United States Department of Agriculture
Forest Service
Pacific Northwest Region
Bureau of Land Management

North Willamette LSR Assessment

Mt. Hood National Forest Cascade Resource Area, Salem BLM

1998

Executive Summary

The North Willamette Interagency LSR Assessment covers all the LSRs (including 100-acre LSRs) south of the Bull Run Watershed on the west side of the Mt. Hood National Forest and on adjacent Salem District BLM lands. It also covers the Opal Creek area on the Willamette National Forest. The purpose of this assessment is to document current conditions and functions of the LSR network and present sideboards for management activities in the LSRs to meet LSR objectives in the Standards and Guidelines of the Northwest Forest Plan, Record of Decision (ROD).

The Assessment Area boundary was drawn along watershed boundaries. It includes nearly 956,000 acres: 690,600 acres are federal lands of which 178,000 acres are within LSRs.

Four wilderness areas (Salmon-Huckleberry, Table Rock, Bull of the Woods, Opal Creek) lie adjacent to LSRs and significantly increase the effective size of the late-successional reserve area. The contribution of these wilderness areas to the present and future functioning of the LSR network is taken into account within this assessment. Conditions (past, present and future) of the entire landscape within and around the LSR network were included in this assessment to establish the context, roles and functioning of the LSRs (present and future) in this landscape. For terrestrial purposes, this assessment also provides a basin scale assessment for watershed analysis to tier to.

Watershed Analysis has been complete for most watersheds across the Assessment Area. To obtain a thorough understanding of the terrestrial and aquatic resources/functions in a specific area, consult the appropriate Watershed Analysis in conjunction with this Assessment. (LSR/Watershed list on page 4-1.)

During the course of the Assessment, a discrepancy of 2,000 acres was discovered between BLM and REO mapping of LSR/Matrix lands (map 1-4). The discrepancy is being resolved at a higher level than this team. The team recommends a BLM amendment to the RMP adjusting these acres to LSR and adjusting other LSR acres to Matrix.

The Regional Ecosystem Office (REO) and the interagency Late-Successional Reserve Work Group have reviewed the North Willamette Late-Successional Reserve Assessment (LSRA). The REO finds that the LSRA, with noted assumptions, provides a sufficient framework and context for future projects and activities within the LSR. Future silvicultural, salvage, and risk reduction activities described in the LSRA that meet its criteria and objectives and that are consistent with the S&Gs in the NFP are exempted from subsequent project-level REO review. REO commends the LSRA team for producing one of the best examples they have reviewed. (The entire REO review memo can be found in Appendix A.)

Acknowledgements

The North Willamette Late-Sucessional Reserve Assessment is an interagency effort between the USDA Forest Service, Mt. Hood National Forest, the USDI Bureau of Land Management, Salem District, and the USDI Fish and Wildlife Service, Oregon State Office.

Core Team

John Haglund, Co-Team Leader/Ecologist (USFS)
Barbara Raible, Co-Team Leader/Ecologist (BLM)
Kim Mellen, Wildlife Ecologist (USFS)
Pat Greene, Landscape Architect (USFS)
John Davis, Biologist (USFWS)
Terry Brown, Fire and Fuels Specialist (USFS)

Primary Support

Larry Robertson, GIS (USFS)
Liz O'Dea, GIS (USFS)
Rich Hagestedt, Analysis/GIS (USFS)
Shelly York, Document Preparation (USFS)

Contributors/Consultants

Forest Service

Bruce Hostetler, Jeanne Rice, Tom Deroo, Craig Edberg, David Kennedy, Denise Pengeroth, Robert Alvarado, Nancy Lankford, Barbara Kott, Lynn Cady, Bob Walker, Don Chase, Sue Richards, John Davis, Joe Moreau, Bill Otani, Nancy Diaz, Rich Torquemada, Shelly Butler, Laura Ceperley, John Berry, Dick Hardman

BLM

Bruce Ahrendt, Jim Irving, Jim England, Dan Schlottmann, Keith Walton, Dick Prather

Table of Contents

Chapter 5 - Fire Management Plan

Chapter 6 - Treatments

Figures

Maps

Tables

Chapter 4

Chapter 1
Introduction

Chapter 1
Introduction

LSR Objectives
(from ROD p. C-11)

Late-Successional Reserves (LSRs) are to be managed to protect and enhance conditions of forest ecosystems, which serve as habitat for late-successional and old-growth related species including the northern spotted owl. These reserves are designed to maintain a functional, interacting ecosystem. A management assessment should be prepared for each large LSR (or group of smaller LSRs) before habitat manipulation activities are designed and implemented. LSR assessments are subject to review by the Regional Ecosystem Office (REO).

LSR Assessment

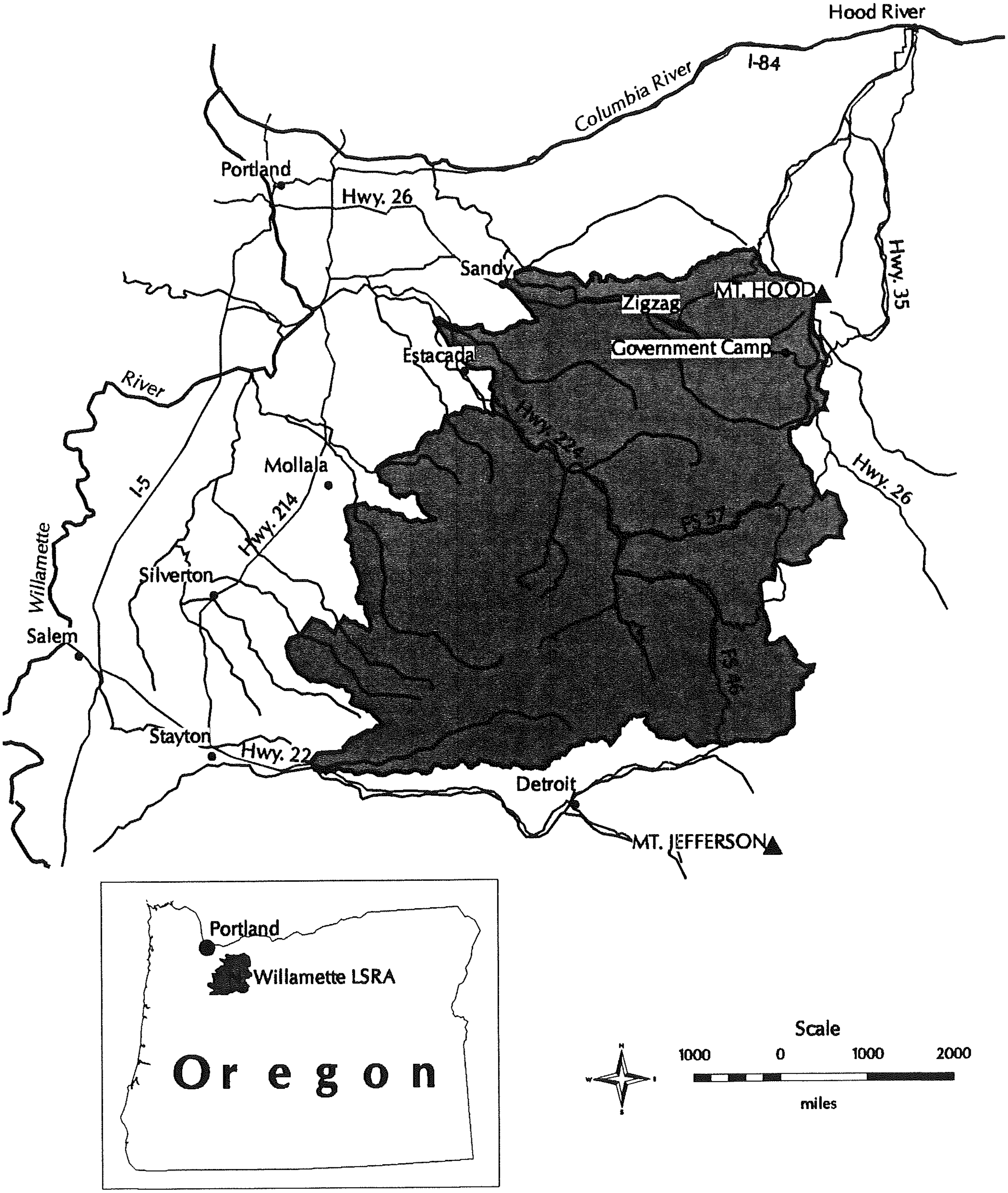
The purpose of this assessment is to document current conditions and functions of the LSR(s) and present sideboards for management activities in the LSR to meet the objectives in the Standards and Guidelines of the Northwest Forest Plan.

The LSR Assessment may serve two purposes, one mandatory and one desirable:

First, the document provides the decision-maker with a complete picture of the LSR so management needs, and implications of management actions, can be recognized and evaluated. It provides the context for management decisions within the LSR.

The second, an optional item that can be included in the LSR Assessment is a description of proposed silvicultural and salvage activities, in sufficient detail that REO can exempt them from further REO review (ROD pp C-12 & C-13).

Map 1-1. North Willamette LSRA Vicinity Map



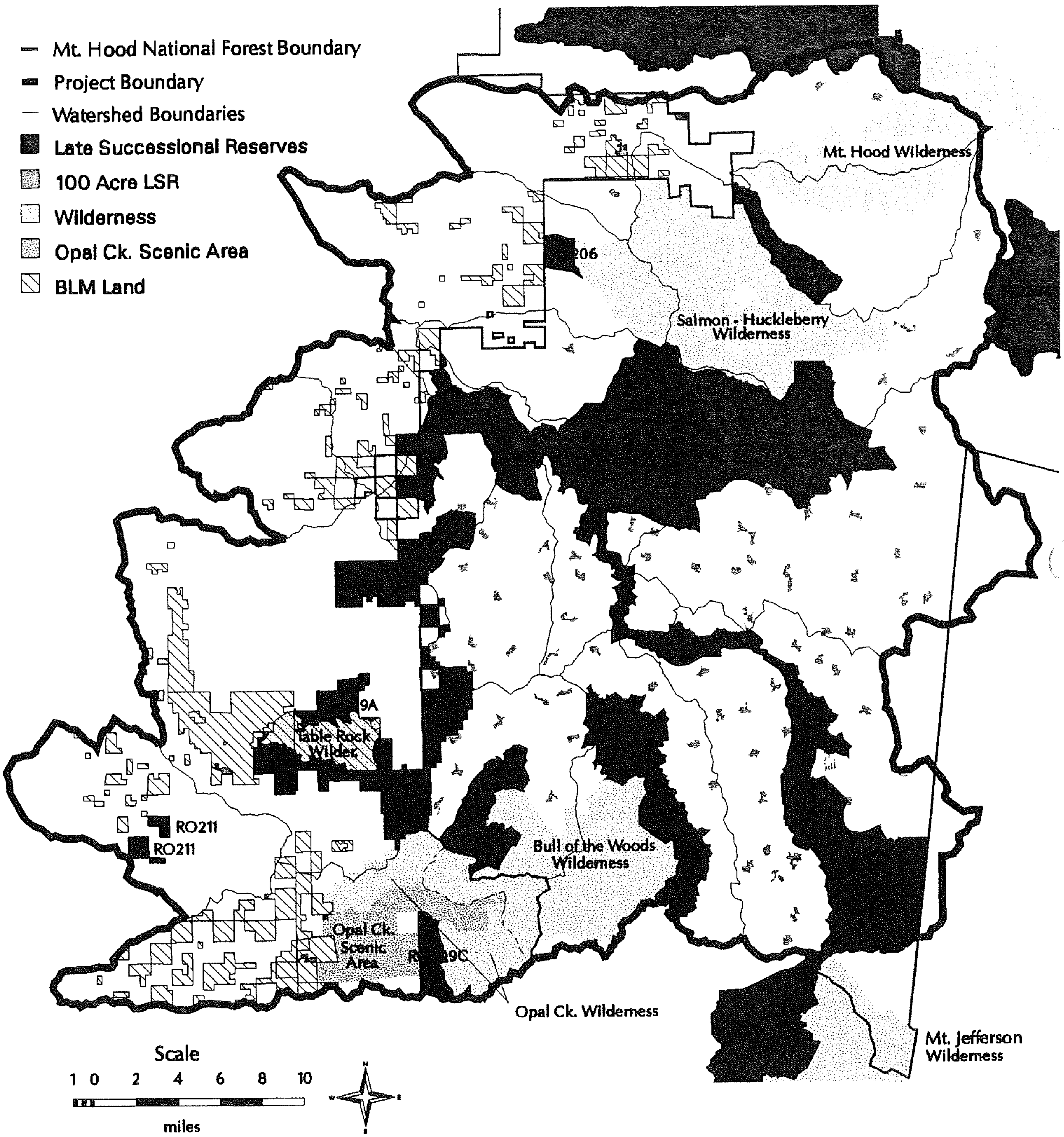
Assessment Direction for LSRs

(from ROD p C-11)

A management assessment should be prepared for each large LSR (or group of smaller LSRs) before habitat manipulation activities are designed and implemented. LSR assessments should include the following:

- A history and inventory of overall vegetative conditions within the reserve.
- A list of identified late-successional associated species known to exist within the LSR and information on their locations.
- A history and description of current land uses within the reserve.
- A fire management plan.
- Criteria for developing appropriate treatments.
- Identification of specific areas that could be treated under those criteria.
- A proposed implementation schedule tiered to higher order (i.e., larger scale) plans.
- Proposed monitoring and evaluation components to help evaluate if future activities are carried out as intended and achieve desired results.

Map 1-2. North Willamette LSRA Assessment Area



North Willamette LSR Assessment Area

The North Willamette LSR Assessment Area lies in the northern portion of the Willamette Province (Map 1-1, Vicinity). This assessment covers a network of LSRs managed by USFS (Mt. Hood and Willamette National Forests) and BLM (Salem District Cascade Resource Area). The assessment boundary is based on fifth field watersheds. It is bounded to the east by the Cascade Crest and to the north by the Sandy River. The southern boundary approximates the Mt. Hood National Forest boundary. The Mid-Willamette LSR Assessment covers LSRs to the south of the Assessment Area.

Table 1-1 lists the LSRs that will be covered by this assessment. LSR numbers are adapted from Northwest Forest Plan sources. LSR names have been assigned by the team. Map 1-2 graphically displays the arrangement of the LSR Network within the Assessment Area.

Table 1-1. LSRs Included in the North Willamette LSR Assessment

LSR #	LSR Name	Land Management Agency	Acres
205	Still Creek	Mt. Hood NF	5,308
206	Eagle Creek	Mt. Hood NF	1,628
207A	Roaring River	Mt. Hood NF, BLM	73,282
207B	Upper Clackamas	Mt. Hood NF	32,499
208	Soosap	BLM, Mt. Hood NF	10,017
209A	Table Rock	BLM	17,406
209B	Bagby	Mt. Hood NF	8,228
209C	Opal	Willamette NF	3,133
210	Collawash	Mt. Hood NF	16,170
211	Abiqua Butte	BLM	1,191
100 ac	100-acre core LSRs	Mt. Hood NF, BLM	8,807
		Total Acres	177,669

To treat this group of LSRs in a coordinated network approach will make for both an ecologically sound and efficient approach (avoids duplicating or overlapping efforts). The level of diversity between LSRs in the Assessment Area does not appear to be too great to preclude including the detail required for REO to make informed decisions about project exemptions.

A letter dated 1/22/96 regarding REO review of documents, states:

> *"An assessment that covers the entire LSR and its relationship to the network of LSRs provides a more complete picture of its current condition and lays a more credible foundation for structuring needed treatments to reach LSR objectives."*
>
> *" LSRs do not stand alone but were designed to function within a network of LSRs that are connected through Riparian Reserves and other land allocations (ROD p. 6). Certain issues and desired projects may necessitate consideration of the condition of surrounding LSRs and related connectivity."*

Name Adjustments to LSRS

This assessment recommends and incorporates two adjustments to the LSR numbering/grouping from original Northwest Forest Plan maps:

LSR 207

This LSR as originally mapped and named, is very extensive, unusually large, and runs nearly the length of the Assessment Area. It includes a large lobe in the north that forms a large complex with the Salmon-Huckleberry Wilderness and two small LSRs. This northern block is connected by a narrow LSR corridor along the Clackamas River to a wider southern lobe. The original LSR crosses many watersheds and a range of ecological conditions and use patterns. For this reason the team has in effect broken this LSR into two LSRs along the Upper Clackamas Watershed boundary.

- 207A - "Roaring River LSR"
- 207B - "Upper Clackamas LSR"

LSR 209

The Oregon Resource and Conservation Act of 1996 incorporated land allocation changes that ultimately broke the original, much larger LSR 209 into three allocations: Opal Creek Wilderness, Opal Creek Scenic Area, and LSR. The remaining LSR allocations are no longer in a continuous block, but are separated into three unconnected blocks of LSR (see map 1-2). These three disconnected blocks are managed by three different federal "jurisdictions" (BLM, Mt. Hood NF, and Willamette NF). For this reason, the team will in effect treat these three blocks of the old LSR 209 as three separate LSRs as outlined below:

- 209A - "Table Rock LSR," located on BLM lands
- 209B - "Bagby LSR," located on Mt. Hood NF lands
- 209C - "Opal Creek LSR," located on Willamette NF lands

LSR/Wilderness Complexes

Some wilderness areas within the Assessment Area are adjacent to LSRs which in effect increase the size of the late-successional reserve area. The Salmon-Huckleberry, Table Rock, Bull of the Woods, and Opal Creek Wilderness areas currently support or have the potential to support significant amounts of late-successional forest. For this reason, these wilderness areas are treated as an LSR/Wilderness complex. See Map 1-3.

LSR Wilderness Complexes

- **Salmon-Huckleberry LSR/Wilderness Complex**
  Includes the wilderness bordered by the small Still Creek LSR to the east, the small Eagle Creek LSR to the west, and the large Roaring River LSR to the south.

- **Table Rock LSR/Wilderness Complex**
  Includes the Table Rock Wilderness which is surrounded by LSR 209A, Table Rock LSR.

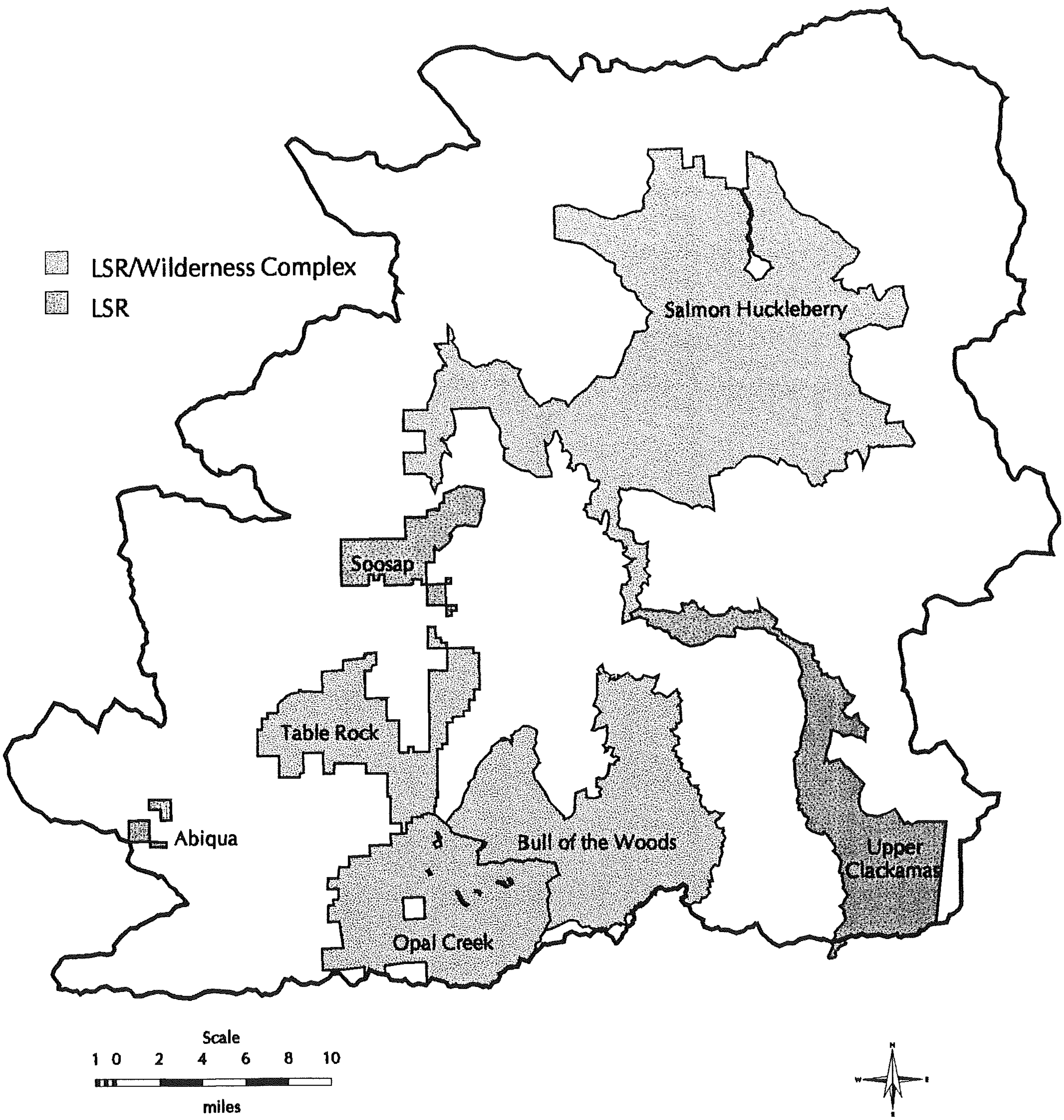
- **Bull of the Woods LSR/Wilderness Complex**
  Includes Bull of the Woods Wilderness bordered to the east by the Collawash LSR and to the northwest by Bagby LSR. This complex shares a common boundary with the Opal LSR/Wilderness Complex to the west. The two are summarized separately as one is entirely on the Mt. Hood N.F. and the Opal Complex, which lies in a different watershed, is administered by the Willamette N.F.

- **Opal Creek LSR/Wilderness Complex**
  This area includes the newly created Opal Creek Wilderness and Scenic Area (formerly part of LSR 209). It still includes a small portion of LSR (209C) and part of the Bull of the Woods Wilderness that lies on the Willamette National Forest.

Individual LSRs

- **Abiqua/Butte LSR**
- **Upper Clackamas LSR**
- **Soosap LSR**

Map 1-3. North Willamette LSRA, LSRA/Wilderness Complexes



Land Use Allocation Mapping Change

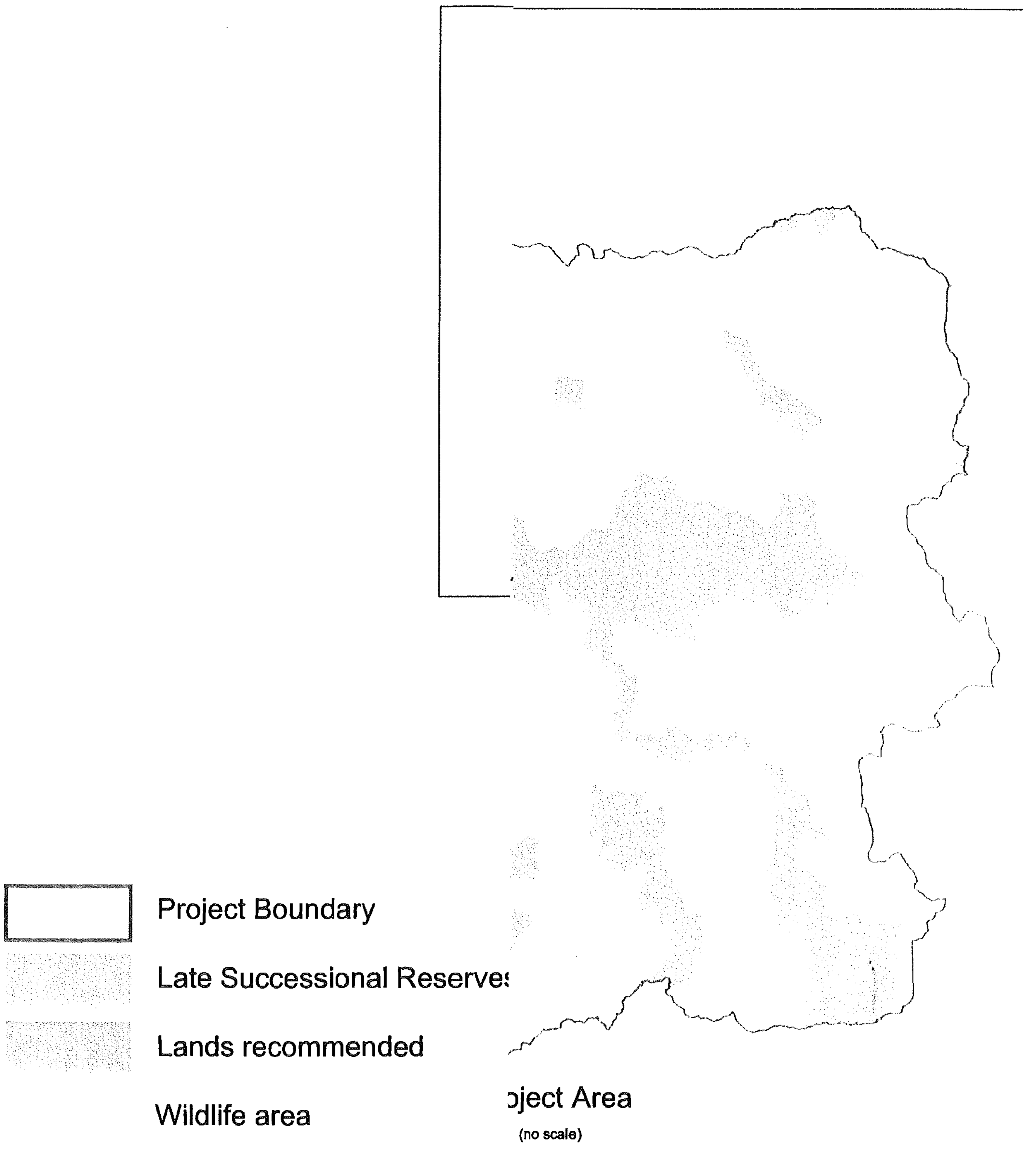
Along the western edge of the Roaring River LSR (RO207) and the northwest corner of Soosap LSR (RO208) where BLM and Forest Service lands overlap, there are approximately 2,000 acres of BLM administered lands that are managed as Matrix (Resource Management Plan, p. 20-22). The lands are located in Sections 20, 29, 30, and 32 T.4S., R.5E. and Section 36, T.5S., R.4E. See Map 1-4. A discrepancy has shown up between the BLM and REO maps. REO maps show these areas as LSR. The discrepancy is being resolved at a higher level than this LSR assessment team.

Since the lands are intermingled with lands managed as LSR by the Forest Service and their potential value in providing short and long-term connectivity for late-successional forest dependent species, this LSR assessment team recommends that these lands be managed as LSR by changing the land use allocation. The current mix of land use allocations in these portions of Roaring River LSR and Soosap LSR does not provide this connectivity of habitats.

The team recommends that the BLM amend its RMP by adjusting land use allocations in the Roaring River LSR and Soosap LSR to provide better connectivity for late-successional forest dependent species, while recognizing that there are tradeoffs in the Northwest Forest Plan and equitably balancing acres.

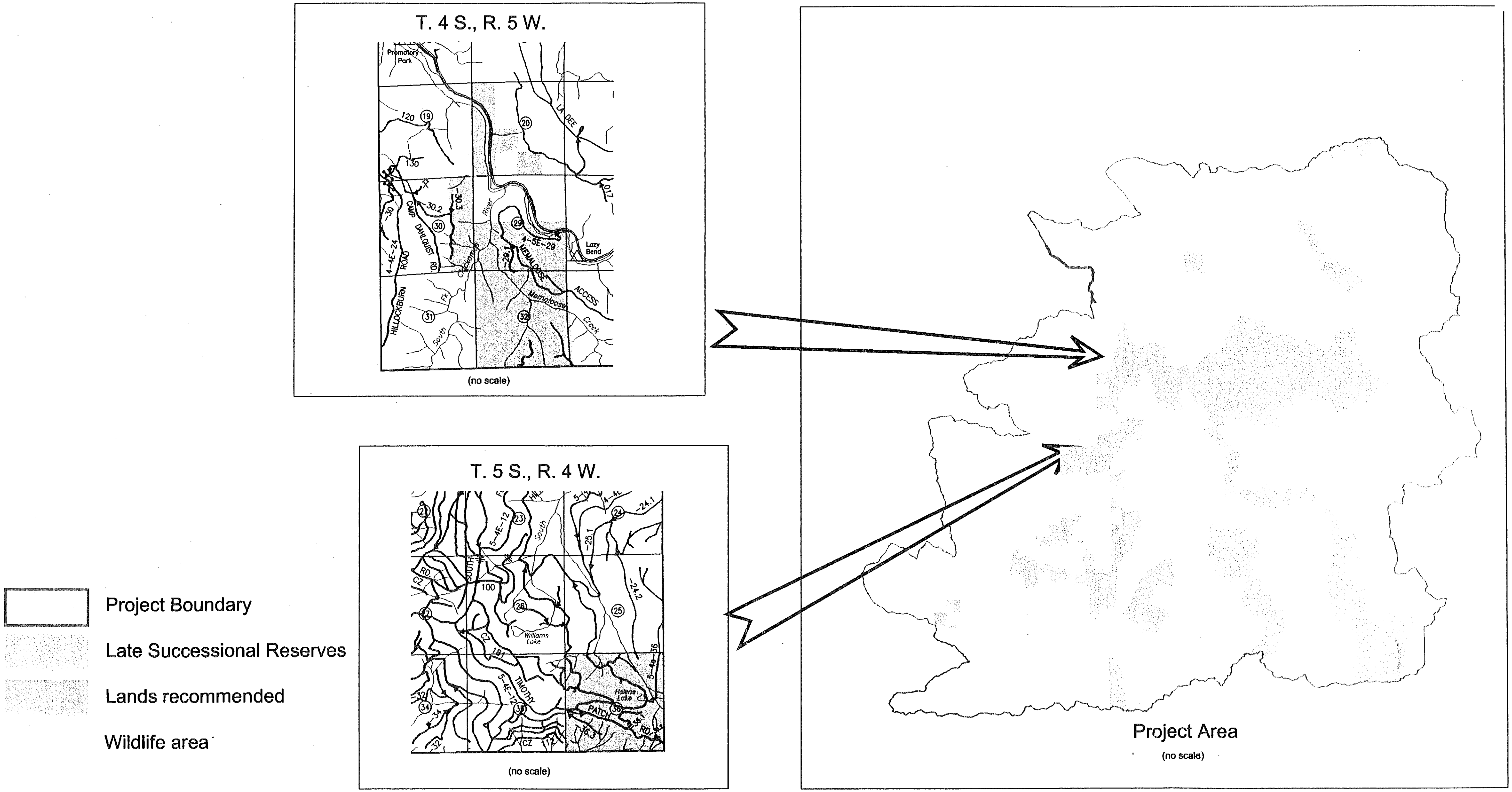
Because of this recommendation, this LSR assessment analyses the lands in question as though their designation were LSR. A proposal for the acres of land to be exchanged is presented in Chapter 6 along with a statement of the impacts of the exchange.

nded to Become LSR and Analyzed as



ɔject Area
(no scale)

Map 1-4. BLM Matrix Lands Recommended to Become LSR and Analyzed as LSR in This Assessment



How This Assessment Will Be Used

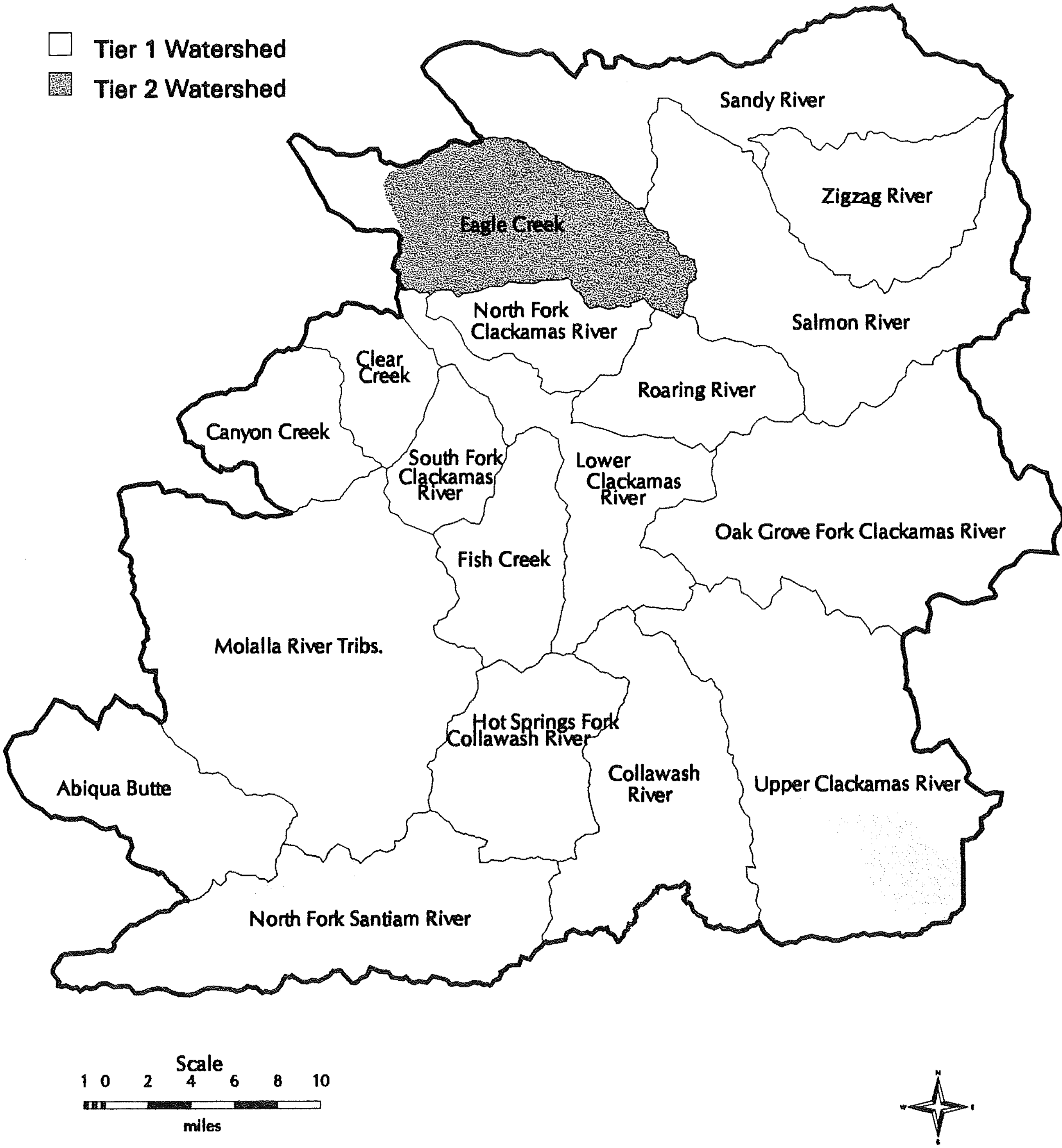
This assessment emphasizes terrestrial habitats in the LSRs. Aquatic habitats are analyzed in detail through watershed analyses which are done on a fifth field watershed level. Completed watershed analyses are available at the Mt. Hood Headquarters or District Offices and/or BLM District Office. To obtain the total picture of the terrestrial and aquatic resources and functions in a specific area, we recommend consulting this LSR assessment and the applicable watershed analysis. Map 1-5 displays the watershed boundaries and names.

This assessment is based on current knowledge and understanding of the ecosystem conditions and processes within and between the LSRs. Recognizing that our knowledge of the ecosystem and the actual conditions will change over time, we recommend a periodic review of this assessment and revisions or updates to reflect new information or changed conditions.

This assessment is not a decision document. It does not result in specific projects or activities. For any activity or project proposed in the LSRs, agency policies and procedures regarding the National Environmental Policy Act (NEPA) and planning regulations should be followed. Managers should use this assessment to establish criteria and guidelines in reaching prudent site-specific decisions.

Watershed analysis documents are completed for most of the watersheds that contain LSR acreage within the Assessment Area. These documents address relationships between terrestrial and aquatic systems at a scale similar to the individual LSR level. The documents include the influence of past management activities, and recommend specific type, location and sequence of future management activities within a watershed. Watershed analyses contain information about individual LSRs and should be consulted as part of any project planning or design.

Map 1-5. North Willamette LSRA Watersheds



Chapter 2
Provincial Setting

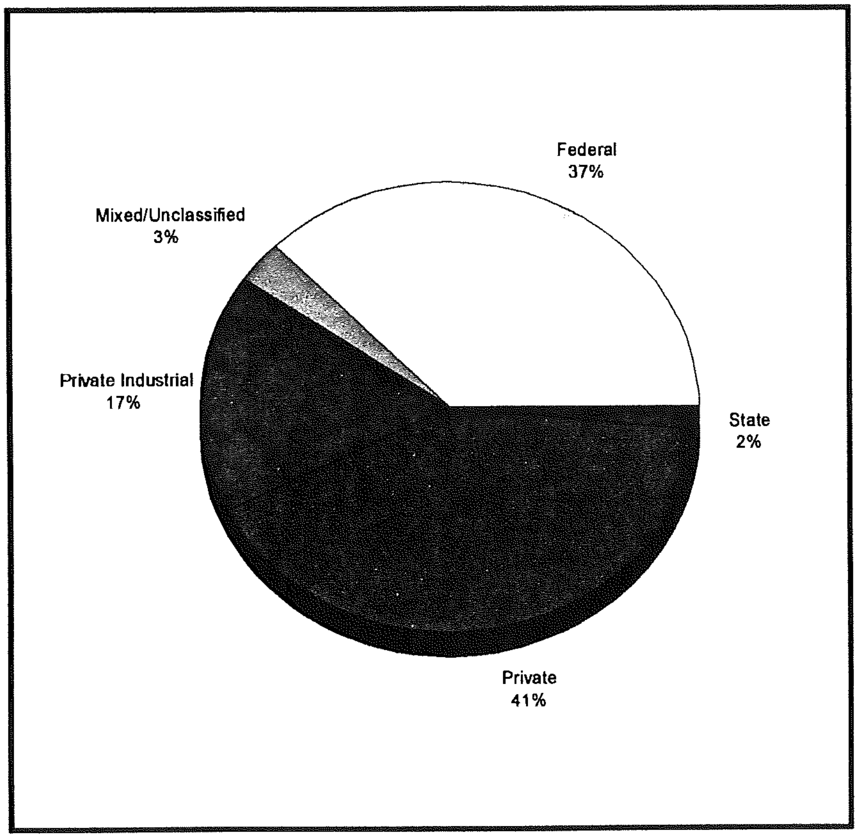
Chapter 2
Provincial Setting

Introduction

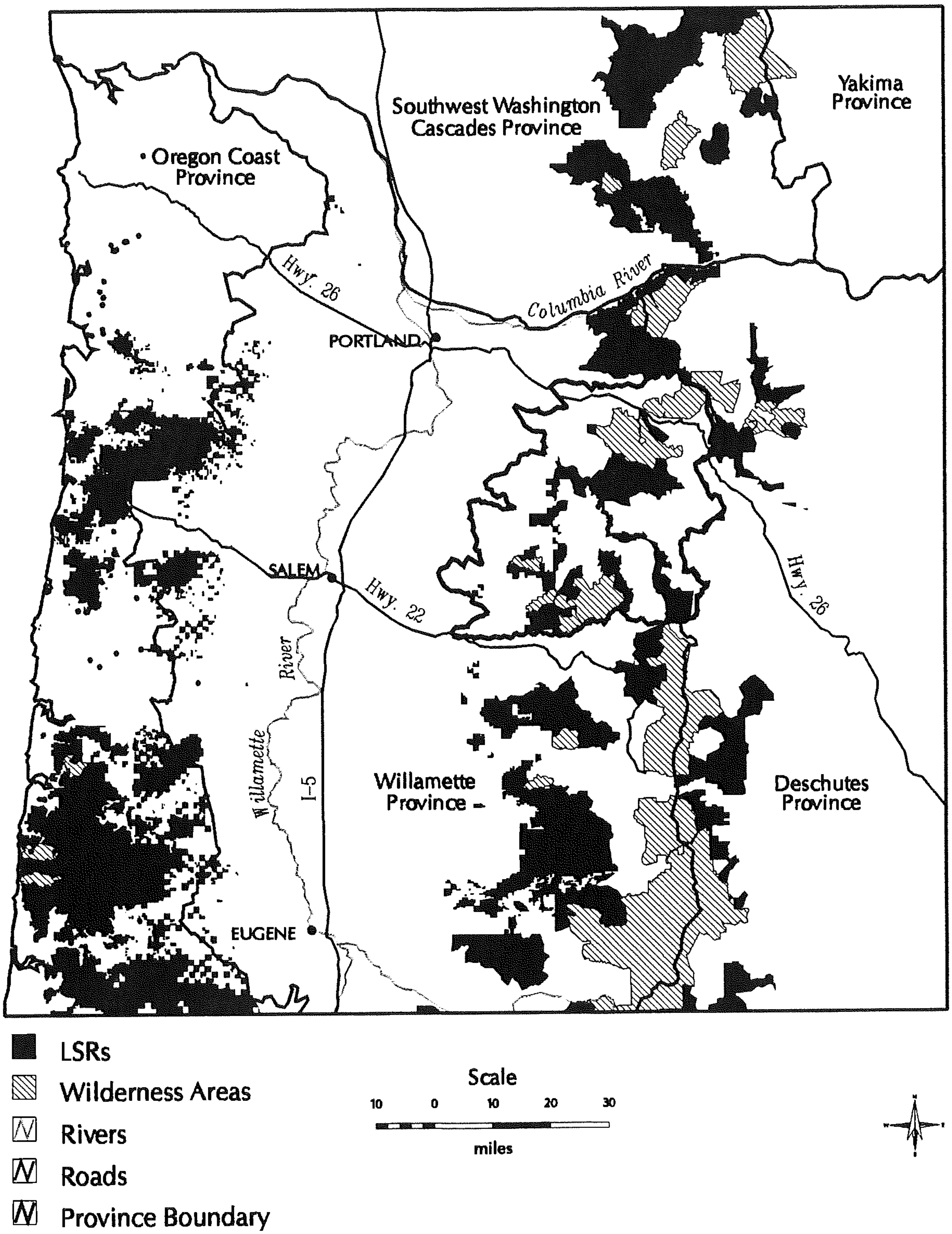
The Willamette Province (Map 2-1) occupies 7.7 million acres of land in northwestern Oregon. Land use within the Willamette Province includes urban and suburban development, agriculture, and forestry. The major ownership categories in the province are private landholder, federal ownership, private industrial forest lands and mixed/unclassified ownership.

The federal land is managed by Forest Service and Bureau of Land Management. This LSR assessment covers approximately 955,521 acres of which 177,669 acres are designated as Late-Successional Reserve. These LSRs represent 2 percent of the land in the province and 24 percent of the LSR designated lands in the province.

Figure 2-1. Willamette Province Landownership



Map 2-1. North Willamette LSRA Provincial Setting



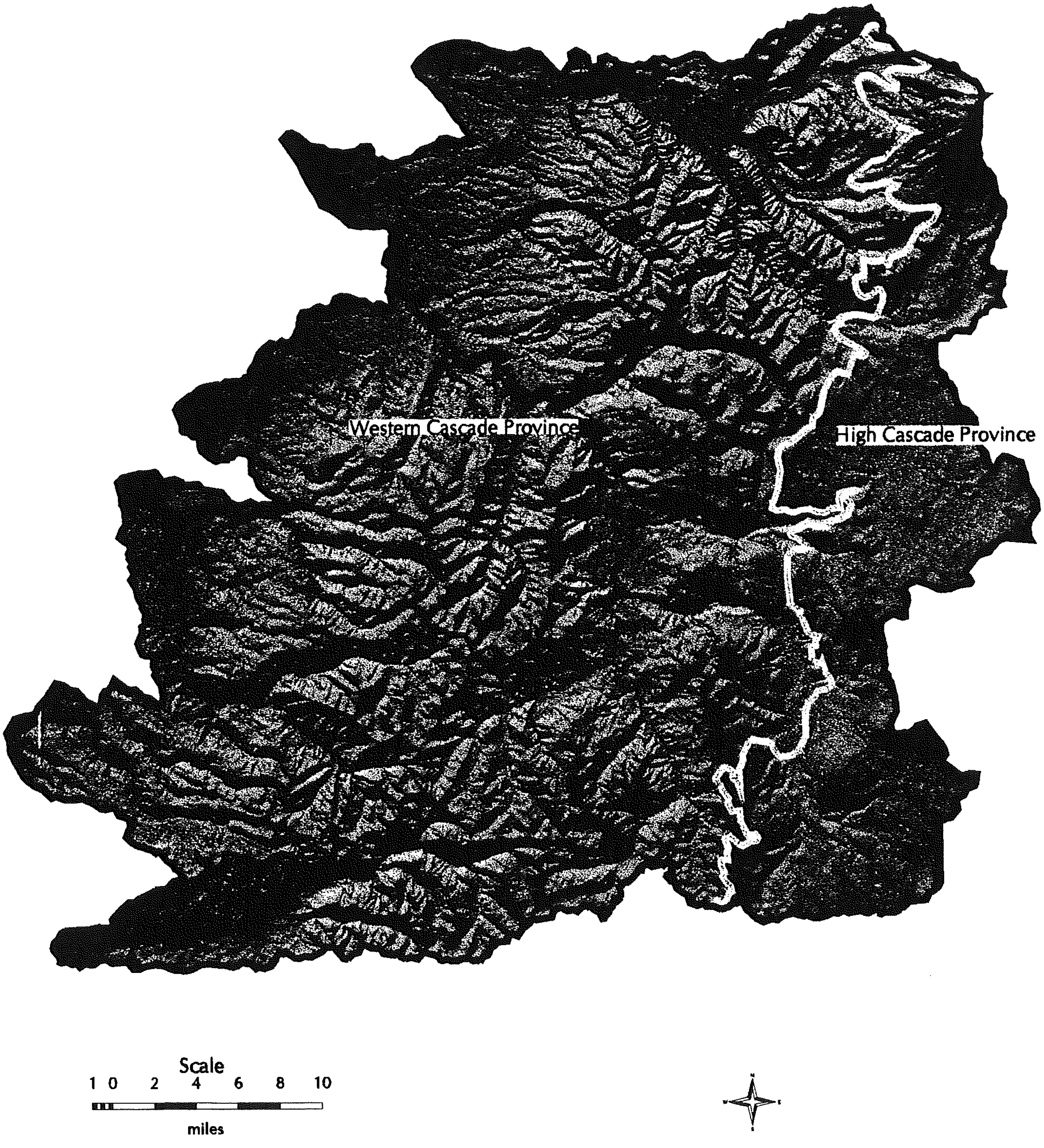
Geology/Landform

This assessment area occurs primarily in the western Cascades and High Cascades physiographic provinces. See Map 2-2, Physiographic Provinces for the location of these two provinces and a shaded relief depiction of landforms in the Assessment Area. The western Cascades province consists chiefly of dark colored lava flows, light colored pyroclastic flows, and associated intrusions. These rocks have undergone widespread low-grade metamorphism and local hydrothermal alteration as a result of extensive dike and sill intrusions and exposure to a north-south-trending hot springs zone. These rocks are often deeply weathered and may be rich in clay. Several periods of alpine glaciation have extensively modified many areas above 3,000 feet elevation. Hillslopes in this province tend to be steep and creeks are usually deeply incised. Some areas contain large ancient landslide deposits. In contrast, the much younger, higher elevation, High Cascade province consists of dark, unaltered lava flows that tend to be less deeply weathered. Most of this province has been covered by ice-cap glaciers and remains blanketed by till deposits. Pumice and ash from recent volcanic eruptions also mantle the surface. Ground slopes are gentle and most creeks are only slightly incised.

Table 2-1. Percent Area of Each LSR That Contains Slopes That are Highly Susceptible to Landslides

LSR/Wilderness	Acres of LSR/ Wilderness Evaluated for Landslide Susceptibility	% of LSR/ Wilderness Evaluated for Landslide Susceptibility	Acres of Evaluated Area Highly Susceptible to Landslides	% of Evaluated Area Highly susceptible to Landslides
Mt. Hood Wilderness	26,211.58	100%	6,987.36	26.66%
RO 205	5,299.79	100%	2,376.62	44.84%
Salmon Huckleberry Wilderness	45,196.38	99.12%	32,648.50	72.24%
RO 206	1,617.87	100%	429.64	26.56%
RO 207A	45,849.66	62.71%	19,921.81	43.45%
RO 207B	32,486.98	100%	2,696.06	8.30%
RO 208	3,608.95	35.98%	1,043.22	28.91%
RO 209A	1,087.88	5.03%	175.05	16.09%
RO 209B	7,950.24	99.98%	2,830.26	35.60%
Bull of the Woods Wilderness	26,681.74	78.05%	10,288.21	38.56%
RO 210	16,171.15	100%	10,019.07	61.96%

Map 2-2. North Willamette LSRA Physiographic Provinces



Some LSR's contain a relatively high proportion of land that has been rated "high" for landslide susceptibility. This designation was made as part of "landform-type mapping" completed during most Watershed Analysis studies. Table 2-1 displays very general information about these landform types that are susceptible to landslides. There are some data gaps, particularly outside the Mt. Hood National Forest. Not surprisingly, those LSR's that are within the Western Cascade physiographic province have a higher percentage of area rated highly susceptible for landslides. Much more detail on the locations of these areas can be found in the appropriate Watershed Analysis documents. These areas should be examined on the ground by a geologist as a part of the planning process before any proposed management activities take place within them.

Vegetation

Vegetation varies from the valley bottom prairie grassland and agriculture through forested valleys and mountain slopes to the Cascades peaks. Ownership gives fairly accurate interpretation of seral stages. Only a small portion of the private land is forested and these are fragmented smaller patches scattered across the valley floor up to the foothills. The industrial forest lands are generally managed on a mid-seral to mature age cycle with regeneration harvests throughout time. The federal land ownership represents the amount of land that has potential to be managed in such a manner as to provide connectivity of older forest habitats.

Disturbance

The disturbance regime of a particular forest usually consists of a complex mixture of infrequent, large-scale events and more frequent, small-scale events. Any given disturbance may be the result of numerous, interconnected factors. Natural agents of disturbance such as windstorms, fire, volcanic events, and insects and disease outbreaks are unpredictable. If efforts have been mounted to control the occurrences of one natural disturbance such as fire, forests may become more susceptible to another disturbance such as insects. Rather than being a bad thing to be avoided and prevented, disturbances often renew ecosystems and diversify landscapes (Perry, 1994). A disturbance tends to prevent forests from maintaining maximum canopy leaf area. In that way, it is a thinning agent, often irregular in extent and sometimes very selective. Absence of disturbance fosters increased competition among trees and reduced growth efficiency. Individual trees or entire stands may become so limited in resources that few reserves are available for protective responses or for maintaining beneficial associations with symbiotic microorganisms. Under such circumstances, a major infrequent disturbance often modifies the entire forest structure (Waring and Schlesinger, 1985).

Human activities are also a major disturbance within this province. Aboriginal burning along the valley margins and foothills, as well as in higher elevations for game or huckleberries influenced the present vegetation patterns. The population growth within the Willamette Valley Province within the last 100 years has increased small impact disturbance through recreational use along with more extensive disturbance through forest management.

Social

The proximity of the LSR Assessment Area to the Portland metropolitan area is the most significant factor underpinning the landscapes human use and social expectation. Currently 71 percent of Oregon's population lives in communities greater than 2,500 people with two-thirds of the population concentrated in just four cities: Portland, Salem, Eugene-Springfield, and Medford. The Assessment Area is within a one hour drive Portland and Salem as well as surrounding rural communities such as Sandy, Estacada, Molalla, and Colton. In addition to the traditional uses associated with national forests and BLM landscapes by rural communities, Mt. Hood National Forest has the distinction of being an Urban Forest. Of the 154 forests in the national forest system, Mt. Hood is one of thirteen forests identified by the Forest Service that meets the Urban Forest definition of being located within a one hour drive of populations greater than one million people. The forest resources within the Assessment Area are valued by a wide diversity of social groups and is subject to concentrated recreation use.

According to the Oregon State Parks and Recreation Division in the *1991 State Comprehensive Outdoor Recreation Plan* (SCORP), the metro region "receives the most recreation participation in the state. This is due to the availability of prime recreation activities opportunities, virtually at Portland's back door and the highest density of population." Federal lands in the Assessment Area play an important role in the provision of forest recreation settings from primitive to semi-urban. Demand for recreation activities is projected to grow faster than the state population growth and tourism alone was a $3.5 billion industry in Oregon in 1995. The 1991 study also included a needs analysis for Forest Service lands based upon use, user demand for preferred settings, and the supply of settings as allocated in approved forest plans. The study concluded that the greatest discrepancy between supply and demand occur in the provision of settings on the primitive and semi-primitive end of the Recreation Opportunity Spectrum.

Statistics for the Mt. Hood National Forest in 1996 also indicate the relative importance of the Special Forest Products (SFP) harvest to residents of the region. Mt. Hood ranked third in the region in the harvest of special forest products excluding those wood products which can be converted to cubic feet. Approximately half of the Forest Service SFP program was in bough sales but beargrass, transplants, mushroom, firewood, and other products are also of importance. Of these, neither mushrooms nor firewood (and other products like posts, poles, shakes, etc.) can be legally harvested within the LSRs.

Urban Forests, like Mt. Hood can have a higher level of use and more diversity in users and visitor expectations. Urban Forests can also experience a higher incidence of antisocial problems. Reported criminal activity in the Clackamas River drainage on the Mt. Hood in 1992 included assaults, theft, criminal mischief, stolen vehicles, illegal shooting, kidnapping, hazardous material dumping, and drug related activity.

Connectivity

LSRs in the North Willamette Assessment Area are part of a larger network of LSRs in the Willamette Province and other adjacent provinces (Map 2-2, Provincial Setting). There are some concerns with connections to areas outside the Assessment Area.

Directly to the north of the Assessment Area is the Bull Run Watershed/LSR. The LSR contains a large amount of contiguous late-successional habitat. There is an area of rural development three to five miles wide, however, between the LSR network in the Assessment Area and the Bull Run LSR. A major highway (Hwy. 26) also runs through this area. Remaining late-successional habitat in this area is at higher elevations in the Mt. Hood Wilderness. Late-successional associated mammals and amphibians would probably have trouble moving between the Salmon Huckleberry Wilderness and the Bull Run LSR. This is due to lack of dispersal or late-successional habitat, particularly for species limited to lower elevations. Historically, the two areas were probably well connected except for mud flows after the eruption of Mt. Hood.

North of the Bull Run LSR is the Columbia River, Interstate 84, and Highway 14, which provide a formidable barrier to all but the most mobile species. As a result, the Willamette Province is isolated from the southwest Washington Cascades Province. Historically the Columbia River has always provided a barrier to dispersal of animals. However, before the Columbia River dams were built the river was narrower. Occasional dispersal opportunities may have occurred when the river froze.

To the east of the Assessment Area is the White River LSR in the Deschutes Province. There are about five miles between the Salmon-Huckleberry Wilderness and the White River LSR. The Salmon River Wild and Scenic Corridor connects the Wilderness to the LSR. At a regional scale this east-west connection of late-successional habitat to the south of Mt. Hood is important. This is because connections to the north of Mt. Hood are poor due to rural development of the Hood River Valley.

Connectivity for spotted owls between LSR 207 and the Warm Springs Indian Reservation to the east was identified as a concern in The Willamette Province Fiscal Year 1998 Habitat Modification Biological Assessment for Effects to Listed Species. Two areas were delineated as concern areas for dispersing spotted owls.

In the southern portion of the Assessment Area, only a narrow connection exists between LSR207B and LSR214 to the south. Most of this area is at high elevation (above 4,000 feet) and thus may present connectivity concerns for late-successional species limited to lower elevations. South of Opal Creek and LSR209C is the Detroit Lake area and a major highway (Hwy. 22) which limit connectivity to LSR213 to the south.

To the west of the Assessment Area, the highly developed Willamette Valley limits connectivity to the Oregon Coast Province. The valley has probably always limited dispersal of organisms between the Cascades and Coast Range. Historically, however, forests extended further into the valley and forested wetlands were more common.

Chapter 3
Landscape Level

Chapter 3
Landscape Level

Introduction

This chapter focuses at the Assessment Area scale with specific attention to factors that pertain to the LSR network being assessed. It provides an assessment of the current conditions, expected future conditions, various ecological stratifications and the foundation for potential treatments as they relate to meeting LSR objectives in this landscape. This chapter is subdivided into major topic areas as outlined in the document table of contents.

In general, land ownership and development follows an elevational gradient within the Assessment Area which reflects the historic use patterns. Publically owned land, principally managed by the Forest Service, is confined to the mountainous headwaters of the Cascade Mountain Range to the west of the Cascade Crest. A smaller percentage of federal land administered by the BLM is mainly limited to the western foothills in a checkerboard pattern interspersed with privately owned industrial forest land. Also in the Cascade foothills are large tracts of state forests, small parks, and small scattered tracts of land administered by Fish and Wildlife and local governments. Tracts of land zoned for rural residential are scattered throughout the foothills and lower elevations of the Assessment Area. Small urban centers are found at and around the incorporated towns of Estacada and Sandy. Agricultural land is located chiefly at lower elevations and along river flood plains. Lands to the east of the Assessment Area are both a continuation of Mt. Hood National Forest and the Warm Springs Indian Reservation.

Prior to 1840, Euroamerican use was minimal throughout the Assessment Area because of the steep rugged terrain and difficult access. A minor amount of exploration and fur trapping was limited primarily to the lower elevation valleys. Evidence indicates, however, that virtually all of the Assessment Area was utilized to some extent by American Indians in their seasonal subsistence rounds.

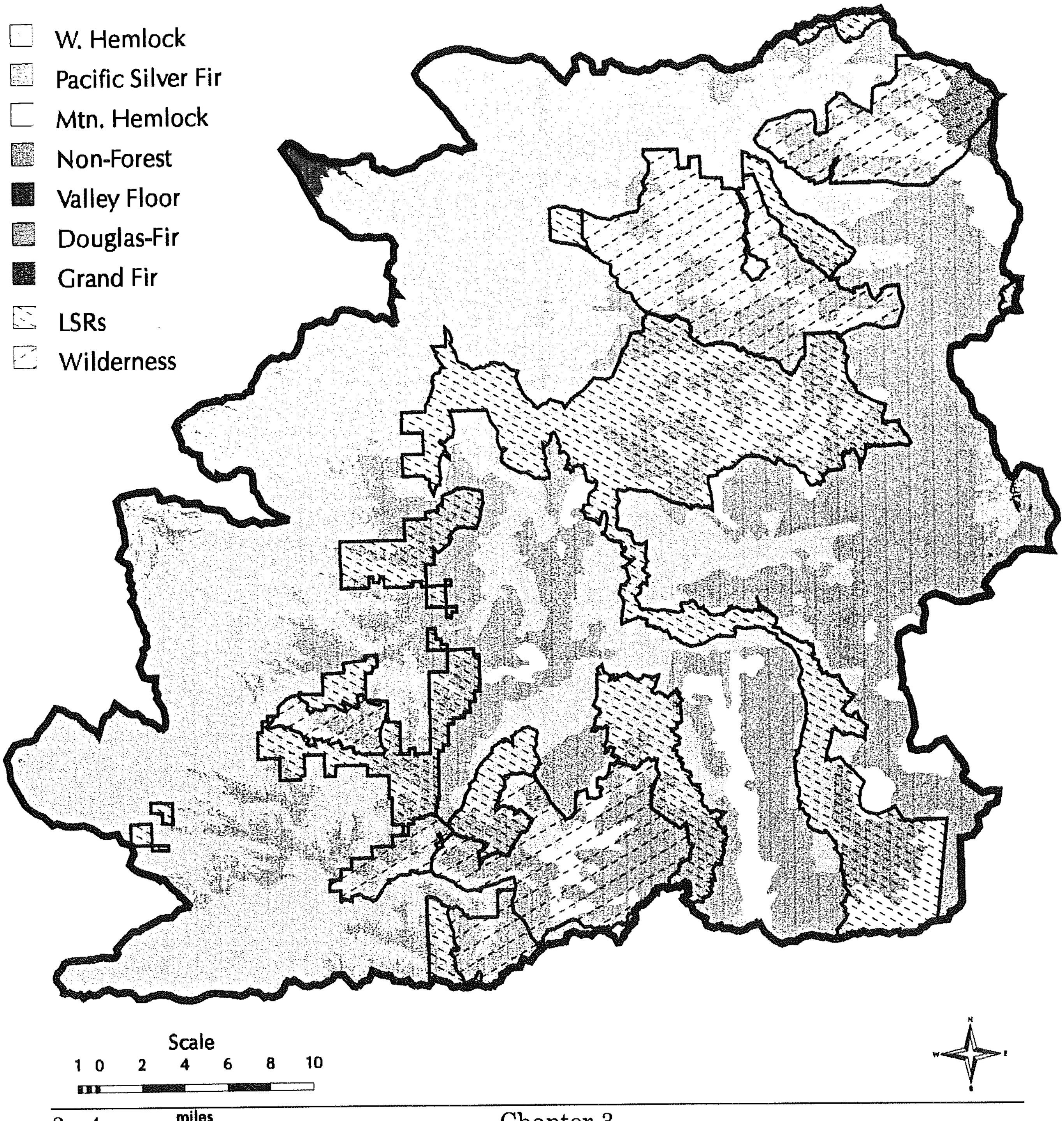
Euroamerican development emerged first in the northern section of the Assessment Area because of the access provided by the Barlow Road. With the construction of the Barlow Road in 1845, pioneer emigrants began to pass through, settle in, and develop lands within the Assessment Area. Most of the emigrants settled in the agricultural lands of the Willamette Valley but some settlement occurred along the Barlow Road and in the mountain foothills near the transportation corridor. By the late 1800's, the Barlow Road had been improved to accommodate the increased use of the expanding population. The growing population of the Willamette Valley and the city of Portland began to create a market demand for lumber and building materials which resulted in extensive harvest in the more accessible areas of the landscape. In 1907 most of the Assessment Area was incorporated into the Cascade Forest Reserve. In 1908, it was designated the Oregon National Forest which later became the Mt. Hood National Forest in 1924. So for much of the Assessment Area, the earliest Euroamerican land use was administrative and consisted of fire suppression, forest inventory, and public use management. The urbanizing population also began to use the new National Forest for camping, hiking, climbing, hunting, and picnicking. Following the basic route of the Barlow Road, the scenic Mt. Hood Loop Highway was constructed in the 1920's in response to recreation demand for access and forested scenery. This road later became Highway 26 which is now an important state highway for both intrastate travel and recreation access. Improved access in this part of the Assessment Area has led to an expanded range of recreation opportunities from backcountry hiking, camping, fishing, and hunting to developed resorts and ski areas. Development of nonfederal lands along Highway 26 includes permanent residences, vacation homes, and a variety of recreation facilities, businesses, and services.

Because the Clackamas River drainage has neither a broad flood plain nor a low pass over the Cascade mountains, development occurred more slowly in this part of the Assessment area. Trappers, miners, and even early recreation users were able to access and use the upper reaches of the river corridor in the 1800's but homesteaders were, as a rule, confined to the lower elevations. Railroad logging and the development of hydroelectric power played a significant role in the history of the Clackamas River drainage along with designation as a National Forest. Railroad construction facilitated both the earliest logging operation in 1923 as well as access for the hydroelectric powerhouse and company town at Three Lynx. The railroad also enabled the earliest recreation use of the river corridor with "speeder" cars taking recreation visitors on scenic excursions, picnics, and fishing expeditions. By the late 1930's the railroad line had been replaced by a truck road which was later to become Highway 224. After World War II, road building and logging continued to the headwaters of the river and throughout the drainage. The upper Clackamas River corridor also includes the northern third of the Olallie Lake Scenic Area. Increased demand for recreational access to the Olallie Lake area served as the impetus for the construction of the Skyline Trail to Olallie Lake in 1916. Olallie Lake has been a continuous recreation attraction since the 1930's.

By the mid 1800s, settlers started moving from the Willamette Valley to the foothills of the Cascades under The Homestead Act of 1860. This Act opened public land for settlement and a number of land claims were filed under the Act through the 1890s. Small communities such as Springwater, Eagle Creek, and Dodge were first settled in the 1850's, reached peak populations in the 1890's and declined in the early 20th century. More accessible land with rolling hills and creek valleys were settled first for agriculture. The more rugged and remote parts of the foothill landscapes were settled later if at all. Timber harvest has been a major landuse in the foothills since the early years of this century and many of the existing roads began as railroad grades to facilitate logging in the 1920's. By the 1940's, these railroad grades were improved to logging roads to meet the timber demands of World War II. Road and logging expansion continued in the landscape as the post war timber industry evolved in western Oregon. Currently, the steep and remote foothills landscape has developed a checkerboard pattern of BLM and private industrial forest land. In general, private industrial forest land is managed on traditional economic rotation schedules of between 50 and 65 years and protection of stream courses are dictated by the state of Oregon's Forest Practice Standards. Most of the nonresidential and agricultural forest lands are managed according to current market conditions with intensive, short rotation forest management.

Most of the agriculture and rural residential landuse occurs in lower foothills and valleys in the Assessment Area. While much of this development pattern is still centered around agriculture, Christmas tree farming, and rural communities, highway access to Portland is of increasing importance. Rural residential and subdivision development continues to expand in accessible parts of the Assessment Area with appropriate zoning and transportation corridors to Portland.

Map 3-1. North Willamette LSRA Forest Zones



Vegetation

Potential Vegetation

The Potential Vegetation concept reflects the endpoint of natural successional processes. It reflects the underlying site qualities, including climate. To describe vegetation based on its potential provides an opportunity to readily understand and communicate environmental gradients, including limitations and opportunities, inherent to the site.

Potential vegetation can be stratified broadly within "forest zones," and defined more specifically by groupings called "plant associations." Forest zones are of interest because they represent major large-scale climatic differences within a region. Forest zones will be used as a primary stratification of landscape potential across this LSR Assessment area.

The Assessment Area is dominated by three forest zones. Within the LSR network itself, the Western Hemlock Zone covers 50 percent of the area, the Pacific Silver Fir Zone covers 39 percent of the area, and the Mountain Hemlock Zone covers 11 percent of the network area. (Map 3-1, Forest Zone Map) A zone is named for the dominant tree species that would be present over time without disturbance.

Western Hemlock Zone

The Western Hemlock Zone occurs on warm, moist sites relative to other forest zones and tends to be the most productive in terms of rapid and large tree growth. Douglas-fir and western redcedar are also common species within this zone. Even though Douglas-fir is shade-intolerant, it is very long-lived (750 years+) and thus, dominates many of the stands in the Western Hemlock Zone (Halverson et al. 1986).

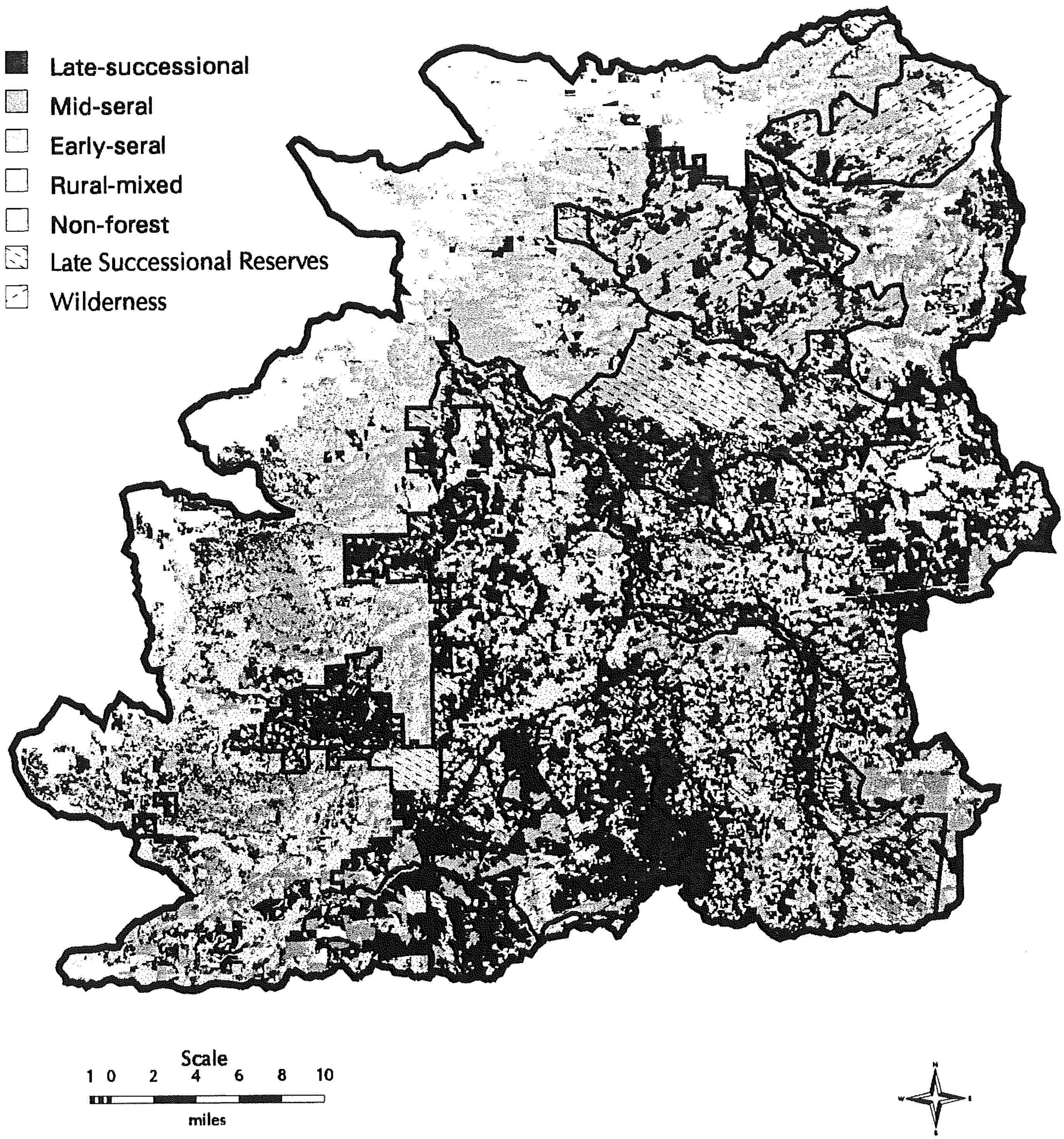
The Western Hemlock Zone occupies lower elevations of the Assessment Area. Within the LSR network, the average elevation of this zone is 2,472 feet. It dominates the western most portion of the Assessment Area and also forms wide bands that extend eastward along the Clackamas and Sandy Rivers and their major tributaries.

Pacific Silver Fir Zone

Temperatures tend to be cooler than the Western Hemlock Zone and summer frost in upper elevations is common, particularly on gentle topography. Winter snow packs tend to be persistent. The Pacific Silver Fir Zone approximates an area where periodic warm winter rains may cause rain-on-snow events.

Douglas-fir is prevalent in this zone, but not as common as in the Western Hemlock Zone. Even though forests are typically dominated by Douglas-fir and noble fir following large fires, these species are eventually replaced by Pacific silver fir.

Map 3-2. North Willamette LSRA Current Vegetation



The Pacific Silver Fir Zone's tree layer is often quite diverse. It commonly includes: noble fir, western white pine, mountain hemlock, western hemlock, and western redcedar (Hemstrom et al. 1982). Trees are slower-growing in this zone and are commonly smaller than within the Western Hemlock Zone.

The Pacific Silver Fir Zone, in general, occurs on higher and harsher sites within the LSR network than does the Western Hemlock Zone. The average elevation of this zone within the network is 3,828 feet.

Mountain Hemlock Zone

The Mountain Hemlock Zone occurs above the Pacific Silver Fir Zone in harsher climatic conditions. Snow packs prevail much of the year and frost can occur during the growing season. Biological processes are slow and result in fragile ecosystems. Trees grow slowly and attain smaller sizes in this zone.

The Mountain Hemlock Zone is concentrated at upper elevational ridgetops in the Roaring River LSR and at the high plateau country in the southern end of the Upper Clackamas LSR. It is also common at high elevations within the Bull of the Woods Wilderness. The average elevation of this zone within the LSR network is 4,496 feet.

Current Vegetation

To build a current vegetation layer for the North Willamette LSR Assessment Area, multiple data sources were used and compiled. The Assessment Area includes federal lands managed by the BLM and the FS and a significant intervening landscape of nonfederal lands. The FS lands cross two national forests (Mt. Hood and Willamette) and three ranger districts (Clackamas River, Zigzag and Detroit). BLM lands are within the Cascades Resource Area of the Salem District. Although less emphasis was placed on describing nonfederal lands, these lands were grouped into broad vegetative types to provide information on the intervening landscapes that often lie adjacent to or between LSRs (Map 3-2).

Forest vegetation can be categorized by physical structure (tree size, canopy closure, coarse woody debris amounts) and seral (or successional) stage. Both are often key determinants of habitat for various species of plants and animals. For example spotted owls may require forest stands of structure with large trees (21"dbh+) and high canopy closure, whereas some species of lichens may require forest stands that have been relatively undisturbed for very long periods (250 years+), but not need the large tree structure. Some late-successional forests in the Assessment Area will meet both requirements, while others will meet the habitat requirements for some late-successional species, but not for others.

To describe the current vegetative conditions of the Assessment Area and in turn the condition of the LSR network, the assessment team stratified vegetation to reflect the habitat needs of different groups of late-successional species. The team adhered to the following objectives:

- Use familiar terminology and characteristics to the extent possible.
- Tier from the same vegetation data sets that were used for watershed analyses across the Assessment Area.
- Substratify vegetation groups in such a way to help analyze the contribution to the differing habitat needs of various late-successional dependent species.
- Incorporate the effect that forest zones may have upon resulting stand characteristics.

Detailed information on the data sources that were incorporated to build the current vegetation layer are available in the LSR analysis file. It also includes specifics on the forest stand characteristics that were used to stratify the groupings and subgroupings. In short, stand structure, stand age, and site potential played key roles in classifying existing stands into the vegetation groups outlined below.

Late-successional

These stands contain many or most of the characteristics of forested stands within LSRs as described following the "Late-Successional Forests" section of this chapter. These stands are dominated by trees over 21"dbh in the Western Hemlock Zone and lower portions of the Pacific Silver Fir Zone. In the Mountain Hemlock and upper portions of the Pacific Silver Fir Zones, stands may be dominated by trees over 21"dbh, or when not, they are quite old (180 years +). Late-successional stands in all zones have at least 40 percent canopy cover, with those over 60 percent considered closed stands. The late-successional group was broken into a number of subgroupings based upon tree size, or canopy closure. They are to be used as building blocks for running habitat models for specific late-successional species or guilds.

Mid-seral

In this assessment, mid-seral forest stands meet the definition of dispersal habitat for spotted owls. These stands have at least 40 percent canopy cover and are dominated by trees in the 8-21"dbh size class. Stands in this class that are under 80 years of age and have canopy closures in excess of 70 percent may be candidates for silviculture manipulation within LSRs. This would accelerate development of some late-successional characteristics.

Early-Seral

Stands in this class may range from areas of potential forest that currently function as openings up through closed sapling/pole stands. Small tree size (below 8"dbh) is the dominating feature of these stands. Closed sapling/pole stands are considered early-seral in this assessment, whereas in some watershed analysis documents this stand condition was lumped with the mid-seral stands. Early-seral stands may contain remnant medium trees (over 8"dbh) or large trees (over 21"dbh) as long as the remnant layer is less than 30 percent canopy cover.

Rural Mix

This vegetation class is used on a portion of nonfederal lands. It includes extensive areas that contain a small patch size mosaic of developed land, openings and trees. This type includes or is found adjacent to the communities of Welches up the Sandy River Valley, and Sandy, Estacada, Colton and Mill City along the western fringes of the Assessment Area. Scattered buildings, homesteads, backyards, orchards and agricultural use may all be found within this type.

Non-forest

This class is used for federal lands dominated by alpine areas, rocky areas, meadows, lakes or administrative sites.

Table 3-1 displays the current amount of the seral stage classes expressed as a percentage of the land area across the Assessment Area and within the LSR network.

Table 3-1. Current Seral stage amounts: Landscape Scale (displayed by percent of landscape area)

Seral Stage	Entire Assessment Area	Federal Lands Within Assessment Area	LSR Network
Late-successional	31%	40%	51%
Mid-seral	25%	25%	18%
Early-seral	32%	31%	28%
Rural Mix	9%	0	0
Non-Forest	3%	4%	3%
Total Acres	955,521	690,662	178,594

Detailed information about the amount and pattern of forest seral stages summarized at the individual LSR level can be found in Chapter 4. The current vegetation Map 3-2 displays the existing spatial arrangement and location of the various forest seral stages across the Assessment Area landscape.

Late-Successional Forests - Desired Conditions

Late-Successional Reserves are to be managed to protect and enhance conditions of late-successional and old-growth forest ecosystems, which are habitat for late-successional and old-growth related species including the northern spotted owl. These reserves are designed to maintain a functional, interacting, late-successional and old-growth forest ecosystem. (ROD p. C-11) In Late-Successional Reserves, standards and guidelines are designed to maintain late-successional ecosystems and protect them from loss due to large-scale fire, insect and disease epidemics, and major human impacts. The intent is to maintain natural ecosystem processes such as gap dynamics, natural regeneration, pathogenic fungal activity, insect herbivory, and low-intensity fire. (ROD p. B-1)

Structure and Composition

The Northwest Forest Plan Record of Decision (ROD) pages B-4 and B-5 outlines stand characteristics and functions that are desired within LSRs. Local data from ecology and CVS plots within late-successional forests were used to provide local quantitative guidance for potential stand characteristics within the North Willamette Assessment Area.

Desired late-successional and old-growth characteristics that will be created as younger stands change through successional development include:

- Multispecies and Multilayered Assemblages of Trees
- Moderate-to-High Accumulations of Large Logs and Snags
- Moderate-to-High Canopy Closure
- Moderate-to-High Numbers of Trees With Physical Imperfections such as Cavities, Broken Tops, and Large Deformed Limbs
- Moderate-to-High Accumulations of Fungi, Lichens, and Bryophytes

Although they may not be duplicates of existing old-growth forests, these stands could provide adequate habitat for many species in the long term. (ROD p. B-5)

Late-successional ecosystems perform several ecological functions that appear to be lacking, or less well developed, in younger natural forests and managed plantations. These functions include buffering microclimates during seasonal climatic extremes, producing food for those consumer organisms that occupy late-successional forests, storing carbon, providing nutrient and hydrological cycling, and providing sources of arthropod predators and organisms beneficial to other ecosystems or successional stages. Old-growth ecosystems appear to have high retention of nutrients and low soil erosion potential, although differences in these functions between stand developmental stages may not be large once canopy closure has occurred. Tall, deep canopies of late-successional forests can also intercept more moisture from clouds and fog than young plantations. (ROD p. B-4)

Potential LSR Stand Characteristics by Forest Zone

To help portray potential future condition at the stand level, ecology plot data were used to describe stand characteristics by forest zone. Ecology plot data that were used are from existing late-successional stands with minimal disturbance. Coarse Woody Debris (CWD) data from the Current Vegetation Survey (CVS) sample plots were also examined.

Western Hemlock Zone

A number of western hemlock plant association groups from warm and wet to cool and mesic are represented in this zone within the LSR network. Dominant late-successional tree species across all associations within this zone include (in order of dominance): western hemlock, Douglas-fir, and western redcedar. (Douglas-fir dominates the early-seral layer, with bigleaf maple and red alder being common associates in the warmer and moister plant associations.) Stands are commonly dominated by trees over 21" dbh across all associations. Stand canopy closure is over 60 percent cover on 95 percent of the plots (sample size = 223), while canopy closure was over 70 percent on 78 percent of the plots. Snags >15" dbh averaged 15 per acre, and down wood ground cover averaged 8.5 percent on CVS plots that were examined in stands over 250 years of age.

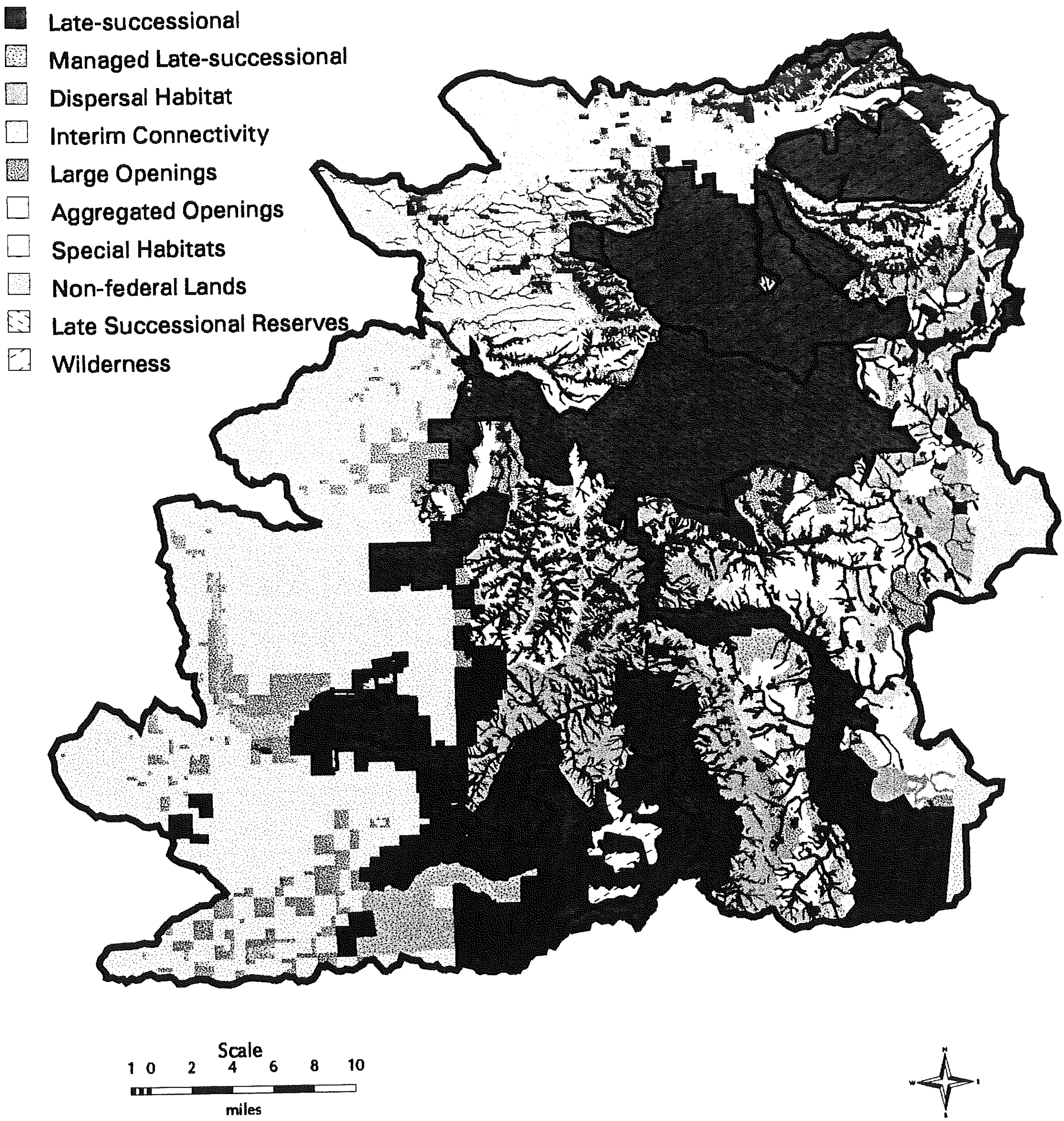
Pacific Silver Fir Zone

Plant associations in the zone range from warm and wet to cold and mesic. The tree layer can be diverse. Late-successional stands are generally dominated by Pacific silver fir, but often include western hemlock, noble fir, Douglas-fir, and lesser amounts of western redcedar, Engelmann spruce, and Alaska yellow cedar. Douglas-fir and noble fir dominate young stands with smaller amounts of western hemlock. (Lodgepole pine, western white pine and western redcedar may be components of some young stands.) Late-successional stands in this zone are still dominated by trees greater than 21 inches according to ecology plot data. Stand canopy closure is over 60 percent cover on 78 percent of the plots (sample size = 41), while canopy closure was over 70 percent on 59 percent of the plots. Snags >15" dbh averaged 14 per acre, and down wood ground cover averaged 6 percent on CVS plots that were examined in stands over 250 years of age.

Mountain Hemlock Zone

The tree layer can be quite diverse. Late-successional species include mountain hemlock, Pacific silver fir, Douglas-fir, noble fir as well as western redcedar, western white pine, Alaska yellow cedar and western hemlock. (Mountain hemlock and Douglas-fir are common in early-seral stands along with lodgepole pine on drier sites and western hemlock and noble fir on moist sites.) Only half of the late-successional ecolgy plots were dominated by trees over 21 inches dbh, while the other half were dominated by trees in the 11-21 inches dbh size class. Only 43 percent of the sample plots had a canopy closure of over 60 percent, and only 13 percent had canopy closures over 70 percent (sample size = 23). Snags >15" dbh averaged 14 per acre, and down wood ground cover averaged 6 percent on CVS plots that were examined in stands over 250 years of age.

Map 3-3. North Willamette LSRA Conceptual Landscape Design



Landscape Analysis and Design

A key component of Watershed Analysis in the Assessment Area was the application of the Landscape Analysis and Design Process (LAD). The LAD process was used to synthesize management direction from the Northwest Forest Plan, the Mt. Hood Forest Plan, and the BLM Resource Management Plan along with the physical and biological potential of the landscape into a spatial arrangement of landscape structures. Information about the LAD process is described in detail in the publication *Forest Landscape Analysis and Design* by Diaz and Apostol, 1992. The first part of the process, analysis, incorporates the principles of landscape ecology at the watershed scale. The second part of the process, design, integrates that analysis with the social expectation of the landscape. Because design is an objective driven process, each underlying and overlapping land allocation serves as the basis for the development the Conceptual Landscape Design. The Conceptual Landscape Designs developed for each watershed graphically displays the vegetation patterns desired under existing management direction with watershed specific analysis. The designs are "Conceptual" because they represent the structures and patterns desired under management objectives, not the existing landscape condition or a condition desired within a given timeframe. Each "design cell" represents a specific vegetation type based upon unique physical, biological, and management characteristics.

For the purposes of this assessment, it was necessary to combine the Conceptual Landscape Designs for each watershed as well as develop design cells for watersheds where the LAD process has not yet been applied. Because each Conceptual Design is watershed specific, the original designs should be consulted for project planning. The approximately 80 unique designs cells were combined based upon like vegetation patterns and structures as they relate to the objectives of this LSR assessment. The resulting Conceptual Design has been used to graphically illustrate the future vegetation patterns on federally administered lands in the Assessment Area and evaluate those vegetation patterns for consistency with LSR objectives (Map 3-3, Conceptual Landscape Design). More information about individual Conceptual Landscape Designs for each watershed can be found in Appendix F. The following design cells represent similar landscape structures and spatial patterns across the Assessment Area.

Late-Successional

This design cell encompasses the Late-Successional Reserves, the Riparian Reserves, and the 100-acre LSRs. Late-successional characteristics vary across forest zones within this design cell.

Managed Late-Successional

This pattern type occurs primarily in the scenic viewsheds of important roads and rivers.

Dispersal Habitat

Dispersal habitat describes a vegetation structure of continuous mid-seral forest with a well connected canopy and 1-5 acre openings. This vegetation pattern occurs primarily in sensitive or unstable landscapes.

Interim Connectivity

This design cell represents the deferment of timber harvest in large blocks of existing late-successional forest stands when possible until adjacent LSRs and/or Riparian Reserves reach a target level of functioning. An additional need for late-successional connectivity was identified in some watersheds particularly for terrestrial connectivity along an elevational gradient or in areas of low stream density. In other watersheds with low amounts of late-successional forest stands, retention of the oldest stands was to enhance landscape level diversity or comply with management direction.

Large Openings

Large created openings shaped to the underlying landform in a well connected forest matrix reflects the management objectives of timber production on stable slopes and forage creation for deer and elk habitat.

Aggregated Openings

Aggregated openings are large patches of early and mid-seral trees in a mosaic pattern which are irregularly shaped and infrequently distributed. Vegetation patterns more closely resemble a natural disturbance pattern with irregular patch edges and should shift across the landscape over time. Aggregated patches occur primarily on flatter, stable land. This design cell also reflects the management objectives of timber production and deer and elk forage.

Special Habitats

This design cell includes non-forested landscape patches like wet and dry meadows, rocky outcrops, lakes, and talus slopes which provide a unique habitat niche for those species associated with them.

Nonfederal Lands

No design cells were developed for nonfederal lands within the Assessment Area. Twenty-nine percent of the Assessment Area consists of nonfederal lands.

The federal lands within the Assessment Area consist of the following distribution of LAD cells:

- Late-Successional, 59 percent
- Managed Late-Successional, 6 percent
- Dispersal, 10 percent
- Interim Connectivity, 5 percent
- Large Openings, 9 percent
- Aggregated Openings, 9 percent
- Special Habitats, 2 percent

Future Amounts and Distribution of Late-Successional Forest

Given current management direction and barring major catastrophic loss, the conceptual amount of late-successional forest that could be present upon the Federal lands of the Assessment Area in the future is 65 percent. *(It's currently at 40 percent.)* It is important to point out that only a portion of this total comes from the LSR network. Table 3-2 breaks out by allocation the potential contribution to the amount of future late-successional forest in the Assessment Area.

Table 3-2. Distribution of Future Late-Successional Forests by Allocation

Allocation Group	Acres	Percent of Total Amount of Future Late-Successional
Late-Successional Reserves	179,716*	41
Wilderness	115,453	26
Other (Riparian Reserves, and other non-timber allocations)	144,222	33
Total	439,391	100

* *Includes small portions of LSRs not assessed in this document.*

Table 3-3 gives the *current* seral stage amount expressed as a percentage of each Conceptual LAD cell (for federal lands within the Assessment Area).

Table 3-3. Current Seral Stage by LAD Cell

LAD Design Cell	Late-Successional	Mid-seral	Early-seral	Non-Veg
Late-succ.	45	27	25	3
Man. Late-succ.	36	27	34	3
Dispersal	37	20	42	1
Interim Conn.	54	9	36	1
Large Open	27	32	36	5
Aggreg. Open	25	22	49	4

Reference Conditions

The distribution of forest zones combined with disturbance and successional processes, influence the type and pattern of vegetation over time and space. Rather than emphasizing any single point in time, the Range of Natural Variability (RNV) concept recognizes the dynamic nature of ecosystems. Knowledge of this range of natural variability with respect to the amounts and pattern of late-successional forest on the landscape can provide useful information about the conditions late-successional species may have adapted to over time. This knowledge of the range of amounts and patterns over time allows us to evaluate and prioritize future management direction.

Applying the RNV concept to late-successional forest amounts in the Assessment Area provides an ecosystem reference from which to assess current conditions and future trends. Data from the *1993 Regional Ecological Assessment Project* or "REAP" (USDA 1993), were used to provide information on the RNV for late-successional forests in the Assessment Area. Data in terms of RNV were presented in the REAP study by forest zone at the River Basin scale on federal lands. This scale is reasonably consistent with the landscape of this LSR Assessment.

A Comparison of Past, Present and Future

The Clackamas Basin, which accounts for a large proportion (64 percent) of the Assessment Area, can be used as a sample landscape to compare past, present and future conditions of late-successional forest. This basin contains a large representative sample of the three major forest zones found in the Assessment Area. This basin also contains 77 percent of the assessed LSR network.

Table 3-4. Clackamas Basin: Comparison of Past, Present and Future Percent of Basin in Late-Successional Forest Conditions Across all Federal Land Allocations

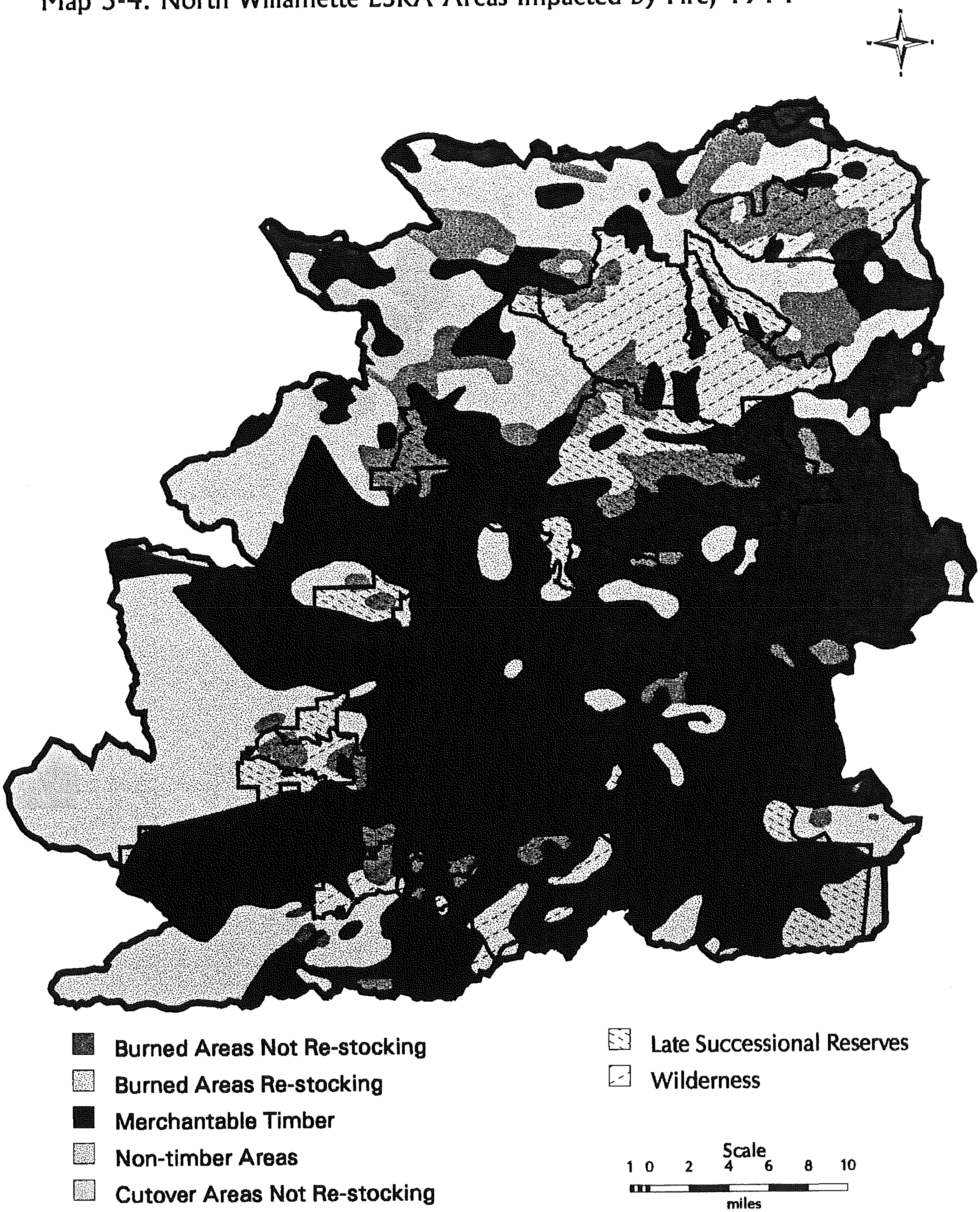
Forest Zone	Range of Natural Variability (from REAP)	Current Condition	Desired Future Condition*
Western Hemlock (173,207 ac)	42-72%	41%	70%
Pacific Silver Fir (224,290 ac)	30-36%	48%	48%
Mountain Hemlock (45,212 ac)	28-60%	39%	62%

** DFC as used here is based on assumption of full implementation of current management direction from Land Management Plans as reflected in the Conceptual Landscape Design (Map 3-3).*

At present, the Western Hemlock Zone is slightly below RNV for late-successional forests. Timber harvest, which has been common across this zone, combined with stand replacing fires in the North Fork and Roaring River watersheds within the past 100 years are primary factors leading to this lower amount. The Mountain Hemlock Zone is within the RNV at present while the Pacific Silver Fir Zone is above. More detailed information about historic conditions is generally available within the individual watershed analyses.

It is important to point out that the amount of late-successional forest in the future condition as presented in the above table comes from multiple allocations. The LSR network only accounts for 31 percent of the federal land acreage within the Clackamas Basin. Other land allocations such as wilderness, Riparian Reserves and various "limited or no timber harvest" allocations make up almost half of the acres predicted to be managed within a late-successional condition in the future in this basin.

Map 3-4. North Willamette LSRA Areas Impacted by Fire, 1914



Landscape Patterns: Past, Present and Future

When quantifying late-successional forest conditions, not only is the total amount of interest, but also the pattern (patch size and arrangement upon the landscape). The pattern affects ecological function. According to Chen et al. (1990), late-successional forests next to clearcuts may have reduced humidity, increased wind velocity, and increased summer temperatures up to 600 feet into the forest. Soil temperature and moisture content may be affected up to 400 feet from the edge. Any species that relies on microhabitats found in interior forest patches may have problems with edge habitat (Chen et al. 1990). High amounts of edge may also allow for invasion by edge predators and introduced species (Simberloff et al. 1992).

Landscape patterns in previous centuries generally consisted of large unfragmented, irregularly-shaped patches of early, mid or late-successional forests (Diaz et al. 1993; Krusemark et al 1996). Forest cover of mid to late-successional stands dominated the landscape in large contiguous areas. These forests were generally well connected across the landscape. Examples of such conditions are evident within the Assessment Area across large portions of the Salmon-Huckleberry, Bull of the Woods and Mt. Hood Wilderness.

Map 3-4, Areas Impacted by Fire (1914) also displays landscape patterns of large irregular patches that dominated the landscape in the early years of this century.

A study by Diaz et al. (1993) compared current and historic landscape patterns and included a quantitative assessment of two watersheds located within this LSR Assessment Area (Hot Springs Fork and Oak Grove Fork). Landscape patterns were compared between two points in time, 1890 and 1990. There has been an increase in the number of patches across the landscape and a decrease in patch size. There has been a marked increase in the edge density ratio for these two watersheds. This study found this trend to be fairly consistent in the western Cascades of Oregon and Washington.

At present, much of the Assessment Area landscape is more fragmented than that of historic landscapes (refer back to Map 3-2, Current Vegetation). Areas of rather unfragmented landscapes dominated by large contiguous patches of forest canopy of mid to late-successional forest do exist, however, in the Assessment Area. These unfragmented blocks are primarily within the Wilderness/LSR complexes of the Salmon-Roaring River area, Mt. Hood Wilderness, Bull of the Woods and Opal Creek area.

An idea of what future landscape patterns may look like given current management direction is apparent by examining the Conceptual Landscape Design Map (Map 3-3). The landscape will be dominated by very large, irregular-shaped and well connected forest patches dominated by late-successional forest. Within LSRs, growth of early-seral stands to mid-seral stands will reduce the edge effects to any adjacent late-successional stands in the short term. The amount and patch size of interior habitat within LSRs will increase over the long term, as early and mid-seral stands progress to late-successional stands.

Landscape patterns outside of reserve areas will be dominated by various arrangements of mid-seral and early-seral forests dissected by linear corridors of late-successional forests within the Riparian Reserves. Some of the areas outside of LSRs, such as wilderness and Riparian Reserves, will contain enough structural elements including canopy continuity to serve as dispersal habitat for some late-successional species. The relationship of present and future landscape patterns to the habitat needs of late-successional associated species is further developed in the Connectivity section later in this chapter.

Disturbance Agents

Fire

Fire History

Fire history maps indicate that prior to 1914, a significant portion of the north half (including the Salmon-Huckleberry Complex), and the western one-third (including the Soosap, Table Rock, and Abiqua LSRs) of the Assessment Area had been burned by wildfire. (Map 3-4, Areas Impacted by Fire.) Speculation attributes most of the fires to human casual factors including vegetation management, timber harvest, land clearing, huckleberry field enhancement, hunting, and abandoned campfires. Lightning was also a factor in fire starts. The lack of fire suppression activity also played a role in allowing fires to burn for weeks or months. These fires would smolder and creep until an east wind event would begin and the fires would increase in size and intensity until the winds died. This cycle of smoldering/creeping fire and east wind events would continue throughout most of the summer until the fall/winter rain would extinguish all fires.

The Forest Service did not actively pursue wildfire suppression until after the great fires in Idaho and Montana in 1910 which burned millions of acres and many lives were lost. Since 1910, the Forest Service has aggressively fought all wildfires to keep them as small as possible. Given the fire regime on the west side of the Cascades, our aggressive suppression efforts since 1910 probably has not significantly altered the natural fire cycle. Fires will still tend to be infrequent large stand-replacement events that occur every 150-400 years. What is probably more significant, in terms of stand composition and related fire impacts, is the vegetation management (timber harvesting) that has occurred over the last 50-60 years. Timber harvesting has reduced the fuel loading and continuity throughout the forest. Decreasing stand density reduces the opportunity for a crown fire to develop. Crown fires are wind-driven, fast-moving fires that are high intensity and stand replacing.

Keeping fire intensity lower greatly increases the survival rate of residual trees. Reducing downed fuel loading decreases the severity of a burn and the fire's resistance to control. One of the drawbacks of the timber harvest in the 60s and 70s was the development of an almost mono-culture type stand. Because of its desirable characteristics of fast growing and high strength, Douglas-fir was the desired species for reforestation. Mono-culture stands tend to be less resilient to natural destructive agents such as insects, disease, and fire. For the past several decades, an increased emphasis has been placed on the development of stand diversity which will ultimately reduce the impacts from wildfires.

Fire Ecology

A team of fire specialists developed the report *Fire Ecology of the Mid-Columbia* (Evers et al. 1995), which summarized current available fire ecology and management information for the Mid-Columbia area of Oregon and Washington, including the Mt. Hood National Forest.

Fire ecology groups were developed based on plant associations and species response to fire, as well as these species' roles during succession. Occurrence and extent of the fire groups were determined by field sample data of plant associations. Each fire ecology group includes a variety of information, including fire management considerations and suggestions for resource managers to consider for incorporation into land management objectives. These fire ecology groups can also be used to describe and predict fire's potential impact on an ecosystem. (For detailed descriptions of these groups, see Evers et al. 1995).

There are six fire ecology groups represented within the Assessment Area, fire group O, 6, 7, 8, 9, and 10. Fire group O is minor in any of the LSRs. (Map 3-5, Fire Ecology Groups.)

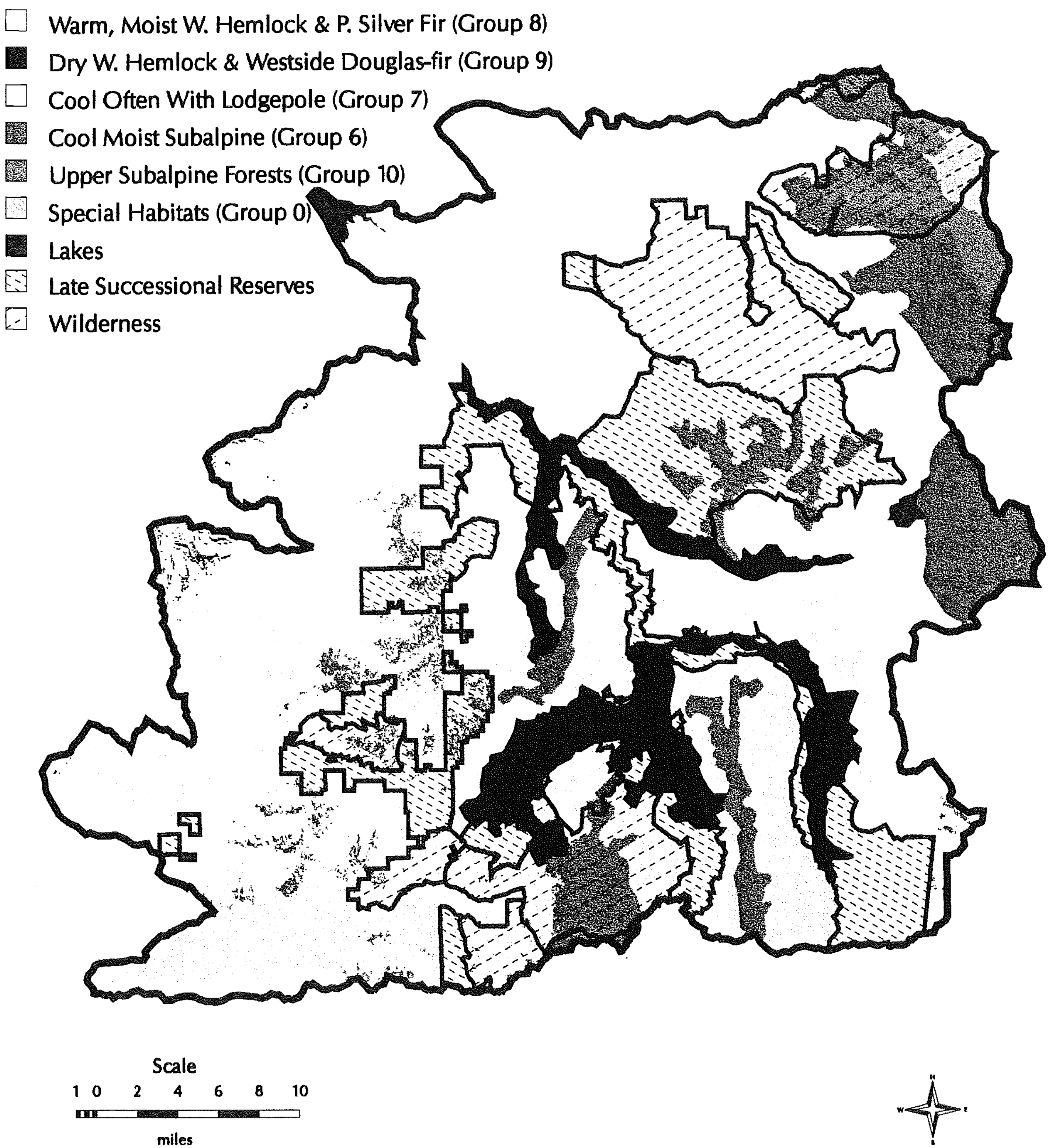
The most significant fire group, in terms of fire effects/impacts and amount of area in the LSRs, is group 8. Fire group 8 covers approximately 70 % of the Assessment Area, which includes approximately 59% of the LSRs. This fire group is characterized by stand replacing crown fires at a fire frequency of 50 - 300+ years.

Fire Group 8 - 59 Percent

Warm, moist western hemlock and pacific silver fir.

Fire group 8 includes most of the western hemlock and Pacific silver fir plant associations found in the mid-Columbia. As such, it includes a wide range of topographic positions, moisture regimes, and temperature regimes. In general, the plant associations reflect a warm, moist climate to the west, gradually shifting to a cooler and drier climate to the east.

Map 3-5. North Willamette LSRA Fire Ecology Groups



Forest Fuels

This group generally lacks fine fuels through most of the stand history. Some sites containing devil's club and skunk cabbage may have heavy fuel buildups, but the presence of water keeps these fuels too moist to burn readily and facilitates relatively rapid decay. "Classic" old-growth stand conditions (closed canopy overstory of large diameter trees over a lush understory) are common in undisturbed areas, indicating infrequent disturbance. Deep duff and large logs are typical of this group.

If the overstory begins to die from insect and disease attack and the stand begins to fall apart, fuel loadings can build rapidly. Conditions become drier in these canopy gaps and provide a suitable fuelbed for fire starts within these gaps.

Fire Ecology/Fire Effects

Depending on weather conditions in a given year and on whether extensive canopy gaps have begun to develop, the wildfire hazard is usually low to moderate for this fire group. Most years the associations in this group are well watered and slow to dry. Once the duff dries, it will carry fire. Prolonged smoldering in deep duff and punky logs can cause severe soil damage. Both western hemlock and Pacific silver fir are extremely fire sensitive due to thin bark, shallow roots, and highly flammable foliage. Fire frequency tends to be low because of the cool, moist habitats that western hemlock/Pacific silver fir generally occupy. The fire return interval is generally between 150 to 400 years or more.

Large fires within these plant series tend to be stand replacement. Due to both species having low fire tolerance, even a light surface fire is damaging because the shallow roots are scorched. Low to moderate intensity fires in multi-storied stands with Douglas-fir and western hemlock in all layers would tend to perpetuate Douglas-fir in the overstory and hemlock in the understory. An old-growth stand dominated by western hemlock can tolerate low intensity fire; but a moderate or high intensity fire would tend to create openings dominated by shrubs and herbs. Fire serves to prepare mineral soil seedbeds, produce a mosaic of stand structures and age classes across the landscape, and affect within-stand species diversity. Fire history maps suggest that most wildfires are either very small (less than 10 acres) or very large (greater than 1000 acres). In the mid-1800s there was a fire on the southwest boundary of the Assessment Area that covered 1,000,000 acres (vicinity of Abiqua/Butte LSR). Conditions which result in large fires, prolonged drought and strong east winds, occur approximately every 30 years.

Current Fire Behavior

High intensity fires occur with extreme east wind episodes, prolonged drought, or both. The highest fire danger occurs from mid-September through October. Most of the active burning occurs during one burning period, although it can occur over several burning periods. Fires can last from days to weeks. Low rates-of-spread and fireline intensities dominate. Prolonged smoldering can create a high severity burn.

Fire Group 9 - 19 Percent

Dry western hemlock and westside Douglas-fir.

Fire group 9 occurs primarily on south and west aspects in the Clackamas, Collowash, and Salmon River drainages. Typical site characteristics include stony, rocky, gravely, or otherwise well drained soils, steep slopes, and generally dry conditions. Group 9 consists of dry western hemlock plant associations where Douglas-fir is the major seral species with a grass or grass/brush understory. Approximately 7 percent (72,571 acres) of the project area is in this fire group. Of the 72,571 acres of fire group 9 in the project area, 34,466 acres (47 percent) is within the LSR network.

Three conifer and two hardwood species tend to dominate the overstory within this fire group:

- Douglas-fir,
- western hemlock,
- western redcedar,
- bigleaf maple, and
- Oregon white oak.

Western redcedar tends to grow primarily in draws and other locations with deeper soils that hold more moisture. Typical shrub species include vine maple, dwarf Oregon grape, red huckleberry, and salal.

Fire in this group serves to prepare a mineral soil seedbed, resprout brush and hardwoods, reduce heavier fuel loadings, and create a generally open canopy. In stands with more closed canopies, fire also serves to create more of a mosaic of stand ages across the landscape.

Forest Fuels

The drier conditions in the understory in late summer provides live fuel in the form of cured grasses and shrubs with fine twigs. In more open canopies, tree crowns can reach closer to the ground, providing a ladder for fire to reach the canopy. Fuel loadings in this fire group are highly variable, depending on individual stand and site conditions. Most sites in this fire group dry out sufficiently and contain enough fine fuels to carry fires in most years.

Fire Ecology/Fire Effects

Prolonged fire exclusion has probably allowed the development of denser stands than before white settlement and altered typical fire behavior from predominately nonlethal underburning to predominantly crown fire. Prior to the current policy of fire exclusion, this fire group may have burned frequently, particularly in the Clackamas and Collowash River drainages. If the fire return interval averaged less than 50 years, then more open stand conditions than present may have been more typical.

Current Fire Behavior

Stand replacing crown fires can develop and do not necessarily depend on the combination of prolonged drought and east wind conditions. In the absence of an east wind event, topography and rockiness tend to control fire size and shape. East wind events tend to perpetuate crown fires within these stands. Most often however, low to moderate rates-of-spread and fireline intensities dominate fire behavior. Most fires within this group typically last from one day to one week.

Fire Group 7 - 13 Percent

Cool sites with lodgepole pine.

Fire group 7 occurs on higher elevation plateaus characterized by lodgepole pine, Pacific silver fir, mountain hemlock, and western white pine. Beargrass and huckleberries dominate the understory vegetation.

Forest Fuels

Fire group 7 sites are characterized by low productivity and generally do not produce very heavy downed woody fuel loading and/or deep duff. Fuel loadings increase when the overstory of lodgepole breaks up from disease related mortality and snow breakage. When fuel loadings do build up, fire can burn very rapidly through the area under dry conditions. Wildfire risk also increases when the climax species invade the understory and provide a fuel ladder into the overstory. However, these stands would tend to burn and replace themselves before mountain hemlock or Pacific silver fir takes over. Fuel buildup tends to start about age 60 to 80 due to natural thinning, snow breakage, and disease.

Fire Ecology/Fire Effects

Fire serves to perpetuate the dominance of lodgepole pine in these stands. Without periodic disturbance, mountain hemlock or Pacific silver fir would eventually replace the lodgepole pine. Lodgepole pine does not regenerate well in duff or shade. Once the stand is established, conditions do not favor rapid fire spread or uniform burning except under extreme burning conditions.

Current Fire Behavior

Large stand replacing fires probably burn every 100-300 years in fire group 7. Occasional low to moderate intensity fires may thin the stands or otherwise rejuvenate it without doing serious damage to large areas of the overstory. Eventually a fire will start, escape initial attack, and become large. Fire exclusion does not appear to have altered successional patterns and potential fire behavior. Timber harvesting may have reduced the risk of large wildfircs in some areas by reducing stand densities and breaking fuel continuity. Wildfire risk rises during periods of prolonged drought and during extreme burning conditions. Fires at such times can crown and become very large if the lodgepole stands are "ready" to burn. During most years, generally cool conditions, a short fire season, and the lack of fuels tend to keep fires to a minimum despite the high potential for starts.

Fire Group 6 - 9 Percent

Cool moist subalpine fir.

Fire group 6 incorporates the wetter portions of the transition zone between the eastside and westside forest types as well as cooler sites on the westside. This fire group occurs at a mix of higher and mid-elevation sites west of the Cascade crest.

Forest Fuels

Deep duff and litter layer are common with this fire group. Most downed woody fuel loading is in the 3+ inch diameter class. Associations in fire group 6 are warm enough that most smaller dead woody fuels decay almost as rapidly as they accumulate. The abundant shrubs also provide a very large heat sink under normal conditions, greatly reducing the rate of fire spread. However, during prolonged drought, these shrubs and forbs can provide a significant fuel load.

Much of the large diameter woody fuels tend to be rotten. The higher moisture holding capacity of these rotten logs also reduces fire risk throughout much of the year. However, once this fuel dries out, severe soil damage from prolonged heating may result if it burns. Once the canopy begins to break apart from other factors, such as insect and disease, and understory of considerable regeneration may develop. This understory combined with the high levels of lichens hanging from the boles, allows crown fires to develop and spread easily.

Fire Ecology/Fire Effects

The typical environment for Fire Group 6 plant associations is the Subalpine zone which includes heavy snowpacks, short growing seasons, frequent frost, and cold/moist soils. Tree species generally found within the Subalpine zone are not fire tolerant. Species found within this group have relatively thin bark, shallow roots, low-hanging branches, highly flammable foliage, and a tendency to grow in dense groups making them very susceptible to fire injury. In the Pacific Northwest, the estimated presettlement fire regime in the Subalpine forest types is 170-430 years. The effects of fire in this group would be expected to: prepare a mineral soil seedbed, increase scenic and wildlife habitat diversity through creation of mosaics, and rejuvenate the shrubs. Following a stand-replacing fire, shrubs and forbs will dominate until seedlings become established. Tree establishment may take much longer in stands dominated by rhododendron. A variety of species may establish, such as western white pine, Douglas-fir, noble fir, and Englemann spruce.

Current Fire Behavior

Current evidence on the Mt. Hood National Forest suggests that fire group 6 experiences high intensity stand-replacing fires almost exclusively. The undergrowth in plant associations does not support fire except during prolonged drought. However, these stands are vulnerable to wind-driven crown fires originating from adjacent stands. With aggressive initial attack, most fires within this group typically last less than one week and generally only one burning period.

Fire Group 10 - <1%

Upper subalpine forests.

Fire group 10 occurs in the higher elevations at timberline around Mt. Hood and the Olallie Lakes area. All stands within this fire group lie above the climatic limits of Douglas-fir and many are above lodgepole pine. Mountain hemlock is the most common tree species in all the associations of this group. Only a few species of shrubs and forbs tend to dominate most sites. Typical shrubs include huckleberries and juniper. Typical forbs include sedges, green fescue, asters, and fleeceflower.

Forest Fuels

Fire group 10 is characterized by relatively sparse fine fuels and moderate to heavy loadings of large diameter woody fuels. Most of the logs are rotten. Much of the dead downed woody fuel loading result from wind and snow breakage, windthrow, insects, and disease.

Fire Ecology/Fire Effects

When a fire does start, it spreads primarily by torching and spotting between clumps of trees and individuals. Burned area within a given fire perimeter usually involves less than 1/3 of the ground. Since most fires involve only one or two trees in a stand, the concept of a fire frequency is not very applicable. Stand replacing fires, especially those that burn up from lower elevation forests, become possible during extended drought. Without disturbance, the mature trees will develop into a climax stand, however, this progression may take as much as 200-300 years.

Current Fire Behavior

Fire is infrequent and tends to do little damage in terms of management objectives. With aggressive initial attack, most fires within this group typically last less than one week and generally last only one day. Fire fighting equipment and tactics can greatly damage these fragile sites. Care should be taken to utilize Minimum Impact Suppression Tactics (MIST) in this fire group.

Fire Group 0

Miscellaneous special habitats.

Fire group zero consists of a miscellaneous collection of habitats that do not fit into the Mt. Hood's plant association classifications. Areas included in this classification are:

- scree (talus slopes),
- forested rock,
- dry meadows,
- wet meadows,
- recent volcanic/glacial deposits,
- alder glades, and
- deciduous riparian communities.

Table 3-5. North Willamette LSR Fire Ecology Groups

Group	Title	Vegetation Zone	Understory	Fire Frequency	Presettle-ment Fire Duration	Current Fire Duration	Presettle-ment Fire Behavior	Current Fire Behavior
Zero	Misc. Special Habitats	Various	Various	Various	Various	1 day	Various	Various
Six	Cool, Moist Subalpine	Pacific Silver Fir, Mountain Hemlock	Rhododendron Huckleberries, and Beargrass	170 - 430 yrs	Days to Weeks	1 day to 1 week	Crown fire, torching, spotting, lethal under-burning	Crown fire, torching, spotting, lethal under-burning
Seven	Cool, often with Lodgepole Pine	Pacific Silver Fir, Mountain Hemlock, possibly Western Hemlock	Huckleberries and Beargrass	100 - 300 yrs	Days to Weeks	1 day to 1 week	Crown fire with lethal under-burning	Crown fire with lethal under-burning
Eight	Warm, Moist Western Hemlock & Pacific Silver Fir	Western Hemlock, Pacific Silver Fir	Herbs and Shrubs	50 - 300+ yrs	Days to Weeks	1 day to weeks	Crown fire	Crown fire
Nine	Dry Western Hemlock & Westside Douglas fir	Western Hemlock	Shrubs and Grasses	25 - 150 yrs	Days to Months	1 day to 1 week	Under-burning with some Crown fire, torching, spotting	Crown fire with some under-burning
Ten	Upper Subalpine Forests	Mountain Hemlock	Heather, Woodrushes, Huckleberries	300+ yrs	Days	1 day to 1 week	Torching, spotting, lethal under-burning	Torching, spotting, lethal under-burning

Insects and Diseases

Disturbances caused by insects and diseases influence the vegetation structure and composition within the Assessment Area. Most of the indigenous insects and pathogens, including western spruce budworm, Ips beetles, fir engraver, annosus root disease and dwarf mistletoes, provide benefits to late-successional forests and will have a low probability of adversely influencing management objectives within the LSR network. However, several key species will have greater probabilities of causing disturbances which may interfere with attaining or preserving late-successional habitat. These species are Douglas-fir beetle, mountain pine beetle, and laminated root rot.

Influences by the nonnative fungal species, white pine blister rust, has affected and is affecting the area; it may adversely influence attainment of some desired characteristics. Two nonnative insect species, balsam woolly adelgid and larch casebearer, which occur in the Assessment Area have caused small scale disturbances in the past, but probably have low importance in regard to current management objectives.

Another exotic insect, gypsy moth (especially the Asian strain), has the potential to adversely impact LSRs by defoliation of conifers, if the insect became established, or by insecticide treatment effects, if gypsy moths are captured in or adjacent to the Assessment Area. If gypsy moth males are captured in pheromone monitoring traps, an area surrounding the captures will be delineated and will likely be treated with insecticides. The current insecticide of choice, B.t.k. (*Bacillus thuringiensis kurstaki*), would have an impact on non-target species and would have to be evaluated before application.

Discussions of expected influences of these key disturbance agents and some items for consideration are presented in the following paragraphs.

Insects

Douglas-fir Beetle

The Douglas-fir beetle, *Dendroctonus pseudotsugae*, is indigenous to North America throughout the range of Douglas-fir. This beetle maintains normal low-level populations by infesting trees weakened by root disease or in scattered windthrow. This is the insect species most likely to be responsible for disturbances (usually not more than several acres in size) within the Assessment Area. After a significant wind event, populations will increase in down and damaged Douglas-firs, and will infest and kill standing green trees in subsequent years. If significant amounts of windthrow do not occur in the following two years, these outbreaks typically will last only three years with successively fewer trees being attacked and killed each year.

Tree mortality caused by Douglas-fir beetle (DFB) can be benign, beneficial, or harmful, depending upon management expectations and desired forest conditions. Moderate amounts of tree mortality, for instance, can significantly improve habitat diversity for numerous species of vertebrate and invertebrate fauna. Conversely, large amounts of mortality can severely damage high value recreation sites, timber stands, old-growth areas, or habitat conservation areas (Hostetler and Ross 1996).

It is significant that some of the areas within this Assessment Area depend upon the number and sizes of old growth trees to meet habitat requirements. Some of the older, less vigorous trees, weakened by disease or other factors, will be the most vulnerable to Douglas-fir beetle.

Beetle Life History

The DFB has one generation per year with most adults emerging, flying to, and infesting new host trees during the months of March through May in most locations west of the Cascade Crest. A smaller flight composed of reemerged parent beetles and progeny of the previous years reemerging parent beetles may occur later in the summer. Only the spring flight of beetles has the potential, in terms of population levels, to infest significant numbers of standing green trees. This potential would be manifested the second spring after occurrence of significant wind events.

Initiation of a Beetle Outbreak

In western Oregon and Washington, windthrow is common in the fall and winter months due to windstorms combined with presence of saturated shallow soils. Occasionally, these storms are severe and result in extensive windthrow over large areas. Factors that favor DFB population increases include large numbers of windthrown trees, felled trees and logging slash, and other diseased and weakened trees.

A critical threshold of felled trees that will result in bark beetle population increases substantial enough to result in subsequent attacks on living trees is not known with certainty. However, based upon experience in forests west of the Cascade Crest, when the number of windthrown trees reaches or exceeds three per acre, the numbers of DFB produced by these down trees is high enough to cause infestation and mortality of some standing live Douglas-firs the spring following initial infestation of the down trees. In these westside forests, DFB generally infest trees greater than 12 inches in diameter at breast height. If all the trees in a stand are smaller than this, the probability of DFB-caused tree mortality is very low. This probability will increase with an increasing proportion of trees greater than 12 inches in diameter. If subsequent windthrow and/or drought are absent, the killing of standing green trees will only last for three years, with successively less trees being killed each year. Our estimate is that for every down Douglas-fir in an initial wind event, 0.6 trees will be killed over a three year period.

History of Assessment Area

In recorded history, the two largest recorded outbreaks of DFB within westside forests occurred following the windstorms of the winter of 1949-1950 combined with the severe windstorm of December 4, 1951, and following the Columbus Day Storm which occurred on October 12, 1962. In the winter of 1989/1990 another windstorm caused significant amounts of windthrow which resulted significant increases in DFB populations.

Large numbers of dead trees were mapped in parts of the Assessment Area for several years (1952 and 1953) following the 1949-1950 windstorms. The amounts of mortality mapped during aerial surveys after the Columbus Day Storm were higher than normal, but not high enough to cause great concern. The numbers of dead trees mapped in 1992 and 1993 following the last large windstorm were much higher than the normal low levels.

Storms during the winter of 1995-1996 resulted in blowdown ranging from small patches to generally scattered in areas west of the Cascade Crest. The lack of large patch blowdown does not mean that DFB will not cause any future mortality of standing green trees. Infested down trees covered by partial to full shade will produce about six times as many beetles as trees fully exposed to the sun (Johnson et al. 1961). Thus, a down tree in a scattered, shaded blowdown situation will produce more beetles in the subsequent generation than a similar size tree within a large patch of blowdown exposed to higher levels of solar radiation.

Stands at the greatest risk of experiencing DFB-caused tree mortality are those with a component of Douglas-firs larger than 12 inches dbh and which are in or near areas which have a high risk of Douglas-fir blowdown. During years following no significant wind events, the numbers of dead trees mapped by aerial survey is quite low. Most of the trees that are infested and killed are in root disease centers, probably caused by laminated root rot, *Phellinus weirii.*

Items for Consideration

There are several situations which may warrant special consideration in the management of Late-Successional Reserve areas. These situations may trigger additional data collection in affected areas which in turn may trigger initiation of adaptive management methods to respond to the findings.

- Blowdown patches of 10 acres or greater may trigger some salvage activity. Any salvage, when completed, must meet the requirement that at least 15 percent of the area be covered by coarse woody debris, with three exceptions. In these exceptions, which follow, the cover requirement will be reduced to 10 percent in an effort to reduce risk of beetle attack on nearby live Douglas-firs; (1) blowdown within 0.5 mile of private forested land with Douglas-firs greater than 12-inches dbh; (2) patches in or adjacent to open, late-successional forest type; or (3) patches in or adjacent to important habitat. The number of currently windthrown Douglas-fir logs that would need to be left is a function of log diameters and lengths, stand composition, and number of sound logs needed as coarse woody debris.

- For a more detailed discussion, see CWD Management in Chapter 6 and Appendix D, CWD Implementation Examples. As the number of windthrown Douglas-firs increases above 3 per acre, the risk of additional Douglas-fir mortality caused by Douglas-fir beetle in surrounding areas also increases.

- Areas of blowdown which are less than 10 acres may allow Douglas-fir beetle populations to increase to a level at which Douglas-firs in surrounding areas may be killed. A wind event which results in these smaller patches may trigger some additional monitoring, especially if: (1) patches are within 0.5 mile of private forested land with Douglas-firs greater than 12-inches dbh; or (2) patches adjacent to northern spotted owl nest sites.

- In second growth stands which are being thinned and in which 12-dbh and larger Douglas-firs are being felled and left as coarse woody debris, an effort should be made to reduce the risk of Douglas-fir beetle attack on live trees by following the guidelines presented in Hostetler and Ross 1996, especially if: (1) stands are within 0.5 mile of private forested land with Douglas-firs greater than 12-inches dbh; or (2) stands are adjacent to or near northern spotted owl nest sites.

Mountain Pine Beetle

The mountain pine beetle will influence pine species which occur in the Assessment Area, primarily lodgepole pine, western white pine, and whitebark pine. This insect will infest and kill trees which are under stress and can cause major disturbances in densely stocked, older lodgepole stands. This insect will also infest and kill western white pines which are being crowded by surrounding vegetation and/or are infected with white pine blister rust. There are management options which can increase the probability that pines will remain as a viable component of many of the stands in the Assessment Area.

History

A report from 1946 (1938-1942 Forest Conditions in Oregon and Washington, July 1946) has record of a mountain pine beetle infestation on the Olallie Lake Recreational Area and the Warm Springs Indian Reservation. "Over a period of several years, most of the mature lodgepole pines were killed on about 12 sections of the most heavily affected area. In all, perhaps one township sustained loss, including the killing of [western] white pine". No other information pertaining to this outbreak was included in the report, but this is evidence that mountain pine beetle outbreaks have occurred in or near the Assessment Area, and will occur again if stands are in or grow into susceptible conditions.

Western Spruce Budworm

Even though it is not expected that western spruce budworm will cause disturbances which will greatly influence the attainment of management objectives within the LSR network, it is worth discussing because of the quite visible nature of the defoliation caused by outbreak populations of this insect.

Western spruce budworm, *Choristoneura occidentalis,* is a small moth which feeds on foliage of Douglas-fir and true firs and occasionally reaches outbreak levels in portions of the northern Oregon Cascades. Significant amounts of defoliation have been recorded on or adjacent to the Mt. Hood National Forest during two outbreak periods – 1941-1957 (Dolph 1980) and 1983-1993 (Sheehan 1996). In addition, defoliation was mapped near Mt. Wilson primarily on the Warm Springs Indian Reservation with a little on the Mt. Hood National Forest, from 1974 through 1979. No defoliation was mapped in the Assessment Area during the 1941-1957 outbreak, and very little during the 1974-1979 episode. The last outbreak resulted in defoliation in parts of the Assessment Area and some of the LSRs during the period from 1987 through 1993. In 1992, for example, 102,000 acres of visible defoliation were mapped during the aerial insect detection survey with 68,000 acres falling within LSR R0207. This was near the end of an outbreak which began causing significant defoliation in parts of Mt. Hood National Forest east of the Cascade Crest in 1983, and eventually caused visible defoliation in on substantial areas west of the Cascade Crest. Parts of the defoliated area, including portions of the Assessment Area were treated with bacterial insecticide (Bacillus thuringiensis kurstaki) in 1988.

The 1987-1993 outbreak was the first time substantial amounts of defoliation have been recorded in the Assessment Area. This defoliation did not seem severe enough over a large enough area to significantly effect change which would be unacceptable in trying to achieve the goals of LSR management.

Exotic Species

Balsam woolly adelgid and larch casebearer, are exotic insect species which have become established in native forests within the Pacific Northwest. They are unlikely to cause significant adverse effects in the future.

Larch casebearer, while occasionally causing conspicuous defoliation on western larch, has never caused noticeable mortality in the Assessment Area.

Balsam woolly adelgid effects visible during annual aerial surveys were first recorded in the Assessment Area in 1956. This insect species is still resident within the Assessment Area, but no known incidents of major disturbance caused by this insect have been recorded.

Diseases

Laminated Root Rot

Laminated root rot, caused by the fungus *Phellinus weirii is* probably the most commonly encountered and significant disease disturbance agent in the Assessment Area. This fungus progressively kills and decays roots of highly susceptible host trees which will eventually die while standing or lose structural support and be windthrown. *Phellinus weirii* has co-evolved with its hosts and is a natural part of many forest ecosystems. Laminated root rot spreads through forest stands by means of root contacts. As it spreads and kills trees this root pathogen creates openings in the canopy, increases volume of down woody debris, increases species diversity in the plant community and probably in the invertebrate community, and may enhance visual quality on a landscape scale. Canopy openings will expand about one foot per year (Bloomberg 1984, Childs 1970, Nelson and Hartman 1975), usually in some variation of a radial pattern (Thies and Sturrock 1995). The highly susceptible tree species which occur in the Assessment Area are Douglas-fir, mountain hemlock, grand fir (minor species only), and, to a somewhat lesser extent, Pacific silver fir.

Before human activities became the dominant agents of disturbance on the landscape, the distribution and spread of the fungus was mediated most likely by the fire history and pattern in an area. Fire determined the location, spread, and longevity of host trees over the landscape and, thus, that of the fungus. A study in the northern Oregon Coast Range found a significant association between laminated root rot and slope position in 70 to 100 year old Douglas-fir stands. The percentage of plots containing *P. weirii*-infected Douglas-firs was highest on ridges and decreased downslope. No relation was found, however, between laminated root rot and plant community type or aspect. This disease moves relatively slowly through stands and is persistent for up to 50 years in large roots and stumps of trees that have been cut or killed (Childs 1963, Hansen 1976, 1979).

The two primary human activities which increased probabilities of spread and intensification of laminated root rot in stands are:

- Suppression of natural fire.
- Planting of almost pure Douglas-fir stands after regeneration harvest or stand replacing fires.

Based on the 264 CVS (Current Vegetation Survey) plots which are within the Assessment Area boundaries, four percent of these plots had evidence of laminated root rot. This number can be extrapolated to indicate that an estimated four percent of the land area within the Assessment boundaries is infected with laminated root rot. The 83 plots which are within LSR boundaries also had an estimated four percent of the plots with evidence of laminated root rot.

Within LSRs, the impact of laminated root rot on management objectives will need to be assessed at the project and landscape scales. To properly assess the impacts of laminated root rot on stands, it is helpful to use existing models such as the Western Root Disease Model which links to FVS (Forest Vegetation Simulator). This will allow one to project effects decades into the future where slow moving agents such as *Phellinus weirii* are likely to have the most profound effects on expected vegetation composition and structure. Although this disease is a natural part of the ecosystem, it could potentially have adverse effects on desired conditions within the LSR network.

White Pine Blister Rust

White pine blister rust has caused a significant decrease in the occurrence and vigor of western white pine throughout the West. As a result, western white pine in general comprises a much smaller percentage of stand composition, especially of large trees, than it did in the past. Substantial amounts of western white pine mortality were detected within the Assessment Area by aerial surveys during the 1950s. Much of the this mortality was located in LSR 207. Future activity will be less in existing stands because of past changes in stand structure and composition. However, this pathogen will be a major influence in the nature of management activities if it is desirous to increase the percentage of western white pine in stands within the Assessment Area (i.e., it will be necessary to collect seed, screen it for rust resistance, and obtain planting stock from resistant families).

Wildlife and Plants

Late-Successional Associated Species

LSRs were designed to be large, contiguous blocks of late-successional habitat that could sustain populations or sub-populations of species associated with late-successional forests. Each LSR is part of a network of LSRs connected by habitat in Riparian Reserves and the Matrix that, including 100-acre LSRs, allows for dispersal of organisms between LSRs (ROD p. B-1,4). In general, LSRs were designated in areas where the most late-successional habitat still exists. Thus, the LSRs currently support species that utilize late-successional habitat. These species are listed in Appendix B. The list includes species such as the spotted owl that appear to be dependent on older forests as well as species that use other habitats in addition to older forests (see Vegetation Structure column, Appendix B).

Late-successional species are keying in on a combination of habitat components provided by these older forests, including: large trees, snags and defective trees, down wood, moderated temperature and moisture regimes, snow interception, forest floor duff and litter, and multi-layered canopies. Many of the habitat "generalists" utilize snags and down logs and will also use younger forest if those components are present. This group includes cavity nesting birds, terrestrial amphibians, and small mammals (see CWD column in Appendix B).

A number of the song bird "generalists" are neotropical migrants. They are attracted to shrubs in canopy gaps and the understory of multilayered late-successional forests. This habitat component also exists in open habitats but is usually absent from young forests. Some of the songbirds are attracted to interior late-successional forest. This habitat occurs in large blocks of late-successional forest that the LSRs are designed to provide.

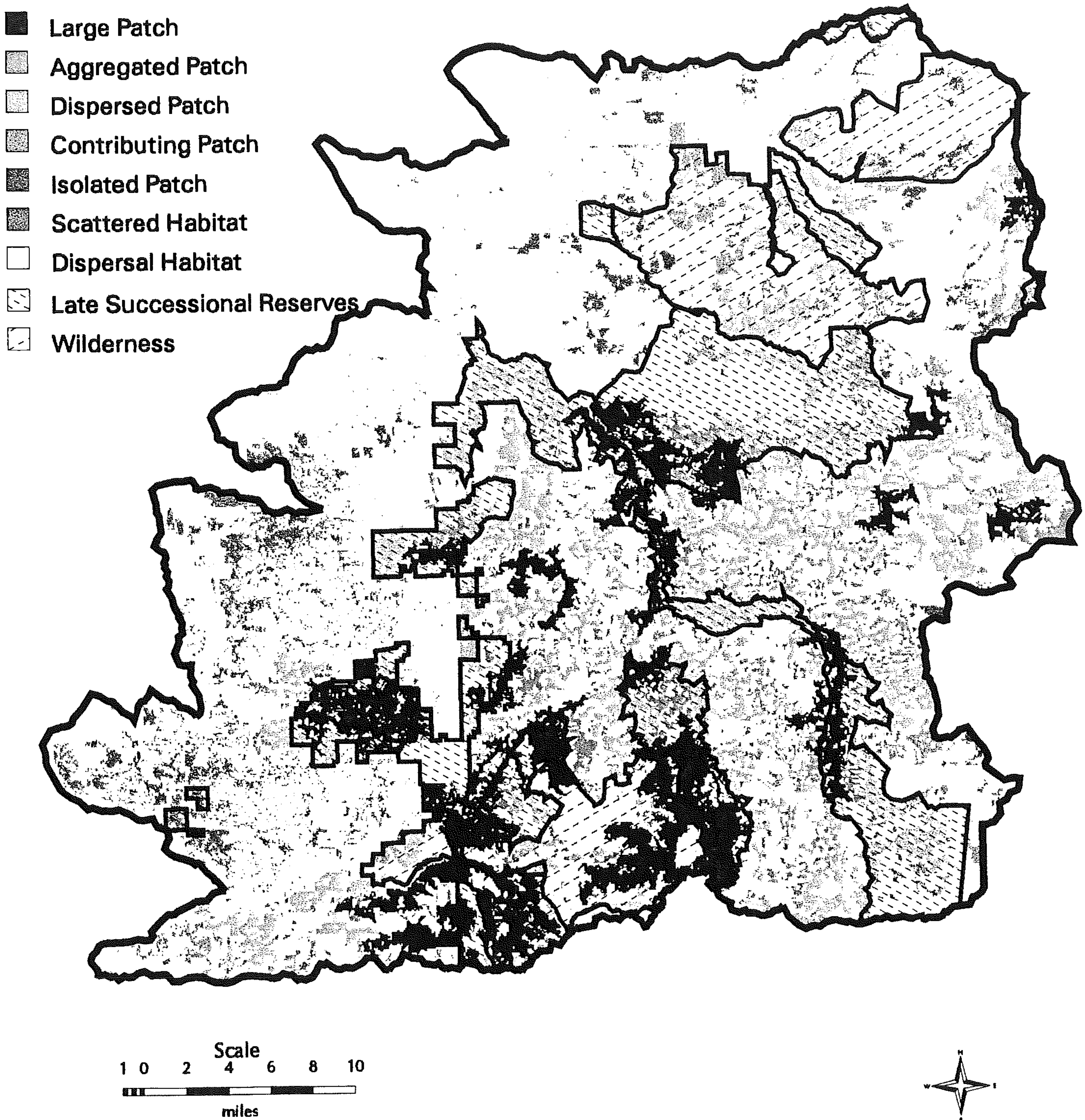
In the FEMAT report there are 126 vascular plants listed in Appendix X, Table IV-A-4 that are considered to be closely associated with late-successional or old-growth forest within the range of the spotted owl. There are 91 of these species that have been identified as occurring on federal lands within the Assessment Area. These species are listed in Appendix C.

The LSRs and Riparian Reserves will help maintain populations of lichens across the landscape by providing the proper mix of microclimates within the canopy and in the understory of late-successional forests with sufficient coarse woody debris. Several studies have been done assessing lichen diversity and function in forests of various ages and management history (Boucher and Stone 1992, Lesica et al. 1991, McCune 1993, McCune et al. 1991, Neitlich 1993, Per-Anders and Renhorn 1996, Sillet 1995). Neitlich and McCune (1997) offer some suggestions to maintain and promote lichen diversity during silvicultural treatments, such as protecting gaps, wolf trees (trees with large-diameter lower branches), old-growth remnant trees, and maintaining hardwoods. These techniques may help in developing late-successional qualities in treatments of younger stands in LSRs.

Many of the structural and microclimate parameters that are beneficial for the lichens and fungi are also beneficial for the late-successional associated bryophytes, such as a diversity of tree species, coarse woody debris, low levels of disturbance, ameliorated temperature, wind, and humidity, and others.

Currently, the LSRs contain large amounts of young forests and plantations (28%). As these stands mature they are expected to develop structural components of late-successional forest important in providing habitat for a number of species. The processes of death and decay will produce defective trees, large snags, and down logs. As stands age, trees will increase in size. Species diversity should increase. Multi-layered canopies should develop, providing a diversity of habitats for many species. Canopy gaps will allow for development of shrubby habitat for songbirds and small mammals.

Map 3-6. North Willamette LSRA Late-Successional, Large Home Range, Mosaic Species



Late-successional habitat in LSRs is currently fragmented to varying degrees. Fragmentation causes reduction in the amount and quality of habitat, and isolation of habitat patches. Some late-successional species are negatively affected by fragmentation and associated edge effects. Some songbirds experience higher nest predation and thus lower reproductive rates in edge habitats versus interior habitats (Mariani et al. 1995, Rudnicky and Hunter 1993, Yahner and Scott 1988). As young forests in LSRs mature, the effects of fragmentation will diminish, providing higher quality, interior habitat for these species.

Map 3-6. (Late-successional, large home range) illustrates the effect of fragme tation on current amount and quality of late-successional habitat. Late-successional habitat, for wildlife purposes, was described as stands where trees averaged 21 inches dbh or greater and where canopy closure was greater than 40 percent. The map was created using the HABSCAPES model (Mellen et al. 1995). The model was run with parameters for late-successional species with large home ranges (3,000 acres). A patch needed to be at least 40 acres in size or it was considered "Scattered Habitat". There also needed to be an adequate amount of habitat (1,500 acres) within a home range circle around each patch to be considered suitable.

Isolated patches are greater than 40 acres, but without enough habitat within the 3,000 acre circle to total 1,500 acres. Polygons identified as "Large Patch" and "Aggregated Patch" are greater than 40 acres and have enough adjacent habitat to meet the 1500 acre criteria. "Dispersed Patch" polygons are greater than 40 acres. The home range does not comprise 1,500 acres of habitat, but at least 2,100 acres of habitat is available without leaving a patch that is intersected by the home range radius. "Contributing Patch" polygons may contribute to the 1,500 acre requirement of an adjacent polygon, but do not themselves meet the 1,500 acre requirement.

The Large Patch polygons represent the largest, least fragmented blocks of habitat. The majority of these patches are within LSRs or wilderness areas. Areas with a high level of fragmentation, however, also exist within the LSRs. Large amounts of "Aggregated and Dispersed Patch" habitat currently exist outside protected areas.

Fragmentation increases habitat for a group of species referred to as "contrast" species (Vegetation Structure column, Appendix B). These species use late-successional habitat for nesting, hiding or resting but forage in adjacent open habitats. This group includes elk and large raptors such as red-tail hawks, great horned owls, and great gray owls. Several species of bats roost in large snags in late-successional forests but forage in open habitats. Snags in late-successional forests provide moderated temperatures which are important to roosting bats. Due to fragmentation, primarily from past timber harvest, habitat for these species is more abundant currently than it has been in the past. As young stands in LSRs mature, habitat for these species is expected to decline.

Riparian Associated Species

Several species of amphibians are closely associated with riparian areas within late-successional forests. These species include: Cope's giant salamander, Pacific giant salamander, Cascade torrent salamander, Dunn's salamander, and the tailed frog. These species require cold, clear water and cool, moist microclimates at the stream edge. Northwest salamander and rough-skinned newt use riparian areas, primarily around ponds, during the breeding season. These species will use, but do not necessarily need, late-successional riparian habitat.

A few ducks are cavity nesters which require large snags in the vicinity of water. These species include wood duck, Barrow's goldeneye, bufflehead, and mergansers.

Several mammals are tied to riparian areas. Many species of bats forage over riparian areas. Riparian areas appear to be important to marten and fisher. In the Washington Cascades a majority of marten locations were within 492 feet of perennial streams (Jones and Raphael 1991), and in the California Sierras martens selected locations within 197 feet of water or meadows (Spence and Zielinski 1983). Fisher frequently move along forested riparian areas (Ruggiero et al. 1994). Both marten and fisher require habitat with large snags and down logs that provide thermal cover, protection from predators, and access to subnivian foraging sites when snow covers the ground (Ruggiero et al. 1994).

Currently, riparian habitat within LSRs and Riparian Reserves consists of large amounts of younger forests. Eventually, as these forests mature, riparian areas should be dominated by late-successional habitat. These areas will provide protected microclimates, large coarse woody debris, and cold, clear water for fish, amphibians and other riparian dependent species.

Threatened, Endangered, and Sensitive Species

Northern Spotted Owl

The primary reason for listing the spotted owl as Threatened was *"a decrease in the habitat ... as a result of the timber harvest of mature/old-growth forests"* (USDA and USDI 1994). There is a general consensus that spotted owl populations are declining and will continue to decline until habitat loss stabilizes. Habitat will continue to be lost on Matrix lands while habitat in LSRs improves over the next 50 to 100 years. LSRs are considered the federal agencies contribution to conservation of the northern spotted owl (ROD, Appendix G, p. 3).

LSRs and adjacent wilderness areas form complexes that support population clusters of spotted owls. Four LSR/wilderness complexes have been delineated in the Assessment Area: Salmon-Huckleberry, Bull of the Woods, Opal Creek and Table Rock. The later three are within close proximity and fairly well connected, thus, they could be lumped into one population center. The LSRs are divided primarily based on ownership boundaries. Before Opal Creek was designated as wilderness and scenic area (1996 Oregon Resource Conservation Act), LSR209 was one big block. The Upper Clackamas LSR and Soosap LSR are not adjacent to wilderness in the Assessment Area. The Upper Clackamas LSR is near the Mt. Jefferson Wilderness but the connection between the two areas is all high elevation forest. The Clackamas River Corridor was separated out from the LSRs because it is not a typical LSR block. It does provide some connectivity between Roaring River and Upper Clackamas LSRs. Only a portion of the Mt. Hood Wilderness is in the Assessment Area. The Abiqua LSR is isolated from the rest of the network. No spotted owls occur in this area.

Owl Numbers

Based on population modeling, the Interagency Scientific Committee (Thomas et al. 1990) determined that self-sustaining clusters of owls need to contain at least 15 pairs. Table 3-6 lists the number of owl activity centers in the LSR/Wilderness Complexes and individual LSRs. Opal Creek and Table Rock complexes contain less than 15 activity centers. However, they are both fairly well connected to Bull of the Woods Complex for a cluster of 39 owls. Soosap, a relatively small LSR, has only 4 owl activity centers. It is separated by less than a mile, however, from both Salmon-Huckleberry and Table Rock complexes. The Upper Clackamas LSR has 15 pairs. Due to its long, narrow shape, it is not clear how the owls in the Clackamas River Corridor may interact with those in the Upper Clackamas LSR in terms of meta-population dynamics.

Table 3-6. Spotted Owls in LSR/Wilderness Complexes

Wilderness/LSR Complex	MTH SPOW Activity Centers	BLM SPOW Activity Centers	WIL SPOW Activity Centers	TOTAL SPOW Activity Centers
Salmon-Huclkeberry/LSRs 205, 206, 207A	38			38
Bull Wood/LSRs 209B, 210	24			24
Opal Creek/LSR 209C			7	7
Table Rock/LSR 209A		8		8
Bagby LSR 207B	15			15
Soosap LSR 208	1	3		4
Clackamas Corridor	7			7
Mt. Hood Wilderness	2			2
Total	87	11	7	105

The Willamette Province Biological Assessment (1997) defined owl activity centers in LSRs as either interior or edge activity centers. Interior activity centers are those with the entire home range within an LSR or wilderness area; edge activity centers are those with part of the home range extending into other land allocations. In addition, the assessment included numbers of activity centers with less than 40 percent of the home range in suitable habitat (see Table 3-7).In LSRs in the entire Willamette Province, 79 percent of owl activity centers are comprised of greater than 40 percent suitable habitat, 66 percent of activity centers are edge centers, and 75 percent of edge centers are comprised of greater than 40 percent suitable habitat. The Biological Assessment states *"the LSRs as a whole, appear to be providing adequate levels of suitable habitat for the owl activity centers located within. Conditions of individual LSRs may not reflect the average and the data should be used to identify special management concerns."* In the North Willamette LSR Assessment Area, all but one interior activity center is comprised of greater than 40 percent suitable habitat. Percent of activity centers that are edge centers range from 53 percent to 100 percent. Percent of edge activity centers that comprise greater than 40 percent habitat range from 72 percent to 100 percent. Only two LSR/Wilderness complexes in this Assessment Area are below the Province-wide average for proportion of activity centers that are edge activity centers. The rest are in worse condition in terms of high proportion of edge owl activity centers. Three of these LSR/Wilderness Complexes are either at or below the Province-wide average for proportion of edge activity centers that contain at least 40 percent suitable habitat. The combination of a higher proportion of edge activity centers than average and average or lower number meeting the 40 percent suitable habitat criteria raises concern for the following LSR complexes: Opal Creek/LSR209, Table Rock/LSR209, and Soosap LSR (208).

Table 3-7. Spotted Owl Activity Centers - Interior vs. Edge

Wilderness/LSR Complex	Interior SPOW Activity Centers	Edge SPOW Activity Centers	Percent Activity Centers That are Edge	Edge Activity Centers 40% NRF	% Edge Activity Centers 40% NRF
Salmon-Huckleberry/LSRs 205, 206, 207A	18	20	53	17	85
Bull Wood/LSRs 209B, 210	5	19	79	18	95
Opal Creek/LSR 209C	1	6	86	4	72
Bagby LSR 207B	6	9	60	7	78
Table Rock/LSR 209A	1	7	88	5	75
Mt. Hood Wilderness	0	2	100	2	100
Soosap LSR 208	0	4	100	3	75
Clackamas Corridor	0	7	100	7	100
Total	31	74	70	63	85

Owl Habitat

Suitable spotted owl habitat is defined as nesting, roosting and foraging habitat. Dispersal habitat is defined as stands with an average dbh of 11 inches and at least 40 percent canopy closure. Suitable spotted owl habitat is not just late-successional habitat as defined earlier for wildlife. Owls will use stands with an average tree dbh of less than 21 inches if nest trees or snags are available. An example of this within the Assessment Area is the Salmon-Huckleberry Wilderness. The area does not show much late-successional habitat (Map 3-6 Late-Successional, Large Home Range, Mosaic Species) but there are a number of nesting owls in the area. The area is predominately composed of stands approximately 80 years of age, with average dbh of less than 21 inches, but there are pockets of larger trees that provide nest sites and the remainder of the area provides adequate foraging habitat.

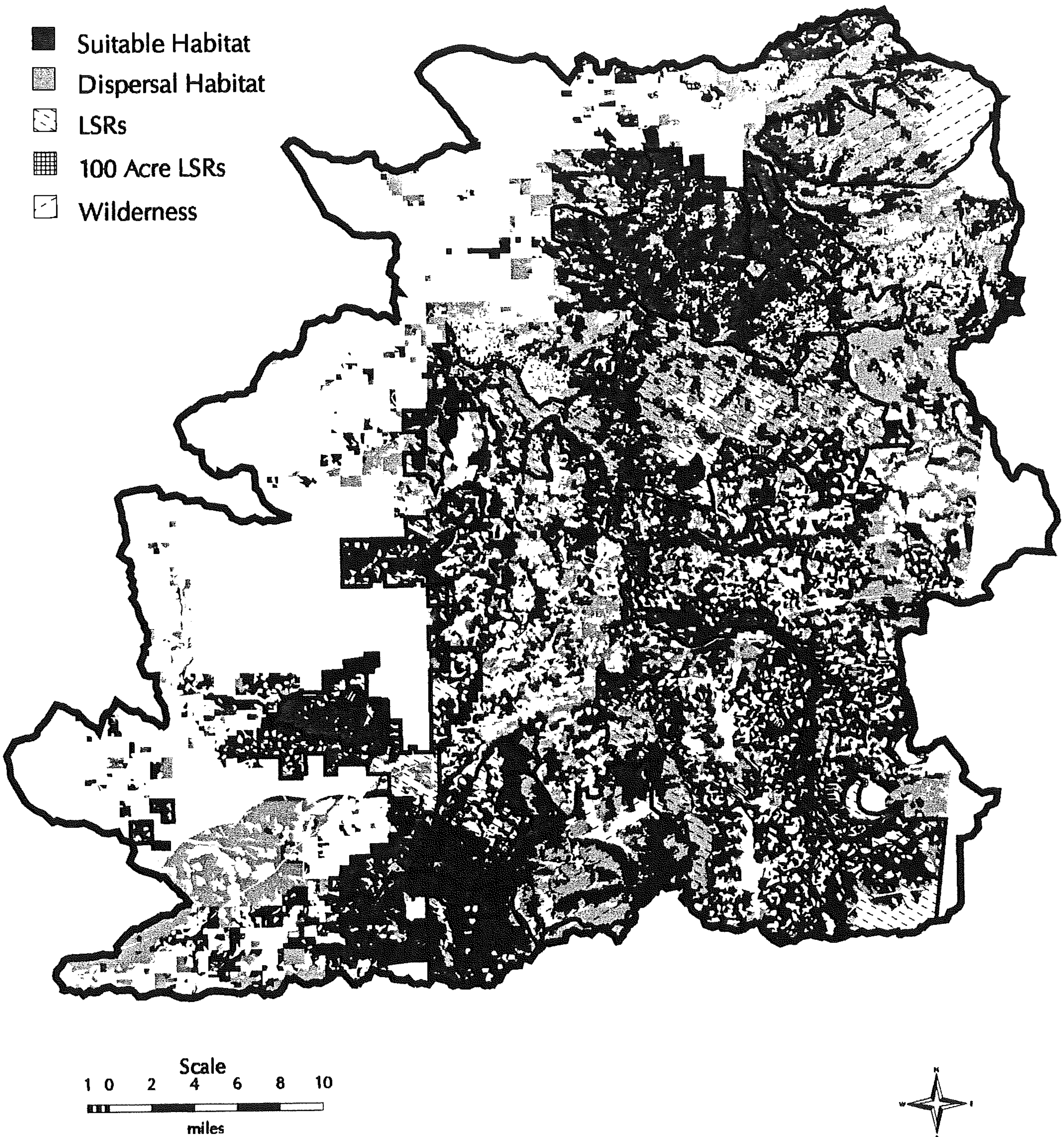
Map 3-7 (Spotted Owl Habitat) shows suitable and dispersal habitat within the Assessment Area. The definition of spotted owl habitat varies by land ownership. On Bureau of Land Management and the Opal Creek area on the Willamette National Forest, suitable owl habitat is defined as stands older than 80 years and dispersal habitat as stands greater than 37 years old. The Mt. Hood National Forest defines suitable habitat as stands below 5,000 feet elevation with greater than 60 percent canopy closure and dbh size classes 8-21", 21-32" and 32+" dbh. The 8-21" size class is a mix of large (21" dbh) and small (8-21" dbh) trees. Dispersal habitat is defined as stands with greater than 40 percent canopy closure and a mix of poles and small trees (5-21" dbh).

The HABSCAPES model (Mellen et al. 1995) was run on suitable spotted owl habitat (Map 3-8 HABSCAPES Assessment). The model allows a comparison of quality of owl habitat in terms of amount and distribution. The model was run with a home range size of 2995 acres, a minimum patch size of 40 acres, and minimum acres of suitable habitat within a home range of 40 percent (1182 acres). The "Large Patch" polygons represent the largest, least fragmented blocks of suitable habitat. "Aggregated Patches" are more fragmented but still represent areas where at least 40 percent of the home range area is in suitable habitat. Other patch types do not meet the 40 percent assumption.

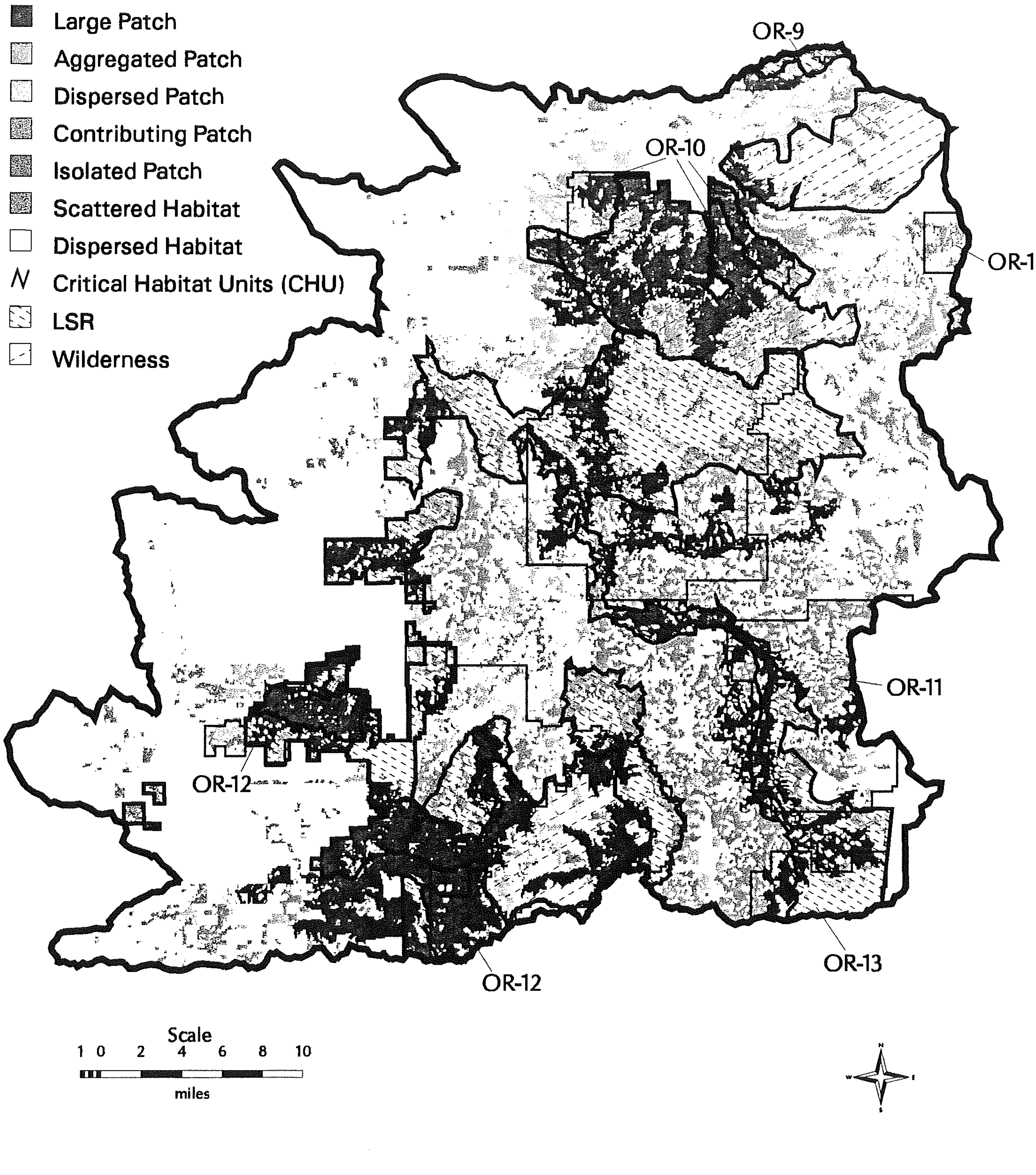
The majority of the "Large Patch" polygons are within LSRs, wilderness areas or Opal Creek Scenic Area. There are large amounts of "Aggregated and Dispersed Patch" habitat outside these protected areas.

On the Mount Hood National Forest, within the Assessment Area, the centers of owl activity centers are located in habitat or patch types approximately as follows: 65% in large and aggregated suitable habitat patch types; 22 percent in other suitable habitat patch types; and 13 percent in dispersal habitat. Because some of the locations are several years old, it is not known how many owls are still occurring in these patch and habitat types.

Map 3-7. North Willamette LSRA Spotted Owl Habitat



Map 3-8. North Willamette LSRA Spotted Owl Habitat Quality HABSCAPES Assessment



Critical Habitat Units (CHUs)

Six CHUs occur in the Assessment Area. CHUs OR-10, OR-11, OR-12 and OR-13 either occur entirely in the Assessment Area or have a major portion in the area. OR-1 falls partially in the area but is tied more closely to White River LSR. Only a small part of OR-9 occurs in the area; it is tied to the Bull Run LSR.

The SEIS assessed the relationship of Option 9 to CHUs (SEIS, App. G, pp 38-34). The assessment identified the Western Oregon Cascades as the area with the lowest amount of overlap between LSRs and CHUs. Thus, a more site-specific analysis follows.

There is a total of 225,093 acres of CHU and 181,285 acres in LSRs in the North Willamette Assessment Area. About half the CHU acres overlap with LSR acres (107,031 acres). Another 14,661 CHU acres are in Table Rock and Opal Creek Wilderness. Thus, 54% of CHUs overlap with LSRs or wilderness areas. In addition, 100 acre LSRs and Riparian Reserves occur between LSRs. These areas do not provide large blocks of habitat, but do serve a dispersal function. The 100 acre LSRs and Riparian Reserves did not exist when CHUs were designated.

Table 3-8 compares the amount of owl habitat in CHUs and LSRs. The total amount of suitable habitat in CHUs is greater than in LSRs. However, the proportion of CHUs and LSRs in suitable and dispersal habitat is similar. There is a higher proportion of suitable habitat in the areas where CHUs and LSRs (including Table Rock and Opal Creek Wildernesses) overlap than in CHUs outside LSRs and the 2 wilderness areas.

Table 3-8. Comparison of Spotted Owl Habitat Within LSRs and CHUs

	Total Acres	Suitable Acres (%)	Dispersal Acres (%)
Entire CHUs	225,093	104,239 (46%)	46,499 (21%)
LSRs	181,285	85,981 (47%)	39,422 (22%)
LSR/CHU Overlap[1]	121,692	61,205 (50%)	26,476 (22%)
CHU outside LSRs and Wilderness	103,401	43,034 (42%)	20,023 (19%)

[1] *Includes Table Rock Wilderness and the portion of Opal Creek Wilderness within CHU.*

Table 3-9 compares the quality of habitat between LSRs and CHUs based on HABSCAPES patch types. There are more acres of "Large and Aggregated Patches" in CHUs than in LSRs. The proportion of habitat in the different patch categories is similar between CHUs and LSRs. However, the proportion of suitable habitat that is in large, contiguous patches is higher in areas where CHUs and LSRs (including Table Rock and Opal Creek Wildernesses) overlap than in CHUs outside LSRs and the 2 wilderness areas.

Table 3-9. Comparison of Spotted Owl Habitat Quality Between LSRs and CHUs

	Large Contiguous Patches (% of Suitable)	Aggregated Patches 40% (% of Suitable)	Dispersed and Contributing Patches (% (% of Suitable)	Isolated and Scattered Patches (% (% of Suitable)
Entire CHUs	60,495 (58%)	26,511 (25%)	9,622 (9%)	7,611 (7%)
LSRs	51,780 (60%)	20,166 (23%)	8,888 (10%)	5,147 (6%)
LSR/CHU Overlap[1]	41,742 (68%)	9,839 (16%)	5,604 (9%)	2,863 (5%)
CHU Outside LSRs and Wilderness	17,984 (42%)	16,655 (39%)	3,841 (9%)	4,704 (11%)

[1] *Includes Table Rock Wilderness and the Portion of Opal Creek Wilderness Within CHU.*

There is a large area of CHU OR-10 outside the Salmon-Huckleberry Complex. The area is to the south of Roaring River LSR and includes some large, contiguous patches of suitable habitat. The Salmon-Huckleberry Complex contains 38 owl activity centers. Thus, the complex supports a large cluster of owls without the CHU.

The area of CHU OR-11 outside the Upper Clackamas LSR overlaps and Area of Concern identified in the Willamette Province Biological Assessment. The area was identified due to concerns over owl dispersal between the LSR and the Warm Springs Indian Reservation. The Upper Clackamas Watershed Analysis recommended a connectivity emphasis area for the north part of this Area of Concern.

There is fairly good overlap between CHU OR-12 and the Bull of the Woods, Opal Creek and Table Rock Complexes. The three complexes support a large population cluster of owls without the CHU.

The portion of CHU OR-13 in the Assessment Area mostly overlaps the Upper Clackamas LSR. The area of the CHU outside the LSR contains a large, contiguous block of suitable habitat. It also occurs in an area identified as a connectivity concern (see Connectivity section which follows). The primary concern is that the connection between the LSR and the Mt. Jefferson Wilderness and LSR214 on the Willamette National Forest is primarily high elevation (above 4,000 feet) forest. The area of the CHU outside the LSR contains lower elevation forest. The Upper Clackamas Watershed Analysis recommended part of this area as a connectivity emphasis area.

While there are some local concerns with CHUs, it is important to note the SEIS did conclude that the continued viability of spotted owls was likely with implementation of the NWFP. The projected future likelihood of achieving Outcome A was 83% (SEIS 3&4-243). This assessment included the knowledge that the overlap of CHUs and LSRs in the Western Oregon Cascades was lower than average for the range of the spotted owl.

Bald Eagle

No bald eagle nest sites occur in the Assessment Area. Eagles have been documented foraging along the Clackamas and Collawash rivers. The Mt. Hood Land and Resource Management Plan (LRMP) identified Bald Eagle Habitat Areas (A13) that were designed to provide potential nesting and communal roosting habitat that would contribute to recovery of the species as identified in the Pacific Bald Eagle Recovery Plan (1986). There are 13 Bald Eagle Habitat areas in the Assessment Area. Ten of the areas are near Timothy Lake, just east of Roaring River LSR. Three of the areas are along the Clackamas River: two in the Roaring River LSR and one just outside the LSR at Timber Lake.

Eagles require large trees and snags for nesting and roosting near foraging areas. Improving fish runs would increase foraging opportunities. LSR objectives are consistent with management of bald eagle habitat.

Peregrine Falcon

Two known peregrine falcon eyries occur in the Assessment Area. One is inside the Roaring River LSR and one is directly adjacent to the LSR. Two cliff sites have been identified in the Roaring River LSR as high potential for peregrine falcon nest sites. A portion of the management zone for the Bald Butte peregrine site extends into the North Willamette LSR Assessment Area between the Collawash and Upper Clackamas LSRs. The nest site is to the south of the Assessment Area on the Willamette National Forest.

A site plan has been developed for the known eyrie adjacent to the Roaring River LSR. The primary and secondary nest protection zones and the tertiary habitat management zone all intersect the LSR. The site plan recommends maintenance of a variety of seral stages across the landscape. Only about 15 percent of the tertiary habitat management zone is within the LSR. Thus, managing for a variety of seral stages is possible in the Matrix surrounding this site. A site plan has not been completed for the peregrine eyrie inside Roaring River LSR. LSR objectives should not conflict with peregrine falcon habitat objectives. Prey species can be found above the canopy of late-successional forests. The site is also adjacent to riparian habitats along the Clackamas River which should also provide prey species.

Federal Sensitive Species

Sensitive species that are known or suspected to occur in the Assessment Area are: Cope's giant salamander, Larch Mountain salamander, red-legged frog, harlequin duck, Townsend's big-eared bat, and wolverine. See Appendix B for occurrence information. The spotted frog is a sensitive species that occurs in high elevation ponds, lakes and meadows. The frog is not associated with late-successional forest. There is no conflict between habitat needs of any of these species and LSR objectives.

Cope's giant salamander, red-legged frog, and harlequin duck are all riparian species. For Larch Mountain salamander see the discussion under the Survey and Manage section below.

Townsend's big-eared bat roosts and hibernates primarily in caves but may also use abandoned buildings. These bats are very sensitive to disturbance, especially when hibernating. The micro-climate in the caves may be affected by vegetation manipulation at the cave entrance.

Wolverines are habitat generalists but have specific denning requirements. Potential wolverine denning habitat has been identified in Roaring River LSR and Bull of the Woods Wilderness (map on file at Mt. Hood Forest Headquarters). Potential denning sites were identified as areas above 4,000 feet in elevation, concave slopes with a north to northeast aspect, and the presence of talus, rock outcrops or perpetual snow and ice. These areas need to be free of human disturbance during the winter months; wolverines may abandon or move their dens due to human presence.

Extirpated Species

Grizzly bear and gray wolf have been extirpated from the Assessment Area. Lynx may have occurred in the area historically, but their historic presence is debated.

It is unlikely that the grizzly bear will repopulate the area. The nearest known bears are near Mt. Rainier National Park. Several major highways and the Columbia River present formidable barriers even to grizzly bear. It is unlikely that they will be intentionally reintroduced south of the Columbia River.

Wolf-dog hybrids probably occur in the northern Oregon Cascades. Gray wolves do occur north of the Columbia River on the Gifford Pinchot National Forest. Unless wolves are intentionally reintroduced, it is unlikely that they will return to the area due to the same barriers mentioned for grizzly bear.

Survey and Manage and Protection Buffer Species

A number of species were identified as Survey and Manage (S&M) species in the ROD (Table C-3). These species were of special concern because other mitigation measures incorporated into the ROD were not expected to be adequate to ensure viable, well-distributed populations of these species. Most of the S&M species are rare and locally endemic. For others, there is very little known about their distribution and life histories so determination of viability was difficult. Surveys were prescribed "to acquire additional information and to determine necessary levels of protection" (ROD, pp C-6).

Protection Buffer Species are rare and locally endemic species. Where these species occur within reserves, viability is likely to be assured. *"However, there might be occupied locations outside these areas that will be important to protect as well."* (ROD, C-19) Surveys need to be conducted prior to ground-disturbing activities in suitable habitat for the species.

Four S&M strategies are discussed in the ROD (C-4-6):

1. Manage Known Sites
2. Survey Prior to Ground-Disturbing Activities
3. Extensive Surveys
4. General Regional Surveys

Protocols have been developed for most S&M and Protection Buffer species. See Chapter 6 for a summary of the protocols. Surveys for some species have already begun.

Larch Mountain Salamander - Survey and Manage Species - Strategy 2

The Larch Mountain salamander is associated with moist rocky outcrops, talus, and exfoliated bark of large Douglas-fir snags in dense conifer forests. The salamander is a rare, local endemic. These salamanders *"tend to be very patchily distributed, but locally abundant"* (Olson 1996). The salamander was originally thought to occur just in the Columbia River Gorge, but has been found in other areas in recent years. The salamander may occur in the northern portion of the Assessment Area.

Surveys were conducted along the Clackamas River in 1995. No Larch Mountain salamanders were found. The Assessment Area was considered outside the range of the Larch Mountain Salamander until June of 1997 when draft revised amphibian survey protocols were released. Surveys will need to be conducted prior to ground-disturbing activities north of a line running east and west 12 miles south of Mt. Hood.

Great Gray Owl - Protection Buffer Species

Great gray owls nest in late-successional forests near natural meadows or man-made openings. Large trees (23 inches dbh) or broken top snags are needed to support their large stick nests. These are nests built and abandoned by other species such as ravens, goshawks or red-tail hawks. The owls forage in the openings or in forests with less than 60 percent canopy closure. Down wood is also an important habitat component tied to prey (small mammal) habitat. Great gray owls are found primarily at elevations above 3,000 feet.

Great gray owls have not been documented to occur anywhere on the Mt. Hood National Forest or Salem BLM. They do, however, occur to the south on the Willamette National Forest. They may also occur at the east edge of the Assessment Area. Surveys have been conducted to protocol standards at the following meadows in the Assessment Area: Salmon River Meadows, Summit Meadows, Squaw Meadows (within Roaring River LSR), Hideaway Lake Meadows, Jackpot Meadows, Frying Pan Lake, Dry Meadow, and Summit Lake.

Black-backed Woodpecker - Protection Buffer Species

This species occurs at higher elevations in the Assessment Area in stands with lodgepole pine, western larch, true firs, or Engelmann spruce. The species is snag dependent for nesting and foraging. *"Black-backed woodpeckers also require beetle infested trees for foraging; some such trees should be provided in appropriate habitat, and sanitation harvest of all such trees would be detrimental to the species."* (ROD, C-46) Surveys are not required for this species. Managing for high levels of large snags is the primary mitigation for this species.

Bats - Protection Buffer Species

Four species of bats that occur in the Assessment Area have been identified as protection buffer species: long-eared myotis, fringed myotis, long-legged myotis, and silver-haired bat. Snags and old, decadent trees provide important roosting habitat for these bats. They were identified as Protection Buffer Species because, *"caves, mines, and abandoned wooden bridges and buildings are extremely important roost and hibernation sites, and require additional protection to ensure that their value as habitat is maintained."* (ROD, C-43)

The Forest Service has conducted surveys of bridges, caves and buildings for roosting bats. Visual searches and the Anabat II Bat Detector were used to locate bats. Long-eared myotis, long-legged myotis and silver-haired bat have been documented in the Upper Clackamas and Roaring River LSRs and Bagby LSR. All four bats have been documented in Collawash LSR. Survey and Manage Protocols for surveying bats are currently being developed.

Red Tree Vole - Survey and Manage Species - Strategy 2

The red tree vole is a canopy dwelling vole. It appears to be more abundant in late-successional forests than young forests (ROD, Appendix J2). These voles eat primarily Douglas-fir needles and are thus limited to lower elevation (below 3,300 feet) forests with a strong Douglas-fir component. They probably have limited dispersal capability because they live and travel primarily in the canopy of conifer forests. Map 3-13, Red Tree Vole Habitat (see connectivity section) shows a map of red tree vole habitat in the Assessment Area. Primary reproductive habitat is late-successional stands greater than 100 acres. Primary habitat is late-successional stands of any size, and potential habitat is closed-small conifer stands (8-21" dbh). All stands occur below 3,300 feet elevation.

Surveys have been conducted in Eagle Creek, Fish Creek, Oak Grove, Clear Creek, and North Fork Clackamas Watersheds. Two nest sites were verified in both Eagle Creek and Fish Creek. An additional 45 potential nests were located. These nests could not be verified by presence of resin ducts. No red tree voles have been documented in LSRs in the Assessment Area. The S&M Protocol calls for surveys in watersheds containing less than 40 percent of the area below 3,300 feet in habitat. The North Fork Clackamas and Clear Creek watersheds are below this threshold.

Mollusks - Survey and Manage Species - Strategies 1 and 2

Table 3-10 lists the survey and manage mollusks that are known or suspected to occur in the Assessment Area. There are few documented sightings of these species. Species are indicated as documented in the table if a documented sighting has occurred in Clackamas County (Furnish et al. 1997). Suspected occurrence indicates that the Assessment Area is within the species known or suspected range.

Table 3-10. Survey and Manage Mollusk Species Known or Suspected to Occur in the North Willamette LSR Assessment Area

Common Name	Scientific Name	Habitat	Key Features	Presence in Assessment Area
Land Snails				
Puget oregonian	*Cryptomastix devia*	Moist conifer forest with hardwood component. Low elevations through upper western hemlock zone.	Large bigleaf maple trees (logs, sword ferns); other hardwood trees and shrubs.	S
Oregon megomphix	*Megomphix hemphilli*	Moist conifer or conifer/hardwood mixed forests. Elevations up to 3000 ft.	Large bigleaf maple trees (leaf litter esp. near logs or sword ferns).	S
Crater Lake tightcoil	*Pristiloma arcticum crateris*	Conifer forest, usually above 2000 ft.	Mosses and other vegetation near wetlands.	S
Slugs				
Evening fieldslug	*Deroceras hesperium*	Forested areas west of the Cascade crest, usually below 2000 ft.	Low shrubs, litter, debris, and rocks.	D
Warty jumping-slug	*Hemphillia glandulosa*	Mesic to moist conifer forests.	Conifer logs and/or heavy ground cover of low vegetation, litter and debris.	S
Malone jumping-slug	*Hemphillia malonei*	Moist conifer plant associations.	Bark under hardwood trees or logs.	D
Blue-grey tail-dropper	*Prophysaon coeruleum*	Conifer forests.	Conifer and hardwood logs, ground litter and mosses.	D
Palipose tail-dropper	*Prophysaon dubium*	Conifer forests, with hardwood component.	Hardwood logs and leaf litter among shrubs.	D
Freshwater Snails				
Columbia duskysnail	*Lyogyrus n. sp. 1*	Springs.	Cold, well oxygenated springs and spring outflows on soft substrates. Shallow slow-flowing areas.	D

D = Documented occurrence in Clackamas County. No occurrences for any species in Marion County.
S = Suspected as described in the Survey Protocol.

Key habitat features for most of these species are hardwood trees, logs, ground litter, and/or shrubs, ferns and mosses. These features occur in late-successional forests, but may also occur in younger forests. Any project that is a ground-disturbing activity, or which may alter vegetation or other habitat elements, may directly or indirectly impact these mollusk species. Surveys need to be conducted prior to those projects.

Vascular Plants - Survey and Manage Species - Strategies 1 and 2

There are six documented vascular plants that are identified as Survey and Manage Species and three other species that are suspected to occur within the Assessment Area (Table 3-11). More detailed information on these species can be found in the Management Recommendations, Appendix J-2, and the scientific literature. Current known locations can be determined from the "Known Site Database".

Table 3-11. Survey and Manage Vascular Plants

Status	Species	Common Name
D	*Allotropa virgata*	candy stick
D	*Botrychium minganense*	mingan moonwort
D	*Botrychium montanum*	mountain moonwort
D	*Cimicifuga elata*	bugbane
S	*Coptis asplenifolia*	spleenwort-leaved goldthread
D	*Coptis trifolia*	threeleaf goldthread
D	*Corydalis aquae-gelidae*	cold-water corydalis
D	*Cypripedium montanum*	mountain lady's slipper
S	*Galium boreale*	boreal bedstraw
S	*Habernaria (Platanthera) orbiculata*	round-leaved orchid

(D) Documented
(S) Suspected to occur within Assessment Area

There are numerous other species of concern that have been identified in the various watershed analyses that overlap the analysis area. These species have been given some form of special status by being on lists such as the Regional Forester's Sensitive List, Bureau Sensitive List, Assessment Species List, Oregon Natural Heritage Program List, or Federal T&E List. Many of the species on these other lists are not necessarily late-successional or old-growth dependent.

Fungi, Lichens, and Bryophytes - Survey and Manage - Strategies 1-4

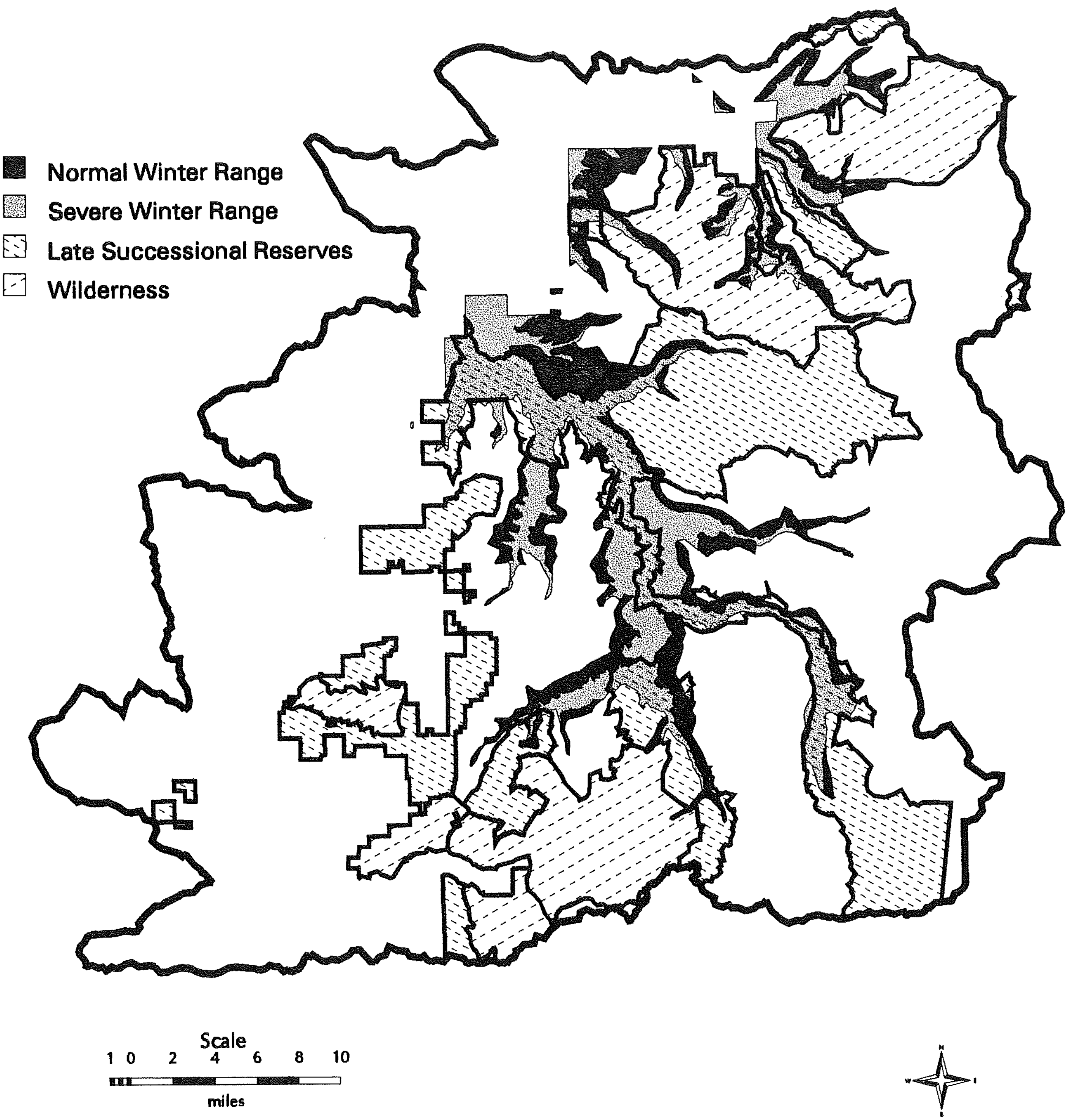
Appendix C lists the species of fungi, lichens, and bryophytes contained in Tables IV-A-1, IV-A-2, and IV-A-3 from Appendix A of the FEMAT document that are known to occur or potentially occur within the Assessment Area. The species included that potentially may be found within the Assessment Area were derived from literature searches and from individuals knowledgeable of the various groups. Many of the non Survey and Manage species are known to be in the Assessment Area but are not in the "Known Site Database" yet. As more surveys are carried out more documented locations will be added to the database.

The air-quality monitoring studies being led by Dr. Linda Geiser are providing important baseline information on many lichens over a wide area on Forest Service and BLM lands and adding many new known sites for lichens. There are 11 survey strategy 1,3 lichens as well as at least one strategy 2 lichen known to occur within the Assessment Area. Management Recommendations and Survey Protocols should be consulted if any activity is proposed in the vicinity of a known population of Survey Strategy 1 lichen. In addition, surveys are required for all ground-disturbing activities with a 1999 and later Decision Notice.

There is very little information on the species and distributions of most of the fungi included in the list. In the past, other than the edible fungi, very few people have collected or tried to identify the other thousands of fungi that are present in the Assessment Area. There are 20 survey strategy 1,3 fungi known to occur within the Assessment Area. As more people become trained and more surveys are done, many more of the fungi on the list will be documented. When projects are proposed in LSRs care should be taken to minimize disturbance and compaction of the soil and coarse woody debris so that less damage is done to the many mycorrhizal and decomposer fungi that are necessary for healthy forests (Amaranthus et al. 1994, 1996). Until more information is available from more extensive surveys these species and their habitat needs to be maintained. Management Recommendations and Survey Protocols should be consulted to address proposed activities near known sites.

Although there is an abundance of bryophytes in the Assessment Area, very little information on species and distribution is known. Many of the structural and microclimate parameters that are beneficial for the lichens and fungi are also beneficial for the late-successional associated bryophytes, such as a diversity of tree species, coarse woody debris, low levels of disturbance, ameliorated temperature, wind, and humidity, and others. There are three survey strategy 1 mosses known within the Assessment Area. Survey Protocols and Management Recommendations should be consulted when a silvicultural or habitat modifying activity is proposed in the area of a known site. In addition, surveys are required for all ground-disturbing activities with a FY 1999 and later Decision Notice.

Map 3-9. North Willamette LSRA Deer and Elk Winter Range



Early-Seral Species

Approximately 60 percent of wildlife species occurring in western Oregon and Washington forage in early-seral habitats (Bruce et al. 1985). Fewer species, approximately 40 percent, reproduce in early-seral habitats. Many species using these habitats rely on structures such as snags and down logs for nesting, roosting, cover, and hunting perches. Historically, fire created openings in the forest, usually leaving remnant trees, snags and logs. Early-seral habitats in LSRs are primarily a result of past timber harvest. Most of these areas have low levels of snags and down wood.

Early-seral habitats currently comprise between 12 to 41 percent of the LSRs, averaging 28 percent. As stands in LSRs age these habitats will generally disappear. Some natural disturbances are expected to occur in LSRs that will create some early-seral habitat. However, it is expected that most of the habitat for these species will be provided in Matrix lands.

Deer and Elk

Management for deer and elk, as outlined in the Mt. Hood LRMP, is a conflict with LSR objectives. The LRMP prescribes managing for a consistent quantity of foraging areas through timber harvest. It is anticipated that the quantity of forage will drop drastically in LSRs. Within 10 years, it is expected that harvested areas in LSRs will no longer be providing forage for deer and elk. This is a concern especially in Severe Winter Range where animals congregate during periods of heavy snow: 42 percent of this areas is within LSRs (Map 3-9 Deer and Elk Winter Range). Forage will still be provided on Matrix lands, but this will not compensate for the loss of forage areas in LSRs.

LSRs will still provide some habitat for deer and elk. Old-growth forests provide optimal cover for deer and elk, intercepting snow and supplying some forage (lichens and shrubs). Much of the Severe Winter Range runs along the Clackamas River (see Map 3-9). Because the LSR is very narrow along a large portion of the river, cover can be provided in the LSR and forage in the adjacent Matrix lands. Young stand thinnings designed to expedite late-successional characteristics involve variable spacing. This type of thinning is expected to provide some foraging opportunities over a longer period of time than pre-commercial thin treatments designed primarily to produce timber volume. Use of these stands can be enhanced by leaving unthinned areas along open roads. Natural openings such as meadows are expected to continue to provide forage in LSRs. In addition, powerlines and frost pockets will provide some forage. Road closures in LSRs will help meet the LRMP goal of maintaining less than 2.5 miles of road per square mile in summer range and less than 2.0 miles of road per square mile in winter range. Road closures can help mitigate for reduced amounts of forage.

The Mt. Hood National Forest has identified subwatersheds that should be managed for high quality big-game habitat as per the Habitat Effectiveness Index elk model (Wisdom et al. 1986). About 75 percent of this area is in Matrix and only 25 percent in LSRs.

A reduction in carrying capacity for big game in the Assessment Area is expected. Habitat effectiveness assessments indicate approximately a 15 percent decline in the next 10 years. Over the long term carrying capacity may decline up to 25 percent. Deer populations are expected to decline more quickly and drastically than elk. Deer are more closely tied to open habitats. Elk are more likely to forage in late-successional stands than deer.

Lodgepole Pine Associated Species

Lodgepole pine forests are rare in the Assessment Area and most occur outside LSRs. They are primarily early- and mid-seral stands within the Pacific Silver Fir or Mountain Hemlock Zones. Lodgepole pine provides important habitat for black-backed and three-toed woodpeckers. They key in on bug infested trees in these stands. These stands may be considered high risk for fire due to high numbers of dead trees. If activities are designed to reduce risk of fire in these stands, a balance needs to be made between habitat needs for these two species and risk reduction.

Special Habitats

Several wet meadows occur in LSRs in the Assessment Area. There are a number of species tied to these wetland habitats. These natural openings add diversity to the ecosystem.

These meadows are not capable of becoming late-successional forest habitats due to high water tables. Wet meadow habitat is expected to continue to occur in LSRs in about the same amount as currently exists. Encroachment of trees into meadows may be a problem in some wetlands. At this time none have been identified in LSRs. If encroachment is identified as a problem in the future management plans will be developed and sent to REO for review at that time.

Rocky areas occur in some LSRs. Tree cover is sparse or nonexistent. These areas are not capable of becoming late-successional forest habitats due to extremely low site productivity.

Nonnative, Introduced and Feral Species

Wildlife

Several introduced wildlife species occur or may occur in LSRs (see Table 3-12). Many of these species are most likely to occur near areas of human habitation. The community of Three Lynx is within the Roaring River LSR, and Timber Lake Job Corps Center and the Ripplebrook Work Center are adjacent to the LSR. The community of Zigzag and numerous summer homes are adjacent to Still Creek LSR. There are houses within a couple miles of Eagle Creek LSR. The bullfrog, wild turkey and nutria are not necessarily associated with human habitation.

Introduced species have the potential to impact native species in LSRs. House sparrows and European starlings compete with native cavity nesting wildlife for nest sites. Both species are generalists but primarily use open habitats that currently are widespread in the LSRs. Neither of these species is expected to venture too far from areas of human habitation and thus their impact to native species should be limited. As open habitats in LSRs mature, these species will present even less of a concern in LSRs. Virginia opossum and Norway rats will eat the eggs of ground nesting birds. These species are unlikely to have a large impact on LSRs because they will not venture far from areas of human habitation. Though there are no documented occurrences of bullfrogs or nutria in LSRs, they may occur at the west end of the Roaring River LSR as the Clackamas River leaves the Forest boundary. Bullfrogs are voracious predators and can decimate populations of native frogs and turtles. Wild turkeys and rock doves probably have little impact on other species in LSRs. Turkeys were introduced into the Clackamas River corridor at one time but it is uncertain if they still occur in the LSR.

Feral species known to occur in the Assessment Area are domestic cats and dogs, wolf/dog hybrids, and feral pigs. Feral pigs (a sow with 2 piglets) have been confirmed in the South Fork Clackamas Watershed. Feral cats, dogs, and wolf/dog hybrids are more of a concern in LSRs than the introduced species discussed above. Their occurrence in LSRs is suspected to be more widespread than that of the introduced species. The numbers of native species killed by feral animals is unknown.

Table 3-12. Introduced Species by LSR

Common Name	Scientific Name	LSR 205	LSR 206	LSR 207	LSR 208	LSR 209	LSR 210	LSR 211
Bullfrog	*Rana catesbeiana*			P				
Wild turkey	*Melagris gallopavo*			D				
Rock dove	*Columba livia*	P	P	P		D		
European starling	*Sturnus vulgaris*		P	S				
House sparrow	*Passer domesticus*		P	P				
Virginia opossum	*Didelphis virginiana*	P	P	P				
Norway rat	*Rattus norvegicus*	P		P				
House mouse	*Mus musculus*	P		P				
Nutria	*Myocastor coypus*			P				

D = Documented occurrence
P = Potential occurrence based on vicinity to habitat or human development

Nonnative Plant Species

There are several general groupings of nonnative plants that may occur within the Assessment Area. The first group thrive in open, disturbed conditions along roadsides, in burned sites, and in silviculturally treated areas but tend not to persist as forests develop. This group includes such non-natives as common burdock (*Arctium minus*), diffuse knapweed (*Centaurea diffusa*), spotted knapweed (*C. maculosa*), meadow knapweed (*C. pratensis*), Canada thistle (*Cirsium arvensis*), bull thistle (*C. vulgare*), scotch broom (*Cytisus scoparius*), teasel (*Dipsacus sylvestris*), foxglove (*Digitalis purpureum*), sweet pea (*Lathyrus latifolia*), tansy ragwort (*Senecio jacobaea*), and others. These plants tend to decrease over time in areas where late-successional forest replaces the more open, early-seral stages. They will continue to be potential problem species, however, along road, trail, powerline, and pipeline corridors.

The second group may also become established in open, disturbed areas, but may persist as an overstory canopy develops. This group includes exotics such as Robert's geranium (*Geranium robertianum*), English ivy (*Hedera helix*), English holly (*Ilex aquifolium*), Himalayan blackberry (*Rubus discolor*), cut-leaved blackberry (*R. lacinatus*), Japanese knotweed (*Polygonum cuspidatum*), Himalayan knotweed (*P. polystachyum*), giant knotweed (*P. sachalinense*), and others. They are able to persist in more shaded conditions and can reduce the diversity of the understory vegetation and in turn, the vertebrates and invertebrates that are dependent on the native plant community. The climbing habit of English ivy can modify canopy conditions and eliminate most epiphytes (some of which are Survey and Manage Species). Although these species occur only at low levels in the Assessment Area, this group presents a greater risk to late successional development than the shade intolerant exotics. It could possibly prevent the development of a species diverse forest by outcompeting or shading out native species.

The third group are those than can persist near wetlands or around small water bodies. This group includes such species as beggarticks (*Bidens cernua*), purple loosestrife (*Lythrum salicaria*), and reed canary grass (*Phalaris arundinacea*), and others. These species can severely reduce or eliminate native vegetation in these areas. Other associated native vertebrate, invertebrate, and fungal species may also be diminished or eliminated.

The standard and guidelines given in the ROD (p. C-19) call for an evaluation of nonnative species currently existing within reserves and the need to develop plans and recommendations for eliminating or controlling nonnative species that are inconsistent with LSR objectives. State noxious weed guidelines are being followed and a Mt. Hood National Forest weed management plan exists concerning the control of non-natives on federal lands (1991, current revisions are underway to expand language to include non-natives not considered noxious weeds). Most of these noxious species are easily recognized and can be monitored or reported to the appropriate specialist by field personnel.

The Mt. Hood database shows record of 179 nonnative species documented for the forest (includes eastside habitats). Of these, 41 were found associated with conifer forest habitat.

Considerations for Treatments in LSRs

- Silvicultural treatments such as thinnings may be used to accelerate the development of late-successional habitat in LSRs. The goal would be to increase the amount of late-successional habitat and to reduce the effects of fragmentation. Objectives should include: develop and protect wolf trees and other remnant trees, maintain hardwoods, and create canopy gaps.

- Snags and down logs are important habitats for many late-successional species. When treating stands in LSRs it is important to consider the coarse woody debris component. Specific goals are discussed in Chapter 6.

- Micro-climates provided by decayed logs, duff, and litter are important to some late-successional species, particularly terrestrial salamanders, mollusks, bryophytes and fungi. Care needs to be taken during treatment of stand to minimize disturbance to these important habitat components.

- Any activities that will cause loss of spotted owl habitat, or may cause disturbance need to be consistent with the Willamette Province Biological Assessment and Biological Opinion (USFWS). Proposed actions included in the biological assessment include: thinning, salvage, individual tree removal, watershed restoration, trail head expansion, underburning, hazard tree removal and habitat enhancement.

- Any risk reduction in lodgepole pine stands need to consider the needs of black-backed and three-toed woodpeckers for dead and dying trees. Insect infested trees provide important habitat for these birds.

- Survey and Manage Protocols need to be adhered to for any ground-disturbing activity in LSRs.

- Avoid manipulation of vegetation at cave or mine entrances to maintain micro-climates for hibernating and roosting bats.

- Avoid any activity around potential wolverine den sites during winter months.

- Deer and elk winter range should be priority areas for road closure.

Aquatics/Fisheries

The Aquatic Conservation Strategy was developed as part of the Northwest Forest Plan to restore and maintain the ecological health of watersheds and aquatic ecosystems contained within them on public lands. The strategy would protect salmon and steelhead habitat on federal lands managed by the Forest Service and Bureau of Land Management within the range of Pacific Ocean anadromy. (ROD p. B-9)

A detailed assessment of the aquatic resource was not an objective of this LSR Assessment. Watershed analysis documents have been prepared for nearly all of the watersheds within this Assessment Area. Those analyses further evaluate aquatic resources and the ability to meet the objectives of the Aquatic Conservation Strategy.

Standards and guidelines for LSRs and the objectives for the Aquatic Conservation Strategy are very compatible. Few conflicts, if any, are anticipated between LSR management activities and fisheries. Late-Successional Reserves are an important component of the Aquatic Conservation Strategy. The standards and guidelines under which LSRs are managed provide increased protection for all stream types. Because these reserves possess late-successional characteristics, they offer core areas of high quality stream habitat that will act as refugia and centers from which degraded areas can be recolonized as they recover. Streams in these reserves may be particularly important for endemic or locally distributed fish species and stocks. (ROD p. B-12)

In addition to LSRs, key components of the Aquatic Conservation Strategy include: Riparian Reserves, Key Watersheds, Watershed Analysis, and Watershed Restoration.

Riparian Reserves

Riparian Reserves, a primary component of the Aquatic Conservation Strategy, improve travel and dispersal corridors for many terrestrial animals and plants, and provide for greater connectivity of the landscape. Riparian Reserves will also serve as connectivity corridors among the LSRs. (ROD p. B-13) LSRs in association with Riparian Reserves offer areas of high quality habitat conditions or high potential for these conditions.

At present, the Assessment Area contains subwatersheds on Matrix lands between LSRs that have low amounts of late-successional forest. Clusters of subwatersheds in the North Fork Clackamas, the lower end of the Upper Sandy, the Zigzag, and Upper Clackamas Watersheds fall below the current regional average of 29 percent for late-successional habitat within Riparian Reserves.

Key Watersheds

A system of Key Watersheds that serve as refugia is crucial for maintaining and recovering at-risk fish species and stocks and provide high quality water (ROD p. B-18). Tier 1 Key Watersheds ensure that refugia are widely distributed across the landscape. Tier 2 Key Watersheds are important sources of high quality water.

Approximately 70 percent of this LSR network overlaps with Key Watershed designation. With the exception of Eagle Creek (Tier 2), all the Key Watersheds within the Assessment Area are Tier 1. See Map 1-5 in Chapter 1. Objectives within Key Watersheds include (from ROD p. B-19):

- No new roads will be built in roadless areas
- Reduce existing system and nonsystem road mileage outside roadless areas. If funding is insufficient to implement reductions, there will be no net increase in the amount of roads in Key Watersheds.
- Key Watersheds are highest priority for watershed restoration.
- Watershed Analysis (WA) is required prior to most management activities. (As of 2/98, the North Fork Santiam WA is in progress whereas WA is complete for the other Key Watersheds within the Assessment Area.)

Watershed Restoration

Watershed restoration will be an integral part of a program to aid recovery of fish habitat, riparian habitat, and water quality (ROD p. B-30). The most important components of a watershed restoration program are control and prevention of road-related runoff and sediment production, restoration of the condition of riparian vegetation, and restoration of instream habitat complexity. Pages B-31 and B-32 from the ROD (NWFP) outline examples of restoration activities to meet the intent of the Aquatic Conservation Strategy. These activities as presented are consistent and go hand-in-hand with the objectives for LSRs.

Aquatic features of the North Willamette LSR Network are summarized in Table 3-13. The network contains important spawning, rearing and migration habitat for a variety of native resident and anadramous species. Several species have special status (Lower Columbia River Steelhead trout were listed in March 1998 under the Federal Endangered Species Act (ESA) as "Threatened"). Others are candidate species for ESA listing and/or on the Region Six Regional Forester's sensitive species list.

Table 3-13. Fish and LSR Aquatic Features

LSR	Contains any Key Watershed?	Key Species*	Unique Conditions
Still Creek (205)	none	ctt, wst, sst, rb, chin, coho, mwf	Important spawning habitat; Adj to Hwy. 26 and Rec. residences
Eagle Creek (206)	Tier 2 (Eagle)	ctt, wst, scs, rb, coho	Eagle Cr.. Fish Hatchery; Upper watershed in wilderness
Roaring River and Upper Clackamas (207A & 207B)	Tier 1	ctt, wst, sst, rb, scs, coho, mwf, exotics	Migration corridor; Late-run coho spawning; Winter steelhead; natives
Soosap (208)	Tier 1		
Table, Bagby, Opal (209A, 209B, 209C)	Tier 1	ctt, wst, sst, rb, scs, coho	Late-run coho; Winter steelhead
Collawash (210)	Tier 1	ctt, wst, sst, rb, scs, coho, mwf	Late-run coho spawning; Winter steelhead
Abiqua/Butte (211)	none		

** Key Species are important salmonids or TES species known to occur within the LSR. A complete list can be obtained from Watershed Analysis documents.*

ctt = coastal cutthroat trout; wst: winter steelhead
sst = summer steelhead
rb = resident rainbow trout
scs = spring chinook salmon
mwf = mountain whitefish
coho = coho salmon

Connectivity

Background

LSRs were designed to be large, contiguous blocks of late-successional habitat that could sustain populations or sub-populations of species associated with late-successional habitat. LSRs were not designed to function alone. They were intended to function as part of a network that is connected by habitat in the Matrix which allows for dispersal of animals between LSRs (ROD p. B-1, 4; FEMAT p. IV-187). Currently, LSRs are not large contiguous blocks of late-successional habitat. They are fragmented to varying degrees by early- and mid-seral habitats. In their current condition they may not be able to sustain populations or sub-populations of some late-successional species. Thus, the current condition of connectivity between LSRs is even more important. Riparian Reserves were designed to be an integral part of the connectivity between LSRs (ROD p. B-13; FEMAT p. IV-187). Riparian Reserves are also fragmented and thus are not providing the connectivity function for which they were, in part, designed.

Dispersal habitat in this assessment is defined as small conifer stands (8-21" dbh) with greater than 40 percent canopy cover. Specific requirements for some species, such as coarse woody debris, may not be met in all areas classified as dispersal habitat.

Several watershed analyses conducted within the Assessment Area identified connectivity as a concern and delineated "interim connectivity areas". This assessment steps up a scale and looks at connectivity across a larger area.

Species of Concern

Mobile Species

Mobile species are either birds or large or medium sized mammals. LSR/Wilderness Complexes are located close enough together in the Assessment Area that they are well within the dispersal capability of these animals. The largest distance between Complexes in the area is six miles. Animals may need to travel up to nine miles between suitable habitat patches as the Complexes are not entirely late-successional habitat.

These animals require adequate dispersal habitat in the intervening landscape as they may take months to disperse 6 to 9 miles. For example, martens are sensitive to overhead cover, thus connectivity of habitat providing overhead cover is important to dispersing martens (Ruggiero et al. 1994). Spotted owls require adequate foraging habitat and cover from predators. Pileated woodpeckers need adequate foraging and roosting habitat in the form of large snags.

Because these animals tend to have larger home ranges, a limited number of breeding pairs will occur in each LSR. It is unlikely that a self-sustaining population of these species could occur in a single LSR (Thomas et al. 1990, pp 292). To avoid problems with genetic, demographic and environmental stochasticity and sustain populations of these species, some interaction between individuals from adjacent Complexes will be important (Thomas et al. 1990).

Poor Dispersers

Poor dispersers include small mammals, amphibians, mollusks, some fungi, bryophytes and lichens. The LSRs are not located close enough together to expect individuals to move between LSRS. To provide connectivity between LSRs there will need to be individuals and subpopulations spread through out the Matrix. Riparian Reserves, retention of old-growth fragments (ROD C-44), 100-acre LSRs, and green tree retention are expected to provide these areas of refugia between LSRs.

Many of the poor dispersers use down wood. These species may occur in younger stands if adequate levels of down wood are available. Thus, providing high levels of down wood in areas throughout the Matrix would increase connectivity of habitats for these species.

Poor dispersers tend to have small area requirements. Thus, thousands of individuals could occur in a single LSR making it likely that a population would be self-sustaining (Thomas et al. 1990, pg 297). Occasional exchange of genetic material between the populations, however, would reduce the risk of loss of genetic diversity. Genetic diversity increases the chances that populations would survive drought, disease, introduced predators, global warming, and other threats.

Terrestrial Salamanders

Northwestern salamander, long-toed salamander, and rough-skinned newt are pond-breeding amphibians that will use upslope forests during the non-breeding season. Oregon slender salamander, clouded salamander, western red-backed salamander, and Larch Mountain salamander breed in upslope habitats. All will use late-successional habitats, and all will use down wood and duff for cover. The Oregon slender salamander and the Larch Mountain salamander are more closely tied to late-successional habitats than the other salamanders. The clouded salamander is closely tied to large logs but will occur in open habitats as long as logs are present (Leonard et al. 1993).

The Oregon salamander and Larch Mountain salamander are of the most concern in terms of connectivity of late-successional habitat because they are closely tied to this habitat. The Oregon slender salamander is a rare endemic species with a limited range. It appears that Riparian Reserves will provide habitat for this species (Olson 1997). Younger, closed-canopy forests with large, decayed logs will also provide habitat for the salamander. Activities that open the canopy of stands, causing drying of logs, or activities that disturb the duff and break down decay logs would have negative impact on the species. See the Survey and Manage section for a discussion of the Larch Mountain salamander.

Small mammals

Trowbridge's shrew, shrew-mole, flying squirrel, and western red-backed vole are all late-successional species closely associated with down wood. The flying-squirrel also uses cavities in snags for nesting. The squirrel's association with down wood is primarily due to its diet, which consists primarily of fungi. Managing for high levels of coarse woody debris in late-successional and younger stands can greatly improve quality of habitat and thus connectivity for all these species except the red tree vole. These voles are not associated with coarse woody debris. See the Survey and Manage section for a discussion of its habitat requirements.

The red tree vole is of particular concern in terms of connectivity. The fact that they are small and live almost exclusively in the canopy of conifers suggests that they have limited dispersal capability (FSEIS, Appx. J2, pp 475-475). They are also limited to lower elevations below about 3,300 feet. The potential for colonies to become genetically isolated resulted in a rating of <80% for Outcome A (FSEIS, Appx. J2, 475).

Red tree voles are most abundant in late-successional forests. However, they do occur in younger conifer forest with a closed canopy. These forests should provide for dispersal. High elevation ridges would present barriers to connectivity of red tree vole habitat.

Mollusks

Mollusks are very poor dispersers and have patchy distribution. See the Survey and Manage section for a discussion of habitat needs. The duff and down wood considerations for the Oregon slender salamander would apply to the terrestrial mollusks as well. In addition, hardwood trees provide habitat for these species.

Lichens

Lichens utilize several means of vegetative and sexual reproduction which are important in their ability to disperse to new locations. Some lichens are only known to produce vegetative structures, some only spores, and some both. Various vegetative reproductive mechanisms, such as soredia, isidia, lobules, and fragmentation are found in many lichens. These structures, which contain both the fungus and alga making up the lichen, are normally too large to be transported very far by wind, so animals and birds may be important in carrying these lichen particles from one location to another. Birds such as kinglets, nuthatches, brown creepers, chickadees, and Stellar's jays often search clumps of lichens and bryophytes growing on trees for invertebrates. In the process they may carry small pieces from one tree to another where they may become established if the right conditions are present. An osprey has been observed taking a large clump of canopy lichens and bryophytes presumably to be used as lining material for nests (Dave Shaw, pers. com.). Numerous other birds utilize lichens in nest building activities and may help introduce lichens into suitable habitat (Richardson and Young 1977). Many terrestrial invertebrates utilize lichens as food, shelter, or camouflage and may help carry fragments or spores into favorable locations (Gerson and Seaward 1977). Both large (deer and elk) and small (red-backed vole, flying squirrel) animals utilize lichens for food and/or shelter and may carry lichen fragments or spores from one location to another (Rochelle 1980, Richardson and Young 1977, Maser 1988, Maser and Maser 1988).

Another vegetative or asexual propagule is the conidium(a). These are produced in conidiomata most often called pycnidia. These propagules are usually very small (less than 10 microns) and are possibly wind dispersed, but very little is known of their role in lichen dispersal.

Sexually produced spores are often produced by the fungal partner of the lichen. The spores range in size from very small (1 micron) to very large (200 microns). Small spores may be wind dispersed and may colonize new areas if conditions are favorable and the algal partner is present.

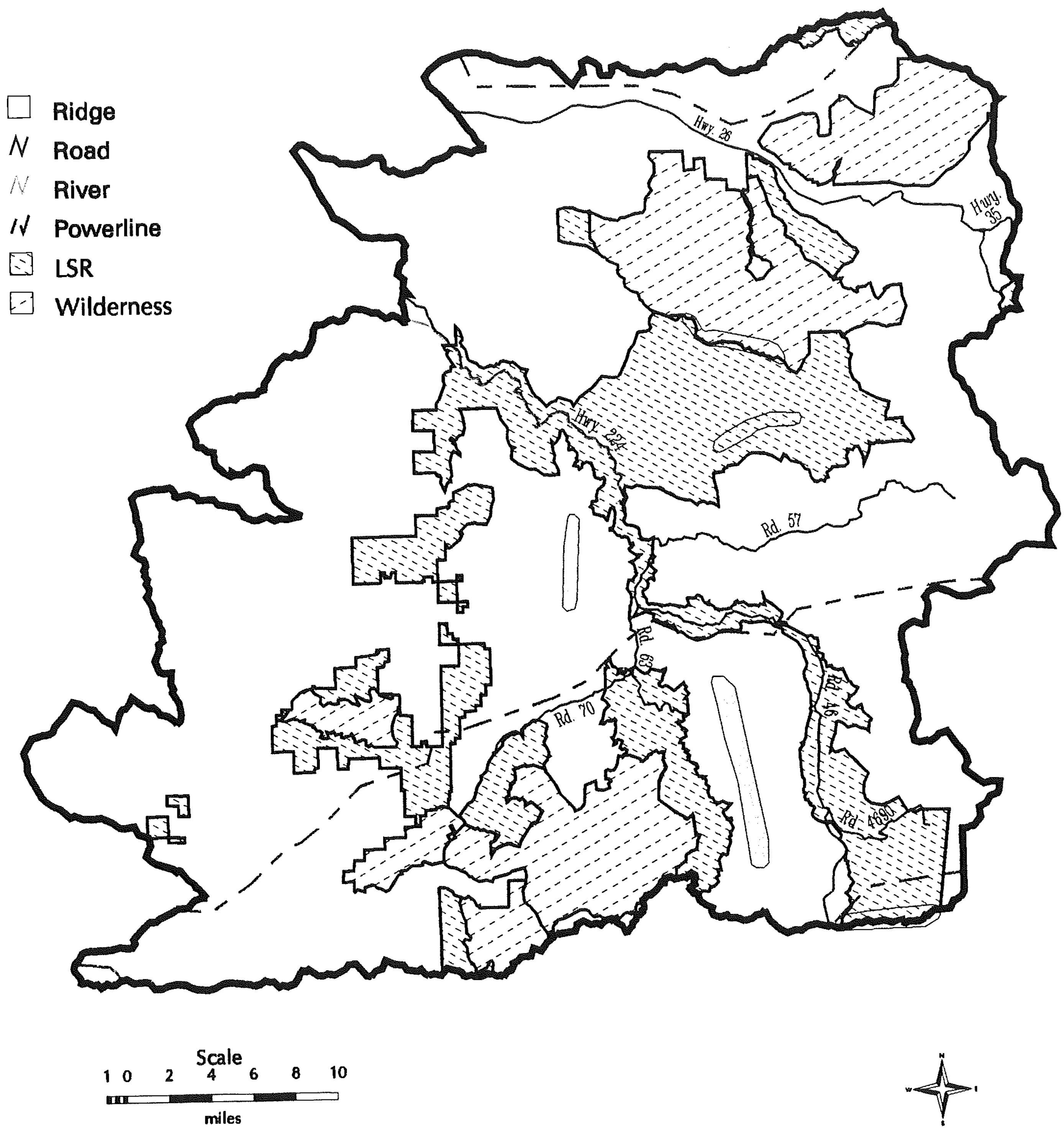
Bryophytes

Bryophytes (mosses and liverworts) reproduce both sexually by spores and vegetatively by gemmae and fragmentation. Spores may be carried by wind for varying distances depending on the size and may start a new or additional population, but most germinating spores fail to survive due to unfavorable conditions. Gemmae, or fragments, are larger and are not normally carried by wind for long distances. They may help form new plants in the vicinity of an existing population such as on tree branches, boles, coarse woody debris, rock, or wet areas, depending on the species being considered. Some gemmae or fragments may be transported on animals, birds (Breil 1976), and invertebrates (Gerson 1969), but the vegetative propagules also must be deposited on a suitable site or substrate to survive.

Fungi

The fungi in Appendix C are considered associated with late-successional and old-growth forest and fall into two main ecological roles, either as mycorrhizal or saprobic (decomposer) fungi. The majority of the plant species have at least one mycorrhizal fungus associated with them. Within the mycorrhizal group there are species that fruit below ground (hypogeous) or above ground (epigeous). Fungi reproduce by spores that are characteristically disseminated by wind, mammals, or invertebrates. Many of the fungi that have wind disseminated spores have been found in late-successional temperate or boreal forests throughout the northern hemisphere. By maintaining or enhancing late-successional conditions in LSRs and Riparian Reserves these species should be able to remain viable. Others have a more restricted distribution, are endemic, or there are few known sites, such as many of the hypogeous fungi and some epigeous fungi. As has been shown by several studies, there are important links between small mammals, spotted owls, hypogeous fungi, coarse woody debris, soil, and forest vegetation (Maser et al. 1985, Maser et al. 1978, Ure and Maser 1982, Molina and Trappe 1982, Molina et al. 1992, Amaranthus et al. 1994, Perry et al. 1989). Survey Protocols and Management Recommendations should be consulted.

Map 3-10. North Willamette LSRA Barriers to Connectivity



Specific Connectivity Concerns

Condition of Riparian Reserves

On average, (across the range of the spotted owl) the percent of Riparian Reserves currently in late-successional habitat is 29 percent (see FSEIS p 3 & 4-41). In the Assessment Area, the percent of Riparian Reserves composed of late-successional habitat, within Matrix, ranges from 0 percent up to 85 percent at the subwatershed scale. Any subwatersheds that were below the regional average were highlighted as areas of potential concern because they are in worse condition than assumed in the FSEIS. Clusters of subwatersheds in the North Fork Clackamas Watershed, the lower end of the Upper Sandy Watershed, the Zigzag Watershed and Upper Clackamas Watershed fall below the regional average for late-successional habitat in Riparian Reserves. The Timothy Lake subwatershed, and a few other scattered subwatersheds are also below the average.

Watersheds Below 15 Percent Late-successional Habitat

The ROD identifies a lower limit for the amount of late-successional habitat within a watershed. Harvest of late-successional habitat is restricted in fifth field watersheds with less than 15 percent of federal forest lands currently in late-successional forest (ROD p. C-44). Watersheds with less than 15 percent late-successional habitat may not meet the assumption that the Matrix will providing refugia and stepping stones for dispersing species.

Watershed analysis determined the Zigzag and North Fork Clackamas watersheds are currently below 15 percent late-successional forest. No additional harvest of late-successional habitat will occur in these watersheds until younger stands mature and can "replace the ecological roles" of the late-successional stands (ROD p. C-44). Both watersheds are dominated by older mid-seral stands that will be transitioning into late-successional forest within the next 50 years.

Barriers

Several barriers to connectivity occur in the Assessment Area (Map 3-10). Natural barriers include ridges and rivers. Human caused barriers include roads and powerlines. Natural fires and timber harvest have removed late-successional habitat from areas, creating a temporary barrier for some species.

High elevation ridges occur in the following areas: between the Upper Clackamas LSR and the Bull of the Woods Complex; between the Roaring River LSR and Soosap LSR; along the boundary between the Salmon-Huckleberry Wilderness and the Roaring River LSR; within the Roaring River LSR; the south end of the Upper Clackamas LSR where it connects to the Mt. Jefferson Wilderness and LSR214. Most of these ridges extend into the Mountain Hemlock Zone. Even older stands in this Zone may not provide habitat characteristics required by some late-successional wildlife species, and thus may be effective barriers to movement.

The lower reaches of the Clackamas River may create a barrier for some species with poor dispersal capability. Small mammals, terrestrial salamanders, slugs and snails would drown crossing wide rivers or streams. Streams narrow enough to be breached by logs, or where canopies on either side meet, are less of a concern. These are natural barriers that have always occurred.

Several major roads run through the Assessment Area. Highway 26 is a very busy state road that runs through the north portion of the Assessment Area. It creates a barrier between the Salmon-Huckleberry Complex and the Mt. Hood Wilderness and White River LSR. Highway 224 and FS Road 46 runs along the entire length of the Clackamas River. The road connects Estacada to Detroit Lake and is well traveled. Forest Service Road 70 which leads to Bagby Hot Springs, FS Road 4690 in the Ollalie Lakes area, and FS Road 57 which leads to Timothy Lake are also relatively well-traveled roads. These roads are expected to be permanent barriers in the Assessment Area.

Roads create the greatest barrier to species with very low mobility, such as some amphibians, mollusks and arthropods, that also rely on microhabitats. Mortality of dispersing individuals may be high on wide, well-traveled roads due to dehydration, increased predation, or roadkill from vehicles (Fahrig et al. 1995). Even mobile species are at some risk of being killed by traffic.

Road densities in some LSRs are high (Table 3-14). Even less-traveled forest roads can fragment late-successional habitat for some species. Road obliteration would reduce the impact of roads in LSRs.

Table 3-14. Road Densities in LSRs; Road Densities Averaged for Entire LSR and Reported in Miles of Road per Square Mile

LSR	Closed Roads	Open Roads	Total Roads
Still Creek (205)	0	0	0
Eagle Creek (206)	5.6	0.9	6.5
Roaring River (207A)	0.2	2.7	2.9
Upper Clackamas (207B)	0.3	11.9	12.2
Soosap (208)	0.1	3.6	3.7
Table Rock (209A)	0.2	3.8	4.0
Bagby (209B)	0.8	2.5	3.3
Opal Creek (209C)	Unknown	Unknown	1.1
Collawash (210)	0.7	10.4	11.1
Abiqua (211)	1.2	2.4	3.6

Three powerlines occur in the Assessment Area. These are long narrow strips of early-seral habitat that will create barriers only for the poorest of dispersers. Opportunities exist to mitigate the effect by providing down logs in the corridors or allowing trees to mature in deep draws under the powerlines.

There are a few locations in the Assessment Area where there are large areas devoid of late-successional habitat. The Upper Sandy, Zigzag, upper Salmon River, Roaring River, and North Fork Clackamas River watersheds all burned in the early 1900s and have low levels of late-successional habitat. Some of these areas reburned, so a lack of large coarse woody debris (CWD) is also a concern. These watersheds do contain large amounts of dispersal habitat, though lack of CWD may limit its use by some species.

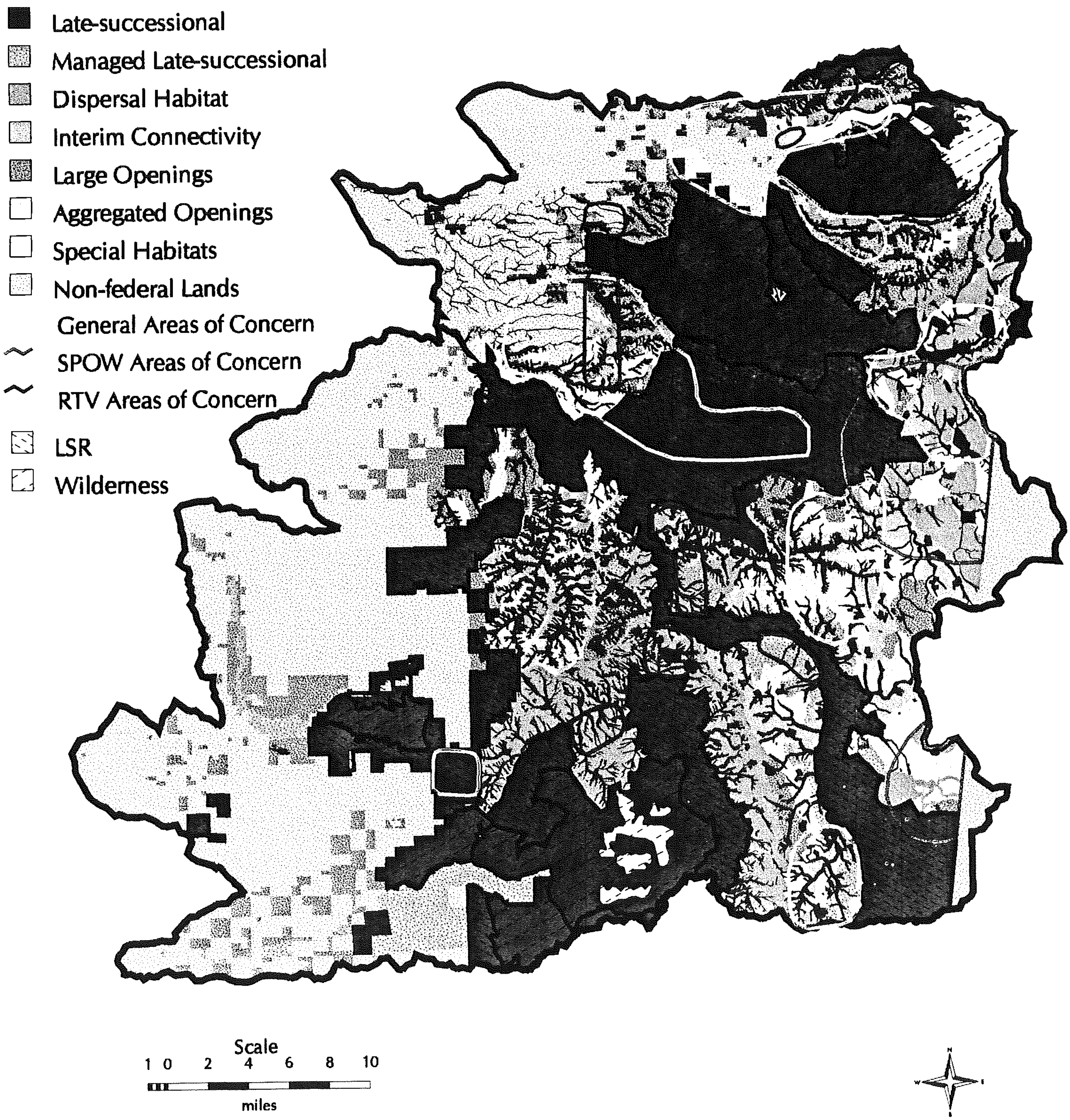
Southeast of the Table Rock Wilderness is a four square mile area within the LSR (209A) that is entirely in young plantations. The area is currently managed by Salem BLM but was acquired from private industry after it was logged. The area isn't even dispersal habitat for late-successional species. This area would be a high priority for treatment to accelerate development of dispersal habitat in the short-term, and late-successional habitat in the long-term.

There are large areas of private land in the western portion of the Assessment Area. Most of these lands provide little dispersal or late-successional habitat. This condition is expected to continue into the future. This situation effectively isolates the Abiqua LSR from the rest of the network. Lack of habitat on private land also creates a barrier between the Salmon-Huckleberry Complex and the Bull Run LSR to the north of the Assessment Area.

Areas of Concern

A number of Areas of Concern were identified in the Assessment Area due to reasons detailed below. Areas of Concern were overlaid with the conceptual landscape design (see Map 3-11, Areas of Connectivity Concern and Conceptual Landscape Design) to assess the likelihood that connectivity would be provided in these areas. The Conceptual Landscape Analysis and Design (LAD) gives an indication of how the landscape pattern and structure may look in the future based on current management direction for Federal lands. It was assumed that LAD design cells identified as Late-successional, Managed Late-successional and Dispersal Habitat would provide connectivity in the future. Interim Connectivity cells are presumed to provide connectivity until Riparian Reserves function as connectivity habitat.

Map 3-11. North Willamette LSRA Connectivity Areas of Concern and Conceptual Landscape Design



Spotted Owl Dispersal Areas of Concern

The Willamette Province Biological Assessment identified two Areas of Concern for spotted owl dispersal in the LSR Assessment Area (Map 3-12, Spotted Owl Areas of Concern). Both areas were identified due to connectivity concerns between the LSRs and the Warm Springs Indian Reservation. This is not specifically a concern for the LSR network. The northern Area of Concern was also identified as an important area for dispersal of owls between the Salmon-Huckleberry Complex and the White River LSR. Both these areas are on fairly flat topography. As a result, stream density and amount of Riparian Reserves is low in these areas of concern. The north area overlaps primarily with LAD dispersal and interim connectivity design cells. Both types of design cells are consistent with connectivity objectives. The south area primarily overlaps aggregated opening design cells which may still provide connectivity for spotted owls.

Red Tree Vole Areas of Concern

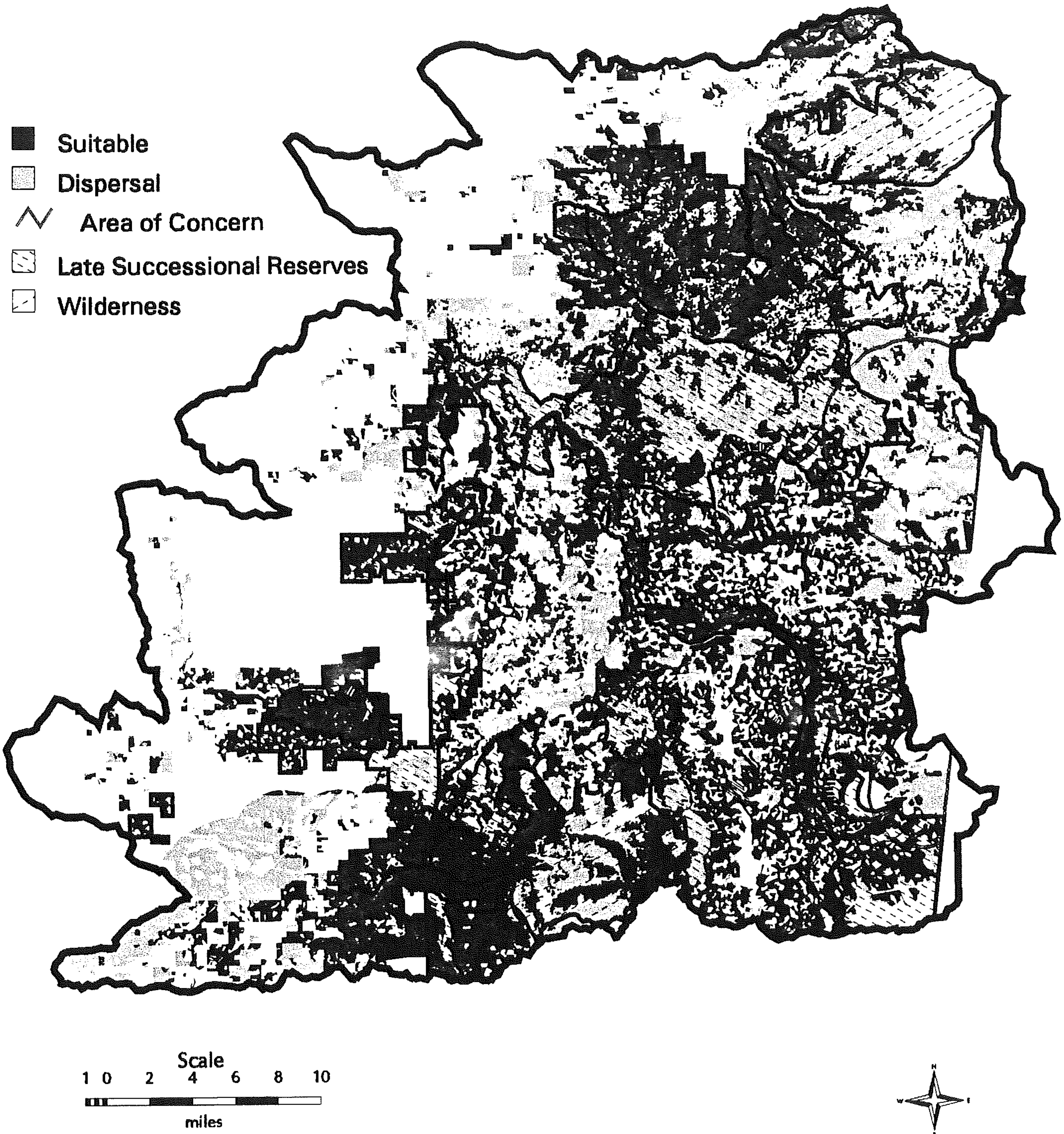
Several areas were identified as concern or areas to emphasis connectivity for the red tree vole (Map 3-13, Red Tree Vole Habitat and Connectivity Areas of Concern).

- High elevations create a barrier to the voles between the Salmon-Huckleberry Wilderness and Roaring River LSR. The entire boundary is above the elevation limit for red tree voles. Lower elevation areas to the west of the complex were identified as areas to emphasize connectivity. Without this connectivity, red tree vole populations would not be able to interact throughout this LSR/wilderness complex. These areas primarily overlap LAD design cells that call for intensive timber management. The LAD is not consistent with an objective of managing for connectivity for red tree voles.

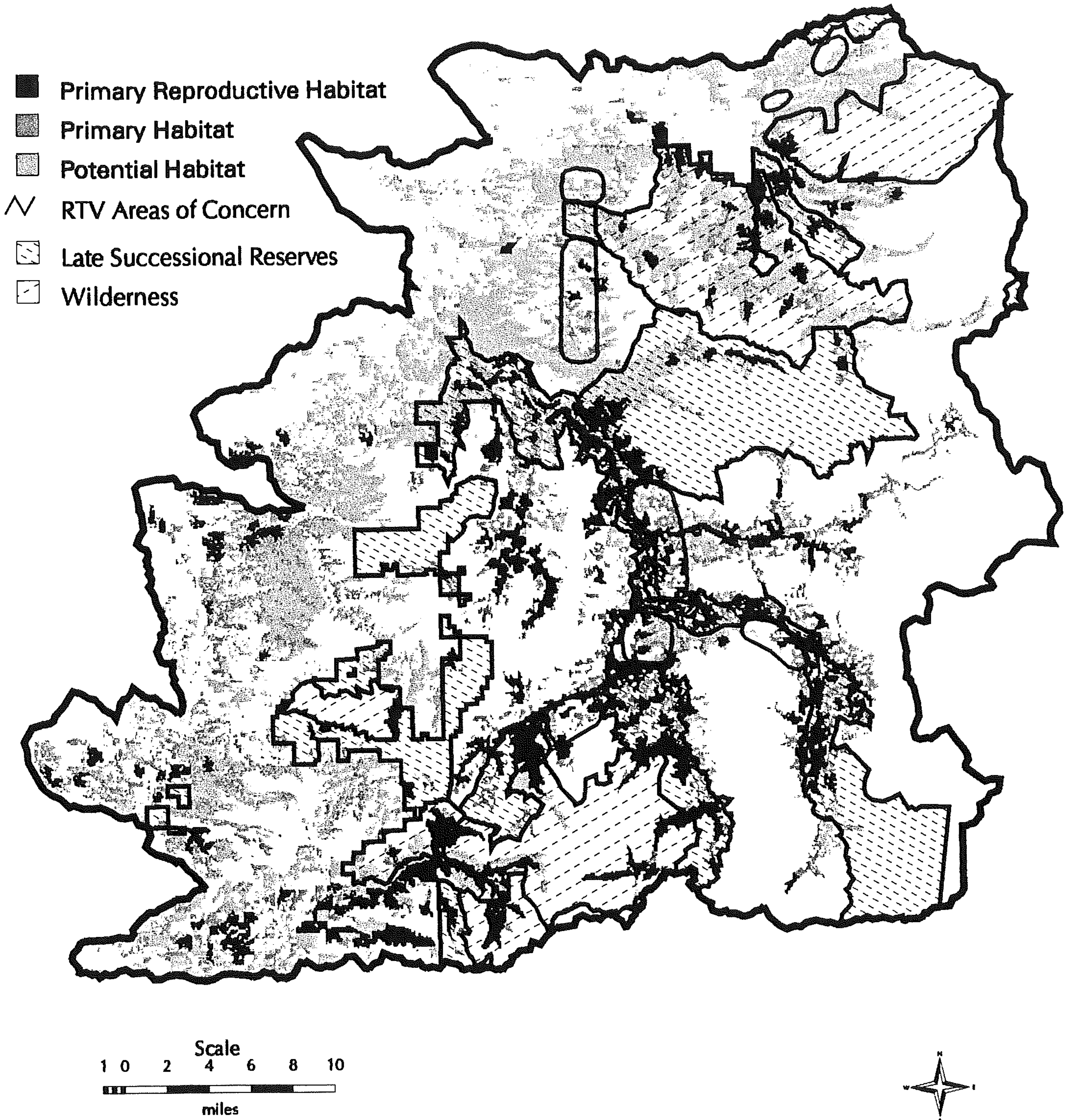
- Two areas of concern were identified along the Clackamas River Corridor. The concern is that the LSR narrows to less than a mile in these areas. These areas overlap dispersal, interim connectivity, and managed late-seral design cells. The LAD is consistent with connectivity objectives in these areas.

- An area was identified to link the Upper Clackamas LSR to the Collawash LSR and another area to link the Collawash LSR to the Bagby LSR. Bull of the Woods Wilderness does not provide that link for red tree voles due to elevations above 3,300 feet. Both areas are in LAD dispersal design cells. This should meet the objective of connectivity for red tree voles.

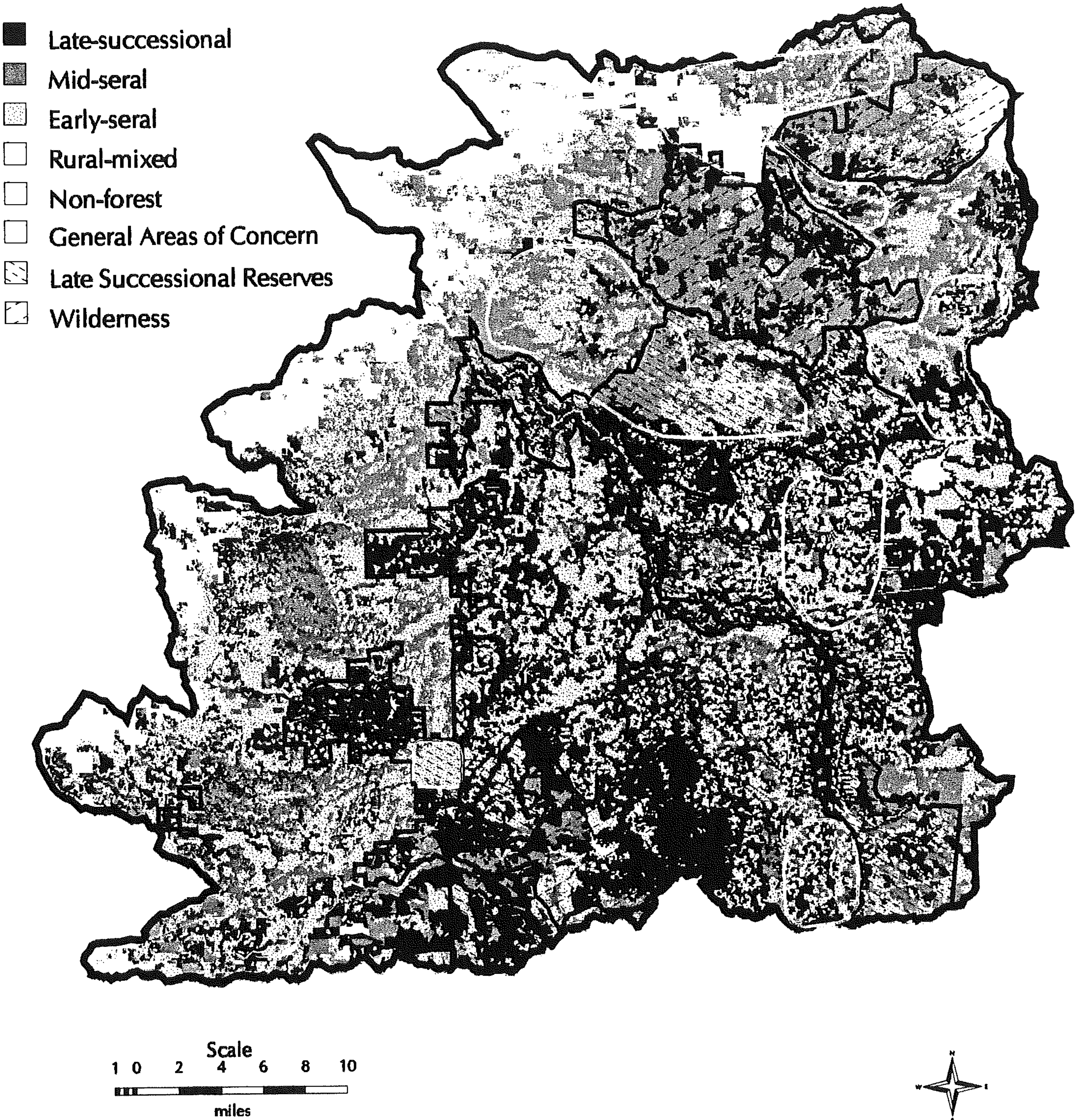
Map 3-12. North Willamette LSRA Spotted Owl Areas of Concern



Map 3-13. North Willamette LSRA Red Tree Vole Habitat and Connectivity Areas of Concern



Map 3-14. North Willamette LSRA General Connectivity Areas of Concern



General Connectivity Areas of Concern

A number of other areas were identified as general areas of concern due to lack of late-successional or dispersal habitat, high elevation habitats, private lands, or important linkages to areas within and outside the Assessment Area (Map 3-14, General Connectivity Areas of Concern). The following areas are identified:

Sandy River/Highway 26 Corridor

This area is between the Salmon-Huckleberry LSR/Wilderness Complex and the Bull Run LSR to the north of the Assessment Area. The Mt. Hood Wilderness is mostly high elevation and thus does not provide a link for some species. Concerns in this area include: large amounts of private land, lack of late-successional and dispersal habitat, Highway 26, and powerline corridors. Riparian Reserves in this area are also below the Regional average for amount of late-successional habitat. Due to private lands and Highway 26 this area will always be a concern.

Still Creek LSR/Mt. Hood Wilderness

There are some nice blocks of late-successional habitat in this area. Highway 26, however, runs through the middle of this area. Riparian Reserves in this area are also below the Regional average for amount of late-successional habitat. The area overlaps with LAD managed late-successional and dispersal design cells which are consistent with connectivity objectives. Highway 26 will be the main concern in the area.

Roaring River LSR, Eagle Creek, North Fork Clackamas

This area has a lack of late-successional forest. Riparian Reserves in this area are also below the regional average for amount of late-successional habitat. Dispersal habitat is abundant but lack of CWD due to past fires may be a concern in some areas for some species. The dispersal habitat within the LSR is expected to become functioning late-successional habitat within 50 years. The area in Eagle Creek and North Fork Clackamas watersheds primarily overlap LAD design cells that call for intensive timber management. The LAD is not consistent with managing for connectivity.

Salmon River Area

This area is important for connectivity between the Salmon-Huckleberry Complex and the White River LSR to the east. The area has little late-successional habitat but does have large amounts of dispersal habitat. Low levels of CWD may be a concern in some areas. The area overlaps LAD managed late-successional, dispersal, interim connectivity, and some aggregated and large opening design cells. The Salmon River Wild and Scenic River Corridor runs through the area. The LAD is consistent with connectivity objectives.

Roaring River/Upper Clackamas LSRs

The Clackamas River Corridor provides connectivity between the two LSRs. The Corridor, however, is very narrow in places and is bisected by a busy highway. Areas in the Oak Grove Watershed were identified as important connectivity areas to provide some habitat redundancy and to compensate for the road. These areas overlap primarily with LAD interim connectivity and aggregated design cells. There is enough area in interim connectivity design cells that connectivity objectives should be met.

Table Rock/Opal Creek LSRs

There is currently a four square mile area between these LSRs and within the Table Rock LSR that is devoid of late-successional or dispersal habitat.

Upper Clackamas LSR/Mt. Jefferson Wilderness

The link between the LSR and the Wilderness is very narrow and all high elevation. An area to the west of the south end of the Upper Clackamas LSR was identified to compensate for high elevation habitats within the LSR. The area overlaps LAD managed late-successional, interim connectivity and some aggregated design cells. The LAD is consistent with connectivity objectives.

Considerations for Treatments in LSRs

- Silvicultural treatments that would accelerate the development of young stands into dispersal or late-successional habitats would improve connectivity within and between LSRs. Those areas with large expanses of young forest would be the highest priority for treatment (Map 3-14).
- Down wood is an important component of connectivity habitat for many species. Increasing levels of down wood in younger stands will improve quality of habitat and increase dispersal of these species.
- Activities that disturb the duff layer or cause breakdown of decayed logs will degrade or destroy habitat for terrestrial salamanders, terrestrial mollusks, fungi, lichens and bryophytes.
- Maintain hardwood trees when treating stands. They are important to several mollusk species.
- Road obliteration would reduce fragmentation of late-successional and dispersal habitat for some species.
- Providing down wood in powerline corridors would improve dispersal of small mammals and terrestrial amphibians. Opportunities may exist to leave some trees in deep draws within the corridor.

Special Forest Products

Special forest products are an important social use of public land within the Assessment Area. The Northwest Forest Plan recognizes that harvesting of certain special forest products can and will occur in the LSRs unless such activity is shown to have a significant effect on late-successional habitat. *"In all cases, evaluate whether activities have adverse effects on Late-Successional Reserve objectives. Sales will ensure resource sustainability and protection of other resource values such as special status plant or animal species. Where these activities are extensive, it will be appropriate to evaluate whether they have significant effects on late-successional habitat. Restrictions may be appropriate in some cases."* (ROD p. C-18) Within the Assessment Area, existing harvest patterns, level of harvest significance, potential impacts to late successional habitat, and recommendations for harvest were evaluated for known special forest products.

Only legal harvest of special forest products were evaluated but it is recognized that illegal harvest does occur. The level of individual incidents of illegal harvest is not seen as a significant risk to the LSR network. Enforcement of commercial permits is reported to be more consistent and practical than the personal use permits. The scattered locations of the 100-acre LSRs throughout the landscape makes enforcement of permits particularly difficult in those areas.

Wood Products Convertible to Board Feet/Cut Sticks

These are products such as firewood, posts, poles, shakes, etc. Existing policy for permits on Forest Service and BLM land follows the ROD direction on p. C-16. Harvest of these products in the LSRs is restricted to *"existing cull decks, where green trees are marked by siviculturists to thin, to remove blowdown blocking roads, and in recently harvested timber sale units where down material will impede scheduled post-sale activities or pose an unacceptable risk of future large-scale disturbances."*

Edible Mushrooms

Currently, maps issued as part of the mushroom permit system on the Mt. Hood Forest exclude the LSRs as collection sites. No commercial mushroom harvest is allowed in LSRs administered by the BLM and the demand for personal use is low.

Based on current understanding, commercial and personal use collection of mushrooms may be in conflict with meeting the objectives of LSRs. The removal of mushrooms, a forage base for many of the late-successional associated species (northern flying squirrels, woodrats, red tree vole: from SAT Report) does not benefit, nor is necessarily neutral to the maintenance of late-successional habitat. Our evaluation of this activity (per ROD p. C-18), indicates that mushroom harvest may be inconsistent with the objectives of the LSRs.

Supporting Rationale

Spotted Owls

Allowing mushroom harvest within LSRs may indirectly impact spotted owls, through the removal of a portion of the forage base for many of the major spotted owl prey species. As stated on page 3&4-182 of the FSEIS: *"Northern flying squirrels, woodrats, red tree voles, and red-backed voles are the primary prey of northern spotted owls throughout their range . . . These small mammals depend on fir needles, fungi, and lichens in coniferous forests, and in turn serve as food sources to predators that eat them."*

Other Late-successional Associated Species

There are many wildlife species not currently classified as threatened, endangered, or sensitive, but considered late-successional habitat associates. According to the FEMAT page IV-20, *"1,098 terrestrial species (not counting arthropods) are identified as closely associated with late-successional forests on federal lands".* Of these, 527 species are fungi, 26 are mammals, 38 are birds, 18 are amphibians, and 102 are mollusks. The viability of these species was addressed by the SAT and then the FSEIS. In the FSEIS assessment it was determined that viability of these species could and should be maintained through implementation of Alternative 9 in the FSEIS.

We have interpreted LSRs to be designed as refugia areas; identified to maintain prolonged processes which are often not known or understood. (Page B-43, FSEIS states, in reference to LSRs *"The intent is to maintain natural ecosystem processes..."* and on page B-46, *"The structure, species composition, and function of these forests are in their entirety not fully understood."*)

We assume we must have high confidence/low risk that an activity is *"neutral or beneficial"* to proceed within the LSRs. It is our interpretation that when the below questions are answered, the activity may or may not proceed, and the level of *"significance"* will be determined. When answered, we will know at what level we can offer mushroom harvest within LSRs in the future.

Research and Monitoring Needs

From FEMAT, page IV-88 *"To determine appropriate levels of sustained harvest for fungi, inventories should be conducted, baseline data collected, and effects of harvest monitored."* On the following page, IV-89, *"A critical need exists for information on the diversity, biology, ecology, and distribution of the old-growth associated fungi in the forests of the Pacific Northwest . . . An inventory program should be developed for fungi, especially for the rare, common, and commercially harvested species. Surveys should be conducted for a minimum of 3-5 years (optimally 10 years) because of their ephemeral nature and seasonal as well as longer term fruiting patterns."*

Follow-up questions include:

- Do the prey species of spotted owls have a direct correlation with the species of fungi that are harvested for commercial or individual purposes? If yes, do these prey species decrease in numbers through this fungal harvest, or do they switch their forage base to some other item?

- If they decrease due to fungal harvest, what level of harvest is *"significant?"*; at what point would harvest be so great as to impact these prey species, and in turn at what level would it be significant enough to effect the viability of the northern spotted owl?

- Are the mushrooms being harvested species which these terrestrial late-successional associate species depend on for survival? (example species include mollusks, red tree vole, northern flying squirrel).

- If so, should this be an allowable activity inside Reserves designed/intended to benefit and/or maintain viability of the these species?

- If it is an allowable activity, is there a point at which the level of mushroom harvest crosses a threshold, and impacts the species' continued survival?

Transplants

A wide variety of species from different elevations are in demand in the Assessment Area for landscape transplants. Current policy for LSRs administered by the FS restricts transplant permits in LSR except in roadside ditches scheduled for maintenance and powerline right-of-ways. BLM policy limits harvest in LSRs to permits which have a written determination from resource specialists that the site specific proposal is consistent with LSR objectives. These policies should ensure that transplant harvest will have a neutral effect on the LSRs.

Moss/Lichens

These forest products are considered as a group to be a late-successional associate and the harvest of coincidental species along with the target species is the main concern with meeting LSR objectives. Demand for these products is very low possibly because the LSRs within the Assessment Area are above the elevational range for the most popular species. It is recommended that no harvest of moss or lichens be permitted within the LSRs with the exception of harvest from trees scheduled for cutting and removal from an approved silvicultural treatment.

Conifer Boughs

Bough harvest is currently permitted in LSRs in the Assessment Area. Bough harvest occurs primarily in second growth plantations of trees less than 50 feet tall with specific guidelines to ensure a sustainable harvest. No adverse effect is noted from this activity.

Beargrass

Beargrass harvest is currently allowed in LSRs in the Assessment Area. Because harvest of Beargrass is focused on the leaf and not the plant or flower, harvest of the plant is considered sustainable. No direct effects to late-successional species are documented. In addition, permittee camps are monitored and managed to limit resource impacts. No adverse effect is noted.

Conks

Currently no harvest of conks is allowed in LSRs administered by the BLM. The FS has had no requests for conk harvest in either LSR or matrix allocations. Risk to LSR objectives from conk harvest could occur with the inadvertent harvest of Survey and Manage species. A consultation with a resource specialist is recommended before issuing any conk harvest permits within LSRs to avoid risk to Survey and Manage species.

Greenery -Floral and Medicinal

Commercial harvest of greenery is currently allowed on Forest Service administered LSRs but has not occurred in practice. A minor amount of personal use harvest in Forest Service LSRs does occur. Both commercial and personal use harvest of greenery on BLM administered LSRs is allowed only with a written determination from resource specialist that the harvest would not preclude the attainment of LSR objectives. There is a concern that large, uncontrolled harvest could destroy local plant populations and/or change the character of existing habitat. It is recommended that commercial harvest of greenery in LSRs throughout the Assessment Area be permitted only after consultation with resource specialists.

Christmas Trees

The harvest of personal use Christmas trees is permitted in all land allocations throughout the assessment area. Current harvest practice limits tree cutting to accessible areas near roads, plantations before the trees reach approximately 8 feet in height, or in cleared powerline right-of-ways. There is little, if any, commercial demand for harvest permits because of the scale of the Christmas tree industry in private land surrounding the assessment area. The level of personal use demand is reported to be decreasing possibly due to the availability of private Christmas tree farms and decreased supply on public land as plantations grow beyond the desirable height. Personal use harvest of Christmas trees should have a neutral effect on the attainment of LSR objectives.

Huckleberries

Huckleberry species are not seen as a close late-successional associate and existing harvest practices might not be as strong a concern for maintaining the plant population as fire exclusion policies. There is little demand for commercial berry harvest permits in the Assessment Area although personal use harvest is popular. Harvest activity is light compared to some other national forests in the region and the effect on the LSRs is noted as neutral at this time. Monitoring is recommended to track major changes in harvest demand or plant population dynamics.

In addition, Mt. Hood National Forest and The Confederated Tribes of the Warm Springs Reservation of Oregon entered into a Memorandum Of Understanding (MOU) in 1997 regarding huckleberry resources on the Mt. Hood National Forest. In the MOU, the Forest Service agrees to:

- Recognize the importance of protecting and managing huckleberry habitat when planning and conducting Forest Service programs.
- To consult and coordinate with the Tribes in huckleberry habitat inventories and in the evaluation of proposed projects that may affect huckleberry habitat, including, but not limited to, timber sales, roads, and special use permits. (MOU p 2)

This is consistent with the ROD p 55, Section D. Protection of Tribal Treaty Rights and Trust Resources. Any future projects or change in harvest policy regarding the huckleberry resource within the LSR network would require government-to-government consultation.

Chapter 4

Individual LSR Level

Chapter 4
Individual LSR Level

Introduction

This chapter provides an overview of conditions specific to individual LSRs. It is intended only as a supplement to the other chapters of this assessment.

Watershed analysis documents are completed for most of the watersheds that contain LSR acreage within the Assessment Area. These documents address relationships between terrestrial and aquatic systems at a scale similar to the individual LSR level. The documents include the influence of past management activities, and recommend specific type, location and sequence of future management activities within a watershed. Watershed analyses contain information about individual LSRs and should be consulted as part of any project planning or design. Map 1-5 in Chapter 1 displays watersheds within the Assessment Area.

Table 4-1. Watersheds and Watershed Analysis Status by LSR

LSR	Watershed Analysis Completed	Watershed Analyses in Progress
205 - Still Creek	Zigzag, Upper Sandy	
206 - Eagle Creek	Eagle Creek	
207A - Roaring River	Roaring River, Lower Clackamas, South Fork Clackamas, Fish Creek, Salmon River, Oak Grove	Clear Creek
207B - Upper Clackamas	Upper Clackamas	
208 - Soosap	South Fork Clackamas, Fish Creek	Molalla River
209A - Table Rock		Molalla River
209B - Bagby	Hot Springs Fork/Collawash	
209C - Opal		North Fork Santiam River
210 - Collawash	Hot Springs Fork/Collawash	
211 - Abiqua Butte	Abiqua Butte	

Some wilderness areas within the Assessment Area are adjacent to LSRs which in effect increase the size of the late-successional reserve area. The Salmon-Huckleberry, Table Rock, Bull of the Woods, and Opal Creek Wilderness areas currently support or have the potential to support significant amounts of late-successional forest. For this reason, these wilderness areas are treated as an LSR/wilderness complex. Refer to Map 1-3 in Chapter 1.

Chapter subsections that relate to individual LSR conditions are arranged as follows:

- **Salmon-Huckleberry LSR/Wilderness Complex**
  Includes the Salmon-Huckleberry Wilderness bordered by the small Still Creek LSR to the east, the small Eagle Creek LSR to the west, and the large Roaring River LSR to the south.

- **Upper Clackamas LSR**

- **Soosap LSR**

- **Table Rock LSR/Wilderness Complex**
  Includes the Table Rock Wilderness which is surrounded by Table Rock LSR (209A).

- **Abiqua/Butte LSR**

- **Bull of the Woods LSR/Wilderness Complex**
  Includes Bull of the Woods Wilderness bordered to the east by the Collawash LSR and to the northwest by Bagby LSR. This complex shares a common boundary with the Opal LSR/Wilderness Complex to the west. The two are summarized separately as one is entirely on the Mt. Hood N.F. and the Opal Complex, which lies in a different watershed, is administered by the Willamette N.F.

- **Opal Creek LSR/Wilderness Complex**
  This area includes the newly created Opal Creek Wilderness and Scenic Area (formerly part of LSR 209). It still includes a small portion of LSR (209C) and part of the Bull of the Woods Wilderness that lies on the Willamette National Forest.

- **100-Acre LSRs**

Salmon-Huckleberry LSR/Wilderness Complex

The Roaring River LSR (207A), Eagle Creek LSR (206), Still Creek LSR (205), and the Salmon-Huckleberry Wilderness combine to form the largest LSR/wilderness complex within the Assessment Area (125,547 acres). This complex, in time, will provide a very large, well-connected block of late-successional habitat within the LSR network (Map 4-1). The lower Clackamas River, the Salmon River, the Roaring River, and Eagle Creek form major drainage patterns in this landscape. The northern half of this block is dominated by steep, highly dissected terrain, while the southern and eastern portions are dominated by broad ridges and a gentle plateau landscape.

Current Vegetation and Habitat

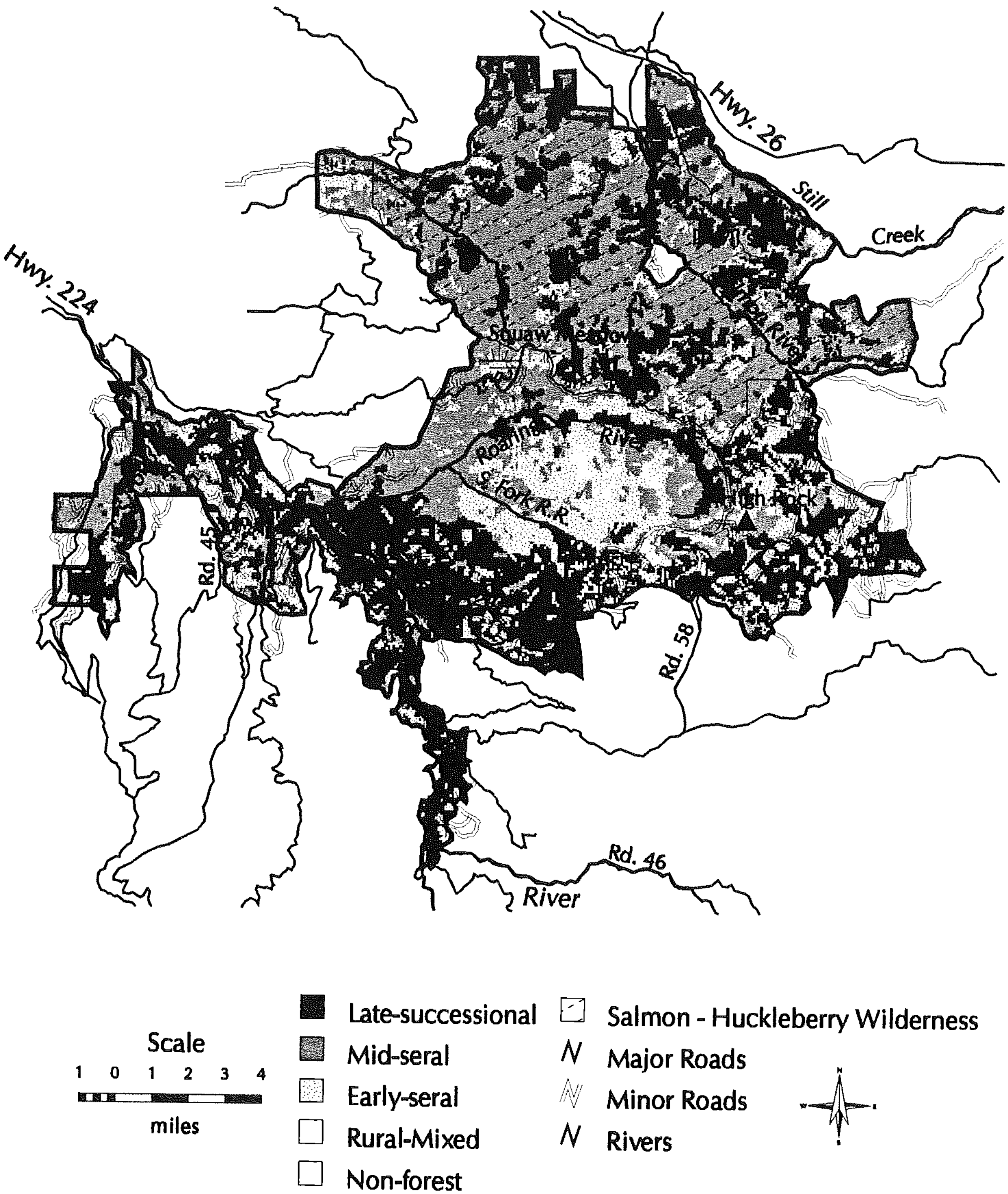
This complex is dominated by the Western Hemlock Zone (54 percent) and the Pacific Silver Fir Zone (36 percent) with the Mountain Hemlock Zone (10 percent) present along the high, broad ridges in the Roaring River LSR.

Table 4-2. Seral Stage Amounts by Percent, Salmon-Huckleberry LSR/WIlderness Complex

Seral Stage	Still Creek LSR (205) (5308 acres)	Eagle Creek LSR (206) (1628 acres)	Roaring River LSR (207A) (73,282 ac)	Salmon-Huckleberry Wilderness (45,328 ac)	Entire LSR Wilderness Complex (125,547 ac)
Late-successional	42	9	44	28	38
Mid-seral	42	47	24	62	39
Early-seral	15	43	29	8	21
Non-forest	1	1	3	2	2

Near the turn of the century, large, stand replacing fires covered a large portion of the wilderness area and Still Creek LSR. Much of this complex is unroaded. Large, unfragmented forest patches of mid to late-successional forest with low contrast edges, similar to historic patterns are common in this block across the wilderness, Still Creek LSR and portions of the Roaring River LSR. These patches are dominated by mid-seral stands that function as dispersal habitat. Pockets of late-successional forest exist in unburned areas, largely in draws. A number of spotted owls occur in this area indicating that the dispersal habitat is already providing some habitat for late-successional species. Most of these stands are near 80 years of age and are expected to provide late-successional habitat within the next 50 years.

Map 4-1. Salmon-Huckleberry LSR/Wilderness Complex



Large patches of late-successional habitat occur in the southern portion of the Roaring River LSR. Areas of fragmentation caused by timber harvest do exist, however, in the eastern end and southern edge of the Roaring River LSR and within Eagle Creek LSR. These areas have many stands less than 80 years of age that may benefit from young stand thinnings designed to accelerate development of late-successional characteristics. Precommercial prescriptions will be common in many of the plantations. Some plantations may be of commercial size and thus CWD objectives will have an increased priority in addition to tree growth enhancement. All of Eagle Creek LSR and the west end of the Roaring River LSR are within the Western Hemlock Zone, which is most responsive to growth enhancement treatments. Plantations in the east end of the Roaring River LSR are largely within the Pacific Silver Fir Zone.

The high ridges near the center of this complex within the Roaring River LSR contain a high amount of young natural stands and rocky and shrubby openings. Many of these stands were initiated following stand replacement fires near the turn of the century. These stands, which are located within the harsher climate of the Mountain Hemlock Zone, are slow-growing and will have minimal late-successional forest characteristics. Many rocky areas of low site potential are also intermixed with these stands and will not support late-successional forest. This area is roadless and there are no intentions nor recommendations to enter this area for stand enhancement activities. Silvicultural activities will be focused on plantations and previously manipulated stands. In addition, conservation of stands of natural origin will be considered. It may be desirable to allow some stands of natural origin to follow successional processes without intervention.

A number of wetlands occur in the Roaring River LSR which provide unique habitat for a number of species. Rocky outcrops occur at higher elevations in the LSR and provide potential denning sites for wolverine.

Connectivity

The area of young natural stands and rocky openings in the center of the complex described above, create a three mile wide break between existing late-successional habitat. This area is a mix of dispersal and open habitats. This presents a short-term connectivity concern as the scattered patches of dispersal habitat should become late-successional within 50 years.

Two major east-west ridges occur in this complex. One ridge, in the southeast portion of the complex is in the Mountain Hemlock Zone and includes a number of rocky areas that will never provide late-successional habitat. The other ridge is between the Roaring River LSR and the Salmon-Huckleberry Wilderness. It is not as high as the first ridge, but provides a barrier for certain lower elevation species such as the red tree vole.

The west end of the Roaring River LSR is low elevation and contains some fairly well connected late-successional habitat along the Clackamas River. Late-successional habitat is fragmented in the east portion of the LSR.

Coarse Woody Debris

Data on coarse woody debris for Roaring River LSR was split out from the rest of the complex due to fire history and expected differences in amounts of snags and down wood.

In the Roaring River LSR snag levels in late-successional habitats are average for the Assessment Area (Table 4-3). Mid-seral stands support many small snags and moderate levels of larger snags. On average, snag height tends to be short. Snag levels are lowest in early-seral stands.

Table 4-3. Existing snag levels in Roaring River LSR. Data from Forest Service CVS plots.

	Late-successional Stands (n=52)		Mid-seral Stands (n=92)		Early-seral Stands (n=44)	
Snag dbh	#/Acre	Avg. Height (feet)	#/Acre	Avg. Height (feet)	#/Acre	Avg. Height (feet)
3-14.9"	28	20	69	21	22	16
15-24.9"	8	27	6	19	2	20
>=25"	4	41	3	27	2	43
All Snags	40	26	78	21	25	22

Down log amounts in late-successional habitats are average for the Assessment Area (Table 4-4). Mid-seral stands have relatively low levels of down logs. This adds to the short-term concern for connectivity in the large area of dispersal habitat in the north portion of the LSR. Early-seral habitats in the LSR have the highest levels of down logs. This may be reflective of the fire history of the area combined with the lack of roads.

Table 4-4. Existing down wood levels in Roaring River LSR. Data from Forest Service CVS plots.

	Late-successional Stands (n=52)		Mid-seral Stands (n=92)		Early-seral Stands (n=44)	
Log Diameter	#/Acre	Avg. Length (feet)	#/Acre	Avg. Length (feet)	#/Acre	Avg. Length (feet)
3-14.9"	200	10	154	13	255	8
15-19.9"	25	20	13	16	67	7
>=20"	25	30	22	16	22	36
All Logs	250	12	189	13	344	9
Percent Ground Cover	6.9		4.4		7.5	

Snag levels are higher in the Salmon-Huckleberry Wilderness area than in the Roaring River LSR (Table 4-5). The snags, however, tend to be even shorter. Early and mid-seral habitats support large numbers of small snags and moderate levels of large snags.

Table 4-5. Existing snag levels in Salmon-Huckleberry Complex. Data from Forest Service CVS plots.

	Late-successional Stands (n=12)		Mid-seral Stands (n=19)		Early-seral Stands (n=3)	
Snag dbh	**#/Acre**	**Avg. Height (feet)**	**#/Acre**	**Avg. Height (feet)**	**#/Acre**	**Avg. Height (feet)**
3-14.9"	47	17	126	20	102	9
15-24.9"	12	25	3	14	5	10
>=25"	4	22	4	30	0	0
All Snags	64	19	135	21	107	10

Down log levels in the complex are relatively low (Table 4-6). Late-successional stands have very low levels of logs. While mid-seral stands support relatively large levels of large logs. Early-seral stands support low levels of logs that are small. The sample size for early-seral stands, however, is quite low (n=3). Within the Salmon-Huckleberry Wilderness, it is not possible to mitigate for low levels of down wood.

Table 4-6. Existing down wood levels in Salmon-Huckleberry Complex. Data from Forest Service CVS plots.

	Late-successional Stands (n=12)		Mid-seral Stands (n=19)		Early-seral Stands (n=3)	
Log Diameter	**#/Acre**	**Avg. Length (feet)**	**#/Acre**	**Avg. Length (feet)**	**#/Acre**	**Avg. Length (feet)**
3-14.9"	167	10	134	13	123	14
15-19.9"	6	20	2	40	0	0
>=20"	0	0	35	20	0	0
All Logs	173	10	171	14	123	14
Percent Ground Cover	2.2		5.2		1.9	

Social and Recreation Use

The Salmon-Huckleberry LSR/Wilderness Complex is extensive and offers many landscapes with different and distinct social values. For the purposes of this analysis, separate watersheds within this complex are summarized individually. (Map 1-3.) These include both the lower and upper mainstem of the Clackamas River, Roaring River, South Fork of the Clackamas River, and the High Rock and Linney Creek area in the Oakgrove Watershed.

Lower Clackamas

The Salmon-Huckleberry LSR/Wilderness Complex encompasses the Clackamas River Corridor and part of the LSR roughly follows the river canyon from the headwaters to the forest boundary. The Clackamas River is a primary use area on the Mt. Hood National Forest and land uses within the corridor include recreation, transportation, municipal water supply, and hydroelectric energy generation and transmission. Although PGE operates five dams in the Clackamas River Basin, none are located within the mainstem of the Clackamas River. Water which is diverted from Harriet Lake in the Oak Grove Fork Watershed is released into the Clackamas River at Three Lynx. A cleared right-of-way with steel transmission towers carries electricity generated at Three Lynx downriver to the Portland metro area.

Timber harvest has occurred within and adjacent to the corridor over the last 70 years. Most of the harvest occurred within the old-growth forests.

Recreation

The Clackamas River corridor is a major recreation destination that attracts thousands of visitors annually. Because of its proximity to Portland, easy accessibility via a major state highway (Highway 224), high amount of public land ownership, and scenic setting for river based recreation, it plays a major role in the provision of recreation opportunities for the greater metropolitan Portland area and surrounding rural communities. Recreation has been an established use within the river corridor throughout most of this century although the high levels of recreation use only commenced since the completion of Highway 224/Road 46. Whitewater boating, sightseeing, photography, fishing, hiking, camping, and hunting are some of the many recreation uses. Demand for the Clackamas River would remain high even without active management or developed facilities. Recreation use is heaviest in the summer with active spring and fall weekend use.

Within the river corridor there are 14 developed campgrounds varying in capacity from eight to eighty units, three developed picnic areas, a rafting put-in area, and a graveled boat launch with parking. Six trails are within, or can be accessed from the river corridor: the Clackamas River Trail (#715), Alder Flat Trail (#574), Riverside National Recreation Trail (#723), Cripple Creek Trail (#703), Dry Ridge Trail (#518), Lodgepole Trail (#706) and a short section of the Pacific Crest Trail (#2000). Five trailheads are within the river corridor, four of which are within developed campgrounds.

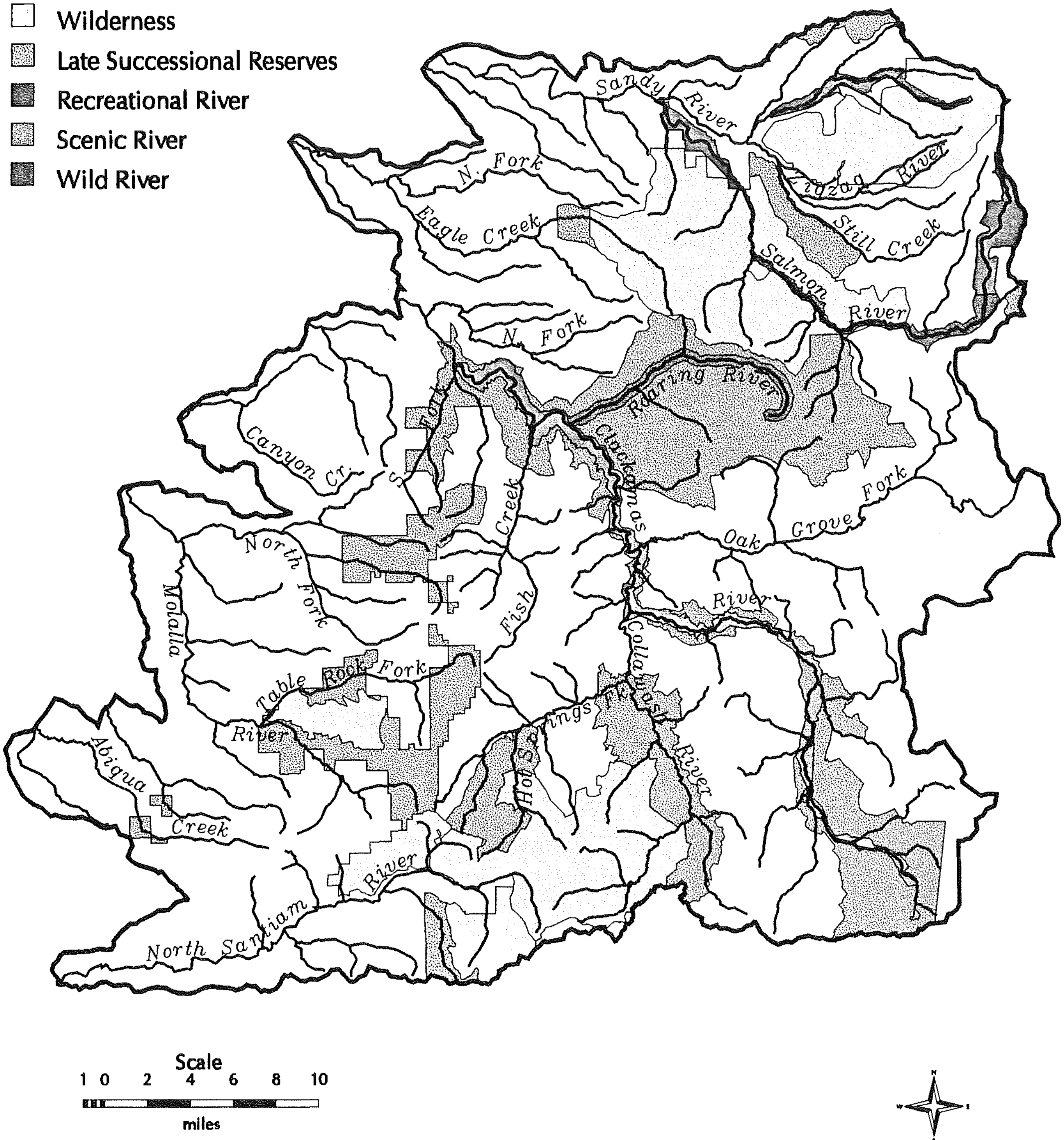
There are no developed snowparks in the corridor and winter use is contingent upon snow pack and plowing. The scale and level of recreation use and facility development decreases as one moves upstream from Estacada. Dispersed recreation campsites and day use areas are numerous within the corridor, particularly south of Ripplebrook. Unlike the downstream portion of the river, the river corridor in the Upper Clackamas Watershed remains undeveloped with a remote and rustic quality. There are approximately 43 dispersed camping areas in the riparian zone from the confluence of the Clackamas with the Collawash to Forest Road 4690; they cover over 38 acres of riparian area.

Highway 224/Forest Road 46 accommodates one of the highest commercial and recreation traffic volumes of any forest highway in Oregon or Washington. It provides the primary access for river recreation and serves as the main haul route for timber and forest products. It is also a popular alternative scenic route to Bend and Central Oregon. In 1995, Highway 224/Forest Road 46 from Estacada to Detroit was designated as a National Scenic Byway and a State Scenic Byway in 1997.

In 1988, Congress designated 47 miles of the Clackamas River from the forest boundary upstream of the North Fork Reservoir to Big Spring in the Olallie Lake Scenic Area as a federal Wild and Scenic River (Map 4-2). The Forest Service was directed to develop a comprehensive management plan for the protection and/or enhancement of the "outstandingly remarkable values"(ORVs) of the river. This was completed in 1993. The outstandingly remarkable values of the designated river corridor include fisheries, botany, ecology, cultural resources, recreation, and wildlife. The Clackamas was also designated an Oregon State Scenic Waterway in 1988. The State Scenic Waterways Act requires that the State Land Board approve any alteration of the bed and/or banks of a scenic river or wetlands within the scenic waterway.

The *Clackamas National Wild and Scenic River and State Scenic Waterway Management Plan* (W&SR) provides the management direction and implementation schedule for the designated river corridor. Standards and guidelines from the Northwest Forest Plan do not apply where they would be contrary to existing law or regulation, or where they would require agencies to take actions for which they have no authority. (ROD p. A-6, C-1) For example, the standards and guidelines from the Northwest Forest Plan are implemented to the extent they are consistent with the 1968 National Wild and Scenic Rivers Act, but do not apply where they are contrary.

Map 4-2. North Willamette LSRA Designated Wild and Scenic Rivers



Management of existing recreation use while protecting the ORVs of the river is the main goal of management. According to the Record of Decision for the management plan, "The general focus is to emphasize public use, services, and developments in the corridor on those users highly dependent upon a "natural" forest setting and river environment, with moderate recreational conveniences in the lower river corridor, and an emphasis on a less affected setting and heightened ecosystem function in the upper corridor." In the management plan, "the emphasis is upon maintaining current overnight capacity in the corridor, expanding day-use opportunities, and upgrading current facilities, both in appearance and function. Priorities for new development, and/or de-investment are based on a "nodal" concept, with highest service and convenience in the Estacada/Promontory Park area on private land downriver from the Forest boundary, second highest at Ripplebrook/Three Lynx/Indian Henry area downstream from the confluence of the Clackamas and Collawash River, and third at Fish Creek/Carter Bridge area at the river's confluence with Fish Creek. Trail based , interpretive, and viewing opportunities would be expanded, and an active public information strategy implemented. Some existing facilities that are inconsistent with the ORV's, low use or uneconomical, may be phased out." For dispersed recreation, the W&SR plan includes direction for "site specific control of automobiles, education, and monitoring while permitting recreation access" to protect the riparian area resource.

Scenic resources in the corridor under the W&SR plan are to be managed to "maintain a near natural appearing landscape with a mature forest character." "Silvicultural prescriptions in the corridor will seek to maintain a continuous forest cover, with old-growth characteristics."

The goals of the W&SR plan to manage existing recreation use and restrict growth to protect the outstandingly remarkable values of fisheries, wildlife, botany, and ecology are expected to be consistent with the LSR objectives.

Special Forest Products harvest is limited in the river corridor because of restrictions based on proximity to state highways, campgrounds and developed facilities, and riparian areas.

Also in accordance with direction in the W&SR plan, a project level LSR Assessment (1995) and an environmental assessment (1996) were completed for a new trail which will link downtown Portland with the Pacific Crest Trail, the Urban Link Trail (ULT). In addition to twenty miles of new construction in the river corridor, the selected trail route and development level is designed to take advantage of the existing pipeline alignment, road to trail conversion opportunities and shared use of existing vehicle bridges. According to the Record of Decision for the Urban Link Trail EA, "Construction of new portions of this trail will not remove mature trees, except in isolated instances where there is no other trail route option." "The trail will be designed to avoid disturbances to nesting sites and calving areas." And "any trees fallen during the course of construction would be left on site and would contribute to coarse woody debris."

As already noted, State Highway 224/Road 46 is a primary transportation route in the LSR. It serves as a main arterial to other access roads throughout the entire river drainage.

Roaring River Watershed

The Roaring River Watershed is within an hour's drive of Portland. Access to the river is primarily from Highway 224. The only developed facility is the Roaring River Campground. It is located at the confluence with the Clackamas River and receives use mainly from Clackamas River users and those fishing the Roaring River.

The Roaring River Watershed is an inventoried roadless area with only 29 miles of road around the rim of the drainage. Several former Forest Service campgrounds are located on the primitive Abbot Road. These provide dispersed camping opportunities and trailheads for trails down to the river. The mainstem of the Roaring River, from its headwaters to its confluence with the Clackamas River, was designated by Congress as a National Wild and Scenic River in 1988. The river's six outstandingly remarkable values include water quality, botany, fisheries, wildlife habitat, recreation, and scenic resources. The management plan for the river "focuses on maintaining the existing level of recreational use within the wild segment of the river corridor while expanding opportunities and developments to accommodate additional use within the recreational segment". The South Fork Roaring River has also been found eligible for designation as a Wild and Scenic River. Until final congressional action on the river's suitability, it is to be managed to protect the free flowing character and "outstandingly remarkable values" which have made the river eligible for designation.

Trails in the watershed include: Plaza Lake Trail #506, Corral Springs Trail #507, Grouse Point Trail #517, Huxley Lake Trail #521, Dry Ridge Trail #518. The W&SR management plan specifies: no new trails are to be built in the 13.5 mile Wild segment of the designated river: existing trails are to be maintained or upgraded within the Wild segment; new trails and interpretation could occur in the lower 0.2 mile Recreational segment. This plan, like that of the Clackamas River, proposes management of existing recreation use and restrictions on growth to protect the river resources and is consistent with LSR objectives.

The upper reaches and exposed ridgelines of the Roaring River Watershed have been recognized as an important huckleberry harvest area for the Confederated Tribes of Warm Springs. The watershed also receives high use for beargrass harvest in the Squaw Lakes area.

South Fork Clackamas Watershed

The focus of recreation use in the South Fork Watershed is motorized dispersed recreation and special forest products harvest. Recreation uses include scenic and recreational driving, hunting, fishing, camping, hiking, and off-highway-vehicle (OHV) use. Use levels are considered low compared to other watersheds in the Clackamas River drainage except recreational driving and hunting. The three primary features of the watershed which attract use are its close proximity to local communities, low level of management presence, and easy, improved access on Forest Road 45.

The lower 4.2 miles of the South Fork River has also been found eligible for Scenic classification under the Wild and Scenic River Act because of its free flowing character and the presence of late winter run coho salmon. It has also been designated an Oregon State Scenic Waterway. The steep slopes and unroaded character of the watershed limits recreation development. Only one trail, #515 Hillockburn Trail, provides access to the lower river corridor.

Road 45 is an improved road which circles the perimeter of the watershed, crossing east to west through the headwaters of Memaloose Creek, East Fork, and South Fork. Road 45 is a popular day use drive because it is a 56 mile loop road close to local communities and provides the primary access for recreation sites and activities in the watershed. Many of the rock pits, borrow pits, and timber sale landings along the road also serve as sites for unmanaged target shooting, dispersed camping, party sites, and garbage dumps. Contingent upon snow levels, the road is heavily traveled in the winter and receives some of the highest use in the Clackamas River drainage for Christmas tree harvest. Sections of LSR 207A and LSR 208 in the South Fork Watershed have a long history of firewood cutting and currently have a higher incidence of illegal firewood cutting because of Road 45 and the "back door" access to local communities. Bough cutting permits also occur in this area.

High Rock/Linney Creek

The Linney Creek and High Rock areas in eastern end of LSR 207A play an important role in the provision of semi-primitive recreation opportunities. The High Rock area is characterized by steep slopes, small natural lakes, high elevation meadows, wetlands, huckleberries, and scenic rock formations. The pattern of recreation use focuses on destination sites small lakes, high elevation huckleberries sites, and the vista point High Rock. The only camping facility is High Rock Springs, which receives capacity use on summer weekends. Trails originating in the High Rock area connect with the Rock Lakes Basin in the northwest and accommodate both hikers and equestrians. High Rock is a popular recreation destination for its scenic vista and huckleberries. It is also a winter snowmobile destination although use is only considered low to moderate. Hunting is also limited in the High Rock Area by the steep slopes and use is considered low. Dispersed hunting camps are found in traditional sites like riparian areas or flat areas like timber sale landings with road access which receive opportunistic use.

In the Linney Creek area, visitor attractions include small lakes and meadows. Semi-primitive recreation opportunities exist at Anvil Lake, Dinger Lake, Black Wolf Meadow and numerous creeks. Because of the presence of deer and elk herds, easy roaded access, and flat terrain, hunting is also a popular recreation activity.

The high elevation, roaded access and consistent snowpack also means winter sports are possible in the area like snowmobiling, dog sledding, snow play, and cross-country skiing. Because the snowmobile trail system uses main system roads with a consistent snowpack, plowed access for vehicles with wheels is limited in the winter.

Eagle Creek Watershed

Eagle Creek LSR (206) is a small LSR adjacent to the western edge of the Salmon-Huckleberry Wilderness. The 1.1 mile of Eagle Creek which runs through the LSR has been found eligible for designation as a Wild and Scenic River. The only trail in this LSR, Trail # 501, the Eagle Creek trail, provides an important access point to the Salmon-Huckleberry Wilderness. Trail system use is low to moderate.

Treatment Summary

Refer to **Treatment Chapter (Chapter 6)** for detailed information on treatment activities.

Young Stand Thinnings (Precommercial)

Landscape Objective

Reduce fragmentation and edge effects to existing late-successional forest in short-term, accelerate development of late-successional forest characteristics and increase amount of late-successional forest over long-term.

Young Stand Thinnings (Commercial)

Landscape Objective

Accelerate development of late-successional characteristics in the short-term including specific attention to increasing snag and down wood amounts which are often low in mid-seral stands in this complex. Overstocked single species plantations and offsite stands in LSR areas of Fish Creek Watershed could benefit from young stand thinnings. Fish Creek Watershed and Oscar Creek in South Fork Watershed also have LSR areas of young mid-seral stands that may benefit from treatments to increase windfirmness.

Stand treatments in the large unroaded area of Roaring River Watershed are not anticipated nor encouraged. Many young stands in this area are natural stands that were initiated after fires.

Opportunities for road decommissioning exist in the eastern and western portions of the Roaring River LSR (207A).

Fire and Fuels

Almost all of this complex (with the exception of the Clackamas River corridor) has been burned over by wildfire sometime around the late 1800s or early 1900s. This complex has an overall fire occurrence rate of 0.02 - .034 fires/1,000 acres/year. There are four fire groups within the complex. Fire group 8 comprises approximately 70 percent (88,590 acres), fire group 7 comprises approximately 13 percent (15,698 acres), fire group 6 comprises approximately 10 percent (12,763 acres), and fire group 9 comprises approximately 7 percent (8,698 acres).

Clackamas River Wild and Scenic River Corridor (Hwy 224)

This area has very high recreational use. As a result, ignition points/sources are numerous. However, the potential for escaped fire and/or stand replacing fire is low due to the relatively high humidity associated with the adjacent river. Dispersed camping and abandoned campfires are a continual problem. This area is considered a low risk to catastrophic loss from wildfire.

Fish Creek Area

Fish Creek has very high recreational use. Sight-seeing, dispersed camping, and hunting are among the recreational uses. Numerous wildfires have been started in this area by campers leaving abandoned campfires. Due to major flooding and road damage which occurred in February 1996, a large portion of the Fish Creek drainage is not accessible and current plans are not to restore the road system. Restricted access will increase initial attack response time resulting in increased fire size. This area is considered a low risk to catastrophic loss from wildfire.

The South Fork of the Clackamas River is adjacent to private industrial forest land and BLM land. Due to its close proximity to the Portland metropolitan area, it receives high recreational use. Because it is so close to urban populations, numerous illegal activities also occur there, i.e. dumping of garbage, illegal firewood cutting, and dumping and torching of stolen vehicles to name a few. Numerous wildfires have been started by burning vehicles. This area is considered a low risk, however, to catastrophic loss from wildfire.

Roaring River Watershed

Due to the wildfire around the late 1800s, Roaring River area is low in downed fuel loading and CWD. Vehicle access to the area is limited. Recreational use is low (mainly backpacking, dispersed camping, and hunting). This area is below the forest average for ground cover for logs. Because there is limited access to the area, the ignition source potential is low with the exception of the east side that lies in the Cascade Crest lightning belt track which is considered moderate. Overall, this area is considered a low risk to catastrophic loss from wildfire.

Eagle Creek LSR (206)

Because of its' proximity to private industrial forest land, this area has had numerous fires since the late 1800s. As a result, this area is low in downed fuel loading and CWD. Natural regeneration has created stands that are overstocked and in some cases they are beginning to stagnate. Potential ignition sources are low due to limited access with only a few trails. This area is considered a low risk to catastrophic loss from wildfire.

Salmon Huckleberry Wilderness

As a result of the fires around the turn of the century, the stands in the wilderness are relatively uniform in age and composition. Downed fuel loading and CWD is low throughout the area. The wilderness is adjacent to industrial forest land and urban/rural interface land. Recreational use is moderate, consisting mainly of hiking and backpacking. Wildfire ignition sources are low with the exception of the Green Canyon area which is moderate. The Wilderness Implementation Plan for the Salmon-Huckleberry Wilderness has a goal of wildfire suppression to limit the size of all fires. This is consistent with the management goals of the adjacent LSRs. Access for suppression would be via aerial delivery or walk-in. This area is considered a low risk to catastrophic loss from wildfire.

Still Creek LSR (205)

Numerous fires have left the area low in CWD and downed fuel loading. The area is adjacent to the wildland/urban interface area of Zigzag summer homes. The area adjacent to LSR 205 has off-site plantations with low productivity and stagnated stands. Insects and diseases are common in the off-site plantation areas. The concern exists that the decadent condition of the adjacent stands could perpetuate a wildfire that starts outside the LSR area and could burn into the LSR with an east wind event. Because of the proximity to the wildland/urban interface areas and the adjacent stands of off site plantations, this area has a Low - Moderate risk for catastrophic loss from wildfire.

Upper Clackamas LSR

The Upper Clackamas LSR (207B) is considered to be that portion of LSR 207 that lies in the Upper Clackamas Watershed (32,499 acres). The LSR is dominated by a long narrow band along the Upper Clackamas River and a wider portion near the Ollalie Lakes area within the High Cascades Province (Map 4-3). The elevation range is wide, 1,450 to 6,192 feet with an average of 3,542 feet.

Current Vegetation and Habitat

The Western Hemlock Zone which occupies 44 percent of the LSR is found along the Clackamas River, while the Pacific Silver Fir Zone (32 percent of area) and Mountain Hemlock Zone (24 percent) dominate the high country.

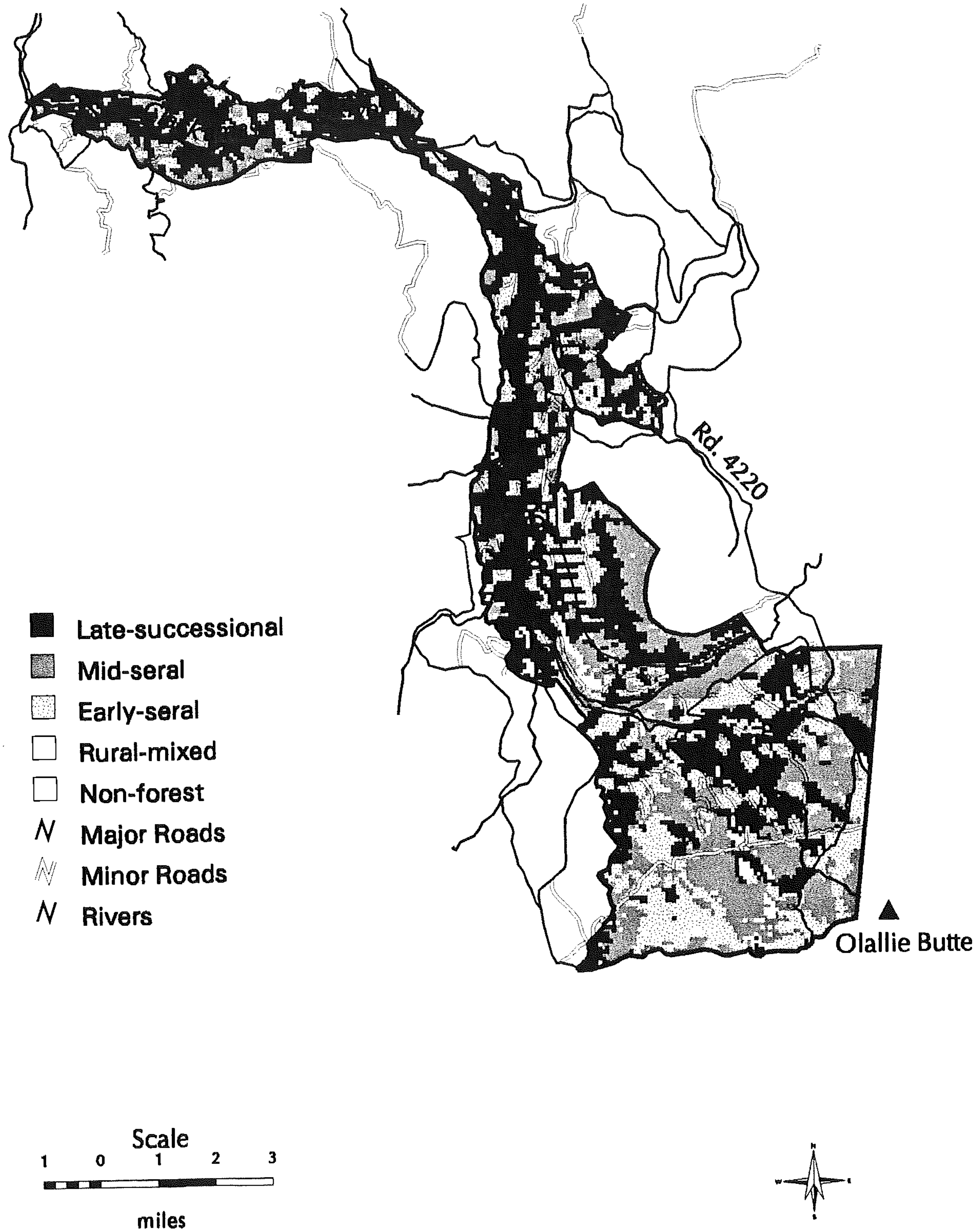
Table 4-7. Seral Stage Amounts by Percent, Upper Clackamas LSR (Percent)

Seral Stage	Upper Clackamas LSR (207B) (32,499 acres)
Late-successional	45
Mid-seral	25
Early-seral	27
Non-forest	3

Most of the existing late-successional forest in this complex is within the Western Hemlock Zone associated with the river corridor. This habitat is relatively unfragmented but distributed in the long, narrow corridor portion of the LSR. The southern portion of the LSR is in higher elevation habitat. Much of this area is currently mapped as dispersal habitat. In the Mountain Hemlock Zone this habitat may never achieve certain late-successional characteristics, such as large trees. This area is never expected to provide spotted owl habitat due to elevation limitations.

Small amounts of lodgepole pine habitats occur in this LSR. More occur just outside the LSR. Lodgepole pine provides important habitat for black-backed and three-toed woodpeckers.

Map 4-3. Upper Clackamas LSR



Connectivity

High elevation habitats at the south end of the Upper Clackamas LSR create a barrier to some species. As a result, the LSR is not well connected to the Mt. Jefferson Wilderness or to the LSRs to the south.

Forest Service Road 46 runs along the Clackamas River. This creates a barrier for some species and a hazard for other species. It is especially a concern where the LSR narrows along the river corridor. The road to Ollalie Lakes is more of a seasonal concern but may create a barrier for some species that require moist microhabitats and are poor dispersers.

A powerline runs through the southern portion of the LSR. The early-seral habitat under the powerline will create a barrier only for the poorest of dispersers. Opportunities exist to mitigate the effect by providing down logs in the corridors or allowing trees to mature in deep draws under the powerlines.

Coarse Woody Debris

Snag levels in late-successional habitats are slightly below average for the Assessment Area (Table 4-8). Mid and early-seral habitats support moderate levels of larger (15" dbh) snags.

Table 4-8. Existing Snag Levels in Upper Clackamas LSR, Data from Forest Service CVS Plots

Snag dbh	Late-successional Stands (n=42)		Mid-seral Stands (n=24)		Early-seral Stands (n=21)	
	#/Acre	Avg. Height (feet)	#/Acre	Avg. Height (feet)	#/Acre	Avg. Height (feet)
3-14.9"	22	20	70	17	24	28
15-24.9"	7	38	5	24	2	25
>=25"	5	35	4	32	2	42
All Snags	34	28	79	20	28	34

Down log amounts in late-successional habitats are about average for the Assessment Area (Table 4-9). In mid-seral habitats log levels are at the low end of the average for the Assessment Area. Overall there are high numbers of large (20 inch diameter) logs. On average, however, the logs are short (8-14 feet).

Table 4-9. Existing Down Wood Levels in Upper Clackamas LSR, Data From USFS CVS Plots

Log Diameter	Late-successional Stands (n=42)		Mid-seral Stands (n=24)		Early-seral Stands (n=21)	
	#/Acre	Avg. Length (feet)	#/Acre	Avg. Length (feet)	#/Acre	Avg. Length (feet)
3-14.9"	242	8.5	155	14	287	9
15-19.9"	24	21	6	43	0	0
>=20"	42	19	57	11	72	4.5
All Logs	308	11	218	14	358	8
Percent Ground Cover	8.7		6.5		5.1	

Social and Recreation Use

Refer to Salmon-Huckleberry LSR/Wilderness Complex social and Recreation Use section, this chapter, for a summary of uses along the Clackamas River Corridor. As already noted, State Highway 224/Road 46 is a primary transportation route in the LSR. It serves as a main arterial to other access roads throughout the entire river drainage.

The Olallie Lake Scenic Area was created in 1965. Timber harvest has not occurred within the area since that time. The Olallie area is unique because it is a high elevation plateau straddling the crest of the Cascades, with over 200 lakes in a region dominated by rivers and streams. As in the past, the scenic area still attracts seasonal recreation use and an estimated 30,000 users visit the scenic area during the summer and early fall season to camp, hike, fish, hunt, and gather huckleberries. Accessed by only one primitive road, Road 4220, the landscape has a remote and primitive character. Recreation use is concentrated at facilities along the road. Only three of the eight developed campgrounds in the scenic area are in the LSR and dispersed motorized camping are restricted. An estimated 23 miles of trail are within the LSR, including the Pacific Crest Trail, which serve as internal linkages between the lakes and buttes.

The Olallie Lake Scenic area is also recognized as a huckleberry harvest area for the Confederated Tribes of Warm Springs.

Treatment Summary

Refer to **Treatment Chapter (Chapter 6)** for detailed information on treatment activities.

Young Stand Thinnings (Precommercial)

Landscape Objective

Reduce fragmentation and edge effects to existing late-successional forest in short-term, accelerate development of late-successional forest characteristics and increase amount of late-successional forest over long-term.

Young Stand Thinnings (Commercial)

Landscape Objective

Accelerate development of late-successional characteristics in the short-term including specific attention to increasing snag and down wood amounts.

Providing down wood in powerline corridor (southern portion of LSR) would improve dispersal of small mammals and terrestrial amphibians. Opportunities may exist to leave some trees in deep draws within the corridor.

Any risk reduction activity in lodgepole pine stands should consider the needs of black-backed and three-toed woodpeckers for dead and dying trees. Insect infested trees provide important habitat for these birds.

Fire and Fuels

The Upper Clackamas LSR includes the upper portion of the Clackamas River Wild and Scenic River Corridor and a portion of the Olallie Lake Scenic Area. This area receives high recreational use from dispersed camping, sight-seeing, and forest visitors traveling from the Portland metropolitan area to Olallie Lake area. All of this area has good access for fire suppression and prevention. Austin Hot Springs (private dispersed recreational area) is located within this area (155 acres). Numerous salvage sales along the Clackamas River corridor have removed most of the CWD and downed fuel loading from the area. The area adjacent to the Confederate Tribes of Warm Springs is comprised of dense stands of true fir that are stagnated and in declining thrift. Upper Clackamas has a fire occurrence rate of 0.110-.182 fires/1,000 acres/year.

There are four fire groups within the Upper Clackamas LSR. Fire group 7 comprises approximately 46 percent (14,940 acres), fire group 9 comprises approximately 32 percent (10,265 acres), fire group 8 comprises approximately 22 percent (7,087 acres), and fire group 5 comprises less than 1 percent (5 acres). See Chapter 5, Fire Risk Mitigation Recommendations.

Soosap LSR

Current Vegetation and Habitat

This 10,055-acre LSR in the west-central portion of the Assessment Area is not directly adjacent to wilderness or other LSRs. Nonfederal land lies adjacent to about one half of this LSR. This LSR is managed by BLM and Forest Service (Map 4-4). Elevations are relatively high within the LSR. Prominent features within the LSR include South Fork Mountain (4,853 feet), Soosap peak (4,661 feet) and Memaloose Lake.

The Soosap LSR is split between the Western Hemlock Zone which occupies 46 percent of the area primarily in the western BLM portion and the Pacific Silver Fir Zone (54 percent) which dominates higher elevational areas primarily in the eastern half.

Large, relatively unfragmented blocks of late-successional habitat occur in the west portion of the Soosap LSR. In the east portion of the LSR the late-successional habitat is less contiguous but the intervening mid-seral forests serve as dispersal habitat. The predominantly high elevations make habitat for low elevation species such as the red tree vole minimal in this LSR.

Table 4-10. Current Vegetation: Percent Seral Stage by Land Area Within the Complex

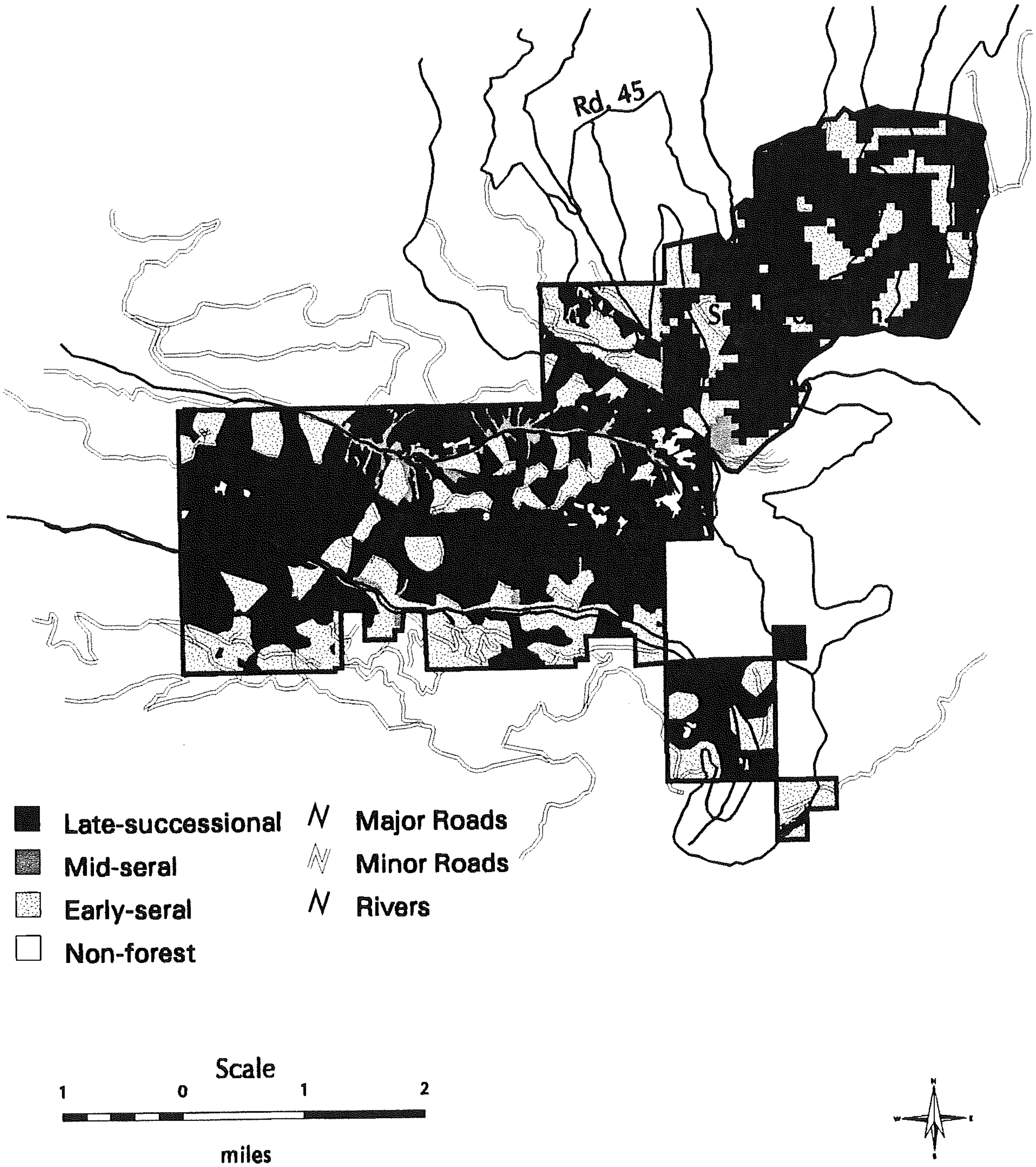
Seral Stage	Soosap LSR (208) (10,055 acres)
Late-successional	69
Mid-seral	1
Early-seral	28
Non-forest	2

Connectivity

A narrow portion of the Roaring River LSR (207A) lies less than one mile to the north and is connected by Riparian Reserve. Table Rock LSR (209A) lies about one mile to the south and is connected somewhat by Riparian Reserves. The southern portion of the Soosap LSR along with the northern portion of Table Rock LSR just below it, form an allocation checkerboard of LSR intermixed with Matrix lands.

The only connectivity concern within the LSR itself, is a ridge above 4,000 feet that runs near the border of BLM and FS lands.

Map 4-4. Soosap LSR



Coarse Woody Debris

Data from Forest Service and BLM were not compatible so they were analyzed and reported separately.

In the Forest Service portion of the LSR, snags greater than 15 inches dbh are relatively abundant in all seral stages (Table 4-11). Down wood levels are some of the lowest in the analysis area, especially in early-seral habitats (Table 4-12). Data from early-seral habitats, however, are from just one plot.

Table 4-11. Existing Snag Levels in Soosap LSR. Data from Forest Service CVS Plots

	Late-successional Stands (n=10)		Mid-seral Stands (n=4)		Early-seral Stands (n=1)	
Snag dbh	#/Acre	Avg. Height (feet)	#/Acre	Avg. Height (feet)	#/Acre	Avg. Height (feet)
3-14.9"	30	23	98	38	0	0
15-24.9"	16	43	19	44	10	19
>=25"	8	45	1	9	5	7
All Snags	54	33	118	39	15	15

Table 4-12. Existing Down Wood Levels in Soosap LSR, Data from Forest Service CVS Plots

	Late-successional Stands (n=10)		Mid-seral Stands (n=4)		Early-seral Stands (n=1)	
Log Diameter	#/Acre	Avg. Length (feet)	#/Acre	Avg. Length (feet)	#/Acre	Avg. Length (feet)
3-14.9"	164	9	151	9	0	0
15-19.9"	31	13	0	0	0	0
>=20"	25	33	4	80	0	0
All Logs	72	12	155	11	0	0
Percent Ground Cover	4.2		2.2		0	

There were no BLM plots in mid-seral habitats. No snags were sampled in five late-successional habitat plots (Table 4-13). A few snags occurred in early-seral habitats. Log levels in late-successional and early-seral stands were low compared to other LSRs in the Assessment Area (Table 4-14).

Table 4-13. Existing Snag Levels in Soosap LSR, Data from BLM CVS Plots, No Plots Occurred in Mid-Seral Stands

Snag dbh	Late-successional Stands (n=5)		Mid-seral Stands (n=0)		Early-seral Stands (n=7)	
	#/Acre	Avg. Height (feet)	#/Acre	Avg. Height (feet)	#/Acre	Avg. Height (feet)
All Snags	0	ND	ND	ND	7	ND

ND = No Data

Table 4-14. Existing Down Wood Levels in Soosap LSR, Data From BLM CVS Plots, No Plots Occurred in Mid-Seral Stands

Log Diameter	Late-successional Stands (n=5)		Mid-seral Stands (n=0)		Early-seral Stands (n=7)	
	#/Acre	Avg. Length (feet)	#/Acre	Avg. Length (feet)	#/Acre	Avg. Length (feet)
3-14.9"	16	22	ND	ND	29	18
15-24.9"	12	14	ND	ND	24	12
>=25"	1	6	ND	ND	0	0
All Logs	29	18	ND	ND	53	15
Percent Ground Cover	1.3		ND		2.5	

ND = No Data

Social and Recreation Use

Recreation opportunities and uses on public land in the western fringe of the assessment area are limited. Public lands are often made up of relatively small tracts of land and road access is limited. There are no known recreation developments, trails, or landscape features. Recreation activities have been limited to adventure driving, target shooting, hunting, and some fishing. The area is primarily used by local residents for short term daytime activities. South Fork Mountain is a recreation destination in the South Fork Clackamas Watershed. The peak has road and trail access to the summit of 4,840 feet and is valued for the scenic vista of five volcanoes.

Treatment Summary

Refer to **Treatment Chapter (Chapter 6)** for detailed information on treatment activities.

Young Stand Thinnings (Precommercial)

Landscape Objective

Reduce fragmentation and edge effects to existing late-successional forest in short-term. Accelerate development of late-successional forest characteristics and increase amount of late-successional forest over long-term.

Young Stand Thinnings (Commercial)

Landscape Objective

Accelerate development of late-successional characteristics in the short-term including specific attention to increasing snag and down wood amounts.

Table Rock LSR/Wilderness Complex

Landforms include sharp ridges, narrow draws with steep sideslopes and occasional terraces and meadows.

Current Vegetation and Habitat

This LSR is fairly evenly divided between the western hemlock zone (56 percent) and the Pacific silver fire zone (44 percent) features notable vegetative diversity.

Table 4-15. Seral Stage Amounts by Percent, Table Rock LSR

Seral Stage	Table Rock LSR (17,408 ac)
Late-successional	49
Mid-seral	6
Early-seral	43
Non-forest	2

The Table Rock area supports a large, relatively unfragmented block of late-successional habitat centered around the wilderness (Map 4-5). The western portion of the complex is older forests fragmented by younger managed stands of the last two decades. The eastern portion becomes more fragmented with old growth stands dispersed with young and mid seral stands. The intervening stands which connect the wilderness portion to the eastern portion, (approximately four square mile block of land) was formerly private industrial forest that was acquired by the BLM.

Connectivity

There is currently a four square mile area in the middle of the Table Rock Complex that is devoid of late-successional or dispersal habitat. The complex is effectively divided into two pieces by this area. Species with poor dispersal capabilities would have a difficult time moving between the two portions of the complex. This area would be a high priority for silvicultural treatment to accelerate development of dispersal habitat in the short-term and late-successional habitat in the long-term.

Coarse Woody Debris

No snags were sampled in 12 early seral plots (Table 4-16). A few snags were found in late-successional stands but at low levels compared to Forest Service data in other LSRs in the Assessment Area. This may be an artifact of the data collection methods. No plots were located in mid-seral stands.

Map 4-5. Table Rock LSR/Wilderness Complex

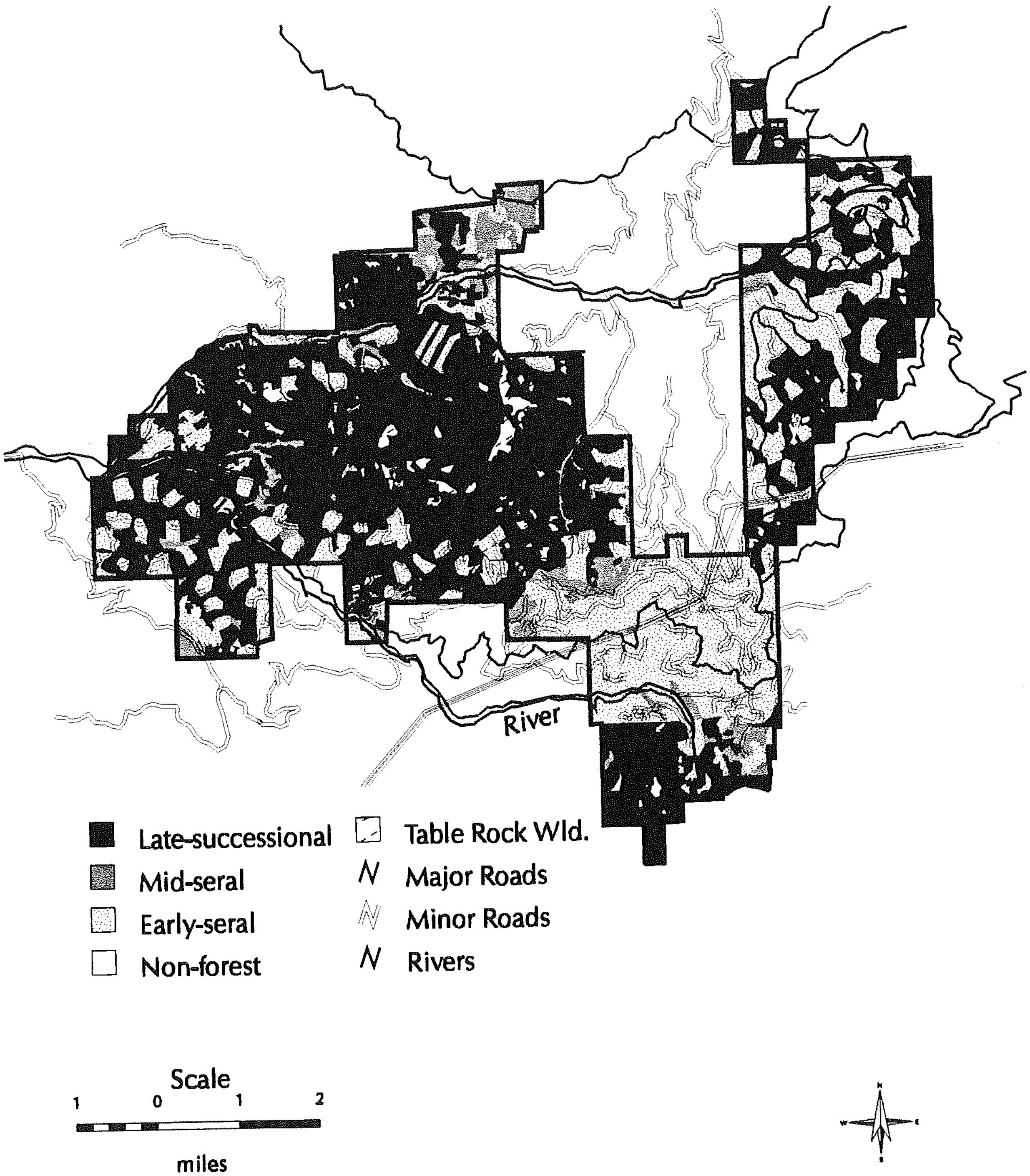


Table 4-16. Existing Snag Levels in Table Rock LSR, Data From BLM CVS Plots, No Plots Occurred in Mid-Seral Stands

Snag dbh	Late-successional Stands (n=20)		Mid-seral Stands (n=0)		Early-seral Stands (n=12)	
	#/Acre	Avg. Height (feet)	#/Acre	Avg. Height (feet)	#/Acre	Avg. Height (feet)
All Snags	10.5	ND	ND	ND	0	ND

Relatively low levels of down logs occurred in both late and early-seral stands (Table 4-17). Wilderness designation in part of the area limits mitigation for low levels by creating coarse woody debris.

Table 4-17. Existing Down Wood Levels in Table Rock LSR, Data From BLM CVS Plots, No Plots Occurred in Mid-Seral Stands

Log Diameter	Late-successional Stands (n=20)		Mid-seral Stands (n=0)		Early-seral Stands (n=12)	
	#/Acre	Avg. Length (feet)	#/Acre	Avg. Length (feet)	#/Acre	Avg. Length (feet)
3-14.9"	20	14.5	ND	ND	13	13.5
15-24.9"	11	25.5	ND	ND	24	14
>=25"	8	20	ND	ND	12	18
All Logs	39	19	ND	ND	49	15
Percent Ground Cover	2.3		ND		2.6	

Social and Recreation Use

The upper Molalla River, from the confluence of the Table Rock fork to the Glen Avon area is considered as an eligible Wild and Scenic River and a high use recreation corridor. The confluence is the beginning of the western edge of the LSR complex which contains the 6,000-acre Table Rock Wilderness. Private land is located along the southwestern edge of the wilderness on the river. It can be assumed that the private forest owners will continue to harvest their timber in late mid-seral rotations. This portion of the Molalla River has also been shown in recent studies to be one of the best breeding sites for the harlequin duck.

The Molalla River Recreation Corridor and Table Rock Wilderness are part of a designated Special Recreation Management Area. The area is heavily used for dispersed recreation including camping, fishing, hunting, mountain biking, horseback riding, target shooting and other activities. It is estimated that the area is visited by more than 25-50,000 visitors each year. The Molalla River's proximity to Portland and the densely populated northern Willamette Valley, combined with extensive road access and river and trail resources provide exceptional recreation opportunities for meeting the continued increasing demand for recreational developments. Four trailhead access points to wilderness trails exist within the LSR. There are no developed recreational facilities in the Molalla so that dispersed camping and use occurs along the Middle Fork and the main river within the LSR. This dispersed use is within the riparian zones and although it was existing prior to the Northwest Forest Plan, it may not be meeting the intent of the Aquatic Conservation Strategy. Management opportunities will be pursued to prevent further degradation and restore habitat.

Treatment Summary

Refer to **Treatment Chapter (Chapter 6)** for detailed information on treatment activities.

Young Stand Thinnings (Precommercial)

Landscape Objective

Provide connectivity while enhancing tree growth with a continuous canopy.

Young Stand Thinnings (Commercial)

Landscape Objective

Accelerate large tree growth, increase CWD component, promote multi-layered canopies and multiple species.

There are two areas of concern within the complex where large areas of young stands are currently present. These large blocks of young stands disrupt connectivity of late-successional forest at the landscape scale. Treatments should balance tree growth enhancement with a desire to achieve rapid canopy closure of 11 inch+ dbh trees. Initial thinning of less than maximum spacing followed most likely by more than one commercial thin (before 80 years of age) to further enhance tree growth and create coarse woody debris.

Along the edges of the complex there are young stands that fragment a matrix of existing late-successional forest. Thinning these stands to a wider spacing to accelerate growth of large diameter trees and create some wolf trees will be considered followed by one or no commercial thinning. Variable spacing to create opportunities for natural understory development will be used

Fire and Fuels

Most if not all of the Table Rock complex was burned over by wildfire in the late 1880s and early 1900s. As a result of repeated wildfires over the years, the residual downed fuel loading and CWD is low throughout the area. Table Rock is adjacent to private industrial forest land. Table Rock has a general fire occurrence rate of approximately 0.029 fires/1,000 acres/year.

There are two fire groups within the Table Rock complex. Fire group 8 comprises approximately 89 percent (21,604 acres) and fire group 6 comprises approximately 11 percent (2,553 acres). This area is considered a low risk to catastrophic loss from wildfire.

Abiqua Butte LSR

This is a small isolated LSR which was designated to provide a stepping stone to the Silver Falls State Park. The acreage is composed of lands within three different sections of BLM ownership which borders other BLM land and private industrial land. The area is at a low elevation and may provide important refugia for some low elevation species such as fungi, bryophytes and lichens (Map 4-6).

Current Vegetation and Habitat

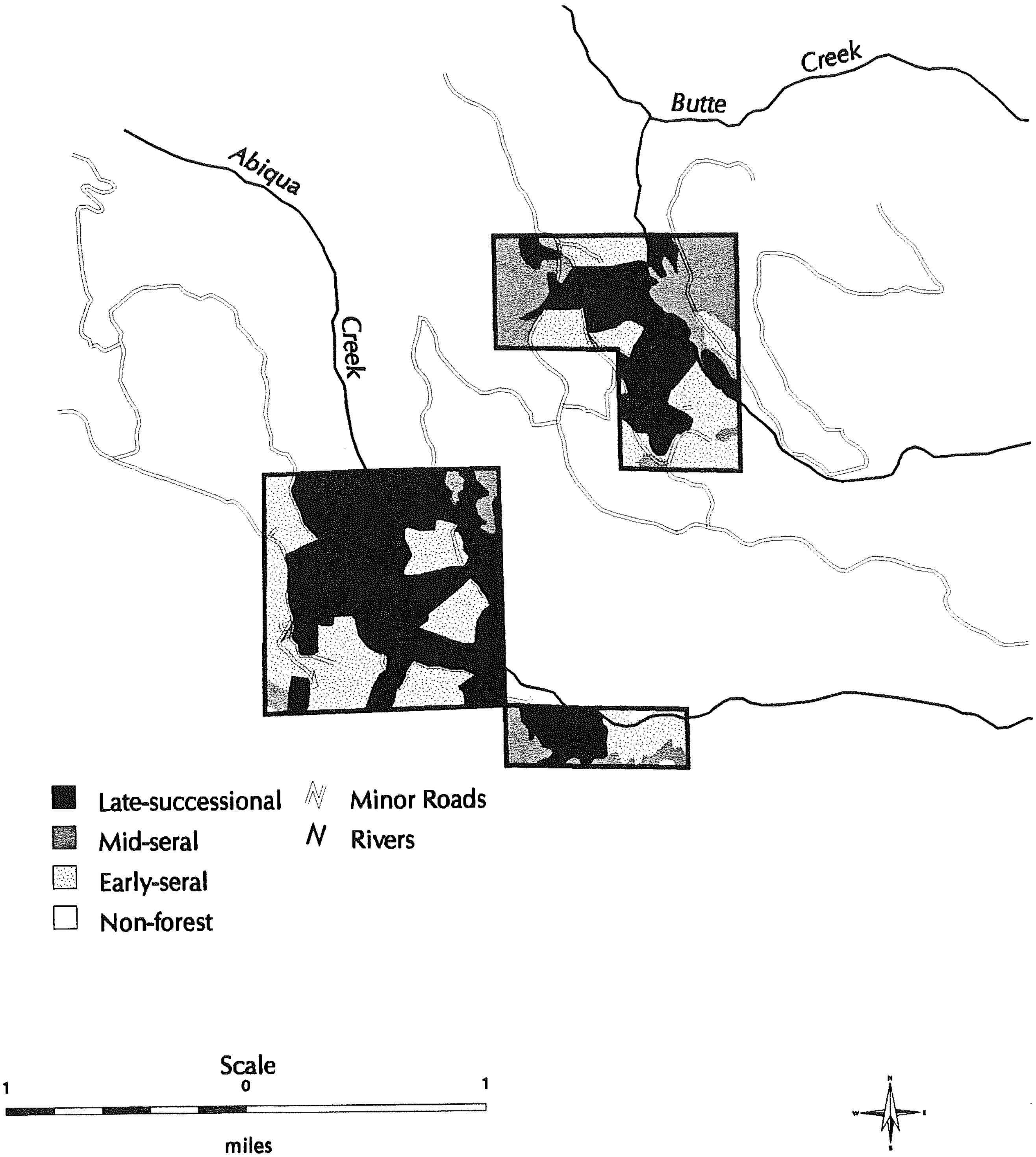
This LSR is within the Western Hemlock Zone.

Table 4-18. Seral Stage Amounts by Percent, Abiqua Butte LSR

Seral Stage	Abiqua Butte LSR (1191 ac)
Late-successional	53
Mid-seral	11
Early-seral	32
Non-forest	4

Within each section of this LSR the largest patch is late successional forest with patches of mid and early seral located mostly along the section boundaries. The stands less than 80 years of age may benefit from young stand thinnings. These are designed to accelerate development of late-successional characteristics and reduce fragmentation. Precommercial prescriptions will be common in many of the plantations. CWD objectives will have a priority in addition to tree growth enhancement, especially in plantations of commercial size.

Map 4-6. Abiqua/Butte LSR



Connectivity

The LSR is isolated from the rest of the LSR network. Species with greater dispersal distances will be able to benefit as well as species that need a low elevation refuge.

Coarse Woody Debris

No inventory plots occur within this section so no accurate coarse woody debris data is available.

Social and Recreation Use

Recreation opportunities and uses on public land in the western fringe of the Assessment Area are limited. Public lands are often made up of relatively small tracts of land and road access is limited. There are no known recreation developments, trails, or landscape features. Recreation activities have been limited to adventure driving, target shooting, hunting, and some fishing. The area is primarily used by local residents for short-term daytime activities.

Treatment Summary

Refer to **Treatment Chapter (Chapter 6)** for detailed information on treatment activities.

Young Stand Thinnings (Precommercial)

Landscape Objective

Minimize fragmentation and accelerate contiguous late-successional forests.

Young Stand Thinnings (Commercial)

Landscape Objective

Accelerate large tree growth, increase CWD component, and promote multi-layered canopies and multiple species.

Fire and Fuels

Most, if not all, of the Abiqua habitat block was burned over in a 1,000,000+ acre fire that occurred in the mid to late 1800s. Abiqua is surrounded by private industrial forest land. Because of the past fire history, it has low levels of CWD and down fuel loading. All of this habitat block is located in fire group 8. The stand composition is 100 year old mixed Douglas-fir and western hemlock. Based on limited access, low fuel loading, age of timber, and relatively low ignition sources, the risk of catastrophic loss from fire is low. The general fire occurrence rate for this area is calculated at 0.029 fire/1,000 acres/year.

Bull of the Woods LSR/Wilderness Complex

The Bull of the Woods Wilderness along with the Bagby LSR (209B) to the west, and the Collawash LSR (210) to the east, combine to form a large potentially well connected LSR/wilderness block (50,799 acres). This area lies within the Mt. Hood National Forest (Map 4-7). It is adjacent to the Opal Creek LSR/Wilderness complex which lies to the west on the Willamette National Forest (described separately in this chapter). This two areas along with the Opal Creek Scenic Area provide a large connected area for potential late-successional forest conditions.

Elevations in the Bull of the Woods Complex vary from 1,660 feet to 5,599 feet with an average of 3,442 feet elevation. The higher elevations occur in the wilderness. The average elevation in Bagby LSR is 3,265 feet while that of the Collawash is 2,877 feet.

Current Vegetation and Habitat

The two LSRs in this complex are dominated by the more productive, lower elevational Western Hemlock Zone, while the majority of the wilderness is within the Pacific Silver Fir and Mountain Hemlock Zone. For the entire complex, Pacific Silver Zone dominates at 51 percent, Western Hemlock Zone comprises 38 percent, and the Mountain Hemlock Zone makes up 11 percent.

Map 4-7. Bull of the Woods LSR/Wilderness Complex

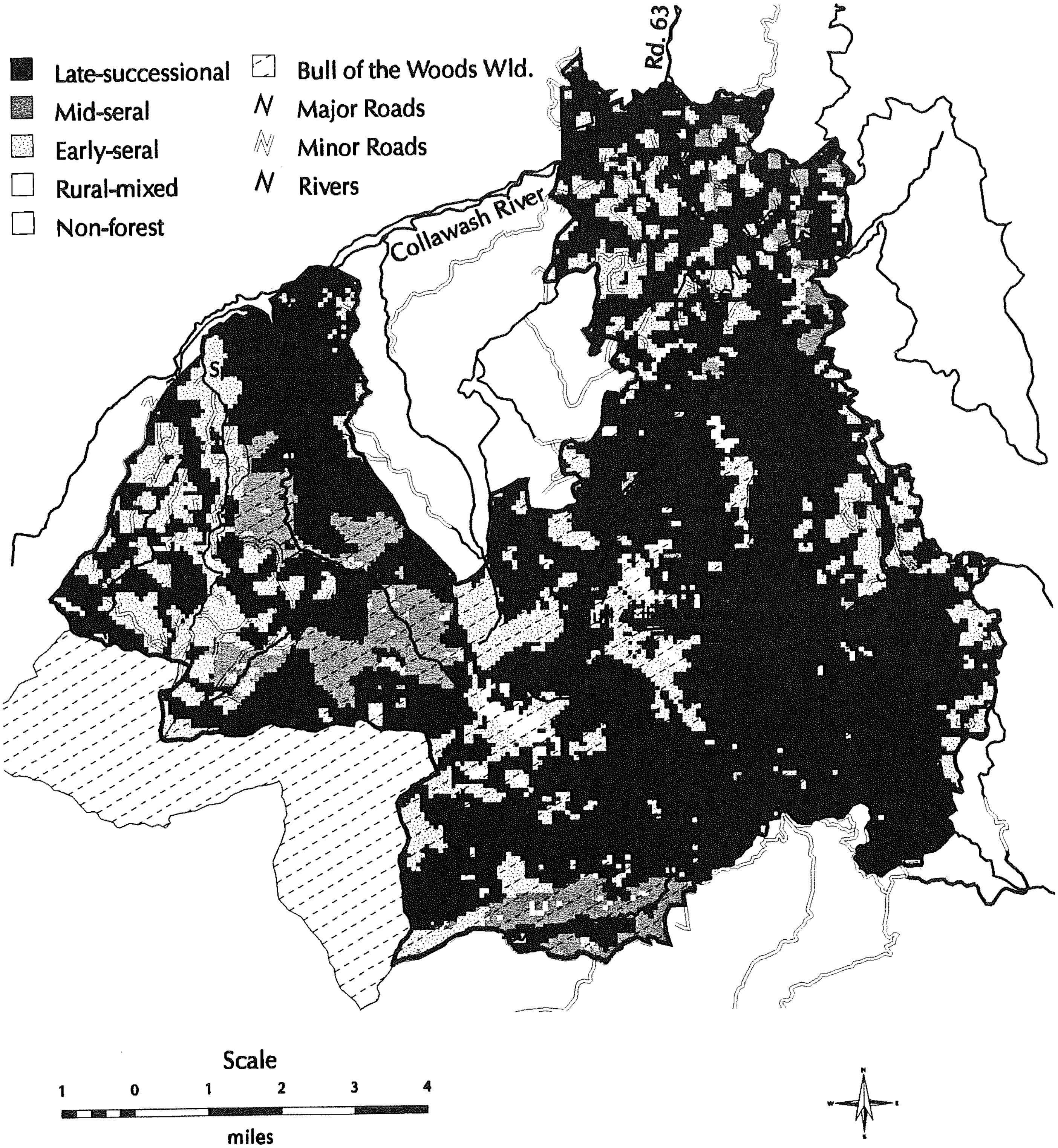


Table 4-19. Seral Stage Amounts by Percent, Bull of the Woods LSR/Wilderness Complex

Seral Stage	Bagby LSR 209B (8228 acres)	Collawash LSR 210 (16,170 acres)	Bull of Woods Wilderness (26,401 acres*)	Entire LSR-Wld Complex (50,799 acres)
Late-successional	59	74	73	71
Mid-seral	5	4	12	8
Early-seral	36	21	13	19
Non-forest	0	1	2	2

* *Note: A portion of the Bull of the Woods Wilderness lies on the Willamette NF and is accounted for within the Opal Creek Complex.*

This complex has a high percentage of late-successional habitat (71 percent). Within the LSRs (209B and 210), late-successional stands are also common, but are often fragmented by early seral stands created from recent timber harvest. There are large, unfragmented blocks of late-successional habitat at the north end of the Bagby LSR and the south end of Collawash LSR, both which extend into the adjacent Bull of the Woods Wilderness. The south end of Bagby LSR and north end of Collawash LSR are fragmented. The intervening stands are mostly young stands which are not providing even dispersal habitat. Silvicultural treatments that would accelerate the development of dispersal habitat in the short-term, and late-successional habitat in the long-term would aid in reducing the effects of the fragmentation in these areas.

The Bull of the Woods Wilderness contains some large, unfragmented blocks of late-successional and dispersal habitat. Because of the Wilderness designation there is no opportunity to accelerate the development of large areas of dispersal habitat into late-successional habitat. There is some natural fragmentation caused by areas of rock outcrops and ridges.

Connectivity

A north/south high elevation ridge runs through the middle of the wilderness. This divides the complex in half for species that do not use high elevation habitats in the Mountain Hemlock Zone.

Coarse Woody Debris

Numbers of snags greater than 15 inches dbh in late-successional habitats are slightly above average for the Assessment Area (Table 4-20). Moderate levels of larger (15 inches) snags occur in mid- and early-seral stands. There are large numbers of small snags in mid-seral stands.

Table 4-20. Existing Snag Levels in Bull of the Woods Complex, Data From Forest Service CVS Plots

Snag dbh	Late-successional Stands (n=40)		Mid-seral Stands (n=14)		Early-seral Stands (n=9)	
	#/Acre	Avg. Height (feet)	#/Acre	Avg. Height (feet)	#/Acre	Avg. Height (feet)
3-14.9"	19	22	83	27	4	18
15-24.9"	12	27	9	33	5	34
>=25"	5	41	1	80	3	63
All Snags	36	27	63	28	13	37

The amount of down wood in early-seral stands is high with a large number of large diameter (>20 inches) logs (Table 4-21). Levels of down wood in late-successional stands is a bit below the average for the Assessment Area but numbers of large (20 inches) logs is higher than in any other LSR or complex. The amount of down wood in mid-seral stands is high compared to levels in other LSRs and complexes.

Table 4-21. Existing Down Wood Levels in Bull of the Woods Complex, Data From USFS CVS Plots

Log Diameter	Late-successional Stands (n=40)		Mid-seral Stands (n=14)		Early-seral Stands (n=9)	
	#/Acre	Avg. Length (feet)	#/Acre	Avg. Length (feet)	#/Acre	Avg. Length (feet)
3-14.9"	161	9	270	12	233	10
15-19.9"	22	15	5	37	84	9
>=20"	47	23	19	25	82	18
All Logs	230	12	295	13	399	11
Percent Ground Cover	7.3		6.5		12.5	

Social and Recreation Use

Bagby Hot Springs is the area of highest concentrated recreation use in LSR 209 with an estimated 40-50,000 visitors per year. The 5 to 6 acre use area for the hot springs includes rustic baths and the old Bagby Guard Station. Access to Bagby is by trail #544 which also serves as access to the Bull of the Woods Wilderness The trailhead for Bagby is a site of frequent vandalism, car clouting, and repeated incidents of antisocial behavior. Use at Bagby is day use only but dispersed camping occurs upstream from the developed facilities at Shower Creek. Bagby Hot Springs has also been listed on the National Register of Historic Places. In an MOU with the volunteer group Friends of Bagby, firewood collection in the LSR is restricted and pellet fuel for administrative use is hauled in from off-site. This restriction is consistent with the coarse woody debris objectives for the LSR.

Bagby Hot Springs is also surrounded by a Research Natural Area (RNA) allocation under the Mt. Hood Forest Plan. The objective of the RNA allocation is to preserve examples of natural ecosystems in an unmodified condition for research and education; and to provide areas to serve as a baseline against which human impacts on natural systems can be measured.

The Collawash Watershed Analysis recommends changing the land allocation for Bagby from LSR to Matrix to permit greater management flexibility. Given the provisions of the existing MOU, and the location within a Riparian Reserve surrounded by a large block of high quality late-successional habitat in an RNA, any change in land allocation is not considered with LSR objectives.

Although Bagby is the only developed recreation facility in LSRs 209 and 210, trailheads in the LSR serve as access points for the extensive network of trails in the Bull of the Woods Wilderness.

Treatment Summary

Refer to **Treatment Chapter (Chapter 6)** for detailed information on treatment activities.

Young Stand Thinnings (Precommercial)

Landscape Objective

Reduce fragmentation and edge effects to existing late-successional forest in short-term, accelerate development of late-successional forest characteristics and increase amount of late-successional forest over long-term.

Local areas of high road concentration exist in the Bagby and Collawash LSRs. Opportunities for road decommissioning exist in both LSRs. Timing with stand enhancement activities should be considered.

Young Stand Thinnings (Commercial)

Landscape Objective

Accelerate development of late-successional characteristics in the short-term including specific attention to increasing snag and down wood amounts.

Fire and Fuels

Bull of the Woods complex includes Bagby Hot Springs. Bagby is a high recreation use area attracting visitors from the Portland metropolitan area. The Bull of the Woods Wilderness area has a moderate recreational use by hikers and backpackers. This complex has an average fire occurrence rate of .049 fires /1,000 acres/year. There are three fire groups within the Bull of the Woods Complex. Fire group 8 comprises approximately 41 percent (20,722 acres), fire group 9 comprises approximately 36 percent (18,431 acres), and fire group 6 comprises approximately 23 percent (11,646 acres). The stand structure is basically large second growth and old-growth forest with high CWD and moderate downed fuel loading. The west and northwest sides of the complex have several areas with high amounts of windthrow timber. This blown down timber is mainly associated with adjacent timber harvest operations. Because of the low fire frequency interval and limited access, this area has a low risk to catastrophic loss from wildfire.

Opal Creek LSR/Wilderness Complex

The Oregon Resource and Conservation Act of 1996 incorporated land allocation changes that ultimately broke the original, much larger LSR 209 into three allocations: Opal Creek Wilderness, Opal Creek Scenic Area, and LSR.

Current Vegetation and Habitat

This LSR is fairly evenly divided between the Western Hemlock Zone (51 percent) and the Pacific Silver Fire Zone (49 percent).

Table 4-22. Seral Stage Amounts by Percent, Opal Creek LSR

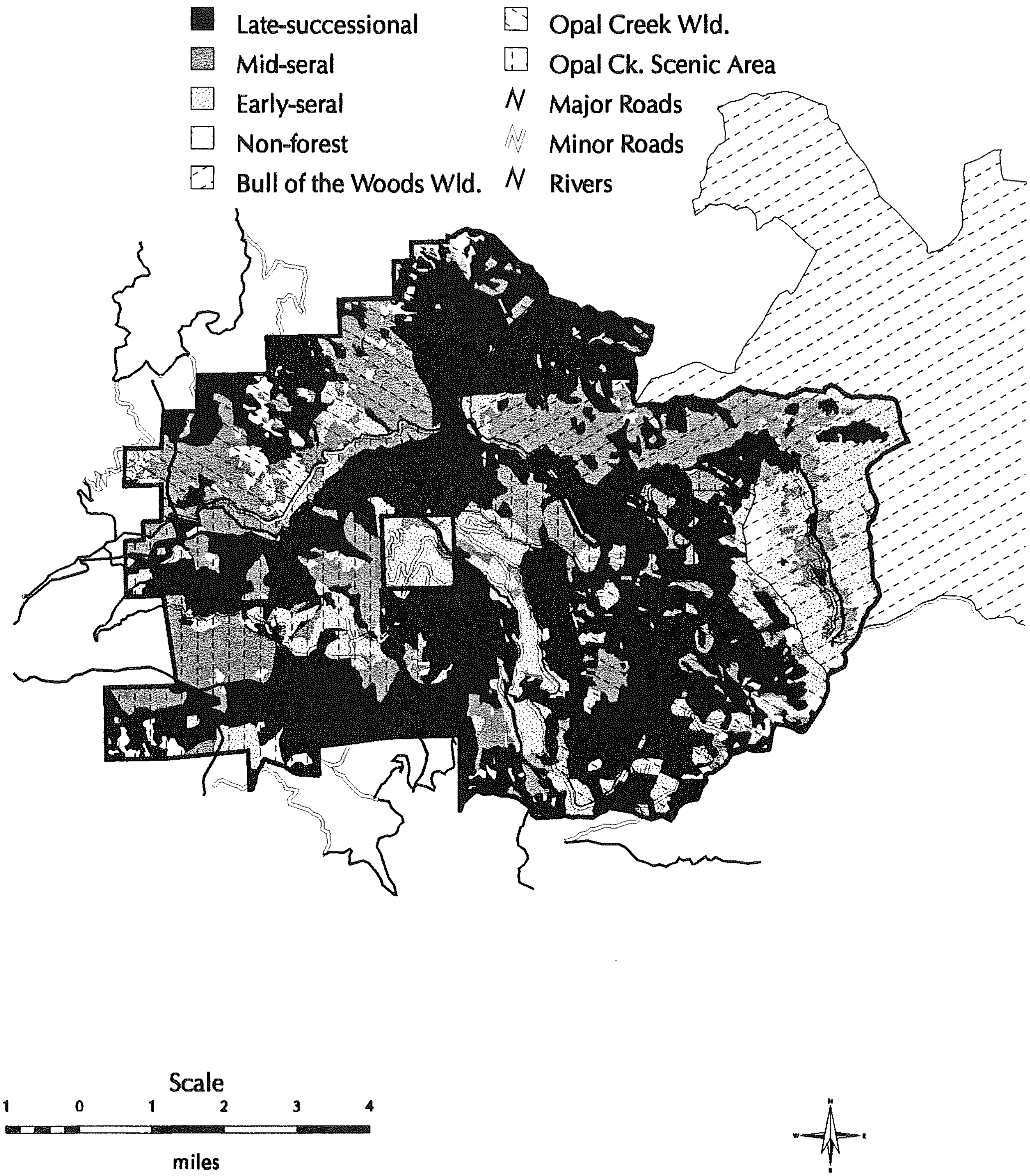
Seral Stage	Opal Creek LSR (3133 ac)
Late-successional	51
Mid-seral	13
Early-seral	35
Non-forest	1

Within the wilderness area late successional habitat occurs in large, relatively, unfragmented blocks with intervening dispersal habitat. A similar condition occurs in the adjacent Opal Creek Scenic Recreation Area (SRA). Stand average diameter for much of the late-successional habitat in the Opal Creek area is less than 21 inches. However, the Little North Santiam Watershed analysis team felt that the stands were functioning as late-successional habitat. This patch of LSR was carved out of the recently legislated Opal Creek area because of the past management of its timber resources. Half of the LSR designated lands are in earlier seral stands.

Connectivity

The Opal Creek Complex is somewhat isolated from the Table Rock and Bull of the Woods complexes by a high elevation ridge that runs northwest to southeast. The ridge presents a barrier to low elevations species such as the red tree vole.

Map 4-8. Opal Creek LSR/Wilderness Complex



Coarse Woody Debris

Coarse woody debris data for the Opal Creek complex includes plots in the adjacent Opal Creek Scenic Area. Numbers of large (15") snags are low in late and mid seral stands and relatively high in early seral stands as compared to other LSR complexes (Table 4-23). There are relatively high numbers of small snags in late and mid-seral stands.

Table 4-23. Existing Snag Levels in Opal Creek Complex, Data From FS CVS Plots

	Late-successional Stands (n=6)		Mid-seral Stands (n=30)		Early-seral Stands (n=8)	
Snag dbh	#/Acre	Avg. Height (feet)	#/Acre	Avg. Height (feet)	#/Acre	Avg. Height (feet)
3-14.9"	64	34	76	16	6	20
15-24.9"	3	40	3	19	7	18
>=25"	2	53	2	35	3	39
All Snags	69	35	8	17	16	22

Percent cover of logs in late-successional stands is lower than in any other LSR or Complex (Table 4-24). The number of large logs (20 inch) is low and the logs are relatively short. Percent cover of logs in early-seral stands is the highest of any LSR or complex, with high numbers of late (20 inch) logs. Numbers and percent cover of logs in mid-seral stands are relatively low.

Table 4-24. Existing Down Wood Levels in Opal Creek Complex, Data From FS CVS Plots

	Late-successional Stands (n=6)		Mid-seral Stands (n=30)		Early-seral Stands (n=8)	
Log diameter	#/Acre	Avg. Length (feet)	#/Acre	Avg. Length (feet)	#/Acre	Avg. Length (feet)
3-14.9"	115	6	142	9	309	5
15-24.9"	0	0	12	15	47	14
>=25"	12	19	23	14	83	20
All Logs	128	7	176	10	439	9
Percent Ground Cover	1.2		3.3		12.9	

Social and Recreation Use

Opal Creek LSR is located between the new Opal Creek Wilderness and the Opal Creek SRA. Two roads are within the LSR, Road 2207 which provide access to Opal Lake and a low maintenance road,#224, which leads to the Phantom Natural Bridge trailhead. Dispersed camping occurs along both roads and is considered moderate on Road 2207 and low on Road 225. There are also a number of abandoned mines on Road 225. The only developed trail in the LSR, #3347 connects with the Bull of the Woods trail system; use is considered light. Numerous informal user trails exist, and a need has been identified to formalize 1.4 mile of existing user trial to protect the physical and biological resources.

Other Concerns

The Bornite Project, a proposed underground copper mine is located approximately three miles southeast of Shady Cove Campground along Cedar Creek. This project was proposed to the U.S. Forest Service in 1991 by Plexus Corporation (now known as Kinross Copper Corporation) and approved in the Decision Notice for the Environmental Impact Statement in April 1993. Since that time, Kinross has attempted to obtain the necessary permits needed to operate the mine as described in the EIS completed for the project. In the fall of 1993, it was discovered that a ruling by the Oregon State Department of Environmental Quality (ODEQ) disallowed any discharge of waste water from commercial sites into streams within the North Santiam drainage. As a result of this finding, the Three-Basin Rule was established to better define the ruling. In 1994, Kinross began lobbying for a rule change to allow the mine to operate with modifications to the waste water discharge systems. No rule changes were made. Subsequently, in the fall of 1996, Kinross Copper Corporation filed a lawsuit against the state of Oregon in the Multnomah County Circuit Court. They contended that the state violated its constitution by essentially condemning the company's property without just compensation and by not allowing the development of the mine. Kinross Copper Corporation's motion was denied. As of December of 1997, the case is now before the Oregon Court of Appeals.

This project was proposed before the implementation of the Northwest Forest Plan. It does not appear to be consistent with the objectives of LSR since above ground disturbing activities would occur along with the underground mining.

Treatment Summary

Refer to **Treatment Chapter (Chapter 6)** for detailed information on treatment activities.

Young Stand Thinnings (Precommercial)

Landscape Objective

Reduce fragmentation and edge effects to existing late-successional forest in short-term: accelerate development of late-successional forest characteristics, and increase amount of late-successional forest over long-term.

Young Stand Thinnings (Commercial)

Landscape Objective

Accelerate development of late-successional characteristics in the short-term including specific attention to increasing snag and down wood amounts which are often low in mid-seral stands in this complex.

Fire and Fuels

Opal habitat block is located directly south of the Bull of the Woods habitat block. Opal is bounded on the west side by intermixed private industrial forest land and Bureau of Land Management land. A large portion of the west half of this habitat block was burned over in the mid to late 1800s. Because of its' accessibility via private land and BLM/FS land, it has moderate recreational visitor use. The stand structure is mixed large second growth and old growth timber with moderate cwd and downed fuel loading on the east half, and smaller second growth light fuel loading on the west half. Opal has an average fire occurrence rate of 0.049 fire/1,000 acres/year. There are two fire groups within the Opal habitat block, fire group 8 comprises approximately 97 percent (35,931 acres) and fire group 6 comprises approximately 3 percent (1,035 acres).

Chapter 5
Fire Management Plan

Chapter 5

Fire Management Plan

Introduction

Major goals for managing LSRs within the Northwest Forest Plan are to maintain and protect late-successional forest ecosystems from loss due to large scale fire, insect and disease epidemics, and major human impacts. Natural ecosystem processes such as gap-dynamics, natural regeneration, pathogenic fungal activity, insect herbivory, and low-intensity fire should be maintained. (ROD, B-1).

The goal of this fire management plan is to provide information on the level and distribution of current risk from catastrophic wildfire and provide guidelines on how to mitigate risk. The judicious use of prescribed fire for hazard reduction has the potential to restore ecosystem processes, lower smoke emissions from wildfires, limit the size of wildfires by facilitating fire suppression (while using methods that have a lower environmental impact), and reduce the costs of wildfire suppression. This plan provides direction for appropriate fire management activities for wildfire prevention, detection, suppression, and hazard reduction. In addition, it describes the uses, benefits and priorities of prescribed fire within the assessment area.

Current fire management strategies on all federal lands in the project area include prevention, detection, and suppression of wildfires in conjunction with natural and activity created fuel treatment program. Three suppression responses to wildfires are allowed under manual direction:

- confine,
- contain, and
- control.

The Mt. Hood National Forest uses a centralized dispatch system on single starts and a district dispatch on multiple starts. All fires handled by Mt. Hood Dispatch start with a control strategy. Since district dispatch is not employed until multiple starts occur, burning conditions are such that only a control strategy is used. Confine and contain strategies are almost never used. The BLM fire management prevention and detection are contracted through the State of Oregon.

In general, forests on the west side of the Cascade range are prone to infrequent, large, high intensity stand replacing fires verses the east side fire regime that promotes more frequent, low intensity fires. Even with stand replacing event type fires, not all of the area sustains 100 percent mortality. Fires tend to burn erratically leaving a mosaic of unburned islands and pockets of residual overstory canopy. When a fire burns through an area, it will create a large amount of 0-3 inch material on the ground in the form of needle/leaf cast and fine twigs and branches from the tree mortality. This material will begin to naturally decompose within 3-5 years adding duff, litter, and nutrients to the soil. Within 10 to 50 years, the snags created by the fire will begin to fall adding coarse woody debris (CWD) to the area.

However, repeated fires in an area (such as in the Salmon-Huckleberry Complex) tend to deplete the duff, litter, and CWD exposing the soil to erosion, depleting soil nutrients and wildlife habitat.

- All of the LSR areas except Upper Clackamas, Bagby, and Collawash appear to be deficient in down fine fuel loading and CWD.

Fire Suppression and Appropriate Response

It is critical that wildfire suppression and prescribed burning activities do not compromise the safety of firefighting personnel. (FSEIS, B8). Safety of fire fighters and forest users is the highest priority in all suppression efforts. All fire suppression activities must follow guidelines developed in the Fireline Handbook and listed by the hazard abatement plan developed after the South Canyon fire deaths. Minimum impact suppression tactics (MIST) will be utilized, where appropriate, in all wildfire suppression strategies. This strategy is implemented through fire management action plans by BLM, State of Oregon, and Forest Service organizations.

Riparian Reserves and LSR Areas

Major goals for managing LSRs within the Northwest Forest Plan are to maintain and protect late-successional forest ecosystems from loss due to large-scale high intensity wildfire, insect and disease epidemics, and any major human impacts which would prevent land managers from meeting resource management objectives. The wildfire management goal in the LSRs is to keep all stand-replacing events as small as possible while at the same time ensuring that firefighter and public safety is the highest priority. Natural ecosystem processes such as gap-dynamics, natural regeneration, pathogenic fungal activity, insect herbivory, and low intensity fire should be maintained where possible. Consideration should be given to rapidly extinguishing smoldering coarse woody debris and duff to preserve the ecosystem elements. In Riparian Reserves, water drafting sites should be located and managed to minimize adverse effects on riparian habitat and water quality.

LSR standards and guidelines will use minimum impact suppression methods. Elements of particular concern are late successional and old growth stands, snags, downed logs, and duff. Tactics include such practices as:

- Allow fires to burn to natural barriers.
- Build only essential fireline. Minimize the width and depth of constructed fireline. Consider alternatives to constructed fireline such as; cold-trailing, fireline explosives, and wet line to lessen impacts from constructed line.
- Minimize falling and bucking of trees and snags in line construction.
- Remove only those limbs with potential to spread the fire beyond the fireline.
- Consider allowing trees and snags to burn out instead of falling them (provided they do not pose a significant safety risk to firefighters or pose a significant risk of spotting outside the fireline.
- Limit use of dozers to slopes of less than 25 percent.
- Minimize spading during mop-up. Utilize water and/or foam as much as possible or allow fuels to burn out naturally.
- Minimize bucking during mop-up.
- Extinguish smoldering logs as soon as possible.
- Locate portable pumps to minimize the risk of fuel spills entering streams, ponds, or other areas containing water. Keep hazardous materials spill kits in close proximity to all portable pumps.

Congressionally Reserved and Wilderness Areas

Fire management in Congressionally Reserved Areas should follow the standards and guidelines in existing Forest and District plans but basically it is "put it out with MIST standards".

Wild and Scenic River Corridor

In addition to the guidelines identified for wildfire suppression in LSR areas, special consideration should be given to minimize suppression impacts within the wild and scenic river corridor located in Salmon-Huckleberry Complex, Upper Clackamas LSR and Roaring River

Opportunities to Reduce Fire Risk

Risk is the chance of a fire starting either by human or natural causes. Although little can be done to reduce the risk of natural caused fires (lightning), there are a number of viable options available to the resource manager to reduce the risk of a fire start and/or to minimize the impacts of an escaped wildfire.

Reduce Vehicle Access

Reducing vehicle access to an area (either by decommissioning or blocking a road) will lower the potential for human caused ignitions. Reducing vehicle access to an area will increase initial attack response times and in some cases may change the type of initial attack resource from a ground based system to aerial delivered resources such as retardant and/or smoke jumpers.

Thinning - Commercial

Thinning will mean some tree removal which results in decreased canopy. Reducing canopy closure in a stand decreases the possibility that a crown fire will occur. Crown fires are generally wind driven, high intensity fires that can encompass large areas in a short period of time. In stands that are nutrient deficient, the limbs and branches may be left on the ground to naturally decompose.

Hazard Fuels Treatment

Depending on stand age, condition, and type of hazard fuels (natural or management created), any of the following hazard reduction treatments may be viable options:

Mechanical Treatment

- Whole Tree yarding - top is not severed from tree bole, tree is not bucked in the woods
- Yard top with last log - tree may be bucked to acceptable log lengths, except for the last log which the top remains attached.
- Grapple (loader) pile
- Grapple (walking backhoe) pile
- Slashbuster - Track hoe or walking backhoe with mulching head to grind up hazard fuels to decrease fuel bed height and increase bulk density.
- Dozer piling - Limited applicability due to soil compaction and disturbance.

Prescribed fire

Use prescribed fire to maintain fire climax conditions and create/maintain canopy gaps, patch openings, and meadows. Prescribed fire can also be used as a hazard reduction tool. Using low intensity prescribed fire to reduce fine fuels leaves larger fuels intact and minimizes impacts on the residual stand, soils, mycorrhizal systems, and invertebrates and small mammal populations. Other objectives that can be met using prescribed fire include: increasing viability of fire dependent species, retarding seed/sapling reproduction and enhancing grass, sedge, flora, fauna associated with meadows, and to maintain species associated with natural fire return interval conditions in stands.

Guidelines for prescribed fire use are:

- Application of prescribed fire should vary in extent, frequency of application and intensity. The differences in application should be related to fire regime, current ecosystem need, and fire risk rating.
- Management or naturally ignited fires may be used with prior approval of plans.
- Site specific burn plans must be prepared for all prescribed burn activities. Prescribed burn plans must meet agency manual direction and the FEIS for managing competing and unwanted vegetation.
- Prescribed fire operations would implement the same guidelines as wildfire suppression, i.e. to minimize adverse impacts to late-successional habitat.
- Prescribed fire projects and prescriptions would be designed to contribute to attainment of aquatic conservation strategy objectives.
- Prescribed fire should not be utilized where fuels inventory surveys indicate insufficient duff/litter layer or down woody material exists to meet minimum established standards.
- For broadcast or underburns, utilize spring like conditions (cool) to minimize impacts on invertebrates and small mammal populations and provide greater protection for mycorrhizal systems in soils.
- Utilize jackpot burning only in those areas where small pockets of fuel accumulations occur.
- Pile (hand and machine pile) burning should be conducted during a period of time that would minimize risk of escape, or extensive spread between piles.

Prescribed Natural Fire

Prescribed natural fire may be utilized within the LSRs.

Lop and Scatter

Lop (delimb boles of trees that are remaining on the ground) and scatter residual material to reduce fuels concentrations.

Chipping

Management or naturally created fuels are pulled to a certain location or they may be chipped in place. Chipped material may be sold or left on site to decompose. Material left on site must be spread in thin layers to prevent heat buildup and spontaneous combustion.

Handpiling

Piling reduces fuel loading and continuity which retards fire spread within the area. Depending on current availability of wildlife habitat, some or all of the piles may not be burned.

Pullback and Pile/Scatter

Pullback and pile/scatter can be utilized to reduce concentrations along roads and trails, create a fuel breaks, and reduce or remove fuels from around the base of trees or sites to protect. Generally this is accomplished within a given distance of a road/trail, unit perimeter, or sites requiring protection. Piling and/or scattering reduces fuel continuity and loading which retards fire spread and intensity within the area.

Fire Risk Mitigation Recommendations

Upper Clackamas LSR

The southern part of Upper Clackamas LSR (Olallie Lake Scenic Area) and the area directly north, lie in an area called the "Cascade Lightening Belt". Numerous lightning fires have been recorded along this north/south line that divides the East and West sides of the Cascade Mountain range. Associated with the above average ignition potential from lightning is the high recreational use in the Olallie Lake area and the declining vigor of the high elevation mountain hemlock stands. Increasing tree spacing and reducing residual fuel loading will reduce the probability of a stand replacing fire and reduce the impacts should one start. The area north of the LSR could pose a potential threat to the LSR in the event of an East wind driven fire. Increased vegetation management in this area could provide a buffer for the LSR from an east wind driven fire.

Prevention

The prevention of unwanted human caused wildfires for the LSR network must occur on two levels. First, management policies should be implemented to reduce the potential for ignitions within the boundaries of each LSR. An analysis should be completed which leads to the development of site specific prevention actions dependent on the risk of destructive wildfires. Actions such as Fire Prevention signing, restriction on the use of spark emitting equipment, or restrictions on the use of campfires are examples of management actions which may be implemented. The second level of Fire Prevention which must be reviewed for each LSR is the opportunity to keep wildfires that are ignited outside the LSR from burning into these reserves. This could also be viewed as a "Preattack Plan", the intention of which would be to utilize topographic, or human created features to protect the attributes of the LSR from being destroyed by wildfire.

Fire Rehabilitation

Rehabilitation plans must be designed to move the area towards late successional conditions, prevent or stop sediment from reaching Riparian Reserves, and restore camp sites and similar areas to pre-fire condition. Wildfire suppression, and its logistical support, will cause some significant damage, regardless of how much care is taken by incident managers and firefighters. The Incident Commander will consult with the Line Officer's designated resource advisor to mitigate all site specific concerns. Rehabilitation planning and implementation should begin as soon as possible after firefighting efforts begin. Rehabilitation guidelines include:

- Pick up and remove all flagging, garbage, litter, and equipment. Reduce the need for litter and garbage pickup by recycling as much material as possible.
- Discourage the conversion of constructed firelines to recreational trails by covering the line with brush, limbs, and both sound and rotten logs. The preferred source of these materials is the material removed to construct the line.
- Fill in the trenches and dug out areas and obliterate berms created during the suppression effort.
- Construct waterbars as needed to reduce erosion on steeper slopes. A soil scientist or hydrologist will provide guidance on the spacing needed.
- Consider subsoiling compacted areas in incident base camps, spike camps, and other high use areas. Scatter rocks and logs and/or transplant small trees and shrubs into the rehabilitated area.
- Erosion control seeding and other rehabilitation work involving planting will use native species or sterile nonnative species.
- Flush cut and cover with soil all stumps in high use or visually sensitive areas such as campgrounds or heavily used dispersed campsites.
- Reshape any constructed helispots in visually sensitive areas or designated viewshed to more closely resemble a natural opening. This rehabilitation effort will likely require falling more trees and potentially the loss of some late successional or old growth trees or habitat.

Post Fire Monitoring and Evaluation

Post fire monitoring and evaluation will serve to identify areas of this plan or of the suppression effort that need improvement, formulate different strategies and tactics to add to the plan, and assist in adaptive management. Initial evaluation should occur before the firefighting effort ends on all extended attack project fires. This evaluation should discuss the strategy and tactics used and success or failure of minimum impact suppression tactics in meeting LSR and Riparian Reserve objectives, standards, and guidelines. It should also discuss whether firefighter safety was compromised and what changes might be made to better protect firefighters and still meet LSR and Riparian Reserve objectives. Lastly, the evaluation should aid the incident resource advisor and the Escaped Fire Situation Analysis in providing clear direction to the incident management team. A copy of the evaluation should be filed with the incident management package and with the LSR assessment.

Within one year of any fire exceeding five acres, an interdisciplinary team should revisit the burn area to ascertain the success of failure of rehabilitation in meeting LSR and Riparian Reserve objectives and standards and guidelines. A copy of their evaluation should be filed with the incident management package, the line officer, and the LSR assessment.

Chapter 6
Treatments

Chapter 6
Treatments

This chapter describes activities planned or anticipated to occur in LSRs in the foreseeable future. Most of these activities are intended to accelerate the development of late-successional habitat. Others, such as trail management or campground construction are included to disclose the conditions under which they would be consistent with LSR objectives.

This chapter is divided into the following subsections:

- Coarse Woody Debris Management
- Silvicultural Activities
- LSR Boundary Adjustment Recommendations
- Recreation Projects
- Road Projects

In addition, information such as Survey and Manage protocols are included which need to be followed before any ground-disturbing activity proceeds.

Treatments in LSRs should follow a process to ensure that the proposed action meets LSR objectives and is consistent with criteria outlined below.

Process

We recommend treatments in the LSRs follow a similar process of evaluating if the proposed action or treatment meets the LSR objectives and associated criteria designed to ensure consistency among implemented actions.

- **Land and Resource Management Plans**
  (as amended by the Northwest Forest Plan)
  All proposed actions will be evaluated to ensure they are consistent with the goals, objectives, and standards and guidelines in these plans.

- **Late-Successional Reserve Assessment**
  This assessment identifies conditions within the LSRs that should trigger a treatment to meet the desired objectives of late-successional forest ecosystems. This assessment also provides specific criteria that shall be applied to the proposed action or treatment to ensure that the objectives are met. This assessment also identifies some priority areas and priorities for the types of stands that should be treated first.

- **Watershed Analyses**
  Most of the LSRs in this assessment are covered by a watershed analysis. These analyses contain significant information regarding local conditions, especially watershed, riparian, aquatic species, and fisheries that shall be integrated into all proposed actions and treatments. Recommendations resulting from the watershed analyses will be reviewed for any inconsistencies with the criteria and recommendations in this assessment. If a treatment or activity is not consistent with this assessment, the proposal will be sent to the REO LSR group for their review.

- **NEPA and Interdisciplinary Team Input**
  All proposed activities and treatments shall meet the applicable level of documentation as required by the Council on Environmental Quality regulations and applicable agency policy. Any issues or concerns arising from the evaluation of a proposed action or treatment will be addressed. Integrated treatment prescriptions will be developed through an interdisciplinary process utilizing all of the sources of information available. This is the critical step where the final treatment prescription is evaluated to ensure that it is consistent with the land and resource management plan directions and objectives, and the logic and the location for the treatment is supported by the analysis and information in this assessment and in the watershed analysis.

- **Implementation and Monitoring**
  Monitoring will begin immediately following the decision to proceed. This will ensure that the treatment is carried out according to the integrated prescription. Pretreatment surveys or other surveys conducted independently of activities can also be an integral part of the monitoring. Monitoring will continue throughout the project implementation and post-treatment phase to evaluate the achievement of LSR objectives.

Survey and Manage Protocols

Background

The survey and manage standard and guideline prescribed by the ROD (pp. C-4-6) was designed to provide benefits to amphibians, mammals, bryophytes, mollusks, vascular plants, fungi, lichens, and arthropods. These species are listed in the ROD, Table C-3 (pp. C49-61). The species that occur or may occur in the Assessment Area are discussed in Chapter 3.

Survey and manage measures apply in all land allocations. In addition, each land allocation has a specific set of standards and guidelines. Some species are listed in these sections as protection buffer species. Protection buffers are additional standards and guidelines from the Scientific Analysis Team report for specific rare and locally endemic species. These species are listed in the ROD (ROD pp. C11-C48). The species that occur or may occur in the Assessment Area are discussed in Chapter 3.

Protocols have been developed to survey for these survey strategy 2 survey and manage species (Fungi and vascular plant protocols are in development). Surveys for survey strategy 2 species need to occur before any ground-disturbing activity in any land allocation. No protocols have been or will be established for "protection buffer" species. Below is a summary of the survey protocols. Consult the specific survey protocol for more detailed information.

Summary of Protocols

Plants, Bryophyte, Lichens, and Fungi

Survey Protocols

There are 16 vascular plant, 81 lichen, 23 bryophyte and 234 fungi species that appear in Table C-3 of the ROD. Appendix C lists species known to occur within the Assessment Area. Known locations can be determined from the "Known Site Database". Specie specific survey protocols should be consulted. Survey protocols for all the survey strategy 2 species have been or are being developed. The steps involved include: a prefield review to determine if known sites are present and then to determine if suitable habitat is in the area, a field survey to document presence or absence, an intuitive controlled survey in areas with the highest potential or a complete survey if the area is small and there is a high potential for the specific species.

Manage Known Sites

Management recommendations should be consulted to address proposed activities near known sites.

Considerations for Maintaining Diversity of Species

Several studies have been done assessing lichen diversity and function in forests of various ages and management history (Boucher and Stone 1992, Lesica et al. 1991, McCune 1993, McCune et al. 1991, Neitlich 1993, Per-Anders and Renhorn 1996, Sillet 1995). Neitlich and McCune (1997) offer some suggestions to maintain and promote lichen diversity during silvicultural treatments, such as protecting gaps, wolf trees (trees with large-diameter lower branches), old-growth remnant trees, and maintaining hardwoods. These techniques may help in developing late-successional qualities in treatments of younger stands in LSRs.

When projects are proposed in LSRs, care should be taken to minimize disturbance and compaction of the soil and coarse woody debris so that less damage is done to the many mycorrhizal and decomposer fungi that are necessary for healthy forests (Amaranthus et al. 1994, 1996).

Many of the structural and microclimate parameters that are beneficial for the lichens and fungi are also beneficial for the late-successional associated bryophytes, such as a diversity of tree species, coarse woody debris, low levels of disturbance, ameliorated temperature, wind, and humidity, and others.

Mollusks

Survey

There are 43 aquatic and terrestrial mollusk species that appear in table C-3 of the ROD. The Mt. Hood National Forest has documented occurrences or suitable habitat for ten of these species; three land snails, five slugs and two aquatic freshwater snails. The Assessment Area has but one of the aquatic species occurring or suspected to occur on the Mt. Hood National Forest (Table 3-9). A draft survey protocol was issued in October 1997 for surveys to begin in the spring of 1998. The protocol is implemented when there are effects to mollusks in proposed project areas with ground disturbing activities. This will affect project areas that have their NEPA document signed in FY99.

To implement the protocols, first determine which C-3 mollusk species are expected in the project area by known or suspected range and habitat association. Use Tables 1 and 2 from the *Terrestrial Mollusk Survey Protocol DRAFT, Version 1.9 (October 28, 1997)* and the *Aquatic Mollusk Survey Protocol DRAFT, Version 1.9 (October 28, 1997)*. Survey potential habitat for those species that may be impacted by the proposed project for at least 60 minutes per 10 acres of survey area. Surveys use a combination of short, opportunistic searches of key habitat features along a survey route and intense searches within established sample areas of the best habitat. Two surveys are required in a given year. These surveys must be at least three weeks apart and one should be done during the fall rainy season.

Manage Known Sites

Management guidelines for protection measures of known and/or discovered populations have not been approved by the Regional Ecosystem Office. Apply mitigation measures in Appendix J-2 of the Northwest Forest Plan (pp. J2-303-J2-411). For most species, a buffer of 10 or more acres around the known population is recommended.

Amphibians

Survey

A draft protocol was released on March 18, 1996 for conducting surveys of the five amphibians listed in Component 2 of the ROD. Of these five species, only the Larch Mountain salamander is potentially in the Assessment Area. Surveys for the species are to be conducted prior to the design of ground-disturbing activities that will be implemented in 1997 or later. The Larch Mountain salamander is associated with moist rocky outcrops, talus and exfoliated bark of large Douglas-fir snags in dense conifer forests. A revision to the survey protocol specifics (10/2/97) surveys are to occur north of the line running east to west 12 miles south of Mt. Hood (north of the Clackamas River). To determine presence or absence of the species, three visits must be conducted at least four days apart in a survey season. One of these visits should be from April to mid-June and one should be late September through late November. Environmental conditions for surveys are tightly coupled to prevailing micro climatic conditions, particularly soil/substrate moisture and temperature. Soil and substrate matter needs to be at least moist, and preferably wet, to the touch before surveys are conducted. This species is also very sensitive to temperature and has only consistently been found when the temperature in the top 10 centimeters of soils is between 4 and 14^0 C. The method used in suitable habitats is belt transects in 25 meter intervals covering 1-7 acres per person. The surveyor is to search under all cover objects, bark, logs, branches, and rocks within a 10 meter swath.

Manage Known Sites

The ROD specifies avoidance of ground disturbing activities if the species is found. In addition, maintain 40 percent canopy closure within the site and provide a buffer of 100 feet or one site potential tree, whichever is greater, around the site.

Bats

Survey

Survey protocols for the five species of bats are being developed. These species are protection buffer species and are to be surveyed in caves, mines, abandoned wooden bridges and buildings. The Forest Service has conducted surveys at these structures using the Anabat II Bat Detector and visual observations.

Manage Known Sites

No timber harvest is allowed within 250 feet of sites containing bats. Retain buildings and bridges as roost sites as safety allows. Buffer caves and mines to preserve microclimate (ROD pp.C-43).

Red Tree Vole

Survey

Surveys for red tree vole presence are conducted in fifth field watersheds that do not meet threshold levels of suitable vegetation. See Chapter 3, Wildlife and Plants. Surveys within these watersheds are to focus on finding occupied nests. Searches for the nests are done with the line-transect method. The surveyor needs to randomize the starting point within the stand and run transects across the environmental gradient. From this point, the surveyor follows a compass bearing for minimum of 90 meters. The surveyor should be able to search 15 meters on both sides of the transect line. While walking the transect line, the surveyor will visually search the branches near the bole of the tree for any mammalian nest material. If nest material is spotted, the ground should be searched for any clumps of resin ducts that come from Douglas-fir needles. This species is the only mammal to feed on Douglas-fir needles and create these clumps; nests can be confirmed by finding these clumps underneath the suspected nest. If resin duct clumps are not found then the tree must be climbed and the nest inspected.

Manage Known Sites

Only populations are required to be protected. The definition of a population is two or more active nest trees spaced no more than 330 feet apart. If a population is discovered in a watershed that did not exceed threshold levels, the manager has three options.

- Populations can be protected with a 10 acre buffer.
- Riparian Reserve buffers could be expanded to include the population if the population is close to an existing reserve.
- Additional surveys could be done in ¼ mile buffer outside the project area. If populations are found in the buffer, those populations may be protected instead of any populations found inside the project area boundary. Red tree vole populations are not required to be protected in watersheds that exceed threshold levels.

Great Gray Owl

Surveys

Protocol for this species was released on May 12, 1995. Surveys for the great gray owl, a protection buffer species, are to be conducted in any ground disturbing project area that meet the following characteristics. Surveys for the great gray owl are within the range of the spotted owl, at elevations above 3,000 feet; within mature stands (80+ years old) with greater that 60 percent canopy closure and within 1,000 feet of a natural meadow larger than 10 acres in size. Six visits are required from March 15 to June 30. The project area must be surveyed to protocol for two years (12 visits) or until presence is detected. Surveys are conducted similar to spotted owl surveys. Calling stations are to be established on roads and trails for night time calling and throughout the stand for daytime searching. These transects should be no more than ¼ mile apart and should have calling stations placed along the route at every 1/10 of a mile. The surveyor is to play a cassette tape of recorded calls for 5-8 minutes at every station and listen for at least 30 seconds between the calls. If a response is received, the surveyor needs pinpoint the location and return during the day no later than 48 hours after the response. A four-hour search is necessary during that day at the location of nighttime search. The search is to be systematic, looking for nesting components and listening for any territorial calling. The goal is to see or hear the male and female and to try to confirm reproductive success.

Manage Known Sites

Protection measures for this species are required and will be applied as described on page C-21 of the ROD. "Specific mitigation measures for the great gray owl, within the range of the northern spotted owl, include the following: provide a no-harvest buffer of 300 feet around meadows and natural openings and establish a ¼ mile protection zone around known nest sites." Protection zones for this species are approximately ¼ mile in radius around known nest sites. The zones do not have to be circular; they should be delineated to provide security for the nest. Once established, the protection zones become unmapped Late-Successional Reserves (LSR's) which are subject to the standards and guidelines for LSR's.

Coarse Woody Debris (CWD) Management

Background

Snags and down logs are important components of late-successional ecosystems. They provide important habitats for many late-successional associated species including fungi, arthropods, bryophytes, some vascular plants and many vertebrates (ROD p. C-40, Harmon et al. 1986). The CWD field in Appendix B indicates those wildlife species that rely on snags and down logs. In addition, Northwest Forest Plan FEIS Tables J2-8a-k indicate that many late-successional species benefit from snags and down logs (mitigation measures 10 and 11). Coarse woody debris is an important pool of energy, carbon, and nutrients in ecosystems and thus can have effects on site productivity. For these reasons the Northwest Forest Plan (ROD p. B-5) states that moderate-to-high accumulations of large logs and snags are desired late-successional characteristics in LSRs.

Standards and guidelines for salvage and silvicultural activities in LSRs require that adequate levels of snags and down logs be maintained after the activities. In a letter dated 7/9/96, the Regional Ecosystem Office (REO) recommends and outlines criteria for exempting commercial thinning projects from REO review. In the letter the REO states, "CWD objectives should be based on research that shows optimum levels of habitat for late-successional forest-related species, and not be based simply on measurements within natural stands." Existing levels of CWD could be misleading due to past harvest activities, salvage, firewood collection or fire. The REO letter suggests that research data from Carey and Johnson and from Spies and others could be helpful at determining appropriate levels of CWD.

Goals

Snags

Snag Numbers

Neitro et al. (1985) describe requirements for snag-dependent wildlife species, and procedures for calculating numbers of snags required to maintain different population levels of woodpeckers for westside forests. Calculations indicate that 4.34 snags per acre greater than 15 inches dbh would result in 100 percent of potential populations of primary cavity excavators. These calculations, however, are based just on nesting habitat for woodpeckers. Lindquist and Mariani (1991) and Bull (pers. comm.) have concluded that managing for nest snags may not provide adequate numbers of snags for foraging habitat for woodpeckers. In addition, the calculations do not take into account the numbers and types of snags used by other snag dependent species such as bats, Vaux's swifts, bears, marten, etc. Thus, 4.34 snags per acre may not be adequate for maintaining populations of all snag-dependent species.

Information on snag densities from studies on snag-dependent wildlife may be more appropriate to use in managing snags levels in LSRs. Data in the literature is quite variable. Levels vary from 6.5 per acre (>16 inches dbh) at pileated woodpecker nest sites (Mellen et al. 1992) to 16 per acre (>20 inches dbh) in stands used by Vaux's swifts (Bull and Ohmann 1993). Carey et al. (1996) state, 6-15 large (>25 inches dbh) snags per acre and 6-20 small (9-24 inches dbh) snags per acre appear to be required to maintain an *"abundant and diverse cavity-using bird community."*

While REO cautions using existing levels of CWD as a goal for LSR objectives, data on existing levels is another piece of information useful in setting goals. Spies et al. (1988) reports snag densities in mature and old-growth stands in the Oregon Cascades are 44 and 24 per acre respectively. Existing numbers of snags from old-growth stands on the Mt. Hood National Forest are given in Table 6-1. The data is from Current Vegetation Survey (CVS plots) in stands with a stand average age of 250 years or older and with at least 25 dominant or codominant trees per acre. The minimum number of trees is necessary to eliminate plots in shelterwoods or leave tree harvest units. Based on all the information given above, the goal is to manage for 15-30 snags per acre in commercially thinned stands and salvage areas in LSRs. This goal is similar to the recommendation of Carey et al. (1996).

Table 6-1. Snags Per Acre From Old-Growth Stands*.

Vegetation Zone	>15" dbh	Total Snags
Western Hemlock	15	30
Pacific Silver Fir	14	36
Mountain Hemlock	14	29

**Data from CVS plots with stand age at least 250 years and at least 25 trees per acre.*

Snag Size

The goal of 15 to 30 snags per acre consists of large and small snags. Table 6-2 gives the breakdown between numbers of large and small snags based on Carey et al. (1996). Large snags are defined as snags with a dbh greater than or equal to the stand average dbh (quadratic mean diameter). Small snags are defined as snags with a dbh less than the stand average dbh. This approach to determining snag size allows flexibility in managing for snags in stands with varying potential to be able to create "large" snags of a preset dbh. The approach also eliminates the concern of turning the largest trees in a stand into snags instead of allowing them to grow into larger trees. The larger the snag, the better in terms of value to wildlife and longevity.

Table 6-2. Desired Snags Per Acre. See Text For Definition of Large and Small Snags.

Vegetation Zone	Large Snags	Small Snags	Total Snags
All Zones	6-15	6-20	15-30

Decay Stage Distribution

Manage for about 70 percent hard snags (stages 1-3) and 30 percent soft snags (stages 4 and 5). See Neitro et al. (1985) for descriptions of decay stages. This split approximates the decay stage distribution of snags in mature and old-growth stands from Spies et al. (1988) (see Table 6-3).

Table 6-3. Snag decay stage distribution from Spies et al. (1988).

	Percent of Snag Biomass	
Snag Decay Stage	Mature Stands	Old-Growth Stands
Hard (stages I-III)	66	83
Soft (stages IV, V)	34	17
Total	100	100

Snag Distribution

Snags may be left in clumps. This helps to address safety concerns, and mimics the natural patchy distribution of snags. Goals for numbers of snags can be averaged over areas up to 10 acres in size. This will ensure snags are distributed within a home range size area for the smaller cavity excavators.

Down Logs

Amount of Down Logs

There is a limited amount of biological information available on the amount of down wood necessary to provide habitat for species. Available data for wildlife species is generally expressed in terms of percent cover of down logs. Research by Carey and Johnson (1995) indicate that populations of small mammals increase as percent cover of down logs increases up to 15-20 percent in forests of the Olympic Peninsula. Carey et al. (1996) indicate that 8 to 10 percent cover of down wood is adequate in southwestern Oregon. The REO letter (7/9/96) states that recent research by Carey and Johnson suggests owl prey base increases as down log (>4 inches diameter) cover increases up to 15 percent in Oregon north of Drain. Data from the Coast Range of Oregon indicate that occupied flying squirrel habitat has an average of 10 percent cover of down logs; unoccupied sites averaged 5 percent cover of down logs (Andrew Carey, pers. comm.).

The amount of down wood needed to maintain mycorrhizal fungi and site productivity appears to be lower than that indicated for small mammal habitat as described above (Graham et al. 1994). Graham et al. (1994) report down wood in terms of biomass. Calculations from this data indicate a percent cover of 2 to 6 percent is adequate to maintain mycorrhizal fungi and site productivity. This data, however, is from forests east of the Cascade Mountains.

Existing levels of down wood in old-growth stands on the Mt. Hood National Forest are given in Table 6-4. The data is from CVS data as described above for snag levels in old-growth stands. The 10-15 percent cover recommended by Carey et al. (1996) is higher than average natural levels, but well below the maximum. Treatments are opportunities to manage areas for high levels of CWD. This will help to compensate for areas in LSRs with below average levels of CWD.

Table 6-4. Down Wood Percent Ground Cover From Old-Growth Stands*.

Vegetation Zone	Avg % Cover	Maximum % Cover
Western Hemlock	8.5	56
Pacific Silver Fir	6	29
Mountain Hemlock	6	28

**Data from CVS plots with stand age at least 250 years and at least 25 trees per acre.*

Based on the above information, **the goal is to manage for 10 to 15 percent cover of down logs in commercially thinned stands in LSRs.** A goal of 10 percent cover may be used in areas where Douglas-fir bark beetles are a concern as described in the Implementation section which follows.

Size of Down Logs

Table 6-5 gives the breakdown between the percent cover of large and small logs. Large and small logs are defined using average stand dbh as described for snag sizes. The breakdown between small and large logs was derived from proportions of logs in different size classes from CVS data from old-growth stands in the different vegetation zones. Larger logs provide better microhabitat by retaining more moisture and less temperature fluctuation.

Table 6-5. Desired percent ground cover of logs. See text for definition of large and small logs.

Vegetation Zone	Large logs	Small logs
Western Hemlock	12%	3%
Pacific Silver Zone	10%	5%
Mountain Hemlock	10%	5%

Decomposition Class Distribution

Manage for about 25-30 percent sound logs (classes I and II) and 70 to 75 percent decayed logs (classes III-V). See Bartels et al. (1985) for a description of decomposition classes. This split approximates the decomposition class distribution of down logs in mature and old-growth stands from Spies et al. (1988) (see Table 6-6).

Table 6-6. Down wood decomposition class distribution from Spies et al. (1988)

	Percent of Down Log Biomass		% Cover Goal	
Log Decomposition Class	Mature Stands	Old-growth Stands	10%	15%
Sound (classes I, II)	30	25	2.5-3%	3.8-4.5%
Decayed (classes III-V)	70	75	7-7.5%	10.5-11.2%
Total	100	100	10%	15%

Down Log Distribution

Amphibians and small mammals have very small home ranges; large areas without log cover do not provide habitat for these animals. Down logs should be well distributed on each acre. Avoid excessive jack strawing of logs. Small logs may be clumped to increase their cover value. Clumps, however, should be distributed across each acre.

Implementation of Goals

The objective is to manage for the above CWD goals through time, not just at the time of the treatment. It may be necessary to leave extra green trees in the stand for snag creation until natural stand mortality is providing desired levels of CWD. The Coarse Wood Dynamics Model (Mellen and Ager) can be used to predict snag and down log levels through time. If down log levels are low, it may be desirable to create excess snags that will fall and become logs. Trees infected with root rot tend to fall within 5-10 years. Consider these as creating down wood rather than counting them toward snag goals.

Retaining existing snags is the most economical and ecologically sound way to provide snags in a stand. Some stands have low levels of existing snags, however, and some will need to be felled for safety reasons. An option is to create snags by killing live trees. Several methods for creating CWD have been used successfully and are listed below. See Bull et al. (1997) and Bull and Partridge (1986) for more information. When selecting trees for snag or down log creation make sure the trees aren't currently providing spotted owl nesting structure, brooms for goshawk nest sites, etc.

- **Blasting Tops Out of Trees**
  This method leaves a jagged top that is readily invaded by decay causing organisms. The tops can be left on site to count toward down log requirements.

- **Cutting Tops Out of Trees**
  Similar to blasting, but less inviting to decay causing organisms.

- **Girdling Trees**
  Girdling should be done at the point where breakage is desired. Trees girdled at the ground tend to break at the ground fairly quickly. This provides a short-lived snag that becomes a down log sooner than with other methods.

- **Inoculation With Decay Organisms**
  This method is experimental but looks to be promising. This method will introduce heartrot into live trees. The inoculation site may be used by woodpeckers for cavity excavation. These trees may remain alive for many years while still providing cavity nester habitat. These trees may eventually develop into hollow snags and logs. Any tree inoculated should be monitored closely to see if the desired results are accomplished.

- **Use of Pheromones to Attract Douglas-fir Beetle**
  Baiting trees with bark beetle pheromones may be a possible way of creating snags. Some knowledge of current beetle densities in the area would be necessary. See Ross and Niwa (1997) for additional information. Risk to adjacent stands needs to be evaluated before using this method.

Ideally, logs left on site should be a mix of sound and decayed logs as described above under the Decomposition Class Distribution section. Decayed logs provide higher quality habitat for many species than do sound logs. Care should be taken to leave as many decayed logs on site as undisturbed as possible. See Carey and Johnson (1995) for suggestions on minimizing disturbance of existing logs during harvest operations. If there are excess soft snags, consider falling them to create decayed logs.

If adequate decayed logs are not available on site, it is important to create sound logs so that the decay process can begin. Western hemlock will decay faster than Douglas-fir and thus will provide the decayed log habitat sooner. Consider favoring western hemlock logs where decayed logs are deficit. Except for cedar, other tree species decay at rates intermediate to Douglas-fir and western hemlock. Leave up to 11 percent cover of sound logs to compensate for decayed logs in areas with a 15 percent goal. This is the percent cover that should ideally come from decayed logs. In areas with a 10 percent goal leave up to 7 percent cover of sound logs.

Managing for high levels of CWD and using percent cover as a goal are new concepts for silvicultural treatments. See Appendix D for some examples of how this relates to numbers of and types of logs to be manage for on site.

Hollow trees, snags, and down logs provide important habitat for a variety of wildlife species (Bull et al. 1997).These structures are rare in managed stands and should be retained where ever they occur.

Snag and down wood goals should usually be met within five years of the harvest operation. This allows time to assess if mortality following harvest partially satisfies CWD goals. Injuries to trees from the harvest operation may kill some trees. Opening the stands may result in some windthrow. Bark beetles may invade new down wood and then move to live trees, creating additional snags. The project area should be monitored for CWD levels in the third year after harvest. If CWD goals have not been met K-V funds, jobs in the woods, or other sources can then be used to create more CWD.

Considerations for Areas of Bark Beetle Concern

Creating logs and snags from green Douglas-fir trees, or heavy windthrow, increases the risk of Douglas-fir bark beetle infestation. The bark beetles typically invade trees larger than 12 inches dbh. If beetles infest the dead wood they typically will also kill adjacent green trees. See the discussion under the Insect and Disease section of Chapter 3. In most cases this disturbance is part of the ecosystem function and is not considered a problem. In some cases, however, killing green trees is not desirable, and minimizing the risk of bark beetle infestation in these areas is warranted. These cases include:

- The risk of bark beetle infestation spreading to adjacent private forest land may be unacceptable. In treatment areas within ½ mile of private forest land with Douglas-fir trees greater than 12 inches dbh, steps should be taken to minimize risk. This will primarily be a concern at the edges of Table Rock, Soosap, and Abiqua LSRs.

- In relatively open stands of dispersal or late-successional habitat losing additional trees to bark beetles may make the stand unsuitable for target species. In treatments within or adjacent to these stands, minimizing risk of bark beetle infestation may be desirable.

- Stands that are stressed may suffer unacceptably high rates of mortality from bark beetles. One such area is the Fish Creek portion of the Roaring River LSR. The stands in this area are stressed because they originated as off-site plantations. Leaving too much CWD in these stands could result in a bark beetle infestation and loss of the entire stand and possible adjoining stands. In this area manage for the low end of the snag goals and manage for 10 percent down log cover in thinning or salvage treatment areas. These stands are between 34 and 52 years of age and total 500 acres.

- It may be desirable to minimize risk of bark beetles in or adjacent to sensitive areas like spotted owl nest sites, cave or mine entrances, etc.

Dropping a number of green Douglas-fir trees at once to create down logs will increase risk of bark beetle infestations. If this is a concern down logs can be created in three pulses. A third of the logs can be felled at time of harvest, a third more can be felled four years after harvest using KV funds or other funding source, and a third of the trees can be girdled at the base four or five years after harvest. These girdled trees should fall and become logs within 5 to 10 years. This method of using three pulses will spread creation of down logs over 10 to 15 years and thus should reduce the risk of bark beetle infestation.

The Douglas-fir bark beetle only infests Douglas-fir. Thus, favoring other tree species for down log and snag creation would reduce the risk of infestation. Douglas-fir creates long-lasting snags and logs compared to other species. A balance between risk of bark beetle infestation and longevity of CWD needs to be considered. Species used to create CWD should be similar to the species composition of the stand. In areas deficit in decayed logs using western hemlock for logs will accelerate development of decayed logs, and reduce risk of bark beetle infestation. Douglas-fir could be used to meet requirements for sound logs and western hemlock to meet decayed log goals.

If Douglas-fir bark beetle populations are high in an area it may be desirable to postpone treatments until populations have subsided. Also, creating the CWD during July through September will reduce risk of bark beetle infestation.

Silvicultural Treatments

The ROD (p. B-5) states, *"Silvicultural systems proposed for Late-Successional Reserves have two principal objectives:*

- *Development of old-growth forest characteristics including snags, logs on the forest floor, large trees, and canopy gaps that enable establishment of multiple tree layers and diverse species composition; and*

- *Prevention of large-scale disturbances by fire, wind, insects, and diseases that would destroy or limit the ability of the reserves to sustain viable forest species populations.*

Small-scale disturbances by these agents are natural processes, and will be allowed to continue."

This section uses the structural and compositional elements described in Chapter 3 to develop a process and criteria for recommending management activities which will benefit the creation of late-successional forest conditions over the long-term. (ROD C-12)

Silvicultural treatments inside reserves are subject to review by the Regional Ecosystem Office (REO) to ensure that the treatments are beneficial to the creation of late-successional forest conditions (ROD p. C-12). The REO has developed criteria to exempt some thinning treatments from review as summarized below under Management Criteria.

Treatment objectives in the Assessment Area should be based on one of three goals aimed at attaining, enhancing, or maintaining late-successional forests and their characteristics:

- growth enhancement (young stand thinning and/or commercial thinning)

- stand structure enhancement (off-site plantation conversion, cwd recruitment)

- risk management (fuel load reduction, salvage, windfirmness)

The effects of accelerated development of structural characteristics on ecosystem processes (i.e. tree growth and maturation, death and decay, disturbances), and functions (i.e. nutrient and hydrologic cycling, buffering of microclimates, storing carbon) is not known. Some processes and functions cannot be accelerated and will take time to develop. Thus, there should be enough variability in treatments and enough unmanaged land to provide for any unknown elements, functions and processes.

Stands on a suitable trajectory for attainment of most late-successional characteristics should not receive any treatment. Stand management in LSRs should focus on stands that have been regenerated following timber harvest. These include stands that will acquire late-successional characteristics more rapidly with treatment, or are prone to fire, insects, diseases, wind or other disturbances at a level that would jeopardize the reserve. (ROD p. B-6) Prioritization for treatment should be on the younger stands for growth enhancement and then for other treatment objectives. Prioritization will also be determined at the Forest, Forest Service district and the BLM district level on their respective jurisdiction.

Depending on stand conditions, treatments could include, but should not be limited to:

- thinning or managing the overstory to produce large trees; release advanced regeneration of conifers, hardwoods, or other plants; or reduce risk from fire, insects, diseases, or other environmental variables;
- underplanting and limiting understory vegetation control to begin development of multistory stands;
- killing trees to make snags and coarse woody debris;
- reforestation; and
- use of prescribed fire.

Thinning prescriptions should encourage development of diverse stands with large trees and a variety of species in the overstory and understory. (ROD p. B-6)

Growth Enhancement Treatments

Growth enhancement treatments can be used to balance density and size, while preventing growth stagnation. Studies have shown that accelerated development of many of the structural components of late-successional stands can be achieved (Oliver and Larson 1990, Marshall 1991). The objectives include using wider spacing to grow big trees faster; promote a diversity of species; and create some wolf trees. Wide spacing provides the site condition for open-grown trees and the development of lateral branches that result in a 'wolfy limb' character to individual trees. Through time, some large trees will die, decay, and fall to the ground. This will serve as a source of coarse woody debris, first as snags, then as down woody material that will either stay on site or move into a stream channel. As a result, growing big trees also accelerates development of the down wood and snag size classes typical of late-successional forests. Multiple canopy layers, canopy gaps, and the development of patchy understory can also be created.

In the Assessment Area, growth enhancement treatments may be applied in applicable stands that are less than 80 years of age. These stands are representative of the "establishment" and/or "thinning" stage of forest development as outlined in the ROD p. B-2 and are not yet functioning as late-successional forests.

Management Criteria for Growth Enhancement Treatments

Guidelines and criteria for silviculture treatments in densely stocked young stands (less than 80 years old) were developed by the Regional Ecosystem Office and are documented in REO memos of May 9, 1995 and July 9, 1996 (Appendix A). These criteria exempt a specific subset of silvicultural treatments from the requirement for project level REO review. These guidelines and criteria should be applied to densely stocked stands where the objective is to follow accelerated pathways to attain late-successional characteristics both spatially and temporally. Treatment criteria and considerations in these memos include:

- variable thinning densities
- creating small gaps
- promoting species diversity
- creating structural components (snags and down wood)

The treatment criteria in these memos reflect treatment needs in the Assessment Area and shall be the basis for silvicultural treatments of densely stocked conifer stands. The memos cited above and the recommendations in this assessment provide the sideboards for treating the densely stocked stands to achieve LSR objectives. Each stand and situation is unique, however, and each treatment prescription must be designed with that in mind.

Young Stand Thinnings

This treatment involves thinning young (10-30 year old), dense stands of trees, most of which were planted after regeneration harvests. Young dense stands will be treatment priorities to accelerate the structural conditions associated with late-successional characteristics within the Assessment Area. Trees were planted at a density which assured full stocking of desired tree species within five years of harvest. Most of these plantations were planted to densities between 400 and 600 seedlings per acre. In some of these plantations, mortality reduced the planted seedlings to a minimally acceptable level which would not need thinning. In most cases, however, natural seeding has increased the stocking far beyond the original planting density.

Some of these stands may contain remnant trees greater than 21 inches dbh left behind in shelterwood cuts (primarily in the eastern end of LSR 207A, Linney Creek area). As long as the total canopy cover of these remnant trees is less than 30 percent, these stands are still considered as young stands for treatment purposes. Remnant trees in these stands should be protected. Treatments should focus on growth enhancement of the younger overstocked layer.

Young stands are usually thinned when the trees are tall enough to have expressed individual relative dominance, but not so large that the resulting slash would persist as a fuel hazard. The target spacing or stocking level in these thinnings is usually designed with the subsequent treatment in mind. If a thinning is expected later in the life of the stand, a predetermined number of trees per acre should be left so that the stand does not stagnate prior to the next thinning. If no subsequent treatments are planned, a wider spacing or lower stocking level is typically prescribed to avoid stagnation.

Stands in the young age classes currently occur on over 50,000 acres or 30 percent of the land within the LSR allocation across the landscape. Some of these stands may require some treatment in the next 10 years.

Commercial Stand Thinnings

Mid-seral dense, uniform stands have always been a part of the landscape. The amount and distribution of these stands in LSRs, however, is inconsistent with the range of natural conditions. Trees which have been uniformly spaced from planting and then precommercial thinned will interact differently when developing through the inter-tree competition phase or stem-exclusion phase than natural stands seeding in after a stand replacement disturbance. Trees have less chance to express dominance when they have been planted and maintained at relatively even spacing. Therefore, when these stands reach density levels in which individual trees are competing with each other for growing space, it may take longer for individuals to express dominance. As tree competition increases, stems will become tall and slender as height growth continues, but diameter growth drastically slows. These trees will become more dependent on neighboring trees for support. Eventually, as some trees dominate and others fall behind, the dominant trees will develop more crown and diameter growth and therefore more individual stability. Still, as trees go through this competition phase, they are more likely to blow down or if drought conditions persist, be more susceptible to insects and disease.

With no intervention, these stands will remain at maximum density for many decades until natural mortality opens the canopy up enough to allow expansion of crowns and understory response from increased light. Development of all the desired late-successional characteristics will process very slowly under these conditions.

The response in diameter growth of trees which have been thinned is well documented (Curtis 1992; Tappeiner 1982; Reukema 1977; Wiley 1974). Wide spacing during thinning treatments should be moderated where dispersal habitat is needed at present or within the near future.

Approximately 18 percent are in dispersal habitat greater than 35 years old and less than 80. While some of the stands greater than 50 years are on a trajectory that meets LSR objectives, some of these stands may also benefit from some vegetation manipulation.

The following table lists the potential acres that could be managed in the next decade.

Table 6-7. Potential Acres That Could be Managed in the Next Decade.

LSR	Early-seral Stands to be Treated	Total Acres Young Stands	Commercial Stand Thinning		Total Acres Mid-seral
			35-50 yrs	50-80 yrs	
205	0	776	0	0	2,249
206	0	694	0	0	773
207A		21,102			17,972
207B	1,600	8,646	1,993	384	8,065
208	97	2,802	0	0	99
209A BLM	1,800	7,445	500	72	1,082
209B MHNF	700	2,936	0	0	408
209C WNF	150	1,107	0	0	408
210	172	3,368	1,032		722
211	160	215	80	60	386
100 ac. LSRs	0	1,045	0	0	1,092
Total	4,679	50,136	3,605	516	33,256

Treatment Triggers and Landscape Priorities

This section provides a summary of key conditions or *triggers* of when a particular type of silvicultural treatment should be pursued within the Assessment Area. There are a variety of existing or potential conditions on the landscape, largely a result of past land-use patterns and/or practices, which could trigger a management activity. Site-specific analysis is necessary to determine if an area would require vegetative manipulation to accelerate attainment of late-successional characteristics. Landscape triggers are a result of a variety of existing or potential individual stand conditions within the LSRs. The following section summarizes stand treatments by seral stage; first by what triggers the activity, the objective of the activity, areas of priority or concern, and then the treatment.

Young Stand Thinnings

The objectives, stand attributes and treatment standards as stated in REO memo 5/9/95 will be met and followed.

Scenario 1

- **Trigger:**
  Large blocks of overstocked young stands within LSRs that disrupt connectivity of late-successional forest at the landscape scale. Average height of trees is at least 10-15 feet and the density of trees is high enough to interfere with rapid development of the stand.

- **Objective:**
  Tree growth enhancement to create dispersal habitat quickly and mitigate connectivity concerns between existing late-successional forest areas. Treatments should balance tree growth enhancement with a desire to achieve rapid canopy closure of 11inch+ dbh trees. Long-term goal is to accelerate development of late-successional characteristics.

- **Treatment:**
  Initial thinning of less than maximum spacing followed most likely by more than one commercial thin (before 80 years of age) to further enhance tree growth and create coarse woody debris.

- **Priority Areas:**
  SE portion of 209A Upper Molalla - approximately four square miles of young large stands 3,000-4,000 foot elevation and another area four miles north of this within 209A. Most of these stands are 10-30 years old with no previous treatment.

Scenario 2

- **Trigger:**
  Overstocked young stands within LSRs that fragment a matrix of existing late-successional forest.

- **Objective:**
  Tree growth enhancement to minimize fragmentation and edge effects to late-successional forests in the short-term and to increase the amount of forest with late-successional forest in the long-term.

- **Treatment:**
  Thin to a wide spacing to accelerate growth of large diameter trees and create some wolf trees. This will be followed by one or no commercial thinning. Use variable spacing to create opportunities for natural understory development. Use spacing that assumes at most one subsequent commercial harvest entry (prior to 80 years of age).

- **Priority Areas:**
  Bagby LSR (209B), southern two-thirds (high priority); Collawash LSR (210), a large block in the north, an area in the central and spots in the southeast portion; Roaring River LSR (207A), eastern end of the LSR and portions in the western end; Soosap LSR (208); Upper Clackamas LSR (207B); and southwest portions of Table Rock LSR (209A).

Commercial Thinnings

The objectives, stand attributes and treatment standards as stated in REO memo 7/9/96 will be met and followed.

Scenario 1

- **Trigger:**
  Overstocked, young mid-seral stands (35-50 years of age) that have uniform tree size, lack of understory and little or no CWD component (those not needed for short term high priority dispersal habitat). Due to harvest practices in the last 30 to 50 years, levels of remnant snags and down logs will likely be low.

- **Objective:**
  Accelerate growth towards large trees. Trees in these stands tend to be relatively small. Thus, snags and logs created at time of harvest will be small. It may be prudent to allow trees to grow larger before meeting high end CWD goals. Only a small number of these stands exist in the LSRs.

- **Treatment:**
  Follow exemption criteria. Minimize soil disturbance for fungi and myccorrhizae concerns. For snags, manage toward the low end of the goal from Table 6-2. Managing for 10 percent cover of logs will be the goal for down logs.

  In areas where reducing Douglas-fir bark beetle infestation risk is desirable, manage for 10 percent cover of down logs. Create CWD in three pulses as described under CWD Management, in this chapter. Consider using species other than Douglas-fir for a portion of the CWD. Bark beetles are only a concern if trees used to create CWD are greater than 12 inches dbh.

- **Priority Area:** Fish Creek Watershed; especially off-site plantations.

Scenario 2

- **Trigger:**
  Older (50-80 years of age) dense stands (those not needed for short term high priority dispersal habitat); lack of CWD in the stand.

- **Objective:**
  Accelerate large tree growth, increase CWD component, promote multi-layered canopies and multiple species.

- **Treatment:** Use wider spacing and variable spacing throughout the stand to create tree growth and gaps for natural regeneration. Potential exists for underplanting for species diversity. Manage towards the high end of CWD level as this entry may be the last opportunity to meet CWD goals. Trees are larger, thus created snags will be of greater value to wildlife than those in younger stands. Existing snag and down log levels may be higher than in younger stands. For these reasons, manage for the high end of snag goals (Table 6-2) and for 15 percent cover of logs.

  In areas where reducing Douglas-fir bark beetle infestation risk is desirable manage for the low end of snag goals and 10 percent cover of down logs. Create CWD in three pulses as described previously. Consider using species other than Douglas-fir for a portion of the CWD.

- **Priority Areas:** S. Fork Oscar Creek, young mid-seral stands where windfirmness is desired. Abiqua Butte and Molalla.

Stand Structure Enhancements

The structure and composition of late-successional and old-growth forest ecosystems have been detailed in numerous publications. Four major structural attributes of old growth Douglas-fir forests are: live old-growth trees, standing dead trees (snags), fallen trees or logs on the forest floor, and logs in streams. Elements typically include multiple canopy layers, smaller understory trees, canopy gaps, and patchy understory. (Rod, B-2)

Treatment Triggers and Landscape Priorities

Scenario 1

- **Trigger:** Stands with low amounts of CWD (less than 5 percent cover) and/or snags because of past salvage logging and fire proofing. In addition, stands must have an excess of standing green trees (i.e. 70 percent canopy closure in WH Zone, 60 percent canopy closure in PSF Zone, greater than 50 percent canopy cover in MH zone)

- **Objective:** Stand structure enhancement to accelerate CWD recruitment. Removal of wood products is not an objective.

- **Treatment:** Create snags and/or fall some standing trees for CWD component. (As described under CWD Management, this chapter.) This is a non-extractive treatment.

- **Priority Areas:** Soosap and Table Rock LSRs.

Scenario 2

- **Trigger:** Young stands (plantations) that significantly lack down wood (less than 5 percent cover) and do not have an adequate recruitment source (i.e. standing snags or remnant trees).
- **Objective:** Stand structure enhancement to increase distribution of down wood across the LSR, enhance local site conditions for some species with small home ranges, and benefit stand throughout rotation. By the time the stand begins to mature it will have large, decayed logs.
- **Treatment**: Consider opportunities during possible adjacent commercial thin or structural enhancement activities in older stands to drop trees into the young stand. When opportunities arise, import wood from off-site sources (including non-LSR sources) to distribute on site. This is a non-extractive treatment.
- **Priority Areas:** Clearcut units with less than 5 percent down wood.

Scenario 3

This activity will require a project review by REO when sites are selected and projects designed.

- **Trigger:** 80 year old overstory with understocked or stagnating understory. Examples: Heavy shelterwood retention (for frost protection) with understory that is scarce due to limited light (overstory is too heavy). Suppressed understory which has grown above the frost level but is experiencing declining growth and health due to dominance of overstory (needs to be released to continue movement upward through canopy).
- **Objective:** create vertical diversity and complexity and release the second story to respond and grow.
- **Treatment:** create gaps less than ½ acre in size to initiate and/or release the understory plus leave unthinned areas. Plant gaps if no understory is present using minor species as needed. Manage the density of the all the canopy levels to release understory but leave large trees on site for snags or CWD. This is a non-extractive activity.

Risk Management

Silvicultural activities aimed at reducing risk shall focus on younger stands in Late-Successional Reserves. The objective will be to accelerate development of late-successional conditions while making the future stand less susceptible to natural disturbances. (ROD, C-13)

Treatment Triggers and Landscape Priorities

- **Trigger:** LSR areas or areas immediately adjacent to LSRs with a high susceptibility to wind throw.
- **Objective:** Windfirmness - improve edge firmness to prevent catastrophic loss to LSR from windthrow.
- **Treatment:** Density control within applicable portions of LSR and/or adjacent to LSR when appropriate. Highest priority would be to use wide spacing in young stands that exist in such areas. Within LSRs, treat stands less than 80 years old to increase spacing, improve root strength, stand vigor, stem strength, and exposure to wind (pp. 4-9, S. Fork WA). In adjacent stands consider other risk treatments (shape, etc.) during harvest activities. (Pp. 4-9, S. Fork WA)

Salvage

The ROD defines salvage as the removal of trees from an area following a stand-replacing event such as those caused by wind, fires, insect infestations, volcanic eruptions, or diseases. The ROD recognizes salvage as an acceptable management practice to avoid excessive amounts of CWD or reduce high risk of future stand replacing events. (ROD C-13)

- **Trigger:** A catastrophic disturbance event >10 acres (fire, windthrow, insects or disease). Ten acres is minimum before salvage, but minimum may be larger depending on site specific concerns.
- **Objective:** Employ management activities if needed to accelerate forest regeneration and reforestation. The priority is to salvage where it would help attain late-successional forest ecosystems. Salvage areas are to be managed for the high end of CWD levels. In natural systems, these are the areas that would provide pockets of high densities of snags and down logs. In areas where salvage is due to windthrow, snag goals may not be attainable. In this case, no standing dead or dying trees should be harvested. Snags and down logs tend to be large in most salvage areas.

- **Treatment:** Use standards from ROD. Leave the largest available dead and dying trees to meet CWD requirements. Leave all hollow logs, trees, and snags.

  In areas where reducing Douglas-fir bark beetle infestation risk is desirable manage for the low end of snag goals and 10 percent cover of down logs. Consider using species other than Douglas-fir for a portion of the CWD.

Other Management Considerations

Stocking Standards

Meet minimum agency stocking standards.

Fertilization is not considered appropriate because it could cause a detrimental effect on fungi, especially myccorrhizal fungi, and decrease biological diversity. The effect of fertilization over the long term is also unknown.

Frost Pocket Management

It is not anticipated that management activities in LSRs will create openings that will result in reforestation problems due to frost pockets. Existing openings in frost pockets are usually a result of past management activities. Reforestation attempts have failed in some of these frost pockets. Four frost pockets, totaling 24 acres, occur in LSR 207. In the past, resources have been invested into these specific sites to manage them as permanent forage openings with seeding.

For these 24 acres of frost pockets the areas will be assessed for the feasibility of reestablishing a conifer stand. If the silviculturist determines that it is not feasible to restock these areas, they will be maintained as forage openings for deer and elk. The areas will be scarified and reseeded every five years to maintain quality forage. Only seeds of native plants will be used.

LSR Boundary Adjustments

This assessment recommends an allocation change for matrix lands shown on REO maps as LSR. Approximately 2000 acres within Soosap LSR (sections 4,9 and portions of 10 and 11 in T6S, R4E) have been identified for possible conversion from LSR to Matrix. This would balance Matrix lands within or on the edge of the Roaring River and Soosap LSRs that would become LSR. See Map 6-1.

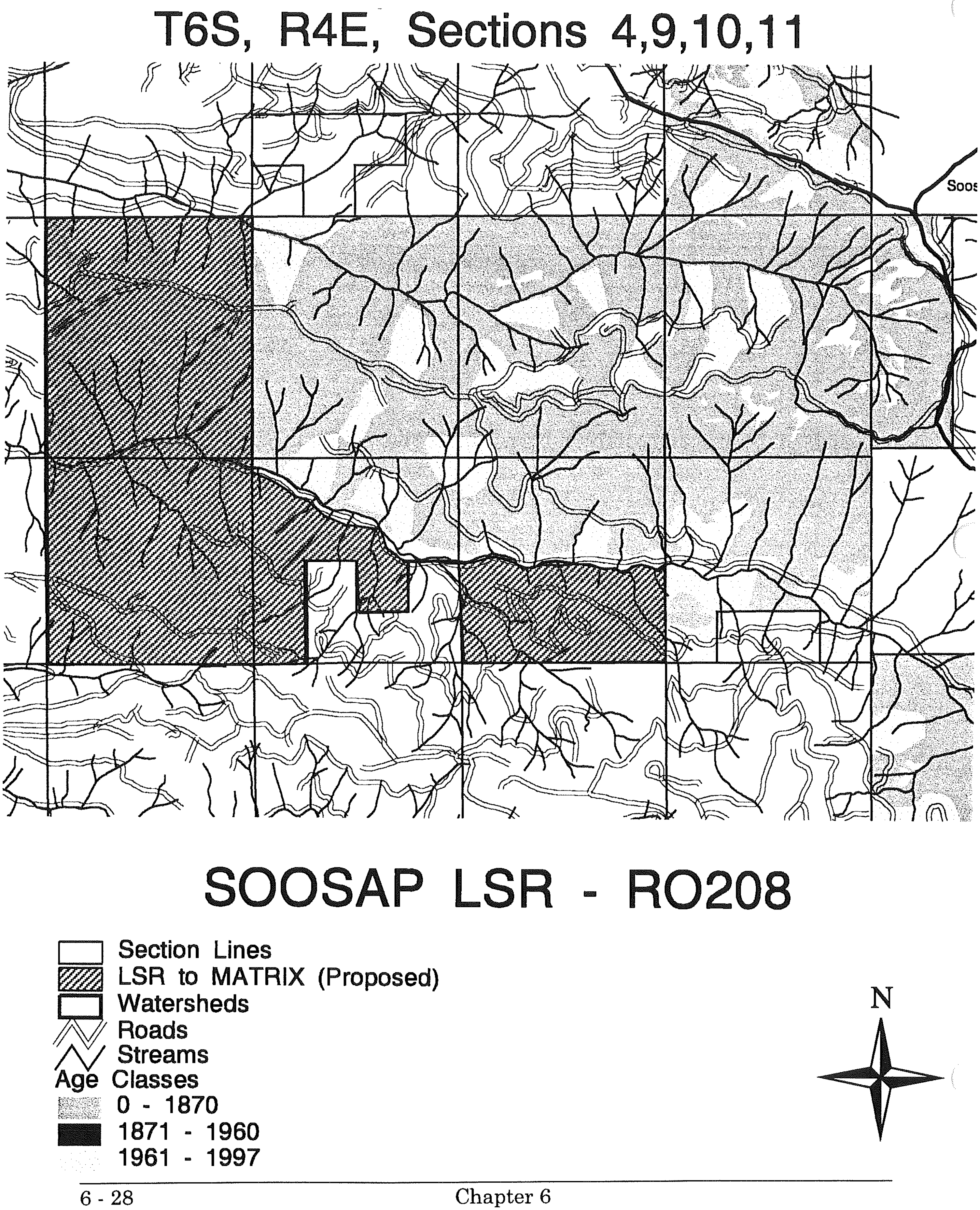
The Soosap BLM lands (LSR to Matrix) are characterized as either greater than 120 years old or less than 40. They do not contribute to connectivity with another LSR or federal lands except to the east. They do not contain any known northern spotted owl sites or other known federally listed species. All lands to the north, south, and west are private and less than 30 years old. Management of the private lands can be assumed to follow a rotation age of 60 years or less. This keeps this block of land isolated to the north, west, and south.

Future Adjustments

Exchange land in the Molalla. The private land holdings adjacent to the western edge of the Table Rock Complex should be acquired. The impact to the complex would be to lessen the effect of private land management and would help improve habitat conditions adjacent to the LSR.

The BLM Cascades Resource Area and the Clackamas River Ranger District should hold discussions to adjust boundaries on BLM and FS lands between the northwestern portion of the Roaring River (207A) LSR through the Soosap (208) LSR to connect with the Table Rock Complex (209A). This would provide a better connectivity corridor in the long-term.

Map 6-1. LSR to Matrix Adjustment (proposed)



Recreation Related Projects

According to the ROD, *"Dispersed recreational uses, including hunting and fishing, generally are consistent with the objectives of Late-Successional Reserves".* The ROD recommends *"use adjustment measures such as education, use limitations, traffic control devices, or increased maintenance when dispersed and developed recreation practices retard or prevent attainment of Late-Successional Reserve objectives."* (ROD C-18) *"New development proposals that address public needs or provide significant public benefits, such as powerlines, pipelines, reservoirs, recreation sites or other public works projects will be reviewed on a case-by-case basis and may be approved when adverse effects can be minimized and mitigated."* (ROD C-17) The close proximity of this Assessment Area to the Portland metro region can create special management circumstances for recreation management consistency with LSR objectives. Dispersed recreation use within the LSRs varies in type and intensity and ranges from primitive, light use to high use, highly concentrated dispersed recreation attractions. All recreation use can be expected to increase as the population of the Portland metro region continues to expand. With or without appropriate developed site design, existing recreation attractions can be expected to increase in numbers of users. New facility development and existing facility expansion may be necessary to protect late-successional habitat in the LSRs under existing and projected recreation demand.

New Facility Development

Many popular dispersed recreation sites receive tens of thousands of visitors in a recreation season. In addition, these sites are almost always located near streams, rivers, or lakes which both limits the supply and can present difficulties meeting Aquatic Conservation Strategy objectives. Closure of such areas can be infeasible to enforce, particularly without the provision of alternative recreation facilities. Closure can also simply shift the use to and strain the capacity of other popular recreation sites. In areas of concentrated dispersed recreation areas like the headwaters of the Molalla River, it is recommended that new facility development be designed to mitigate the effects on late-successional habitat and provide appropriate alternative recreations sites. New day-use facilities, trails and associated trailhead development may also be necessary to reduce effects on existing high use trails.

Table Rock LSR

Campground Development

This project would include development of a primitive campground and equestrian group use site (25-30 units) of approximately 10 to 12 acres upstream from the confluence of the Table Rock Fork and Copper Creek near the western edge of the wilderness and within the LSR. This development would include installations of restrooms (vault type), improving/graveling campground access road and site pads, and drilling a well for a hand pump.

Wilderness Trailhead Improvements

Proposed new improvements at the existing trailheads include expansion and graveling of parking areas, installation of small, portable composting toilets, and improved signing involving less than 5 acres total. Development of a new trailhead to the south of the Rooster Rock area would replace the old Peachuck trailhead and result in the ripping of the existing road to that trailhead.

Trail Development

An existing trail system on the west side of the Molalla River on Matrix lands would be tied into the existing trail system in the Table Rock Wilderness. This would include approximately 0.5 miles of new trail through LSR land. The BLM will continue to manage and attempt to maintain portions of the old ridge trail system that connects Nasty Rock Area with Baty Butte and Round Mountain and points north. Future trail proposals would include connecting this trail system with the Table Rock and Bull of the Woods Wilderness areas. Much of the proposed trail connections would incorporate existing forest roads and reestablish old historic tails. The new trail connections would require the development of approximately 5 to 10 miles of trail with much of that utilizing old forest roads.

Considerations for new and existing recreation development:

- Limit and/or reduce habitat area affected.
- Close or restrict dispersed recreations sites in conjunction with facility development if possible.
- Locate and/or relocate camping facilities outside of riparian areas and sensitive habitat if possible.
- Provide toilet facilities to meet water quality and public safety objectives.
- To ensure consistency with coarse woody debris objectives, restrict firewood collection.
- If hazard tree removal is necessary, leave on site.

- Consider topping hazard trees instead of removal.
- Route or reroute trails away from nest trees, calving areas, special habitats, or sensitive habitat areas.
- Use "roads to trail" concept for new trail development where possible.
- New trail alignment should avoid mature tree removal if possible. If tree removal is necessary, leave on site to meet objectives for coarse woody debris.
- Limit trail use during critical wildlife breeding periods.
- Rehabilitate and/or restore closed dispersed recreation sites, sites affected by construction activities, and impacted areas.
- Plan vegetation restoration at the outset of design and construction to allow for plant salvage and reuse, seed collection, and/or propagation of local native species.
- Use vegetation to prevent off trail access.

Recreation Recommendations from Watershed Analysis

The retention of existing recreation facilities is recognized in the ROD but some modification may be necessary to ensure consistency with LSR objectives. The Collawash Watershed Analysis recommended changing the LSR boundary around Bagby Hot Springs "to give the Forest Service more management flexibility." This assessment team does not see the need to change management allocations at this time. The existing Memorandum of Understanding with Friends of Bagby which reinforces ROD restrictions on firewood harvest in LSRs is consistent with LSR objectives for CWD. If future development or expansion at the site becomes necessary, it is recommended to "be reviewed on a case-by-case basis" and "approved when adverse effects can be minimized and mitigated". (ROD C-17)

A limited number of off-highway-vehicle (OHV) trails are located in the Roaring River Watershed in RO207A. The Roaring River Watershed Analysis recommends the LSR Assessment develop "a multiwatershed OHV management plan that includes Roaring River Watershed". The development or expansion of new OHV trails in LSRs is not recommended by this assessment team. OHV trails and roads are not considered neutral or beneficial to LSR objectives because they function like roads in terms of habitat fragmentation, potential sediment delivery, loss of soil productivity, and wildlife harassment.

Road Related Activities

Road Decommissioning

Reduction of road mileage in the LSRs within the Assessment Area to reduce habitat fragmentation, barriers to connectivity, and wildlife harassment is recommended for consistency with LSR objectives. Maintenance and reduction of road mileage within the Assessment Area is expected to vary with the individual characteristics of each LSR and maintenance budgets. Recommendations for road reduction are based upon the Access and Travel Management Plan (ATM), recommendations from watershed analysis, and BLM management direction. This assessment supports the decommissioning of roads already identified by those analyses. It is also recommends that district ATMs be reviewed for additional road decommissioning to meet LSR objectives. A list of additional roads within LSRs identified by the Clackamas River Ranger Districts for potential decommissioning can be found in Appendix E. Considerations used for these additions included: road is redundant within a locally heavy concentration of roads and other access is available; road functions primarily as trailhead access. Consider road to trail conversion opportunities and moving trailhead outside LSR. Road closure priorities supported by this assessment must also be balanced against greater Forest/District priorities for road decommissioning (for example ACS concerns outside of LSRs).

Criteria to use for road decommissioning in LSRs include:

- road is part of a locally heavy concentration of roads
- road dissects an important patch of current late-successional forest (See TLMLT Map)
- road dissects multiple blocks of late-successional forest.
- road is not needed for LSR Silvicultural treatment in the near future
- road is located within deer and elk winter range
- road is within a Riparian Reserve
- road is within an LSR with a high density road network
- road value for fire control access is low

(Other priorities should also be weighted beyond LSR objectives, i.e. road is within a key watershed, road presents ACS conflicts, excessively costly to maintain, etc.).

New Roads

New road construction in the LSRs is not expected "unless potential benefits exceed the cost of habitat impairment" (ROD C-16). Although it is not anticipated that new road construction will occur in LSRs it is recognized the construction is sometimes necessary. During the floods in February, 1996, a one half mile of catastrophic road failure occurred on Highway 224 near milepost 47. Construction is under way to relocate this section of road upslope on more stable land. As a result, 20 acres of Late Successional Reserve habitat is being lost. The Lower Clackamas Watershed Analysis recommended that this project proceed because Highway 224 is the major access route in the Clackamas River drainage and is identified as Forest Service level 4 which is critical access. Maintaining access is also consistent with the objectives of the Wild and Scenic River plan.

The ROD also includes direction on road building in Key Watersheds (which overlap 70 percent of the LSR network in the Assessment Area). No new roads will be built in roadless areas in Key Watersheds. Reduce existing system and nonsystem road mileage in Key Watersheds. If funding is insufficient to implement reductions, there will be no net increase in the amount of roads in Key Watersheds (ROD p. B-19).

Maintenance

We anticipate over time there will be trees that present a safety hazard along major roadways and/or facilities within the LSRs. At such a time that a maintenance and safety concern arises, hazard trees may be cut and a portion removed consistent with LSR Standards and Guidelines (ROD p. C-16). Such maintenance work may be accomplished through a timber sale. Felled hazard trees should be left on site to the extent practicable (i.e. amounts beyond that needed to offset costs of activity). Material should be left in areas where down wood amounts are furthest from desired goals (as specified in Treatment Chapter, CWD Mgmt). Topping trees should be considered as an alternative to felling.

When trees fall across roadways (for example from a storm event) that portion of the bole that lies within the road prism may be cut and removed. In cases where the log or portion of the down log adjacent to roadways does not affect road maintenance or safety, consideration of using the log to meet down wood objectives should be weighed against the need to fund the activity as discussed above.

Chapter 7
Monitoring

Chapter 7
Monitoring

Monitoring is critical to evaluating our success in achieving late-successional structural characteristics across the landscape. Several large scale ecological questions surfaced in this assessment. These questions generally revolve around management activities to improve older forest patch function by increasing the area of late-successional and interior forest, the connectivity between patches, and/or controlling human access. These questions are not new and have been extensively discussed in the literature and locally in the following documents: FEMAT (1993), First Approximation of Ecosystem Health (1993), in the Assessment Report (1995), and a biodiversity conservation plan by Noss (1992).

Current Monitoring Efforts

Implementation Monitoring

Implementation monitoring is already done under the Forest Plan monitoring plan. Key items to monitor include:

- Are timber harvests consistent with standards and guidelines and with REO review requirements?
- Are other management activities in the Late-Successional Reserve consistent with the standards and guidelines (e.g. prescribed fire and resulting emissions) Late-Successional Reserve plan completed?
- Are management activities consistent with the Late-Successional Reserve Plan? (ROD p. E-5)

The Forest Service implementation monitoring plan is being developed. On BLM lands, at least 20 percent of management activities within Late Successional Reserves will be examined following project completion, to determine:

- whether proposed activities within the LSR were well defined and stipulated in the supporting documentation,
- whether the proposal clearly documented how the activities were consistent with LSR objectives and appropriate Standards and Guidelines, and
- whether post project results were consistent with the proposal.

Effectiveness Monitoring

Silvicultural standards and guidelines for Late-Successional Reserves provide examples of the close relationship between effectiveness and validation monitoring and research. Thinning in young stands is permitted for the purpose of maintaining or creating late-successional forest conditions. Monitoring the effectiveness of various thinning strategies will be important so that managers can apply those techniques which will be most likely to create and maintain late-successional conditions. It requires a measurable set of late-successional attributes which can provide the basis for assessment of post-thinning successes and failures. General attributes have been identified, but further research is required to identify those characteristics which are key elements of late-successional forests, i.e. the desired outcomes of thinning programs must be further refined. Effectiveness monitoring programs could be designed to answer evaluation questions such as: "did silvicultural treatments benefit the creation and maintenance of late-successional conditions?"

It would be more efficient to combine effectiveness with validation monitoring and research to provide more complete critical input to adaptive management. Therefore, an effectiveness monitoring program for standards and guidelines may best be developed as an element of a combined effectiveness and validation monitoring plan, and since this will establish research priorities, significant input from research is needed. (Report of the Monitoring Design Team, 1995)

The long-term goal is to provide future managers, scientists, and citizens with better information and the opportunity to evaluate the effectiveness of different management approaches to achieving LSR objectives. A landscape level approach needs to be implemented to address such issues as the amount of late-successional habitat, interior forest habitat, and connectivity. The Province level teams are working on baseline data for this approach by querying existing vegetation databases using agreed upon late-successional and old growth criteria. A pilot project in the Coast Range Province will be evaluating the following questions for an effectiveness monitoring plan.

- What are the amount and distribution of forest classes, including LSOG, at the large landscape scale? How are they expected to change in the foreseeable future?
- What is the patch size distribution, patch interior area distribution, and interpatch distance distribution of LSOG at the large landscape scale?
- What are the effects of silvicultural treatment and salvage on LSOG composition and structure at the stand scale?
- What is the trend in amount and changes in distribution of habitat, particularly in Late-Successional Reserves?
- What is the trend in amount and distribution of dispersal habitat?

Monitoring Specific to this LSR Assessment

Implementation

Utilize the current monitoring efforts. The following are site-specific questions to be considered that are specific to this LSR assessment. This list is not all inclusive but should be developed by the project ID team as they work through a project.

LSR Objectives

- Are management activities consistent with the recommendations of this assessment?
- Are treatments consistent with the priorities established in the LSR Assessment to focus on young managed stands first?
- Are stands that appear to be on the right trajectory to develop late-successional characteristics on their own being left to develop?

Growth Enhancement

- Were the stocking density and species distribution goals achieved in young stand thinnings?
- Are wider spaced thinning treatments accelerating the development of late-successional characteristics such as tree growth?
- Where dispersal habitat is a current concern, were thinnings used that will achieve rapid canopy closure to maintain and enhance connectivity?

CWD Goals

- Are the CWD goals established for the LSR being met in treatment areas?
- If not, is there a written plan established for meeting those goals?
- Is CWD already on-site retained and protected during treatments?

Insects and Disease

- Are risk assessments being done on the impacts of insect and disease prior to treatments, especially for salvage?
- Are treatments being monitored after treatment to assess the impact?

Road management

- Are road closures being considered and addressed along with management activities and for other wildlife concerns?

Other Treatments

- Is the roadside salvage of hazard trees consistent with the objectives of this plan?
- Are recreation activities consistent with LSR goals and objectives?

Late-successional Species

- Are survey and manage species protocols being followed?
- Are specific species addressed in the assessment being managed for in a project?

Exotic Species

- What is the status/trend of late-seral associated invasive weeds and their impact on LSR objectives?
- Are noxious weed treatments effectively eradicating or controlling their spread?

Fire

- Are the fire plan monitoring and evaluation guidelines of this LSR assessment being followed during a fire situation?

Chapter 8
References

Chapter 8
References

Allen, Edith B., Michael F. Allen, Dot J. Helm, James M. Trappe, Randy Molina, and Emmanuel Rincon. 1995. Patterns and regulation of mycorrhizal plant and fungal diversity. In: The significance and regulation of soil biodiversity, 47-62. Collins, Robertson, Klug (eds).

Allen, Michael F. and Edith Bach Allen. 1992. Mycorrhizae and plant community development: mechanisms and patterns. In: The funal community: its organization and role in the ecosystem. (eds. D.T. Wicklow and G.C. Carroll).

Amaranthus, M. P. and D. A. Perry. 1994. The functioning of ectomycorrhizal fungi in the field: linkages in space and time. Plant and Soil 159:133-140.

Amaranthus, Michael P., Debbie Page-Dumroese, Al Harvey, Efren Cazares, and Larry F. Bednar. 1996. Soil compaction and organic matter removal affect conifer seedling nonmycorrhizal and ectomycorrhizal root tip abundance and diversity. PNW-RP-494.

Amaranthus, Michael, James M. Trappe, Larry Bednar, and David Arthur. 1994. Hypogeous fungal production in mature Douglas-fir forest fragments and surrounding plantations and its relation to coarse woody debris and animal mycophagy. Can. J. For. Res. 24:2157-2165.

Bartels, R., J.D. Dell, R.L. Knight, and G. Schaefer. 1985. Dead and down woody material. in. Management of wildlife and fish habitat in forests of western Oregon and Washington. USDA Forest Service, Pacific NW Region, Pub. No. R6-F&WL-192-1985.

Bloomberg, W.J. 1984. A ground survey method for estimating loss caused by *Phellinus weirii* root rot. III: Simulation of disease spread and impact. Inf. Rep. BC-R-7. Victoria BC: Pacific Forest Research Centre, Canadian Forestry Service. 25 p.

Boddy, Lynne. 1992. Development and function of fungal communities in decomposing wood. In: The funal community: its organization and role in the ecosystem. (eds. D.T. Wicklow and G.C. Carroll).

Boucher, Virginia L. and Daphne F. Stone. 1992. Epiphytic lichen biomass. In: The fungal community: its organization and role in the ecosystem. (eds. D.T. Wicklow and G.C. Carroll).

Breil, David A. and Susan M. Moyle. 1976. Bryophytes used in construction of bird nests. Bryologist 79:95-98.

Brown, Valerie K and Alan C. Gange. 1990. Insect herbivory below ground. Adv. Ecol. Res. 20:1-58.

Bruce, C., D. Edwards, and K. Mellen, and others. 1985. Wildlife relationships to plant communities and stand conditions. in E.R. Brown, tech. ed., Management of wildlife and fish habitats in forests of western Oregon and Washington. USDA Forest Service, Pacific Northwest Region, Portland, OR. Pub. No. R6-F&WL-192-1985.

Bull, E.L., and J.E. Ohmann. 1993. The association between Vaux's swifts and old-growth forests in northeastern Oregon. Western Birds 24:38-42.

Bull, E.L., C.G. Parks, and T.R. Torgersen. 1997. Trees and logs important to wildlife in the Interior Columbia River Basin. USDA Forest Service, General Technical Report, PNW-GTR-391. 55 pp.

Bull, E.L., and A.D. Partridge. 1986. Methods of killing trees for use by cavity nesters. Wildlife Society Bulletin 14:142-146.

Carey, A.B., C. Elliot, B.R. Lippke, and others. 1996. Washington forest landscape management project - a pragmatic, ecological approach to small landscape management. Washington DNR, Washington Forest Landscape Project, Report No. 2. 99pp.

Carey, A.B., and M.H. Huff. Wildlife and vegetation of unmanaged Douglas-fir forests. USDA Forest Service, Gen. Tech. Rpt. PNW-GTR-285.

Carey, A.B., and M.L. Johnson. 1995. Small mammals in managed, naturally young, and old-growth forests. Ecol. Appl. 5:336-352.

Carroll, George C. 1992. Fungal mutualism. In: The fungal community: its organization and role in the ecosystem. (eds. D.T. Wicklow and G.C. Carroll).

Castello, Donald J. Leopold, and Peter J. Smallidge. 1995. Pathogens, patterns, and processes in forest ecosystems. Bioscience, 45(1): 16-24.

Chen, Jiquan, Jerry F. Franklin, and Thomas A. Spies. 1990. Microclimate pattern and basic biological responses at the clearcut edges of old growth Douglas-fir stands. NW Environmental Journal 6:424-425.

Chen, Jiquan and Jerry F. Franklin. 1997. Growing-season microclimate variability within an old-growth Douglas-fir forest. Cli. Res. 8:21-34.

Childs, T.W. 1963. *Poria weirii* root rot. Phytopathology 53:1124-1127.

Childs, T.W. 1970. Laminated root rot of Douglas-fir in western Oregon and Washington. Res. Pap. PNW-102. Portland, OR: US Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station. 2 p.

Cromack, Kermit, Jr. and Bruce A. Caldwell. 1992. The role of fungi in litter decomposition and nutrient cycling. In: The fungal community: its organization and role in the ecosystem. (eds. D.T. Wicklow and G.C. Carroll).

Curtis, R.O. and G.W. Clendenen. 1994. Levels-of-Growing Stock Cooperative Study in Douglas-fir: Report number 12 The Iron Creek Study: 1966-89. USDA Forest Service. Pacific Northwest Research Station. PNW-RP-475, December, 1994.

Deyrup, Mark Amidon. 1981. Deadwood decomposers. Nat. Hist. 90: 84-91.

Diaz, N. and D. Apostol. 1992. Forest Landscape Analysis and Design: A process for developing and implementing land management objectives for landscape patterns. USDA Forest Service PNW R6 ECOL-TP-043-92.

Dickman, Alan. 1992. Plant pathogens and long-term ecosystem changes. In: The fungal community: its organization and role in the ecosystem. (eds. D.T. Wicklow and G.C. Carroll).

Dolph, R.E. 1980. Budworm activity in Oregon and Washington: 1947-1979. R6-FIDM-033-1980. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Region. 54 p.

Evers, Louisa, Heidi Hubbs, Rob Crump, John Colby, and Robin Dobson. 1995. Fire ecology of the Mid-Columbia Region. Mt. Hood National Forest.

Fahrig, L. and G. Merriam. 1985. Habitat patch connectivity and population survival. Ecology 66:1762-1768.

FEMAT 1993. Forest Ecosystem Management: An Ecological, Economic, and Social Assessment, Report of Forest Ecosystem Management Assessment Team, USDA Forest Service, Ogden, UT.

Franklin, Jerry F., H. H. Shugart, and Mark E. Harmon. 1987. Tree death as an ecological process. Bioscience, 37(8): 550-556.

Franklin, Juliet C. 1992. Mechanisms in fungal succession. In: The funal community: its organization and role in the ecosystem. (eds. D.T. Wicklow and G.C. Carroll).

Furnish, J., T. Burke, T. Weasma, and others. 1997. Survey protocol for terrestrial mollusk species from the Northwest Forest Plan. Draft Unpublished Report.

Gerson, Uri. 1969. Moss-arthropod associations. Bryologist 72:495-500.

Gerson, U. and M.R.D. Seaward. 1977. Lichen - Inverbret Associations. In Lichen Ecology, Ed. Seaward M.R.D., pages 69-119. Academic Press, London.

Ghersa, Claudio M. and Mary Lynn Roush. Searching for solutions to weed problems. BioScience 43:104-109.

Gilbertson, R. L. 1980. Wood rotting fungi of North America. Mycologia 72:1-49.

Graham, R.T., A.E. Harvey, M.F. Jurgensen, and others. 1994. Managing coarse woody debris in forests of the Rocky Mountains. USDA Forest Service, Intermountain Research Station, Res. Paper INT_RP-477. 13 pp.

Halverson, N.M., C. Topic and R. Van Vickle. 1986. Plant association and management guide for the western hemlock zone, Mt. Hood National Forest. USDA Forest Service Area Guide R6-ECOL-232A-1986. Pacific Northwest Region, Portland, OR. 111 pp.

Hansen, E.M. 1979. Survival of *Phellinus weirii* in Douglas-fir stumps after logging. Canadian Journal of Forest Research.. 9:484-488.

Hansen, E.M. 1976. Twenty-year survival of *Phellinus (Poria) weirii* in Douglas-fir stumps. Canadian Journal of Forest Research.. 6:123-128.

Harkenrider, Daniel T. 1993. Meeting Customer Expectations: Can Public Safety be Assured in an "Urban Proximate" Forest? Region 6, Mount Baker-Snoqualmie National Forest, Skykomish Ranger District.

Harmon, M. E. et. al. 1986. Ecology of coarse woody debris in temperate ecosystems. Adv. Ecol. Res. 15:133-302.

Harmon, M.E., J.F. Franklin, F.J. Swanson, and others. 1986. Ecology of coarse woody debris in temperate ecosystems. Advances in Ecological Research 15:133-302.

Hemstrom, Miles A., W.H. Emmingham, N.M. Halverson, S.E. Logan and C.L. Topik. 1982. Plant Association and Management Guide for the Pacific Silver Fir Zone, Mt. Hood and Willamette National Forests. USDA Forest Service, Pacific Northwest Region Publication No. R6-ECOL-100-1982a.

Hostetler, B.B.; Ross, D.W. 1996. Generation of coarse woody debris and guidelines for reducing risk of adverse impacts by Douglas-fir beetle. 6 p. Unpublished report. On file with: Westside Forest Insect and Disease Technical Center, 16400 Champion Way, Sandy, OR 97055.

Ingham, Russell E. 1992. Interactions between invertebrates and fungi: effects on nutrient availability. In: The fungal community: its organization and role in the ecosystem. (eds. D.T. Wicklow and G.C. Carroll).

Interagency Monitoring Design Team. Effectiveness Monitoring. Report of the Monitoring Design Team to the Research and Monitoring Committee. July 21, 1995.

Johnson, N.E.; Wright, K.H.; Orr, P.W. 1961. Attack and brood survival by the Douglas-fir beetle in four types of windthrown trees in western Washington. Forestry Research Note No. 40. Centralia, Washington: Weyerhaeuser Company. 16 p.

Jones, L.L., and M.G. Raphael. 1991. Ecology and management of marten in fragmented habitats of the Pacific Northwest. Progress Rpt: FY91. Unpublished Rpt. USDA Forest Service, Pacific Northwest Research Station, Olympia, WA.

Kjoller, Annelise and Sten Struwe. 1992. Functional groups of microfungi in decomposition. In: The fungal community: its organization and role in the ecosystem. (eds. D.T. Wicklow and G.C. Carroll).

Krusemark, F., J. Agee, and D. Berry. 1996. The history of fire in the Bull Run Watershed, Oregon.

Laaka, Sanna. 1992. The threatened epixylic bryophytes in old primeval forests in Finland. Biol. Cons. 151-154.

Leonard, W.P., H.A. Brown, L.L.C. Jones and others. 1993. Amphibians of Washington and Oregon. Seattle Audubon Society, Seattle, WA. 168 pp.

Lesica, Peter, Bruce McCune, Stephen V. Cooper, and Won Shic Hong. 1991. Differences in lichen and bryophyte communities between old-growth and managed second-growth forests in the Swan Valley, Montana. Can. J. Bot. 69: 1745-1755.

Lindquist, R.W., and J.M. Miriani. 1991. Nesting habitat and abundance of snag-dependent birds in the southern Washington Cascade Range. pp. 221-239. in. L.F. Rugiero, K.B. Aubry, A.B.

Marini, M.S., S.K.Robinson, and E.J. Heske. 1995. Edge effects on nest predation in the Shawnee National Forest, Southern Illinois. Biol. Conserv. 74:203-213.

Marshall, D. 1991. Hoskins Levels of Growing Stock Study. Oregon-Washington Silviculture Council Tour, September 6 and 7, 1984.

Maser, C. 1988. The redesigned forest. R. & E. Miles, San Pedro, CA.

Maser, C. and Z. Maser. 1988. Mycophagy of red-backed voles, *Clethrionomys californicus* and *C. gapperi*. Great Basin Naturalist. 48(2):269-273.

Maser, Z., C. Maser, and J. M. Trappe. 1985. Food habits of the northern flying squirrel (*Glaucomys sabrinus*) in Oregon. Can. J. Zool. 63:1085-1088.

Maser, C, Trappe, J. M., and Nussbaum, R. A. 1978. Fungal-small mammal interrelationships with emphasis on Oregon coniferous forests. Ecology. 59:799-809.

McCune, Bruce. 1993. Gradients in epiphyte biomass in three Pseudotsuga-Tsuga forests of different ages in western Oregon and Washington. The Bryologist, 96(3):405-411.

McCune, Bruce and T.F.H. Allen. 1985. Will similar forests develop on similar sites? Can. J. Bot. 63:367-376.

McCune, B., C.C. Derr, P.S. Muir, A. Shirazi, S.C. Sillett, and W.J. Daly. 1996. Lichen pendants for transplant and growth experiments. Lichenologist 28:161-169.

Mellen, T.K. 1987. Home range and habitat use of pileated woodpeckers, western Oregon. M.S. Thesis. Oregon State Univ., Corvallis, OR. 96 pp.

Mellen, K., M. Huff, and R. Hagestedt. 1995. "HABSCAPES" Interpreting landscape patterns: a vertebrate habitat relationships approach. in J.E.Thompson, compiler, Analysis in support of ecosystem management: analysis workshop III, April 10-13, 1995, Fort Collins, Colorado. USDA Forest Service, Ecosystem Management Analysis Center, Washington, D.C.

Molina, R. and Trappe, J. M. 1982. Patterns of ectomycorrhizal specificity and potential among Pacific Northwest conifers and fungi. Forest Science. 28:423-458.

Molina, R., M. Amaranthus, D. Pilz, and C. Fischer. 1996. Commercial harvest of edible ectomycorrhizal fungus sporcarps from Pacific northwest forests: ecological and management implications. In: Mycorrhizas in integrated systems: from genes to plant development. Barea and Azcon (eds).

Molina, R., Massicotte, H. B., and Trappe, J. M. 1992. Specificity phenomena in mycorrhizal symbioses: community ecological consequences and practical implications. In: Mycorrhizal functioning: an integrative plant-fungal process. (M. F. Allen, ed.) CAB Internationl.

Nash, Thomas H. 1996. Lichen biology. Cambridge Univ. Press.

Neitlich, Peter. 1993. Lichen abundance and biodiversity along a chronosequence from young managed stands to ancient forest. Master of Science Thesis. University of Vermont.

Neitlich, Peter, and Bruce McCune. 1995. Lichen diversity in the upper Willamette and Siuslaw watersheds Eugene district of the Bureau of Land Management. OSU Report.

Neitlich, Peter, and Bruce McCune. 1995. Structural factors influencing lichen biodiversity in two young managed stands, western Oregon, USA. OSU Report.

Neitlich, Peter, and Bruce McCune. 1997. Hotspots of epiphytic lichen diversity in two young managed forests. Cons. Biol. 11:172-182.

Neitro, W.A., R.W. Mannan, D.Taylor, and others. 1985. Snags (wildlife trees). in. Management of wildlife and fish habitat in forests of western Oregon and Washington. USDA Forest Service, Pacific NW Region, Pub. No. R6-F&WL-192-1985.

Nelson, E. E.; Hartman, T. 1975. Estimating spread of *Poria weirii* in a high elevation mixed conifer stand. Journal of Forestry. 73:141-142.

Noss, Reed F.

Oliver, C.D., and B.C. Larson. 1990. Forest Stand Dynamics. McGraw-Hill, Inc. New York. 467 pp.

Olson, Dede. 1997. Preliminary report: Oregon slender salamander. Riparian buffer study - Keel Mountain study site. USDA Forest Service, PNW Research Station, Corvallis, OR. Unpublished Report.

Olson, D.H. 1996. Survey protocols for component/strategy 2 amphibian species. USDA and USDI. Unpublished Report.

Oregon State Parks and Recreation Department, 1991. Oregon State Comprehensive Outdoor Recreation Plan, Recreational Needs Bulletin.

Oregon State Parks and Recreation Division, 1988. Statewide Comprehensive Outdoor Recreation Plan 1988-1993.

Oregon Parks and Recreation Department, 1993. Oregon Outdoor Recreation Plan 1994-1999, Public Review Draft.

Oregon Heritage Task Force Report, 1995.

Per-Anders Esseen, and Renhorn, K. 1996. Epiphytic biomass in managed and old-growth boreal forests: effect of branch quality. Ecol. Appl. 6(1), pp. 228-238.

Perry, D.A. 1994. Forest Ecosystems. The John Hopkins University Press, Baltimore, Maryland. 649pp.

Perry, D. A., M. P. Amaranthus, J. G. Borchers, S. L. Borchers, and R. E. Brainerd. 1989. Bootstrapping in ecosystems. Bioscience, 39(4):230-237.

Pike, Lawrence H. 1978. The importance of epiphytic lichens in mineral cycling. Bryologist 81:247-257.

Read, D. J. 1992. The mycorrhizal fungal community with special reference to nutrient mobilization. In: The fungal community: its organization and role in the ecosystem. (eds. D.T. Wicklow and G.C. Carroll).

Resources Northwest, Inc. 1995. Initial Late-Successional Reserve Assessment Lower Clackamas Watershed - Mt. Hood National Forest.

Reukema, D.L., and D. Bruce. 1977. Effect of thinning on yield of Douglas-fir: Concepts and some estimates obtained by simulation, USDA Forest Service Gen. Tech. Rept. PNW-58, 36 pp.

Richardson, D. H. S. 1981. The biology of mosses. Blackwell Scientific Publications

Richardson, D. H. S. and C. M. Young. 1977. Lichens and vertebrates. Pages 121-144. In: Lichen Ecology. (ed. M. R. D. Seaward).

Rochelle, J. A. 1980. Mature forests, litterfall and patterns of forage quality as factors in the nutrition of black-tailed deer on northern Vancouver Island. PhD. thesis, University of British Columbia.

Rogers, Paul. 1996. Disturbance ecology and forest management: a review of the literature. Intermountain Research Station, General Technical Report INT-GTR-336.

Ross, D.W., C.G. Niwa. 1997. Using aggregation and antiaggregation pheromones of the Douglas-fir beetle to produce snags for wildlife habitat. Western Journal of Appl. Forestry 12:52-54.

Rudnicky, T.C., and M.L. Hunter. 1993. Avian nest predation in clearcuts, forests, and edges in a forest-dominated landscape. J. Wildl. Manage. 57:358-364.

Ruggiero, L.F., K.B. Aubry, S.W. Buskirk, and others. 1994. The scientific basis for conserving forest carnivores, American marten, fisher, lynx, and wolverine in the western United States. USDA Forest Service General Technical Report RM-254. Rocky Mountain Forest and Range Experiment Station. Fort Collins, CO. 184 pp.

Schlosser, William E. and Keith A. Blatner. 1995. The wild edible mushroom industry of Washington, Oregon, and Idaho. J. For., March pp 31-36.

Shaw, P.J.A. 1992. Fungi, fungivores, and fungal food webs. In: The fungal community: its organization and role in the ecosystem. (eds. D.T. Wicklow and G.C. Carroll).

Sheehan, K.A. 1996. Defoliation by western spruce budworm in Oregon and Washington from 1980 through 1994. R6-NR-TP-04-96. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Region. 34 p.

Sillett, Stephen C. 1995. Distribution and ecology of *Pseudocyphellaria rainierensis*, an epiphytic cyanolichen endemic to the Pacific northwest.

Sillett, Stephen C. 1995. Branch epiphyte assemblages in the forest interior and on clear cut edge of a 700 year Douglas-fir canopy in western Oregon. Bryologist 98:301-312.

Simberloff, Daniel, James A. Farr, James Cox, and David W, Mehlman. 1992. Movement corridors: conservation bargains or poor investments? Conserv. Biol. 6:493-504.

Soderstrom, Lars. 1988. Sequence of bryophytes and lichens in relation to substrate variables of decaying coniferous wood in northern Sweden. Nord. J. Bot., 8(1): 89-97.

Soderstrom, Lars. 1988. The occurrence of epiylic bryophyte and lichen species in an old natural and managed forest stand in northeast Sweden. Biol. Conserv., 45: 169-178.

Sollins, Phillip, Steven P. Cline, Thomas Verhoeven, Donald Sachs, and Gody Spycher. Patterns of log decay in old-growth Douglas-fir forests. 1987. Can. J. For. Res. 17: 1585-1595.

Spencer, W.D., and W.J. Zielinski. 1983. Marten habitat preferences in the northern Sierra Nevada. J. Wildl. Mange. 47:1181-1186.

Spies, T.A., J.F. Franklin, and T.B. Thomas. 1988. Coarse woody debris in Douglas-fir forests of western Oregon and Washington. Ecology 69:1689-1702.

Stoszek, Karl J. 1988. Forests under stress and insect outbreaks. The Northwest Environ. Journal, 4: 247-261.

Tappeiner. J.C. II, J.F. Bell, and J.D, Brodie, 1982. Response of young Douglas-fir to 16 years of intensive thinning, Forestry Research Laboratory of Oregon State University, Corvallis, Research Bulletin 38, 17pp.

Thies, W.G.; Sturrock, R.N. 1995. Laminated root rot in western North America. Gen. Tech. Rep. PNW-GTR-349. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 32 p. In cooperation with Natural resources Canada, Canadian Forest Service, Pacific Forestry Centre.

Thomas J.W., E.D. Forsman, J.B. Lint, E.C. Meslow, B.R. Noon, and J. Verner. 1990. A conservation strategy for the northern spotted owl. A report by the Interagency Scientific Committee to address the conservation of the northern spotted owl. USDA, Forest Service; USDI, Fish and Wildlife Service, Bureau of Land Management, and National Park Service. Portland, OR. 427 pp.

Torgersen, Torolf R., and Evelyn L. Bull. 1995. Down logs as habitat for forest-dwelling ants-the primary prey of pileated woodpeckers in northeastern Oregon. Northwest Science, 69(4):294-302.

Trappe, James M. and Daniel L. Luoma. 1992. The ties that bind: fungi in ecosystems. In: The fungal community: its organization and role in the ecosystem. (eds. D.T. Wicklow and G.C. Carroll).

Ure, D. C. and C. Maser. 1982. Mycophagy of red-backed voles in Oregon and Washington. Can. J. Zool. 60:3307-3315.

USDA Forest Service. October 1990. Final Environmental Impact Statement, Land and Resource Management Plan, Mt. Hood National Forest. Pacific Northwest Region. 491 pp.

USDA Forest Service. 1993. A First Approximation of Ecosystem Health: National Forest system Lands. Pacific Northwest Region (Regional Ecological Assessment Project). 109 pp.

USDA Forest Service, Pacific Northwest Region, Mt. Hood National Forest, Estacada Ranger District, 1993. Environmental Assessment and Management Plan for Roaring National Wild and Scenic River.

USDA Forest Service, Pacific Northwest Region, Mt. Hood National Forest, Clackamas Ranger District, Estacada Ranger District, 1996. Environmental Assessment for the Urban Link Trail.

USDA Forest Service, Pacific Northwest Region, Mt. Hood National Forest, Clackamas Ranger District, 1993. Environmental Assessment For Clackamas River Dispersed Site Rehabilitation Project.

USDA Forest Service, Pacific Northwest Region, Mt. Hood National Forest, Estacada Ranger District, Clackamas Ranger District, 1993. Environmental Assessment and Management Plan for Clackamas National Wild and Scenic River and State Scenic Waterway.

USDA Forest Service. 1979. (unpublished) Cultural Resources Overview Clackamas Badger Jordan Planning Units. Mt. Hood National Forest.

USDA Forest Service. 1995. Collowash Watershed Analysis. Mt. Hood National Forest, Sandy, Oregon.

USDA Forest Service. 1996. Lower Clackamas Watershed Analysis. Mt. Hood National Forest, Sandy, Oregon.

USDA Forest Service. 1996. North Fork Clackamas Watershed Analysis. Mt. Hood National Forest, Sandy, Oregon.

USDA Forest Service. 1997. South Fork Clackamas Watershed Analysis. Mt. Hood National Forest, Sandy, Oregon.

USDA Forest Service. 1995. Eagle Creek Watershed Analysis. Mt. Hood National Forest, Sandy, Oregon.

USDA Forest Service. 1994. Fish Creek Watershed Analysis. Mt. Hood National Forest, Sandy, Oregon.

USDA Forest Service. 1995. Salmon Watershed Analysis. Mt. Hood National Forest, Sandy, Oregon.

USDA Forest Service. 1995. Zigzag Watershed Analysis. Mt. Hood National Forest, Sandy, Oregon.

USDA Forest Service and USDI Bureau of Land Management. 1994. Final supplemental environmental impact statement on management of habitat for late successional and old growth forest related species within the range of the northern spotted owl; Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl, and Standards and Guidelines for Managment of Habitat for Late Successional and Old Growth Forest Related Species Within the Range of the Northern Spotted Owl. Forest Service, Bureau of Land Management. Portland, OR. 3 vol. 1 map.

USDI Bureau of Land Management. 1995. Salem District Record of Decision and Resource Management Plan. Salem District BLM, Salem, Oregon.

USDI Bureau of Land Management. 1998. Little North Fork Santiam Watershed Analysis (in preparation). Salem District BLM, Salem, Oregon.

USDI Bureau of Land Management. 1998. Molalla River Watershed Analysis (in preparation). Salem District BLM, Salem, Oregon.

USDI Bureau of Land Management. 1995. Abiqua Butte Watershed Analysis. Salem District BLM, Salem, Oregon.

USDI Bureau of Land Management. 1995. Upper Clear Watershed Analysis (in preparation). Salem District BLM, Salem, Oregon.

USDI Fish and Wildlife Service. 1986. Pacific bald eagle recovery plan.

Van der Kamp, B. J. 1991. Pathogens as agents of diversity in forested landscapes. For. Chron. 67:353-354.

Vogt, Kristina A., Janice Bloomfield, Joseph F. Ammirati, and Susan R. Ammirati. 1992. Sporocarp production by basidiomycetes, with emphasis on forest ecosystems. In: The fungal community: its organization and role in the ecosystem. (eds. D.T. Wicklow and G.C. Carroll).

Waring, R.H., and Schlesinger, W.H. 1985. Forest Ecosystems: concepts and management. Academic Pree, Orlando, Fls., pp345.

Wiley, K.N., and M.D. Murray. 1974. Ten-year growth and yields of Douglas-fir following stocking control. Weyerhaeuser Forestry Paper No. 14, Weyerhaeuser Research Center, Centralia, Washington. 88pp.

Wisdom, M. J., L.R. Bright, C.G Carey, and others. 1986. A model to evaluate elk habitat in western Oregon. USDA, Forest Service, Pacific Northwest Region, Pub No. R6-F&WL-216-1986. 35 pp.

Yahner, R.H., and D.P. Scott. 1988. Effects of forest fragmentation on depredation of artificial nests. J. Wildl. Manage. 52:158-161.

Zak, John C. 1992. Responses of soil fungal communities to disturbance. In: The fungal community: its organization and role in the ecosystem. (eds. D.T. Wicklow and G.C. Carroll).

Appendix A
REO Memos

Appendix A
REO Memos

REGIONAL ECOSYSTEM OFFICE
333 SW 1st
P.O. Box 3623
Portland, Oregon 97208-3623
Phone: 503-808-2165 FAX: 503-808-2163

MEMORANDUM

DATE: July 24, 1998

TO: Robert W. Williams, Regional Forester, Region 6, Forest Service
Elaine Zielinski, State Director

FROM: Donald R. Knowles, Executive Director Don Knowles

SUBJECT: Regional Ecosystem Office Review of the North Willamette Late-Successional Reserve Assessment

Summary
The Regional Ecosystem Office (REO) and the interagency Late-Successional Reserve Work Group have reviewed the North Willamette Late-Successional Reserve Assessment (LSRA). The REO finds that the LSRA, with the assumptions noted below, provides a sufficient framework and context for future projects and activities within the LSR. Future silvicultural, salvage, and risk reduction activities described in the LSRA that meet its criteria and objectives and that are consistent with the S&Gs in the NFP are exempted from subsequent project-level REO review.

Basis for the Review
Under the S&Gs for the NFP, a management assessment should be prepared for each large LSR (or group of smaller LSRs) before habitat manipulation activities are designed and implemented. As stated in the S&Gs, these assessments are subject to the REO review. The REO review focuses on the following:

1. Under the S&Gs for the NFP, a management assessment should be prepared for each large LSR (or group of smaller LSRs) before habitat manipulation activities are designed and implemented. These assessments are subject to REO review. This review considers whether the assessment contains sufficient information and analysis to provide a framework and context for making future decisions on projects and activities. The eight specific subject areas that an assessment should generally include are found in the NFP (S&Gs, page C-11). The REO may find that the assessment contains sufficient information or may identify topics or areas for which additional information, detail, or clarity is needed. The findings of the review are provided to the agency or agencies submitting the assessment.

2. The review also considers treatment criteria and potential treatment areas for silvicultural, risk-reduction, and salvage activities if addressed in the LSRA. When treatment criteria are clearly described and their relationship to achieving desired late-successional conditions are also clear, subsequent projects and activities within the LSR(s) may be exempted from the further REO review, provided they are consistent with the LSRA criteria and S&Gs. The REO authority for developing criteria to exempt these actions is found in the S&Gs (pages C-12, C-13, and C-18). If such activities are not described in the LSRA and exempted from further review in this memo, they remain subject to future REO review.

Both aspects of this review are described separately below.

Scope of the Assessment and Description of the Assessment Area
The LSRA addresses ten LSRs on the Mt. Hood and Willamette National Forests and the Salem District of

Robert Williams 2

the Bureau of Land Management, totaling about 178,000 acres. Unmapped 100 acre owl cores are also included in this assessment. The LSRs are in the Willamette Province. The LSRs were addressed in the context of a 956,000 acre assessment area, bounded on the north by the Sandy River, on the east by the Cascade Crest, on the south by roughly the Mt. Hood Forest boundary, and by the Willamette Valley on the west.

Review of the Assessment
The REO reviewed the LSRA in light of the eight subject areas identified in the NFP S&Gs. The REO finds the LSRA provides a sufficient framework and context for making future decisions on projects and activities within the LSR.

The LSRA states that all silviculture activities will meet the criteria in the REO memoranda "REO Review Exemption Criteria" (dated April 20, 1995) and "Criteria to Exempt Specific Silvicultural Activities in Late-Successional Reserves and Managed Late-Successional Areas from Regional Ecosystem Office Review" (July 9, 1996). REO notes that the latter memo has been slightly modified by an amendment (September 30, 1996) and assumes that this will be incorporated into treatment criteria for silviculture activities proposed in this LSRA.

In addition, salvage and risk reduction activities described in the LSRA that are consistent with NFP S&Gs are exempt from subsequent project-level REO review. The only risk reduction activities proposed in the LSRA were described under the heading "Risk Management" on page 6-25. Other risk reduction activities were mentioned in the fire management plan (Chapter 5) but were not described sufficiently to exempt these activities from future review, nor was it the LSRA team's intent to exempt them from review.

Projects described in the document that are not subject to REO review (i.e., activities other than silviculture or salvage) have not been reviewed for consistency with the ROD. In addition, this review does not make a finding on the proposed boundary adjustment of approximately 2000 acres, as discussed on page 6-27 of the LSRA; that review is occurring on a separate track through REO and will be forthcoming.

The REO is working with the Research and Monitoring Group (RMG) to ensure that projects within LSRs, including projects exempted from the REO review, are considered in the development of the effectiveness, implementation, and validation monitoring programs. We also expect the local units to continue their long-standing partnership with key researchers regarding management of late-successional stands, particularly in the area of young-stand management.

REO commends the LSRA team for producing one of the best documents this office has reviewed. The logic, synthesis and treatment recommendations were well founded and easy to follow. We appreciate your in-depth discussion of and recommendations for non-silvicultural activities such as special forest products and access and travel management. Documents of this caliber make our review process much easier.

Conclusions
Based on documentation found in the LSRA, the REO finds that the LSRA provides a sufficient framework and context for future projects and activities within the LSR. As identified above, silvicultural, salvage, and risk reduction activities described in the LSRA which are consistent with the NFP S&Gs and the treatment criteria identified in the assessment and meet the above assumptions are exempted from subsequent project-level REO review.

cc: REO, RIEC
Mt Hood Forest Supervisor, Roberta Moltzen
Salem BLM District Manager, Van Manning

1173/ly

United States Department of Agriculture | Forest Service | R-6/R-5

Reply to: 2470/1920 **Date:** May 9, 1995

Subject: Criteria to Exempt Specific Silvicultural Activities in LSRs and MLSAs from REO Review

To: Forest Supervisors, Owl Forests

Enclosed is a memorandum from the Regional Ecosystem Office (REO) exempting certain precommercial thinning, release, and reforestation activities within LSRs from REO review. I am pleased about this exemption and consider it a key step toward accomplishing ecosystem management objectives in a timely manner. However, since some readers will view the criteria as unnecessarily restrictive, I ask you to keep the following points in mind.

This is the first REO review exemption. It is based on proposals submitted to REO for review or upon proposals REO has discussed in the field. It is, of necessity, conservative. REO continues to express a desire to expand this exemption to other types of activities at the earliest possible time.

Before this memorandum was signed, all silvicultural activities were subject to REO review. Now most young stand thinning (including related sale), release, and reforestation proposals are not subject to review. This is a positive step, and there is little to be gained by discussing whether the criteria should have gone farther at this time. Since no commercial thinning proposals have ever been submitted to REO for review, for example, REO had little basis to expand these criteria at this time.

The criteria do not infer a right or wrong, or consistency or non-consistency with standards and guidelines. The criteria simply draws the line between those proposals no longer subject to REO review, and those that remain subject to review. Proposals not meeting the criteria should be submitted for review as in the past, and REO expects to continue to meet its committment to complete such reviews within 3 weeks, or less, of date received.

Note that the exemption for reforestation is in addition to the somewhat broader exemption already included in the standards and guidelines for reforestation activities required because of existing timber sales.

This exemption also applies to the Issue Resolution Team (IRT) since IRT review was only required in preparation for sending to REO. Specific questions about this exemption should be adressed to the President's Forest Plan coordinator on your unit.

/s/ John E. Lowe

JOHN LOWE
Regional Forester, R-6

/s/Steve Clauson (for)

LYNN SPRAGUE
Regional Forester, R-5

Enclosure

Regional Ecosystem Office
P.O. Box 3623
Portland, Oregon 97208
(503) 326-6265
FAX: (503) 326-6282

Memorandum

Date: April 20, 1995

To: Regional Interagency Executive Committee (See Distribution List)

From: Donald R. Knowles, Executive Director /s/ Don Knowles

Subject: Criteria to Exempt Specific Silvicultural Activities in LSRs and MLSAs from REO Review

Pages C-12 and C-26 of the Record of Decision (ROD) for the Northwest Forest Plan state that "[t]he Regional Ecosystem Office may develop criteria that would exempt some activities from review." Enclosed are criteria that exempt certain young-stand thinning, release, and reforestation projects that are proposed in Late-Successional Reserves (LSRs) and Managed Late-Successional Areas (MLSAs) from review by the Regional Ecosystem Office (REO). These criteria were developed by an interagency work group and the REO based on the review of silvicultural projects, field visits, and discussions with agencies and technical specialists. The REO may expand the review exemption criteria as experience with additional forest management activities is gained. Please distribute the attached REO review exemption criteria to the field.

It is important to note that these criteria do not affect the kind of activities the ROD permits within LSRs and MLSAs. The criteria apply only to the requirement for REO review of silvicultural activities in LSRs and MLSAs and only to a specific subset of silvicultural treatments. It should also be noted that compliance with the ROD's standards and guidelines and other statutory and regulatory requirements is not affected by these exemption criteria. For example, requirements to do watershed analyses and Endangered Species Act consultation are not affected by the REO review exemption criteria.

Enclosure

cc:
IAC Members (See Distribution List)
362/ly

Distribution List Date: April 20, 1995

Subject Criteria to Exempt Specific Silvicultural Activities in LSRs and MLSAs from REO Review

TO: **Regional Interagency Executive Committee**

Anita Frankel, Director, Forest and Salmon Group, Environmental Protection Agency
John Lowe, Regional Forester, USDA Forest Service, R-6
Stan Speaks, Area Director, Bureau of Indian Affairs
Michael Spear, Regional Director, U.S. Fish & Wildlife Service
William Stelle, Jr., Regional Director, National Marine Fisheries Service
William Walters, Acting Regional Director, National Park Service
Elaine Zielinski, State Director, Bureau of Land Management, OR/WA

cc: **Other Members of Intergovernmental Advisory Committee**

California
Francie Sullivan, Shasta County Supervisor
Terry Gorton, Assistant Secretary, Forestry and Rural Economic Dev., California Resource Agency

Oregon
Rocky McVay, Curry County Commissioner
Paula Burgess, Federal Forest and Resource Policy Advisor, Office of the Governor

Washington
Harvey Wolden, Skagit County Commissioner
Amy F. Bell, Deputy Supervisor for Community Relations, WA Dept. of Natural Resources
Bob Nichols, Senior Executive Policy Assistant, Governor's Office (Alternate)

Tribes
Greg Blomstrom, Planning Forester, CA Indian Forest & Fire Mgmt. Council
Mel Moon, Commissioner, NW Indian Fisheries Commission
Jim Anderson, Executive Director, NW Indian Fisheries Commission (Alternate)
Gary Morishima, Technical Advisor, Intertribal Timber Council
Guy McMinds, Executive Office Advisor, Quinault Indian Nation

Federal Agencies
Michael Collopy, Director, Forest and Rangeland Ecosystem Science Center,
National Biological Service
Eugene Andreuccetti, Regional Conservationist, Natural Resources Conservation Service
Bob Graham, State Conservationist, Natural Resources Conservation Service (Alternate)
G. Lynn Sprague, Regional Forester, USDA Forest Service, R-5 (Alternate)
Thomas Murphy, Director, Environmental Research Laboratory, Environmental Protection Agency
Charles Philpot, Station Director, Forest Service, PNW
Tom Tuchmann, Director, Office of Forestry and Economic Development (Ex Officio)
Ed Hastey, State Director, Bureau of Land Management, CA (Alternate)

REO Review Exemption Criteria

Background

Standards and Guidelines (S&Gs) in the "Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl" (referred to as the ROD) provide that silvicultural activities within Late-Successional Reserves (LSRs) and Managed Late-Successional Areas (MLSAs) are subject to review by the Regional Ecosystem Office (REO). The S&Gs also state that "REO may develop criteria that would exempt some activities [within LSRs and MLSAs] from review."

Based upon proposals submitted to REO for review, field visits, discussions with the agencies and technical specialists, and our understanding of LSR objectives, REO is hereby exempting the following types of activities from the REO review requirement stated on pages C-12 and C-26 of the ROD. Silvicultural projects meeting the following criteria are exempted from REO review because such projects have a high likelihood of benefitting late-successional forest characteristics.

Activities must still comply with all S&Gs in the ROD (e.g., initial LSR assessments, watershed analysis, riparian reserves) and with other statutory and regulatory requirements (e.g., National Forest Management Act, Federal Land Management Policy Act, National Environmental Policy Act, Endangered Species Act, Clean Water Act). This exemption applies only to the REO review requirement found on pages C-12 and C-26 in the ROD. Silvicultural activities described in the S&Gs that do not meet the criteria listed below continue to be subject to REO review at this time.

Silvicultural treatments in LSRs and MLSAs are exempted from REO review (ROD, pages C-12 and C-26), where the agency proposing the treatments finds that the following criteria are met:

1. <u>Young-Stand Thinning,</u> commonly referred to as TSI or precommercial thinning, where:

a. Young stands, or the young-stand component (understory) of two-storied stands, is overstocked. Overstocked means that reaching the management objective of late-successional conditions will be significantly delayed, or desirable components of the stand may be eliminated, because of stocking levels. The prescription should be supported by empirical information or modeling (for similar, but not necessarily these specific, sites) indicating the development of late-successional conditions will be accelerated or enhanced.

b. Cut trees are less than 8" dbh, and any sale is incidental to the primary objective.

c. Tracked, tired, or similar ground-based skidders or harvesters are not used.

d. Treatments promote a natural species diversity appropriate to meet late-successional objectives; including hardwoods, shrubs, forbs, etc..

e. Treatments include substantially varied spacing in order to provide for some very large trees as quickly as possible, maintain areas of heavy canopy closure and decadence, and encourage the growth of a variety of species appropriate to the site and the late-successional objective.

f. Treatments minimize, to the extent practicable, the need for future entries.

g. Cutting is by hand tools, including chain saws.

2. <u>Release,</u> also commonly referred to as TSI, where:

a. There is undesirable vegetation (competition) which delays attainment of the management objective of late-successional conditions, or desirable components of the stand may be eliminated, because of such competition. The prescription should be supported by empirical information or modeling (for similar, but not necessarily these specific, sites) indicating the development of late-successional conditions will be accelerated or enhanced.

b. Cut material is less than 8" dbh, and any sale is incidental to the primary objective.

c. Tracked, tired, or similar ground-based skidders or harvesters are not used.

d. Treatments promote a natural species diversity appropriate to meet late-successional objectives, including hardwoods, shrubs, forbs, etc.

e. Cutting is by hand tools, including chain saws.

3. <u>Reforestation and Revegetation,</u> including incidental site preparation, release for survival, and animal damage control, where:

a. No site preparation is required other than hand scalping.

b. Reforestation is necessary to quickly reach late-successional conditions, protect site quality, or achieve other ROD objectives.

c. Treatments promote a natural species diversity appropriate to meet late-successional objectives, including hardwoods, shrubs, forbs, etc.

d. Treatments, either through spacing, planting area designation, or expected survival or growth patterns, result in substantially varied spacing in order to provide for some very large trees as quickly as possible, create areas of heavy canopy closure and decadence, and encourage the growth of a variety of species appropriate to the site and the late-successional objective.

e. Treatments minimize, to the extent practicable, the need for future entries.

Regional Ecosystem Office
333 SW 1st
P.O. Box 3623
Portland, Oregon 97208-3623
Phone: 503-326-6265 FAX: 503-326-6282

Memorandum

Date: July 9, 1996

To: Regional Interagency Executive Committee (RIEC)

Ken Feigner, Director, Forest & Salmon Group, Environmental Protection Agency
Robert W. Williams, Regional Forester, R-6, Forest Service
Stan M. Speaks, Area Director, Bureau of Indian Affairs
Michael J. Spear, Regional Director, U.S. Fish & Wildlife Service
William Stelle, Jr., Regional Director, National Marine Fisheries Service
William C. Walters, Deputy Field Director, National Park Service
Elaine Y. Zielinski, State Director, Oregon/Washington, Bureau of Land Management

From: Donald R. Knowles, Executive Director

Subject: Criteria to Exempt Specific Silvicultural Activities in Late-Successional Reserves and Managed Late-Successional Areas from Regional Ecosystem Office Review

Enclosed are criteria that exempt certain commercial thinning projects in Late-Successional Reserves (LSRs) and Managed Late-Successional Areas (MLSAs) from review by the Regional Ecosystem Office (REO), pursuant to pages C-12 and C-26 of the Northwest Forest Plan (NFP) Record of Decision (ROD). These criteria were developed by an interagency work group and the REO based on review of silvicultural projects, field visits, and comments from agencies, researchers, and technical specialists.

We believe we are ready for these exemptions. Several versions of these criteria have been distributed to your agencies and others for review over the last several months. The comments received have been used to help clarify and focus the criteria. Use of the criteria will expedite implementation of beneficial silvicultural treatments in LSRs and MLSAs. We suggest that you transmit them to your field units at your earliest convenience.

It is important to note that these criteria do not affect the kind of activities the ROD permits within LSRs and MLSAs. The criteria simply exempt a specific subset of silvicultural treatments from the requirement for project level REO review of silvicultural activities within LSRs and MLSAs. Please also note that compliance with the ROD's standards and guidelines and other statutory and regulatory requirements is not affected by these exemption criteria. For example, requirements to do watershed analyses and Endangered Species Act consultation are not affected by the

We expect implementation monitoring procedures of the Northwest Forest Plan to select enough silvicultural projects within LSRs and MLSAs, both exempted and reviewed, to determine if actual projects meet standards and appropriate criteria. Obviously, if any of you have questions or comments about the attached, please call me directly at 503-326-6266, Dave Powers at 503-326-6271, or Gary S. Sims at 503-326-6274.

cc: IAC, RMC, LSR Workgroup

Enclosure

694/ly

Criteria Exempting Certain Commercial Thinning Activities From REO Review

Background

Standards and Guidelines (S&Gs) in 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) provide that silvicultural activities within Late-Successional Reserves (LSRs) and Managed Late-Successional Areas (MLSAs) are subject to review by the Regional Ecosystem Office (REO). The S&Gs also state that the REO may develop criteria that would exempt some activities (within LSRs and MLSAs) from review.

Based upon project proposals submitted to the REO for review, field visits, discussions with the agencies, researchers, and technical specialists, and our understanding of LSR objectives, the REO is hereby exempting certain commercial thinning activities (sometimes referred to as density management activities) from the REO review requirement (ROD, pages C-12 and C-26). Silvicultural projects meeting the criteria below are exempted from REO review because such projects have a high likelihood of benefiting late-successional forest conditions. Many of the commercial thinning proposals reviewed thus far by the REO have met these criteria.

In some cases the criteria refer to the prescription. All silvicultural treatments within LSRs will be conducted according to a silvicultural prescription fully meeting agency standards for such documents. A description of the desired future condition (DFC), and how the proposed treatment is needed to achieve the DFC, are key elements in this prescription. The description of desired future condition should typically include desired tree species, canopy layers, overstory tree size (e.g., diameter breast height), and structural components such as the range of coarse woody debris (CWD) and snags.

Some elements of these exemption criteria may seem prescriptive, and reviewers suggested several changes to accommodate specific forest priorities. While such suggestions may have been within the scope of the S&Gs, there are several reasons they are not included here:

These criteria are based on numerous submittals already reviewed by the REO and found to be consistent with the S&Gs. Other treatments, such as thinning with fire, may be equally appropriate. The REO simply has not had sufficient experience with such prescriptions within LSRs to write appropriate exemption criteria at this time. Agencies are encouraged to develop and submit such prescriptions for review. The REO will consider supplementing or modifying these criteria over time.

These criteria apply range wide. It may be more appropriate to seek exemption at the time of LSR assessment review where specific vegetation types, provincial issues, or objectives do not fit within these criteria or where silvicultural prescriptions are needed other than as described below.

These exemption criteria are not standards and guidelines, and projects meeting LSR objectives but not fitting these criteria should continue to be forwarded to the REO for review.

Four other key points about thinning are important to consider when developing thinning prescriptions:

1. We urge caution in the use of silvicultural treatments within LSRs. Silvicultural treatments within old habitat conservation areas (HCAs) and designated conservation areas (DCAs) were extremely limited, and many of the participants in the Forest Ecosystem Management Assessment Team/Supplemental Environmental Impact Statement (FEMAT/SEIS) process advanced good reasons for continuing such restrictions. Only high eastside risks and a case made that late-successional conditions could clearly be advanced by treatments in certain stand conditions led decision makers toward the current S&Gs. Note that the examples for the westside (S&Gs, page C-12) are for even-age stands and young single-species stands. Agencies must recognize when younger stands are developing adequately and are beginning to become valuable to late-successional species. Such stands should be left untreated unless they are at substantial risk to large-scale disturbance.

2. Thinning can easily remove structural components or impede natural processes such as decay, disease, or windthrow, reducing the stand s value to late-successional forest-related species. Thinning prescriptions that say leave the best, healthiest trees could eliminate structural components important to LSR objectives.

3. While historic stand conditions may be an indicator of a sustainable forest, they are not the de facto objectives. The S&Gs require an emphasis toward late-successional conditions **to the extent sustainable.**

4. Treatments need to take advantage of opportunities to improve habitat conditions beyond natural conditions. For example, exceeding natural levels of CWD within a 35-year-old stand can substantially improve the utility of these stands for late-successional forest-related species. Treatments must take advantage of opportunities to optimize habitat for late-successional forest-related species in the short term.

Relation to S&Gs and Other Exemption Criteria

Exempted thinnings must still comply with all pertinent S&Gs in the ROD (e.g., initial LSR assessments, watershed analyses, riparian reserves) and with other statutory and regulatory requirements (e.g., National Forest Management Act, Federal Land Management Policy Act, National Environmental Policy Act, Endangered Species Act, Clean Water Act). Interagency cooperation, monitoring, and adaptive management are key components of the ROD and were key assumptions underlying the development of these criteria. Additionally, field units are strongly encouraged to engage in intergovernmental consultation when developing projects. This exemption applies only to the REO review requirement (ROD, pages C-12 and C-26). Many treatments not meeting these exemption criteria may be appropriate within LSRs and MLSAs, and these treatments remain subject to REO review. These exemption criteria are in addition to criteria issued April 20, 1995, for Young Stand Thinning, Release, and Reforestation and Revegetation, and are in addition to exemption criteria adopted through the LSR assessment review process.

EXEMPTION CRITERIA

Silvicultural treatments in LSRs and MLSAs are exempted from REO review (ROD, pages C-12 and C-26) **where the agency proposing the treatments finds that ALL of the following criteria are met:**

Objectives

1. The objective or purpose of the treatment is to develop late-successional conditions or to reduce the risk of large-scale disturbance that would result in the loss of key late-successional structure. Further, the specific treatment would result in the long-term development of vertical and horizontal diversity, snags, CWD (logs), and other stand components benefiting late-successional forest-related species. The treatment will also, to the extent practicable, create components that will benefit late-successional forest-related species in the short term.

   Timber volume production is only incidental to these objectives and is not, in itself, one of the objectives of the treatment. Creation or retention of habitat for early successional forest-related species is not a treatment objective.

2. Negative short-term effects to late-successional forest-related species are outweighed by the long-term benefits to such species and will not lessen short-term functionality of the LSR as a whole.

3. The leave-tree criteria provide for such things as culturing individual trees specifically for large crowns and limbs and for the retention of certain characteristics that induce disease, damage, and other mortality or habitat, consistent with LSR objectives. Healthiest, best tree criteria typical of matrix prescriptions are modified to reflect LSR objectives.

4. Within the limits dictated by acceptable fire risk, CWD objectives should be based on research that shows optimum levels of habitat for late-successional forest-related species, and not be based simply on measurements within natural stands. For example, recent research by Carey and Johnson in young stands on the westside indicates owl prey base increases as CWD (over 4") within Douglas-fir forests increases, up to 8- to 10-percent groundcover south of the town of Drain, Oregon, and 15-percent groundcover north of Drain, increasing to 15 to 20 percent in the Olympic Peninsula and Western Washington Cascades. Other references that could help identify initial considerations involving natural ranges of variability in CWD include Spies and Franklin, for discussions on Washington Cascades, Oregon Cascades, and Coast Ranges; and Graham, et al., for east of the Cascades.

   If tree size, stocking, or other considerations preclude achievement of this objective at this time, the prescription includes a description of how and when it will be achieved in the future.

5. Agencies having an interest in LSR projects proposed under these criteria should continue to be given the opportunity to participate in project development.

Stand Attributes

1. The stand is currently **not** a complex, diverse stand that will soon meet and retain late-successional conditions without treatment.
2. West of the Cascades outside of the Oregon and California Klamath Provinces, the basal-area-weighted average age of the stand is less than 80 years. Individual trees exceeding 80 years in those provinces, or exceeding 20-inches dbh in **any** province, shall not be harvested except for the purpose of creating openings, providing other habitat structure such as downed logs, elimination of a hazard from a standing danger tree, or cutting minimal yarding corridors. Where older trees or trees larger than 20-inches dbh are cut, they will be left in place to contribute toward meeting the overall CWD objective. Thinning will be from below, except in individual circumstances where specific species retention objectives have a higher priority. Cutting older trees or trees exceeding

   20-inches dbh for **any** purpose will be the exception, not the rule.

3. The stand is overstocked. Overstocked means that reaching late-successional conditions will be substantially delayed, or desirable components of the stand will likely be eliminated, because of stocking levels.

Treatment Standards

1. The treatment is primarily an intermediate treatment designed to increase tree size, crown development, or other desirable characteristics (S&Gs, page B-5, third paragraph); to maintain vigor for optimum late-successional development; to reduce large-scale loss of key late-successional structure; to increase diversity of stocking levels and size classes within the stand or landscape; or to provide various stand components beneficial to late-successional forest-related species.

2. The prescription is supported by empirical information or modeling (for similar, but not necessarily these specific sites) indicating that achievement of late-successional conditions would be accelerated.

3. The treatment is primarily an intermediate thinning, and harvest for the purpose of regenerating a second canopy layer in existing stands is no more than an associated, limited objective as described below under openings and heavily thinned patches.

4. The treatment will increase diversity within relatively uniform stands by including areas of variable spacing as follows:

   Ten percent or more of the resultant stand would be in unthinned patches to retain processes and conditions such as thermal and visual cover, natural suppression and mortality, small trees, natural size differentiation, and undisturbed debris.

   Three to 10 percent of the resultant stand would be in openings, roughly 1/4 to 1/2 acre in size to encourage the initiation of structural diversity.

   Three to 10 percent of the resultant stand would be in heavily thinned patches (e.g., less than 50 trees per acre) to maximize individual tree development and encourage some understory vegetation development.

   The treatment does not inappropriately simplify stands by removing layers or structural components, creating uniform stocking levels, or removing broken and diseased trees important for snag recruitment, nesting habitat, and retention of insects and diseases important to late-successional development and processes.

5. To the extent practicable for the diameter and age of the stand being treated, the treatment includes falling green trees or leaving snags and existing debris to meet or make substantial progress toward meeting an overall CWD objective.

6. Snag objectives are to be identified as part of the DFC. Prescriptions must be designed to make substantial progress toward the overall snag objective, including developing large trees for future snag recruitment and retaining agents of mortality or damage. To the extent practicable for the diameter and age of the stand being treated, each treatment includes retention and creation of snags to meet the DFC. Publications useful in identifying snag-related DFCs include but are not limited to Spies, et al.

   To the extent snag requirements for late-successional species are known, one objective is to attain 100 percent of potential populations for all snag-dependent species.

7. The project-related habitat improvements outweigh habitat losses due to road construction.

Cited References:

Carey, A.B., and M.L. Johnson. 1995. Small mammals in managed, naturally young, and old-growth forests. Ecological Applications 5:336-352.

Graham, R.T., A.E. Harvey, M.F. Jurgensen, T.B. Jain, J.R. Tonn, and D.S. Page-Dumroese. 1994. Managing coarse woody debris in forests of the Rocky Mountains. Res. Paper INT-RP-477. USDA Forest Service, Intermountain Research Station, Ogden, UT. 12p.

Spies, T.S. and J.F. Franklin. 1991. The structure of natural young, mature, and old-growth Douglas-fir forests in Oregon and Washington. Pages 19-121 in: Ruggiero, L.F., K.B. Aubry, A.B. Carey, M.H. Huff (tech. coords). Wildlife and Vegetation on Unmanaged Douglas-fir Forests. Gen. Tech. Rep. GTR-PNW-285. USDA Forest Service, Pacific Northwest Research Station, Portland, OR.

REGIONAL ECOSYSTEM OFFICE

333 SW 1st
P.O. Box 3623
Portland, Oregon 97208-3623
Phone: 503-326-6265 FAX: 503-326-6282

MEMORANDUM

DATE: September 30, 1996

TO: Regional Interagency Executive Committee (RIEC)
Mike Collopy, Center Director, Forest & Rangeland Science Center, National Biological Service
Ken Feigner, Director, Forest & Salmon Group, Environmental Protection Agency
Thomas Mills, Station Director, Pacific Northwest Station, Forest Service
Thomas Murphy, Director, Environmental Research Lab, Environmental Protection Agency
Stan M. Speaks, Area Director, Bureau of Indian Affairs
Michael J. Spear, Regional Director, U.S. Fish & Wildlife Service
William Stelle, Jr., Regional Director, National Marine Fisheries Service
William C. Walters, Deputy Field Director, National Park Service
Robert W. Williams, Regional Forester, R-6, Forest Service
Elaine Y. Zielinski, State Director, Oregon/Washington, Bureau of Land Management

FROM: Donald R. Knowles, Executive Director Don Knowles

SUBJECT: Amendment to "Criteria to Exempt Specific Silvicultural Activities in Late-Successional Reserves and Managed Late-Successional Areas from Regional Ecosystem Office Review" of July 9, 1996

On July 9, 1996, the Regional Ecosystem Office (REO) released criteria to exempt certain commercial thinning projects in Late-Successional Reserves (LSRs) and Managed Late-Successional Areas (MLSAs) from review. The memo stated, in part, that the "REO will consider supplementing or modifying these criteria over time." This memo contains the first amendment to the July 9 criteria.

After issuance of the July 9 criteria, members of my staff and the LSR Work Group continued to review current research, particularly that of Drs. Andrew Carey and Connie Harrington on commercial thinning in northwest Washington. Based on this additional review, it is apparent that although 1/4 to 1/2 acre openings will add structural diversity in some stands, they are larger than needed to improve small mammal populations (forage species for northern spotted owls), and are larger than normal processes would typically create in the course of naturally developing late-successional forests. "Best guess" thinning studies currently being conducted by the researchers do not include openings this large. Therefore, the second and third bullets under Treatment Standard #4 in the July 9 Exemption Criteria are combined to now read:

> "Three to 10 percent of the resultant stand would be in heavily thinned patches (i.e., less than 50 trees per acre), or in openings up to 1/4 acre in size, to maximize individual tree development, encourage some understory vegetation development, and encourage the initiation of structural diversity."

Please implement this amendment at the earliest convenient time. However, projects already planned under the original July 9, 1996, version of the exemption criteria remain exempted from REO review. We suggest you transmit this amendment to your field units at your earliest convenience.

cc:
REO Reps
LSR Work Group
801/ly

Appendix B
Wildlife Species

Appendix B
Wildlife Species

Wildlife Species Using Late-Successional Habitat by LSR

Species have primary use of late-successional habitat but may also use other habitat types. Many of these species are not late-successional "dependent".

Amphibians

Common Name	Scientific Name	Vegetation Structure	CWD	Status	LSR 205	LSR 206	LSR 207	LSR 208	LSR 209	LSR 210	LSR 211
Northwestern salamander	*Ambystoma gracile*	Generalist	L		S	S	D	D	D	S	S
Cope's giant salamander	*Dicamptodon copei*	Riparian		FSS, J2	S	S	S	S		S	
Pacific giant salamander	*Dicamptodon tenebrosus*	Riparian			S	S	D	D	D	D	S
Cascade torrent salamander	*Rhyacotriton cascadae*	Riparian		J2	S	S	S	S	D	S	S
Clouded salamander	*Aneides ferreus*	Generalist	L		S	S	S	D	D	S	S
Oregon slender salamander	*Batrachoseps wrighti*	Generalist	L		S	S	S	D	D	S	D
Ensatina	*Ensatina eschscholtzii*	Generalist	L		S	S	S	D	D	S	D
Larch mountain salamander	*Plethodon larselli*	Late		S&M, FSS	P	P	P				
Dunn's salamander	*Plethodon dunni*	Riparian	L		S	S	S	D	D	S	S
Western red-backed salamander	*Plethodon vehiculum*	Generalist	L		S	S	S	S	S	S	S
Rough-skinned newt	*Taricha granulosa*	Generalist			S	S	D	D	D	S	D
Pacific treefrog	*Pseudacris regilla*	Generalist	L		S	S	D	D	D	S	S
Tailed frog	*Ascaphus truei*	Riparian	L	J2	S	S	D	D	D	D	S
Red-legged frog	*Rana aurora*	Generalist		FSS	S	S	D	S	D	D	S
Cascades frog	*Rana cascadae*	Generalist			S	S	D	D	S	S	P

Birds

Common Name	Scientific Name	Vegetation Structure	CWD	Status	LSR 205	LSR 206	LSR 207	LSR 208	LSR 209	LSR 210	LSR 211
Great blue heron	*Ardea herodias*	Generalist			S	S	D	S	D	S	S
Wood duck	*Aix sponsa*	Riparian	SL		S	S	D	D	D	S	S
Harlequin duck	*Histrionicus histrionicus*	Riparian		FSS	D	S	S	D	D	D	S
Barrow's goldeneye	*Bucephala islandica*	Riparian	SL		S	S	D	S	S	S	S
Bufflehead	*Bucephala albeola*	Riparian	S		S	S	D	S	S	S	S
Hooded merganser	*Lophodytes cucullatus*	Riparian	S		S	S	D	S	S	S	S
Common merganser	*Mergus merganser*	Riparian	S	J2	S	S	D	S	D	S	S
Turkey vulture	*Cathartes aura*	Contrast	L		S	S	D	D	D	S	S
Osprey	*Pandion haliaetus*	Generalist	S		S		D		D	D	
Bald eagle	*Haliaeetus leucocephalus*	Generalist	S	T&E			D		P	D	
Sharp-shinned hawk	*Accipiter striatus*	Generalist			S	S	D	D	D		S
Cooper's hawk	*Accipiter cooperii*	Generalist			S	S	D	D	D	S	S
Northern goshawk	*Accipiter gentilis*	Late			S	P	D	D	D	S	S
Red-tailed hawk	*Buteo jamaicensis*	Contrast			S	S	D	D	D	D	S
Golden eagle	*Aquila chrysaetos*	Contrast					D	D	D	D	
American kestrel	*Falco sparverius*	Contrast	S		S	S	S	S	D	S	S
Peregrine falcon	*Falco peregrinus*	Generalist		T&E			D				
Blue grouse	*Dendragapus obscurus*	Generalist	L		S	S	D	D	D	S	S
Ruffed grouse	*Bonasa umbellus*	Generalist	L		S	S	D	S	D	S	S
Wild turkey	*Meleagris gallopavo*	Generalist	L				D				
Band-tailed pigeon	*Columba fasciata*	Generalist			S	S	D	D	D	S	D
Great horned owl	*Bubo virginianus*	Contrast			S	S	D	S	D	S	D
Northern pygmy-owl	*Glaucidium gnoma*	Generalist	S		S	S	D	D	D	S	S
Northern spotted owl	*Strix occidentalis caurina*	Late		T&E	D	D	D	D	D	D	S
Barred owl	*Strix varia*	Late	S		S	S	D	S	D	D	

Common Name	Scientific Name	Vegetation Structure	CWD	Status	LSR 205	LSR 206	LSR 207	LSR 208	LSR 209	LSR 210	LSR 211
Great gray owl	*Strix nebulosa*	Contrast	S	PB	P		P				
Northern saw-whet owl	*Aegolius acadicus*	Generalist	S		S	S	D	D	D	S	S
Common nighthawk	*Chordeiles minor*	Generalist			S	S	S	S	D	S	S
Vaux's swift	*Chaetura vauxi*	Generalist	S		S	S	D	D	D	S	S
Rufous hummingbird	*Selasphorus rufus*	Generalist			S	S		D	D	S	S
Red-naped sapsucker	*Sphyrapicus nuchalis*	Generalist	S		S			S			
Red-breasted sapsucker	*Sphyrapicus ruber*	Generalist	S		S	S	D	D	D	S	S
Williamson's sapsucker	*Sphyrapicus thyroideus*	Mid/Late	S		P		P				
Downy woodpecker	*Picoides pubescens*	Mid/Late	S		S	S	D	S	S	S	S
Hairy woodpecker	*Picoides villosus*	Generalist	SL		S	S	D	D	D	S	S
Three-toed woodpecker	*Picoides tridactylus*	Late	SL		P		D				
Black-backed woodpecker	*Picoides arcticus*	Late	S	PB	S		D		D	S	
Northern flicker	*Colaptes auratus*	Generalist	SL		S	S	D	D	D	S	S
Pileated woodpecker	*Dryocopus pileatus*	Late	SL		S	S	D	D	D	D	D
Olive-sided flycatcher	*Contopus borealis*	Contrast			S	S	S	D	D	S	S
Hammond's flycatcher	*Empidonax hammondii*	Generalist			S	S	S	D	D	S	S
Pacific slope flycatcher	*Empidonax difficilis*	Late			S	S	D	D	D	S	S
Tree swallow	*Tachycineta bicolor*	Generalist	S		S	S	D	D	D	S	S
Violet-green swallow	*Tachycineta thalassina*	Generalist	S		S	S	D	S	D	S	S
Gray jay	*Perisoreus canadensis*	Generalist			S	S	D	D	D	S	S
Steller's jay	*Cyanocitta stelleri*	Generalist			S	S	D	D	D	S	S
American crow	*Corvus brachyrhynchos*	Generalist			S	S	D	S	S	S	S
Common raven	*Corvus corax*	Generalist			S	S	D	D	D	S	S
Mountain chickadee	*Parus gambeli*	Generalist	S		S		S	S	S	S	
Chestnut-backed chickadee	*Parus rufescens*	Generalist	S		S	S	D	D	D	S	S
Red-breasted nuthatch	*Sitta canadensis*	Generalist	SL		S	S	D	S	D	S	S

Common Name	Scientific Name	Vegetation Structure	CWD	Status	LSR 205	LSR 206	LSR 207	LSR 208	LSR 209	LSR 210	LSR 211
White-breasted nuthatch	*Sitta carolinensis*	Generalist	S		S	S	S	S	S	S	S
Brown creeper	*Certhia americana*	Mid/Late	S		S	S	D	S	D	S	S
Winter wren	*Troglodytes troglodytes*	Generalist	L		S	S	D	D	D	S	S
American dipper	*Cinclus mexicanus*	Riparian			S	S	D	S	D	S	S
Golden-crowned kinglet	*Regulus satrapa*	Generalist			S	S	D	D	D	S	S
Ruby-crowned kinglet	*Regulus calendula*	Generalist			S	S	D	S	S	S	S
Townsend's solitaire	*Myadestes townsendi*	Generalist	L		S	S	S	S	D	S	S
Swainson's thrush	*Catharus ustulatus*	Generalist			S	S	S	D	D	S	S
Hermit thrush	*Catharus guttatus*	Generalist			S	S	S	D	D	S	S
American robin	*Turdus migratorius*	Generalist			S	S	D	D	D	S	S
Varied thrush	*Ixoreus naevius*	Generalist			S	S	D	D	D	S	S
Solitary vireo	*Vireo solitarius*	Generalist			S	S	S	S	S	S	S
Yellow-rumped warbler	*Dendroica coronata*	Generalist			S	S	D	S	D	S	S
Black-throated gray warbler	*Dendroica nigrescens*	Generalist			S	S	D	S	D	S	S
Townsend's warbler	*Dendroica townsendi*	Mid/Late			S	S	D	S	D	S	S
Hermit warbler	*Dendroica occidentalis*	Mid/Late			S	S	D	D	D	S	S
Wilson's warbler	*Wilsonia pusilla*	Generalist			S	S	D	D	D	S	S
Western tanager	*Piranga ludoviciana*	Generalist			S	S	D	S	D	S	S
Dark-eyed junco	*Junco hyemalis*	Generalist			S	S	D	D	D	S	S
Cassin's finch	*Carpodacus cassinii*	Contrast			S		S		D		
Red crossbill	*Loxia curvirostra*	Generalist			S	S	S	S	D	S	S
Pine siskin	*Carduelis pinus*	Generalist			S	S	D	S	D	S	S
Evening grosbeak	*Coccothraustes vespertinus*	Generalist			S	S	D	S	D	S	S

Mammals

Common Name	Scientific Name	Vegetation Structure	CWD	Status	LSR 205	LSR 206	LSR 207	LSR 208	LSR 209	LSR 210	LSR 211
Virginia opossum	*Didelphis virginiana*	Generalist	SL			S	S				
Baird's shrew	*Sorex bairdii*	Generalist	L		S	S	S	S	S	S	S
Dusky shrew	*Sorex monticolus*	Generalist	L		S	S	S	S	S	S	S
Water shrew	*Sorex palustris*	Riparian	L		S	S	S	S	S	S	S
Pacific water shrew	*Sorex bendirii*	Riparian	L		S	S	S	S	S	S	S
Trowbridge's shrew	*Sorex trowbridgii*	Late	L		S	S	D	S	S	S	S
Shrew-mole	*Neurotrichus gibbsii*	Late	L		S	S	S	S	S	S	S
Coast mole	*Scapanus orarius*	Generalist			S	S	D	S	S	S	S
Little brown myotis	*Myotis lucifugus*	Contrast	S		S	S	D	S	S	S	S
Yuma myotis	*Myotis yumanensis*	Generalist	S		S	S	S	S	S	S	S
Long-eared myotis	*Myotis evotis*	Generalist	S	PB	S	S	D	S	D	D	S
Fringed myotis	*Myotis thysanodes*	Contrast		PB	S	S	S	S	S	D	S
Long-legged myotis	*Myotis volans*	Generalist	S	PB	S	S	D	S	D	D	S
California myotis	*Myotis californicus*	Contrast	S		S	S	S	S	S	S	S
Western small-footed myotis	*Myotis ciliolabrum*	Generalist			S	S	S	S	S	S	S
Silver-haired bat	*Lasionycteris noctivagans*	Contrast	S	PB	S	S	D	S	D	D	S
Big brown bat	*Eptesicus fuscus*	Contrast	S		S	S	S	S	S	S	S
Hoary bat	*Lasiurus cinereus*	Generalist		J2	S	S	S	S	S	S	S
Townsend's big-eared bat	*Plecotus townsendii*	Generalist		FSS	S	S	S	S	S	S	D
Brush rabbit	*Sylvilagus bachmani*	Generalist			S	S	D	S	S	S	S
Townsend's chipmunk	*Tamias townsendii*	Generalist	L		S	S	D	S	S	S	S
Golden-mantled ground squirrel	*Spermophilus lateralis*	Generalist	L		S	P	S	S	S	S	P
Western gray squirrel	*Sciurus griseus*	Generalist	S				D				
Douglas' squirrel	*Tamiasciurus douglasii*	Generalist	SL		S	S	D	S	S	S	S

Common Name	Scientific Name	Vegetation Structure	CWD	Status	LSR 205	LSR 206	LSR 207	LSR 208	LSR 209	LSR 210	LSR 211
Northern flying squirrel	*Glaucomys sabrinus*	Late	S		S	S	D	S	S	S	S
Deer mouse	*Peromyscus maniculatus*	Generalist	L		S	S	D	S	S	S	S
Bushy-tailed woodrat	*Neotoma cinerea*	Generalist			S	S	S	S	S	S	D
Western red-backed vole	*Clethrionomys californicus*	Mid/Late	L		S	S	S	S	S	S	S
Red tree vole	*(Arborimus) phenacomys longicaudus*	Late		S&M	S	S	S	S	S	S	S
Creeping vole	*Microtus oregoni*	Generalist	L		S	S	S	S	S	S	S
Pacific jumping mouse	*Zapus trinotatus*	Generalist	L		S	S	S	S	S	S	S
Porcupine	*Erethizon dorsatum*	Generalist	L		S	S	D	S	S	S	S
Black bear	*Ursus americanus*	Generalist	L		S	S	D	D	D	D	S
Raccoon	*Procyon lotor*	Generalist	S		S	S	D	S	S	S	S
Marten	*Martes americana*	Late	SL		S	S	D	S	S	S	S
Fisher	*Martes pennanti*	Late	SL		P	P	P	P	P	P	P
Ermine	*Mustela erminea*	Generalist	L		S	S	D	S	S	S	S
Mink	*Mustela vison*	Generalist	L		S	S	D	S	D	S	S
Wolverine	*Gulo gulo*	Generalist		FSS	P		S		P	P	
Mountain lion	*Felis concolor*	Generalist			S	S	D	D	D	D	S
Elk	*Cervus elaphus*	Contrast			S	S	D	D	D	D	S
Black-tailed & mule deer	*Odocoileus hemionus*	Generalist			S	S	D	D	D	D	S

CWD
S - snags primary habitat
L - logs primary habitat
SL - snags and logs primary habitat

Status
T&E - Federally threatened or endangered species
J2 - viability concerns assessed in Appendix J2 of EIS
FSS - Forest Service Sensitive
S&M - Survey and Manage Species

Occurrence
D - documented (WILDOBS, STRIX or BLM database)
P - species may occur - edge of range or status of habitat unsure
S - suspected - habitat occurs within species known range

Appendix C
Plant Species

Appendix C
Plant Species

Plants

Survey and manage species and other species associated with late-successional forests within the North Willamette LSR Assessment Area.

Late-successional and Old-growth Bryophytes Documented (D) or Suspected (S) to Occur Within the Assessment Area		
Scientific Name	**Strategy**	**Status**
Mosses		
Antitrichia curtipendula	4	D
Brachythecium hyalotapetum		S
Brotherella roelli	1,3	S
Bryum gemmascens		S
Buxbaumia piperi		D
Buxbaumia viridis	1,3	S
Dichodontium pellucidum		S
Dicranella palustris		S
Dicranum fuscescens		D
Encalypta brevicolla var. crumiana	1,3	S
Fissidens pauperculus		S
Fissidens ventricosus		S
Herzogiella seligeri		S
Heterocladium dimorphum		S
Heterocladium macounii		S
Heterocladium procurrens		S
Hookeria lucens		S
Hypnum circinale		D
Isoterygiopsis pulchella		S
Plagionmium insigne		D
Plagiothecium piliferum		S
Plagiothecium undulatum		D
Porotrichum bigelovii		S
Pseudoleskea stenophylla		S
Pseudotaxiphyllum elegans		S
Pterigynandrum filiforme		S

Late-successional and Old-growth Bryophytes Documented (D) or Suspected (S) to Occur Within the Assessment Area		
Scientific Name	**Strategy**	**Status**
Racomitrium aciculare		S
Racomitrium aquaticum	1,3	S
Racomitrium pacificum		S
Rhizomnium glabrescens		D
Rhizomnium nudum	1,3	D
Rhytidiopsis robustus		D
Roellia roelii		S
Schistidium agassizii		S
Schistidium rivulare		S
Scouleria aquatica		D
Scouleria marginata	4	D
Tetraphis geniculata	1,3	D
Tetraphis pellucida		D
Thamnobryum neckeroides		S
Timmia austriaca		S
Ulota megalospora	1,2	D
Ulota obtusiuscula		D
Liverworts		
Apometzeria pubescens		S
Bazzania ambigua		S
Bazzania denudata		S
Bazzania tricrenata		S
Blepharostoma trichophylum		S
Calopogeia azurea		S
Calopogeia fissa		S
Calopogeia muelleriana		S
Calopogeia neesiana		S
Calopogeia suecica		S
Cephalozia bicuspidata sp. lammersiana		S
Cephalozia lunulifolia		S
Chiloscyphus polyanthos		S
Conocephalum conicum		S
Diplophyllum albicans	1,3	S
Diplophyllum plicatum	1,2	S
Douinia ovata	4	S
Geocalyx graveolens		S
Herberus aduncus	1,3	S
Jungermannia atrovirens		S

Late-successional and Old-growth Bryophytes Documented (D) or Suspected (S) to Occur Within the Assessment Area		
Scientific Name	**Strategy**	**Status**
Kurzia makinoana	1,3	S
Lepidozia reptans		D
Lophocolea bidentata		S
Lophocolea cuspidata		S
Lophocolea heterophylla		S
Lophozia incisa		S
Lophozia longiflora		S
Lophozia ventricosa		S
Marsupella emarginata var. aquatica	1,2	S
Metzgeria conjugata		S
Pellia epiphylla		S
Pellia neesiana		S
Plagiochila asplenoides complex		S
Plagiochila satoi	1,3	S
Ptilidium californicum	1,2	D
Radula bolanderi		S
Riccardia latifrons		S
Riccardia palmata		S
Scapania bolanderi		S
Scapania umbrosa		S
Scapania undulata		S
Tritomaria exsectiformis	1,2	S
Tritomaria quinquedentata	1,3	S

Survey and Manage, Late-successional, and Old-growth Fungi Documented (D) or Suspected (S) Within the Assessment Area		
Scientific Name	**Strategy**	**Status**
Albatrellus avellaneus	1,3	S
Albatrellus caeruleoporus	1,3	S
Albatrellus ellisii	3	S
Albatrellus flettii	3	S
Aleuria (Sowerbyella) rhenana	1,2	D
Aleurodiscus (Acanthophysium) farlowii	1,3	S
Aleurodiscus grantii		S
Aleurodiscus penicillatus		S
Alpova alexsmithii	1,3	D
Alpova trappei		S
Alpova sp. nov. #Trappe 1966, (aurantiacus)	1,3	S
Amanita constricta		S
Amanita farinosa		S
Amanita francheti		S
Amanita gemmata		S
Amanita inaurata		S
Amanita muscaria var. formosa		S
Amanita pachycolea		S
Amanita pantherina		S
Amanita porphyria		S
Amanita smithiana		S
Amphinema byssoides		S
Arcangeliella sp. nov. #Trappe 12382(camphorata)	1,3	S
Arcangeliella sp. nov. #Trappe 12359(camphorata)	1,3	S
Arcangeliella lactarioides	1,3	S
Asterophora lycoperdoides	3	S
Asterophora parasitica	3	S
Baeospora myriadophylla	3	S
Balsamia nigra	1,3	S
Boletus chrysenteron		S
Boletus coniferarum		S
Boletus edulis		S
Boletus mirabilis		S
Boletus haematinus	1,3	S
Boletus piperatus	3	S
Boletus pulcherrimus	1,3	S
Boletus rubripes		S
Boletus smithii		S
Boletus subtomentosus		S

Survey and Manage, Late-successional, and Old-growth Fungi Documented (D) or Suspected (S) Within the Assessment Area		
Scientific Name	**Strategy**	**Status**
Boletus truncatus		S
Boletus zelleri		S
Bondarzewia mesenterica	1,2,3	D
Bryoglossum gracile	1,3	S
Cantharellus formosus	1,3	D
Cantharellus subalbidus	3,4	S
Cantharellus tubaeformis	3,4	D
Catathelasma ventricosa	3	S
Chamonixia caespitosa		S
Chamonixia pacifica sp. nov. Trappe #12768(caespitosa)	1,3	S
Choiromyces alveolatus	1,3	D
Choiromyces venosus	1,3	S
Chroogomphus loculatus	1,3	S
Chroogomphus tomentosus		S
Chrysomphalina aurantiaca		S
Chrysomphalina grossula	3	S
Clavariadelphus borealis	3,4	S
Clavariadelphus ligula	3,4	S
Clavariadelphus pistillaris	3,4	S
Clavariadelphus truncatus	3,4	S
Clavariadelphus sachalinensi	3,4	S
Clavariadelphus subfastigiatus	3,4	S
Clavicorona avellanea	3	S
Clavulina cinerea	3,4	S
Clavulina cristata	3,4	S
Clavulina ornatipes	3,4	S
Clitocybe avellaneialba		S
Clitocybe clavipes		S
Clitocybe senilis	1,3	S
Clitocybe subditopoda	1,3	S
Clitopilus prunulus		S
Collybia acervata		S
Collybia bakerensis	1,3	S
Collybia butyracea		S
Collybia maculata var. maculata		S
Collybia maculata var. occidentalis		S
Collybia maculata var. scorzonerea		S
Collybia racemosa	3	S
Colltrichia perennis		S

Survey and Manage, Late-successional, and Old-growth Fungi Documented (D) or Suspected (S) Within the Assessment Area		
Scientific Name	**Strategy**	**Status**
Coniophora arida		S
Cordyceps capitata	3	S
Cordyceps ophioglossoides	3	S
Cortinarius acutus		S
Cortinarius adalberti		S
Cortinarius allutus		S
Cortinarius anomalus		S
Cortinarius arquatus		S
Cortinarius azureus	3	S
Cortinarius badiovinaceus		S
Cortinarius boulderensis	1,3	S
Cortinarius callisteus		S
Cortinarius calochrous		S
Cortinarius camphoratus		S
Cortinarius caninus		S
Cortinarius clandestinus		S
Cortinarius collinitus var. collinitus		S
Cortinarius crassus/subaustralis		S
Cortinarius cyanites	3	S
Cortinarius delibutus		S
Cortinarius evernius		S
Cortinarius flexipes		S
Cortinarius gentilis		S
Cortinarius glaucopus		S
Cortinarius griseoviolaceus		S
Cortinarius guttatus		S
Cortinarius herpeticus/montanus		S
Cortinarius infractus		S
Cortinarius junghuhnii		S
Cortinarius laniger		S
Cortinarius limonius		S
Cortinarius miniatopus		S
Cortinarius mutabilis		S
Cortinarius obtusus		S
Cortinarius olympianus	1,3	D
Cortinarius paleaceous		S
Cortinarius paragaudis		S
Cortinarius pinetorum sensu kauffman		S
Cortinarius pseudoarquatus		S

Survey and Manage, Late-successional, and Old-growth Fungi Documented (D) or Suspected (S) Within the Assessment Area		
Scientific Name	**Strategy**	**Status**
Cortinarius renidens		S
Cortinarius rubicundulus		S
Cortinarius salor		S
Cortinarius scutulatus		S
Cortinarius spilomius	3	S
Cortinarius tabularis	3	S
Cortinarius traganus		S
Cortinarius valgus	3	S
Cortinarius variipes	1,3	S
Cortinarius vanduzerensis		S
Cortinarius venetus var. montanus		S
Cortinarius vibratilis		S
Cortinarius violaceus		S
Cortinarius wiebeae	1,3	D
Cortinarius zinziberatus		S
Cudonia circinans		S
Cudonia monticola	3	S
Cyphellostereum laeve	3	S
Dermocybe crocea		S
Dermocybe idahoensis		S
Dermocybe malicoria		S
Dermocybe phoenicea var. occidentalis		S
Dermocybe sanquinea		S
Dermocybe semisanguinea		S
Dermocybe zakii		S
Destuntzia fusca	1,3	S
Dichostereum granulosum (boreale)	1,3	S
Elaphomyces sp. nov. #Trappe 1038(Martellia maculata)	1,3	S
Elaphomyces anthracinus	1,3	S
Elaphomyces granulatus		S
Elaphomyces muricatus		S
Elaphomyces subviscidus	1,3	S
Endogone acrogena	1,3	S
Endogone oregonensis	1,3	S
Endoptychum depressum		S
Fayodia gracilipes (rainierensis)	3	S
Galerina atkinsoniana	3	S
Galerina cerina	3	S
Galerina heterocystis	3	S

Survey and Manage, Late-successional, and Old-growth Fungi Documented (D) or Suspected (S) Within the Assessment Area		
Scientific Name	**Strategy**	**Status**
Galerina mammillata		S
Galerina setipes	3	S
Galerina siderioides		S
Galerina sphagnicola	3	S
Galerina stylifera		S
Galerina vittaeformis		S
Ganoderma oregonense		D
Ganoderma tsugae		D
Gastroboletus imbellus	1,3	S
Gastroboletus ruber	1,3	D
Gastroboletus subalpinus	1,3	D
Gastroboletus turbinatus	3	D
Gautieria magnicellaris	1,3	S
Gautieria pterosperma		S
Gelatinodiscus flavidus	1,3	S
Geopora cooperi f. cooperi		S
Glomus radiatum	1,3	S
Gomphus bonarii	3	S
Gomphus clavatus	3	D
Gomphus floccosus	3	D
Gomphus kauffmanii	3	S
Grandinia alutaria		S
Grandinia aspera		S
Grandinia breviseta		S
Grandinia microsporella		S
Gymnomyces sp. nov. Trappe #7545 (abietis)	1,3	S
Gymnomyces sp. nov. Trappe #1690,1706,1710 (abietis)	1,3	S
Gymnomyces sp. nov. Trappe #4703,5576 (abietis)	1,3	S
Gymnomyces sp. nov. Trappe #5052 (abietis)	1,3	S
Gymnopilus bellulus		S
Gymnopilus hybridus		S
Gymnopilus puntifolius	1,3	D
Gymnopilus spectabilis		S
Gyromitra californica	3,4	S
Gyromitra esculenta	3,4	S
Gyromitra infula	3,4	S
Gyromitra melaleucoides	3,4	S
Gyromitra montana (syn. G. gigas)	3,4	S
Hebeloma crustuliniforme		S

Survey and Manage, Late-successional, and Old-growth Fungi Documented (D) or Suspected (S) Within the Assessment Area		
Scientific Name	**Strategy**	**Status**
Helvella compressa	1,3	S
Helvella crassitunicata	1,3	S
Helvella elastica	1,3	S
Helvella maculata	1,3	S
Hemimycena delectabilis		S
Hericium abietis		D
Hydnotrya cerebriformis		S
Hydnotrya subnix sp. nov. Trappe #1861	1,3	S
Hydnotrya variiformis var. pallida, Trappe var. nov.		S
Hydnotrya sp. nov. Trappe #787,792 (inordinata)	1,3	S
Hydnum repandum	3	D
Hydnum umbilicatum	3	S
Hygrocybe conica		S
Hygrocybe laeta		S
Hygrophoropsis aurantiaca		S
Hygrophorus amarus		S
Hygrophorus bakerensis		S
Hygrophorus caeruleus	1,3	D
Hygrophorus camarophyllus		S
Hygrophorus chrysodon		S
Hygrophorus discoideus		S
Hygrophorus eburneus		S
Hygrophorus erubescens		S
Hygrophorus inocybiformis		S
Hygrophorus karstenii	3	S
Hygrophorus megasporus		S
Hygrophorus olivaceoalbus		S
Hygrophorus tephroleucus		S
Hygrophorus vernalis	1,3	S
Hypholoma capnoides		S
Hypholoma dispersum		S
Hypomyces luteovirens	3	S
Inocybe agglutinata		S
Inocybe calamistrata		S
Inocybe fuscodisca		S
Inocybe hirsutus var. maxima		S
Inocybe lanuginosa		S
Inocybe obscura		S
Inocybe praetervisa		S

Survey and Manage, Late-successional, and Old-growth Fungi Documented (D) or Suspected (S) Within the Assessment Area		
Scientific Name	**Strategy**	**Status**
Inocybe sororia		S
Inocybe whitei		S
Ischnoderma resinosus		S
Jahnoporus hirtus		S
Kuhneromyces lignicola		S
Kuhneromyces mutabilis		S
Laccaria amethysteo-occidentalis		S
Laccaria bicolor		S
Laccaria laccata		S
Lactarius alnicola		S
Lactarius deliciosus var. deliciosus		S
Lactarius deliciosus var. olivaceosordidus		S
Lactarius fallax var. concolor		S
Lactarius fallax var. fallax		S
Lactarius kauffmanii		S
Lactarius olivaceoumbrinus		S
Lactarius olympianus		S
Lactarius pallescens		S
Lactarius pseudomucidus		S
Lactarius scrobiculatus		S
Lactarius subviscidus		S
Laetiporus sulfureus		D
Leucogaster citrinus	1,3	S
Leucogaster microsporus	1,3	D
Leucogyrophana mollusca		S
Limacella glioderma		S
Lycoperdon nigrescens		S
Lycoperdon pyriforme		S
Lyophyllum semitale		S
Macowanites chlorinosmus	1,3	S
Macowanites lymanensis	1,3	S
Macowanites mollis	1,3	D
Marasmiellus papilatus		S
Marasmiellus pluvius		S
Marasmius pallidocephalus		S
Marasmius quercophilus		S
Marasmius salalis		S
Martellia fragrans	1,3	S
Martellia idahoensis	1,3	S

Survey and Manage, Late-successional, and Old-growth Fungi Documented (D) or Suspected (S) Within the Assessment Area		
Scientific Name	**Strategy**	**Status**
Martellia maculata		S
Martellia monticola	1,3	S
Martellia variabilispora		S
Martellia sp. nov. Trappe #649 (nondistincta)	1,3	S
Martellia sp. nov. Trappe #311 (G. abietis)	1,3	S
Martellia sp. nov. Trappe #1700 (G. abietis)	1,3	S
Martellia sp. nov. Trappe #5903 (G. abietis)	1,3	S
Melanotus textalis		S
Micromphale perforans		S
Mycena amabilissima		S
Mycena amicta		S
Mycena aurantiidisca		S
Mycena aurantiomarginata		S
Mycena capillaripes		S
Mycena elegantula/purpureofusca		S
Mycena epipterygia		S
Mycena filopes		S
Mycena galericulata (syn. M. rugulosiceps)		S
Mycena galopus		S
Mycena hudsoniana	1,3	S
Mycena leptocephala		S
Mycena lilacifolia	3	S
Mycena longiseta		S
Mycena maculata		S
Mycena marginella	3	S
Mycena monticola	1,3	S
Mycena overholtsii	1,3	S
Mycena quinaultensis	1,3	S
Mycena rosella		S
Mycena rubromarginata		S
Mycena sanguinolenta		S
Mycena strobilinoides		S
Mycena tenax	3	S
Mycena viscosa		S
Mycolevis siccigleba		S
Mythicomyces corneipes	3	S
Neolentinus adherens	1,3	S
Neournula pouchetii	1,3	S
Nivatogastrium nubigenum	1,3	S

Survey and Manage, Late-successional, and Old-growth Fungi Documented (D) or Suspected (S) Within the Assessment Area		
Scientific Name	**Strategy**	**Status**
Nolanea cetrata		S
Nolanea cuneata		S
Nolanea staurospora		S
Nolanea stricta		S
Octavianina sp. nov. Trappe #7502 (cyanescens)	1,3	S
Octavianina macrospora	1,3	D
Oligoporus guttulatus		S
Omphalina epichysium		S
Ostenia obducta		S
Otidea leporina	3	S
Otidea onotica	3	S
Otidea smithii	1,3	S
Oxyporus (Bridgeoporus) nobilissimus	1,2,3	D
Panellus longiquus		S
Paxillus atrotomentosus		S
Paxillus panuoides		S
Phaeocollybia attenuata	3	S
Phaeocollybia californica	1,3	S
Phaeocollybia carmanahensis	1,3	S
Phaeocollybia dissiliens	1,3	S
Phaeocollybia fallax	3	S
Phaeocollybia kauffmanii	1,3	D
Phaeocollybia olivacea	3	S
Phaeocollybia oregonensis	1,3	D
Phaeocollybia picaea	1,3	S
Phaeocollybia pseudofestiva	3	S
Phaeocollybia scatesiae	1,3	S
Phaeocollybia sipei	1,3	S
Phaeocollybia spacicea	3	S
Phlebia diffusa		S
Phlebia tremellosa		S
Phlebiella vaga		S
Phellodon atratum	3	S
Phlogiotis helvelloides	3,4	S
Pholiota albivelata	1,3	D
Pholiota astragalina		S
Pholiota decorata		S
Pholiota flammans		S
Pholiota flavida		S

Survey and Manage, Late-successional, and Old-growth Fungi Documented (D) or Suspected (S) Within the Assessment Area		
Scientific Name	**Strategy**	**Status**
Pholiota lubrica		S
Pholiota scamba		S
Phytoconis ericetorum	3,4	S
Pithya vulgaris	1,3	S
Plectania (Sarcosoma) latahensis	1,3	S
Plectania melastoma	3	S
Plectania milleri	1,3	S
Pleurocybella porrigens		S
Podostroma alutaceum	3	S
Polyporoletus sublividus		S
Polyporus melanopus		S
Polyozellus multiplex	1,3	D
Postia rennyii		S
Pseudoaleuria quinaultiana	1,3	S
Pycnoporellus alboluteus		S
Pycnoporellus fulgens		S
Ramaria abietina	3	S
Ramaria amyloidea	1,3	S
Ramaria araiospora	1,3	D
Ramaria aurantiisiccescens	1,3	S
Ramaria botrytis var. aurantiiramosa	1,3	S
Ramaria celerivirescens	1,3	S
Ramaria claviramulata	1,3	S
Ramaria concolor f. marri	1,3	S
Ramaria concolor f. tsugina	3	S
Ramaria coulterae	3	S
Ramaria cyaneigranosa	1,3	S
Ramaria gelatiniaurantia	1,3	S
Ramaria gracilis	1,3	S
Ramaria largentii	1,3	S
Ramaria maculatipes	1,3	S
Ramaria rainierensis	1,3	S
Ramaria rubella var. blanda	1,3	S
Ramaria rubribrunnescens	1,3	S
Ramaria rubrievanescens	1,3	S
Ramaria rubripermanens	1,3	S
Ramaria spinulosa	1,3	S
Ramaria stuntzii	1,3	D
Ramaria suecica	3	S

Survey and Manage, Late-successional, and Old-growth Fungi Documented (D) or Suspected (S) Within the Assessment Area		
Scientific Name	**Strategy**	**Status**
Ramaria verlotensis	1,3	S
Resinicium furfuraceum		S
Resinomycena montana		S
Resupinatus applicatus		S
Rhizopogon abietis	3	S
Rhizopogon atroviolaceus	3	S
Rhizopogon brunneicolor	1,3	D
Rhizopogon evadens var. subalpinus	1,3	D
Rhizopogon exiguus	1,3	S
Rhizopogon flavofibrillosus	1,3	S
Rhizopogon inquinatus	1,3	S
Rhizopogon truncatus	3	S
Rhizopogon sp. nov., Trappe #1698 (parksii)	1,3	S
Rhizopogon sp. nov., Trappe #1692 (parksii)	1,3	S
Rhizopogon sp. nov., Trappe #9432 (chamaleontinus)	1,3	S
Rhodocybe speciosa	1,3	S
Rhodocybe trachyospora var. purpureoviolaceum		S
Rickenella setipes		S
Rozites caperata		S
Russula aeruginea		S
Russula albonigra		S
Russula bicolor		S
Russula brevipes var. acrior		S
Russula crassotunicata		S
Russula decolorans		S
Russula mustelina	3	S
Russula occidentalis		S
Russula olivascens		S
Russula pelargonia		S
Russula rosacea		S
Russula variata		S
Russula xerampelina		S
Sarcodon fuscoindicum	3	S
Sarcodon imbricatus	3	S
Sarcoleotia globosa		S
Sarcosoma latahensis	1,3	S
Sarcosoma mexicana	3	S
Sarcosphaera eximia	3	S
Sedecula pulvinata	1,3	S

Survey and Manage, Late-successional, and Old-growth Fungi Documented (D) or Suspected (S) Within the Assessment Area		
Scientific Name	**Strategy**	**Status**
Scytinostroma cf. galatinum		S
Sparassis crispa	3	D
Spathularia flavida	3	S
Stagnicola perplexa	3	S
Stromatoscypha fimbriata		S
Stropharia hornemannii		S
Thaxterogaster pingue	3	S
Tomentella spp.		S
Trechispora farinacea		S
Trechispora mollusca		S
Tricholoma flavovirens		S
Tricholoma focale		S
Tricholoma imbricatum		S
Tricholoma inamoenum		S
Tricholoma magnivelare		S
Tricholoma pessundatum		S
Tricholoma portentosum		S
Tricholoma saponaceum		S
Tricholoma sejunctum		S
Tricholoma squarrulosum		S
Tricholoma vaccinum		S
Tricholoma virgatum		S
Tricholomopsis decora		S
Tricholomopsis flavissima		S
Tricholomopsis fulvescens	1,3	D
Trichophaeopsis tetraspora		S
Tuber rufum		S
Tuber sp. nov., Trappe #2302 (asa)	1,3	S
Tuber sp. nov., Trappe #12493 (pacificum)	1,3	S
Tylopilus pseudoscaber (porphyrosporus)	1,3	S
Xeromphalina cauticinalis		S
Xeromphalina campanelloides		S
Xeromphalina cirris		S
Xeromphalina cornui		S
Xeromphalina fulvipes		S
Zelleromyces oregonensis		S

Survey and Manage, Late-successional and Old-growth Associated Lichens Documented (D) or Suspected (S) to Occur Within the Assessment Area		
Scientific Name	**Strategy**	**Status**
Ahtiana sphaerosporella		S
Alectoria lata		S
Alectoria sarmentosa		D
Alectoria vancouverensis		S
Baeomyces rufus		S
Bryoria capillaris		D
Bryoria friabilis		S
Bryoria glabra		D
Bryoria pikei		S
Bryoria pseudofuscescens		S
Bryoria tortuosa	1,3	D
Buellia penichra		S
Calicium abietinum	4	S
Calicium adaequatum	4	S
Calicium adspersum	4	D
Calicium glaucellum	4	S
Calicium viride	4	D
Cavernularia hultenii		D
Cetraria subalpina		D
Cetrelia cetrarioides	4	D
Chaenotheca brunneola	4	S
Chaenotheca chrysocephala	4	S
Chaenotheca ferruginea	4	S
Chaenotheca furfuracea	4	S
Chaenotheca subroscida	4	S
Chaenothecopsis pusilla	4	S
Cladonia bacillaris		S
Cladonia bellidiflora		D
Cladonia cenotea		S
Cladonia macilenta		S
Cladonia norvegica	3	S
Collema nigrescens	4	D
Cyphelium inquinans	4	D
Dendriscocaulon intriculatum	1,3	S
Dermatocarpon luridum	1,3	S
Dimerella lutea		S
Epilichen scabrosus		S
Hypocenomyce friesii		S
Hydrothyria venosa	1,3	D
Hypogymnia duplicata	1,2,3	D
Hypogymnia metaphysodes		D
Hypogymnia oceanica	1,3	D

Survey and Manage, Late-successional and Old-growth Associated Lichens Documented (D) or Suspected (S) to Occur Within the Assessment Area		
Scientific Name	**Strategy**	**Status**
Hypogymnia rugosa		D
Icmadophila ericetorum		D
Lecanactis megaspora		S
Leptogium burnetiae var. hirsutum	4	D
Leptogium cyanescens	4	D
Leptogium rivale	1,3	D
Leptogium gelatinosum		S
Leptogium saturninm	4	D
Leptogium teretiusculum	4	D
Lobaria hallii	1,3	D
Lobaria linita	1,2,3	S
Lobaria oregana	4	D
Lobaria pulmonaria	4	D
Lobaria scrobiculata		D
Lopadium pezizoideum		D
Loxosporopsis corallifera	1,3	D
Melanelia subelegantula		S
Mycoblastus alpinus		S
Mycoblastus sanguinarius		D
Microcalicium arenarium	4	S
Mycocalium subtile	4	S
Nephroma bellum	4	D
Nephroma helveticum	4	D
Nephroma laevigatum	4	D
Nephroma occultum	1,3	D
Nephroma parile	4	D
Nephroma resupinatum	4	D
Ochrelechia androgyna		S
Ochrelechia oregonensis		D
Pannaria cyanolepra		S
Pannaria leucostictoides	4	D
Pannaria mediterranea	4	D
Pannaria pezizoides		S
Pannaria rubiginosa	1,3	S
Pannaria saubinetii	4	D
Parmelia kerguelensis (pseudosulcata)		S
Parmelia squarrosa		S
Parmeliopsis hyperopta		D
Parmotrema arnoldii		S
Peltigera collina	4	D
Peltigera horizontalis		S
Peltigera neckeri	4	D

Survey and Manage, Late-successional and Old-growth Associated Lichens Documented (D) or Suspected (S) to Occur Within the Assessment Area		
Scientific Name	**Strategy**	**Status**
Peltigera neopolydactyla		D
Peltigera pacifica	4	D
Peltigera venosa		S
Pertusaria amara		D
Pilophorus acicularis		D
Pilophorus clavatus		D
Pilophoris nigricaulis	1,3	D
Platismatia herrei		D
Platismatia lacunosa	4	S
Platismatia norvegica		D
Platismatia stenophylla		D
Protoparmelia ochrococca		D
Pseudocyphellaria anomala	4	D
Pseudocyphellaria anthraspis	4	D
Pseudocyphellaria crocata	4	D
Pseudocyphellaria rainierensis	1,2,3	D
Psoroma hypnorum		S
Ramalina pollinaria	3	S
Ramalina thrausta	4	S
Sphaerophorus globosus		D
Stenocybe clavata	4	S
Stenocybe major	4	S
Sticta arctica	1,3	S
Sticta beauvoisii	4	D
Sticta fuliginosa	4	D
Sticta limbata	4	D
Thelotrema lepadinum		S
Tholurna dissimilis	1,3	D
Tuckermannopsis pallidula		D
Usnea filipendula		S
Usnea hesperina	1,3	S
Usnea longissima	4	D
Xylographa abietina		D
Xylographa vitiligo		S

Vascular Plants Considered Closely Associated With Late-Successional and Old-Growth Forest Found Within the Assessment Area	
Scientific Name	**Common Name**
Achlys triphylla	vanilla leaf
Adenocaulon bicolor	pathfinder
Adiantum pedatum	maidenhair fern
Allotropa virgata	candystick
Anemone deltoidea	threeleaf anemone
Apocyanum pumilum	mountain dogbane
Arnica latifolia	broadleaf arnica
Asarum caudatum	wild ginger
Botrychium minganense	Mingan moonwort
Botrychium montanum	mountain moonwort
Botrychium virginanum	Virginia grapefern
Calypso bulbosa	fairy-slipper
Chamaecyparis nootkatensis	Alaska yellow-cedar
Chimaphila menziesii	little pipsissewa
Chimaphila umbellata	prince's pine
Cimifuga elata	tall bugbane
Cimifuga lacinata	cut-leaved bugbane
Clintonia uniflora	queencup beadlily
Coptis laciniata	cut-leaved goldthread
Coptis trifoliata	three-leaf goldthread
Corallorhiza maculata	spotted coralroot
Corallorhiza mertensiana	Merten's coralroot
Corallorhiza striata	striped coralroot
Corydalis aquae-gelidae	cold-water corydalis
Cypripedium montanum	mountain ladyslipper
Disporum hookeri	fairy bells
Disporum smithii	Smith's fairy bells
Dryopteris austriaca	mountain woodfern
Eburophyton austiniae	phantom orchid
Erythronium montanum	avalanche lily
Galium oreganum	Oregon bedstraw
Gaultheria humifusa	alpine wintergreen
Gaultheria ovatifolia	slender wintergreen
Goodyera oblongifolia	rattlesnake plantain
Gymnocarpum dryopteris	oak-fern
Habenaria saccata	slender bog-orchid
Habenaria unalaskensis	Alaska rein-orchid

Vascular Plants Considered Closely Associated With Late-Successional and Old-Growth Forest Found Within the Assessment Area	
Scientific Name	**Common Name**
Hemitomes congestum	gnome plant
Hiericium scouleri	wooly-weed
Hypopitys monotropa	common pinesap
Isopyrum hallii	Hall's rue-anemone
Lathyrus polyphyllus	leafy peavine
Listera caurina	western twayblade
Listera convallarioides	broad-lipped twayblade
Listera cordata	heart-leaf twayblade
Luzula hitchcockii	smooth woodrush
Lycopodium selaga	fir clubmoss
Lysichiton americanum	skunk cabbage
Melica subulata	Alaska oniongrass
Menziesia ferruginea	fool's huckleberry
Mitella breweri	Brewer's mitrewort
Mitella caulescens	star-shaped mitella
Mitella pentandra	five-stamen mitrewort
Mitella trifida	three-tooth mitrewort
Monotropa uniflora	Indian pipe
Oxalis oregana	Oregon oxalis
Oxalis trilliifolia	great oxalis
Pleuricospora fimbriolata	fringed pinesap
Polystichum californicum	California swordfern
Pterospora andromedea	pine drops
Pyrola asarifolia	large pyrola
Pyrola chorantha	green pyrola
Pyrola picta	white vein pyrola
Pyrola secunda	one-sided wintergreen
Pyrola uniflora	woodnymph
Rubus lasiococcus	dwarf bramble
Rubus nivalis	snow bramble
Rubus pedatus	trailing blackberry
Satureja douglasii	yerba buena
Scoliopus hallii	Oregon fetid adder's tongue
Selaginella oregana	Oregon selaginella
Smilacina racemosa	false Solomon's seal
Smilacina stellata	starry Solomonplume
Streptopus amplexifolius	clasping-leaved twisted-stalk
Streptopus roseus	purple twisted-stalk
Streptopus streptopoides	kruhsea

Vascular Plants Considered Closely Associated With Late-Successional and Old-Growth Forest Found Within the Assessment Area	
Scientific Name	**Common Name**
Synthyris schizantha	fringed systheris
Taxus brevifolia	yew
Thuja plicata	western redcedar
Tiarella trifoliata	coolwort foamflower
Tiarella unifoliata	coolwort foamflower
Trillium ovatum	western trillium
Vaccinium alaskensis	Alaska huckleberry
Vaccinium membranaceum	big huckleberry
Vaccinium ovalifolium	oval-leaf huckleberry
Vaccinium parvifolium	red huckleberry
Vancouveria hexandra	white vancouveria
Vicia americana var. villosa	American vetch
Viola glabella	pioneer violet
Viola orbiculata	round-leaved violet
Whipplea modesta	yerba del selva

Appendix D
Coarse Woody Debris

Coarse Woody Debris

Coarse Woody Debris Implementation Examples

The down wood guidelines as outlined in Coarse Woody Debris section of Chapter 6 call for maintaining 10 or 15 percent cover of down wood in salvage areas and thinning treatments. The down wood is composed of sound and decayed logs of differing sizes. Eight examples are given of different scenarios for implementing the guidelines. These scenarios show the number of green logs that will need to be created to meet the guidelines given different treatments and differing amounts of existing logs. The scenarios also show the number of logs per acre that should be left at each pulse if a three pulse system is used to minimize risk of bark beetle infestation. The pulse approach will obviously not apply to salvage of windthrow, but could apply to fire salvage. The mix of logs sizes is just one example of how the goal may be met. An infinite number of combinations may be used. These examples are intended to give managers and idea of what the goals equate to in terms of green trees that need to be converted to logs, or, in the case of salvage, the number of logs that need to be left on site.

Scenarios

Scenario 1

Salvage sale with a goal of 15% cover of down logs - adequate levels of existing logs exist to contribute to the goal of about 11% cover of decayed logs.

The goal is to leave 4.5% ground cover of sound logs. No compensation is needed for lack of decayed logs.

This scenario equates to the **best case**, where the **minimum number of sound or green logs** need to be left on site. For salvage sales the largest down logs available should be left on site, thus the scenario shows logs of 20 and 30 inches diameter (equates to dbh of tree). The log length approximates the height of a tree of that dbh down to a 4 inch top.

Total # Logs/Acre	# Logs per Pulse	Diameter	Length	% Ground Cover
13	4	20	100	3.06
3	1	30	140	1.34
			Total % Cover	4.40

Scenario 2

Salvage sale with a goal of 15% cover of down logs - the site is deficit in existing, decayed logs so sound or green logs are left to compensate.

The goals is to leave 11% ground cover of sound logs to compensate for lack of existing and/or decayed logs.

This scenario equates to the **worst case**, where the **maximum number of sound or green logs** need to be left on site. For salvage sales the largest down logs available should be left on site, thus the scenario shows logs of 20 and 30 inches diameter (equates to dbh of tree). The log length approximates the height of a tree of that dbh down to a 4 inch top.

Total # Logs/Acre	# Logs per Pulse	Diameter	Length	% Ground Cover
30	9	20	100	7.05
9	3	30	140	4.02
			Total % Cover	11.07

Scenario 3

Salvage sale with a goal of 10% cover of down logs - adequate levels of existing logs exist to contribute to the goal of about 7% cover of decayed logs.

The goal is to leave 3% ground cover of sound logs. No compensation is needed for lack of decayed logs.

This scenario equates to the **best case**, where **the minimum number of sound or green logs** need to be left on site. For salvage sales the largest down logs available should be left on site, thus the scenario shows logs of 20 and 30 inches diameter (equates to dbh of tree). The log length approximates the height of a tree of that dbh down to a 4 inch top.

Total # Logs/Acre	# Logs per Pulse	Diameter	Length	% Ground Cover
8	3	20	100	1.88
3	1	30	140	1.34
			Total % Cover	3.22

Scenario 4

Salvage sale with a goal of 10% cover of down logs - the site is deficit in existing, decayed logs so sound or green logs are left to compensate.

The goals is to leave 7% ground cover of sound logs to compensate for lack of existing and/or decayed logs.

This scenario equates to the **worst case**, where the **maximum number of sound or green logs** need to be left on site. For salvage sales the largest down logs available should be left on site, thus the scenario shows logs of 20 and 30 inches diameter (equates to dbh of tree). The log length approximates the height of a tree of that dbh down to a 4 inch top.

Total # Logs/Acre	# Logs per Pulse	Diameter	Length	% Ground Cover
20	6	20	100	4.70
5	2	30	140	2.24
		Total % Cover		6.94

Scenario 5

Thinning treatment with a goal of 15% cover of down logs - adequate levels of existing logs exist to contribute to the goal of about 11% cover of decayed logs.

The goal is to leave 4.5% ground cover of sound logs. No compensation is needed for lack of decayed logs.

This scenario equates to the **best case**, where the **minimum number of sound or green logs** need to be left on site. For thin treatments approximately 2/3 of the logs should be large (greater than or equal to stand average dbh) and 1/3 of the logs can be as small as 4 inches diameter. For purposes of this example ½ the large logs are 12 inches diameter and ½ the logs are 15 inches diameter. Small logs are divided equally into 10, 8 and 6 inch diameter logs. These diameters equate to the dbh of the trees used to create the logs. The log length approximates the height of a tree of that dbh down to a 4 inch top. Number of logs per pulse are not given for small logs because they do not create a concern for bark beetle infestation risk.

<u>Large Logs</u>

Total # Logs/Acre	# Logs per Pulse	Diameter	Length	% Ground Cover
15	6	12	65	1.47
11	4	15	75	1.53
		Total % Cover		3.00

Small Logs

Total # Logs/Acre	# Logs per Pulse	Diameter	Length	% Ground Cover
9		10	40	0.50
15		8	30	0.51
26		6	20	0.49
			Total % Cover	1.50

Scenario 6

Thinning treatment with a goal of 15% cover of down logs - the site is deficit in existing, decayed logs so sound or green logs are left to compensate.

The goals is to leave 11% ground cover of sound logs to compensate for lack of existing and/or decayed logs.

This scenario equates to the **worst case**, where the **maximum number of sound or green logs** need to be left on site. For thin treatments approximately 2/3 of the logs should be large (greater than or equal to stand average dbh) and 1/3 of the logs can be as small as 4 inches diameter. For purposes of this example ½ the large logs are 12 inches diameter and ½ the logs are 15 inches diameter. Small logs are divided equally into 10, 8 and 6 inch diameter logs. These diameters equate to the dbh of the trees used to create the logs. The log length approximates the height of a tree of that dbh down to a 4 inch top. Number of logs per pulse are not given for small logs because they do not create a concern for bark beetle infestation risk.

Large Logs

Total # Logs/Acre	# Logs per Pulse	Diameter	Length	% Ground Cover
41	15	12	65	4.02
29	10	15	75	4.03
			Total % Cover	8.05

Small Logs

Total # Logs/Acre	# Logs per Pulse	Diameter	Length	% Ground Cover
18		10	40	0.97
29		8	30	0.97
53		6	20	1.01
			Total % Cover	2.95

Scenario 7

Thinning treatment with a goal of 10% cover of down logs- adequate levels of existing logs exist to contribute to the goal of about 7% cover of decayed logs.

The goal is to leave 3% ground cover of sound logs. No compensation is needed for lack of decayed logs.

This scenario equates to the **best case**, where the **minimum number of sound or green logs** need to be left on site. For thin treatments approximately 2/3 of the logs should be large (greater than or equal to stand average dbh) and 1/3 of the logs can be as small as 4 inches diameter. For purposes of this example ½ the large logs are 12 inches diameter and ½ the logs are 15 inches diameter. Small logs are divided equally into 10, 8 and 6 inch diameter logs. These diameters equate to the dbh of the trees used to create the logs. The log length approximates the height of a tree of that dbh down to a 4 inch top. Number of logs per pulse are not given for small logs because they do not create a concern for bark beetle infestation risk.

Large Logs

Total # Logs/Acre	# Logs per Pulse	Diameter	Length	% Ground Cover
11	4	12	65	1.08
7	2	15	75	0.97
			Total % Cover	2.05

Small Logs

Total # Logs/Acre	# Logs per Pulse	Diameter	Length	% Ground Cover
6		10	40	0.32
10		8	30	0.34
17		6	20	0.32
			Total % Cover	0.98

Scenario 8

Thinning treatment with a goal of 10% cover of down logs - the site is deficit in existing, decayed logs so sound or green logs are left to compensate.

The goals is to leave 7% ground cover of sound logs to compensate for lack of existing and/or decayed logs.

This scenario equates to the **worst case**, where the **maximum number of sound or green logs** need to be left on site. For thin treatments approximately 2/3 of the logs should be large (greater than or equal to stand average dbh) and 1/3 of the logs can be as small as 4 inches diameter. For purposes of this example ½ the large logs are 12 inches diameter and ½ the logs are 15 inches diameter. Small logs are divided equally into 10, 8 and 6 inch diameter logs. These diameters equate to the dbh of the trees used to create the logs. The log length approximates the height of a tree of that dbh down to a 4 inch top. Number of logs per pulse are not given for small logs because they do not create a concern for bark beetle infestation risk.

Large Logs

Total # Logs/Acre	# Logs per Pulse	Diameter	Length	% Ground Cover
26	10	12	65	2.55
18	6	15	75	2.50
			Total % Cover	5.05

Small Logs

Total # Logs/Acre	# Logs per Pulse	Diameter	Length	% Ground Cover
12		10	40	0.65
20		8	30	0.68
35		6	20	0.66
			Total % Cover	1.99

Conversion of Logs to Percent Cover

Percent cover of logs of given large end diameter (or dbh) and length can be converted to percent cover using taper equations to determine area of the ground covered. The following table gives percent ground cover and volume (ft^3/acre) of logs of various sizes.

Large End Diameter	Log Length	% Cover	Volume Ft^3/Acre
6	20	0.019	2.70
8	30	0.034	6.51
10	40	0.054	12.76
12	20	0.042	13.31
12	40	0.078	23.40
12	65	0.098	28.00
15	20	0.054	21.92
15	40	0.101	38.97
15	60	0.134	48.09
15	75	0.139	49.84
20	20	0.073	39.49
20	40	0.139	72.62
20	60	0.192	95.27
20	80	0.227	107.37
20	100	0.235	114.68
30	20	0.109	88.26
30	40	0.211	167.45
30	60	0.302	231.58
30	80	0.376	276.77
30	100	0.428	304.37
30	140	0.447	348.03
40	20	0.145	157.17
40	40	0.282	299.15
40	60	0.407	419.04
40	100	0.601	578.10
40	155	0.650	682.45

Appendix E
Roads

LSR R0207

Primary ATM	Secondary ATM	Keep Open	Soft Closure
4200 (B)	4220	4220	4200530
4600 (B)	4500 (B)	4500320	4500280
4620	4670 (B)	4510	*4500340
5400	4690	4600200	4500350
6300	5400 (B)	4600380 (B)	*4600350
	5800	4610 (B)	*4600370
	5820 (B)	4610240	4610113 (B)
	5830 (B)	*4611	4611130 (B)
		4620 (B)	4621150
		*4635	4621160
		*4635140	4621162
		4640 (B)	*4635130
		4650 (B)	4645
		4671 (B)	4650120
		*4680 (B)	4671170
		4680140 (B)	4672230 (B)
		4680150 (B)	4680
		*4691	*4680160
		*4691120	*4690120
		5410 (B)	5410012
		5710 (B)	5410120
		5720 (B)	5430120
		*5800140	5720180 (B)
		*5800160	5810210 (B)
		*5800190	6310
		5830	6310200
		5860	
		6310	

** LSR review board recommends modification to the existing ATM plan, see attached.*

(B) Some portion or portions of this road act as part of the boundry of the LSR.

Continued Recommended Modifications to ATM

*** 4500340** 1997 restoration obliterated 4500340 from Helion Creek (m.p. 2.2) to the end (m.p. 3.52) for a total of 1.32 miles.

*** 4600350** Recommends going from the current Soft Closure to Full Closure, possible Roads to Trails with a destination of Bump Lake project. Mile post 0.00 to m.p. 1.43 for a total of 1.43 miles.

*** 4600370** Recommends going from the current Soft Closure to Full Closure, possible Roads to Trails with a destination of Bump Lake project. Mile post 0.00 to m.p. 0.54 for a total of 0.54 miles.

*** 4611** Recommends going from the current Keep Open to Full Closure from the 4611017 jct. (m.p.3.57) to the end (m.p. 5.9). Possible Roads to Trail project with Huxley Lake as the destination. A total of 2.33 miles.

*** 4635** Recommends going from the current Keep Open to Soft Closure from the 4635140 jct. (m.p. 8.6) to end (m.p. 13.95) for a total of 5.35 miles.

*** 4635130** Recommends going from the current Soft Closure to Obilterate from the 46350/130 jct. (m.p. 0.00) to the end (m.p. 1.35) for a total of 1.35 miles.

*** 4635140** Recommends going from the current Keep Open to Soft Closure from the 4635/140 jct. (m.p. 0.00) to the 702 trail head (m.p. 1.84) for a total of 1.84 miles.

*** 4680** Recommends going from the current Soft Closure to Full Closure from the 4680/150 jct. (m.p. 2.65) to Lemiti Creek (m.p. 8.65) for a total of 6.0 miles.

*** 4680160** Recommends going from the current Soft Closure to Obliterate from 4681150/160 jct. (m.p. 0.00) to the end (m.p. 2.70) for a total of 2.7 miles.

*** 4690120** Recommends going from the current Soft Closure to Obliterate from 4690120/016 jct. (m.p. 2.38) to the end (m.p. 5.04) for a total of 2.66 miles.

*** 4691** Recommends going from the current Keep Open to Soft Closure from 4690/4691 jct. (m.p. 0.00) to 4691/120 jct. (m.p. 1.44) for a total of 1.44 miles. This is a BPA access road.

*** 4691120** Recommends going from the current Keep Open to Soft Closure from 4691/120 jct. (m.p. 0.00) to Trail Head 717 (m.p. 1.23) for a total of 1.23 miles.

*** 5800140** Recommends going from the current Keep Open to Full Closure from 5800/140 jct. (m.p. 0.00) to Pyramid Lake Trail Head (m.p. 1.65) for a total of 1.65 miles. Possible Roads to Trails project.

*** 5800160** Recommends going from the current Keep Open to Full Closure from 5800/160 jct. (m.p. 0.00) to end (m.p. 2.21) for a total of 2.21 miles. Possible Roads to Trail project from 5800/160 jct. to Trail Head 724 (m.p. 0.45) for a total of 0.45 miles.

*** 5800190** Recommends going from the current Keep Open to Soft Closure from 5800/190 jct. (m.p. 0.00) to High Rock Springs (m.p. 1.30) for a total of 1.3 miles. Also recommends going from the current Keep Open to Obliterate from High Rock Springs (m.p. 1.30) to 4610240/5800190 jct. (m.p. 2.23) for a total of 0.93 miles.

LSR R0208

Primary ATM	Secondary ATM	Keep Open)	Soft Closure
	* 4500	4500270 (B)	4500250
		*4530	4540150
		4531	
		4540	
		4540170	
		4545 (B)	
		4550 (B)	

** LSR Review Board recommends modification to the existing ATM Plan, see attached.*

(B) Some portion or portions of this road act as part of the LSR boundry.

Continued Recommended Modifications to ATM

*** 4500** Recommends reducing from the current Secondary ATM route to Keep Open route on the aggregate section from 4500/220 jct. (m.p. 14.86) to 4500/4550 jct. (m.p. 19.20) for a total of 4.34 miles.

*** 4530** Recommends reducing from the current Keep Open to Soft Closure from 4530/BLM 5-4E-12 jct. (BLM Timothy Patch Road m.p. 2.50) to 4530/4540 jct. (m.p. 4.08) for a total of 1.58 miles.

LSR R0209

Primary ATM	Secondary ATM	Keep Open	Soft Closure
7000 (B)		4540	7010160
		5400	*7020120
		6341 (B)	*7020170
		7000 (B)	*7020180
		7010	7021 (B)
		*7020 (B)	
		*7030	

** LSR Review Board recommends modification to the existing ATM Plan, see attached.*

(B) Some portion or portions of this road act as part of the LSR boundry.

Continued Recommended Modifications to ATM

*** 7020** Recommends reducing from current Keep Open to Soft Closure from 70/7020 jct. (m.p. 0.00) to the 7020/7021 jct. (m.p. 4.0) for a total of 4.0 miles. Also reducing from current Keep Open to Obliterate from 7020/7021 jct. (m.p. 4.0) to the 7020/7030 jct. (m.p. 5.97) for a total of 1.97 miles, and reducing from the current Keep Open to Soft Closure from the 7020/7030 jct. (m.p. 5.97) to 546 Trail Head (m.p. 6.73) for a total of 0.76 miles.

*** 7020120** Recommends reducing from current Soft Closure to Obliterate from Hughs Horse Pit (m.p. 0.91) to end (m.p. 2.28) for a total of 1.37 miles.

*** 7020170** Recommends reducing from current Soft Closure to Obliterate from 7020/7020120 jct. (m.p. 0.00) to end (m.p. 0.82) for a total of 0.82 miles.

*** 7020180** Recommends reducing from current Soft Closure to Obliterate from 7020170/180 jct. (m.p. 0.00) to end (m.p. 0.39) for a total of 0.39 miles.

*** 7030** Recommends reducing from current Keep Open to Soft Closure from 70/7030 jct. (m.p. 0.00) to 7030/7020 jct. (m.p. 5.50) for a total of 5.5 miles.

LSR RO210

Primary ATM	Secondary ATM	Keep Open	Soft Closure
6300	6300 (B)	6310	6311 (B)
7000 (B)	6340 (B)	6320 (B)	6322120 (B)
	6370 (B)	6322 (B)	*6330160
	*6380	6330	630170
		*6380130	

** LSR Review Board recommends modification to the existing ATM Plan, see attached.*

(B) Some portion or portions of this road act as part of the LSR boundary.

Continued Recommended Modifications to ATM

*** 6330160** Recommends reducing from current Soft Closure to Obliterate from 6330/6330160 jct. (m.p. 0.00) to end (m.p. 2.10) for a total of 2.1 miles.

*** 6380** Recommends reducing from current Secondary ATM route to Keep Open from 6300/6380 jct. (m.p. 0.00) to fee Elk Lake Trail Head (m.p. 2.92) for a total of 2.92 miles.

*** 6380130** Recommends reducing from current Keep Open to Obliterate from 6380/6380130 jct. (m.p. 0.00) to end (m.p. 2.0) for a total of 2.0 miles.

Potential Blm Road Closures Within LSR #RO 209

No additional roads proposed for closure in RO 208 & 211 (partial list).

Road #	Length	Closure Type*	Comments
7-4e-20.1	0.39	Soft	
7-4e-22.1	1.37	Soft	Camp Creek system.
7-4e-23	0.57	Soft	"
7-4e-32 b,c,d	2.75	Hard	Upper Molalla River brush, slides.
7-4e-21	1.21	Hard	Dirt road system.
7-4e-21.1	0.05	Hard	"
7-4e-28.1	0.04	Hard	"
7-4e-28.2	0.13	Hard	"
7-4e-7.1	0.35	Soft	
7-4e-8	1.67	Soft	
7-4e-8.1	0.56	Soft	Partly closed by washout of low water crossing.
7-4e-8.2	0.2	Soft	"
7-4e-29.2,3	0.9	Soft	Growing over.
7-5e-6.3	2.3	Soft	Lost Creek system closed by slides.
7-5e-6.2	2.55	Soft	"
7-5e-32	0.3	Soft	"
7-5e-5.1	0.68	Soft	
7-5e-5.6	0.27	Soft	
7-5e-5	0.45	Soft	
7.5e.7.4	2.48	Soft	Possible conflict with Forest Service.
7-5e-8.2	0.52	Soft	
7-5e-8.1	0.08	Soft	
7-5e-8	1.24	Soft	
Totals	20.67		

**Soft closure* = *Tank trap, gate, etc.*
Hard closure = *Decommission, storm proof, pull culverts, out slope*

Appendix F

Landscape Analysis and Design Legend Key

Appendix F
Landscape Analysis and Design Legend Key

To create the Conceptual Landscape Design for the Assessment Area, it was necessary to combine the designs for individual watersheds together as well develop new design cells for watersheds where the LAD process has not yet been applied. This table illustrates how the approximately 80 unique design cells were combined based upon like vegetation patterns and structures as they relate to the objectives of this LSR assessment. Additional information about GIS codes is provided to facilitate district use.

LATE-SUCCESSIONAL				
GIS LAD Code	**GIS LAD Description**	**Pattern Type from WA Legends**	**GIS Concept Code from WA**	**Watershed**
RNP LS	Retain and Promote Late Seral	Retain and Promote Late Seral		All Clackamas Watersheds
		Continuous Mature Forest (Late Seral)	CMF	Salmon
		Continuous Mature Forest (Late Seral)	CMF	Zigzag
		Old Forest/Continuous	04 OF/CONT	Upper Sandy
		Old Forest/Linear	05 OF/LIN	Upper Sandy

INTERIM CONNECTIVITY				
GIS LAD Code	**GIS LAD Description**	**Pattern Type from WA Legends**	**GIS Concept Code from WA**	**Watershed**
INT CON	Interim Connectivity	Interim Connectivity		All but Eagle
		Interim Retention of the Oldest Forest Patches (Interim Retention)	INTERIM RETENTIO	Eagle

MANAGED LATE-SUCCESSIONAL				
GIS LAD Code	**GIS LAD Description**	**Pattern Type from WA Legends**	**GIS Concept Code from WA**	**Watershed**
MANLS	Managed Late Seral	Managed Late Seral	2	Lower Clackamas
		Managed Late Seral with Small Perforations	WSR VS	N.Fork
		Mature Forest/Occasional Openings (Mid to Late Seral)	MFO	Salmon
		Mature Forest/Occasional Openings (Mid to Late Seral)	MFO	Zigzag
		Aggregated Viewshed	VIEW	Upper Clackamas

DISPERSAL HABITAT				
GIS LAD Code	**GIS LAD Description**	**Pattern Type from WA Legends**	**GIS Concept Code from WA**	**Watershed**
2ACPERF	Very Small Perforations acre	Small variable perforations and thinning	VAR PERFORATED	Eagle
		Small perforations and thinning		Eagle
		Mid-seral continuous cover	LPB	Upper Clackamas
		Retain Forested Conditions with small perforations to maintain root strength	SM Perforations	Fish Creek
		Summit Lake - Thinning and Group Select (acres)	SM PERF THIN	Oak Grove
		Continuous Forest Cover (60% canopy closure) with small perforations	CONT CC 60 SM PE	Oak Grove
		Uneven-age Management	UNEVEN AGE MGT	Oak Grove
		Variable Canopy with small perforations	TRAIL VS	N. Fork
SMPERF	Small Perforations 1-5 acre	Continuous Forest Cover (70%) with 2-5 acre perforations	SMPER2_5	Oak Grove
		Perforated Forest	Perforated Perforated Unstable	Collawash
		Small Perforations (2-5 acres)		Lower Clackamas
		Mature Forest/Small Openings (Mid Seral-Perforated Openings)	MFS	Salmon
		Mature Forest/Small Openings (Mid Seral-Perforated Openings)	MFS	Zigzag
		Mature Forest/Small Openings	07 MATF/SMA	Upper Sandy
SMPATCH	Small patches 1-5 acre with shelterwood	Patchy Forest (1-2 acre openings with shelterwood retention)		Collawash
		Perforated/Patchy (2-5 acre openings with shelterwood retention)		Collawash
		Perforated/Patchy		Upper Clackamas

SPECIAL HABITATS				
GIS LAD Code	**GIS LAD Description**	**Pattern Type from WA Legends**	**GIS Concept Code from WA**	**Watershed**
SPHAB	Special Habitats	Late Seral & Meadow Mosaic	LS MEADOW MOSAIC	Oak Grove
		Williams Lake Management Area	WILLIAMS LK	South Fork
		Wet Meadows Complex	WMC	Salmon
		Alpine/Subalpine	01 ALP/SUBALP	Upper Sandy
		Old Maid Flat	03 OLDMAIDFLAT	Upper Sandy
		Wet Meadows	02 WETMEADOW	Upper Sandy
		Alpine	ALP	Zigzag
		Prescribed Natural Fire Openings	Prescribed Natural Fire	Collawash
		Lake	LAKE	Oak Grove

LARGE OPENINGS				
GIS LAD Code	**GIS LAD Description**	**Pattern Type from WA Legends**	**GIS Concept Code from WA**	**Watershed**
LGPERF	Large perforations up to 20 acres	Variable perforated pattern and thinning. ≤ 20 acre openings of variable sizes and spacing.	VAR PERFORATED	Eagle
		Perforated (5-20 acres)	PERFORATED	South Fork
		Patchy (create irregular openings of variable size and spacing)		Lower Clackamas
		Large perforations (<20 acres)		Oak Grove
		Mature Forest/Ridgetop Openings (mid Seral-Perforated Forest)	MFR	Salmon
		Mature Forest/Ridgetop Openings (mid Seral-Perforated Forest)	MFR	Zigzag
MANMOS	Managed Mosaic	Managed Mosaic (same as Aggregated but smaller patches because of adjacent allocations and landforms)	MOSAIC	N. Fork
		Managed Mosaic (same as Aggregated but smaller patches because of adjacent allocations and landforms)	MOSAIC	S. Fork
		Mixed Age Forest/Sandy	09 MAF/SANDY	Upper Sandy
FRAG	Fragmented	Fragmented	B11	Upper Clackamas
		Fragmented	FRAGMENTED	Eagle
		Lodgepole/Fragmented	FRAG LP	Oak Grove
WBDBK	Windbreak	Windbreak (Variable openings of 5-40 acre openings embedded in well connected matrix of mid-seral forest stands.)	BUFFER	S. Fork
BUF	Buffer	Mixed Age Forest Buffer	08 MAF/BUFF	Upper Sandy
PATCHY	Large patches	Patchy (BLM)	PATCHY	Eagle
		Old Forest/Discontinuous	06 OF/DISCONT	Upper Sandy
MFV	Mid seral with 5-60 acre openings	Mature Forest /Variable Openings	MFV	Zigzag

AGGREGATED OPENINGS				
GIS LAD Code	**GIS LAD Description**	**Pattern Type from WA Legends**	**GIS Concept Code from WA**	**Watershed**
AGG	Aggregated	Aggregated		Oak Grove, Fish, S. Fork, N. Fork, Upper Clackamas, Lower Clackamas
		Lodgepole Aggregation	LPA	Upper Clackamas
		Rehabilitation	REHAB	Oakgrove
		Open Immature Forest (Early to Mid Seral-Aggregated Forest)	PAF	Salmon

NON-FEDERAL LANDS				
GIS LAD Code	**GIS LAD Description**	**Pattern Type from WA Legends**	**GIS Concept Code from WA**	**Watershed**
PRI		Private Land	PVT	Zigzag
		Non Federal Ownership	10 Non-Fed Own	Sandy
DEV	Developed	Developed Areas	DEV	Salmon
		Developed/BPA Power Lines	11 DEV/BPA	Upper Sandy
		Developed/Hwy 26 Corridor		Upper Sandy
		Developed Areas (Human Patch/Infrastructure)	DEV	Zigzag
ORRIPBUF	OR State Forest Act Riparian Buffers	State Forest Act riparian buffers		Eagle
PROFRAG	Projected Fragmented	WSPR (CWTS)	WSPR	Oak Grove
		Fragmented private industrial forestland managed under OR F.P.A.	FRAGMENTED	Eagle
PROAGG	Projected Aggregate	Projected Aggregated	PROJ AGG	S. Fork
		Projected Aggregated	PROJ AGG	N. Fork
		Projected Aggregated		Lower Clackamas
		Inverse perforation R.R. & Ag managed under L.C.D.C. - small pockets of vegetation may remain		Eagle
		Open -Agriculture		Eagle