maintained in this area to sustain or increase its constituency.

High Cascades

The High Cascade Crest has not been developed for commercial and commodity use, but the recreational opportunities within the Diamond Peak Wilderness and the undeveloped recreation areas attract additional users to facilities and businesses at Willamette Pass and Crescent Lake Junction. Trailheads to the area are located adjacent to Shelter Cove and Odell Lake Resorts and the Willamette Pass Ski Lodge. Currently, the Shelter Cove Resort provides special services to through-hikers of the Pacific Crest Trail. Hikers can receive or buy supplies and have designated overnight accommodations.

Because the area is easily accessible from Highway 58 and the Waldo Lake Road, there are other opportunities for special uses, including specialized outfitters and trail guides. These services would probably increase use in the area and may decrease the outdoor solitude experience for some recreationists. The undeveloped recreation area provides the most flexibility for additional special uses.

Stratovolcanoes

Within the Odell Watershed, the stratovolcanoes are the most productive growing sites for a variety of vegetation. On the Crescent Ranger District, these buttes and mountains have provided the greatest volume of high value timber to the wood products industry over the years, including large saw timber ponderosa pine and Douglas-fir.

The stratovolcanoes also support a variety of fungi including the matsutake mushroom. Since 1988, commercial mushroom harvesting in the area has grown exponentially. Commercial mushroom harvesters and buyers now travel to the area during the fall collecting season. In about 40 days, commercial mushroom collectors can bring in between $75,000-100,000 to the local economy at Crescent Lake Junction (CAT 1994).

The fall mushroom collecting season coincides with the big game hunting season. Consequently, conflicts between early season big game hunters and mushroom collectors have been increasing over the last few years.

LaPine Basin

The LaPine Basin within the Odell Watershed consists primarily of lodgepole pine. A majority of the lodgepole stands have dead and dying trees from the mountain pine bark beetle. These trees are used by the wood products industry to manufacture wood chips, post, and poles. This lodgepole pine is also utilized for personal and commercial fuelwood. Some big game and mushroom hunting also occurs in the LaPine Basin.

Odell Creek

The geologic processes which created Odell Lake and Creek also created an excellent gravel source for the Forest Service. The glacial moraine which dams Odell Lake ended near McCool Butte, and glacial outwash in the form of gravels were deposited from east of McCool Butte to Davis Lake. The coarsest gravel settled first near McCool Butte with finer material moving further toward Davis Lake. The coarser gravels near McCool Butte are desirable for a variety of uses including road construction. Currently, one pit, the Odell Pit, is in operation in this area.

In the early 1900s, a fish hatchery operated in the area near Odell Lake, but it no longer exists (History Papers). In comparison to other creeks outside of the Odell Watershed, the Odell Creek area is not very popular for fishing, camping, and hunting.

Davis Lake

The current management of Davis Lake does not emphasize commodities or commercial use. The area is primarily undeveloped with no resorts or highly developed recreation facilities. The three campgrounds around the lake are currently operated by a concessionaire who maintains the facilities and collects fees.

The fishery at Davis Lake, which is excellent during high water years, is managed at its natural capacity during low water years. Water is not artificially retained in the lake to support a sport fishery like it is for Crane Prairie and Wickiup Reservoirs located just north of the Odell Watershed. The lake is also designated for fly fishing only, and most anglers catch and release their fish. Duck hunting is also popular at Davis Lake. Both hunting and fishing require state license fees.

HERITAGE RESOURCES

Odell Lake-Willamette Pass

The Odell Lake-Willamette Pass area is one of the most culturally rich areas within the Odell Watershed. Many cultures have utilized the resources found at Odell Lake and crossed over the Cascades near Willamette Pass. There is physical evidence that humans used Odell Lake before the eruption of Mount Mazama nearly 7,600 years ago.

The historic resources in the area reflect early Forest Service management (Hickerson 1994). Cy J. Bingham was most likely the first forest ranger in the area. During the early 1900s, Cy blazed trails through the area and carved his name and date on selected trees. One of these trees is located at the Pebble Bay Campground. An early ranger station was located near Odell Lake Resort. There are also artifacts from the early railroad years and CCC era.

Because of the intensive development and recreational use around Odell Lake, the integrity of the prehistoric and historic resources has been degraded over the years either by trampling or theft. Currently, a heritage plan for the Odell Lake area is being developed by the Crescent District archeologist with input from the Klamath Tribe and other archeologists. This pilot plan will help guide future development in the area,

such as septic tank installation, to protect the integrity of prehistoric and historic resources (Hickerson 1994).

High Cascades

Currently, there is not much information available about the cultural resources within the High Cascades due to a lack of cultural surveys conducted in the wilderness and dispersed recreation areas. Cultural resource surveys are usually conducted in areas where planned ground disturbing activities, such as timber harvest and construction, will occur. The wilderness and dispersed recreation designations have prevented these ground disturbing activities from occurring, so few resource surveys have been completed. However, the majority of heritage resources in the area, except in high use areas such as lakes, should be in good condition.

Stratovolcanoes

Archeologists and Native Americans have suggested that the stratovolcanoes within the Odell Watershed such as Davis Mountain could have been used by Native Americans as burial and vision quest sites. Although no physical evidence has been collected to document this use, the possibility of this evidence makes the tops of these volcanic features sensitive to ground disturbing activities (Coburn 1994). Known historic resources include the remnants of early Forest Service lookouts on Maiden Peak and Davis Mountain.

LaPine Basin and Odell Creek

Since it is a flat corridor between the high Cascade Crest and the stratovolcanoes, the LaPine Basin within the Odell Watershed served as a north/south travel route. Evidence of Native American use of this area is scattered throughout the basin. Evidence is most abundant along Odell Creek which attracted human use and led the way to Davis Lake. Historic resources reflect this same use. During the late 1800s, Judge Waldo documents his use of this route in his diary (Williams 1985).

Davis Lake

Prehistoric use of Davis Lake is very evident along its lakeshore and the lava flow. Physical evidence can be surveyed without any ground disturbing activity, consequently, the integrity of these scattered prehistoric resources has been degraded around the lake even though minimal development and recreational use has occurred in the area. Areas around the original channel of Odell Creek are probably the most sensitive if human use occurred before the eruption of the lava flow that created Davis Lake nearly 5,500 years ago (Hickerson 1994).

Historic resources around Davis Lake include evidence of temporary settlements and grazing such as old irrigation ditches, bridges, and fencing (Finneran 1988). The Davis Lake Ranger Station site (Section 3 TS 24, R 6), which was designated in 1907, was located near Ranger Butte and Ranger Creek, which was originally known as Cold Creek. The Ranger's cabin and barn were built in 1911 and valued at $221.00 and $16.00 respectively (History Papers). In the 1970s the guard station at Davis Lake was moved to Crescent, Oregon and now serves as a private residential home.

The cultural surveys around Davis Lake have primarily been conducted to provide clearance for ground disturbing activities. Extensive survey of the entire area have not occurred. Until additional surveys are completed or a heritage plan is written, the area is highly suceptible to the loss of the integrity of historic and prehistoric resources.

CHAPTER 4

SYNTHESIS AND INTEGRATION

(PHASE D)

TRENDS

DEFINITION OF TREND

A trend is a result of factors which over time influence change on a given element or portion of the ecosystem. In this document, the discussion of trends in Phase D concerns trends which have been identified from the past, continuing to the present. The trends have not been futured. However, if the causal factors of the trend continue, then the trend is expected to continue. If the causal factors stop or are reversed, then the trend is not expected to continue, or it may change. Restoration opportunities exist for elements or portions of the ecosystem that are not resilient or where the recovery is expected to take longer than desired.

Refer to Appendix E - Trends for listings of the trends determined for plant association groups, riparian areas, wildlife, fisheries, soils, and social.

TREND DESCRIPTIONS

Listed below is a summary of the trends.

1. Red flag - Reduction of large-tree dominated forest stands, with corresponding increase in pole and seedling/sapling dominated stands; moving outside the HRV (historic range of variability) for late and old structured stands; increasing fragmentation. (Applies to all PAG's that have been entered for commercial timber harvest activities).

2. Red flag - Reduction in ability of western white pine to effectively invade and establish in root rot pockets (mountain hemlock associated PAG's).

3. Red flag - Bull trout have been eliminated from Odell Creek and Davis Lake and their viability is questionable within Odell Lake and its tributaries.

4. Yellow flag - Increase in soil compaction.

5. Yellow flag - Forest stands which have not been disturbed in the past few decades or more are moving towards later seral stages in their development. The mountain hemlock associated PAG's tend towards the middle of their successional cycle, and the other PAG's tend towards the end of their successional cycles.

6. Yellow flag - Human use has increased and diversified.

7. Yellow flag - Continued maintenance of non-native fish species in most water bodies (lakes and streams).

8. Green flag - Meadows are moving towards late seral species composition with associated reduction in grass/forb/shrubs and increase in conifer species.

9. Green flag - General state of riparian areas is good, except in localized areas of trails, roads, and dispersed campsites.

10. Green flag - Water quality has declined and stabilized at a nutrient level above historic (trophic) levels in Odell Lake.

11. Green flag - Use of Davis Lake fluctuates with water level.

TREND SENSITIVITY AND RISK

Each trend was ranked according to its sensitivity (susceptibility, the ability to resist a change in properties, and resiliency, the ability to self-restore) and risk, and was then identified as being a red, yellow, or green trend. The colors indicate a combination of the level of risk and sensitivity. Red implied a "red flag", which meant that there was an urgent need for something to be done, such as management activities or intervention to prevent further deterioration of that resource, endangered species, or species viability. Yellow indicated that something needed to be done soon to prevent the resource from becoming a red trend. Green indicates that management opportunities exist within that trend, but that the urgency was not great or that the trend was good and should continue.

TABLE 4 - 1, SENSITIVITY X RISK = TREND RATING

Trend #	Sensitivity S ± R = Sensitivity *	Risk to Ecosystem	Trend Color Code
1	H ± L = H	H	Red
2	H ± L = H	H	Red
3	H ± L = H	H	Red
4	M ± L = H	M	Yellow
5	M ± L = H	M	Yellow
6	H ± H = M	H	Yellow
7	H ± H = M	M	Yellow
8	M ± H = L	L	Green
9	H ± H = M	L	Green
10	H ± H = M	L	Green
11	M ± H = L	L	Green

* S ± R = Sensitivity, implies Susceptibility ± Resiliency = Sensitivity

The table below contains a brief explanation of the susceptibility, resiliency, and risk determinations as used in the table above.

TABLE 4 - 2, TREND RISK DETERMINATION

Trend	Susceptibility	Resiliency	Risk To Ecosystem
Trend #1	High - activities have already occurred and large trees are susceptible to future loss.	Low - takes centuries to recover large tree stands.	High risk to habitat for many wildlife species and to scenic resources.
Trend #2	High - white pine are susceptible to the disease.	Low - cannot combat disease.	High - loss of genetic diversity.
Trend #3	High - continued pressure on the only adfluvial population in Oregon.	Low - population levels are low.	High - loss of a genetic strain.
Trend #4	Moderate - only a portion of the landscape has been impacted; no direct input of sediment.	Low - soils take a long time to restore themselves.	Moderate - will inhibit or decrease vegetation establishment and growth.
Trend #5	Moderate - effects fire climax PAG's; not very far outside HRV.	Low - vegetation will continue to come into stand without fire or vegetation manipulation.	Moderate - may still have time to reverse this trend before catastrophic loss.
Trend #6	High - reduction of amphibians and macroinvertebrates well documented with non-native fish; competition with non-natives renders the bull trout very susceptible.	High resiliency with removal of non-native species, macroinvertebrates and amphibians will recover.	High - may be loss of genetic strains; need to establish critical corridors and remove non-natives where needed.
Trend #7	High - people will continue to visit the area and establish new and diversified uses; population will increase as will movement to Central Oregon for recreation environment.	Moderate - experiences change with additional people; recreation capacity will be reached.	Moderate - impacts not great at this time; opportunity to focus use in order to limit impacts.
Trend #8	Moderate - encroachment/ succession is occurring slowly.	High - water tables over time will control encroachment.	Low - meadow encroachment not extensive; easily reversed.
Trend #9	High - easily disturbed; major attraction to recreating public and wildlife.	High - will restore itself if left alone.	Low - few areas impacted and they are isolated; system is relatively intact.
Trend #10	High - the formation of the lake leads to this trend.	High - will fluctuate over time as it has for eons.	Low - natural process.
Trend #11	Moderate - influx of nutrients will lower quality.	High - large volume of water will reverse trend if input truncated.	Low - water quality has stabilized at acceptable level.

RED FLAG TRENDS

Listed below are the trends, the risk/sensitivity rating, and the reasons for assigning that rating.

1. Trend: Reduction of large-tree dominated forest stands, with corresponding increase in pole and seedling/sapling dominated stands; moving outside the HRV (historic range of variability) for late and old structured stands; increasing fragmentation. (Applies to all PAG's that have been entered for commercial timber harvest activities). Rating: **Red Flag.** Reasons for rating: The large tree component within the watershed has been severely reduced, and current within stand structural diversity is in danger of being lost, due to the significant risk of disturbance activities. This risk is due, in part, to the complex fuel structure that has resulted from the exclusion of low intensity fires. The loss of the large tree component and structural diversity would have direct effects on the suitability of the habitat for numerous species of wildlife, such as the northern spotted owl, goshawk, deer, elk, etc. The distribution of successional stages has and will continue to move outside the HRV if the trend is allowed to continue.

2. Trend: Reduction in ability of western white pine to effectively invade and establish in root rot pockets (mountain hemlock associated PAG's). Rating: **Red Flag.** Reasons for rating: Due to white pine blister rust (a non-native disease), the western white pine component within the watershed is being severely reduced, thus decreasing genetic and biological diversity. The only mitigation activity possible, at this time, is the planting of propagated western white pine trees that are resistant to the blister rust.

3. Trend: Bull trout have been eliminated from Odell Creek and Davis Lake and their viability is questionable within Odell Lake and its tributaries. Rating: **Red Flag**. Reasons for rating: The bull trout is the only remaining natural adfluvial population in Oregon. The loss of the population in Odell Lake would mean the loss of a gene pool for the species and a reduction of biodiversity. The bull trout is a candidate species for listing under the Endangered Species Act.

TABLE 4 - 3, RED FLAG TRENDS WITH ASSOCIATED CAUSES AND RESOURCES AFFECTED WITHIN THE ODELL WATERSHED

Trends	Causes	Ecological Processes Affected	Primary Outcome or Resources Affected	Related Outcomes or Resource Affected
Reduction of large-tree dominated forest stands, with corresponding increase in pole and seedling/sapling dominated stands; moving outside the HRV (historic range of variability) for late and old structured stands; increasing fragmentation. (Applies to all PAG's that have been entered for commercial timber harvest activities). Trend #1--Red Flag	Conifer regeneration harvest methods; exclusion of low intensity fire; insect (bark beetle) infestation; disease; high density understory and lack of stocking control.	Vegetative succession including: structure, composition, age, health and vigor, and competition for water and nutrients; regeneration; nutrient cycling; erosion; natural disturbance regimes-fire, insects, and disease; successional time frame. NOTE: All references to vegetative succession in these trends refer to and include the ecological processes mentioned above.	Economic benefits through jobs and products; change of standing vegetative structure; change in microclimate-increase in frost pocket effects (l. pine-dry); movement towards earlier structural stages, away from late/old; disturbance to wildlife; reduction in species favoring old structural stands; increase in species favoring earlier structural stages; decrease in species favoring contiguous habitat; increase in species favoring contrast (edge) habitat.	Reduction of large tree component (overstory and replacement ponderosa pine) which provides nesting habitat for the bald eagle; reduction of habitat for spotted owl, marten, voles, woodpeckers and related wildlife species; change in brush/forb composition; decrease in scenic quality, due to loss of visible large trees in foreground and visibility of harvest units on the stratovolcanoes in middle and background; change in fuelwood availability; change in the amount of fuel and down woody present; accelerated conversion from late and old stands to regeneration dominated stands; increased compaction and change in sustainability; changes in site productivity due to increased duff layer (p. pine); diversity in structure is at risk due to increasingly complex fuel structure; high risk of significant mortality in overstory and/or understory as a result of disturbance activities; direct loss of trees through competition; distribution of successional stages has moved outside HRV and trend may continue.
Reduction in ability of western white pine to effectively invade and establish in root rot pockets (mountain hemlock associated PAG's). Trend #2--Red Flag	White pine blister rust - an introduced an endemic disease.	Western white pine survival and growth.	Reduction of genetic diversity of western white pine in the watershed; loss of small stands of western white pine able to invade disturbance areas and successfully grow to reproduction age; loss of biodiversity.	Wildlife species associated with western white pine; species diversity within root rot pockets is outside the HRV.

TABLE 4 - 3, RED FLAG TRENDS WITH ASSOCIATED CAUSES AND RESOURCES AFFECTED WITHIN THE ODELL WATERSHED (continued)

Trends	Causes	Ecological Processes Affected	Primary Outcome or Resources Affected	Related Outcomes or Resource Affected
Bull trout have been eliminated from Odell Creek and Davis Lake and their viability is questionable within Odell Lake and its tributaries. Trend #3–Red Flag	At Odell Lake and tributaries: angling pressure; historic poaching of fish during spawning season; introduction of non-native fish; competition with non-native species for spawning (kokanee) and/or rearing (brook trout) habitats; At Odell Creek and Davis Lake: parasite *Ceratomyxa shasta*; historic poisoning of system to remove chubs and whitefish.	Predator/prey relationship; population viability; social pressures; competition with non-natives--kokanee and brook trout; predation by lake trout; natural selection.	Loss of genetic pool for only remaining natural adfluvial population in Oregon; loss of bull trout; decreasing juvenile survival; decreasing spawning success; national/regional concern for (C1) candidate species for listing under the Endangered Species Act.	Probable amphibian loss due to poisoning; change in prey base for eagle and osprey; catch and release program implemented to facilitate bull trout population growth; social conflict.

ODELL WATERSHED PROJECT

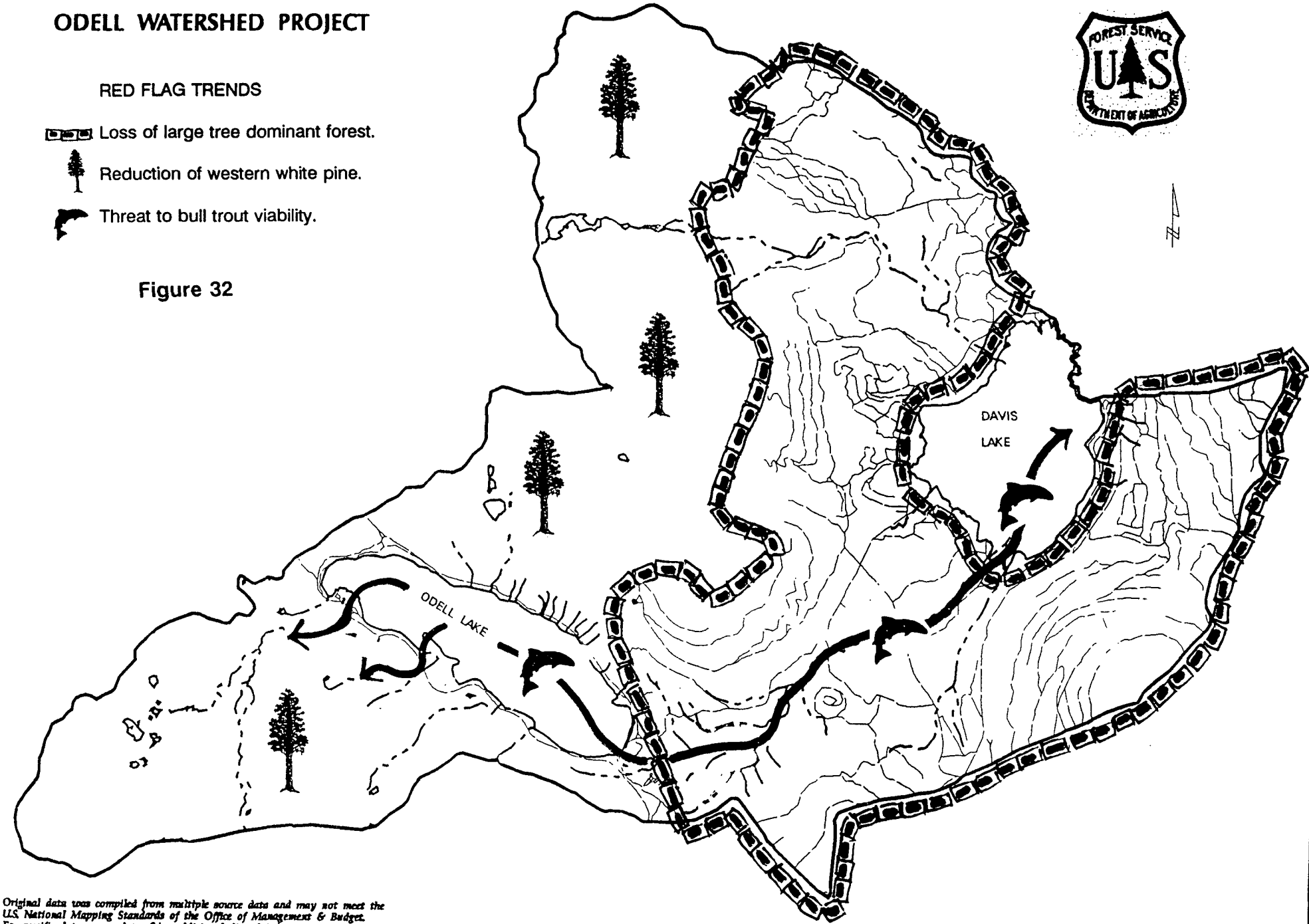
RED FLAG TRENDS

Loss of large tree dominant forest.

Reduction of western white pine.

Threat to bull trout viability.

Figure 32



Original data was compiled from multiple source data and may not meet the U.S. National Mapping Standards of the Office of Management & Budget. For specific data source dates &/or additional digital information contact the Deschutes National Forest, Crescent Ranger District, Crescent, Oregon. This map has no warranties to its content or accuracy.

Scale 1:119032

YELLOW TRENDS

Listed below are the trends, the risk/sensitivity rating, and the reasons for assigning that rating.

4. Trend: Increase in soil compaction. Rating: **Yellow.** Reasons for rating: Where ground-based silviculture and fuels activities have occurred within the watershed, soils have been compacted. Compaction has long-term impacts on soil productivity, soil quality, vegetative diversity and growth rates, and water quality, among others.

5. Trend: Forest stands which have not been disturbed in the past few decades or more are moving towards later seral stages in their development. The mountain hemlock associated PAG's tend towards the middle of their successional cycle, and the other PAG's tend towards the end of their successional cycles. Rating: **Yellow.** Reasons for rating: Natural processes are still occurring and controlling the stands, however, the probability of a major disturbance event occurring within these stands is increasing. This is due, in part, to fire suppression and lack of stocking level manipulation which have resulted in high levels of fuel accumulation.

6. Trend: Continued maintenance of non-native fish species in most water bodies (lakes and streams). Rating: **Yellow.** Reasons for rating: The continued maintenance of non-native fish populations within the watershed has direct, negative effects on the bull trout, amphibian, and zooplankton populations, however, angling for these non-native species is an extremely popular recreation activity.

7. Trend: Human use has increased and diversified. Rating: **Yellow**. Reasons for rating: Social expectations within the watershed are increasing, which leads to a variety of impacts on other resources. Conflicts between uses and resources is a primary outcome and includes: conflicts between mushroom pickers and hunters, impacts of mushroom harvesting on the environment, disturbance to wildlife, etc.

TABLE 4 - 4, YELLOW TRENDS WITH ASSOCIATED CAUSES & RESOURCES AFFECTED WITHIN THE ODELL WATERSHED

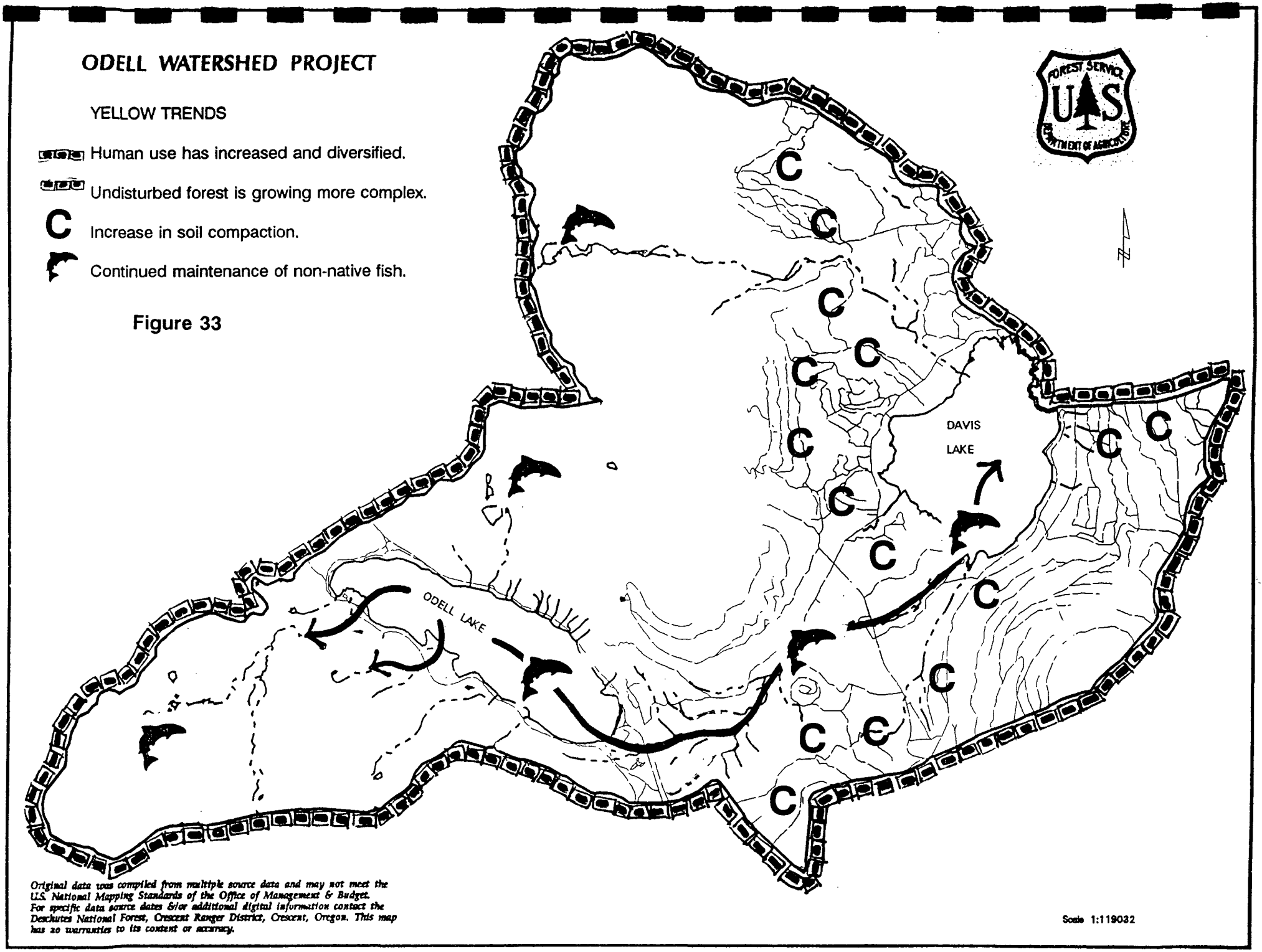
Trends	Causes	Ecological Processes Affected	Primary Outcome or Resources Affected	Related Outcomes or Resource Affected
Increase in soil compaction. Trend #4--Yellow	Ground based silviculture and fuels treatments including roading, skidding, etc.; transportation system; recreation facilities.	Erosion; aeration; soil strength; biological activity; nutrient cycling; water retention; infiltration rates; sustained root growth; succession.	Long-term impacts to soil productivity; reduction in soil quality; reduced resiliency.	Potential decrease in old growth sustainability; roads constitute acreage out of production; decrease in water quality; change in vegetative diversity; slowed growth; extension of stream network; compacted areas serve as ephemeral channels; disturbance to wildlife from the road network; increase in fragmentation.
Forest stands which have not been disturbed in the past few decades or more are moving towards later seral stages in their development. The mountain hemlock associated PAG's tend towards the middle of their successional cycle, and the other PAG's tend towards the end of their successional cycles. Trend #5--Yellow	For areas other than the mountain hemlock associated PAG's: Historical processes; natural succession; suppression of natural underburns; lack of stocking level manipulation.	Vegetative succession towards late seral species including: composition, structure, and age; fire cycles.	Risk of losing large trees from system; increase in forest structure complexity; large proportion of areas moving toward climax.	Increase in amount and distribution of fuels; increasingly complex fuel structure; increased tree density; increased mortality; increased probability of stand replacement disturbance; conversion of wildlife species from those that prefer pioneer habitat to those that prefer late climax seral; meets general public's scenic quality expectations.
	In mountain hemlock associated PAG's: root rot; insects; fire; human uses are highly subordinate to historic processes due to past land allocations including no roads or harvest activities.	All successional processes continue, except western white pine survival and growth.	Stand composition and structure within HRV; maintenance of primitive setting.	Provides a diversity of habitats for wildlife species including contiguous and contrast habitat in the vicinity of root rot pockets; unique transitional wildlife habitat-corridor for E-W travel over and along Cascade crest; habitat provided for small mammals and wolverines; recreational corridor between Diamond Peak and Three Sister's Wildernesses.

TABLE 4 - 4, YELLOW TRENDS WITH ASSOCIATED CAUSES & RESOURCES AFFECTED WITHIN THE ODELL WATERSHED (continued)

Trends	Causes	Ecological Processes Affected	Primary Outcome or Resources Affected	Related Outcomes or Resource Affected
Human use has increased and diversified. *Trend #6--Yellow*	Increased social expectations within watershed for activities such as hunting, fishing, boating, birdwatching, recreational mushroom/flower/berry picking, hiking, mountain biking, camping, driving, skiing, horseback riding, snowmobiling, OHV, etc.; increased population; area is readily accessible-Highway 58, Scenic Byway, other arterial and collector roads, National Scenic Trail, etc.; solitude. For Davis Lake OHV: Regulated and unregulated use; no posting; increased desire to recreate in area; lack of direction or conflicting management direction; enforcement; increased use from Waldo Lake area.	Wildlife life cycles; erosional processes; hydrologic processes, mycorrhizal relationships; succession-vegetation; nutrient accumulation; compaction.	Increased economics; social benefits; change/shift in local cultural use; increased ecotourism; change in experience, i.e more people, trash, etc. For Davis Lake OHV: Conflicts in use; conflicts with wildlife; reduced vigor of conifer species in dispersed recréation sites; impacts to riparian habitat.	Increased wildlife disturbance; erosion in riparian areas; disruption of hydrologic cycles; impacts to riparian zones; water quality; impacts to riparian dependent species including amphibians; reduction of native fishery; increase in user conflicts; decrease in solitude opportunities; isolated heavy use areas; train-noise pollution. For Davis Lake OHV: disturbance to wildlife, vegetation, cultural resources; decrease in scenic quality experience (decreased recreation quality); pressure for additional facilities (boat ramp and horse camp).
	Diversity of commercial uses including: sport fisheries, mushroom harvesting, service community, resorts, ski area-Willamette Pass, fuelwood, campground concessionaires, guides, wood chips, saw timber, post and pole, boat facilities, summer homes, gravel pits.	Same as above.	Same as above.	Same as above and compaction/erosion.

TABLE 4 - 4, YELLOW TRENDS WITH ASSOCIATED CAUSES & RESOURCES AFFECTED WITHIN THE ODELL WATERSHED (continued)

Trends	Causes	Ecological Processes Affected	Primary Outcome or Resources Affected	Related Outcomes or Resource Affected
Continued maintenance of non-native fish species in most water bodies (lakes and streams). Trend #7--Yellow	Management for non-native species including kokanee and brook trout; stocking of non-native species; fishing for non-natives is a popular recreation activity; economically viable for ODFW.	Competition; natural selection; predator/prey relationships; genetic flows.	Competition for bull trout spawning and rearing habitat; suppressed amphibian populations; zooplankton and macroinvertebrate populations selectively modified and reduced by fish predation; potential barrier to genetic interchange--amphibians and zooplankton.	Increased prey base for eagles, osprey; backcountry fishing-attraction for wilderness use; non-native species are the primary fishing attraction at Odell Lake; supports ecotourism, local economics, and local cultural use.


ODELL WATERSHED PROJECT
YELLOW TRENDS
Human use has increased and diversified.
Undisturbed forest is growing more complex.
C
Increase in soil compaction.
Continued maintenance of non-native fish.
Figure 33
FOREST SERVICE
U S
DEPARTMENT OF AGRICULTURE
DAVIS
LAKE
ODELL LAKE
Original data was compiled from multiple source data and may not meet the U.S. National Mapping Standards of the Office of Management & Budget. For specific data source dates &/or additional digital information contact the Deschutes National Forest, Crescent Ranger District, Crescent, Oregon. This map has no warranties to its content or accuracy.
Scale 1:119032

GREEN TRENDS

Listed below are the trends, the risk/sensitivity rating, and the reasons for assigning that rating.

8. Trend: Meadows are moving towards late seral species composition with an associated reduction in grass/forb/shrubs and increase in conifer species. Rating: **Green**. Reasons for rating: The meadows are within their historical range of variability (percentage, size), and those that are impacted or being encroached upon can be restored with relative ease through management.

9. Trend: General state of riparian areas is good, except in localized areas of trails, roads, and dispersed campsites. Rating: **Green**. Reasons for rating: Within the riparian areas, there is only localized disturbance, while the remainder of the area is relatively undisturbed and unimpacted. Access to and through the riparian areas is limited.

10. Trend: Use of Davis Lake fluctuates with water level. Rating: **Green**. Reasons for rating: The water level fluctuations that take place within Davis Lake are a natural phenomena that result from the geologic formation of the lake and precipitation. The lake is unique for that reason. Use of the lake by humans and wildlife varies according to the water level.

11. Trend: Water quality has declined and stabilized at a nutrient level above historic (trophic) levels in Odell Lake. Rating: **Green**. Reasons for rating: Water quality within Odell Lake has stabilized. Nutrient input was greater prior to the improvement of the septic systems at the resorts and campgrounds. Nutrient input levels are at an acceptable level today, but can be reduced in the future with further septic system improvements.

TABLE 4 - 5, GREEN TRENDS WITH ASSOCIATED CAUSES & RESOURCES AFFECTED WITHIN THE ODELL WATERSHED

Trends	Causes	Ecological Processes Affected	Primary Outcome or Resources Affected	Related Outcomes or Resource Affected
Meadows are moving towards late seral species composition with associated reduction in grass/forb/shrubs and increase in conifer species. Trend #8--Green	Suppression of natural fires.	Succession.	Encroachment of conifer species; reduction of open meadow habitat.	Reduction in habitat for meadow dependent species of wildlife and plants; reduction in establishment opportunities for early seral species.
General state of riparian areas is good, except in localized areas of trails, roads, and dispersed campsites as noted under causes. Trend #9--Green	Area is attractive; high human value; continuation of natural processes; vegetation generally is in good shape; minimum of human activity including recreation and timber harvest; controlled roaded access-limited number of roads and road closures; minimum development; specific management objectives to maintain riparian area.	Hydrologic cycle; erosion; succession; wildlife fitness; species viability; migration; genetic interchange.	Overall maintenance of hydrologic processes; maintenance of viable corridors for wildlife species and amphibians; localized impacts/degradation to riparian areas (vegetation and streambanks) from trails, roads, and dispersed sites; decrease in water quality-sedimentation and nutrients; area for solitude; good fishery.	Additional access to and through riparian areas; risk to degrade cultural resources; some disturbance and localized displacement of wildlife-NTMB's, amphibians, and big game reproduction; healthy populations-elk and ruffed grouse; continued high viability of wildlife populations; watchable wildlife; increased hunting opportunities; increased wildflower, camping, dispersed recreation opportunities.
	At Odell Creek: Increased dispersed camping and trail use (summer and winter); access is controlled (non-parallel to creek).	Erosion; vegetation succession; hydrologic function-channeling.	Increased erosion of streambanks-localized; decreased riparian habitat; disruption of hydrologic function.	Disturbance to wildlife from OHV's and other recreation uses; meets local expectation and needs; degraded experience at impacted sites.
	At Trapper and Crystal Creeks: Railroad crossings; campground use; increased human use. -- At Trapper Creek: Resort/marina; wilderness trailhead; channeling with gabions.	Revegetation; LWM reduction; timing of water flow; erosion; vegetative succession.	Reduction of instream LWM -hazard tree removal, roads; stream channelization; degrading streambanks.	Recreation activities; economic resources; increased rate of water flow; degradation of water quality-phosphorus and sediment; change in fish habitat suitability.
Water quality has declined and stabilized at a nutrient level above historic (trophic) levels in Odell Lake. Trend #10--Green	Overall human use, including summer home/campground/ resort septic systems; lakeshore erosion, cinder input from Highway 58; boats docking on shore.	Eutrophication; erosion.	Lake shore stability; increasing amounts of food for fish (zooplankton and phytoplankton); improved fisheries.	Improved recreation experience by improving fishery; aesthetics (erosion); areas to dock boats.

TABLE 4 - 5, GREEN TRENDS WITH ASSOCIATED CAUSES & RESOURCES AFFECTED WITHIN THE ODELL WATERSHED (continued)

Trends	Causes	Ecological Processes Affected	Primary Outcome or Resources Affected	Related Outcomes or Resource Affected
Use of Davis Lake fluctuates with water level. Trend #11–Green	Highly variable/fluctuating aquatic and riparian habitats at Davis Lake--Natural fluctuations of water availability to lake; geologic formation of lake–shallow lake with channel; outlet controlled by fractures in lava at all levels; diatomaceous soils (mud) limits the amount of recreation development possible, it is a natural barrier/deterrent to human and animal use.	Unique hydrologic regime-flow; wetting/drying processes; accumulation/decay; water temperature; food chains-availability; nutrient cycling; fish susceptibility to disease (increased temperature as the catalyst); evaporation.	Fishery population fluctuation (salmonids)-based on water availability; stability of the chub population; uniqueness of lake–hydrologic system; cultural resources affected.	Chubs provide primary prey base for fish eating birds (waterfowl, eagles, osprey, cormorants), the predator base fluctuates with the prey base; retention of natural processes (diatomaceous soil, fluctuating water levels) leads to limited desire for recreation opportunities such as fishing, hunting, and bird watching; limited development for recreation; boat access fluctuates (no low water access); human use fluctuates, but demand remains high; local desire to reduce lake level fluctuations in order to maintain fishery and waterfowl hunting opportunities; water and other habitat for wildlife species fluctuates, including waterfowl nesting habitat and habitat composition, and affects species such as dabblers, divers, and shorebirds; conflicts between humans and wildlife.

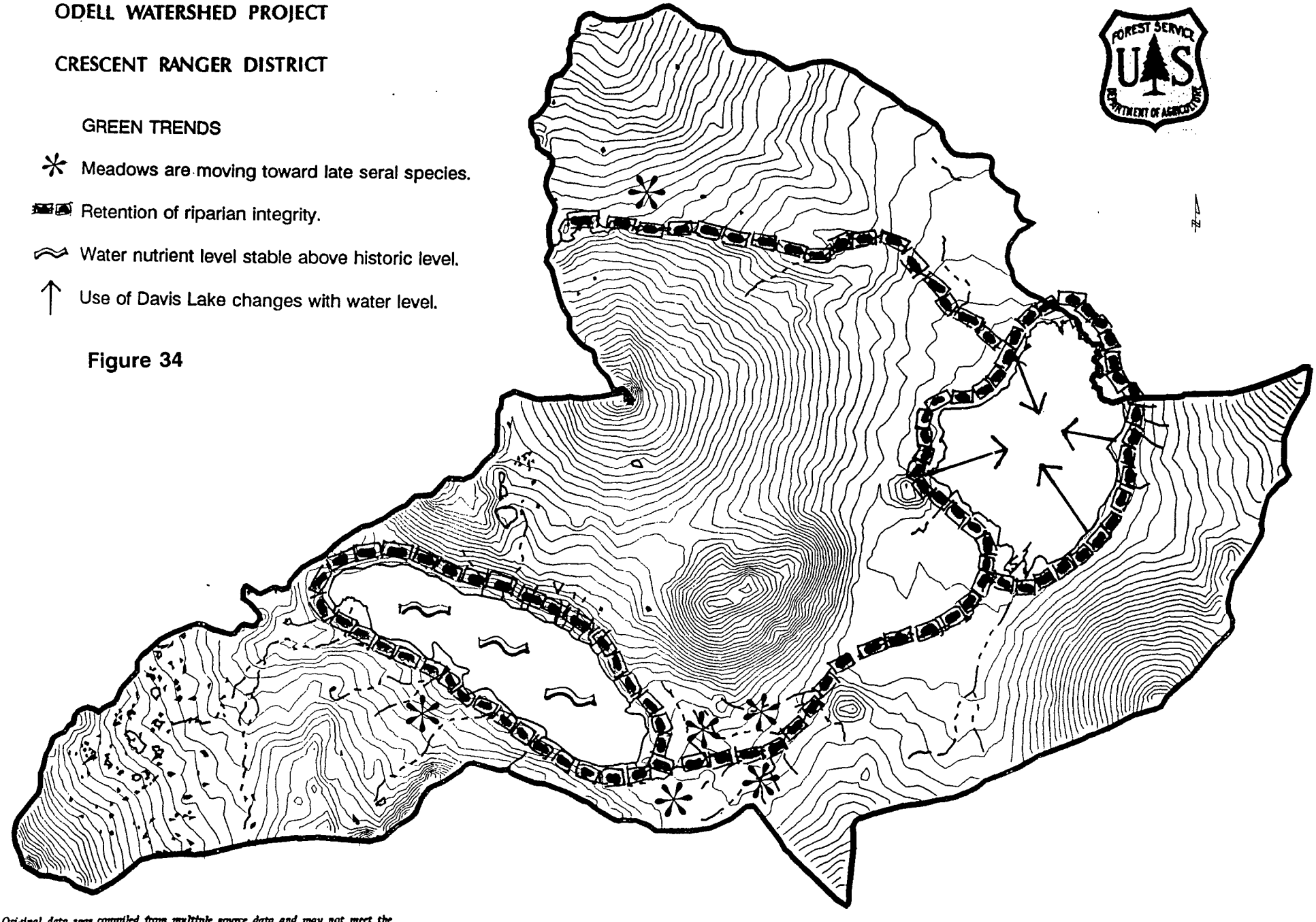
ODELL WATERSHED PROJECT

CRESCENT RANGER DISTRICT

GREEN TRENDS

- Meadows are moving toward late seral species.
- Retention of riparian integrity.
- Water nutrient level stable above historic level.
- Use of Davis Lake changes with water level.

Figure 34



Original data was compiled from multiple source data and may not meet the U.S. National Mapping Standards of the Office of Management & Budget. For specific data source dates &/or additional digital information contact the Deschutes National Forest, Crescent Ranger District, Crescent, Oregon. This map has no warranties to its content or accuracy.

Scale 1:119032

CHAPTER 5

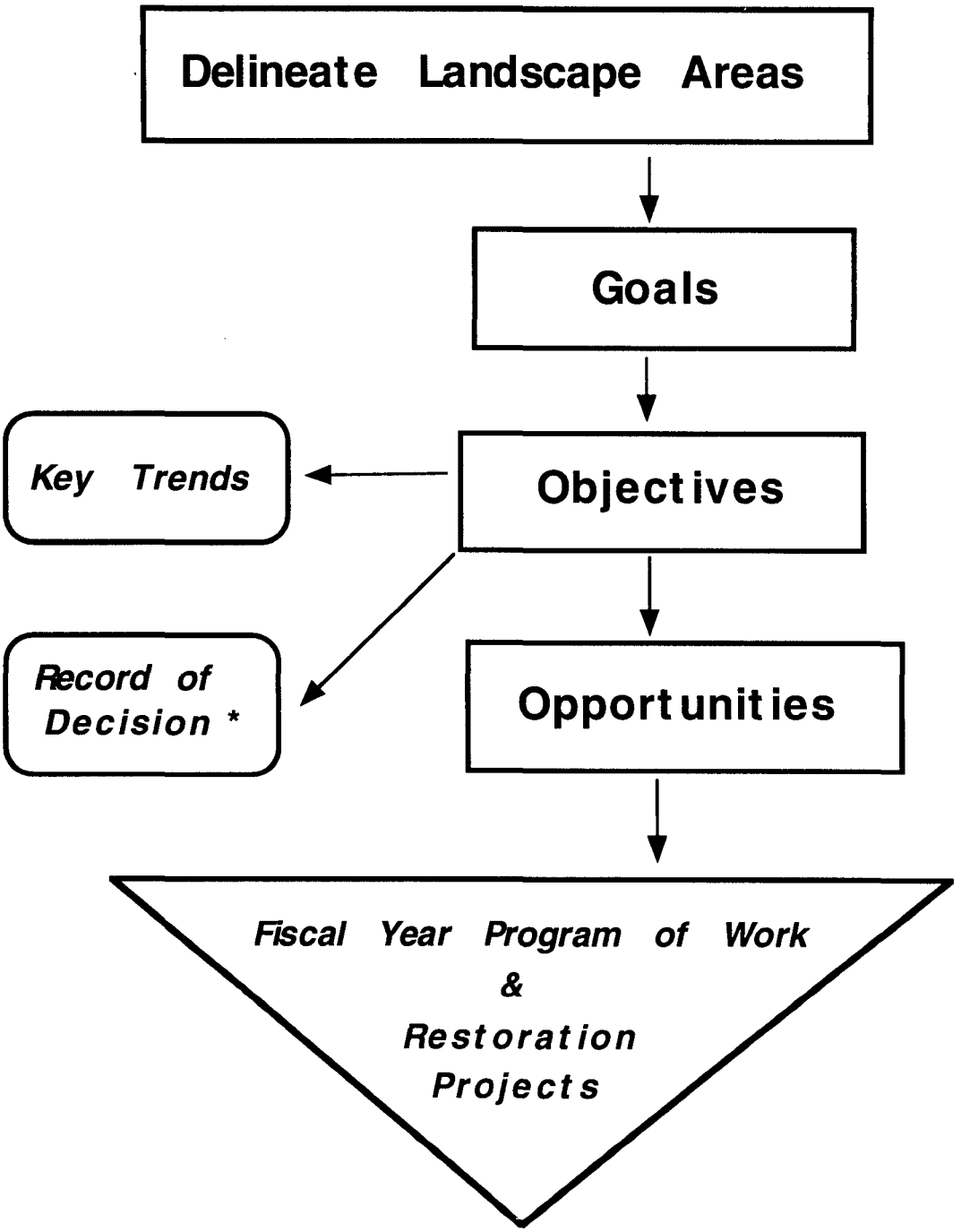
LANDSCAPE GOALS AND OPPORTUNITIES

(PHASE E)

PHASE E PROCESS

ODELL PILOT WATERSHED ANALYSIS

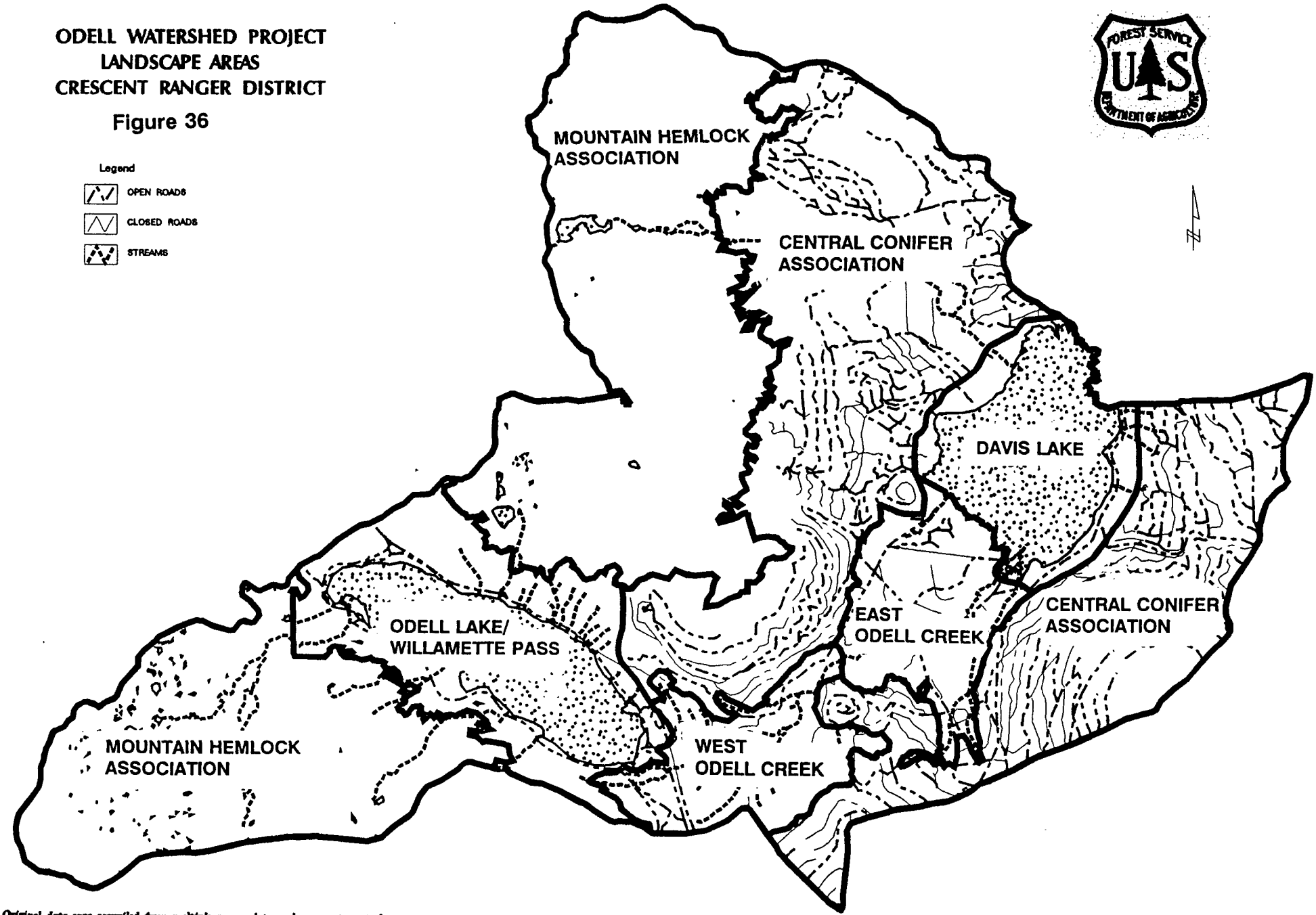
Figure 35



* Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl and as appendixed Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl, dated April 13,1994.

ODELL WATERSHED PROJECT
LANDSCAPE AREAS
CRESCENT RANGER DISTRICT

Figure 36



Original data was compiled from multiple source data and may not meet the U.S. National Mapping Standards of the Office of Management & Budget. For specific data source dates &/or additional digital information contact the Deschutes National Forest, Crescent Ranger District, Crescent, Oregon. This map has no warranties to its content or accuracy.

B.Hazby
24-SEPT-94
Scale 1:119032

LANDSCAPE AREA GOALS, OBJECTIVES, AND OPPORTUNITIES

WEST ODELL CREEK

Goal--

Reserve this area for the present and future benefit of riparian dependent species by allowing the continuation and conservation of natural processes.

Objectives--

A. Maintain the integrity of the riparian area for wildlife, including movement corridors and areas for genetic transfer, and hydrologic function. In addition, maintain the water tables and subsurface flow. (B-11)[1] [Trend # 9; Opportunity #'s 1, 2, 3, 4, 5, 6, 7]

B. Maintain or enhance open meadows due to their uniqueness as a landscape feature through the use of prescribed fire and/or manual removal of encroaching conifer trees. Natural, wet (high moisture regime) areas should be used for fire containment, in addition, low impact fire suppression techniques should be used. (B-11) [Trend # 8; Opportunity #'s 8, 9, 10, 12]

C. Accelerate conversion of plantation areas to later structural stages. This may be accomplished by thinning, soil restoration, and/or fertilization. (C-12) [Trend #'s 1, 4; Opportunity #'s 3, 11, 12]

D. Maintain or enhance habitat for wildlife species by promoting development of stands of large trees. A succession of large lodgepole pine stands should be provided. These stands will benefit species such as the goshawk, osprey, and great gray owl among others and will promote maintenance of large tree dominance, soil aeration, and the ability of roots, fungi, and microorganisms to penetrate the soil. Promote development of trees 11" DBH and greater in size, since they provide nesting habitat for the species listed above. Over time, provide large areas (1000+ acres) of contiguous habitat for black-backed woodpeckers. This habitat will be created by fire and endemic populations of insects and disease. Areas of this size and type are not sustainable within the watershed itself, but if examined on a larger scale, this habitat type can be sustainable, and the Odell Watershed can provide an important portion of it. Maintain dead and dying trees, since they are utilized by a variety of species including: the black-backed woodpecker, other associated woodpeckers, secondary cavity users, ruffed grouse, marten, and fisher. Within lodgepole pine maintain standing dead trees as a structural component within goshawk and great gray owl habitat until canopy cover (dead & live) falls below 50% or known birds vacate the area. Harvest access, layout, and design should consider travelways as well as additional habitat needs for goshawks and other species. (C-11) [Trend #'s 1, 5; Opportunity #'s 3, 4, 8, 9, 10, 12]

E. Maintain or enhance the quality aquatic habitat and explore options for bull trout recovery. (B-9) [Trend #'s 3, 9; Opportunity # 12]

F. Reduce and obliterate roads and trails that are not compatible with the goal while maintaining adequate access. Additional roaded access should not occur, since this would cause fragmentation to increase.(B-19; C-7, 32, 34) [Trend #'s 1, 7; Opportunity #'s 3, 4, 5, 6, 7, 10, 12]

[1]*Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl* and as appendixed *Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl*, dated April 13, 1994

G. Funnel the north-south through-traffic around the West Odell Riparian Reserve area while meeting the Recreation Opportunity Spectrum (ROS). The ROS for the majority of the area will shift from roaded modified to semi-primitive motorized; the only area that will retain the roaded natural designation is the area around Highway 58. (C-6, 18, 32, 34) [Trend #'s 7, 9; Opportunity #'s 4, 5, 6, 7, 10]

H. Tier to the Odell Lake Basin Historic Preservation and Management Plan (OLBHPMP) in order to identify cultural concerns and opportunities. (C-16) [Trend # 7; Opportunity #'s 3, 4, 5, 7, 11, 12]

Opportunities--

1. Delineate the area as a Riparian Reserve. [Objective A]

2. Provide information and education at Odell Lodge about wetlands including their importance to wildlife and hydrologic function. [Objective A]

3. Timber harvest activities may be appropriate within the area as long as access through riparian areas does not occur. (B-18, 19; C-7, 13, 32) [Objectives A, C, D, F, H]

4. Additional recreational use and access should not be encouraged within this riparian zone. Rehabilitation should occur on existing recreation sites or trails which have had undesirable effect(s) on riparian features or hydrologic function. [Objectives A, D, F, G, H]

5. The abandoned snowmobile race track and disposal site are located within this area and should be considered as a potential restoration opportunity. Examine the use of the parking area at this site as an industrial camp (for mushroom hunters). Evaluate whether or not this is an appropriate use, if the use is not appropriate, explore the feasibility of restoration, since a large amount of fill would be required. Revegetate the disposal site. [Objectives A, F, G, H]

6. Maintain the trail location at the bridge crossing near McCool Butte; guide through-traffic, including the Metolius-Windigo horse trail, south of the butte around the riparian area. Modify or restructure the bridge at McCool to accommodate multiple uses, including horse use, to fit in with ROS. Repair gates on either side of the bridge. Recreational uses are linked to areas outside the watershed, so should also be examined at a broader scale. Encourage summer hiking in areas outside of this watershed that are more appropriate. [Objectives A, F, G]

7. Consider placing underpass in the best physical and most economical location; reroute trails to avoid riparian areas. [Objectives A, F, G, H]

8. Consider management with fire versus harvest in areas where appropriate. [Objectives B, D]

9. Within meadows, manual or prescribed fire methods should be used to reduce conifer encroachment and to rejuvenate patches of decadent willows in order to maintain a diverse structure of age classes. [Objective B, D]

10. Obliterate roads in meadows that are not presently major travel corridors. [Objectives B, D, F, G].

11. Restore soils in activity areas by subsoiling compacted areas. [Objectives C, H]

12. Management activities can be used where they clearly enhance the goal. [Objectives B, C, D, E, F, H]

Land Allocations--

Late Successional Reserve
Riparian Reserve
Key Watershed (This is not technically an allocation, but is a management scheme which overlays other allocations). (A-5)

EAST ODELL CREEK

Goal---

Manage a viable lodgepole pine component in the area in order to provide a sustainable forest ecosystem. In addition, maintain or enhance the integrity and resiliency of the riparian systems and wildlife movement corridors which are used for dispersal and genetic transfer.

Objectives--

A. Maintain or enhance habitat for wildlife species by reducing fragmentation and promoting development of stands of large trees. A succession of large lodgepole pine stands should be provided. These stands will benefit species such as the goshawk, osprey, and great gray owl among others and will promote maintenance of large tree dominance, soil aeration, and the ability of roots, fungi, and microorganisms to penetrate the soil. Promote development of trees 11" DBH and greater in size, since they provide nesting habitat for the species listed above. Over time, provide large areas (1000+ acres) of contiguous habitat for black-backed woodpeckers. This habitat will be created by fire and endemic populations of insects and disease. Areas of this size and type are not sustainable within the watershed itself, but if examined on a larger scale, this habitat type can be sustainable, and the Odell Watershed can provide an important portion of it. Maintain dead and dying trees, since they are utilized by a variety of species including: black-backed woodpecker, other associated woodpeckers, secondary cavity users, ruffed grouse, marten, and fisher. Within lodgepole pine maintain standing dead trees as a structural component within goshawk and great gray owl habitat until canopy cover (dead & live) falls below 50% or known birds vacate the area. Harvest access, layout, and design should consider travelways as well as additional habitat needs for goshawks and other species. Maintain the down, woody component in order to provide big game security, travelways for marten, and small mammal habitat. (C-11) [Trend # 1; Opportunity #'s 1, 2, 4]

B. Maintain or enhance the quality aquatic trout habitat and explore options for bull trout recovery. (B-9) [Trend #'s 3, 9; Opportunity # 3]

C. Prescribed fires in the area will be of an intensity to maintain nutrients and the nutrient cycling regime. They will also be utilized to provide a diversity of structural conditions and to reduce fuel loading in order to protect large portions of the area from catastrophic fires. (B-7, 8; C-18, 35) [Trend #'s 1, 5; Opportunity # 1]

D. Use management methods that will maintain soil capabilities on undisturbed sites and restore those that are degraded. (B-1-8) [Trend # 4; Opportunity #'s 1, 2, 3, 4, 5, 6, 7, 8]

E. Manage dispersed recreation to provide healthy riparian areas and conserve features. Streambanks will be stable, bound by healthy vegetation which adds nutrients and large, woody material to the channel. Areas containing vigorous, stable, non-riparian vegetation adjacent to the riparian area will be provided for dispersed camping (recreational and hunting). (B-11, 18, 19; C-34) [Trend # 9; Opportunity # 3, 7, 8]

F. Commodity uses in the area for public and administrative benefit will be used to obtain or enhance stated landscape goals. (B-9, 18, 19; C-11, 12-15, 31, 32) [Trend # 7; Opportunity #'s 2, 6]

G. To the extent it is relevant, tier to the OLBHPMP to identify cultural concerns and opportunities. (C-16) [Trend # 7; Opportunity #'s 1, 4, 5, 6, 7]

Opportunities:

1. Reduce fragmentation of lodgepole pine by consolidation of harvested areas. Vegetative treatments, such as salvage or firewood cutting could be designed to enhance foraging, roosting, and nesting needs of the black-backed woodpecker. Maintain burned areas for an adequate length of time in order to provide forage habitat for wildlife species, including woodpeckers. [Objectives A, C, D, G]

2. Commercial uses can occur within the area and may be a by-product of restoration of the vegetation to the HRV. For instance, fuelwood cutting may be used to facilitate the return of vegetation to within the HRV, and firewood can also be provided as the remaining stands become less suitable for the goshawk and snag dependent species. [Objectives A, D, F]

3. Revegetate harvested areas along Odell Creek, with diverse species if possible, to provide shade to the stream. [Objectives B, D, E]

4. Restore soils in activity areas by subsoiling or some other appropriate means. Refer to the soil restoration priority map (Figure 18). [Objective A, D, G]

5. Rehabilitate the abandoned gravel pit that is located along the bank of Odell Creek. [Objectives D, G]

6. The gravels obtained from the Odell Gravel Pit constitutes an economic resource or commodity use. The opportunity for expansion of the pit exists outside the riparian zone. The rehabilitation plan could be used, for instance, to provide wildlife habitat or recreation uses. (see C-17) [Objective D, F, G]

7. Identify appropriate locations for dispersed recreation. Rehabilitate dispersed sites that are within 100 feet of water, including the dispersed site located between the channels of Odell Creek immediately west of the 4660 road. Restore or harden dispersed sites and limit access with barriers to riparian areas, if needed. [Objectives D, E, G]

8. Eliminate or obliterate roads and trails that are parallel to Odell Creek when they are not appropriate or necessary for access. The road to East Davis Lake Campground should be considered for obliteration if problems with camping and access to the riparian area become an issue. No new parallel trails, roads, etc. to the creek should be constructed, if access to the creek would be encouraged. [Objective D, E]

Land Allocations--

Late Successional Reserve
Riparian Reserve
Key Watershed (This is not technically an allocation, but is a management scheme which overlays other allocations). (A-5)

ODELL LAKE/WILLAMETTE PASS

Goal--

Accommodate recreational use that is both appropriate and diverse by providing a wide spectrum of quality, outdoor settings that range from primitive (pristine) to developed, while maintaining water quality, fishery productivity, critical wildlife habitat and corridors, riparian integrity, heritage resources, large tree dominance, and special uses such as summer homes, utilities, and travel routes.

Objectives--

A. Maintain or enhance areas of healthy, large-tree dominated forests. Large ponderosa pine and Douglas-fir trees at least 30" DBH should be maintained for bald eagle nesting and roosting habitat as well as for other species. (C-13) [Trend # 1; Opportunity #'s 1, 2, 12]

B. Manage areas for increased resistance to insects, disease, and fire. This can be achieved, in part, by maintaining multiple stand structures and seral conditions which will also benefit wildlife species. A variety of management tools and techniques should be used across the landscape, and could include prescribed fire in appropriate locations. (B-1-8; C-12, 13) [Trend #'s 1, 5, 8; Opportunity #'s 1, 2, 12]

C. Maintain or improve habitat for PETS species; including both plants and wildlife and maintain the integrity of wildlife and amphibian habitat and corridors. (50, B-12, 13; C-4) [Trend #'s 1, 5, 9; Opportunity #'s 1, 2, 3, 4, 5, 6, 7, 12]

D. Maintain the health and integrity of riparian areas. (B-9; C-31-38) [Trend # 9; Opportunity #'s 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12]

E. Maintain or enhance the quality aquatic habitat, while promoting restoration of bull trout populations. (B-9) [Trend #'s 3, 6, 9; Opportunity #'s 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12]

F. Provide interagency coordination for bull trout and water quality management. (53-54) [Trend #'s 3, 11; Opportunity #'s 8, 9, 10, 11]

G. Maintain or improve water quality (trophic level) of the lake. (B-11) [Trend # 11; Opportunity #'s 3, 4, 5, 7, 8, 9, 10, 11]

H. Identify the desired outdoor settings which range from primitive to developed and the appropriate linkages between them. Undeveloped areas that provide opportunities for solitude should not be linked with areas of high use. (C-29) [Trend # 7; Opportunity # 6]

I. Maintain low human disturbance levels on south side of Odell Lake between Odell Lake Resort and Shelter Cove. Provide areas for reproductive and rearing activities of riparian dependent and associated species. The other areas surrounding the lake are heavily impacted by major transportation routes (Highway 58), campgrounds, and summer residents which preclude areas of seclusion for wildlife. Any future facility development should be subordinate to wildlife needs. (C-6, 29, 34) [Trend #'s 7, 9; Opportunity #'s 2, 6]

J. Participate in community planning for Crescent Lake Junction and other areas that are directly involved in the use of Odell Lake and the Willamette Pass Area. (B-21) [Trend # 7; Opportunity #'s 4, 6, 7, 8, 12]

K. Coordinate management of the Willamette Pass Ski Area with the Willamette National Forest. Maintain or enhance water and soil quality as well as key wildlife habitat and corridors within the permit area. (15; B-1-5; C-18) [Trend # 7; Opportunity # 2]

L. Continue to allow commercial uses as long as they do not interfere with the maintenance of the desirable physical, biological, and social qualities inherent to the character of the area. (15; C-18) [Trend # 7; Opportunity #'s 4, 6, 7, 8]

M. Tier to the Odell Lake Basin Historic Preservation and Management Plan (OLBHPMP) to identify cultural concerns and opportunities. [Trend # 7; Opportunity #'s 1, 3, 4, 6, 12]

Opportunities--

1. Stands containing immature and mature trees which could be managed to produce suitable replacement trees for the bald eagle and to meet the habitat needs of other wildlife species should be identified. Management of these stands could include underthinning, prescribed low intensity fires, creation of small openings for regeneration, and designated removal of some trees to reduce competition and stress. [Objectives A, B, C, M]

2. Riparian corridors should be identified for movement of amphibians across the Cascade Crest. Lakes identified as critical to the maintenance of travel corridors for amphibians may have non-native fish stocking discontinued. A minimum of two corridors for amphibians should be identified and established. Maintain wildlife corridors north of Highway 58 and south of Odell Lake with the focal point located at the west end of Odell Lake in order to allow for genetic interchange across the Cascade Range. [Objectives A, B, C, D, E, I, K]

3. Relocate campsites that are < 50 feet from the water at Odell Creek Campground (move campsite, which includes fire ring, table, and parking spur) and rehabilitate abandoned sites. [Objectives C, D, E, G, M]

4. In Trapper Creek Campground, all campsites that are < 100 feet from Trapper Creek (including the campsite, fire ring, table, and parking spur) should be relocated. This is especially true for those sites located between the entrance road and the creek. Maintain or relocate the trail in Trapper Creek Campground. Plant willow and mountain alder along the streambanks of Trapper Creek. Provide educational services at Trapper Creek, which could possible include a boardwalk with interpretation. [Objectives C, D, E, G, J, L, M]

5. Place LWM into Trapper Creek where it is deficient and where the removal of hazard trees has reduced the long-term recruitment potential. Add spawning gravels to Trapper Creek if found insufficient to meet the spawning needs of the bull trout. [Objectives C, D, E]

6. Develop a master plan for the Shelter Cove Resort which should address management of the trailheads as well as the resort, including its potential for expansion. If it is determined through the master plan that expansion is a feasible option, then the following considerations should be met: expansion of the resort should not result in the occupation or disruption of riparian zones or the impairment of ground and surface water quality. If riparian areas could not be avoided, then off-site mitigation measures including wetland development would be required. [Objectives C, D, E, G, I, J, L, M]

7. Remove fire rings, tables, and other unnecessary developments (not including boat docks or other anchoring systems) located on the summer home tracts that are within 50 feet of Odell Lake or any creeks. [Objectives C, D, E, G, J, L]

8. During the next routine inspection of the summer homes, information should be gathered, including a map and verbal description of the plumbing or on-site waste disposal system as well as a discussion on how the permit holder disposes of solid and liquid waste. This information will be kept in the files and reported to the Klamath County Department of Health (KCDH). All summer homes that are identified during the routine inspection to meet one or more of the following criteria: have an on-site sewage disposal system that is less than 100 feet horizontal distance from the lake or a creek; have the disposal system located within 7 vertical feet of the lake level; or the seasonal groundwater is within 7 feet of the surface, are suspect of being a source of pollution (conditions vary slightly dependent upon the on-site sewage disposal system). A joint evaluation will be made within six months of identification of the suspect facility jointly by the Forest Service and KCDH as to whether the on-site waste disposal system is a source of pollution (the permit holder may hire a licensed engineer to do the evaluation). If any system is identified as a source of pollution, an alteration permit with subsequent modifications should be required and approved by KCDH. As ownership changes for the summer homes or resorts, on-site sewage disposal systems should be inspected by Klamath County Department of Health. Issuance of a permit should be contingent upon the required modification and/or repairs to the system as required by KCDH. [Objectives D, E, F, G, J, L]

9. Restore riparian areas along lakeshore and tributary streams where surface runoff causes the delivery of fine sediments to the lake. [Objectives D, E, F, G]

10. Coordinate with ODOT to explore ways to reduce the entry of cinders into the water bodies and stream channels. [Objectives D, E, F, G]

11. Coordinate with Amtrak Railroad to remove litter along the railroad tracks and to seek ways to reduce the dumping of waste along the Odell Lake area. [Objectives D, E, F, G]

12. Provide interpretive services and/or facilities (including signing) to enhance heritage resources; increase public awareness and appreciation of wetlands, wildlife, and fish species; and raise public sensitivity and awareness of the fragile nature of these resources. [Objectives A, B, C, D, E, J, M]

Land Allocations--

Late Successional Reserve
Administratively Withdrawn (Intensive Recreation, Spotted Owl Management)
Riparian Reserve
Matrix (note: Further coordination needs to be accomplished with the Willamette NF to determine whether a recommendation to change this piece of matrix to LSR should be pursued).

DAVIS LAKE

Goal--

Conserve the overall ecological processes that result in maintaining this unique habitat, including the appearance and overall natural ambience of the lake area. The secondary goal is to provide dispersed recreation opportunities which focus on the uniqueness of the geology, wildlife, and scenery of the area.

Objectives--

A. Maintain the natural water fluctuation of the lake. (B-11) [Trend # 10; Opportunity #'s 3, 4, 8]

B. Maintain the large-tree character of the lakeshore and enhance wildlife habitat and visual quality through the use of silvicultural treatments. (C-12) [Trend #'s 1, 5; Opportunity #'s 1, 2]

C. Enhance wildlife habitat such as providing cover (edge management) for species which use the meadows around Davis Lake. (B-18) [Trend # 8; Opportunity #'s 1, 2, 4]

D. Maintain or enhance the aquatic habitat and explore options for bull trout recovery. (B-9) [Trend #'s 3, 6, 9, 10; Opportunity # 3]

E. Appreciation of the area should be enhanced without disturbance to wildlife. The primary recreation focus within the area should be on the enjoyment of the uniqueness of the Davis Lake area from all standpoints, including wildlife, geology, fisheries, and scenery without degradation of the habitat. Maintenance of the quality fishery is subordinate to the overall setting. The fishery will fluctuate with the water level. Recreation planning is needed in the areas of access, vegetation management, fire, and cultural resources. Since use is expected to increase the resources in and around the lake warrant protection. Recreation should take a subordinate position to the ecology of the area. (B-1-5, 11, 12; C-29, 34) [Trend #'s 6, 7, 10; Opportunity #'s 3, 4, 5]

F. Maintain the lake in an undeveloped condition. Maintain but do not increase overnight use. Future advertisement of the area should be discouraged. Instead, people will discover it by exploring and word-of-mouth. Recreational facilities should be visually subordinate to the landscape and should not encourage additional use. (B-1-5, 11, 12; C-17, 29, 34) [Trend # 7; Opportunity #'s 6, 7]

G. Establish or maintain recreational sites; limit access. Existing and new facilities should discourage off-road vehicle and mountain bicycle use, since this is not a focal area for either activity. (B-1-5, 11, 12; C-17) [Trend # 7; Opportunity #'s 6, 7, 8, 9]

H. Protect the integrity of the historic and prehistoric heritage resources around the lake. [Trend # 7; Opportunity #'s 6, 7, 8, 9, 10]

Opportunities--

1. Vegetative treatments should be designed to promote development of large-tree dominated stands, late successional forests, and bald eagle habitat and may include prescribed fire and thinning. These treatments should concentrate on those trees infected with bark beetles and/or at risk from mistletoe. [Objectives B, C]

2. Continue to reintroduce prescribed fire in meadows, lakeside vegetation, and adjacent timber. [Objectives B, C]

3. Improve the fishery within Davis Lake without manipulating the water level. Maintain or enhance LWM in Davis Lake at the confluence with Odell Creek. Manage for bull trout recovery including evaluating the potential to stock the species in Ranger Creek. Request that ODFW move the Odell Creek deadline (fishing closure to protect spawning fish) approximately 300-400 yards downstream from current location. [Objectives A, D, E]

4. Improve the habitat for wildlife in and around Davis Lake, including introducing cavity snags into lake; creating waterfowl nest islands; placing nest structures for birds, bats, and squirrels to supplement habitat; enhancing lakeshore vegetation for wildlife species; and maintaining beaver habitat near inlet at Ranger Creek. [Objectives A, C, E]

5. Resolve or mitigate the conflicts between campground users and eagles, or allow the interaction of eagles and humans to take place with monitoring if the impacts favor the eagle. [Objective E]

6. Establish a site capacity for dispersed sites. Rehabilitate recreational facilities and dispersed campsites. They should be redesigned to reduce conflicts with wildlife. Restore and/or perform erosion control in areas where humans have impacted the lakeshore and streambanks. Decompact campgrounds and harden designated travelways and campsites only if these activities can be completed without detrimentally impacting cultural resources. [Objectives F, G, H]

7. Construct a bridge that would connect East and West Davis Lake Campgrounds and would allow for a significant amount of road obliteration. (This is an option within this area, but there are some potential problems including: use may actually increase, riparian integrity may be compromised, and impacts to wildlife would occur.) A second alternative would be to consider designing West Davis Lake Campground as a hike-in only campground and constructing a foot bridge between East and West Davis Lake Campgrounds. In both cases, the appropriateness of road obliteration would have to be evaluated. Other roads not identified as necessary for transportation should be obliterated and rehabilitated to consolidate access to the Davis Lake area. [Objectives F, G, H]

8. Assess appropriateness of constructing a boat ramp for low water access. The current boat ramp should be signed during low water periods to restrict wheeled access onto the lakeshore. [Objectives A, E, F, H]

9. Sign area in regards to OHV restrictions; consider barriers to control access. Design through-trail traffic to avoid impacting the ecology or aesthetics of the area; this includes bike traffic originating from Waldo Lake, snowmobile traffic, the Metolius-Windigo horse trail, and potential horse camp. Bike traffic should be routed around the lava flow. [Objectives E, F, G, H]

10. Develop a cultural resources plan. [Objective H]

Land Allocations--

Administratively Withdrawn (Intensive Recreation at East and West Davis Lake Campgrounds, Bald Eagle Management Area, Special Interest
Late-Successional Reserve
Riparian Reserve

MOUNTAIN HEMLOCK ASSOCIATION

Goal--

Maintain pristine quality of this area. Emphasize and enhance habitat for native and naturalized terrestrial and aquatic biota. Natural processes are the dominant features that shape the landscape and include fire and development of root rot pockets.

Objectives--

A. Plant resistant strains of western white pine to counteract white pine blister rust and maintain vegetative species diversity. (B-1-8) [Trend # 2; Opportunity # 1]

B. A fire plan should be developed for this landscape area and should evaluate moving from a control to a confine and/or contain strategy that would assist in the maintenance of sustainable processes. Development of a fire plan should include discussion and analysis of managed fires regardless of ignition source. (B-7, 8; C-18, 35) [Trend #'s 5, 7; Opportunity # 2]

C. Evaluate removal of non-native fish species that become, or currently are, a hinderance to successful exchange of genetic material across the Cascade Crest for amphibians. At a minimum, two corridors should be identified and managed for amphibian exchange within this area. (B-11; C-4) [Trend # 7; Opportunity # 3]

D. Maintain or enhance habitat for wildlife species such as the marten, fisher, and wolverine. (C-8, 29) [Trend # 5; Opportunity # 4]

E. Wilderness: Provide for non-motorized and non-mechanized access and enjoyment of the landscape. Follow wilderness regulations and minimize new trail development. (B-1, 11; C-8) [Trend # 6; Opportunity #'s 5, 6]

F. Non-wilderness--provide for winter mechanized access on designated trails which minimize disturbance to other users and wildlife. No new trails should be constructed. Provide for summer mechanized access (mountain bikes only) on designated trails which are appropriately designed and built and will minimize disturbance to wildlife. Foot and horse travel should be allowed throughout the area. No new bike trail construction should take place and new hiking/horse trails should only be constructed if they minimize resource damage. (B-1-8; C-29) [Trend # 7; Opportunity #'s 5, 6, 7, 8]

Opportunities--

1. Coordinate collection of western white pine seeds with seed procurement personnel and appropriate nurseries. Plant western white pine that is resistant to white pine blister rust. [Objective A]

2. Maintain meadows from encroachment as needed. [Objective B]

3. Surveys should be conducted on lakes stocked with non-native fish species and surrounding lakes and potholes to determine amphibian presence and the importance of the stocked lakes as a corridor link for genetic transfer. Surveys should also be conducted on adjacent watersheds both on Deschutes and other National Forests to determine linkage corridors between watersheds in accessing the non-native stocked lakes. Where stocked lakes are found to be a barrier for

amphibian linkage, agreements should be made with the Oregon Department of Fish and Wildlife as to where future fish stocking should and should not occur. [Objective C]

4. Identify and designate wildlife corridors and manage them for conservation of species. [Objective D]

5. Establish capacity levels and monitor use at back country sites, in particular, those located at Bobby, Rosary, and the High Cascade Lakes. Relocate inappropriate dispersed campsites and obliterate sites. [Objectives E, F]

6. Restore and/or perform erosion control on trails, dispersed sites, and riparian areas. [Objectives E, F]

7. Develop a recreation management plan for area (winter/summer). Include a Willamette Pass comprehensive plan which addresses the primitiveness of the Waldc Lake Area and OCRA. [Objective F]

8. Evaluate bike trails by conducting a suitability study with soils and ROS, if unsuitable, redesign trails for bike use, ie. Maiden Peak and Moore Creek Trails. [Objective F]

Land Allocations--

Congressionally Withdrawn
Administratively Withdrawn (Undeveloped Recreation)
Riparian Reserve

CENTRAL CONIFER ASSOCIATION

Goal--

Encourage vegetation to move towards historic ranges in pattern, structure, and seral stage in order to sustain late and old structure related wildlife species such as the spotted owl and bald eagle. To meet the above goals utilize methods, when possible, to obtain forest products for human economic and recreational needs.

Objectives--

A. Reduce fragmentation by decreasing road density while maintaining adequate access for appropriate fire management, hunting, general sightseeing and administrative use. Decreasing motorized vehicle access will also reduce disturbance to wildlife. A reduction in fragmentation could also be achieved by vegetative manipulation activities which could help contrast areas (edges) develop similar structure more rapidly. (C-11, 16) [Trend #'s 1, 4, 7; Opportunity #'s 2, 3, 14, 15]

B. Encourage late and old size structure through the use of vegetative manipulation which will improve the foreground scenic quality and enhance the suitability of the habitat for late successional wildlife species such as the spotted owl, goshawk, great gray owl, black-backed woodpecker, and marten. Large ponderosa pine and Douglas-fir trees at least 30" DBH should be maintained for bald eagle nesting and roosting habitat as well as for other species. (B-1-8; C-11-15) [Trend #'s 1, 5; Opportunity #'s 1, 2, 3, 4, 12, 15]

C. Encourage pioneer and mixed seral stages by underburning to control understory conifer and brush species and planting for the desired mix of species where appropriate. (B-4-8; C-12, 13, 17, 18) [Trend #'s 5, 8; Opportunity #'s 1, 3, 4, 6]

D. A variety of management tools and techniques should be used across the landscape. Manage areas for increased resistance to insects, disease, and fire which can be achieved, in part, by maintaining multiple stand structures and seral conditions, which will also benefit wildlife species. Prescribed fire could be used as a method to simplify fuel beds in order to effectively reduce the risk of stand replacement fires. (B-1-8; C-12, 13) [Trend #'s 1, 2, 4, 5, 8; Opportunity #'s 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 13, 14, 15, 16]

E. Maintain or enhance habitat for wildlife species. Over time, provide large areas (1000+ acres) of contiguous habitat for black-backed woodpeckers. This habitat will be created by endemic populations of insects and disease. Areas of this size and type are not sustainable within the watershed itself, but if examined on a larger scale, this habitat type can be sustainable, and the Odell Watershed can provide an important portion of it. Vegetative treatments, such as salvage or firewood cutting could be designed to enhance foraging, roosting, and nesting needs of the black-backed woodpecker. Areas where wildfires have burned should not be immediately harvested, since burned stands become infested with bark beetles and provide a food source for woodpecker species for several years. Maintain dead and dying trees, since they are utilized by a variety of species including: black-backed woodpecker, other associated woodpeckers, secondary cavity users, ruffed grouse, marten, and fisher. In addition, maintain down woody material since it supports a prey base for goshawk, great gray owl, spotted owl, marten, and fisher. Within lodgepole pine maintain standing dead trees as a structural component within goshawk and great gray owl habitat until canopy cover (dead & live) falls below 50% or known

birds vacate the area. Harvest access, layout, and design should consider travelways as well as additional habitat needs for goshawks and other species. Mixed conifer wildlife movement corridors should be reestablished to benefit species such as the spotted owl and other species that utilize the canopy. (C-11) [Trend #'s 1, 4, 5; Opportunity #'s 2, 3, 4, 9, 10, 12]

F. Utilize natural tree mortality to meet fiber and fuelwood demands, while achieving the main goals. (C-13-15) [Trend #'s 1, 5, 7; Opportunity # 2]

G. Plant resistant strains of western white pine on the upper slope of Hammer Butte to counteract white pine blister rust and maintain vegetative species diversity. (B-1-8) [Trend # 2; Opportunity #'s 2, 4, 5]

H. Maintain ecological interrelationships both above and below ground to assure long-term sustainability of species such as fungi, bryophytes, and lichens. (B-1-8; C-4, 18) [Trend #'s 1, 2, 4, 5, 7; Opportunity #'s 2, 4, 5, 6, 7, 8, 9, 10, 11, 13]

I. Use management methods that will maintain soil capabilities on undisturbed sites and restore those that are degraded. (B-1-8, 11) [Trend # 4; Opportunity #'s 2, 3, 4, 8, 9, 10, 13, 14, 15, 16]

J. Recreational through-traffic and uses should be compatible with wildlife and other users and resources. Efforts should be made to reduce existing and potential future conflicts between dispersed uses. These uses are linked to areas outside the watershed and should also be examined at a broader scale. (C-6, 16-18) [Trend #'s 4, 7; Opportunity #'s 10, 15, 16, 17, 18]

Opportunities--

1. Stands containing immature and mature trees which could be managed to produce suitable replacement trees for bald eagle and other wildlife species needs should be identified. Management of these stands could include underthinning, prescribed low intensity fires, creation of small openings for regeneration, and designated removal of some trees to reduce competition and stress. [Objectives B, C, D]

2. Vegetative manipulation within this area could include thinning or removal of the understory trees, precommercial thinning of regenerated areas to reduce competition and facilitate more rapid growth of the remaining trees, thinning individual species to enhance a particular seral stage, and/or underburning to control understory conifer and brush species. Most regeneration cuttings would probably not enhance the desired characteristics for the area, unless the purpose of the cut is to respond to a disturbance agent which has already had major impacts on stand structure or composition. [Objectives A, B, D, E, F, G, H, I]

3. Fragmentation reduction by means of vegetative manipulation activities could include thinning of regeneration areas to enhance height and diameter growth, treatment of small patches between existing regeneration areas to more closely match the regenerated stands, and/or entering large contiguous areas with future harvest activities in ways which will allow development of viable patch sizes to meet relevant wildlife management objectives. [Objectives A, B, C, D, E, I]

4. Reintroduction of fire in the ponderosa pine and mixed conifer dry plant associations could be used as a vegetative manipulation tool and as a method to simplify fuel beds in order to to effectively reduce the risk of stand replacement fires. Underburning can be used to meet the management objectives for this area, while jackpot burning and/or broadcast burning are possible methods to use in previously harvested regeneration units. Pre-treatment of underburn areas may be

needed to minimize stand replacement events. Such treatments could include understory thinning, mechanical piling, crushing, or similar activities which would effectively reduce the risk of destroying the overstory by underburning. Create fuel reduction breaks which will aid in high intensity fire suppression. Within these areas intensive thinning, removal of limbs, and reduction of the large fuel component should take place. [Objectives B, C, D, E, G, H, I]

5. Coordinate collection of western white pine seeds with seed procurement personnel and appropriate nurseries. Plant western white pine that is resistant to blister rust. [Objectives D, G, H]

6. Enhance sugar pine regeneration on the buttes and in other suitable locations by thinning existing areas and/or underplanting. [Objectives C, D, H]

7. Maintain or enhance large, woody material (LWM) in Moore Creek which may be achieved by thinning stands to promote development of future LWM. [Objectives D, H]

8. Identify and mitigate cold air drainage areas when planning vegetation manipulation. [Objectives D, H, I]

9. The exact distribution, quantity, types, and sustainability of fungi within this area are unknown. Baseline surveys should be conducted to determine the density and diversity of fungi species present, and monitoring studies should be used to determine the effects of extensive mushroom harvesting on the sustainability of the mushroom species and ecosystems. (Tie to Chemult study in progress). In addition, information needs to be obtained on the mycorrhizal relationship between fungi and tree species, the effects of mushroom harvesting on the tree species, and the effects of tree harvesting on the mushrooms. Mushrooms and their relationship to wildlife as a food source should also be explored. Information should be obtained on the amount, type, and location of mushrooms that are commercially harvested. The impacts on aesthetics and pristine areas from mushroom harvesting and associated uses (industrial camp sites) should be quantified. [Objectives D, E, H, I]

10. Seasonal limits or restrictions should be explored due to the conflicts between mushroom hunters and other users, such as archery hunters. Seasonal restrictions would also allow recreational mushroom pickers the opportunity to harvest mushrooms for their personal use and would ensure that larger quantities of mushrooms would be left for consumption by wildlife. Restrictions should be placed on the mushroom harvest methods, if they are detrimental to the forest ecosystem. For instance, the displacement of large, woody material should not be allowed as a mushroom harvest method. [Objectives D, E, H, I, J]

11. Maintain or enhance Jepson's monkey-flower (*Mimulus jepsonnii*) populations. Jepson's monkey-flower is a sensitive plant species. [Objective H]

12. Assess the appropriateness of installing guzzlers. [Objectives B, E]

13. Rehabilitate soils in harvest areas with excess compaction. [Objectives D, H, I]

14. Decrease motorized vehicle access throughout the Central Conifer Association to reduce disturbance to wildlife, and rehabilitate suitable roads to reduce fragmentation and as well as the opportunity for wildlife poaching. Close or obliterate roads based on slope and skid trail/road density maps, the need to reduce fragmentation, and overall access plans. Assess the impacts to areas where trails and/or roads extend the stream/runoff network. Establish priorities for rehabilitation and standards for maintenance. [Objectives A, D, I]

15. Evaluate trails by conducting a suitability study with soils and ROS, if unsuitable, redesign trails for appropriate use. Evaluate multiple-use trails and appropriateness of mountain bike trails. Design trails and links for appropriate uses including a bike trail from Davis Lake/BEMA around the wetlands to the underpass. Where feasible, convert roads to trails. As appropriate, extend or develop the Metolius-Windigo horse trail. Evaluate the appropriateness of and establish the Ranger Butte horse camp. [Objectives A, B, D, I, J]

16. Identify, designate, and harden dispersed camp sites. Consider development of dispersed camp sites at trail heads. [Objectives D, I, J]

17. Consider potential future conflicts between users, i.e. mushroom hunters/bow hunters, horseback riders/hikers/mountain bikers, snowmobilers/skiers, etc., and prepare educational programs to reduce conflicts. [Objective J]

18. Assess cultural aspects on buttes. [Objective J]

Land Allocations--

Late Successional Reserve
Matrix--The opportunities listed above apply to both matrix and LSR areas, however, the scale of the opportunities may be different.
Riparian Reserve

PRIORITY LANDSCAPE AREAS AND OPPORTUNITIES

The following evaluation criteria were used to determine the priorities for the Odell Watershed:

* Immediacy of need
* Meet intent of ROD
* Preventative
* Feasible

TABLE 5 - 1, LANDSCAPE AREA PRIORITIES

Landscape Area	Priority Opportunity #'s	Primary Priority Areas	Ranking
West Odell Creek	1, 4, 6/7, 10, 11	Recreation; soils; access	
East Odell Creek	1, 7, 8	Reduce fragmentation; restore riparian; obliterate roads	4
Odell Lake/Willamette Pass	9, 8, 1, 6,	Restore riparian; recreation (summer homes, Shelter Cove); wildlife	2
Davis Lake	1, 3, 6, 9	Vegetation management; fish; recreation	3
Mountain Hemlock Association	1, 3, 6, 4	Vegetative species management; fish/amphibians; soils; wildlife corridors	
Central Conifer Association	1-6, 13, 14, 15	Vegetation management; soils; access	1

COMPARISON OF THE GOALS, OBJECTIVES, AND OPPORTUNITIES WITH THE PRESIDENT'S FOREST PLAN

On the west end of Odell Lake, a small piece of Matrix designation overlaps a previous "Eagle Habitat" designation from the Deschutes Land and Resource Management Plan. A preliminary study of this indicates that the PFP allocation should be changed to Administratively Withdrawn. However, coordination with the Willamette NF should be conducted prior to making a decision.

On the south side of Odell Lake, small areas of Matrix designation overlap "Intensive Recreation" designations from the Deschutes LRMP. Again, a preliminary study indicates that the PFP allocation should be changed to Administratively Withdrawn.

At Davis Lake, a closer look needs to be taken with GIS layers to determine whether campgrounds at this lake, particularly Lava Flow Campground are included within an LSR allocation or Administratively Withdrawn. Preliminarily, those at the upper end of Davis Lake should be included in Administratively Withdrawn. Since Lava Flow Campground and the main boat ramp are within an active eagle area, the decision as whether or not to change this allocation needs further discussion.

MONITORING AND INVENTORY

The following opportunities are relevant to all landscape areas.

INVENTORY AND SURVEYS

Late successional species--

1. Conduct 3-5 years of surveys to obtain baseline data, then every ten years conduct two years of surveys to determine the trend. Plots will be set up in each PAG for appropriate species.

2. Partnerships with the National Audubon Society, High Desert Museum, and other birding groups may be utilized to conduct bird surveys in a timely manner.

3. Specific species to survey include spotted owl, great gray owl, flammulated owl, northern goshawk, black-backed woodpecker, white-headed woodpecker, three-toed woodpecker, and pileated woodpecker.

Amphibians--

1. Conduct 3-5 years of surveys to obtain baseline data, then every ten years conduct two years of surveys to determine the trend. Plots will be located in water bodies containing appropriate habitat for the various species.

Non-native species--

1. Conduct initial surveys to determine the presence/absence and extent of non-native plant and wildlife species within the watershed.

2. Plant surveys may need to be conducted annually if treatment is being administered.

3. For non-native wildlife species conduct 3-5 years of surveys to obtain baseline data, then every ten years conduct two years of surveys to determine the trend or invasion potential. Plots will be set up in appropriate habitats.

Birds--

1. Initiate a Breeding Bird Survey route within the watershed, that would be conducted on one day annually.

Mammals--

1. Initiate track surveys for marten, fisher, and wolverine.

2. Conduct 3-5 years of surveys to obtain baseline data, then every ten years conduct two years of surveys to determine the trend. Plots will be set up in each PAG for appropriate species.

Ecological Units--

1. Update vegetation inventories and soil surveys in wilderness and dispersed recreation areas where traditional surveys were cursory.

Recreation–

1. Participate in community planning in those areas that are influenced by or cause influences to the Odell Watershed, in order to determine appropriate uses of the watershed resources, i.e. Odell Lake, Davis Lake, etc.

MONITORING

Strategies

The Forest Service and ODFW have planned an extensive monitoring program for the bull trout in 1994 in Odell Lake and its tributaries. Water temperature, trap netting, and stream, spawning, and angler surveys will be accomplished.

Macroinvertebrates are good indicators of watershed health, and have been used for the last three years as the primary monitoring tool in Odell Creek for sediment and water quality concerns. Stream surveys have been conducted on Odell, Trapper, and Crystal Creeks, and a few small streams on the west side of Odell Lake. These stream surveys will be repeated at regular intervals in order to monitor watershed health.

Monitoring in General

Bull trout
Water quality/quantity
Forest Plan items
Priorities based on watershed trends
Human/riparian interface
Fungus/mycorrhizae relationships
I & D--impact/extent/potential

CUMULATIVE EFFECTS

The following is a list of items to consider and address when completing NEPA analysis:

Recreation opportunities
Reduction of habitat for sensitive species
Fragmentation
Soil quality
Riparian condition and sensitive riparian areas
Ecological processes
Water quality
Movement corridors
Roads
Vegetation management in context of HRV
Historic fire patterns
Disturbance regimes
Overall social context
Fish management information

These items have been discussed in the watershed analysis.

AQUATIC CONSERVATION STRATEGY

INTRODUCTION

The President's Forest Plan developed a strategy for the protection and restoration of aquatic/riparian ecosystems for Forest Service administered lands within the range of the Northern Spotted Owl. The President's Forest Plan identified nine objectives for the Aquatic Conservation Strategy. These objectives can be summarized as follows: Ensure protection of aquatic systems, maintain connectivity, maintain water quality, maintain water and sediment storage and transport regimes, maintain and restore fish, wildlife, and plant populations and diversity. There are four components of the strategy: Riparian Reserves, Key Watersheds, Watershed Analysis, and Watershed Restoration.

The President's Forest Plan identified Odell Creek as a Key Watershed (Tier 1). This watershed is to provide a refugia for management and recovery of at-risk fish species (bull trout) and to provide high quality water. Watershed Analysis is a planning tool which ensures the above objectives are considered and incorporated in all management decisions. Implementation occurs through watershed restoration and the following special standards, guidelines, and recommended riparian reserves. The interim riparian reserves as defined in the President's Forest Plan are shown in Figure 5.

RIPARIAN RESERVES

RESOURCE CONSIDERATIONS FOR SETTING RIPARIAN RESERVES

Processes which drive the dynamics of the floodplain and channel are paramount considerations for setting Riparian Reserve widths and conditions. The width of the channel and floodplain and flow regime characteristics dictate the minimum size of the trees needed to provide effective, instream wood. The presence of LWM within a streamchannel is critical to maintaining the integrity of the system, in fact, there cannot be an overabundance of LWM. This wood plays an active role in the storage of sediment in the channel. The general rule is, the larger the tree, the more stable it will be in the floodplain, and the more stream shade it will provide while it is alive. Natural sediment storage in the uplands results from woody material that accumulates on the forest floor and impedes its movement downslope.

The floodplain vegetation is important in resisting the erosive forces of flood events. These zones are very important filters of sediment and nutrients; the thick vegetation creates an extreme roughness which inhibits water movement through and over it.

Riparian areas provide a moist zone for amphibians and other wildlife species to travel and reside in. Ungulates use the riparian areas disproportionately more than terrestrial areas for fawning and calving, and lactating females take advantage of the improved cover and succulent vegetation. Nearly 80% of the terrestrial wildlife species are either directly or indirectly dependent upon riparian areas for meeting their habitat needs.

Riparian Reserves provide important wildlife habitat, which justifies the heavy loading of LWM in the creeks and the floodplains. Refer to Chapter 3 Biological Domain/Wildlife for additional information on riparian habitats. In the Riparian Reserves (particularly in the Lodgepole Pine Plant Association Group), it is desirable to maintain healthy forest stands over the long-term, while maintaining high snag densities and green tree replacements. Wildlife, water quality, and stand health should dictate stand treatment needs within the Riparian Reserves. It is recognized that the Reserves constitute an area where higher risks are taken (including reduced fire suppression efforts) in order to allow natural processes to occur

and continue without human intervention. Agee (1990) reports that by far the greatest disturbance factor for riparian zones is flood events, not fire.

RIPARIAN RESERVE WIDTHS AND MANAGEMENT REQUIREMENTS

The Riparian Reserves, as described in the President's Forest Plan and Record of Decision (ROD) have been adapted (USDA, USDI, 1994) for the Odell Watershed. These Riparian Reserves will be managed as special management areas, utilizing the sideboards listed below in addition to the Standards and Guidelines in the ROD. Site specific conditions and mitigation will be developed in the project Environmental Assessments (EA).

Vegetation

In the Eastern Cascades it is recognized that fire played an important role in shaping the vegetative pattern across the landscape. A combination of salvage, thinnings, and fire can be used as tools to create small openings in the riparian zone. No large trees that have the potential to provide shade (within the distance equal to the height of two site-potential trees) or LWM to the creek will be disturbed. Wildlife needs will dictate the remaining condition of the patches to be created. The fuel loading in the Reserves will be greater than that in the surrounding uplands except within established facilities (campgrounds, summer home tracts, etc). Operations within the Reserves will result in less than 2% compaction spatially over the length of a mile.

Roads, Grazing and Minerals Management

As per the ROD. Site specific conditions and mitigation will be developed in the project EA. No net increase in roads will occur.

Recreation Management

No new campgrounds will be developed within the distance equal to the height of two site-potential trees of any water body. It is recognized that picnic areas can be developed within that zone if the soils are coarse and riparian vegetation is not trampled or destroyed such that sediment has the potential to wash into the waterbody. Use vegetative buffers to contain any sediment in the uplands. Techniques which are desirable to use are designated trails, hardening sites or creating causeways across sensitive areas. Any existing campsites that are closer than 50 feet to the water (fire ring or picnic bench) will be relocated at a greater distance from the water.

Fire/Fuels Management

Develop a fire management strategy for the Riparian Reserves within five years that will allow for fire by prescription (both natural and human caused ignitions). The intent is for heavy loading of down fuels in the Reserves to result, however, some openings can be created in order to provide a diversity of habitats and to reduce encroachment of conifers in the wetlands.

Lands, General Riparian Area Management, Watershed and Habitat Restoration, Fish and Wildlife Management and Research

As per the ROD, site specific conditions and mitigation will be developed in the project EA.

RIPARIAN RESERVES WITHIN THE LANDSCAPE AREAS

WEST ODELL CREEK

Lodgepole pine occupies the flats and slight depressions (cold air sinks) among the moraine landform; mixed conifer occupies the slopes and top of the moraines; and mixed conifer is present on the upper terrace and along the creek. This area is dominated by riparian/wetland habitat and few human impacts have occurred on the landscape. Due to the desire to maintain the integrity of this segment of the creek and riparian associations, the entire West Odell Landscape Area is recommended for designation as a Riparian Reserve. This zone is dominated by riparian vegetation in conjunction with the creek and the numerous intermittent streams. The source of water for this zone is the groundwater that moves through the moraine, which holds Odell Lake. Few roads or trails penetrate this zone and vegetative manipulations have been minimal. The lodgepole pine is showing signs of bark beetle infestation, which will result in the creation of pockets of dead and dying lodgepole.

In order to maintain water quality and floodplain integrity, minimal activities should occur within the zone outlined by the top of the outermost stream terrace. The recommended riparian widths are wide enough to maintain floodplain water quality. These widths ensure that when floods occur there is enough room for the anticipated water to pass, allow for sediment deposition to occur, and there is adequate vegetation to provide long-term large, woody material recruitment. Wildlife species will benefit from the corridors created by this riparian reserve.

A diversity of vegetative structure is desired. Flexibility in management of this zone will allow for vegetative manipulation to maintain or achieve this diversity. The emphasis is for management of later structural stages of vegetation in the conifer zone and a mix of seral stages in the riparian/wetlands. Opportunities exist to use management techniques such as horse logging, a small tractor over frozen ground, and fire to maintain or manipulate this zone. The emphasis within this area is to limit compaction, thin overstocked stands, provide for diversity, and manage for no net increase in road or trail densities.

Riparian Reserve Widths

West Odell Creek Landscape Area has a broad floodplain/water influence zone and the outer terrace defining the vegetation break is approximately a quarter mile from the creek in most segments. The recommendation is for the entire landscape area to be managed as a Riparian Reserve, where any activities conducted within this zone are to be complimentary to riparian goals.

Fire

Develop a fire management plan that allows for fire to burn to and through the water influence zone. Fire management strategies should include the three C's--confine, contain, and control. No firelines constructed with mechanized equipment should be allowed within or across riparian areas. Manage fire commensurate with the surrounding vegetation zone, providing for structural diversity.

Recreation

Future recreation development will not occur in this zone with the exception of through way non-motorized summer use trails and snowmobile trails.

EAST ODELL CREEK

Lodgepole pine occupies the upper terrace and mixed conifer is present between the terrace and the creek (the floodplain). Outside the riparian zone lodgepole pine is the dominant tree species with minimum diversity of other vegetative species. The zone is gently sloping with high water infiltration.

In order to maintain water quality, at a minimum the Riparian Reserve buffer width needs to be located at the top of the outermost stream terrace which nearly defines the 100+ year floodplain. The recommended riparian widths are wide enough to maintain floodplain water quality. These widths ensure that when floods occur there is enough room for the anticipated water to pass, allow for sediment deposition to occur, and there is adequate vegetation to provide long-term large, woody material recruitment. Corridors needed for wildlife extend beyond the readily recognizable riparian/wetland vegetation.

Emphasis for vegetation management in the adjacent conifer zone is LSR. The resulting later structural stage will assure a continual supply of LWM in the floodplain for shade purposes, wood to the creek, and downed wood and snags for wildlife. A diversity of vegetative structure is desired. Flexibility in management of riparian areas is needed to allow for vegetative manipulation to maintain or achieve this diversity. Small openings to create early seral stages are desirable. Opportunities exist to use management techniques such as horse logging, a small tractor over frozen ground, and fire management techniques. The emphasis in this area is to limit compaction and have no net increase in road densities.

Riparian Reserve Widths

East Odell Creek floodplain zone has a broad water influence zone and the outer terrace defines the vegetation break; being approximately a quarter mile wide in most segments. Any activities within this zone are to be complimentary to riparian goals. A large diversity of wildlife species use this habitat (within the terrace) as compared to non-riparian lodgepole. For these reasons, the riparian reserve will be a minimum of the 300 feet on either side of Odell Creek, and will extend beyond where the vegetation zone break is defined by the outer terrace. This will capture all of the floodplain, water influence zone. The intermittent channels in this zone will adapt the riparian zone width as outlined in the President's Forest Plan.

Fire

Develop a fire management plan that allows for fire to burn to and through the water influence zone. Fire management strategies should include the three C's--confine, contain, and control. The down logs within this riparian area contain a great deal of moisture. Because of this moisture the logs will not burn thoroughly. These down logs in turn will help to protect the soil so that it will be minimally impacted by fire. No fire lines built with mechanized equipment should be allowed within or across riparian areas. Manage fire commensurate with the surrounding vegetation zone, providing for structural diversity along the stream.

Recreation

Future recreation development sites are to be located outside of the primary terraces or 300+ feet from the stream.

ODELL LAKE/WILLAMETTE PASS

Mixed conifer occupies the terraces, the floodplains, and the zone along the lake and creeks. There are numerous intermittent and small perennial streams, and many high water table areas occupied by

riparian/wetland vegetation. Nearly 20% of these areas are occupied by or are in close proximity to the railroad right of way, summer home tracts, campgrounds, and resorts. This zone is designated as a recreation emphasis area in the LRMP and the ROD. Recreation facilities directly occupy and adversely impact small portions of riparian zones. Mitigation measures and restoration opportunities have been identified in the management goals and opportunities segment of this report to address the most critical conflict areas.

In order to maintain water quality and floodplain integrity, at a minimum the riparian reserve buffer width needs to be located at the top of the outermost stream or lake terrace. The recommended riparian widths are wide enough to maintain floodplain water quality. These widths ensure that when floods occur there is enough room for the anticipated water to pass, allow for sediment deposition to occur, and there is adequate vegetation to provide long-term large, woody material recruitment. Corridors for wildlife are needed which extend beyond the readily recognizable riparian/wetland vegetation.

The vegetative emphasis in this zone is to manage for later structural conditions. A diversity of vegetative structure is desired. Flexibility in management of riparian areas is needed to allow for vegetative manipulation to maintain or achieve some diversity. The primary goals of vegetative treatments should be to limit compaction, thin overstocked stands, reduce road and trail densities, and provide for maximum standing and down wood.

Riparian Reserve Widths

The Odell Lake riparian area has a small floodplain but large water influence zone. The outer terrace along the creek channels defining the vegetation break is very close to the edge of the active channel. Most channels are perennial in nature but do not contain fish. It is important that vegetation along the lakeshore is maintained in good health such that it can resist wave action and protect the lakeshore from erosion. Water quality, wildlife corridors, and vegetative integrity are key components controlling the management needs of the Riparian Reserves. The riparian reserve widths recommended in the President's Forest Plan are to be used in this zone. All management activities are commensurate with riparian goals for existing facilities and complimentary to riparian goals in the undeveloped areas.

Fire

Develop a fire management plan for the area that allows for fire to burn to and through the water influence zone. Fire management strategies should include the three C's--confine, contain, and control. The down logs within this riparian area contain a great deal of moisture. Because of this moisture, these logs will not burn thoroughly. These down logs in turn will help to protect the soil. No firelines constructed with mechanized equipment should be allowed within or across riparian areas. Manage fire commensurate with the surrounding vegetation zone. Avoid machinery operations through the stream channel, and provide for structural diversity along the stream. Fire suppression efforts will be used to protect life and structural improvements.

Recreation

Future recreation development sites are to be located outside of the primary stream terraces, the floodplain, and 150+ feet from stream channels and lakeshore.

DAVIS LAKE

Lodgepole and ponderosa pine occupy the zone along the lake while the floodplain is occupied by herbaceous vegetation, shrubs, and coniferous species. Less than 2% of the shoreline area is occupied by, or in close proximity to, campgrounds. This zone is designated as a wildlife emphasis area in the

LRMP and ROD. Recreation facilities directly occupy and adversely impact a very small portion of the floodplain/riparian zone.

In order to maintain water quality, the Riparian Reserve width needs to be located beyond the floodplain. These widths ensure that when floods occur there is enough room for the anticipated water to pass, allow for sediment deposition to occur, and there is adequate vegetation to provide long-term large, woody material recruitment. It is important to maintain the health of vegetation along the lakeshore to ensure that it can resist wave action and protect the lakeshore from erosion. Wildlife use the zone beyond the readily recognizable riparian/wetland vegetation.

The conifer stands adjacent to the lake fall into one of three categories for land allocation: BEMA, LSR, and Intensive Recreation. The emphasis is for later vegetative structural stages to be maintained, but this requires some diversity of vegetative structure. Flexibility in management of riparian areas is needed to allow for vegetative manipulation to maintain or achieve this diversity. When vegetative treatments occur the emphasis is to limit compaction, thin overstocked stands, reduce road densities, and provide for wildlife habitat.

Riparian Reserve Widths

The Davis Lake Landscape Area has a large floodplain/water influence zone. The Riparian Reserve for the lake is 300 feet and 150 feet for the associated wetlands adjacent to the lake. The resultant reserve will be the larger of the two conditions applied to the situation. Odell, Ranger, and Moore Creeks occupy a small portion of this zone. The two perennial streams (Odell and Ranger) have been assigned 300 foot reserve widths and the intermittent stream (Moore) is assigned a 150 foot reserve width. Water quality, wildlife corridors, and vegetative integrity are key components controlling the management needs of these riparian reserves. Any activities are performed in a manner which is complimentary to riparian goals.

Fire

Develop a fire management plan that allows for fire to burn to and through the water influence zone. Fire management strategies should include the three C's--confine, contain, and control. No fire lines constructed with mechanized equipment should be allowed within or across riparian areas. Manage fire commensurate with the surrounding vegetation zone. Avoid machinery operations through the stream channel and provide for structural diversity along the stream.

Recreation

Future recreation development sites are to be located outside of the floodplain and 300+ feet from the stream channel or floodplain.

MOUNTAIN HEMLOCK ASSOCIATION

Mountain hemlock and lodgepole pine occupy the upper terrace, while mixed conifer is present between the terrace and the creek (floodplain). This zone is comprised of both wilderness and roadless areas. Natural processes have prevailed across this landscape.

In order to maintain water quality and floodplain integrity, at a minimum the riparian reserve width needs to be located at the top of the outermost stream terrace. The recommended riparian widths are wide enough to maintain floodplain water quality. These widths ensure that when floods occur there is enough room for the anticipated water to pass, allow for sediment deposition to occur, and there is adequate

vegetation to provide long-term large, woody material recruitment. Corridors needed for wildlife extend beyond the readily recognizable riparian/wetland vegetation.

The President's Forest Plan has identified this area as LSR, roadless, and wilderness. Late structural stages of vegetation are emphasized, however, a diversity of vegetative structure is desired. Flexibility in management of riparian areas is needed to allow for vegetative manipulation to maintain or achieve healthy stands. Few vegetative treatments will occur since the emphasis is to allow natural processes to occur, and for fire and hydrologic events to continue to design the vegetative patterns on the landscape. When vegetative manipulation does take place in riparian areas management flexibility is needed in order to maintain or achieve healthy stands.

Riparian Reserve Widths

The mountain hemlock association landscape area has a narrow floodplain/water influence zone (except upper Moore and Trapper Creeks) and the outer terrace defining the vegetation break is very close to the edge of the active channel. Most channels are intermittent or ephemeral in nature. Some of the channels in the wilderness area contain flowing water for several months each year, particularly during the snowmelt and early summer season. Since this landscape area has had minimum impacts from human activities, little to none of the hydrologic function has been compromised. The riparian reserve widths to be used in this segment of the watershed are equivalent to what is reported in the President's Forest Plan. Water quality, wildlife corridors, and vegetative integrity are key components controlling the management needs of this Riparian Reserve. Any activities within this zone are conducted in a manner which is complimentary to riparian goals.

Moore Creek is an amphibian corridor when the water is running. Wood (LWM) recruitment is important for shade, habitat and channel stability. Maintain healthy, green stands, with a reserve width set at 150 feet. Vegetation management should occur for stand health only. Heavy loading of snags and down woody material will be left in the buffer (>6 snags per acre). Clumps should be left to provide for future snag development.

Fire

Develop a fire management plan that allows for fire to burn to and through the water influence zone. Fire management strategies should include the three C's--confine, contain, and control. The down logs within this riparian area contain a great deal of moisture and because of this, they will not burn thoroughly. These down logs then will help to protect the soil so that it will be minimally impacted by a fire. No firelines built with mechanized equipment should be allowed within or across riparian areas. Manage fire commensurate with the surrounding vegetation zone, providing for structural diversity along the stream.

Recreation

Future recreation development sites are to be located outside of the floodplain and primary terraces of the stream channel.

CENTRAL CONIFER ASSOCIATION

Mixed conifer stands are located on the upper terrace as well as between the terrace and the creek (floodplain). This zone has moderate to steep terrain but has a high water infiltration capacity. There are few stream channels in this zone, and they are nearly all intermittent or ephemeral.

In order to maintain water quality and floodplain integrity, at a minimum the riparian reserve width needs to be located at the top of the outermost stream terrace. Corridors needed for wildlife extend beyond the readily recognizable riparian/wetland vegetation.

The majority of this zone has been assigned LSR status in the President's Forest Plan. A diversity of vegetative structure is desired but emphasis is on later structural stages. Flexibility in management of riparian areas is needed to allow for vegetative manipulation to maintain or enhance the later structural stages. When any vegetative treatments occur, the emphasis is to limit compaction, thin overstocked stands, reduce roads, restore soil productivity, and restore water infiltration.

Riparian Reserve Widths

The central conifer zone has a narrow floodplain/water influence zone (except Moore Creek) and the outer terrace defining the vegetation break is very close to the edge of the active channel. Most channels are intermittent or ephemeral in nature, with running water rarely occurring on the surface. A few of these ephemeral channels have been abused during past vegetative manipulation activities which resulted in compaction of the ground and removal of the LWM. Fortunately, sediment movement and accelerated erosion have not detrimentally affected the integrity of the channel. It is recommended that the riparian reserves identified in the President's Forest Plan be adapted. Water quality, wildlife corridors, and vegetative integrity are key components controlling the management needs of the riparian reserve. Any activities occurring in this zone will be complimentary to riparian goals.

Moore Creek constitutes an amphibian corridor when the water is running. Wood (LWM) recruitment is important for shade, habitat, and channel stability. Maintain healthy, green stands with a buffer width set at 150 feet. Vegetative manipulation (sanitation entry) should occur only for stand health reasons. Heavy loading of snags and down woody material will be left in the buffer (>6 snags per acre). Clumps should be left to provide for future snag development.

Fire

Develop a fire management plan that allows for fire to burn to and through the water influence zone. Fire management strategies should include the three C's--confine, contain, and control. The down logs within this riparian area contain a great deal of moisture and because of this will not burn thoroughly. These down logs, in turn, will help to protect the soil so that it will be minimally impacted by a fire. No fire lines constructed with mechanized equipment should be allowed within or across riparian areas. Manage fire commensurate with the surrounding vegetation zone, providing for structural diversity along the stream.

Recreation

Future recreation development sites are to be located outside of the primary terraces or 150+ feet from the stream channel.

ACCESS

GENERAL THOUGHTS AND CONSIDERATIONS

1. Along the open road system, determine the need to restore unauthorized and/or undesigned user developed accesses through such methods as entrance management or complete restoration.

2. Access is a highly sensitive issue to the public. The decision to temporarily close or obliterate an established access needs to consider not only the physical and biological but the social implications as well. The Deschutes National Forest Travel Management Guide (Chapter 2-8 and 2-13) identifies questions to consider in the decision to close a road or trail. Once a decision has been made to close or obiterate a road or trail, the method chosen will be the most economical, while also meeting the intent of the decision, and consistency of management objectives.

3. Roads to be used for winter use (i.e., winter haul, snowmobiling) need to have sufficient drainage designed for compacted snow conditions.

4. In riparian areas with high recreational use, consider "directing" use rather than "restricting" or "prohibiting", particularly if the current use is not causing undesirable impacts. "Allowing" use on designated routes signed on the ground may be a more successful way to redirect use patterns.

5. When constructing or reconstructing accesses, minimize sidecasting to reduce the potential for sedimentation.

6. Reconstruct roads and associated drainage features that pose a substantial risk to water quality and fisheries.

7. Prioritize reconstruction based on current and potential impacts to riparian resources and the ecological value of riparian resources affected.

8. Before looking at closing or obliterating new accesses, look at the effectiveness of existing obliterations. How well does the obliteration meet the intent of the following definition?

   Obliteration:

   > The reclamation and/or restoration of land to resource production from that of a transportation facility (FSM 7709.54-90-1).
   >
   > (A travelway) over which travel has been and will continue to be denied, the entrance obscured, and the wheel tracks or pathway is no longer continuous and suitable for travel. It includes travelways obliterated by natural processes such as revegetation or other natural occurrences, and for which the drainage is not in need of further attention (FSM 7700-90-2).

   If the decision is to "re-obliterate" the access, be certain that this action will not result in a greater potential for sedimentation. The entire road or trail prism needs to be restored for drainage concerns.

   After looking at the effectiveness of existing obliterations, consider temporarily closed travelways as candidates for obliterations (Maintenance Level 1 roads). Typically, these travelways have

been closed and reduced to a Level 1 status because they will not be needed in the near future (3 to 5 years).

9. The majority of the existing road system was planned and designed for tractor logging methods. If other logging methods are used in the future, a reduction in road densities may be appropriate. However, landing sites along the open roads may need to be enlarged and the increased likelihood for impacts in these locations will need to be evaluated.

ADDITIONAL NEEDS/DATA GAPS/PROCESS SHORTCOMINGS

The following is a list and short explanation of areas the Pilot Team thinks are shortcomings of this study. We recommend for further analysis of this area, or for other watershed analysis teams to take note of these areas.

* LACK OF PATCH ANALYSIS. Due to a lack of timely data (good vegetative species composition for current conditions and difficulty with implementing the Relational Habitat Model, no patch analysis was done. Until a patch analysis is completed, predictions for maintaining wildlife diversity are difficult.

* LACK OF FIRE BEHAVIOR MODELS. While the Team did run fire behavior models, it became apparent that our assumptions were not valid. Without appropriate predictive models of disturbance regimes, it is difficult to project future stand conditions given management scenarios. NOTE: During future watershed planning ventures the following should be considered.

> APPLICATION OF INFORMATION PROVIDED THROUGH HISTORIC FIRE INFORMATION AND PRESENT FUEL LOADING INVENTORIES:
>
> Transition from specific PAG(s) and historic fire return intervals, intensities, size, time and duration is inadequate.
>
> The fire history itself is well documented and expressed, however, linkage to facilitate applying fire management objectives and /or resource objectives will require an additional step.
>
> Fuel loading and surface structure of reproduction, shrub community, arrangement and composition of the down woody component will require further investigation, utilizing site specific (elevation/Aspect) information. With the above information fire behavior characteristics can be modeled for particular PAG(s) with similar loading/topographic details. Thus fire management planning; both prescribed fire entries and modified fire suppression plans can be developed and applied within historic range of variability parameters.

* PUBLIC INVOLVEMENT. More extensive public involvement is needed, especially with the "general public" that lives locally and recreates in area. Involve people during Phase A (the Pilot Team did not involve general public in Phase A); continue with expanded involvement in Phases B, D & E.

* INTERAGENCY INVOLVEMENT. Explore options to involve other agencies, especially non-Federal agencies and Tribal Governments, without being repetitive to those agencies who have been involved more frequently in the process.

* DATA GAPS. Many data gaps exist. Our methods for gathering data in the past have left many gaps in areas surveyed (non-timber producing areas had little to no data or information sources), and resources surveyed (little to no information about certain species such as bryophytes, molluscs, etc. and little information about relational functions of ecosystems).

* COORDINATION WITH ADJOINING FORESTS. Coordination with Willamette National Forest to determine context of Matrix allocation on west edge of Odell Lake.

* INSUFFICIENT VEGETATION DATA. PMR data came late, and was much more complex to use than originally thought. Gaps of data added large workload to model from existing databases. PMR for this

area and probably much of Deschutes is not valuable to determine species composition. This leaves a major data gap in modeling wildlife habitat.

* RELATIONAL HABITAT MODELING. Use of the relational habitat model was not possible due to a lack of sufficient vegetative data as well as the time involved. The Team biologist spent a lot of time trying to get the model working for this analysis, it just wasn't possible.

* HISTORIC RANGE FOR FRAGMENTATION. No attempt was made at determining an historic range of variability for fragmentation.

* INTEGRATED LANDSCAPE OPPORTUNITIES. Opportunities could be more integrated for more "ecosystem" recommendations. The Team simply ran out of time.

* DISTURBANCE REGIMES. Did not do a "landscape level" analysis of fire and insect and disease.

* HISTORIC HUMAN USE. It should be noted that a wealth of information exists about conditions of pre-European influence, but this information is very difficult to use in its present form. It is probable that a great deal of insight could be gained by taking the steps necessary to automate this information in spatial and attributed electronic data.

The following would have made a more complete analysis:

* Habitat analyses for owls for watershed and in relationship to LSR.

* LSR analyses and fire management plan.

* Pictograph of seral/stuctural matrix.

* Data for logs and snags (need).

* Some needed information is available, but not in useable format.

* Need "ecological" surveys.

* Need document index by keywords, subject.

* GIS needs lead, prep time. Suggest doing Phase A, then have a time gap (data, gis, etc.), then continue.

* Need fire ecology skills on team. Identify GIS as full Team member. Need separate responsibilities for Team Leaders and writer-editors.

* Tended to lose focus/refocus to "critical few" issues from Phase A.

* Need vegetation information early in process, for others to use. Didn't know what time/money it would take to get data useable. Vegetation data/PAG data need to precede other biological data.

* Need a fire module in WEAVE.

* Provincial assessments could provide information from that perspective.

* Tendency to revert to functional roles when push comes to shove due to expedience. Problem-solving process tended to functionalism; rely more on Diaz-Apostle.

REFERENCES

REFERENCES

Bisbee, B. 1994. Personal Communication.

Blair, G.S. and Idaho Dept. of Fish & Game. 1993. Species Conservation Plan for the White-headed Woodpecker (Picoides albolarvatus). USDA-FS-Region 1, Nez Perce National Forest. Grangeville, Idaho. 14 pp.

BLM. 1985-1993. Automatic Lightning Detection System (ALDS) Maps.

Bowerman, W. W., and J. P. Giesy. 1991. Factors Influencing Breeding Success of Bald Eagles in Upper Michigan. Masters Thesis. Northern Michigan University. Marquette, MI.

Boyer, D. 1993. Bend Pine Nursery Soil Management Plan.

Brewer, R., G. McPeek, and R. A. Adams, Jr. 1991. The Atlas of Breeding Birds of Michigan. Michigan State University Press. East Lansing, MI.

Broley, C. L. 1947. Migration and Nesting of Florida Bald Eagles. Wilson Bulletin, 59:3-20.

Bulletin (Bend). July 3, 1994. Bend, Oregon. A copy is included in the Odell Watershed Analysis File.

Bulletin (Bend). September 28, 1994. Bend, Oregon. A copy is included in the Odell Watershed Analysis File.

Caraher, D. L., J. Henshaw, F. Hall, W. H. Knapp, B. P. McCammon, J. Nesbitt, R. J. Pederson, R Ragenovitch, and C. Tietz. 1992. Restoring Ecosystems in the Blue Mountains. A report to the Regional Forester and the Forest Supervisors of the Blue Mountain Forests. USDA Forest Service, Pacific Northwest Region. 14 p + appendices.

Coburn, J. 1994. Personal Communication.

Community Action Team (CAT). 1994. Community Action Plan. Crescent Lake Junction-Odell Lake-Willamette Pass Area Recreation and Infrastructure. Deschutes National Forest. Bend, Oregon.

Department of Planning, Public Policy and Management, University of Oregon. 1984. An Analysis of the Current and Potential Demand for Overnight Accomodations in the Willamette Pass Recreation Area. USDA Forest Service, Deschutes National Forest. Bend, Oregon.

Dickman, Alan and Stanton Cook. 1988. Fire and Fungus in a Mountain Hemlock Forest,in Canadian Journal of Botany. Vol. 67:2005-2016.

Doran, J. W., et al., eds. 1994. Defining Soil Quality for a Sustainable Environment. Soil Science Society of America Special Publication No. 35.

Douglas, C.W. and M.A. Strickland. 1987. Fisher pp. 510-529 *in* Wild Furbearer Management and Conservation in North America. Ministry of Natural Resources. Ontario, Canada. 1150pp.

Ehrlich, P.R., D.S. Dobkin, and D. Wheye. 1988. The Birder's Handbook: a Field Guide to the Natural History of North American Birds. Simon & Schuster Inc. New York. 785pp.

Finneran, C. K. 1988. Interpretive Plan Davis Lake. USDA Forest Service, Deschutes National Forest, Crescent Ranger District. Crescent, Oregon.

Forest Service Handbook FSH 2509.18 Soil Management Handbook, WO Amendment 2509.18-91-1 Chapter 2 Soil Quality Monitoring

Franklin, J. F., and C. T. Dyrness. 1973. Natural Vegetation of Oregon and Washington. Portland, Oregon. USDA Forest Service. Pacific Northwest Forest and Range Experiment Station: GTR PNW-8.

Grub, T., W. W. Bowerman, and J. P. Giesy. 1991. Ecology of Bald Eagles on the AuSable, Manistee, and Muskegon Rivers. Michigan State University. Michigan State University. East Lansing, MI.

Hall, S., and H. LeGrand. 1989. Element Stewardship Abstract for *Haliaeetaus leucocephalis leucocephalus*. The Nature Conservancy: Arlington, VA.

Harris, A. S. 1989. Wind in the Forests of Southeast Alaska and Guides for Reducing Damages. PNW-GTR-244, USDA Forest Service, Pacific Northwest Research Station. Portland, Oregon. 27pp.

Harvey, A. E., et al. 1994. Biotic and Abiotic Processes in Eastside Ecosystems: The Effects of Management on Soil Properties, Processes, and Productivity. General Technical Report PNW-GTR-323.

Hayward, G.D., T. Holland, and R. Escano. 1990. Goshawk Habitat Relationships.

Hickerson, L. 1994. Personal Communication.

History Papers. Copies of general history papers that address areas within the Odell Watershed. All copies are included in the Odell Watershed Analysis File.

Hopkins, W. E. 1994. Personal Communication.

Ingles, L. G. 1965. Mammals of the Pacific States. Stanford University Press. Stanford, CA. 506pp.

Ingram, Rod. 1973. Wolverine, Fisher and Marten in Central Oregon, *in* Oregon State Game Commission Report No. 73-2.

Larson, D.M. 1976. Soil Resource Inventory, Deschutes National Forest, Pacific Northwest Region.

Leonard, W.P., H.A. Brown, L.C. Jones, K.R. McAllister, and R.M. Storm. 1993. Amphibians of Washington and Oregon. Seattle Audubon Society. Seattle, Washington. 168pp.

Macleod and Sherrod, Geologic Map, West Half Crescent 1 by 2 Quad, OR 1:250,000, Map I-2215

Maffei, H. 1994. Personal conversation.

Marshall, D.B. 1992a. Sensitive Vertebrates of Oregon. Oregon Department of Fish and Wildlife. First Edition. Portland, Oregon.

Marshall, D.B. 1992b. Status of the Black-backed woodpecker in Oregon and Washington. Audubon Society of Portland. Portland, Oregon. 13pp

McCauley, K. J. and S. A. Cook. 1980. *Phellinus Weirii* Infestation of Two Mountain Hemlock Forests in the Oregon Cascades. Forest Service, Vol. 26, No. 1:23-29.

McCauley, P. 1993. Deschutes National Forest Fire History Narrative. Draft.

Molina, R., T. O'dell, D. Luoma, M. Amaranthus, M. Castellano, and K. Russell. 1992. Biology, Ecology, and Social Aspects of Wild, Edible Forest Mushrooms in the Pacific Northwest: A Preface to Managing Commercial Harvest. USDA Forest Service, Pacific Northwest Research Station. Portland, Oregon.

Putnam, D. 1994. Personal Communication.

Register Guard. September 6, 1994. Eugene, Oregon. A copy is included in the Odell Watershed Analysis File.

Reynolds, R.T., E.C. Meslow and H.M. Wright. 1982. Nesting Habitat of Coexisting Accipiters in Oregon. Journal of Wildlife Management, 46(1):124-138.

Settlement Papers. 1908-1915. Various settlement documents, located in the Deschutes National Forest Supervisor's Office Library. Bend, Oregon. Copies are included in the Odell Watershed Analysis File.

Sharp, B.E. 1962. Neotropical Migrants on National Forests in the Pacific Northwest: A Compilation of Existing Information. Portland, Oregon.

Sherman, J. 1993. Deschutes National Forest Fire History (Ongoing Assembly).

Simon, S. A. 1991. Fire History in the Jefferson Wilderness Area East of the Cascade Crest.

Simpson, M., D. Zalunardo, A. Eglitis, D. C. Wood, D. Roy, and S. Johnson. 1994. Viable Ecosystems Management Guide - Ochoco National Forest. 103 p + appendices (Draft).

Simpson, R. L. 1994. Cascade Lakes National Scenic Byway Interpretive Planning. USDA Forest Service. Deschutes National Forest. Bend, Oregon.

Smith, David Martyn. 1962. The Practice of Silviculture. Seventh Edition. John Wiley & Sons, Inc. New York.

Strickland, M.A. and C.W. Douglas. 1987. Marten pp. 530-547 *in* Wild Furbearer Management and Conservation in North America. Ministry of Natural Resources. Ontario, Canada. 1150pp.

Swanson, F. J., J. A. Jones, D. O. Wallin, and J. H. Cissel. 1993. Natural Variability - Implications for Ecosystem Management. p 89-103 *in* Jensen, M. E. and P. S. Bourgeron, 1993. Eastside Forest Ecosystem Health Assessment Vol. II. Ecosystem Management: Principles and Applications. USDA Forest Service. 397 p.

USDA Forest Service. Charlton-Davis Lake Land Study. USDA Forest Service, Deschutes National Forest. Bend, Oregon. A copy is included in the Odell Watershed Analysis File.

USDA Forest Service. 1970. Maiden Peak Potential Winter Sports Site, Multiple Use Survey Report Stage 1. USDA Forest Service, Pacific Northwest Region. Portland, Oregon.

USDA Forest Service. 1990a. Land and Resource Management Plan (LRMP), Deschutes National Forest. USDA Forest Service, Pacific Northwest Region. Deschutes National Forest. Bend, Oregon.

USDA Forest Service. 1990b. Final Environmental Impact Statement, Land and Resource Management Plan, Deschutes National Forest. USDA Forest Service, Pacific Northwest Region. Deschutes National Forest. Bend, Oregon.

USDA Forest Service. 1994. Crescent Ranger District, Deschutes National Forest 1994-1995 Travel Map. USDA Forest Service, Crescent Ranger District. Crescent, Oregon.

USDA Forest Service. 1994. Viable Ecosystems Management Guide. Ochoco National Forest. Prineville, Oregon.

USDA Forest Service. 1994. Appendix J-2, Results of Additional Species Analysis from the 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. Washington D.C.

USDA Forest Service, USDI Bureau of Land Management. 1994. Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl, Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species within the Range of the Northern Spotted Owl. Washington D.C.

USGS Map. 1903. Central Oregon Cascade Reserve.

Video. 1994a. "Eye on America" segment on Bend, Oregon.

Video. 1994b. Z21 Newscast segment on the draining of Davis Lake.

Virgin, T. 1994. Personal Communication.

Vroman, J. 1994. Personal Communication.

Williams, G. W. 1983. Crossing the Willamette Pass, or is it Pengra? *in* Lane County Living. Eugene, Oregon.

Williams, Gerald W., ed. 1985. Judge John Breckenridge Waldo: Diaries and Letters from the High Cascades of Oregon 1880-1907. Umpqua and Willamette National Forests. Eugene, Oregon.

Williams, Gerald W., ed. 1994. Reference on the American Indian Use of Fire in Ecosystems. Draft electronic mail pater. USDA Forest Service. Pacific Northwest Region.

GLOSSARY

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Abiotic -- Referring to the absence of living organisms.

Activity center -- (Spotted Owl activity center) An area of concentrated activity of either a pair of spotted owls or a territorial single owl.

Adfluvial -- Refers to fish which spend their adult life stages in a lake, but spawn and are reared in streams.

Administratively withdrawn areas -- Areas removed from the suitable timber base through agency direction and land management plans.

Air quality related values -- Values within Class I areas, such as visibility, biological diversity, and water quality, that under the Clean Air Act, should be protected from the adverse impacts of air pollution.

Alluvial -- Originated through the transport by and deposition from running water.

Amphibian -- A cold blooded, smooth skinned vertebrate organism including frogs, salamanders and toads.

Anadromous fish -- Fish that are born and reared in freshwater, move to the ocean to grow and mature, and return to freshwater to reproduce. Salmon, steelhead, and shad are examples.

Andesite -- Extrusive igneous rock of diorite composition; occurs as lava.

Aquatic ecosystem -- Any body of water, such as a stream, lake or estuary, and all organisms and non-living components within it, which function as a natural system.

Aspect -- The direction a slope faces.

Bark beetles -- Beetles (Coleoptera/Scolytidae) that attach to tree stems and produce their young in galleries located between the outer wood and inner bark.

Basalt -- Extrusive igneous rock of gabbro composition; occurs as lava.

Basin (River Drainage Area; Catchment) -- The area of land that drains water, sediment and dissolved materials to a common point along a stream channel.

Biodiversity -- See Biological Diversity

Biological diversity -- (Biodiversity, Diversity) (1) The distribution and abundance of plant and animal communities. (2) The variety of life forms and processes, including a complexity of species, communities, gene pools, and ecological functions.

Biota -- The animal and plant life in an area.

Candidate species -- Those plants and animals included in Federal Register "Notices of Review" that are being considered by the Fish and Wildlife Service for listing as threatened or endangered. Two categories that are of primary concern: Category 1 (C1) - Taxa for which there is substantial information to support proposing the species for listing as threatened or endangered. Listing proposals are either being prepared or have been delayed by higher priority listing work. Category 2 (C2) - Taxa information indicates that listing may be appropriate. Additional information is being collected.

Canopy -- The part of any stand of trees represented by the tree crowns; canopies may occur in layers.

Canopy closure -- The degree to which the canopy (forest layers above one's head) blocks sunlight or obscures the sky. It can only be accurately determined from measurements taken under the canopy as openings in the branches and crowns must be accounted for.

Cavity nester -- Wildlife species, most frequently birds, that require cavities (holes) in trees for nesting and reproduction.

Cirgue -- A steep hollow, often containing a small lake, at the upper end of a mountain valley.

Class I areas -- National Parks or Wildernesses that receive the greatest air quality protection under the Clean Air Act's Prevention of Significant Deterioration (PSD) Program.

Clearcut -- An area of forest from which all merchantable trees have been removed by harvesting.

Clearcutting -- A regeneration harvest method whereby all trees (with the exception of advanced regeneration) are removed from an area of the forest.

Climatic climax -- A climax condition that is maintained by climatic factors such as temperature and precipitation regimes and length of growing season; compare with edaphic climax.

Climax -- The terminal, theoretically stable, self-perpetuating condition in a series of plant communities that culminates plant succession on any given site in the absence of any major disturbance.

Climax species (or series) -- The tree species predominating on a site at climax, especially in the absence of major disturbances. Sites are often described in terms of the major forest series they belong to. For example, grand fir climax series includes plant associations where grand fir is the dominant overstory species at climax.

Climax vegetation -- The pattern or complex of climax plant communities on a landscape corresponding to the pattern of environmental gradients or habitats.

Coarse woody debris -- Portion of a tree that has fallen or been cut and left in the woods. Usually refers to pieces at least 20 inches in diameter.

Congressionally Withdrawn Area -- Areas that require congressional enactment for their establishment such as National Parks, Wild and Scenic Rivers, National Recreation Areas, National Monuments, and Wilderness.

Connectivity of habitats -- The linkage of similar but spatially separated vegetative stands (such as mature forests) by patches, corridors, or "stepping stones" of the same vegetation across the landscape; also, the degree to which similar habitats are so linked.

Contrast -- The degree to which two adjacent ecosytems (edge) are different from one another.

Cover -- Any feature that provides concealment for fish and wildlife. Cover may consist of live or dead vegetation and geomorphic features such as boulders and undercut banks. Cover may be used for the purposes of escape from predators, feeding, or resting.

Critical habitat -- Under the Endangered Species Act, critical habitat is defined as (1) the specific areas within the geographic area occupied by a federally listed species on which are found physical and biological features essential to the conservation of the species, and that may require special management

considerations or protection; and (2) specific areas outside the geographic area occupied by a listed species, when it is determined that such areas are essential for the conservation of the species.

Crown -- The part of any tree containing live foliage.

Crustacean -- A class of aquatic invertebrates having a hard exoskeleton, includes species such as shrimp.

Cryic -- A description of soil temperature regime. The soils have a mean annual temperature higher than 0° C (32° F) but lower than 8° C (47° F) with an O horizon (litter layer).

Cumulative effects -- Those effects on the environment that result from the incremental effect of the action when added to the past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-federal) or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions that take place over a period of time.

Defoliating insects -- Insects which feed on leaves or needles of living trees.

Demography -- The quantitative analysis of population structure and trends; population dynamics.

Desired Condition -- (Desired Future Condition, Desired Ecological Condition)
(a) A portrayal of the land or resource conditions which are expected to result if goals and objectives are fully achieved. (219 REGS)
(b) A description of the landscape as it could reasonably be expected to appear at the end of the planning period: that is, if the plan goals, objectives, standards and guidelines for that landscape are fully achieved.

Diatom -- A minute unicellular or colonial algae.

Dispersal habitat -- Habitat that supports the life needs of an individual animal during dispersal. Generally satisfies needs for foraging, roosting, and protection from predators.

Disturbance -- An event that causes significant change in structure, function, or composition through natural events such as fire, flood, wind, earthquake, mortality caused by insect or disease outbreaks, or by human-caused events, e.g., the harvest of forest products.

Domain -- A sphere of common activities, knowledge, and processes. For convenience, analytical modules of the WEAVE process have been grouped into three domains: physical, biological, and social.

Dominance -- An index related to diversity indices that measures the relative dominance of vegetation types across the landscape. High dominance values indicate a landscape area dominated by few vegetation types; whereas, low values occur in landscapes having diverse vegetation. Dominance does not measure the pattern of distribution.

Dominant -- A group of plants that by their collective size, mass, or number exert a primary influence on other ecosystem components.

Drainage -- An area (basin) mostly bounded by ridges or other similar topographic features, encompassing part, most, or all of a watershed and enclosing some 5,000 acres (see Subdrainage and Forest Watershed).

Duff layer -- As specifically defined in the FEMAT Report, the layer of loosely compacted debris underlying the litter layer on the forest floor.

Early successional forest -- Forest seral stages younger than mature and old-growth age classes.

Eastside -- Generally, east of the crest of the Cascade Range.

Ecological Classification -- A hierarchical approach to delineating, at different levels of resolution, areas of land having similar capabilities and potentials for management. These areas of land are characterized by unique combinations of the physical environment (such as climate, geomorphic processes, geology, soil, hydrologic function, and potential natural community), biological communities (such as plants, animals, and bacteria), and the human dimension (such as social, economic, cultural and infrastructure).

Ecological process -- The major actions or events that regulate or influence the function, structure, composition and pattern of ecosystems and that link organisms and their environment, including energy flows, trophic levels (food chains), predation, mutualism, successional development, nutrient cycling, carbon sequestration, primary productivity, decay, hydrologic cycles, and weathering.

Ecoregion -- Regions of relative homogeneity in ecological systems or in relationships between organisms and environments based on patterns of terrestrial vegetation and environment.

Eco-subregion -- A geographic area over which the combination of climate, geomorphic process, and topography are sufficiently uniform to permit development of similar ecosystems on sites with similar properties. There are 13 eco-subregions classified on the Deschutes National Forest.

Ecosystem -- (a) A community of living plants and animals interacting with each other and with their physical environment. A geographic area where it is meaningful to address the interrelationships with human social systems, sources of energy, and the ecological processes that shape change over time. (b) The complex of a community of organisms and its environment functioning as an ecological unit in nature. (219 REGS/DRAFT)

Ecosystem Health -- (Forest Health) The state of an ecosystem in which structure and functions are sufficiently resilient to allow the maintenance of biological diversity over time and through a range of disturbances.

Ecosystem management -- The use of an ecological approach in land management to sustain diverse, healthy, and productive ecosystems. Ecosystem management is applied at various scales to blend long-term societal and environmental values in a dynamic manner that may be adapted as more knowledge is gained through research and experience.

Ecotone -- A zone of intergradation between ecological communities.

Edge -- See Habitat Edge.

Edge effect -- The effect of adjoining vegetative communities on the population structure along the margin, which often provides for greater numbers of species and higher population densities than either adjoining community. Edge may result in negative effects as well; habitat along an edge is different than in the patch of habitat, thus reducing the effective area of the habitat patch.

Effects -- Effects, impacts, and consequences are synonymous. Effects may be direct, indirect or cumulative and may fall in one of these categories: aesthetic, historic, cultural, economic, social, health or ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems).

Endangered species -- Any species of plant or animal defined through the Endangered Species Act as being in danger of extinction throughout all or a significant portion of its range, and published in the Federal Register.

Endemic -- A species that is unique to a specific locality.

Environmental analysis (EA) -- A systematic analysis of site-specific activities used to determine whether such activities have a significant effect on the quality of the human environment and whether a formal environmental impact statement is required; and to aid an agency's compliance with the National Environmental Policy Act when no environmental impact statement is necessary.

Ephemeral streams -- Streams that contain running water only sporadically, such as during and following storm events.

Eutrophic -- A term applied to a body of water with high nutrient content and high productivity.

Evapotranspiration -- The loss of water through evaporation and transpiration.

Even-aged management -- A silvicultural system which creates forest stands that are primarily of a single age or limited range of ages. Creation of even-aged stands may be accomplished through the clearcut, seed tree or shelterwood harvest methods.

Extirpation -- The elimination of a species from a particular area.

Fauna -- The animal life of a region or geological period.

Federal agencies -- The Federal Ecosystem Management Assessment Team was composed of representatives from the USDA-Forest Service, USDI-BLM, the US EPA, the National Marine Fisheries Service and the US Fish and Wildlife Service.

FEMAT -- Federal Ecosystem Management Assessment Team. This is the title of the group of interagency scientists formed by President Clinton to develop a policy analysis of alternatives for implementation of ecosystem management on federal lands within the range of the northern spotted owl.

Final Environmental Impact Statement (FEIS) -- The final report of environmental effects of proposed action on an area of land. This is required for major federal actions under Section 102 of the National Environmental Policy Act. It is a revision of the draft environmental impact statement to include public and agency responses to the draft.

Fire cycle -- The average time between fires in a given area.

Fire frequency -- The return interval of fire.

Fire regime -- The frequency, predictability, intensity, seasonality, and extent characteristics of fires in an ecosystem.

Fire severity -- The effect of fire on plant communities. For trees, it is often measured as the percentage of basal area killed by fire.

Fish-bearing streams -- A stream that contains any species of fish for any period of time.

Floodplain -- Level lowland bordering a stream or river onto which the flow spreads at flood stage.

Flora -- The plant life of a region or geological period.

Fluvial -- Refers to fish which spend their entire life cycles in streams.

Food web -- A modified food chain that expresses feeding relationships at various changing trophic levels.

Forb -- An herbaceous plant that is not a sedge, grass, or other plant with grass-like foliage.

Forest health -- A measure of the robustness of forests in terms of their biological diversity; soil, air, and water productivity; disturbance ecology; and capacity to supply a sustainable flow of goods and services for humans.

Forest land -- Land that is now, or is capable of becoming, at least 10 percent stocked with forest trees and that has not been developed for nontimber use.

Forest types -- A classification of forest land based on the tree species presently forming a plurality of basal area stocking or crown cover of live tree.

Forest watershed -- The forested drainage area contributing water, organic matter, dissolved nutrients, and sediments to a lake or stream.

Fragmentation -- The process of reducing size and connectivity of stands that compose a forest. See Habitat Fragmentation.

Fuel -- Dry, dead tree parts which can readily burn.

Fuelbreak -- An area of land on which the native vegetation has been removed or modified so that fires burning into it can be controlled more readily. Some fuelbreaks contain firelines which can be quickly widened with hand tools or by burning.

Fuel loading -- The weight of fuel present at a given site; usually expressed in tons per acre. This value generally refers to the fuel that would typically be available for consumption by fire. Fuel loading varies as a result of disturbance (including human activities), the magnitude of that disturbance, the successional stage of the vegetation, and other conditions of the site.

Geomorphic -- Pertaining to the form or shape of those processes that affect the surface of the earth.

Glide -- A portion of a river where the water is relatively slow and has an unbroken surface, a gentle gradient where the substrate consists of fines to boulders.

Graben -- A trenchlike depression representing the surface of a fault block dropped down between two opposed, infacing normal faults.

Granitic -- Any light-colored, coarse-grained rock formed at a considerable depth by crystallization of molten rock.

Green tree retention -- A stand management practice in which live trees as well as snags and large down wood are left as biological legacies within harvest units to provide habitat components over the next management cycle. There are two levels: High level - A regeneration harvest designed to retain the

highest level of trees possible while still providing enough disturbance to allow regeneration and growth of the naturally occurring mixture of tree species. Such harvest should allow for the regeneration of intolerant and tolerant species. Harvest design would also retain cover and structural features necessary to provide foraging and dispersal habitat for mature and old-growth dependant species. Low level - A regeneration harvest designed to retain only enough green trees and other structural components (snag, coarse woody debris, etc.) to result in the development of stands that meet old growth definitions within 100 to 120 years after harvest entry, considering overstory mortality.

Habitat -- The area where a plant or animal lives and grows under natural conditions. Habitat consists of living and non-living attributes, and provides all requirements for food and shelter.

Habitat capability -- The estimated number of pairs of spotted owls that can be supported by the kind, amount, and distribution of suitable habitat in the area. As used in the Final Draft Recovery Plan for the Northern Spotted Owl, this means the same as the capability to support spotted owl pairs.

Habitat edge -- The margin where two or more vegetation patches meet, such as the boundary of a clearcut next to a mature forest stand; also see Habitat Fragmentation.

Habitat fragmentation -- The splitting or isolating of patches of similar habitat, typically forest cover (but could also apply to grass fields, shrub patches, and other habitats); habitat can be fragmented from natural conditions, such as thin or variable soils, or from forest management activities, such as clearcut logging.

Habitat interior species -- See Unitype Species.

Habitat type -- The land area capable of supporting a single plant association.

Harvest -- Felling and removal of tree stems from the forest for the manufacture of forest products.

Harvest systems -- Patterns of tree removal that mimic aspects of partial or complete stand-replacing disturbances.

Healthy ecosystem -- An ecosystem in which structure and functions allow the maintenance of biological diversity, biotic integrity, and ecological processes over time.

Herb -- Non-woody vegetation that includes both grasses and broad-leaf plants of low profile, known as forbs.

High intensity fire -- A fire with the capability to be stand replacing or to cause excessive damage to late successional forest characteristics.

High severity fire -- A wildfire event with acute ecological impacts; usually, but not always of high intensity.

Human dimension -- The aspect of ecosystem management which reflects the integration of people, and recognizes that people's past, present, and future values and desires (including perceptions, beliefs, attitudes, behaviors, and needs) influence ecosystems, and that ecosystems in turn affect people's physical, mental, spiritual, social and economic well-being.

Hybridization -- The crossing or mating of two different varieties of plants or animals.

Hydrolic -- Pertaining to the movement, exchange, and storage of water.

Impact -- An environmental change that negatively affects a beneficial use or value. The value judgement of "negative" is generally construed to mean that conditions or processes are moving away from desired states.

Ingrowth -- The period after successional growth of a forest stand when it reaches a specified age or structure class. For instance, spotted owl forage habitat.

Insectivores -- Plants or animals which feed on insects.

Interdisciplinary team -- A group of individuals with varying areas of specialty assembled to solve a problem or perform a task. The team is assembled out of recognition that no one scientific discipline is sufficiently broad enough to adequately analyze the problem and propose action.

Intermittent stream -- Any non-permanent flowing drainage feature having a definable channel and evidence of annual scour or deposition. This includes what are sometimes referred to as ephemeral streams if they meet these two criteria.

Issue -- An issue refers to a topic, a subject, a category, or a value which is registered by a person as something in which they have a high level of interest. The term "issue" is used synonomously with the term "concern." Identification of aquatic and fisheries issues can occur through formal solicitation, content analysis of publications and periodicals, or informal communications.

Key Watershed -- As defined by FEMAT a watershed containing (1) habitat for potentially threatened species or stocks of anadromous salmonids or other potentially threatened fish, or (2) greater than six square miles with high-quality water and fish habitat.

Landscape -- A heterogenous land area with interacting ecosystems that are repeated in a similar form throughout.

Landscape ecology -- (1) A study of the principles concerning structure, function and change of landscapes, and the use of these principles in the formulation and solving of problems. (2) The body of knowledge pertaining to the structure, function, and change of spatial patterns in ecosystems.

Large-scale fire -- A very large-sized fire compared to the natural range of fire sizes of the fire regime in the geographic area considered. Fires that greatly exceed the typical fire size are often of high intensity and may cause profound fire effects.

Late-successional forests -- Forest seral stages which include mature and old-growth age classes.

Late-successional reserve -- A forest in its mature and/or old-growth stages that has been reserved under The ROD.

Lava flow -- A congealed stream of lava.

Lichen -- A plant consisting of a fungus in close combination with a green or blue-green algae.

LIIT -- Local Interagency Interdisciplinary Team.

Litter layer -- The loose, relatively undecomposed organic debris on the surface of the forest floor made up typically of leaves, bark, small branches, and other fallen material.

Littoral Zone -- The shallow water zone of a lake in which light penetrates to the bottom permitting vegetative growth.

Long-term soil productivity -- The capability of soil to sustain inherent, natural growth potential of plants and plant communities over time.

Macroinvertebrates -- Large aquatic insects.

Macrophytes -- Aquatic plants.

Management activity -- An activity undertaken for the purpose of harvesting, traversing, transporting, protecting, changing, replenishing, or otherwise using resources.

Matrix -- Federal lands outside of reserves, withdrawn areas, and Managed Late-Successional areas.

Mesic -- Pertaining to or adapted to an area that has a balanced supply of water; neither wet nor dry.

Mesotrophic -- A term applied to a body of water with moderate nutrient content and moderate productivity.

Microhabitats -- A restricted set of distinctive environmental conditions that constitute a small habitat, such as the area under a log.

Mid-seral forest -- See Seral Stage.

Mitigation measures -- Modifications of actions that (1) avoid impacts by not taking a certain action or parts of an action; (2) minimize impacts by limiting the degree of magnitude of the action and its implementation; (3) rectify impacts by repairing, rehabilitating, or restoring the affected environment; (4) reduce or eliminate impacts over time by preservation and maintenance operations during the life of the actions; or (5) compensate for impacts by replacing or providing substitute resources or environments.

Mixed stand -- A stand consisting of two or more tree species.

Monitoring -- A process of collecting information to evaluate if the objectives and anticipated or assumed results of a management plan are being realized or if implementation is proceeding as planned.

Moraines -- An accumulation of rock debris carried by an alpine glacier or an ice sheet and deposited by the ice to become a depositional land form. The following are several examples of types of moraines:

Terminal moraine - a moraine deposited as an embankment at the terminus of an alpine glacier or at the leading edge of an ice sheet.

Lateral moraine - a moraine formed by an embankment between the ice of an alpine glacier and adjacent valley wall.

Recessional moraine - moraine produced at the ice margin during a temporary halt in the recessional phase of glaciation.

Ground moraine - moraine distributed beneath a large expanse of land surface covered at one time by an ice sheet.

Multistoried -- Forest stands that contain trees of various heights and diameter classes and therefore support foliage at various heights in the vertical profile of the stand.

Mycorrhizae -- An association between a fungus and the roots of a higher plant which improves the plants' uptake of nutrients from the soil.

Mycotrophic -- Feeding on or otherwise being nourished by fungi.

National Environmental Policy Act (NEPA) -- An Act passed in 1969 to declare a national policy that encourages productive and enjoyable harmony between humankind and the environment, promotes efforts that prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of humanity, enriches the understanding of the ecological systems and natural resources important to the nation, and establishes a Council on Environmental Quality (The Principal Laws Relating to Forest Service Activities, Agric. Handb. 453 USDA Forest Service, 359 p.).

National Forest Management Act (NFMA) -- A law passed in 1976 as an amendment to the Forest and Rangeland Renewable Resources Planning Act, requiring the preparation of Forest Plans and the preparation of regulations to guide that development.

Natural fire rotation -- A fire return interval calculated as the quotient of a time period and the proportion of a study area burned in that time period.

Nesting, roosting, and foraging habitat -- The forest vegetation with the age class, species of trees, structure, sufficient area, and adequate food source to meet some or all of the life needs of the northern spotted owl.

Neotropical -- Relating to or constituting the biogeographic realm that includes South America, the Indies, Central America and tropical Mexico.

Non-forest land -- Land developed for nontimber uses or land incapable of supporting 10 percent stocking with forest trees.

Old growth -- Old forest often containing several canopy layers, variety in tree sizes and species, decadent old trees, standing and down dead woody material.

Old-growth associated species -- Plant and animal species that exhibit a strong association with old-growth forests.

Old-growth forest -- A forest stand usually at least 180-220 years old with moderate to high canopy closure; a multilayered, multispecies canopy dominated by large overstory trees; high incidence of large trees, some with broken tops and other indications of old and decaying wood (decadence); numerous large snags; and heavy accumulations of wood, including large logs on the ground.

Oligotrophic -- A term applied to a body of water low in nutrients and low in productivity.

Outwash -- Accumulation of layers of sand and gravel deposited by meltwater streams near the margin of a stagnant ice sheet or alpine glacier.

Overstory -- Trees that provide the uppermost layer of foliage in a forest with more than one roughly horizontal layer of foliage.

Park-like stands -- Stands having scattered, large, seral overstory trees and open growing conditions usually maintained by frequent ground fires.

Partial cutting -- Removal of selected trees from a forest stand.

Passerine -- Pertaining to an order (Passeriformes) of small or medium-sized, chiefly perching songbirds having grasping feet with the first toe directed backwards.

Patch -- An area of vegetation with homogeneous composition and structure as viewed from aerial photography.

Pathogen -- An entity such as a fungus, bacterium, or virus that has the capacity to incite disease in another organism (host).

Pattern -- The arrangement of vegetation types or other features across landscapes.

Perched water table -- Ground water layer occupying a position above the main water table.

Perennial stream -- A stream that typically has running water on a year-round basis.

Phalarope -- A wading bird of the family Phalaropodidae, having lobed toes to facilitate swimming.

Physical process -- The rate and timing of the interaction of biotic and abiotic ecosystem components.

Phytoplankton -- A microscopic floating aquatic animal.

Plant Association -- The distinctive combination of trees, shrubs, grasses, and herbs occurring in a theoretical terminal or climax community or a series of communities.

Plant series -- Aggregations of plant associations having the same dominant overstory.

Polygon -- The map representation of a vegetation patch. The delineation of vegetation patches by computer with geographic information systems results in a polygon formed by lines that define the boundaries of the patch. The term polygon is generally synonymous with patch; polygon generally is used when describing data analysis procedures that involve manipulation of patch data.

Population viability -- Probability that a population will persist for a specified period across its range despite normal fluctuations in population and environmental conditions.

Precommercial thinning -- The practice of removing some of the trees less than merchantable size from a stand so that remaining trees will grow faster.

Prescribed fire -- A fire burning within an approved, predefined and planned prescription. The fire may result from either a planned or natural ignition. When a prescribed fire exceeds the prescription and/or planned perimeter, it may be declared a wildfire.

Productivity -- (1) Yielding useful or favorable results or involved in the creation of goods and services to produce value. (adapted from Webster)

(2) The growth rate of biomass per unit area, usually expressed in terms of weight or energy.

Project planning -- A site specific application of information gained from watershed analysis to obtain management objectives. Applied watershed analysis.

Range of the northern spotted owl -- The range of the northern spotted owl in the United States is generally comprised of land in western Washington and Oregon, and northern California.

Rate of spread (ROS) -- The rate at which a fire moves across a landscape, usually measured in meters/second.

Record of Decision -- A document separate from but associated with an environmental impact statement that states the management decision, identifies all alternatives including both the environmentally preferable and selected alternatives, states whether all practicable means to avoid environmental harm from the selected alternative have been adopted, and if not, why not.

Recovery plan -- A plan for the conservation and survival of an endangered species or a threatened species listed under the Endangered Species Act, to improve the status of the species to justify delisting in accordance with the Endangered Species Act.

Redd -- A fish spawning area usually found in gravels.

Reforestation -- The natural or artificial restocking of an area with forest trees; most commonly used in reference to artificial stocking.

Refugia -- Locations and habitats that support populations of organisms that are limited to small fragments of their previous geographic range (i.e., endemic populations).

Region -- A Forest Service administrative unit. The two Regions affected are the Pacific Northwest Region (Region 6) which includes National Forests in Oregon and Washington, and the Pacific Southwest Region (Region 5) which includes National Forests in California.

Resilience -- The ability of an ecosystem to return to a predicted, desired, or earlier state after disturbance.

Restoration -- Actions taken to return an ecosystem in whole or in part to a desired condition.

Riffle -- A portion of a river where gravel, cobble or small boulders constitute the substrate, and the water moves fast and is well oxygenated by white water.

Riparian -- Pertaining to land that is next to water, where plants dependent on a perpetual source of water reside.

Riparian area -- As specifically defined in the FEMAT Report, a geographic area containing an aquatic ecosystem and adjacent upland areas that directly affect it. This includes floodplain, woodlands, and all areas within a horizontal distance of approximately 100 feet from the normal line of high water of a stream channel or from the shoreline of a standing body of water.

Riparian reserves -- The area adjacent to streams, lakes and wetlands which is designed to protect aquatic and riparian functions and values.

Riparian zone -- As specifically defined in the FEMAT Report, those terrestrial areas where the vegetation complex and microclimate conditions are products of the combined presence and influence of perennial and/or intermittent water, associated high water tables, and soils that exhibit some wetness characteristics.

Normally used to refer to the zone within which plants grow rooted in the water table of these rivers, streams, lakes, ponds, reservoirs, springs, marshes, seeps, bogs and wet meadows.

Ripping -- The process of breaking up or loosening compacted soil (e.g., skid trails or spur roads) to better assure penetration of roots of young tree seedlings.

River basin analysis -- The collection and organization of issues and process or condition knowledge on large river basins that contain many analysis watersheds. These analyses will identify regional and downstream concerns that will need to be addressed in Watershed Analyses.

Roadless area -- Areas typically exceeding 5,000 acres that were inventoried during the Forest Service's Roadless Area Review and Evaluation (RARE II) process and remain in a roadless condition.

Roost -- The resting behavior of an animal.

Root disease center -- An infection center in the forest having infected, dead, and dying trees, where the causative agent is a pathogenic root-infecting fungus. Root diseases typically spread underground via fungal growth from diseased to healthy host roots.

Salmonid -- Refers to fish of the family Salmonidae. Within the range of the northern spotted owl these include all salmon, trout, and whitefish.

Scale -- The degree of resolution at which ecological processes, structures, and changes across space and time are observed and measured. For the purpose of this document, watershed-scale is an area ranging from 20 to 200 square miles. Smaller-scale generally refers to something smaller than a watershed (project-level) and larger-scale is bigger than a watershed (river-basin or provincial). **Note:** this "scale" terminology is opposite of traditional map-scale; that is the ratio of map distance to actual distance. (A map scale of 1:24,000 is a larger-scale map with more detail than on at 1:100,000).

Scree -- See talus.

Scrubland -- A land area consisting of shrubs and having a canopy coverage of about 50%.

Second growth -- Relatively young forests that have developed following a disturbance (e.g., wholesale cutting, serious fire, or insect attack) of the previous old-growth forest.

Seeps -- Places where water oozes from the ground to form a pool

Selection cutting -- A method of uneven-aged management involving the harvesting of single trees from stands (single-tree selection) or in groups (group selection) without harvesting the entire stand at any one time.

Sensitive species -- Those species that (1) have appeared in the Federal Register as proposed for classification and are under consideration for official listing as endangered or threatened species or (2) are on an official state list or (3) are recognized by the U.S. Forest Service or other management agency as needing special management to prevent their being placed on Federal or state lists.

Seral -- (1) Successional; (2) A species or a community which will be replaced by another in succession.

Seral stages -- The series of relatively transitory planned communities that develop during ecological succession from bare ground to climax stage.

Series -- An aggregation of taxonomically related associations that takes the name of the climax species that dominates the principal layer. A taxonomic unit in a classification.

Shelterwood -- A regeneration method under an even-aged silvicultural system. A portion of the mature stand is retained as a source of seed and/or protection during the period of regeneration. The mature stand is removed in two or more cuttings.

Silvicultural prescription -- A professional plan for controlling the establishment, composition, constitution and growth of forests.

Silvicultural system -- A planned sequence of treatments or prescriptions over the entire life of a forest stand needed to meet management objectives.

Site-potential tree -- A tree that has attained the average maximum height possible given site conditions where it occurs.

Snag -- A standing dead tree.

Soil productivity -- Capacity or suitability of a soil, for establishment and growth of a specified crop or plant species, primarily through nutrient availability.

Staging area -- Temporary locations near wildfires or other emergency events where fire suppression resources (e.g., firefighting personnel and heavy equipment) are available to respond at very short notice.

Stand -- Vegetation occupying a specific area that is sufficiently uniform in composition, size, arrangement, structure, and condition as to be distinguished from the vegetation in adjoining areas.

Stand (tree stand) -- An aggregation of trees occupying a specific area and sufficiently uniform in composition, age, arrangement, and condition so that it is distinguishable from the forest in adjoining areas.

Standard deviation -- A statistic used as a measure of dispersion in a distribution, the square root of the arithmetic average of the squares of the deviations from the mean.

Standards and guidelines -- The rules and limits governing actions, and the principles specifying the environmental conditions or levels to be achieved and maintained.

Stocked/stocking -- The degree an area of land is occupied by trees as measured by basal area or number of trees.

Structure -- The physical organization and arrangement of vegetation; the size and arrangement (both vertical and horizontal) of trees and tree parts.

Structural diversity -- The diversity of forest structure, both vertical and horizontal, that provides for a variety of forest habitats for plants and animals. The variety results from layering or tiering of the canopy and the die-back, death and ultimate decay of trees. In aquatic habitats, the presence of a variety of structural features such as logs and boulders create a variety of habitat.

Substrate -- Any object or material upon which an organism grows or is attached.

Succession -- A series of dynamic changes by which one group of organisms succeeds another through stages leading to potential natural community or climax. An example is the development of a series of plant communities (called seral stages) following a major disturbance.

Surface fire -- A fire burning along the surface without significant movement into the understory or overstory, usually flame lengths are less than one meter in size.

Sustainability -- The ability of an ecosystem to maintain its organization and autonomy over time including but not limited to maintenance of ecological processes, biological diversity and productivity.

Talus -- Accumulation of loose rock fragments derived by rockfall from a cliff.

Territory -- The area that an animal defends, usually during breeding season, against intruders of its own species.

The President's Plan -- Alternative 9 and the preferred alternative of the FSEIS. Sometimes referred to as the Forest Plan, (not to be confused with the National Forest Management Act of 1976 (NFMA) definition of a Forest Plan). The other part of the President's Plan includes local community economic revitalization.

Thermal stratification -- The layering of a water body based upon water temperature.

Threatened species -- Those plant or animal species likely to become endangered throughout all or a significant portion of their range within the foreseeable future. A plant or animal identified and defined in accordance with the 1973 Endangered Species Act and published in the Federal Register.

Till -- A heterogeneous mixture of rock fragments ranging in size from clay to boulders, deposited beneath moving glacial ice or directly from melting in place of stagnant glacial ice.

Timber management -- A general term for the directing, managing or controlling of forest crops and stands of trees.

Timber production -- The purposeful growing, tending, harvesting, and regeneration of regulated crops of trees to be cut into logs, bolts, or other round sections for industrial or consumer use other than for fuelwood.

Transpiration -- The loss of water vapor by land plants.

Ultramafic -- Dark-colored igneous rocks composed of minerals which are rich in iron and magnesium.

Underburn -- Burn by surface fire.

Underburning -- Prescribed burning of the forest floor or understory for botanical or wildlife habitat objectives, hazard reduction, or silvicultural objectives.

Understory -- The trees and other woody species growing under the canopies of larger adjacent trees and other woody growth.

Understory fire -- A fire that burns in the understory, more intense than a surface fire with flame lengths of 1-3 meters.

Uneven-aged management -- A combination of actions that simultaneously maintains continuous tall forest cover, recurring regeneration of desirable species, and the orderly growth and development of trees through a range of diameter or age classes. Cutting methods that develop and maintain uneven-aged stands are single-tree selection and group selection.

Ungulate -- A hoofed mammal.

Unitype species -- A wildlife species that presumably requires one kind of habitat or successional stage. Unitype species typically prefer interior, more secluded, portions of their habitat.

Ustic -- Refers to the soil moisture regime. The soil moisture control section is dry for 90 or more cumulative days but is moist in some part for more than 180 cumulative days. Soil moisture is limited, but available when conditions are suited for plant growth.

Variability -- (Natural Variability, Historic Variability, Range of Variability) The observed limits of change in composition, structure, and function of an ecosystem over time as influenced by frequency, magnitude, and pattern of disturbances.

Vegetative composition -- The plant species present in a plant community.

Viability -- The ability of a wildlife or plant population to maintain sufficient size so that it persists over time in spite of normal fluctuations in numbers; usually expressed as a probability of maintaining a certain population for a specified period.

Viable population -- A wildlife or plant population that contains an adequate number of reproductive individuals appropriately distributed on the planning area to ensure the long-term existence of the species.

Water quality -- The chemical, physical, and biological characteristics of water.

Watershed -- The drainage basin contributing water, organic matter, dissolved nutrients and sediments to a stream or lake.

Watershed analysis -- A systematic procedure for characterizing watershed and ecological processes to meet specific management and social objectives. Watershed analysis is a stratum of ecosystem management planning applied to watersheds of approximately 20 to 200 square miles.

WEAVE -- Acronym for the Watershed Analysis process developed by the Deschutes National Forest - [**W**atershed **E**valuation and **A**nalysis for **V**iable **E**cosystems]. It incorporates our ultimate purpose for doing watershed ecosystem analysis...to sustain viable ecosystems. It evokes visions of an intricate tapestry of many colors and textures, each thread having an important function in creating a viable, interconnected whole. It also symbolizes that the work of many others is inextricably woven into the Deschutes process, and that each past and future thoughtful addition will add functionality and strength to the whole effort.

Westside -- Generally, west of the crest of the Cascade Range.

Wetlands -- Areas that are inundated by surface water or ground water with a frequency sufficient to support, and under normal circumstances do or would support, a prevalence of vegetative or aquatic life that require saturated or seasonally saturated soil conditions for growth and reproduction (Executive Order 11990). Wetlands generally include, but are not limited to, swamps, marshes, bogs and similar areas.

Wilderness -- Areas designated by congressional action under the 1964 Wilderness Act. Wilderness is defined as undeveloped Federal land retaining its primeval character and influence without permanent improvements or human habitation. Wilderness areas are protected and managed to preserve their natural conditions, which generally appear to have been affected primarily by the forces of nature with the imprint of human activity substantially unnoticeable; have outstanding opportunities for solitude or for a primitive and confined type of recreation; include at least 5,000 acres or are of sufficient size to make practical

their preservation, enjoyment, and use in an unimpaired condition; and may contain features of scientific, education, scenic or historical value as well as ecologic and geologic interest.

Wildfire -- Any wildland fire that does not meet management objectives, thus requiring a fire suppression response. Once declared a wildfire, the fire can no longer be declared a prescribed fire.

Windthrow -- A tree or trees uprooted or felled by the wind.

Woody debris -- See Coarse woody debris.

Xeric -- Very dry.

Young-seral forest -- See Seral Stage.

Zooplankton -- A floating, often microscopic aquatic animal.

ACRONYMS

ACRONYMS USED IN ODELL WATERSHED ANALYSIS

ACS:	Aquatic Conservation Strategy
BEMA:	Bald Eagle Management Area
BLM:	Bureau of Land Management
CCC:	Civilian Conservation Corp
CCS:	Challenge Cost Share
DBH:	Diameter at Breast Height
DEQ:	Department of Environmental Quality
DSEIS:	Draft Supplemental Environmental Impact Statement
EA:	Environmental Assessment
EPA:	Environmental Protection Agency
FEMAT:	Forest Ecosystem Management Assesment Team
FS:	Forest Service
FSEIS:	Final Supplemental Environmental Impact Statement
FSM:	Forest Service Manual
FWS:	Fish and Wildlife Service
GIS:	Geographical Information Systems
HRV:	Historic Range of Variability
IDT:	Interdisciplinary Team
KCDH:	Klamath County Department of Health
LIIT:	Local Interagency Interdisciplinary Team
LP:	Lodgepole
LPD:	Lodgepole Dry
LPH:	Lodgepole with Mountain Hemlock
LPW:	Lodgepole Wet
LRMP:	Land and Resource Management Plan

ROS:	Recreational Opportunity Spectrum
SRI:	Soil Resource Inventory
USDA:	United States Department of Agriculture
USDI:	United States Department of the Interior
USFS:	United States Forest Service
USGS:	United States Geological Survey
WEAVE:	Watershed Evaluation and Analysis for Viable Ecosystems