Chapter 1

Introduction and Highlights

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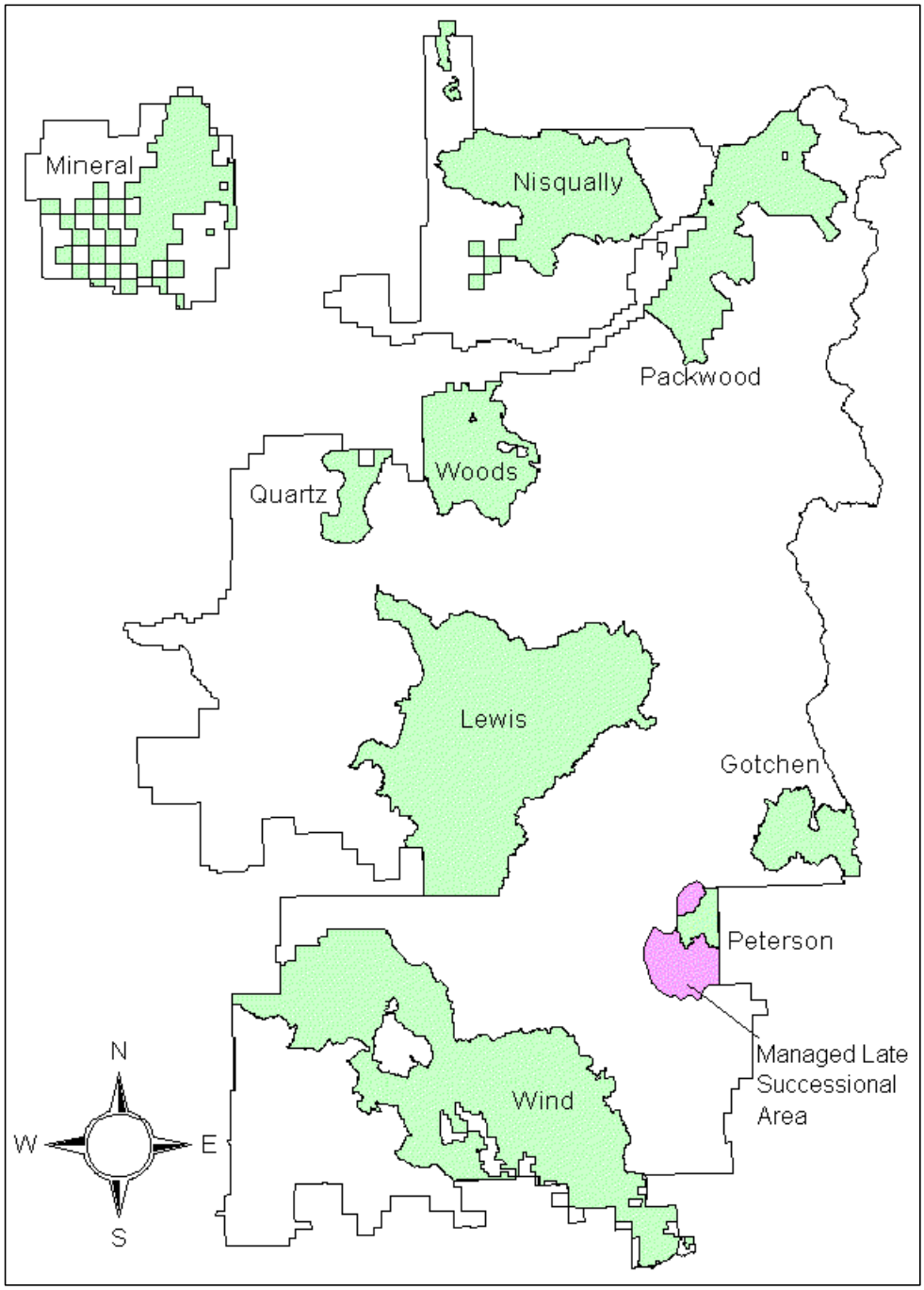
Map 1-1 Late-Successional Reserves Map



Chapter 1
Introduction

In 1994 the Northwest Forest Plan (NWFP) designated a network of Late-Successional Reserves (LSR) with the object of protecting and enhancing conditions of late-successional and old-growth forest ecosystems. As part of its strategy for protecting these ecosystems, the NWFP directs us to prepare an assessment of conditions and the functions of each LSR. This Assessment was prepared by an interdisciplinary team comprised of Forest Service resource specialists and managers. A biologist from the U.S. Fish and Wildlife Service also participated on the team. A list of prepares is included at the end of the document.

Its purpose is to describe the ecological framework within which projects will be designed to ensure they will meet LSR standards and guidelines and further LSR objectives. Decisions on where, when and how projects will be implemented are made through project level environmental analysis, not in this Assessment.

The Regional Ecosystem Office (REO) exemption letter is reproduced beginning on page 1-5. This letter describes the types of projects which are subject to review by the REO prior to implementation.

The emphasis of this document is on terrestrial habitats in the LSRs. Aquatic habitats are analyzed in watershed analyses. To obtain the total picture of the ecosystem and its functions, the watershed analyses should be examined concurrently with this Assessment.

For the purposes of this Assessment, there are nine Late-Successional Reserves including one Managed Late-Successional Area on the Gifford Pinchot National Forest. The LSRs comprise about 450 thousand acres, which is nearly one third of the Forest. See Map 1-1. They range in size from about 9 thousand to 125 thousand acres.

Seven of the LSRs are on the west side of the Cascade Range. The Peterson and Gotchen LSRs in the drier east side present a different set of management concerns and opportunities. The Managed Late-Successional Area in the Peterson LSR has the same objectives as the Late-Successional Reserves but was identified by the FEMAT scientists as an area in a drier province where regular and frequent fire is a natural part of the ecosystem. In Managed Late-Successional Areas, a wider range of silvicultural treatments may be appropriate to help prevent stand destruction by fire or insects and disease.

Through site-specific analyses of the LSRs, the Gotchen LSR was found to be the driest of the nine LSRs and better fit the FEMAT description for the Managed Late-Successional Area than the Peterson area.

All Late-Successional Reserves and the Managed Late-Successional Area are addressed in this province-wide assessment. Unless otherwise noted, we use the acronym LSR to apply generically to the Late-Successional Reserves and the Managed Late-Successional Area.

1-1 Management Objectives

The objective of the Late-Successional Reserve system is to protect and enhance conditions of late-successional and old-growth forest ecosystems which serve as habitat for late-successional and old-growth related species, including the northern spotted owl. The reserves are designed to maintain a functional, interacting, late-successional and old-growth forest ecosystem. They were designed to provide distribution, quantity and quality of old-growth forest habitat sufficient to avoid foreclosure of future management options. (ROD p. B-5). They provide habitat for viable, well-distributed populations of species including spotted owl and marbled murrelets. They will help ensure that the full range of late-successional biodiversity will be conserved. (FEMAT p. IV-31)

1-2 Approach to the Assessment

The assessment begins with broad-scale discussions of the Southwest Washington Province in Chapter 2 and becomes more site specific as the emphasis shifts to stand level treatments in Chapter 5. Each chapter takes a hierarchical approach by presenting information from up to four scales: Province, Forest, plant zone, and LSR.

Chapter 2 provides context for the assessment by describing the relationship of the vegetation and management objectives of the Gifford Pinchot National Forest to the other lands and ownerships in the Southwest Washington Province. This chapter contains province-scale discussions of landscape patterns and connectivity.

Beyond Chapter 2, we follow the model common to environmental analyses:

Chapter 3 - Desired Conditions
Chapter 4 - Existing Conditions
Chapter 5 - Treatments
Chapter 6 - Fire Management Plan
Chapter 7 - Monitoring

Chapter 3 describes desired LSR conditions and functions. This chapter interprets the broad goals and objectives outlined in the NWFP in terms of the late-successional structure, function, wildlife habitat relationships and human uses for the Gifford Pinchot LSRs.

Chapter 4 assesses the existing condition and functions parallel to the descriptions of desired conditions in Chapter 3. Also discussed in Chapter 4 are plant and animal species in the LSRs with special status and unique habitats.

The focus of Chapter 5 is on any disparity between desired and existing conditions and how through management we can bring the existing condition closer to desired. Criteria are developed to describe conditions, which would trigger management activities.

Chapter 6 is the plan for managing fire within the LSRs. Fire behavior is described for each fire group. Fire groups are analogous to the plant zone scales applied in Chapters 3 and 4. Fire hazards are assessed and guidelines are provided for appropriate fire suppression response. The fire plan describes historical fire occurrence and cause in each LSR over the past 25 years.

The final chapter summarizes monitoring questions raised throughout the document. These questions provide the foundation for developing monitoring programs which will assist in ensuring projects are implemented as intended and achieve the desired results.

We intend that this be a dynamic document. With Regional Ecosystem Office (REO) concurrence, we will update or amend it as conditions change and new information becomes available.

1-3 Highlights of the Assessment

1. The Forest provides most of the late-successional habitat in the SW Washington Province. This relationship is not expected to change in the future because of the predominantly private ownership in the province. See page 2-1.
2. Site of the only known nesting sites of marbled murrelets on the Forest, the Mineral LSR is recognized as an important island of late-successional vegetation at the province scale. See page 3-17.
3. The LSRs contain over half the Forest's deer and elk winter range. There will be a reduction in the quality of deer and elk habitat as LSR vegetation matures. Forage enhancement is recommended where it does not retard development of late-successional habitat and is consistent with LSR objectives. See pages 4-25 and 5-10.
4. Where they provide necessary habitat for species which are federally listed or sensitive, meadows may be maintained through fire or mechanical methods. See page 5-47.
5. Within the LSRs there are many opportunities to accelerate development of late-successional characteristics through:
   - Young Stand Thinning - see page 5-1
   - Commercial Thinning of stands less than 80 years old - see page 5-6
   - Older Stand Structural Enhancements - see page 5-11
6. All LSRs are low fire risks in general but have localized areas of moderate risk. See page 6-11.
7. There is a concern in the Gotchen LSR, that if left unchecked, the combination of the relatively dry environment, abundance of fire intolerant tree species and endemic levels of insect and disease will pose significant risk of catastrophic stand replacing fire in the future. Vegetation management and risk reduction treatments are proposed in the Gotchen LSR to reduce the risk of large scale stand replacing fires. See pages 3-15, 4-41, and 5-14.

8. The Managed Late-Successional Area was combined with the adjacent Peterson LSR for assessment. The assessment team found the Gotchen LSR to be a drier environment with a greater fire risk than the Managed Late-Successional Area (MLSA). The Gotchen LSR conditions more closely resemble NWFP description of an MLSA. See pages 4-41 and 4-82.
9. Revised guidelines for snags and down wood are developed for application in LSRs. See pages 5-22 and 5-26.
10. NWFP salvage guidelines are refined to acknowledge the functions of insects and disease and to incorporate refinements to the snag and down wood standards developed in this Assessment. See page 5-43.

Literature Cited

[FEMAT]Forest Ecosystem Management Assessment Team. 1993. Forest ecosystem management: an ecological, economic, and social assessment. Portland, OR: US Department of Agriculture; US Department of the Interior [and others].

[NWFP] Record of decision for amendments to Forest Service and Bureau of Land Management planning documents within the range of the northern spotted owl. 1994. Portland OR: US Department of Agriculture; US Department of the Interior [and others].

1-4 REO Exemption Letter

REGIONAL ECOSYSTEM OFFICE

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MORANDUM

DATE: November 18, 1997

TO: Robert W. Williams, Regional Forester, Region 6, Forest Service

FROM: Donald R. Knowles, Executive Director

SUBJECT: Regional Ecosystem Office Review of the Gifford Pinchot National Forest Forestwide Late-Successional Reserve Assessment

Summary

The Regional Ecosystem Office (REO) and the interagency Late-Successional Reserve (LSR) Work Group have reviewed the Gifford Pinchot National Forest Forestwide Late-Successional Reserve Assessment (LSRA). The REO finds that the LSRA, with the assumptions and modifications explained below, provides sufficient framework and context for future projects and activities within the LSR. Future silvicultural activities described in the LSRA (as discussed below) that conform to the LSRA criteria and objectives and are consistent with the Standards and Guidelines (S&Gs) in the Northwest Forest Plan (NFP) are exempt from further project-level REO review. In addition, future salvage activities less than 1,000 acres in size that are described in the document and that conform to the LSRA criteria and objectives and are consistent with the S&Gs in the NFP are exempt from further 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. The 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-1 1). 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 considers potential treatment criteria and treatment areas 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 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).

Scope of the Assessment and Description of the Assessment Area

The REO reviewed the LSRA for conformity with the eight subject areas identified in the S&Gs (page C-11), Several initial questions regarding proposed silvicultural, salvage, and risk-reduction treatments were resolved by meetings and conference calls between the work group and staff of the Gifford Pinchot National Forest. The LSRA was revised to reflect the results of those meetings and conversations and the revised portions of the LSRA were resubmitted by the Forest. The REO finds that the revised LSRA, with the assumptions and modifications discussed below, provides a sufficient framework and context for making future decisions on projects and activities within the LSR.

The LSRA addresses approximately 450,000 acres within eight LSRs and one Managed Late-Successional Area (MLSA) across the entire Forest. Individual reserves range in size from 9,000 to 125,000 acres. All of the LSRs in the Southwest Washington Province occur in this Forest. Plant zones across all LSRs include: silver fir (48% of total LSR acres), western hemlock (41 %), grand fir (6%), mountain hemlock (5%), and subalpine fir (>1%). Approximately 25% of the LSRs is in stands >200 years old.

The assessment addresses LSR management at several scales, beginning with a provincial scale, then stepping down to the stand level for proposed treatments. The assessment describes habitat conditions for several wildlife guilds in an attempt to address connectivity within and between LSRs, across the forest. The assessment details desired future conditions at several different levels, including a forest-wide scale, by individual LSRs, and for each plant zone. Detailed information on existing condition is presented for each individual LSR.

Assumptions and Clarifications

Members of the work group visited with the assessment team as the LSRA was being developed. The work group visit looked at potential treatment areas. Upon receipt of the assessment for review, work group members held meetings and phone conversations with LSRA team members to clarify portions of the assessment. The Forest submitted an addendum revising portions of the LSRA in response to these meetings and discussions. Additional assumptions and clarifications not found in this addendum or the originally submitted LSRA are noted below.

- The LSRA, as originally submitted, proposed silvicultural treatments for the enhancement of late-successional characteristics in stands between 80 and 100 years. However, REO has not made any finding on whether such projects that meet the criteria described in this assessment would meet the purposes of LSRs and the intent of the NFP. Any projects proposing to do non-risk-related silvicultural treatments in stands over 80 years old would, therefore, require review by REO prior to implementation.
- Several places in the document discuss projects that may provide enhancement opportunities for elk forage. Any enhancement of elk forage will only be incidental to the project's primary purpose, which is to enhance late-successional conditions.
- In Section ***5-2 Commercial Thinning***, under the heading "Treatments Description," reference is made to the portion of the REO memo (Criteria to Exempt Specific Silvicultural Activities in Late-Successional Reserves and Managed Late-Successional Areas dated July 9,

1996) that describes criteria for leaving small openings and heavily thinned patches to increase diversity (viz., Treatment Standard #4). This standard was amended by REO memo (dated September 30, 1996) to modify the size and extent of the patches. REO assumes that this amendment will be incorporated into the treatment criteria for commercial thinnings within this LSR.

- In Chapter ***5-2 Commercial Thinning***, RE0 assumes that all snags and down wood existing prior to treatment will be retained. Any snags that pose a hazard to safe operations may be felled but will be left on site.
- In Chapter ***5-4*** Treatments to Reduce Fire Risk and Maintain Late-Successional Forest in Gotchen LSR, under "Treatments Description," the Group 6 treatment for fully stocked stands that contain large, old-growth early seral tree species will be applied throughout the Gotchen LSR. Also in this section, activities under the Group 7 treatment within fully stocked stands that contain few or no large, early seral tree species, REO assumes that any existing large early-seral trees will be retained.
- In Chapter ***5-6 Down Wood Management***, **Figure 5-1** (Down Wood Decision Tree) is modified as follows: the decision box that reads "Emphasize CWD at >low level" is changed to "Emphasize CWD at >low level." We assume that the CWD levels to be retained in these circumstances will, to the degree possible, equal or exceed those levels identified as "moderate."
- In Chapter ***5-11 Salvage and Risk Reduction***, three treatment situations are described under the section "Refinements to NWFP Salvage Guidelines, Guideline 2." In treatment group 3, which describes possible treatments in laminated root rot and dwarf mistletoe infection centers, REO assumes that conversion of green trees to snags would only occur if reforestation by host or susceptible species is necessary to meet LSR objectives. The following, or similar, edit is suggested to help clarify the intent to this treatment:

  In the last sentence under the group 3 treatment description, replace "Where reforestation options are limited," with "Where reforestation of non-host or non-susceptible species will not meet attainment of desired future late-successional conditions, …"

Conclusions

Based on the discussion presented in the final LSRA, the REO finds that it provides sufficient framework and context for future projects and activities within the LSR. Silvicultural activities, risk reduction activities, and salvage activities less than 1,000 acres described in the LSRA which are consistent with the S&Gs and the treatment criteria identified in the assessment, as discussed above, are exempted from future project-level REO review. Because of the issues surrounding the management of CWD at the levels proposed in this document, the LSR work group is interested in seeing if a project with these levels meets the work group's expectations. Please inform me when such a project is completed so that the work group may arrange a site visit. I would also appreciate a copy of the revised final LSRA.

cc:
REO, RIEC
Lisa Freedman
Gifford Pinchot NF

1041/ly

Chapter 2

Provincial Setting

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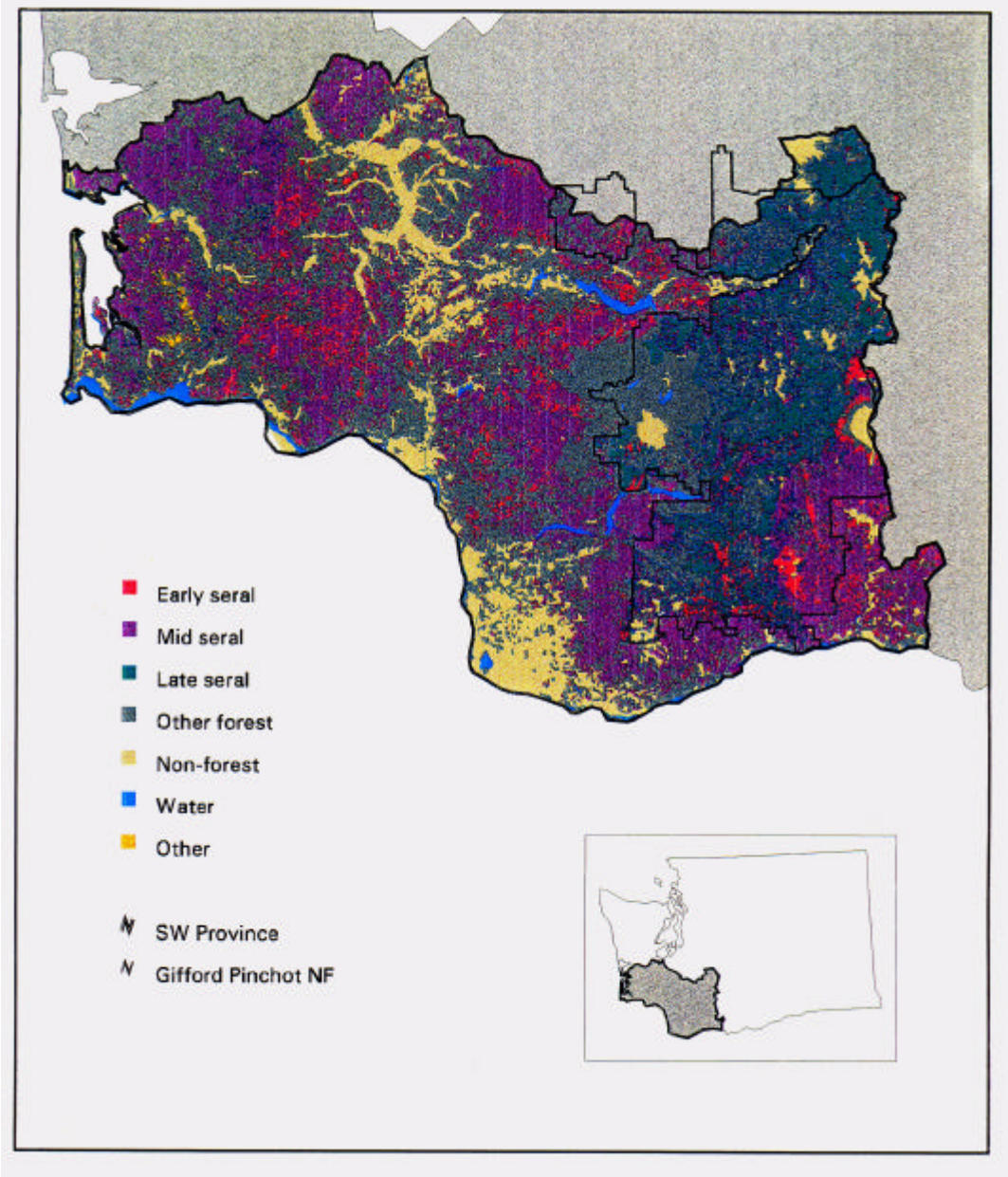
Map 2-1 Southwest Washington Province Seral Stages



Chapter 2

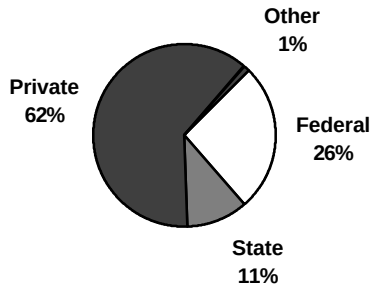
Provincial Setting

The Gifford Pinchot NF occupies 1.4 million acres of land in southwestern Washington. Most of the Forest is located in the Southwestern Washington Province. The remainder (5 percent) of the Forest is located in the Nisqually and Puyallup River watersheds which are in the Western Washington Cascades Province. The Forest comprises about one quarter of the 5.7 million acres in the Southwest Washington Province.

2-1 Land Use and Ownership

Land use within the Southwestern Washington Province includes urban and suburban development, agriculture and forestry. Intensive private forest management is the most widespread land use. The Gifford Pinchot NF is located in the eastern third of the province and includes mostly forested lands.

Figure 2-1 Southwest Washington Province Landownership



Land within the Province is mostly in private ownership (62 percent), followed by federal (26 percent), State of Washington (11 percent) and other (less than 1 percent)

2-2 Vegetation Conditions

Forest cover data supplied by the Washington Department of Natural Resources was used to provide a provincial context for this assessment. The data was developed from forest canopy characteristics derived from 1988 LandSat satellite imagery. Structural stage definitions used by LandSat differ from those used elsewhere in this Assessment.

Figure 2-2 Provincial Vegetation

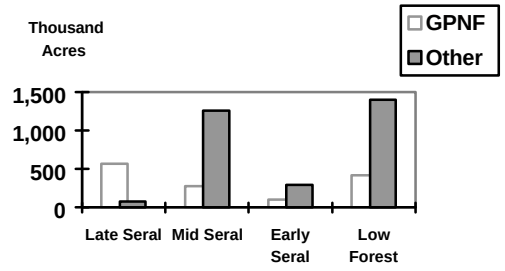


Table 2-1 LandSat Seral Stage Definitions

Seral Stage	Conifer Crown Closure	Crown Closure >21" DBH	Hard-wood/ Shrub Cover
Late Seral	>70%	>10%	<75%
Mid-Seral	>70%	<10%	<75%
Early Seral	10-75%	<75%	
Low Forest Cover	Includes other lands in forested areas (<10% crown closure of conifer or >75% hardwood; also included are plantations, meadows, etc.)		

It should be noted that LandSat late-seral classification does not necessarily equate to late-successional or old-growth habitat. However, it is apparent that within the province most of the forest land which is likely to contain late-successional habitat in the future is on the Gifford Pinchot NF because most non-federal land is managed for other values.

2-3 Province Scale Connectivity

Connectivity at provincial and regional scales is limited by the geographical isolation of Gifford Pinchot NF LSRs from late-successional habitat located on other federal lands. See Map 2-2.

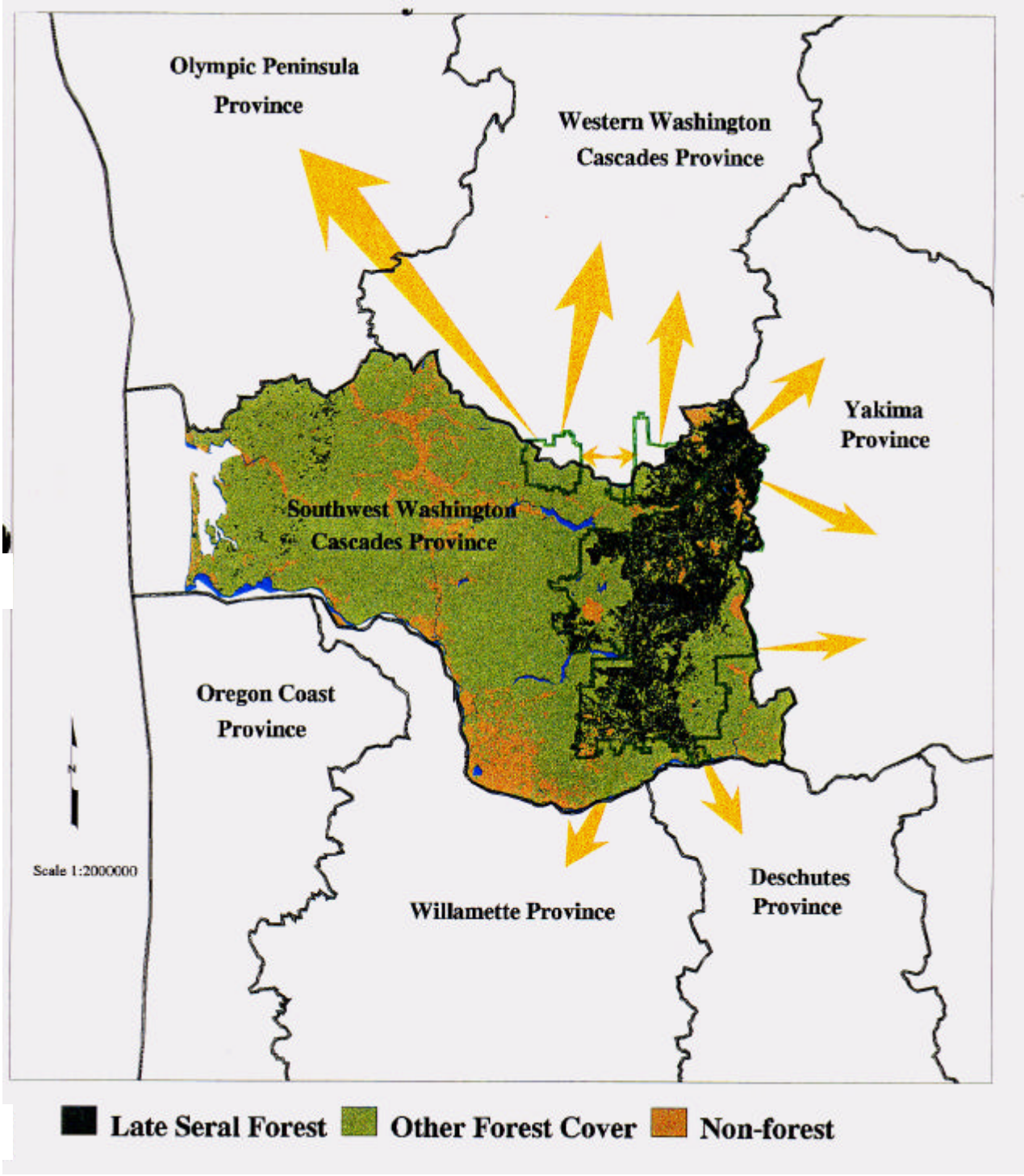
To the south, the Columbia River presents a formidable obstacle to most terrestrial species. It is possible, however, for dispersal of birds, such as spotted owls, to occur across the river. Therefore, it is desirable to foster and maintain old-growth forest conditions as close to the river as possible. The area with greatest potential to contribute to cross Columbia River connectivity is located in the Dog Mountain area where the Forest boundary extends to the river. Presently, there is little late-successional forest on Dog Mountain because of past wildfires. Accelerating the recovery of these stands should be a high priority for LSR management. The Forest should coordinate the development of connectivity habitat with the Columbia River Gorge National Scenic Area.

To the east, connectivity to Yakama Indian Nation forest land is broken by high elevation, alpine and sub-alpine areas but connections exist through the Clear Fork of the Cowlitz/Upper Klickitat valleys in the northern part and across the southeastern corner of the Forest. The land to the east of the Forest becomes progressively drier with less timber cover and diminishing habitat for many late-successional species. The crest of the Cascade Mountains, with its open, park-like subalpine and treeless alpine regions provide little connectivity. The Goat Rocks and Mt. Adams wilderness areas and the Gotchen LSR represent the best connectivity available to Wenatchee National Forest, Yakama Indian Reservation and state lands to the east.

To the north, Mt. Rainier National Park, with its contiguous forest cover around the lower elevations of the mountain, provides connectivity to other federal forest land to the north and east. The Park and the adjacent Glacier View Wilderness also provide connectivity between the units of the Nisqually LSR.

To the west, the only opportunity for late seral connectivity is through the Mineral LSR in the northwest corner of the Forest. It is important because it provides connectivity to the Olympic Province and, to some degree, the Northern Cascade Province. There are known marbled murrelet nesting sites within this LSR. Connectivity between the Mineral and other LSRs is limited by state and private forest land and by non-forest land uses. The best opportunity to improve connectivity in this area is with Washington DNR forest land which lies between the Mineral and Nisqually LSRs.

Map 2-2 Connectivity At The Province Scale



2-4 Disturbance Processes

The current state of any ecosystem is the result of the balance between disturbance and recovery processes. Forest disturbances are natural and human induced processes. The disturbances at work in the forests of the province included fire, wind, floods, insect and disease, volcanic events and human activities. Knowledge of forest disturbances; type, extent, frequency and intensity, is fundamental to accurate interpretation of the dynamics of individual forest stands and the stand mosaic that makes up the landscape.

Historically, land use conversion, wildfires, volcanic activity and timber harvest have had the greatest effect on vegetation change in the province. The combination of fire exclusion and timber harvest practices has changed the species makeup and forest structure now found throughout the province.

Fire

Fires have two primary ignition sources, natural (lightning) or human caused. Historical records document large fire events as early as 1764. Native American burning prior to European settlement was often documented as natural ignitions.

Vegetative conditions across the Forest are greatly affected by the vast forest fires which burned large acreages during the early part of this century. These fires occurred in the presence of strong east winds following periods of summer drought. In 1902, 480,000 acres on and near the Forest burned. The Yacolt Burn accounted for half this acreage, other fires that year over 30,000 acres each were the Lewis River Burn, Siouxon Fire and the Cispus Burn. Similar large-scale fires occurred naturally or were set in the past and have been of primary importance in the establishment of extensive Douglas-fir forests.

The fire frequency in this province is very similar to those found in other westside forest ecosystems. Wildfires as a disturbance process are less frequent (70 - 400 year intervals) than in eastside ecosystems. Fires in these fire groups tend to be lethal and stand replacing. In the warm, dry plant zone primarily on the eastside, fire is more frequent (5 - 200 years). Historically, these stands tended to be more open and park-like, composed mainly of large diameter ponderosa pine and Douglas-fir. Fires were less intense and usually not stand replacing.

Volcanic Eruptions

The 1980 eruption of Mount St. Helens destroyed vegetation on about 150 thousand acres; 61 thousand acres of National Forest land, 61 thousand acres of state lands and 28 thousand acres of private lands. National Forest lands outside the legislated monument boundary and most of the private and state lands were replanted immediately after the eruption. The 110 thousand acres of National Volcanic Monument was not replanted and ecological processes are allowed to progress at natural rates.

Timber Harvest

Outside of the volcano blast zone, most stands less than 50 years of age originated from timber harvest. Timber harvest in the Pacific Northwest expanded rapidly on private lands in the early 1900. The Puget Sound area was growing rapidly and construction materials were in demand. Demand for timber from the Pacific Northwest was stimulated by the 1906 San Francisco earthquake and fire which destroyed 28,000 wood frame buildings. The first large sale of national forest timber in the Pacific Northwest was a 6 MMBF sale on what is now the Gifford Pinchot National Forest (Hirt 1994). By 1909 over a quarter of the forestland west of the Cascades in Washington had been logged. Total Washington state lumber production peaked in the 1920s. (Williams 1989)

National Forest Timber Harvest

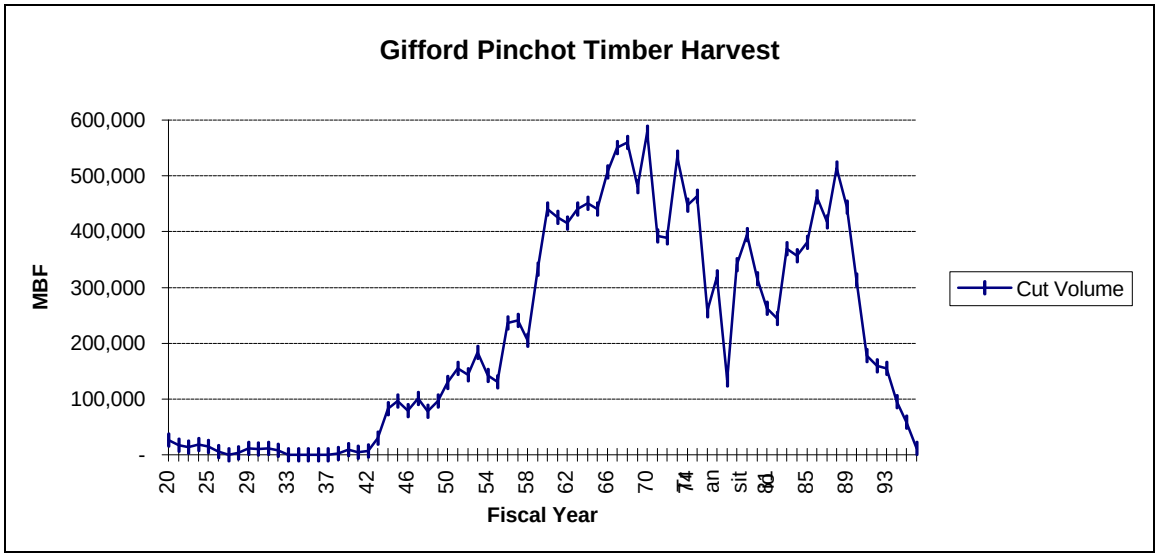
While supplies on private lands were abundant, little harvest occurred on the national forests. From records going back to 1920, the Forest sale level averaged less than 20 million board feet (MMBF) per year between 1920 and

1940. Timber harvest increased steadily after 1940 and fluctuated between 300 and 500 MMBF between 1960 and 1990. Harvest levels peaked in 1970 near 580 MMBF. See Figure 2-3.

After an annual sale level averaging over 400 MMBF during the decade of the 1980s, the Dwyer injunction in 1990 and NWFP reduced the sale level to an average of 28 MMBF between 1991 and 1996. The projected harvest level for the Forest under the NWFP is presently 73 MMBF.

Timber harvest through the 1980s was primarily by clearcutting. Harvest units were usually between 10 and 60 acres in size. Clearcutting was prescribed as the most efficient method for regenerating Douglas-fir. The resulting habitats favored early-seral species, particularly deer and elk. The use of clearcutting and the NFMA 60-acre limit on opening size resulted in a highly fragmented landscape in areas where timber harvest was permitted. The use of clearcutting on the National Forest, as a silvicultural practice, ended with the implementation of the Northwest Forest Plan.

Figure 2-3 Historical Timber Harvest



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Chapter 3

Desired Conditions

Chapter 3

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Chapter 3

Desired Conditions

This chapter is structured by scale of influence; Forest, plant zone, and individual Late-Successional Reserve (LSR). Desired conditions emphasize vegetative conditions and wildlife habitat. Desired conditions for vegetation are described for the relatively stable late-successional/old-growth conditions as prescribed for LSRs by the Northwest Forest Plan (NWFP). Desired conditions for younger stands are described in Chapter 5 in terms of treatments to put them on a trajectory to achieving the ultimate old-growth desired condition. Desired conditions for human uses, and facilities consistent with LSR objectives are also developed at the appropriate scale. Some components are discussed at several scales. For example, vegetative conditions will be described in general terms at the Forest scale and with increasing specificity at the scales of plant zone and LSR.

3-1 Forest Scale Desired Condition

Vegetation

The desired condition for Late-Successional Reserves is large patches of old-growth forest which provide habitat for the northern spotted owl and other old-growth dependent species. This condition may be outside the range of historical variability, at the LSR scale. Reconstruction of historical stand conditions indicates the LSRs would provide more large contiguous blocks of old-growth than was present before European settlement.

By the nature of old-growth forest, the composition of these old-growth patches is expected to be very diverse in structure. Where LSRs include eastside (grand fir zone) conditions, more structural heterogeneity may be introduced through management to reduce the risk of large scale loss of habitat from wildfire. (See Grand Fir Zone, p. 13).

Old-growth structure is characterized by trees that are large in diameter and tall. Canopies are usually deep and diverse with many broken tops and large, gnarled branches. A multi-layered canopy consisting of one to several cohorts of younger trees is established as mortality creates shifting gaps in the overstory layer. Reproduction usually consists of the more shade-tolerant tree species but in larger openings intolerant early seral species may also be present. A patchy understory consisting of shrubs and forbs is also characteristic of the old-growth stage.

Old-growth stands have numerous snags of various sizes including very large snags. Large snags are important habitats for a number of vertebrates, especially cavity nesters, and many invertebrates. Snags also serve as a future source for down wood.

On the forest floor are many, often large, down logs. The large size of these down logs, allows them to persist for many decades, even centuries. Large down logs provide habitat for many species and are important for erosion protection, nitrogen fixation, and mycorrhizal function. Down logs also serve as a seedbed for certain species and are a source of moisture during summer drought. Down logs are critical components of small to medium sized streams - supplying energy and nutrients and creating dams, pools, and gravel deposits.

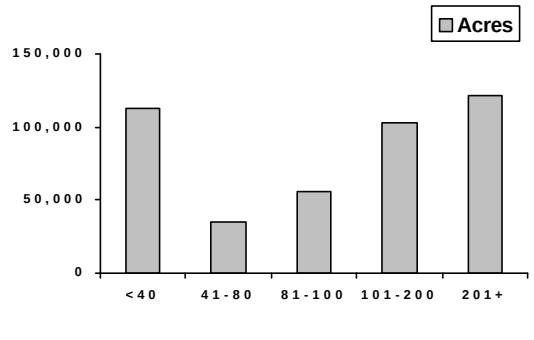
Old-growth structure provides for ecosystem function by cycling and conserving nutrients (rates of erosion are very low), absorbing water and releasing it to streams through groundwater flow (providing base flow for periods of summer drought) and acting as cover and a source of food for small mammals, insects, and other organisms. It also helps to create a moderate microclimate, buffered against climatic extremes, and supplies additional moisture by intercepting fog. Old-growth stands are characterized by high accumulations of fungi, lichens and bryophytes (ROD p. B-5).

All of these characteristics provide a diversity of forest structure and a wide array of habitats for many, often specialized, forest organisms.

Early and mid-seral forest habitats are expected to be a minor component of the LSR network. Small-scale natural disturbances by fire, wind, insects, and diseases will generate early and mid-seral forest habitat within the LSRs by creating forest canopy gaps of varying sizes. Such canopy gaps are considered important components of old-growth forest characteristics. Wildlife species that are dependent on early and mid-seral forest habitats will continue to utilize LSRs because of the creation of canopy gaps. However, Matrix land allocations are expected to provide the majority of early and mid-seral forest habitat for these wildlife species.

Habitat complexity in all LSRs derives from two sources; existing conditions and small-scale disturbances. Because of the extreme diversity of seral stages present (see Figure 3-2), the LSRs will remain very diverse for at least 150-200 years as young stands develop and mature. However, we expect that in 200 years they will be predominantly in the old-growth stage. With absence of large scale disturbance (aided by fuels management as described in Chapter 6), older stands will also evolve. Although the desired condition for these areas is old-growth forest, in practice, they will not likely be large contiguous blocks of old-growth forest for several hundred years, if ever. Natural disturbances due to insects, diseases, windthrow, and fire will continue provide stand diversity into the future.

Figure 3-1 LSR Acres by Age Class



In the long-run, natural non-forest areas will continue to contribute to habitat complexity within LSRs. Meadows, wetlands and rock outcrops are unique non-forest habitats providing micro-climates sought by many species of plants, birds, amphibians, mollusks and small mammals, some of which may not be old-growth dependent species but whose coexistence is compatible with LSR objectives. These natural openings should be free of non-native species.

Because we are directed to manage these areas to prevent large scale disturbances and to create late-successional forest conditions (ROD p. C-12), the expected diversity of stand structure and landscape patterns is different than would occur under natural conditions at the scale of the LSRs. However, by providing large blocks of late-successional and old-growth vegetation these reserves will contribute to bringing the stand composition at the river basin scale

within the range of historic range of variability. Across all ownerships, the amount of late-successional forest at the basin scale is presently well below the historic range of variability. (USDA 1993).

Plants and Fungi

Late-Successional Reserves provide critical habitat to vascular plants, bryophytes, lichens, and fungi associated with late-successional and old-growth forests. Most species of bryophytes do not become established in stands until 100 years, and they are best developed in stands 400 years or older. It may take over 200 years for late-successional lichens to become established. Old-growth associated vascular plants and fungi are often involved in complex mycorrhizal relationships that may require old-growth associated animals for dispersal and pollination. The desired future condition of LSRs for plants and fungi is to provide a network that will contribute to the maintenance of viable populations of these species and their functions in the ecosystem.

Unmapped Managed Late-successional Areas result from the application of Protection Buffers established to maintain viable populations of non-vascular plants. These were species afforded special protection in the Scientific Analysis Team Report (Mitigation Step 5-Standards and Guidelines for Rare and Locally Endemic Species, USDA 1993), and the standards and guidelines were carried forward in the Northwest Forest Plan (ROD). The Protection Buffer species documented from LSRs include (*Buxbaumia viridis, Tetraphis geniculata, Ulota megalospora, Polyozellus multiplex,* and *Sarcosoma mexicana*). The desired condition for these LSRs is that they are inhabited by viable, reproducing populations of the Protection Buffer species.

The desired future condition of vegetation includes a decline of noxious weeds and introduced plants to thresholds that do not adversely affect native plants and animals. Noxious weeds introductions will be prevented and controlled.

Wildlife Habitat

Late-Successional Associated Species

In the future, LSRs are intended to be large, contiguous blocks of late-successional habitat that can sustain populations or sub-populations of those species associated with late-successional forests. Each LSR is part of a network of LSRs connected by habitat in the Matrix that allows for dispersal of animals between LSRs (ROD p. B-1, 4).

Those species using late-successional habitat include species such as the spotted owl that appear to be dependent on older forest, species that rely on snags and down wood, and generalists that use older forests as well as other habitats. All these species are expected to use habitat in LSRs.

Some late-successional species are negatively affected by fragmentation and associated edge effects. As young forests in LSRs mature, the effects of fragmentation will diminish, providing higher quality habitat for these species. As stands mature, the processes of death and decay produce defective trees, large snags, and down logs. These structural components of late-successional forests provide important habitat for a number of wildlife species. Late-successional stands are multi-species and multi-layered providing a diversity of habitats for many species. Canopy gaps and understory vegetation provide shrubby habitat for songbirds and small mammals.

Riparian associated species

Healthy, functioning riparian habitats will occur across the landscape. These areas will

provide protected microclimates, large coarse woody debris, and cold, clear water for fish, amphibians, and other riparian dependent species.

Threatened, Endangered, Extirpated, and Sensitive Species

All threatened, endangered and sensitive species currently occurring in LSRs should be present in the future. Northern spotted owls and marbled murrelets will directly benefit from the expansion of late-successional habitat provided by LSRs. Reduced fragmentation in the LSRs should reduce the number of great horned owls and their predation on spotted owls in LSRs (Johnson 1993).

Gray wolf and grizzly bear (currently extirpated) will benefit from anticipated reduction of permanent road density in most LSRs. Both species are sensitive to human disturbance associated with roads. Reduced road densities will increase the probability of grizzly bear repopulating the LSRs. Those LSRs nearest Mt. Rainier National Park have the highest likelihood of grizzly bears becoming reestablished.

Introduced species

House sparrow and starling competition with native species for nest cavities should be reduced as availability of early seral habitat decreases. Bullfrogs may still be present in lower elevation wetlands. Wild turkeys will still be present as they readily use late-successional habitats and down wood. Other introduced species are habitat generalists associated with human habitation and are expected to occur in areas where LSRs are adjacent to human habitation. Examples are the Virginia opossum and Norway rat, which are predators on eggs of ground nesting birds.

The effect that future conditions of LSRs will have on barred owls, and their competition with spotted owls, is uncertain. It is not known what has caused the range extension of barred owls. Thus, changes in management practices in LSRs may or may not impact barred owl range expansion. (Thomas et al. 1993).

Open habitat species

Open habitats will still occur in LSRs but in lesser amounts than are currently available. Species associated with these habitats will primarily occur in Matrix lands. Some open habitat species will utilize small gaps formed by windthrow, insects and disease. Fire suppression will limit disturbance caused by fire but some open habitat patches will probably still be produced by fires. Meadows and other natural openings will still be present in LSRs.

Habitat for “contrast” species - those species associated with late-successional habitats for part of their life history requirements and with open habitats for other parts of their life history requirements - will be limited in LSRs. These species include elk, great horned owls, and red-tail hawks. Fragmented habitats are more of a benefit to these species than contiguous blocks of late-successional habitat.

Deer and Elk Winter Range

Habitat for deer and elk is a concern in LSRs. Optimal cover will be plentiful but foraging habitat for deer and elk will be restricted to natural openings and small forest gaps created naturally or by silvicultural treatment. This is especially of concern within biological winter range (BWR) because BWR is critical for maintaining deer and elk populations when snows bury upper elevational ranges. The LSRs contain 56 percent of the classified BWR found on the Forest. As a result, deer and elk populations on the Forest are expected to decline. Amount of habitat on private land is uncertain. For the short-term, structural stages on private land may not provide adequate forage and thermal cover to maintain existing populations.

Connectivity

Connectivity provides the following ecological functions: 1) animals are able to travel and migrate; 2) plants are able to propagate and disperse; 3) genetic interchange occurs; 4) movement in response to environmental changes and natural disasters; and 5) recolonization of habitats from which populations have been locally extirpated (Beier and Loe 1992).

Large, contiguous blocks of late-successional habitat provide connectivity within LSRs. LSRs are situated close enough together to allow for mobile species to disperse between them and interact with at least an occasional genetic interchange. The Matrix is designed to provide connectivity between LSRs (ROD p. B-1). The combination of Riparian Reserves, green tree retention, small blocks of late-successional habitat (e.g. owl activity centers) and younger forested stands provides dispersal habitat.

Riparian Reserves are designed to provide connectivity corridors of contiguous late-successional habitat. "Riparian Reserves are used to improve travel and dispersal corridors of many terrestrial animals and plants, and provide for greater connectivity of the watershed. The Riparian Reserves will also serve as connectivity corridors among the Late-Successional Reserves" (ROD p. B-13).

The Matrix is designed to include small blocks of late-successional habitat to provide both "stepping stones" for species to move between LSRs and refugia for immobile species. "Isolated remnant old-growth patches are ecologically significant in functioning as refugia for a host of old-growth associated species, particularly those with limited dispersal capabilities that are not able to migrate across large landscapes of younger stands." Remnant old-growth stands "function as refugia where old-growth associated species are able to persist until conditions become suitable for their dispersal into adjacent stands" (ROD p. C-44).

Green tree retention in the matrix is also designed to provide habitat for many organisms. "These trees may also act as refugia or centers of dispersal for many organisms including plants, fungi, lichens, small vertebrates, and arthropods" (ROD p. B-6).

Patches of down logs provide refugia for some species and are an important habitat component for many late-successional associated species. To provide the appropriate microclimate for organisms using down logs, existing down logs should be left within retained forest patches (ROD p. C-41). Logs in the Matrix may not provide the same microclimate as those in older forest and thus may not provide habitat for all species. However, logs in the younger forests "may provide transitional islands for the

maintenance and eventual recovery of some late-successional organisms in the matrix" (ROD p. B-7).

Roads can fragment habitat and isolate populations of some species by creating barriers to movement for less mobile species. Roads provide access to humans which causes disturbance for some species. They also provide corridors for movement of introduced species. Road densities are expected to decline in LSRs and across the Forest, improving conditions for most species.

Disturbance Processes

Fine scale disturbances, generally by insects and diseases, but also fire and wind, cause deaths of single trees or small groups of trees. These processes are desirable as they create small gaps in the overstory that characterize the transition and shifting-gap stages of old-growth forest development. They also create essential structures (brooms, cavities, snags, and downed logs). At some point, the extent of these disturbances, dominates stand conditions, favoring early successional flora and fauna. Introduced disease, such as white pine blister rust, while not desired, are here to stay. Still, we want to maintain present species diversity provided by western white pine and whitebark pine.

Rarely will insects and disease result in continuous mortality over ten acres. The exception would be when multiple agents impact a stand over several years. Most salvage scenarios would likely follow disturbances from fire or wind.

When it is deemed prudent to salvage disturbed sites for safety, facilitate habitat recovery, and/or reduce the risk of future stand replacing events, the salvage prescription should evaluate the response of insects and disease already present or expected. There is generally no shortage of insect and disease pathogens and their spread need not be accentuated where it would diminish adjacent suitable habitat or delay forest development. At the same time, the ability of pathogens to create desired structures for wildlife, should be integrated into management actions.

Existing Developments

Existing developments, such as campgrounds, interpretive sites and trails, and those operated by the public under special use permit, should be managed to avoid conflict with goals and objectives of LSRs or the Aquatic Conservation Strategy. Development of new facilities will be permitted that do not adversely affect Late-Successional Reserves and are consistent with other standards and guidelines. Standards and guidelines permit maintenance to ensure public safety (campgrounds, recreation residences), and to protect and maintain infrastructure investments (utility corridors, electronic sites). Existing developments within LSRs are described in Chapter 4.

Roads

New roads will be kept to a minimum, routed through other than late-successional habitat where possible and be designed to minimize adverse impacts (ROD p. C-16).

The road system in LSRs will be the minimum necessary to provide access to existing facilities and uses, implement activities proposed in Chapter 5, and provide access for fire protection. There will be few new permanent roads constructed for silvicultural manipulation, salvage, or other activities. Most needs will be met by the present network of roads and limited temporary road construction.

Roads will be maintained and repaired as needed to provide safe travel routes and minimize adverse effects on aquatic resources.

LSRs are priority areas for road decommissioning or obliteration. Because many of the LSRs overlap with key watersheds, road densities will decrease to meet aquatic conservation strategy objectives. Watershed Analyses and District Access and Travel Management Plans list roads to be considered for decommissioning/ obliteration due to either the lack of immediate need or resource concerns.

Treaty Rights

Nothing in the NWFP and GPNF Forest Plan direction is intended to conflict with or restrict treaty rights of the tribes. The Yakama, Nisqually, Puyallup, Squaxin Island and Steilacoom Indian Tribes have treaty rights on the Gifford Pinchot National Forest.

Human Uses

Most lands in the LSRs will meet or exceed the visual quality objective of retention. Human uses in the LSRs will conform with the roaded natural classification of the Recreation Opportunity Spectrum. Exceptions are pre-existing developments such as seed orchards, and administrative and utility sites. Compatible human uses expected to continue in the LSRs include:

- Treaty rights.
- Hunting and fishing.
- Hiking and camping
- Developed and dispersed camp-ground and picnic areas.
- Placer and lode mining.
- Existing rights-of-way, contracted rights and special use permits which are neutral or beneficial to the creation of late-successional habitat
- Collection of berries, nuts, mushrooms, and firewood for incidental and personal use. Limited harvest of mushrooms and other plant species of concern on a commercial basis.
- Christmas tree harvest for personal use.
- Evergreen bough harvest on a commercial basis where permitted. Noxious weed removal, e.g., Scotch broom.
- Seed cone collection.
- Firewood for personal and commercial use where permitted.

Range

As early seral vegetation matures, forage production and its value as transitory range will diminish. Range-related management that does not adversely affect late-successional habitat will be developed in coordination with wildlife and fisheries biologists. (ROD p. C-17).

The Mt. Adams, Ice Caves, and Twin Buttes Allotments will remain active with the numbers of livestock allowed near current levels. Traditional livestock handling facilities will also remain in use at their current locations. Within LSRs use by domestic livestock is low and likely to decrease over time as early-successional forests mature and transitory range diminishes.

Monitoring of sensitive sites and high use areas will continue. It will form the basis for adjusting grazing practices, as would the discovery of Survey and Manage or other sensitive species. Known and newly discovered sites of specified mollusks will be protected from grazing by all practical methods to ensure that the local populations of the species will not be impacted (ROD p. C-6).

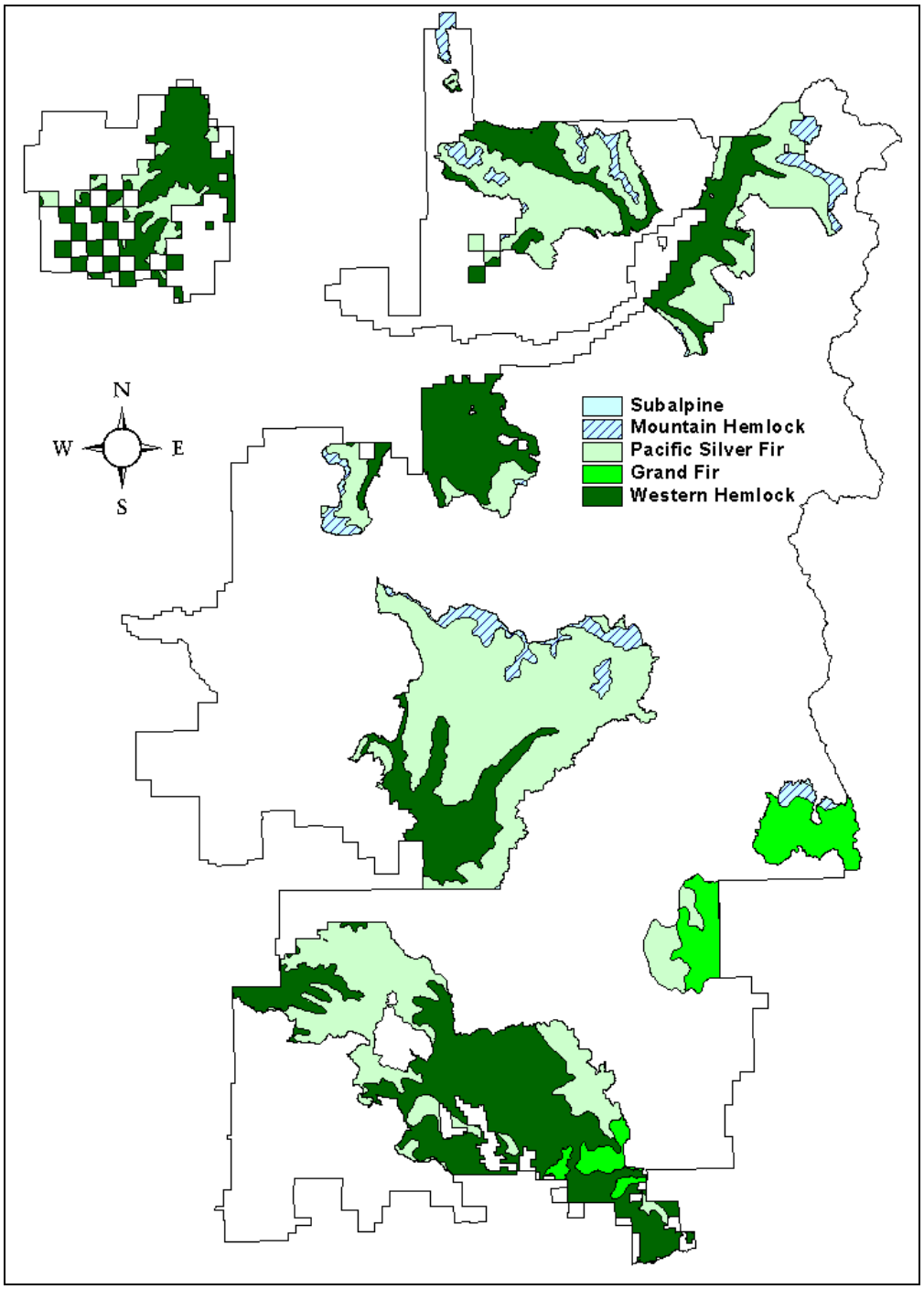
Any needed adjustments in range management would be implemented through each allotment annual operating plan, and need not wait for the ten-year term permit to expire. This will ensure that the grazing program within LSRs remains neutral to LSR objectives.

Fire

Fire has a role in the maintenance of ecosystems. Fire will be used or suppressed in the context of achieving ecosystem management objectives at the landscape level. Natural disturbance is an important process within late-successional forest ecosystems but humans have altered the disturbance regimes. Fire may be reintroduced or suppressed, depending on plant zone, length of time since last disturbance and other management objectives. The fire management plan for the LSRs is described in Chapter 6.

Fire management activities will consist of wildfire suppression and wildfire hazard reduction (mechanical, prescribed fire, or a combination) resulting in a fuel mosaic across the landscape. Some treatments may have short-term effects that reduce the quality of habitat for late-successional species. Thus, managers need to seek a balanced approach that reduces risk of fire while protecting late-successional habitat.

Map 3-1 Plant Zone Distribution



3-2 Plant Zone Scale Desired Condition

Plant Zones are defined as areas where a particular tree species is expected to dominate in stable, mature stands approximating climax conditions (Topik, 1989). On the Gifford Pinchot NF these zones include the western hemlock (*Tsuga heterophylla* - TSHE), Pacific silver fir (*Abies amabalis* - ABAM), mountain hemlock (*Tsuga mertensiana* - TSME), grand fir (*Abies grandis* - ABGR), subalpine parklands and alpine zones. All but the alpine zone are represented in LSRs on the Forest, and the acreage of subalpine parklands is small. Map 3-1 displays plant zone in each LSR. Plant zones are of interest because they generally reflect major large-scale climatic differences within a region, and thus, represent areas with similar potentials and limitations for vegetation development. Different kinds of manage-ment practices may be appropriate to each zone.

Table 3-1 Plant Zone Composition of Late-Successional Reserves

Trees	Acres	Percent
Silver Fir	211,510	48
Western Hemlock	183,964	41
Grand Fir	27,690	6
Mountain Hemlock	24,258	5
Subalpine Fir	75	0
Totals	447,497	100

Western Hemlock Zone

The western hemlock zone includes the lower elevation moist forest portion of the Western Cascade region of the Forest (See Map 3-1). The transition to the Pacific silver fir zone occurs at about 3000 feet in elevation. The western hemlock zone is usually dominated by Douglas-fir and is define by the presence of western hemlock reproducing in the shade of a mature forest overstory.

The desired condition of stands within the western hemlock zone is essentially a continuous large patch of old-growth forest. This old-growth forest will have large trees, snags of all sizes, fallen logs, multiple canopy layers, a significant amount of broken tops and deformed limbs, and a patchy understory.

The late-successional and old-growth conditions of the stands in this zone will be dominated by Douglas-fir, western hemlock and western redcedar. Although the goal is late-successional habitat, natural distur-bances from insects, diseases, windthrow, and fire will maintain a variety of seral stages. A high percentage of the land area (80 percent or more) in this zone is expected to be in a late-successional or old-growth condition. Fire is the dominant disturbance agent, though wind and root rot disease are expected to also reduce the area in late-successional or old-growth condition.

The data in the following tables provide a quantitative description of the desired vegetative conditions. It was summarized from *Region 6 Interim Old-growth Definitions* and from the *Plant Association and Management Guide for the Western Hemlock Zone on the Gifford Pinchot NF*. Consult these publications for more detailed information. Both references utilized Region 6 Ecology Program ecology plot data.

These values are intended as references rather than a target value for every stand in the western hemlock zone. The range in attribute values is accounted for by differences in site potential and stand history. More site-specific values can be developed by assessing site potential as reflected by plant associations. Also, it should be noted that these values reflect slightly different data sets. *Plant Association* and *Management Guide* values

reflect the range of conditions encountered in sampling mature stands. The *Interim Old-Growth Definition* methodology selected only those stands meeting the old-growth criteria, i.e., those greater than 200 years old and, thus, may better represent old-growth conditions.

Table 3-2 Western Hemlock Quantative Description of Desired Conditions

Description	Plant Association and Management Guide		R6 Old-Growth Definition.	
	Ave	**Range**	**Ave**	**Range**
Trees/acre	200	118-307	106	54-177
Basal Area (ft^2)	288	200-370	314	305-318
Mean Tree Diameter (in.)	18.6	13.7-24.5	30	20.0-39.8
Snags/acre	35	N/A	44	20-68
Snag DBH	38	N/A		
Snag quad. Mean Diameter (in.)	N/A	N/A	29.5	19.5-43.1
Down Logs/acre	257	N/A	101	76-166
Down Logs Diameter (in.)	N/A	N/A	15	12-17

In addition to the ranges displayed in Table 3-2, the *Interim Old-Growth Definition* provides old-growth reference values which varies by site. This is the minimum condition to be achieved, in contrast to the desired condition. For site class 4, the most prevalent western hemlock site of LSRs on the Forest, the reference values are shown in Table 3-3.

Table 3-3 Minimum Old-Growth Conditions - Western Hemlock Zone

Large Trees per acre:	8 at least 31" DBH
Canopy Layers:	2 or more
Snags per acre:	4 at least 20" DBH
Down Logs per acre:	29 at least 8" diameter

Pacific Silver Fir Zone

The Pacific silver fir zone on the Gifford Pinchot NF ranges from about 3000 feet in elevation up to about 4200 feet (See Map 3-1) It lies between the western hemlock zone and the mountain hemlock zone. It is the most extensive zone on the Forest. Moderately cool summer temperatures and a winter-long snowpack are typical of this zone. It is characterized by the presence of at least 10 percent canopy cover of Pacific silver fir, reproducing in the shade of mature stands. In the lower elevation areas of this zone, Douglas-fir may be a long-lived component of these forests. Other associated tree species include noble fir, western redcedar, western white pine, and western hemlock, while at higher elevations these give way to Engelmann spruce, mountain hemlock, Alaska yellow cedar (*Chamaecyparis nootkatensis*) and sub-alpine fir (*Abies lasiocarpa*).

Table 3-4 Pacific Silver Fir Quantative Description of Desired Conditions

Description	Plant Association and Management Guide		R6 Old-Growth Definition.	
	Ave	**Range**	**Ave**	**Range**
Trees/acre	157	99-254	201	153-182
Basal Area (ft^2)	274	221-325	356	345-409
Mean Tree Diameter (in.)	20	16-24	21	20-22
Snags/acre	N/A	N/A	48	32-45
Snag quad. mean diameter (in.)	N/A	N/A	23	21-26
Stand Age	424	312-554	250	180-360

Pacific silver fir is seldom found growing in pure stands in the juvenile stage. It usually exists as advanced regeneration under less shade tolerant species. In late-successional stages a mixture of species is still common, with silver fir in approximately equal proportions with western hemlock.

Although the goal is late-successional habitat, natural disturbances in these areas are expected to keep a lower percentage of this land area in late-successional or old-growth conditions than in the western hemlock zone (75 percent or more), because of greater susceptibility to disease, the higher fire frequencies associated with elevation and exposure to lightening and slower stand development.

The stand characteristics in Table 3-4 provides a quantitative description of the desired vegetative conditions. (R6 Interim Old-Growth Definitions 1993 and the Plant Association and Management Guide for the Pacific Silver Fir Zone on the Gifford Pinchot NF 1983.)

The values provide general guidance on determining desired stand characteristics. Site-specific decisions will be made after considering existing stand conditions and site potential reflected by plant associations.

In addition to the ranges displayed in Table 3-4 the R6 Interim Old-Growth Definition provides old-growth reference values which vary by site. This is the minimum condition to be achieved, in contrast to the desired condition. For site class 4, the average silver fir site in LSRs on the Forest, the reference values are shown in Table 3-5

Table 3-5 Minimum Old-Growth Conditions - Pacific Silver Fir Zone

Large Trees per acre:	7 at least 25” DBH
Canopy Layers:	2 or more
Snags per acre:	4 at least 22” DBH
Down Logs per acre:	4 at least 24” diameter

Mountain Hemlock Zone

The mountain hemlock zone extends from the upper boundary of the silver fir zone (about 4200 feet elevation) to subalpine parklands (Map 3-1) It has the slowest growth rates of any plant zone on the Forest due to a short, cool growing season and a deep, persistent snowpack. Elevations are generally higher than those used by the spotted owl.

Mountain hemlock zone forests are distinguished by the presence of at least 10 percent canopy cover of mountain hemlock reproducing in the shade of mature stands. Because of the cool, relatively moist climate and reduced risk of fire, a high percentage (85 percent or more) of the land area in this zone is expected to be in a late-successional or old-growth condition. Most fires in this zone are spotty and involve only a few trees scattered among clumps. Old-growth stands in this zone have traits in common with other forest zones including large trees and snags, accumulations of fallen logs, broken tops and gnarly canopies, and two or more canopy layers. Tree size, especially height, is considerably less than in other zones because of the harsh climate. Major tree species, in addition to mountain hemlock, are western hemlock, subalpine fir, Engelmann spruce (Picea engelmannii), Alaska yellow cedar, Pacific silver fir, lodgepole pine, whitebark pine (Pinus albicaulis) at the upper margin and Douglas-fir at the lower margin.

Descriptions of desired conditions have not been developed for this zone by the Plant Association Guide. Table 3-6 displays the minimum attributes for cool, mesic mountain hemlock forests.

Table 3-6 Minimum Old-Growth Conditions - Mountain Hemlock Zone

Large Trees per acre:	11 $\geq$ 21” DBH
Canopy Layers:	1-2
Snags per acre:	4 $\geq$ 15” DBH
Stand age:	230 - 400 years.

Grand Fir Zone

The grand fir zone is the driest on the Gifford Pinchot NF. It is located along the eastern margin of the Forest, south of Mt. Adams to the Columbia River (See Map 3-1) It is bounded to the north and west by the Pacific silver fir zone. It is defined by the presence of at least 10 percent grand fir reproducing in the shade of mature stands. Because of the relatively higher fire risk in this zone a lower percent (70 percent or more) is expected to be in a late-successional or old-growth condition.

Major tree species include Douglas-fir, ponderosa pine, western white pine, western hemlock, western larch, lodgepole pine, western hemlock and grand fir. Also included are several small patches of quaking aspen (*Populus tremuloides*) and western redcedar in moist areas, and Oregon white oak (*Quercus garryana*) in very droughty areas.

Historically, fire played the major disturbance role in these ecosystems, particularly in the drier sites. Fire tolerant, open, "park-like" stands, composed mainly of large diameter ponderosa pine and Douglas-fir, dominated parts of the landscape. This condition resulted as multiple-canopy forests, with shade-tolerant, primarily grand fir understories, were periodically set back by fire.

Twentieth century management has allowed multiple-canopy forests to develop through fire exclusion. In addition, many old-growth trees have been removed through partial timber harvests. Stands today are generally more dense, and differ in species composition.

The risk of catastrophic loss from fire calls for a more complex pattern of stand conditions in the grand fir zone, particularly in the drier portions of the zone. These drier portions of the grand fir zone are included in fire groups 2 and 3 (Evers, et al. 1996), and occur primarily within the Gotchen LSR. The desired condition, at the stand level, consists of large, old-growth ponderosa pine or Douglas-fir trees, with secondary canopies made up of younger, shade-tolerant grand fir, along with some western hemlock, Douglas-fir, and ponderosa pine. This condition functions as late-successional habitat. The shade-tolerant understory should be less than 100 years old; at older ages (or when the shade-tolerant layer becomes overly dense) tree vigor may decrease, and stands become more susceptible to insect and disease pathogens.

Table 3-7 Grand Fir Quantative Description of Desired Conditions

Description	Plant Association and Management Guide	
	Ave	Range
Trees/acre	216	100-431
Basal Area	295	240-365
Mean Tree Diameter	18.6	12.6-24.9
Canopy Layers	2	
Snags/acre	N/A	11-42
Down Logs/acre	12-19	15-25
Down Logs/acre >19"	N/A	1-10

At any given point in time, not all stands will match the desired condition. Some stands will provide late-successional habitat, yet may contain few large, old-growth trees. Younger stands, such as old clearcuts, wildfire areas, and areas where pathogens have resulted in significant tree mortality, will be open and lightly stocked. Species composition in these stands will consist mostly of early seral ponderosa pine and Douglas-fir, with some western larch and western white pine. These open stands will result in maximum individual tree growth, providing large trees for future old-growth stands.

Table 3-7 provides a quantitative description of the desired vegetative conditions. It was summarized from the Plant Association and Management Guide for the Grand Fir Zone on the Gifford Pinchot NF. Comparable data were not provided in the R6 Interim Old-Growth Definitions.

In addition to the ranges displayed in Table 3-7, the R6 Interim Old-Growth Definition provides old-growth reference values which vary by site. This is the minimum condition to be achieved, in contrast to the desired condition. The reader is cautioned that these figures were developed from plots in central Oregon and may need to be adjusted for conditions on the Gifford Pinchot NF when local data becomes available. For low and medium site potentials, the minimum reference values are shown in Table 3-8.

Table 3-8 Minimum Old-Growth Conditions - Grand Fir Zone

Large Trees per acre:	10 at least 21" DBH
Canopy Layers:	2 or more
Snags per acre:	1 at least 14" DBH
Down Logs per acre:	5 at least 12" diameter

Subalpine Parklands

Subalpine parklands are characterized by a mosaic of forest patches and intervening grass/forb or shrub-dominated openings. Also characteristic of this area are clumps of low-growing trees and shrubs known as krummholtz. The dynamics of subalpine parklands are poorly understood. Openings may be caused by soils with seasonally high water tables or due to deep, persistent snowpacks which retard tree seedling development. Only 75 acres in LSRs are classified as subalpine parklands. This zone is transitional between the mountain hemlock zone of continuous forest cover below, and the treeless alpine zone above.

Species composition is similar to that of the upper part of the mountain hemlock zone with subalpine fir, mountain hemlock, Alaska yellow cedar, whitebark pine and lodgepole pine being the most widespread.

This zone is not considered commercial forest land on the Gifford Pinchot NF. Forest structure in this zone has been and will continue to be shaped by natural forces. Scattered clumps and stringers of trees and large natural openings probably do not function well for many late-successional species. These areas are, however, likely at their potential under the present climatic regime. Therefore, the desired condition for these areas is the same as the existing condition.

3-3 Desired Conditions By LSR

Following is a description of desired conditions specific to individual LSRs. Only aspects of the desired condition which do not apply either Forest-wide or plant zone-wide are discussed. To obtain a complete picture of the desired condition for an LSR, all three scales must be reviewed.

Gotchen LSR

The Gotchen LSR is comprised of the Grand Fir (86 percent) and Western Hemlock (13 percent) plant zones. Gotchen LSR is the only location of Subalpine Parklands (1 percent). See the respective plant zone desired condition descriptions earlier in this chapter.

Riparian Resources

Conditions of riparian resources and functions are described in the *Upper White Salmon Watershed Analysis* and are not repeated here.

Disturbance Regimes

Insect, Disease, and Fire. The desired condition within the Gotchen LSR is to maintain the current acreage of late-successional forest, and reduced risk of stand replacing insect and disease infestations and subsequent catastrophic fire. This may be accomplished by increasing the amount of single-story large tree forests comprised of early seral tree species (e.g. ponderosa pine, western larch, Douglas-fir), that are maintained by under-burning. These stands carry a lower hazard of stand disturbance, and their arrangement on the landscape can reduce the overall risk of the LSR to large stand replacing fires.

Being on the more moist, west end of the grand fir zone, most of these stands are expected to remain late-successional forest following this budworm episode. Likewise, the risk of stand replacing fire is also not currently high, given the topography, surrounding stand conditions, and ignition history of this LSR. Still, a gradual conversion of grand fir dominated stands is prudent where it is no longer late-successional habitat and where it can serve as a fuel break.

In the absence of a large, stand replacing fire, grand fir dominated stands will comprise the majority of forests in this LSR into the future. Though they carry a high hazard for disturbance, they also provide dense, multi-layered canopies that are desired by late-successional wildlife. In addition, they currently serve the larger province by providing large blocks of late-successional forest that are well connected to similar forests on Yakama Indian Nation land to the east.

Special Habitats

This LSR contains ponderosa pine habitat for the protection buffer species, flamulated owl, pigmy nuthatch and white-headed woodpecker (ROD p. C-45 to C-47). Future management activities should ensure habitat is maintained for these species.

This LSR contains important great gray owl habitat where large trees are found adjacent to meadows. Great grey-owl habitat may decline as trees encroach on the existing meadows.

Grazing

Although the amount of available forage will decline as current early seral vegetation matures, grazing consistent with LSR objectives is expected to continue into the future.

Lewis LSR

The Lewis LSR is comprised of the Pacific Silver Fir (72 percent), Western Hemlock (21 percent) and Mountain Hemlock (7 percent) plant zones. See the respective plant zone desired condition descriptions earlier in this chapter.

Riparian Resources

Desired conditions for riparian resources and functions are described in the *Upper North Fork Lewis River* and *Middle North Fork Lewis River Watershed Analyses* and are not repeated here.

Special Habitats

Management activities in this LSR should be designed to maintain or enhance the special botanical sites, habitat for bull trout and hybernacular caves for Townsends big-eared bats.

Over 20 thousand acres in this LSR consists of deer and elk biological winter range. As an objective secondary to those of the LSR treatments should consider opportunities to provide forage for deer and elk. Such treatments will not retard the attainment of the late-successional habitat.

Management activities should emphasize improving connectivity east and west within the LSR.

Grazing

Although the amount of available forage will decline as current early seral vegetation matures, grazing consistent with LSR objectives is expected to continue into the future.

Mineral LSR

The Mineral LSR is comprised of the Western Hemlock (78 percent) and Pacific silver-fir (22 percent) plant zones. See the respective plant zone desired condition descriptions earlier in this chapter.

Riparian Resources

Desired conditions for riparian resources and functions will be described in the *Tilton and Nisqually Watershed Analyses* which are scheduled for completion in 1998.

Special Habitats

Management activities should be designed to maintain or enhance nesting habitat for the marbled murrelet on the Forest. This LSR contains the only known marbled murrelet nesting habitat on the Forest.

Roads

Open road density will continue to be high in this area because of numerous cooperative road management agreements associated with access of adjacent private property.

Connectivity

The Mineral LSR is important because it provides connectivity to the Olympic Province and, to some degree, the Northern Cascade Province. The best opportunity to improve connectivity is with Washington Department of Natural Resources (DNR) forest land which lies between the Mineral and Nisqually LSRs. Collaboration with Washington DNR forest managers should be pursued to encourage development of late-successional habitat on their lands, at least in riparian areas.

Extensive young stands in the middle of the LSR provide an opportunity to accelerate the development of late-successional functions through stand manipulation activities.

Nisqually LSR

The Nisqually LSR is comprised of the Pacific silver-fir (60 percent), western hemlock (29 percent) and mountain hemlock (11 percent) plant zones. See the respective plant zone desired condition descriptions earlier in this chapter.

Because of the higher elevation of this LSR, progress toward late-successional conditions will be at a slower rate than others on the Forest.

Riparian Resources

Desired conditions for riparian resources and functions will be described in the *Puyallup and Nisqually Watershed Analyses* which are scheduled for completion in 1998.

Packwood LSR

The Packwood LSR is comprised of the Pacific silver fir (54 percent), western hemlock (36 percent) and mountain hemlock (10 percent) plant zones. See the respective plant zone desired condition descriptions earlier in this chapter.

Riparian Resources

Desired conditions for riparian resources and functions will be described in the *Clear Fork Cowlitz and Upper Cowlitz Watershed Analyses* which are scheduled for completion in 1998.

Peterson LSR/MLSA

The Peterson LSR/MLSA is comprised of the grand fir (57 percent) and Pacific silver fir (43 percent) plant zone. See the respective plant zone desired condition descriptions earlier in this chapter.

Riparian Resources

Desired conditions for riparian resources and functions are described in the *Trout Lake Creek Watershed Analysis* and are not repeated here.

Special Habitats

Meadow habitats will be maintained where they support populations of sensitive plant species, such as pale-blue eyed grass.

Ponderosa pine habitat for the protection buffer species flamulated owl, pigmy nuthatch and white-headed woodpecker occurs in this LSR (ROD p. C-45 to 47). Future management activities should ensure habitat is maintained for these species.

Owl Habitat

Within the Managed Late-Successional Area the *NWFP* specifies amounts of suitable owl habitat to be maintained within the home range. Amount of suitable habitat is not given for the Eastern Cascades physiographic province. *NWFP* Table C-1 shows the median home range in the Eastern Cascades Province is 7124 acres. While no median amount of habitat is given in Table C-2 for this province, in the Western Cascades Province roughly half of the home range is suitable habitat which suggest about 3600 acres is needed in the Peterson MLSA.

Human Uses

Although the amount of available forage will decline as current early seral vegetation matures, grazing consistent with LSR objectives is expected to continue into the future.

Opportunities for huckleberry picking are expected to diminish as early and mid-seral vegetation matures.

Quartz LSR

The Quartz LSR is comprised of the Pacific silver fir (52 percent), mountain Hemlock (30 percent) and western hemlock (18 percent) plant zones. See the respective plant zone desired condition descriptions earlier in this chapter.

Riparian Resources

Desired conditions for riparian resources and functions are described in the *Lower Cispus West Watershed Analysis* and are not repeated here.

Wind LSR

The Wind LSR is comprised of the western hemlock (58 percent), Pacific silver fir (37 percent), and grand fir (5 percent) plant zones. See the respective plant zone desired condition descriptions earlier in this chapter.

Riparian Resources

Desired conditions for riparian resources and functions are described in the *Wind and Lower North Fork Lewis River Watershed Analyses* and are not repeated here.

Connectivity

The Columbia River presents a formidable obstacle to most terrestrial species. It is possible, however, for migration of birds, such as spotted owls, to occur across the river. The area with greatest potential to provide connectivity across the river is located in the Dog Mountain area. Presently there is little late-successional forest on Dog Mountain due to past wildfires. Accelerating the development of these stands should be a high priority for LSR management.

Management activities should emphasize restoring the gap in connectivity that exists because of the expanse of young stands in the middle of the LSR.

Existing Developments

Research within the TT Munger Experimental Forest will continue subject to NWFP consistency requirements described in the ROD page C-4.

The Wind River Nursery site should be managed to minimize effects on the adjacent late-successional habitats. New uses which would adversely effect the late-successional reserve should not be permitted (ROD p. C-17).

Special Habitats

Over 45 thousand acres in this LSR are considered deer and elk biological winter range. As an objective secondary to those of the LSR, treatments should consider opportunities to provide forage for deer and elk.

Meadows in this LSR are believed to provide habitat for the great gray owl.

Woods LSR

The Woods LSR is comprised of the western hemlock (85 percent) and Pacific silver fir (15 percent) plant zone. See the respective plant zone desired condition descriptions earlier in this chapter.

Riparian Resources

Desired conditions for riparian resources and functions are described in the *Lower Cispus East Watershed Analysis* and are not repeated here.

Special Habitats

Over 17 thousand acres in this LSR are considered of deer and elk biological winter range. As an objective secondary to those of the LSR, treatments should consider opportunities to provide forage for deer and elk.

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Chapter 4

Existing Conditions

Chapter 4

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Existing Conditions

This chapter describes existing conditions at two scales, Forest-wide and individual Late-Successional Reserve (LSR). Existing Conditions for Late-Successional Reserves emphasize vegetative conditions and wildlife habitat. Existing conditions for ecological processes, human uses, and facilities are also described at the appropriate scale. Some components are described at both Forest and LSR scales. Vegetative conditions, for example, are described in aggregate at the Forest scale and in more detail for each LSR.

4-1 Forest Scale Existing Condition

Vegetation

Forest-wide, the dominant tree species comprising stands of the LSRs are Douglas-fir (63 percent), silver fir (12 percent), western hemlock (10 percent) and Noble fir (5 percent) (see LSR Ecoclass Map 4-8, Map 4-13, Map 4-18, … Map 4-48, and Table 4-38. Hardwoods are the dominant tree in less than 1 percent of the acres within the LSRs. Only about a quarter of the area in LSRs contains stands beyond 200 years old, the minimum age standard in the R6 Old-Growth Definition. Another quarter of the area is in plantations less than 40 years old (See LSR Age Class Map 4-9, Map 4-14, Map 4-19, Map 4-24, … Map 4-49, and Table 4-36, page 4-117). Forestwide, about 20 thousand acres or 5 percent of the area in LSRs is comprised of sites such as rock outcropping and wet meadows which are incapable of supporting late-successional vegetation.

The following table shows the total acres for all stands less than 80 years old for all LSR's on the Gifford Pinchot National Forest.

Table 4-1 Age Distribution Summary - All LSRs

Age Class (Years)	Total Acres (Thinning)		
	Young Stand	Commercial	Total
<10	25,915		25,915
10-20	31,979		31,979
21-40		55,175	55,175
41-80		35,116	35,116
TOTAL	57,894	90,291	148,185

Potentially all acres in the LSRs between the ages of 10 and 80 are suitable for some form of stand density management, because they are the result of past management practices which planned for such treatments. All of these stands are growing rapidly, and are subject to being severely overstocked for many decades which can result in greatly delaying the development of desired conditions and increasing the risk of stand-replacement disturbances. Many of these stands are already in overstocked conditions.

Most of the 57,894 acres of young stands are in an overstocked condition and are ready for stocking control (thinning) treatment within the next five years. Those which are less than ten years old

now will come on line over the next ten years. Table 5-1, page 5-4, summarizes an estimate of net acres per year (net of stands which may not need thinning for various reasons) that could be thinned each year for the next five years. All of acres will subsequently become eligible for commercial thinning when they near the age of 35-45.

Most of the 90,291 acres of commercial thinning in Table 4-1 plus most of the above young stand thinning acres will develop the need for commercial thinning over the next few decades.

These stands represent the best opportunity to accelerate the development of the LSRs toward the desired landscape condition.

The LSRs contain about 55 thousand acres stands in the 80 to 100 year-age class. Many of these areas were established after the large burns around the turn of the century. These stands are often lacking in snags and down wood as a result of reburns. Because of high stocking levels, they lack the structural characteristics of late-successional habitat.

The main change in vegetation conditions from pre-settlement times to the present is a reduction in late-successional forest due to forest fires and timber harvest. This change was associated with a large increase in the amount of mid-successional forest in the small tree and single-story large tree category. The trend in the reduction of late-successional forest continued until the implementation of the Northwest Forest Plan. Within the past decade, managers have attempted to implement new practices to maintain and increase forest diversity. Examples are reserve areas within harvest units, levels of tree retention, and retention of large woody debris.

Plants and Fungi

Late-successional and old-growth forests on the Gifford Pinchot National Forest are inhabited by a diverse array of vascular plants, bryophytes, lichens, and fungi. Our knowledge of population trends, distribution, and habitat associations and requirements for most species of bryophytes, lichens, and fungi on the Gifford Pinchot National Forest is limited. Botanical species were not used by FEMAT as indicators for late-successional and old-growth habitat due to insufficient data on late-successional and old-growth conditions. In the future, using plant indicators may add a dimension that is more closely tied to soil condition and mycorrhizal habitats.

The viability analyses conducted by the Forest Ecosystem Management Assessment Team led to the identification of species of concern under the Northwest Forest Plan (Survey and Manage Species). For Strategy 1 species, known sites have been identified and existing information compiled on their ecological requirements. Because of the direction in the NWFP to manage for these Survey and Manage Species, they will be specifically addressed in this document. In addition, plants listed on the Regional Forester's Sensitive Species List which occur in LSRs are also discussed within the context of addressing possible conflicts between LSR objectives and viability requirements for these species.

Vascular Plants Associated with Late-successional and Old-growth Forests

A total of 124 vascular plant species met the Forest Ecosystem Management Analysis Team criteria for being closely associated with late-successional and old-growth forest within the range of the northern spotted owl. Of these, 76 (61 percent) have been documented on the Gifford Pinchot National Forest (Table 4-3). Six species of vascular plants which have been documented on the Forest were identified as Survey and Manage Species (Table 4-2). An additional five species are suspected to occur, based on available habitat.

Table 4-2 Survey and Manage Vascular Plants

Status	Species	Common Name
D	*Allotropa virgata*	sugar stick
D	*Arceuthobium tsugense*	dwarf mistletoe
D	*Botrychium minganense*	mingan moonwort
D	*Botrychium montanum*	mountain moonwort
S	*Coptis asplenifolia*	spleenwort-leaved goldthread
S	*Coptis trifolia*	threeleaf goldthread
D	*Corydalis aquae-gelidae*	cold-water corydalis
D	*Cypripedium fasciculatum*	clustered lady's slipper
S	*Cypripedium montanum*	mountain lady's slipper
S	*Galium kamtschaticum*	boreal bedstraw
S	*Platanthera orbiculata*	round-leaved orchid

(D) Documented
(S) Suspected to occur on the Gifford Pinchot National Forest.

Other late-successional and old-growth species of concern include those which are on the periphery of their range, are local endemics, or have special status (e.g., Regional Forester's Sensitive List, Washington Natural Heritage Program List, federal candidates). Information on selected species is provided below.

Table 4-3 Vascular plants considered closely associated with late-successional and old-growth forest. Documented on the Gifford Pinchot National Forest.

Species	Family	Common Name	Species	Family	Common Name
Abies lasiocarpa	*PINACEAE*	*subalpine fir*	*Listera convallarioides*	*ORCHIDACEAE*	*broad-lipped twayblade*
Achlys triphylla	*BERBERIDACEAE*	*vanilla leaf*	*Listera cordata*	*ORCHIDACEAE*	*northern listera*
Adenocaulon bicolor	*ASTERACEAE*	*pathfinder*	*Luzula hitchcockii*	*JUNCACEAE*	*smooth woodrush*
Adiantum pedatum	*POLYPODIACEAE*	*western maidenhair fern*	*Lycopodium selago*	*LYCOPODIACEAE*	*fir clubmoss*
Allotropa virgata	*ERICACEAE*	*sugarstick*	*Lysichiton americanum*	*ARACEAE*	*skunk cabbage*
Anemone deltoidea	*RANUNCULACEAE*	*threeleaf anemone*	*Melica subulata*	*POACEAE*	*Alaska oniongrass*
Arnica latifolia	*ASTERACEAE*	*broadleaf arnica*	*Menziesia ferruginea*	*ERICACEAE*	*fool's huckleberry*
Asarum caudatum	*ARISTOLOCHIACEAE*	*wild ginger*	*Mitella breweri*	*SAXIFRAGACEAE*	*Brewer's miterwort*
Botrychium minganense	*OPHIOGLOSSACEAE*	*Mingan moonwort*	*Mitella caulescens*	*SAXIFRAGACEAE*	*star-shaped mitella*
Botrychium virginanum	*OPHIOGLOSSACEAE*	*Virginia grapefern*	*Mitella pentandra*	*SAXIFRAGACEAE*	*five-stamen miterwort*
Calypso bulbosa	*ORCHIDACEAE*	*deer-head orchid*	*Mitella trifida*	*SAXIFRAGACEAE*	*three-tooth mitrewort*
Chamaecyparis nootkatensis	*CUPRESSACEAE*	*Alaska yellow-cedar*	*Monotropa uniflora*	*ERICACEAE*	*Indian pipe*
Chimaphila menziesii	*ERICACEAE*	*little pipsissewa*	*Oxalis oregana*	*OXALIDACEAE*	*Oregon oxalis*
Chimaphila umbellata	*ERICACEAE*	*prince's pine*	*Oxalis trilliifolia*	*OXALIDACEAE*	*great oxalis*
Cimicifuga elata	*RANUNCULACEAE*	*tall bugbane*	*Pleuricospora fimbriolata*	*ERICACEAE*	*fringed pinesap*
Cimicifuga laciniata	*RANUNCULACEAE*	*cut-leaved bugbane*	*Pterospora andromedea*	*ERICACEAE*	*pine drops*
Clintonia uniflora	*LILIACEAE*	*queencup beadlily*	*Pyrola asarifolia*	*ERICACEAE*	*large pyrola*
Coptis laciniata	*RANUNCULACEAE*	*cut-leaved goldthread*	*Pyrola chlorantha*	*ERICACEAE*	*green pyrola*
Corallorhiza maculata	*ORCHIDACEAE*	*spotted coralroot*	*Pyrola picta*	*ERICACEAE*	*white vein pyrola*
Corallorhiza mertensiana	*ORCHIDACEAE*	*Merten's coralroot*	*Pyrola uniflora*	*ERICACEAE*	*woodnymph*
Corallorhiza striata	*ORCHIDACEAE*	*striped coralroot*	*Rubus lasiococcus*	*ROSACEAE*	*dwarf bramble*
Disporum hookeri	*LILIACEAE*	*fairy bells*	*Rubus pedatus*	*ROSACEAE*	*trailing blackberry*
Disporum smithii	*LILIACEAE*	*Smith's fairy lantern*	*Smilacina racemosa*	*LILIACEAE*	*feather solomonplume*
Dryopteris austriaca	*POLYPODIACEAE*	*mountain woodfern*	*Smilacina stellata*	*LILIACEAE*	*starry solomonplume*
Eburophyton austiniae	*ORCHIDACEAE*	*phantom orchid*	*Steptopus roseus*	*LILIACEAE*	*purple twisted stalk*
Galium oreganum	*RUBIACEAE*	*Oregon bedstraw*	*Synthyris schizantha*	*SCROPHULARIACEAE*	*fringed synthyris*
Gaultheria humifusa	*ERICACEAE*	*alpine wintergreen*	*Tellima grandiflora*	*SAXIFRAGACEAE*	*fringecup*
Gaultheria ovatifolia	*ERICACEAE*	*slender wintergreen*	*Thuja plicata*	*CUPRESSACEAE*	*western redcedar*
Goodyera oblongifolia	*ORCHIDACEAE*	*rattlesnake plantain*	*Tiarella trifoliata*	*SAXIFRAGACEAE*	*coolwort foamflower*
Gymnocarpum dryopteris	*POLYPODIACEAE*	*oak-fern*	*Tiarella unifoliata*	*SAXIFRAGACEAE*	*coolwort foamflower*
Habenaria saccata	*ORCHIDACEAE*	*slender bog-orchid*	*Trillium ovatum*	*LILIACEAE*	*western trillium*
Habenaria unalascensis	*ORCHIDACEAE*	*short-spurred rein orchid*	*Vaccinium alaskense*	*ERICACEAE*	*Alaska huckleberry*
Hemitomes congestum	*ERICACEAE*	*gnome plant*	*Vaccinium membranaceum*	*ERICACEAE*	*big huckleberry*
Hieracium scouleri	*ASTERACEAE*	*Scouler's hawkweed*	*Vaccinium ovalifolium*	*ERICACEAE*	*oval-leaf huckleberry*
Hypopitys monotropa	*ERICACEAE*	*common pinesap*	*Vaccinium parvifolium*	*ERICACEAE*	*red huckleberry*
Isopyrum hallii	*RANUNCULALACEAE*	*Hall's rue-anemone*	*Vancouveria hexandra*	*BERBERIDACEAE*	*white vancouveria*
Lathyrus polyphyllus	*FABACEAE*	*leafy peavine*	*Viola glabella*	*VIOLACEAE*	*pioneer violet*
Listera caurina	*ORCHIDACEAE*	*western twayblade*	*Viola orbiculata*	*VIOLACEAE*	*darkwoods violet*

Detailed information on these plants is provided in Conservation Strategies and Management Guidelines.

Allotropa virgata - Survey and Manage Strategy 1 and 2: The LSR network may provide an important contribution to the viability of this species on the Forest. Small old-growth fragments are considered important for this species; seed dispersal corridors may be important for this and other late-successional and old-growth associated species which have complex mycorrhizal relationships and small, ephemeral seeds (e.g., *Cypripedium fasciculatum*).

Botrychium minganense - Survey and Manage Strategy 1 and 2: A total of 3 populations of Mingan moonwort have been documented from the Forest; one population occurs within the Woods LSR. A related species, Mountain moonwort (*B. montanum*) is suspected to occur in deep shade under old-growth western red-cedar. Mingan moonwort occurs in more diverse habitats.

Cimicifuga elata - Regional Forester's Sensitive Species: Only two populations of tall bugbane have been documented from the Gifford Pinchot National Forest and a total of 30 from Washington, with populations sizes often less than 25 individuals. This species may require gaps and small openings in canopy for reproduction. Specific prescriptions to maintain viable populations within LSRs should be developed and incorporated into a conservation strategy.

Corydalis aquae-gelidae - Federal Candidate, Regional Forester's Sensitive Species, Survey and Manage Strategy 1 and 2: A total of 45 populations of cold-water corydalis have been documented from the Forest, with 32 (71 percent) occurring within the Wind LSR. This species inhabits riparian areas and may be adversely affected by sedimentation and increased water temperature.

Cypripedium fasciculatum - Two populations of clustered lady's slipper have been documented from the Forest. Because of the extremely slow growth rate, complex symbiotic relationships with other organisms, and possible fire requirements, management for this species may require specific treatment, including prescribed burning.

Pleuricospora fimbriolata - Regional Forester's Sensitive Species in Washington: A total of 233 populations of fringed pinesap have been documented from the Forest, with 183 (79 percent) occurring within LSRs. This species is on the edge of its range in Washington. The LSRs provide a high level of assurance that this species will remain viable on the Gifford Pinchot National Forest. Small old-growth fragments are also important habitats for this species. Seed dispersal corridors may be important for this and other late-successional and old-growth associated species which have complex mycorrhizal relationships. It may require seed dissemination by fungivores such as the red-backed vole and northern flying squirrel.

Streptopus streptopoides - Although no occurrences have been documented for the Forest, kruhsea is listed by the Regional Forester as sensitive in Oregon. The LSRs would provide suitable habitat for this species, which is found in old-growth forests in microsites with thick organic layers including decomposing coarse woody debris.

Synthyris schizantha - Fringed synthyris is known only from a few mountain peaks in the north Coast Range in Oregon, and from the Olympic and Cascade Mountains of Washington. It is known from the Little Rockies area within the Mineral LSR.

Lichens Associated with Late-successional and Old-growth Forests

Of the 157 species of lichens considered closely associated with late-successional and old-growth forest within the range of the northern spotted owl, 77 have been documented on the Gifford Pinchot National Forest and an additional 31 species are strongly suspected to occur here. Seven of these species are considered Survey and Manage Species Strategy 1 (Table 4-4). Those which have been documented within one or more LSR include: *Dendriscocaulon intricatulum, Hydrothyria venosa, Leptogium rivale, Lobaria hallii, Nephroma occultum, Pseudocyhellaria rainierensis,* and *Tholorna dissimilis.*

Bryophytes Associated with Late-successional and Old-growth Forests

Of the 106 species of bryophytes considered closely associated with late-successional and old-growth forest within the range of the northern spotted owl, 48 have been documented on the Gifford Pinchot National Forest and an additional 41 species are suspected to occur here. Fourteen of these species are considered Survey and Manage Species (Table 4-6). *Rhizomnium nudum* is the only Strategy 1 bryophyte which has been documented within an LSR, to date.

In addition, populations of *Buxbaumia viridis,* and *Ulota megalospora*, which are Protection Buffer species have been documented within LSRs.

Fungi Associated with Late-successional and Old-growth Forests

Of the 527 species of fungi considered closely associated with late-successional and old-growth forest within the range of the northern spotted owl, at least 128 have been documented on the Gifford Pinchot National Forest and at least an additional 166 species are suspected to occur here. The fungal flora has been poorly documented on the forest, with very few areas intensively inventoried (e.g., T.T. Munger Research Natural Area and the DEMO study areas). Nine Survey and Manage Species Strategy 1 fungi have been documented from within one or more LSRs (Table 4-6). These include *Aleuria rhenana, Bondarzewia montana, Cortinarius olympianus, Gymnopilus punctifolius, Helvella elastica, Leucogasster microsporus, Otidea smithii, Polyozellus multiplex,* and *Tylopilus pseudoscaber*.

Species and Habitats within LSR Not Associated with the Late-Successional Habitat

In addition to species considered by FEMAT to be closely associated with late-successional and old-growth forest, there are species of concern which occur within other habitats that may be affected by forest management. On the Gifford Pinchot National Forest, the Regional Forester's sensitive species include those that require openings, such as *Sisyrinchium sarmentosum*, *Calochortus longebarbartus* var. *longebarbatus*, *Botrychium pinnatum, Montia diffusa*, *Penstemon barrettiae, Polemonium carneum,* and *Veratrum insolitum.* Some of these species may be negatively affected by closing of the forest canopy, fire suppression, or encroachment by woody vegetation.

Non-Native Plant Species within the LSRs

Introduced plants may adversely affect the LSRs by competing with native plants and reducing their populations and in turn, those insects and other animals dependent upon them. The major exotic species which have been documented within LSRs include spotted knapweed (*Centaurea maculosa*), diffuse knapweed (*Centaurea diffusa*), black knapweed (*Centaurea nigra*) yellow hawkweed (*Hieracium pratense*), and scotch broom (*Cytissus scoparius*). All are designated as Class B noxious weeds. Most noxious weeds are early- to mid-seral species, which decline in abundance in later successional stages.

Table 4-4 Lichens considered closely associated with late-successional and old-growth forest. Documented (D) or suspected (S) on the Gifford Pinchot National Forest.

Species	Status	Habitat	Species	Status	Habitat	Species	Status	Habitat
Ahtiana sphaerosporella	D	arboreal (leafy)	*Hypygymnia duplicata*	S	rare arboreal (leafy)	*Peltigera neopolydactyla*	D	soil
Alectoria lata	D	arboreal (forage)	*Icmadophila ericetorum*	D	decaying wood	*Peltigera pacifica*	D	nitrogen-fixing
Alectoria sarmentosa	D	arboreal (forage)	*Leptogium burnetiae var. hirsutum*	S	riparian	*Peltigera venosa*	D	soil
Alectoria vancouverensis	D	arboreal (forage)	*Leptogium cyanescens*	S	riparian	*Pertusaria amara*	S	tree boles
Baeomyces rufus	D	soil	*Leptogium gelatinosum*	S	rock	*Pilophorus acicularis*	D	rock
Bryoria capillaris	D	arboreal (forage)	*Leptogium rivale*	D	aquatic	*Pilophorus clavatus*	D	rock
Bryoria friabilis	D	arboreal (forage)	*Leptogium saturninum*	D	riparian	*Pilophorus nigricaulis*	D	rare rock
Bryoria glabra	D	arboreal (forage)	*Leptogium teretiusculum*	D	riparian	*Platismatia herrei*	D	arboreal (leafy)
Bryoria pikei	D	arboreal (forage)	*Lobaria hallii*	D	rare nitrogen-fixing	*Platismatia lacunosa*	D	riparian
Bryoria pseudofuscescens	D	arboreal (forage)	*Lobaria linita*	D	rare nitrogen-fixing	*Platismatia norvegica*	D	arboreal (leafy)
Bryoria subcana	D	rare oceanic influenced	*Lobaria oregana*	D	nitrogen-fixing	*Platismatia stenophylla*	D	arboreal (leafy)
Calicium abietinum	D	pin	*Lobaria pulmonaria*	D	nitrogen-fixing	*Protoparmelia ochrococca*	D	tree boles
Calicium adaequatum	D	pin	*Lobaria scrobiculata*	D	nitrogen-fixing	*Pseudocyphellaria anomala*	D	nitrogen-fixing
Calicium adspersum	S	pin	*Loxospora sp. nov. "corallifera"*	D	oceanic	*Pseudocyphellaria anthraspis*	D	nitrogen-fixing
Calicium glaucellum	D	pin	*Melanelia subelegantula*	D	arboreal (leafy)	*Pseudocyphellaria crocata*	D	nitrogen-fixing
Calicium viride	D	pin	*Mycoblastus sanguinarius*	D	tree boles	*Pseudocyphellaria rainierensis*	D	rare nitrogen-fixing
Cavernularia hultenii	D	arboreal (leafy)	*Mycocalicium subtile*	S	pin	*Ramalina thrausta*	D	riparian
Cavernularia lophyrea	S	arboreal (leafy)	*Nephroma bellum*	D	nitrogen-fixing	*Sphaerophorus globosus*	D	arboreal (leafy)
Cetraria californica	S	oceanic	*Nephroma helveticum*	D	nitrogen-fixing	*Stenocybe major*	S	pin
Cetraria subalpina	D	arboreal (leafy)	*Nephroma laevigatum*	D	nitrogen-fixing	*Sticta beauvoisii*	S	nitrogen-fixing
Cetrelia cetrarioides	D	riparian	*Nephroma occultum*	D	rare nitrogen-fixing	*Sticta fuliginosa*	D	nitrogen-fixing
Chaenotheca brunneola	D	pin	*Nephroma parile*	D	nitrogen-fixing	*Sticta limbata*	D	nitrogen-fixing
Chaenotheca ferruginea	S	pin	*Nephroma resupinatum*	D	nitrogen-fixing	*Tholurna dissimilis*	D	rare arboreal (leafy)
Cladonia bacillaris	S	decaying wood	*Niebla cephalota*	U	rare oceanic influenced	*Tuckermannopsis pallidula*	D	arboreal (leafy)
Cladonia bellidiflora	D	decaying wood	*Parmotrema chinense*	S	arboreal (leafy)	*Usnea filipendula*	D	arboreal (forage)
Cladonia cenotea	S	decaying wood	*Peltigera collina*	D	nitrogen-fixing	*Usnea longissima*	D	riparian
Cladonia macilenta	S	decaying wood	*Peltigera horizontalis*	S	soil	*Xylographa abietina*	S	decaying wood
Cladonia norvegica	D		*Peltigera leucophlebia*	S	soil	*Xylographa vitiligo*	S	decaying wood
Cladonia umbricola	D	decaying wood	*Ochrolechia androgyna*	D	tree boles			
Collema nigrescens	D	riparian	*Ochrolechia oregonensis*	D	tree boles			
Cyphelium inquinans	S	pin	*Pannaria leucostictoides*	D	nitrogen-fixing			
Dendriscocaulon intricatulum	D	rare nitrogen-fixing	*Pannaria mediterranea*	S	nitrogen-fixing			
Dermatocarpon luridum	S	aquatic	*Pannaria pezizoides*	S	soil			
Epilichen scabrosus	S	soil	*Pannaria rubiginosa*	D	rare nitrogen-fixing			
Erioderma sorediatum	S	rare oceanic influenced	*Pannaria saubinetii*	D	nitrogen-fixing			
Hypocenomyce friesii	S	tree boles	*Parmelia kerguelensis=P. pseudosulcata*	S	arboreal (leafy)			
Hypogymnia oceanica	D	rare oceanic influenced	*Parmelia squarrosa*	D	arboreal (leafy)			
Hypogymnia rugosa	D	arboreal (leafy)	*Parmeliopsis hyperopta*	D	tree boles			
Hypogymnia metaphysodes	D	arboreal (leafy)	*Parmotrema arnoldii*	S	arboreal (leafy)			
Hypogymnia vittata	S		*Peltigera neckeri*	S	nitrogen-fixing			

Table 4-5 Bryophytes considered closely associated with late-successional and old-growth forest. Documented (D) or suspected (S) on the Gifford Pinchot National Forest.

Species	Status	Habitat	Species	Status	Habitat
Antitrichia curtipendula	D	canopy interior	*Lophozia incisa*	D	decaying wood-abundant
Apometzgeria pubescens	S	flood plain	*Lophozia longiflora*	S	decaying wood-less common
Bazzania ambigua	S	decaying wood-less common	*Lophozia ventricosa*	S	decaying wood-abundant
Bazzania denudata	S	decaying wood-less common	*Marsupella emarginata var. aquatica*	S	rare
Bazzania tricrenata	S	decaying wood-less common	*Metzgeria conjugata*	S	flood plain
Blepharostoma trichophyllum	D	decaying wood-abundant	*Pellia epiphylla*	S	flood plain
Brachythecium hylotapetum	D	shaded duff/humic soil	*Pellia neesiana*	D	flood plain
Brotherella roelli	S		*Plagiochila asplenioides complex*	D	wet shaded humic soil
Bryum gemmascens	S	shaded rock outcrop w/ thin soil	*Plagiomnium insigne*	D	flood plain
Buxbaumia piperi	D	decaying wood-less common	*Plagiothecium piliferum*	D	shaded rock outcrop w/ thin soil
Buxbaumia viridis	D	decaying wood-less common	*Plagiothecium undulatum*	D	decaying wood-abundant
Calypogeia fissa	D	wet shaded humic soil	*Porotrichum bigelovii*	D	flood plain
Calypogeia muelleriana	D	wet shaded humic soil	*Pseudoleskea baileyi*	S	tree boles/understory
Calypogeia neesiana	S	decaying wood-abundant	*Pseudoleskea stenophylla*	D	tree boles/understory
Calypogeia suecica	S	decaying wood-less common	*Pseudotaxiphyllum elegans*	D	shaded mineral soil
Cephalozia bicuspidata sp. lammersiana	S	decaying wood-abundant	*Pterigynandrum filiforme*	S	tree boles/understory
Cephalozia connivens	S	decaying wood-abundant	*Ptilidium californicum*	D	tree boles/understory
Cephalozia lunulifolia	S	decaying wood-abundant	*Racomitrium aciculare*	D	splash zone
Chiloscyphus polyanthos	S	aquatic (submerged)	*Racomitrium aquaticum*	S	
Conocephalum conicum	D	flood plain	*Racomitrium obesum*	S	flood plain
Dichodontium pellucidum	D	splash zone	*Racomitrium pacificum*	D	rare
Dicranella palustris	S	flood plain	*Radula bolanderi*	D	tree boles/understory
Dicranum fuscescens	D	tree boles/decaying wood	*Rhizomnium glabrescens*	D	decaying wood-abundant
Diplophyllum albicans	S		*Rhizomnium nudum*	D	flood plain
Diplophyllum plicatum	S		*Rhytidiadelphus subpinnatus*	S	flood plain
Ditrichum schimperi	S	shaded mineral soil	*Rhytidiopsis robusta*	D	shaded duff/humic soil
Douinia ovata	D	canopy interior	*Riccardia latifrons*	D	decaying wood-abundant
Encalypta brevicolla var. crumiana	S		*Riccardia palmata*	S	decaying wood-less common
Fissidens ventricosus	D	aquatic (submerged)	*Roellia roellii*	D	shaded duff/humic soil
Fontinalis howellii	D		*Scapania bolanderi*	D	tree boles/decaying wood
Geocalyx graveolens	S	decaying wood-less common	*Scapania umbrosa*	D	decaying wood-less common
Herbertus aduncus	S		*Scapania undulata*	D	aquatic (submerged)
Herzogiella seligeri	S	decaying wood-less common	*Schistidium agassizii*	S	flood plain
Heterocladium dimorphum	D	shaded rock outcrop w/ thin soil	*Schistidium rivulare*	D	splash zone
Heterocladium macounii	D	shaded rock outcrop w/ thin soil	*Schistostega pennata*	S	rare
Heterocladium procurrens	D	shaded rock outcrop w/ thin soil	*Scouleria aquatica*	D	splash zone
Hookeria lucens	S	flood plain	*Scouleria marginata*	S	
Hypnum circinale	D	tree boles/decaying wood	*Tetraphis geniculata*	D	
Isoterygiopsis pulchella	S	wet shaded humic soil	*Tetraphis pellucida*	D	decaying wood-abundant
Jungermannia atrovirens	S	splash zone	*Thamnobryum neckeroides*	D	
Lepidozia reptans	D	decaying wood-abundant	*Timmia austriaca*	D	shaded rock outcrop w/ thin soil
Lophocolea bidentata	S	decaying wood-abundant	*Tritomaria exsectiformis*	S	rare
Lophocolea cuspidata	S	decaying wood-abundant	*Tritomaria quinquedentata*	S	
Lophocolea heterophylla	D	decaying wood-abundant	*Ulota megalospora*	D	canopy exterior
			Ulota obtusiuscula	D	canopy exterior

Table 4-6 Fungi considered closely associated with late-successional and old-growth forest. Documented (D) or suspected (S) on the Gifford Pinchot National Forest.

Species	Status	Species	Status	Species	Status	Species	Status
Albatrellus avellaneus	S	*Clitocybe clavipes*	S	*Cortinarius rainierensis*	S	*Gyromitra esculenta*	D
Albatrellus ellisii	D	*Clitopilus prunulus*	D	*Cortinarius renidens*	S	*Gyromitra infula*	D
Albatrellus flettii	D	*Collybia acervata*	D	*Cortinarius salor*	S	*Gyromitra melaleucoides*	S
Aleuria rhenana	D	*Collybia bakerensis*	S	*Cortinarius traganus*	D	*Gyromitra montana*	D
Amanita constricta	S	*Collybia butryracea*	S	*Cortinarius vanduzerensis*	D	*Hebeloma crustuliniforme*	D
Amanita farinosa	D	*Collybia maculata var. maculata*	S	*Cortinarius variipes*	S	*Helvella compressa*	D
Amanita franchetii	D	*Collybia maculata var. occidentalis*	S	*Cortinarius vibratilis*	S	*Helvella crassitunicata*	D
Amanita gemmata	S	*Collybia maculata var. scorzonerea*	S	*Cortinarius violaceus*	D	*Helvella elastica*	S
Amanita inaurata	S	*Collybia racemosa*	S	*Cortinarius wiebeae*	S	*Helvella maculata*	D
Amanita muscaria var. formosa	D	*Coltrichia perennis*	D	*Cortinarius zinziberatus*	S	*Hemimycena delectabilis=Mycena delectabilis*	S
Amanita pachycolea	D	*Cordyceps capitata*	D	*Cortinarius scutulatus*	S	*Hericum abietis*	D
Amanita pantherina	S	*Cordyceps ophioglossoides*	S	*Cudonia circinans*	D	*Hydnum repandum*	D
Amanita porphyria	D	*Cortinarius acutus*	D	*Cudonia monticola*	D	*Hydnum umbilicatum*	S
Amanita smithiana	D	*Cortinarius allutus*	D	*Dermocybe idahoensis*	S	*Hygrocybe conica=Hygrophorus conicus*	D
Amphinema byssoides	S	*Cortinarius anomalus*	D	*Dermocybe phoenicea var. occidentalis*	S	*Hygrocybe laeta*	S
Asterophora lycoperdoides	D	*Cortinarius badiovinaceus*	S	*Dermocybe sanguinea*	S	*Hygrophoropsis aurantiaca*	D
Asterophora parasitica	S	*Cortinarius callisteus*	S	*Dermocybe semisanguinea*	D	*Hygrophorus bakerensis*	D
Baeospora myriadophylla	S	*Cortinarius calochrous*	D	*Dichostereum granulosum*	S	*Hygrophorus camarophyllus*	D
Boletus chrysenteron	S	*Cortinarius camphoratus*	S	*Elaphomyces granulatus*	S	*Hygrophorus chrysodon*	S
Boletus coniferarum	S	*Cortinarius caninus*	S	*Endogone oregonensis*	S	*Hygrophorus eburneus*	D
Boletus edulis	D	*Cortinarius collinitus var. collinitus*	D	*Endoptychum despressum*	S	*Hygrophorus erubescens*	S
Boletus mirabilis	D	*Cortinarius cyanites*	S	*Fayodia gracilipes (rainierensis)*	S	*Hygrophorus inocybiformis*	D
Boletus piperatus	D	*Cortinarius delibutus*	S	*Galerina atkinsoniana*	S	*Hygrophorus vernalis*	S
Boletus smithii	S	*Cortinarius evernius*	D	*Galerina heterocystis*	S	*Hypholoma capnoides= Naematoloma capnoides*	D
Boletus subtomentosus	D	*Cortinarius gentilis*	S	*Galerina mammillata*	S	*Hypholoma dispersum*	S
Boletus truncatus	S	*Cortinarius glaucopus*	D	*Galerina sphagnicola*	S	*Hypomyces lactifluorum*	D
Boletus zelleri	S	*Cortinarius griseoviolaceus*	S	*Galerina vittaeformis*	S	*Hypomyces luteovirens*	D
Bondarzewia mesenterica	D	*Cortinarius herpeticus*	S	*Ganoderma oregonense*	D	*Inocybe calamistrata*	S
Cantharellus cibarius	D	*Cortinarius infractus*	S	*Ganoderma tsugae*	D	*Inocybe hirsuts var. maxima*	S
Cantharellus formosus	D	*Cortinarius junghuhnii*	S	*Gastroboletus subalpinus*	D	*Inocybe lanuginosa*	D
Cantharellus subalbidus	D	*Cortinarius laniger*	S	*Gastroboletus turbinatus*	D	*Inocybe sororia*	D
Cantharellus tubaeformis	D	*Cortinarius limonius*	S	*Gelatinodiscus flavidus*	D	*Ischnoderma resinosum*	D
Catathelasma ventricosa	D	*Cortinarius magnivelatus*	S	*Geopora cooperi f. cooperi*	S	*Kuhneromyces ligicola*	S
Chroogomphus tomentosus	D	*Cortinarius miniatopus*	S	*Gomphus bonarii*	D	*Kuhneromyces mutabilis*	S
Chrysomphalina aurantiaca	S	*Cortinarius mutabilis*	D	*Gomphus clavatus*	D	*Laccaria amethysteo-occidentalis*	D
Clavaria americana	S	*Cortinarius obtusus*	S	*Gomphus floccosus*	D	*Laccaria bicolor*	D
Clavariadelphus spp.	D	*Cortinarius olympianus*	D	*Gomphus kauffmanii*	D	*Laccaria laccata*	D
Clavulina cinerea	D	*Cortinarius paleaceus*	S	*Gymnopilus hybridus*	S	*Lactarius alnicola*	S
Clavulina cristata	D	*Cortinarius paragaudis*	D	*Gymnopilus puntifolius*	S	*Lactarius deliciosus var. deliciosus*	D
Clavulina ornatipes	S	*Cortinarius pinetorum sensu Kaufman*	S	*Gymnopilus spectabilis*	S	*Lactarius deliciosus var. olivaceosordidus*	S
Clitocybe avellaneialba	D	*Cortinarius pseudoarquatus*	D	*Gyromitra californica*	D	*Lactarius fallax var. concolor*	S

Table 4-6 Fungi considered closely associated with late-successional and old-growth forest. Documented (D) or suspected (S) on the Gifford Pinchot National Forest.

(Continued)

Species	Status	Species	Status	Species	Status
Lactarius fallax var. fallax	S	*Nolanea cetrata*	S	*Rozites caperata*	D
Lactarius kauffmanii	D	*Nolanea cuneata*	S	*Russula aeruginea*	S
Lactarius olivaceoumbrinus	S	*Nolanea staurospora*	S	*Russula albonigra*	D
Lactarius olympianus	S	*Nolanea stricta*	S	*Russula bicolor*	S
Lactarius pallescens	D	*Oligoporus guttulatus*	S	*Russula brevipes var. acrior*	S
Lactarius pseudomucidus	D	*Ostenia obducta*	S	*Russula crassotunicata*	D
Lactarius scrobiculatus	D	*Otidea leporina*	S	*Russula decolorans*	S
Lactarius subviscidus	S	*Otidea onotica*	S	*Russula nigricans*	D
Laetiporus sulphureus	D	*Otidea smithii*	S	*Russula occidentalis*	S
Limacella glioderma	S	*Oxyporus nobilissimus*	D	*Russula olivascens*	S
Lycoperdon nigrescens=L. foetidum	D	*Paxillus atrotomentosus*	S	*Russula pelargonia*	S
Lycoperdon pyriforme	S	*Paxillus panuoides*	S	*Russula rosacea*	S
Macowanites chlorinosmus	S	*Phaeocollybia fallax*	S	*Russula variata*	S
Macowanites mollis	S	*Phaeocollybia kauffmanii*	S	*Russula xeramphelina*	D
Marascmiellus pluvius	S	*Phaeocollybia olivacea*	S	*Sarcodon fuscoindicum*	D
Marasmiellus papillatus	S	*Phaeocollybia pseudofestiva*	S	*Sarcodon imbricatus*	D
Marasmius pallidocephalus	S	*Phellodon atratum*	D	*Sarcosoma mexicana*	D
Marasmius salalis	S	*Phlogiotis helvelloides*	D	*Sarcospaera eximia*	D
Melanotus textilis	S	*Pholiota albivelata*	S	*Sparassis crispa*	D
Mycena amabilissima	S	*Pholiota astragalina*	D	*Spathularia flavida*	D
Mycena amicta	S	*Pholiota decorata*	S	*Stagnicola perplexa*	S
Mycena aurantiidisca	S	*Pholiota flammans*	S	*Stropharia hornemannii*	S
Mycena aurantiomarginata	S	*Pholiota flavida*	S	*Suillus punctatipes*	D
Mycena capillaripes	D	*Pholiota lubrica*	S	*Thaxterogaster pingue*	D
Mycena elegantula	S	*Pholiota scamba*	S	*Tomentella spp.*	S
Mycena epipterygia	D	*Phylloporus rhodoxanthus*	D	*Trechispora farnacea*	S
Mycena galericulata	S	*Phytoconis ericetorum*	S	*Trechispora mollusca*	S
Mycena galopus	S	*Pithya vulgaris*	S	*Tricholoma flavovirens*	D
Mycena hudsoniana	S	*Plectania melastoma*	D	*Tricholoma focale=Armillaria zelleri*	S
Mycena leptocephala	D	*Pleurocybella porrigens*	S	*Tricholoma imbricatum*	S
Mycena lilacifolia	S	*Polyozellus multiplex*	D	*Tricholoma inamoenum*	S
Mycena longiseta	S	*Polyporoletus sublividus*	S	*Tricholoma magnivelare*	D
Mycena maculata	S	*Polyporus melanopus*	S	*Tricholoma pessundatum*	S
Mycena monticola	S	*Pycnoporellus alboluteus*	S	*Tricholoma portentosum*	D
Mycena overholtsii	D	*Ramaria spp.*	D	*Tricholoma saponaceum*	D
Mycena rosella	D	*Ramaria araiospora*	D	*Tricholoma sejunctum*	S
Mycena sanguinolenta	S	*Ramaria stuntzii*	D	*Tricholoma vaccinum*	D
Mycena strobilinoides	D	*Resupinatus applicatus*	S	*Tricholoma virgatum*	D
Mycena tenax	S	*Rhizopogon evadens var. subalpinus*	D	*Tricholomopsis decora*	D
Mycena viscosa	S	*Rhodocybe nitida=Entoloma nitidum*	S	*Tricholomopsis flavissima*	S
Mythicomyces corneipes	S	*Rhodocybe speciosa*	S	*Tricholomopsis fulvescens*	S
Neournula pouchetii	S	*Rhodocybe trachyospora var. purpureoviolaceum*	S	*Tylopilus pseudoscaber*	D
Nivatogastrium nubigenum	D	*Rickenella setipes*	D	*Xeromphalina cauticinalis*	D
				Xeromphalina cornui	S

Wildlife Habitat

Late-Successional Dependent Species

Current condition of wildlife habitat in LSRs is different than desired conditions. There is currently less late-successional habitat in LSRs and Riparian Reserves than is expected to occur in the future and that habitat is fragmented to varying degrees. Fragmentation causes reduction in the amount and quality of habitat and isolation of habitat patches.

In general, LSRs were designated in areas where the most late-successional habitat still exists. Thus, the LSRs currently support a host of species that utilize late-successional habitat (Table 4-7) which include species such as the spotted owl that appear to be dependent on older forest and other species that use older forests as well as other habitats (see Vegetation Structure dependent column, Table 4-7).

The "dependent" species are keying in on a combination of habitat components provided by late-successional forests, including: large trees, snags and defective trees, down wood, moderated temperature and moisture regimes, snow interception, forest floor duff and litter, and multilayered canopies. Many of the habitat "generalists" utilize snags and down logs and will also use younger forests if those components are present. This group includes cavity nesting birds, terrestrial amphibians, and small mammals (see CWD column, Table 4-7). A number of the song bird "generalists" 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.

Another group of species, referred to as "contrast" species (Vegetation Structure column, Table 4-7) use late-successional habitat for nesting, hiding, or resting but forage in adjacent open habitats. Due to fragmentation, primarily from past timber harvest, habitat for these species is more abundant currently than it has been in the past. 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 forest provide moderated temperatures which are important to roosting bats.

Table 4-7 Wildlife Species Using Late-Successional Habitat by LSR

Common Name	Scientific Name	Vegetation Structure	CWD	Status	LSR								
					Wind	Lewis	Quartz	Woods	Nisqually	Packwood	Mineral	Gotchen	Peterson
AMPHIBIANS													
Northwestern salamander	*Ambystoma gracile*	General	L		S	D	S	D	S	S	S	S	S
Cope's giant salamander	*Dicamptodon copei*	Riparian		FSS, J2	D	D	S	S	S	S	S		
Pacific giant salamander	*Dicamptodon tenebrosus*	Riparian	L		D	D	D	S	D	S	S	S	S
Cascade torrent salamander	*Rhyacotriton cascadae*	Riparian		J2	S	S	S	S	S	S	S		
Ensatina	*Ensatina eschscholtzii*	General	L		S	S	D	S	S	S	S	S	S
Larch mountain salamander	*Plethodon larselli*	Late		S&M, FSS	D	D	P	P	P	D	P		
Van dyke's salamander	*Plethodon vandykei*	Riparian	L	S&M	S	S	S	S	S	S	D		
Western red-backed salamander	*Plethodon vehiculum*	General	L		S	S	D	S	S	S	S	S	S
Rough-skinned newt	*Taricha granulosa*	General			S	D	S	D	S	S	S	S	S
Pacific treefrog	*Pseudacris regilla*	General	L		D	D	S	D	S	S	S	S	S
Tailed frog	*Ascaphus truei*	Riparian	L	J2	D	D	D	D	D	D	S	S	S
Red-legged frog	*Rana aurora*	General			S	S	S	D	D	D	S		
Cascades frog	*Rana cascadae*	General			D	D	S	D	D	S	D	S	S
BIRDS													
Great blue heron	*Ardea herodias*	General			D	D	S	D	S	D	S	D	S
Wood duck	*Aix sponsa*	Riparian	SL		D	S	S	D	S	S	S	S	S
Harlequin duck	*Histrionicus histrionicus*	Riparian			D	D	S	D	D	D	S	S	S
Barrow's goldeneye	*Bucephala islandica*	Riparian	SL		S	S	S	D	S	S	S	S	S
Bufflehead	*Bucephala albeola*	General	S		S	S	D	D	S	S	S		
Hooded merganser	*Lophodytes cucullatus*	Riparian	S		S	S	S	D	S	S	S	S	S
Common merganser	*Mergus merganser*	Riparian	S	J2	D	S	S	S	S	S	S	S	S
Turkey vulture	*Cathartes aura*	Contrast	L		S	S	S	D	S	D	S	S	S
Osprey	*Pandion haliaetus*	General	S		S	S	S	S	S	S	S	S	S
Bald eagle	*Haliaeetus leucocephalus*	General	S	T&E	D	D	D	D	D	D	D	D	S
Sharp-shinned hawk	*Accipiter striatus*	General			D	D	S	D	S	S	D	D	S
Cooper's hawk	*Accipiter cooperii*	General			D	D	S	S	S	D	S	S	S
Northern goshawk	*Accipiter gentilis*	Late			D	D	S	D	D	D	D	D	D
Red-tailed hawk	*Buteo jamaicensis*	Contrast			D	D	S	D	S	D	D	D	S
Golden eagle	*Aquila chrysaetos*	Contrast			D	D	S	S	D	D	D	S	S
Peregrine falcon	*Falco peregrinus*	General		T&E	D	D		D	P	P			
Blue grouse	*Dendragapus obscurus*	General	L		S	S	S	D	S	S	D	D	S
Ruffed grouse	*Bonasa umbellus*	General	L		D	S	S	D	S	S	S	S	S
Wild turkey	*Meleagris gallopavo*	General	L		D	S	S	S	S	S	S	D	S
Marbled murrelet	*Brachyramphus marmoratus*	Late		T&E					P		D		
Band-tailed pigeon	*Columba fasciata*	General			S	S	S	S	D	S	D	S	S
Flammulated owl	*Otus flammeolus*	Contrast	S	PB								S	S
Great horned owl	*Bubo virginianus*	Contrast			D	D	S	D	D	D	D	D	D
Northern pygmy-owl	*Glaucidium gnoma*	General	S		D	D	S	D	D	D	D	D	D
Northern spotted owl	*Strix occidentalis caurina*	Late		T&E	D	D	D	D	D	D	D	D	D

Table 4-7 Wildlife Species Using Late-Successional Habitat by LSR (con't)

Common Name	Scientific Name	Vegetation Structure	CWD	Status	LSR								
					Wind	Lewis	Quartz	Woods	Nisqually	Packwood	Mineral	Gotchen	Peterson
Barred owl	*Strix varia*	Late	S		D	D	S	D	D	D	D	S	D
Great gray owl	*Strix nebulosa*	Contrast	S	S&M	S						D	D	S
Long-eared owl	*Asio otus*	General			S	S	S	S	S	S	S		
Northern saw-whet owl	*Aegolius acadicus*	General	S		S	S	S	D	D	S	S	S	S
Black swift	*Cypseloides niger*	General							P	P			
Vaux's swift	*Chaetura vauxi*	General	S		S	D	S	S	S	S	S	S	S
Rufous hummingbird	*Selasphorus rufus*	General			D	S	S	S	S	S	S	S	S
Belted kingfisher	*Ceryle alcyon*	Riparian	S		S	D	S	S	S	S	S	S	S
Lewis' woodpecker	*Melanerpes lewis*	Contrast	SL		S							S	S
Red-naped sapsucker	*Sphyrapicus nuchalis*	General	S		S	S		S	S	S		S	S
Red-breasted sapsucker	*Sphyrapicus ruber*	General	S		D	S	S	D	S	S	S	S	S
Williamson's sapsucker	*Shpyrapicus thyroideus*	Late/Mid	S		S	S		S	S	S		D	S
Hairy woodpecker	*Picoides villosus*	General	SL		S	S	S	D	S	S	S	S	S
White-headed woodpecker	*Picoides albolarvatus*	General	S	PB	S							S	S
Three-toed woodpecker	*Picoides tridactylus*	Late	SL		S	D	P	P	P	D	P	S	S
Black-backed woodpecker	*Picoides arcticus*	Late	S	J2	D	D	P	P	P	S	P	D	S
Northern flicker	*Colaptes auratus*	General	SL		D	S	S	S	S	S	S	S	S
Pileated woodpecker	*Dryocopus pileatus*	Late	SL		D	D	S	D	D	D	D	D	D
Olive-sided flycatcher	*Contopus borealis*	Contrast			S	S	S	S	S	S	S	S	S
Hammond's flycatcher	*Empidonax hammondii*	General			S	S	S	S	S	S	S	S	S
Pacific slope flycatcher	*Empidonax difficilis*	Late			S	S	S	S	S	S	S	S	S
Purple martin	*Progne subis*	General	S		P		P	P	P	P	P		
Pygmy nuthatch	*Sitta pygmaea*	General	S	PB	S	S		P	P	S	P	S	S
Brown creeper	*Certhia americana*	Late/Mid	S		S	S	S	S	S	S	S	S	S
Winter wren	*Troglodytes troglodytes*	General	L		S	S	S	S	S	S	S	S	S
American dipper	*Cinclus mexicanus*	Riparian			S	S	S	S	S	S	D	S	S
Golden-crowned kinglet	*Regulus satrapa*	General			S	S	S	S	S	S	S	S	S
Ruby-crowned kinglet	*Regulus calendula*	General			S	S	S	S	S	S	S	S	S
Townsend's solitaire	*Myadestes townsendi*	General	L		S	S	S	S	S	S	S	S	S
Swainson's thrush	*Catharus ustulatus*	General			S	S	S	S	S	S	S	S	S
Hermit thrush	*Catharus guttatus*	General			S	S	S	S	S	S	S	S	S
Varied thrush	*Ixoreus naevius*	General			S	S	S	S	S	S	S	S	S
Solitary vireo	*Vireo solitarius*	General			D	S	S	S	S	S	S	S	S
Warbling vireo	*Vireo gilvus*	General			S	S	S	S	S	S	S	S	S
Yellow-rumped warbler	*Dendroica coronata*	General			S	S	S	D	S	S	S	S	S
Black-throated gray warbler	*Dendroica nigrescens*	General			S	S	S	S	S	S	S	S	D
Townsend's warbler	*Dendroica townsendi*	Late/Mid			S	S	S	S	S	S	S	D	S
Hermit warbler	*Dendroica occidentalis*	Late/Mid			S	S	S	S	S	S	S	S	S
Wilson's warbler	*Wilsonia pusilla*	General			S	S	S	S	S	S	S	S	S
Western tanager	*Piranga ludoviciana*	General			D	S	S	S	S	S	S	D	S
Dark-eyed junco	*Junco hyemalis*	General			S	S	S	S	S	S	S	S	S
Pine grosbeak	*Pinicola enucleator*	General			S	S	S	S	S	S	S	S	S

Table 4-7 Wildlife Species Using Late-Successional Habitat by LSR (con't)

Common Name	Scientific Name	Vegetation Structure	CWD	Status	LSR								
					Wind	Lewis	Quartz	Woods	Nisqually	Packwood	Mineral	Gotchen	Peterson
Cassin's finch	*Carpodacus cassinii*	Contrast			S	S	S	S	S	S	S	S	S
Red crossbill	*Loxia curvirostra*	General			S	S	S	S	S	S	S	S	S
White-winged crossbill	*Loxia leucoptera*	Late			P	P	P	P	P	P	P	P	P
Pine siskin	*Carduelis pinus*	General			S	S	S	S	S	S	S	S	S
Evening grosbeak	*Coccothraustes vespertinus*	General			S	S	S	S	S	S	S	S	S
MAMMALS													
Masked shrew	*Sorex cinereus*	General			S	S	S	S	S	S	S		
Dusky shrew	*Sorex monticolus*	General	L		S	S	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		D	S	S	S	S	S	S	S	S
Shrew-mole	*Neurotrichus gibbsii*	Late	L		S	S	S	S	S	S	S		
Coast mole	*Scapanus orarius*	General			S	S	S	S	S	S	S	S	S
Little brown myotis	*Myotis lucifugus*	Contrast	S		D	S	S	S	S	S	D	S	S
Yuma myotis	*Myotis yumanensis*	General	S		S	S	S	S	S	S	S	S	S
Keen's myotis	*Myotis keenii*	Contrast	S	J2			P	P	P	P	P		
Long-eared myotis	*Myotis evotis*	General	S	S&M	S	S	S	S	S	S	S	S	S
Fringed myotis	*Myotis thysanodes*	Contrast		S&M	D	S	S	S	S	S	S		
Long-legged myotis	*Myotis volans*	General	S	S&M	S	S	S	S	S	S	S	S	S
California myotis	*Myotis californicus*	Contrast	S		D	S	S	S	S	S	S	S	S
Western small-footed bat	*Myotis ciliolabrum*	General			S	S	S	S	S	S	S	S	S
Silver-haired bat	*Lasionycteris noctivagans*	Contrast	S	S&M	D	S	S	S	S	S	S	S	S
Big brown bat	*Eptesicus fuscus*	Contrast	S		S	S	S	S	S	S	S	S	S
Hoary bat	*Lasiurus cinereus*	General		J2	D	S	S	S	S	S	S	S	S
Townsend's big-eared bat	*Plecotus townsendii*	Contrast		FSS	D	D					D	S	S
Townsend's chipmunk	*Tamias townsendii*	General	L		S	S	S	S	S	S	S	S	S
Cascade golden-mantled ground squirrel	*Spermophilus saturatus*	General	L		S	S	S	S	S	S	S	S	S
Douglas' squirrel	*Tamiasciurus douglasii*	General	SL		S	S	S	S	S	S	S	S	S
Northern flying squirrel	*Glaucomys sabrinus*	Late	S		S	S	S	S	S	S	S	S	S
Forest (long-tailed) deer mouse	*Peromyscus oreas*	General	L		D	S	S	S	S	S	S	S	S
Deer mouse	*Peromyscus maniculatus*	General	L		D	S	S	S	S	S	S	S	S
Bushy-tailed woodrat	*Neotoma cinerea*	Late/Mid			S	S	S	S	S	S	S	D	S
Southern red-backed vole	*Clethrionomys gapperi*	Late/Mid	L		D	S	S	S	S	S	S	S	S

Table 4-7 Wildlife Species Using Late-Successional Habitat by LSR (con't)

Common Name	Scientific Name	Vegetation Structure	CWD	Status	LSR								
					Wind	Lewis	Quartz	Woods	Nisqually	Packwood	Mineral	Gotchen	Peterson
Porcupine	*Erethizon dorsatum*	General	L		S	S	S	S	S	S	S	S	S
Gray wolf	*Canis lupus*	General		T&E	D	P	P	P	D	D	P	P	P
Black bear	*Ursus americanus*	General	L		D	D	D	D	D	D	D	D	D
Grizzly bear	*Ursus arctos*	General		T&E	E	E	E	E	E	E	E	E	E
Raccoon	*Procyon lotor*	General	S		S	S	S	S	S	S	S	S	S
Marten	*Martes americana*	Late	SL	J2	S	D	D	S	D	D	S	D	D
Fisher	*Martes pennanti*	Late	SL	J2	S	S	S	S	S	S	S	S	S
Ermine	*Mustela erminea*	General	L		S	S	S	S	S	S	S	S	S
Mink	*Mustela vison*	General	L		D	S	S	S	S	D	D	S	S
Wolverine	*Gulo gulo*	General		FSS	S	D	P	P	D	S	P	S	S
River otter	*Lutra canadensis*	Riparian			D	D	S	D	D	D	S	S	S
Mountain lion	*Felis concolor*	General			D	D	S	D	D	D	D	D	S
Lynx	*Felis lynx*	General	L	S&M	D	P	P	P	P	P	P	P	P
Elk	*Cervus elaphus*	Contrast			D	D	D	D	D	D	D	D	D
Black-tailed & mule deer	*Odocoileus hemionus*	General			D	D	D	D	D	D	D	D	D
Mountain goat	*Oreamnos americanus*	General			D	D	S	D	D	D		S	D

KEY:
CWD - Indicates species for which Coarse Woody Debris is an important habitat component: S - Snags; L - Logs; SL - Snags and Logs
Status: T&E - Federally Threatened or Endangered;
FSS - Forest Service Sensitive Species;
S&M - Survey and Manage Guidelines apply;
PB - Protection Buffer Standards and Guidelines apply;
J2 - Received additional analysis in Appendix J2 due to viability concerns.
Occurrence by LSR: D - Documented -WILDOBS, STRIX, DEMO Database
S - Suspected (occurrence likely though not documented)
P - Potential (habitat available but occurrence uncertain)
E - Extirpated

Table 4-8 Mollusks Assessed in the Northwest Forest Plan

Common Name	Scientific Name	Habitat	Status	LSR								
				Wind	Lewis	Quartz	Wood	Nisqually	Packwood	Mineral	Gotchen	Peterson
Land Snails												
Puget oregonian	*Cryptomastix devia*	Riparian	S&M	S(D)	S	S	S	S	S	S		
Columbia oregonian	*Cryptomastix hendersonii*	Talus/seeps	S&M	S								
Dalles sideband	*Monadenia fidelis minor*	Talus/seeps	S&M	S								
Dalles hesperian	*Vespericola depressa*	Talus/seeps	J2	P								
Slugs												
Evening field slug	*Deroceras hesperium*	Rip/OG	S&M	H	H	H	H	H	H	H		
Malone jumping-slug	*Hemphillia malonei*	OG	S&M	P								
Warty jumping-slug	*Hemphillia glandulosa*	OG/Rip	S&M	S	S	S	S	S	S	S		
Panther jumping-slug	*Hemphillia pantherina*	OG/Rip	S&M					S (D)				
Blue-grey tail-dropper	*Prophysaon coeruleum*	OG/Rip	S&M	H	H	H	H	H	H	H		
Palipose tail-dropper	*Prophysaon dubium*	Rip/Rock	S&M	H	H	S	S(D)	S	S(D)	H		
Freshwater Snails												
Columbia duskysnail	*Lyogyrus n. sp. 1*	Riparian	S&M	S(D)								
Shortface lanx	*Fisherola nuttalli nuttalli*	Riparian	J2	P								
Columbia pebble snail	*Fluminocola columbiana*	Riparian	J2	P								
Dalles juga	*Juga(J.) hemphilli dallesensis*	Riparian	J2	S								
Barren juga	*Juga (J.) hemphilli hemphilli*	Riparian	J2	P								
Brown juga	*Juga (J.) n. sp. 1*	Riparian	J2	S								
Tall juga	*Juga (J.) n. sp. 3*	Riparian	J2	H								
None	*Juga (O.) n. sp. 1*	Riparian	J2	S								
Rotund physa	*Physella (P.) columbiana*	Riparian	J2	H								
Nerite rams-horn	*Vorticifex neritoides*	Riparian	J2	S								
Freshwater clams												
California floater	*Anodonta californiensis*	Riparian	J2	H								

Status: S&M - Survey and Manage Standards and Guidelines apply to this species.
J2 - Species of concern - received additional analysis in Appendix J2 due to viability concerns.
Occurrence by LSR: D - Documented; (D) - Documented nearby; S - Suspected; P - Potential; H - Historic range
Sources: FEIS Appendix J2, Frest and Johannes (1993).

Table 4-9 Introduced Species by LSR

Common Name	Scientific Name	LSR								
		Wind	Lewis	Quartz	Woods	Nisqually	Packwood	Mineral	Gotchen	Peterson
Bullfrog	*Rana catesbeiana*	P								
Wild turkey	*Meleagris gallopavo*	D	D						D	S
California quail	*Callipepla californica*	P		P	P	P	P	P	P	P
Rock dove	*Columbia livia*	P		P	P	P	P	P	P	P
European starling	*Sturnus vulgaris*	D	P	S	D	S	S	S	S	S
House sparrow	*Passer domesticus*	D	P	S	D	S	S	S	S	S
Virginia opossum	*Didelphis virginiana*	S			D	S	S	S	P	P
House mouse	*Mus musculus*	S			S	S	S	S	P	P
Norway rat	*Rattus norvegicus*	P			P	P	P	P	P	P

Occurrence by LSR: D - Documented
S - Suspected (not documented but likely)
P - Potential (occurs adjacent to LSR, not documented within LSR)

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, Van Dykes salamander, and the tailed frog. These species require cold, clear water and cool, moist microclimates at the stream's edge. A few ducks are cavity nesters which require large snags in the vicinity of water. These species include: wood duck, Barrow's goldeneye, bufflehead, hooded merganser, and common merganser.

Survey and Manage Wildlife Species

The NWFP identified a host of species to be managed with the Survey and Manage standards and guidelines. The "Status" fields in Table 4-7, pages 4-13 through 4-16 and Table 4-8, page 4-17, indicates those wildlife and mollusk species, respectively, which occur or are expected to occur on the Gifford Pinchot that are considered Survey and Manage species. None of the known sites for mollusks are within LSRs though a few have been documented adjacent to LSRs. Most of the Survey and Manage wildlife species have been documented in LSRs.

Threatened, Endangered, Extirpated, and Sensitive Wildlife Species

The following federally threatened or endangered species have been documented to occur within LSRs (see Table 4-7): bald eagle, peregrine falcon, marbled murrelet, northern spotted owl, and gray wolf. These species will use late-successional habitat, and thus management of LSRs for late-successional habitat should have beneficial or no impact on these species. The exception may be the gray wolf, because prey populations of large herbivores are expected to decline in LSRs.

The spotted frog is a federal candidate species. The frog inhabits ponds and wetlands. Habitat for this species is not expected to be affected by management of LSRs.

Grizzly bears are the only species known to be extirpated from the Forest. The species has been sighted within 10 miles northwest of the Nisqually LSR on private property. Grizzly bears and gray wolf are sensitive to road density.

Forest Service sensitive species that use late-successional forests are identified in Table 4-7. All should benefit by management for late-successional habitat in LSRs. Additional sensitive species include: ferruginous hawk, western pond turtle, common loon, and sandhill crane. Ferruginous hawks occasionally may occur in open habitats on the east side of the Forest. The other species use wetlands, lakes, and ponds. Habitat for these additional species is not expected to be impacted by management of LSRs.

Critical Northern Spotted Owl Habitat

Critical habitat is established as part of recovery plan efforts for endangered species. It is designed to maintain and protect habitat components essential for recovery of an endangered species. Eight critical habitat units totaling 596,159 acres were established for the spotted owl on the Gifford Pinchot National Forest in 1992.

Establishment of LSRs under the NWFP purposefully encompassed critical habitat units. Since the objective of spotted owl critical habitat was to maintain and protect old-growth and late-successional forest, the purposes of the LSRs and critical habitat are similar. Across the Forest, the LSRs cover 371,623 acres or 62 percent of the critical habitat units. Not all of the LSRs are contained within the critical habitat units. Thus, some portions of LSRs are not designated as critical habitat. Only one critical habitat unit does not contain a LSR; unit WA-39 in the Upper Kalama River watershed.

Map 4-1 and Table 4-11 display area for each critical habitat unit and the area of overlap with a LSR.

Marbled Murrelet critical habitat was established in 1996, after implementation of the NWFP. In this case, certain LSRs were designated as critical habitat on federal lands. On the Gifford Pinchot National Forest the Mineral and Nisqually LSRs are designated as Marbled Murrelet critical habitat.

Table 4-10 displays suitable owl habitat in each LSR, on timber suitable and non-timber suitable lands and the Forest total.

Table 4-10 Suitable Owl Habitat by Land Class

Land Class	Nesting	Foraging	Dispersal	Non-Habitat	Unknown
Gotchen LSR	5,997	5,983	1,423	1,765	4
Lewis LSR	37,644	27,908	17,599	37,315	173
Mineral LSR	12,323	7,401	2,177	15,164	525
Nisqually LSR	13,469	56	15,214	22,616	2
Packwood LSR	18,825		7,213	19,066	4
Peterson LSR	7,166	714	1,033	6,593	8
Quartz LSR	5,665	1,289	430	1,474	1
Wind LSR	32,155	28,404	24,152	40,162	127
Woods LSR	15,128	3,714	4,622	4,768	11
LSR Totals	**148,373**	**75,469**	**73,863**	**148,923**	**855**
Other Non-Timber Suitable Lands	**137,622**	**58,892**	**101,029**	**349,795**	**1,900**
Total Non-Timber Suitable	**285,995**	**134,361**	**174,891**	**498,718**	**2,755**
Timber Suitable Lands:					
Matrix	54,880	26,281	31,344	104,530	284
Cispus AMA	18,813	9,530	9,994	16,313	18
Total Timber Suitable	**73,693**	**35,812**	**41,338**	**120,843**	**302**
Grand Total	**359,688**	**170,173**	**216,229**	**619,561**	**3,057**

Map 4-1 LSR Associations with Critical Habitat Units

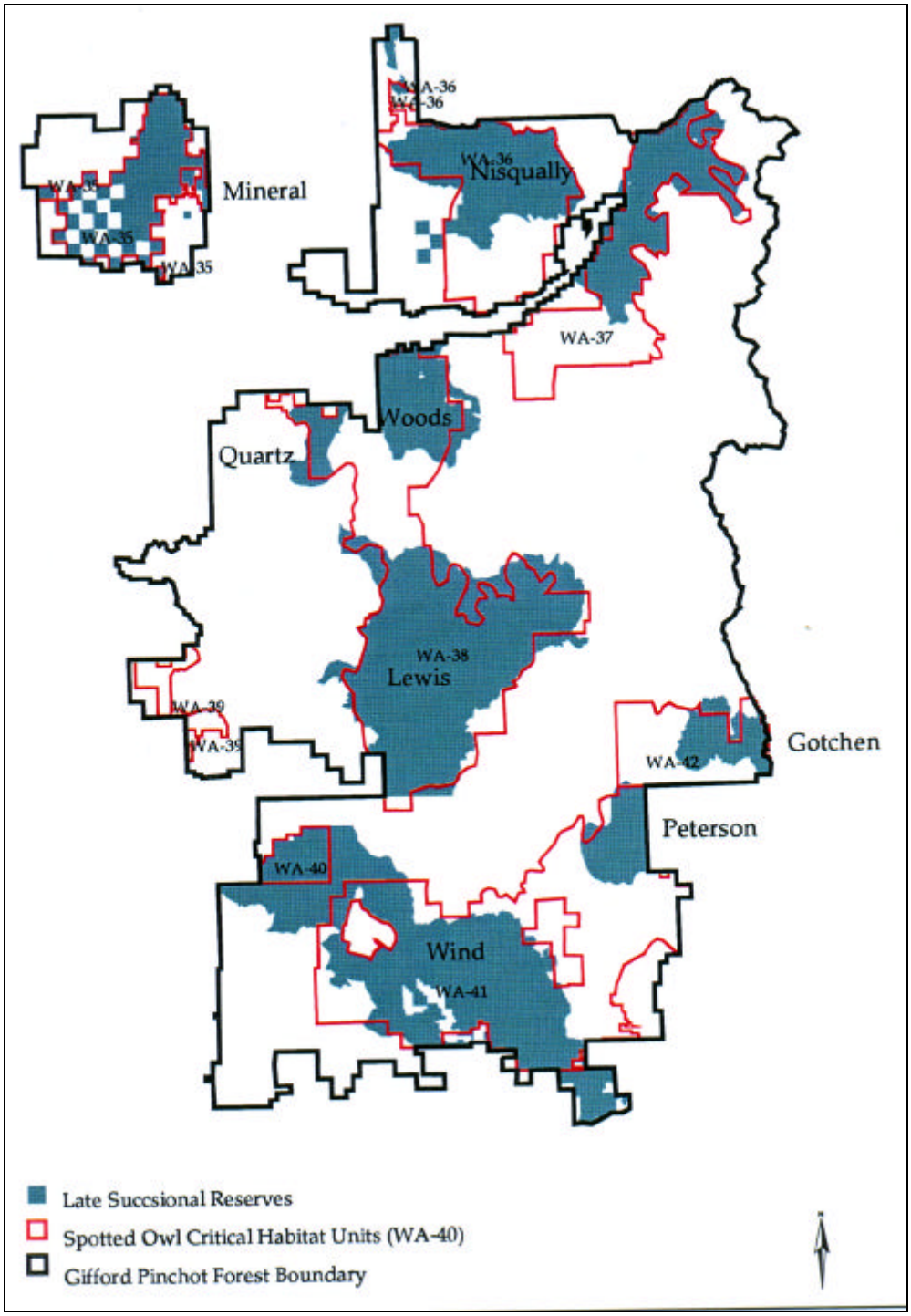


Table 4-11 Acreage of Northern Spotted Owl Critical Habitat Units and Associated LSRs.

Critical Habitat	Total Area	LSR									
		Gotchen	Lewis	Mineral	Nisqually	Packwood	Peterson	Quartz	Wind	Woods	Total w/in LSRs
WA-35	50,726	0	0	37,592	0	0	0	0	0	0	37,592
WA-36	75,605	0	0	0	44,357	0	0	0	0	0	44,357
WA-37	68,470	0	0	0	0	38,077	0	0	0	0	38,077
WA-38	169,831	0	102,845	0	0	0	0	6,636	0	22,978	132,460
WA-39	9,711	0	0	0	0	0	0	0	0	0	0
WA40	12,032	0	0	0	0	0	0	0	9,998	0	9,998
WA-41	173,901	0	0	0	0	0	11,927	0	84,798	0	96,725
WA-42	35,884	12,414	0	0	0	0	0	0	0	0	12,414
Total	596,160	12,414	102,845	37,592	44,357	38,077	11,927	6,636	94,796	22,978	371,623

Introduced Species

Several introduced species are likely to occur in LSRs (see Table 4-9). House sparrows and starlings compete with native cavity nesting wildlife for nest sites. The house sparrow is most likely to occur near areas of human habitation along the Cowlitz River and south end of Wind LSR. Starlings will venture further into the LSRs. Both species are generalists but primarily use open habitats that currently are widespread in LSRs. Rock dove, Virginia opossum, house mouse, and Norway rat are all associated with human habitation and their distribution in LSRs is probably limited. The Virginia opossum and Norway rat will eat the eggs of ground nesting birds. Bullfrogs occur in low elevation wetlands. There are no documented occurrences of bullfrogs in any of the LSRs. These voracious predators can decimate populations of native frogs and turtles. Wild turkey and California quail were introduced for sport hunting. Wild turkeys occur in forested habitats in LSRs. Quail occur at lower elevations at the fringes of Wind LSR. Effects of these two game birds on native species is unknown.

Open Wildlife Habitats

Forested stands of age 0 to about 40 years old provide open habitat and make up approximately 25 percent of the LSR network. (See Table 4-35, page 4-117.) The presence of this open habitat is largely the result of regeneration timber harvest. These habitats are characterized by few large live trees, standing snags, or down woody debris remaining within the unit boundaries. To this lack of remnant forest structures in harvested units is attributed the loss of species diversity as the stand ages (Hansen et al. 1991).

Bruce et al. (1985) determined that 60 percent of the 460 described vertebrate wildlife species found in western Oregon and Washington utilize open habitats for feeding purposes. However, only 39 percent of the same vertebrate wildlife species utilized open habitat for breeding purposes. Reproductive use of early seral habitat is probably due to a lack of vegetative structure necessary for nest construction or cover (i.e., snags, down wood, etc.) required by certain species.

Naturally occurring open habitat within the LSRs consist of dry and wet meadows and shrublands. These areas are limited, currently comprising less than 1 percent of the LSRs (see Table 4-34). Natural openings are typically the result of geomorphic factors. They persist over time changing only with gradual modifications of soils or microclimate (Logan et al. 1985). The inherent edges that are produced by different plant communities provide nesting and foraging areas (Logan et al. 1985). Black-tailed deer and elk are noted as frequent users of natural openings (Witmer et al. 1985). As many as 130 species use these natural openings and their inherent edges for breeding while as many as 183 species use them for foraging (Brown 1985).

Mid-Seral Wildlife Habitats

Forested stands between 41 and 100 years old provide closed mid-seral habitat and represent approximately 20 percent (90,718 acres) of the LSRs. (See Table 4-36.) Some of the younger stands of mid-seral habitat are the result of past timber harvest, but most of the stands are the result of large scale fire disturbances that occurred around the turn of the century. The size and amount of trees, snags, and down wood from the original stand present in these mid-seral stands depends on fire and management history occurrence. Intensive removal of burned trees to reduce subsequent fire hazard left stands devoid of snag or down wood habitat. Where trees were left, they now provide snag and downwood in soft decay classes. Hard snags and sound down wood of large diameter may be deficient in most stands. Species use of closed mid-seral stands appears related to the presence of remnant forest structures. No native species are known to depend on closed-canopy forest which lack remnant forest structures (Hansen et al. 1991).

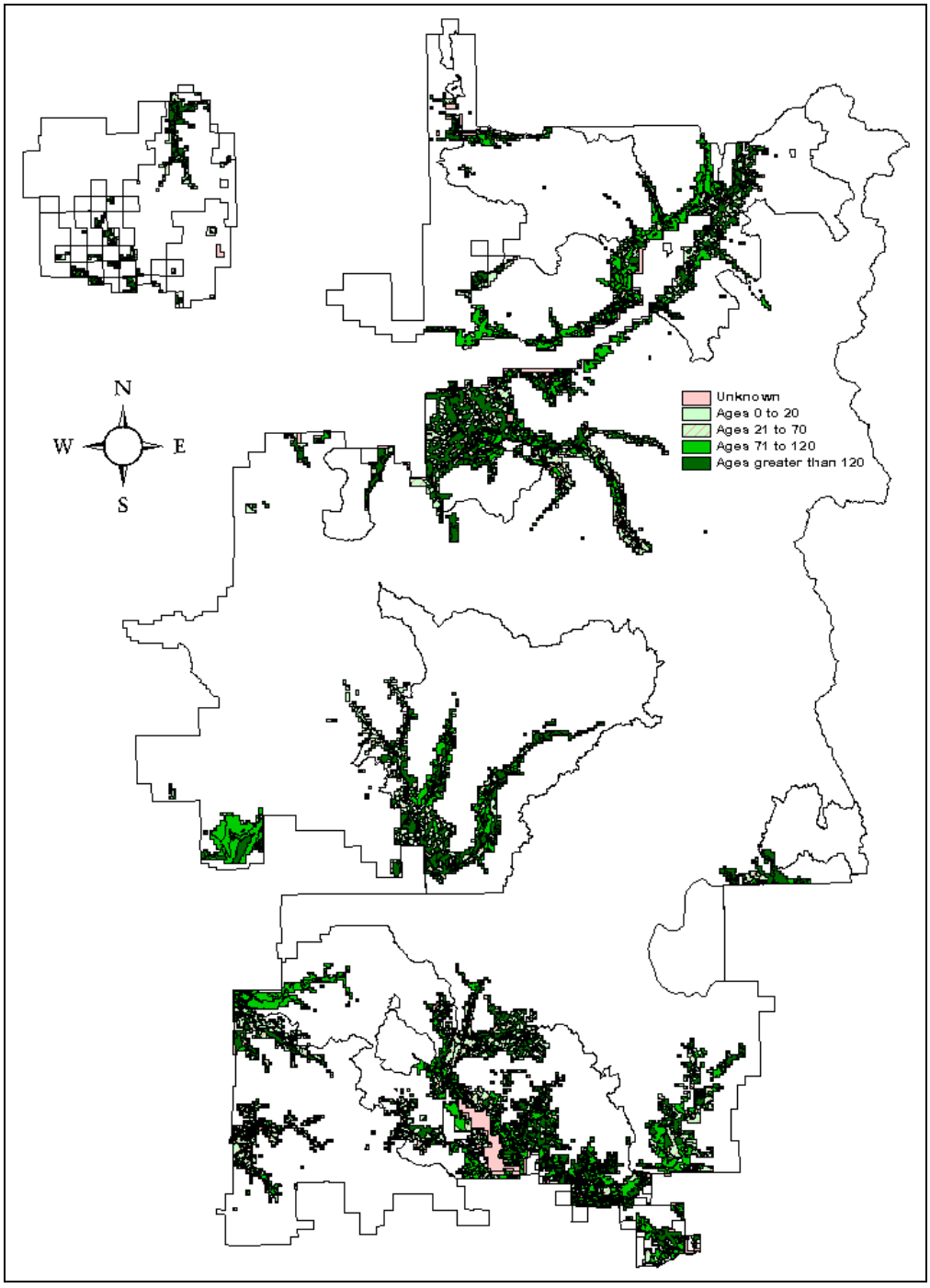
Deer and Elk Winter Range

Two species of high public interest that frequently utilize open habitats are black-tailed deer and elk. Forested stands 0 to 40 years old provide an increased forage base beneficial to deer and elk populations. Stands with large trees (greater than 21 inches) provide optimal cover and have been identified as a critical component of biological winter range (BWR). Optimal cover stands provide forage under a forest canopy that has snow interception capabilities. This capability maintains some forage accessibility when heavy snows bury forage in openings (Witmer et al. 1985). Open habitats are still an important component of BWR because they provide high quantities of forage when snowfall is not excessive.

The LSRs contain 56 percent of the classified BWR found on the forest (see Map 4-2 and Table 4-35).

Table 4-35 overstates usable winter range because it includes areas with non-forested and unknown ecoclass. Currently, 42 percent of BWR in the LSRs are in stands greater than 120 years old. Open habitats only comprise 9 percent of the winter range in LSRs.

Map 4-2 Biological Deer and Elk Winter Range



Wildlife Habitat Relationship Analysis

The program HABSCAPES (Mellen et al. 1995) was used to assess the amount and distribution of habitat for late-successional (large tree) associated species across the Gifford Pinchot National Forest. Wildlife species expected to occur on the Forest were grouped into life-history guilds. Species were first placed into three groups: special and unique habitat obligates, riparian habitat obligates, and terrestrial habitat users. The riparian habitat and terrestrial habitat groups were further divided into guilds.

The terrestrial habitat group was divided into guilds based on combinations of home range size; patch configuration use; and use of open, small tree (less than 21 inches DBH), or large tree (greater than 21 inches DBH) structural habitats.

Table 4-12 Habitat Attributes

Attribute	
Home Range Size (Acres)	**Patch Configuration**
Small <60 Medium 61-1,000 Large >1,000	Patch Mosaic Contrast Generalist

Home range categories include: small (less than 60 acres), medium (60-1,000 acres) and large (greater than 1,000 acres). Patch configuration categories include: patch (uses one homogeneous patch), mosaic (can use aggregate patches in close proximity), contrast (uses two different seral stages in close proximity), and generalist (uses a variety of structural stages).

There are four terrestrial species guilds that use large tree habitat, or a combination of large and small tree habitat as primary habitat for breeding and foraging. These are the species that will be most benefited by the establishment of late-successional reserves. The following is a list of the species found on the Gifford Pinchot National Forest in each of the four guilds.

Guild TLMLT

(Terrestrial, Large home range, Mosaic, Large Tree dependent):

--Northern goshawk
--Pileated woodpecker
--Marten
--Fisher
--Northern spotted owl
--Barred owl
--Marbled murrelet

The marbled murrelet is atypical of this group as it only requires a single late-successional patch within its home range for nesting.

Guild TMMLT

(Terrestrial, Medium home range, Mosaic, Large Tree dependent)

--Black-backed woodpecker
--Three-toed woodpecker

Guild TSPLT

(Terrestrial, Small home range, Patch, Large Tree dependent):

--Pacific slope flycatcher
--Northern Flying squirrel
--White winged crossbill
--Shrew-mole
--Trowbridge's shrew

Guild TSGSL

(Terrestrial, Small home range, Generalist, Small and Large Tree dependent):

--Brown creeper
--Southern red-backed vole
--Hermit warbler
--Townsend's warbler
--Williamson's sapsucker

Maps of suitable habitat for these guilds have been created using HABSCAPES. See Map 4-3 Habitat Conditions - Guild TLMLT through Map 4-6 for a description of habitat conditions for each of these guilds. On these maps, the most important habitat is found in the areas shown as large patch habitat, followed by aggregated patch and dispersed patch. The size of the patch alone, however, is not the only measure of quality. The amount of fragmentation of these patches by natural or created openings is an important consideration.

As would be expected, habitat for species with large home ranges (TLMLT) is most limiting across the Forest, because these species require the most acres of relatively contiguous habitat. Wind, Lewis, Gotchen, Peterson and Quarts LSRs provide the highest amounts of contiguous large-patch habitat for this guild. Mineral, Nisqually, Woods LSRs and the lower elevations of Packwood LSR provide little contiguous habitat for the guild.

Habitat for the TMMLT guild is similar to that of the TLMLT guild. However, due to smaller area requirements of these species, more areas provide contiguous habitat for the guild.

Habitat for the TSPLT guild is fairly widespread throughout the LSRs. However, because most of the species in the guild have low mobility, habitat quality is affected by fragmentation (see connectivity discussion, below).

Since species in guild TSGSL utilize both small and large tree structure stages, and have small home ranges, habitat for this guild is least limiting across the forest. Large amounts of habitat for the TSGSL occur in all LSRs though habitat fragmentation occurs in many areas as a result of recent timber harvest. Also, the southern red-backed vole requires down wood and the Williamson's sapsucker requires snags. These components are missing in much of the small tree habitat. Mineral LSR is the only LSR with large blocks of unsuitable habitat.

All of the LSRs contain large amounts of closed small tree habitat. This structural stage has a high canopy closure that provides cover, but generally lacks structural diversity including multiple canopy layers, large snags and logs. Late-successional habitat is expected to develop in these stands in the next 50 years or so, significantly increasing the size of suitable habitat patches in the LSRs.

The TSGSL (Map 4-6, page 4-34) gives an indication of the expected extent of late-successional habitat in the next 50 years or longer. Thinning these stands and creating snags and down logs would accelerate the development of late-successional forest attributes, while increasing structural diversity in the short-term.

Connectivity

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 (FEMAT p. IV-187). All the LSRs are below the desired condition for amounts of late-successional habitat. The current fragmented conditions in LSRs results in isolation of individuals or small groups of less mobile species. Both may interfere with an LSRs ability to provide for self-sustaining populations.

Wind, Lewis, Nisqually, and Mineral LSRs have relatively large expanses of younger habitat in the middle of the LSRs. Most of this habitat is in the small-tree structural stage and should develop into late-successional habitat in the next 50 years or longer. Silvicultural treatment that accelerates the development of late-successional habitat would be beneficial in these areas. Some of these are 80-100 years of age and would benefit from thinning. Many of the less mobile species are small mammals, terrestrial amphibians and terrestrial mollusks which use down wood. Increasing the level of down wood in these areas should result in increased habitat connectivity for these species.

Each LSR is designed to function as part of a network connected by habitat in the Matrix that allows for dispersal of animals between LSRs (ROD p. B-1, 4; FEMAT p. IV-187). Riparian Reserves were designed to be an integral part of the connectivity between LSRs (ROD p. B-13; FEMAT p. IV-187). Currently, Riparian Reserves are highly fragmented and thus are not providing the connectivity function for which they were designed. On average, (across the range of the spotted owl) the percent of Riparian Reserves (outside LSRs) currently in late-successional habitat is 29 percent (see FSEIS pages 3&4-26, 39, and 41). On the Gifford Pinchot, the percent of Riparian Reserves between LSRs currently in late-successional habitat (large-tree structural stage) ranges from 18 to 46 percent. Mid-seral (small conifer) habitat comprises between 27 to 40 percent of Riparian Reserves between LSRs. Thus, the connectivity function of Riparian Reserves should improve in the next 40 years as the mid-seral stands develop late-seral characteristics. Riparian reserves will recover in the next 40 years. The small conifer habitat type may provide dispersal habitat for some late-successional species. The general lack of down wood, snags, and remnant trees in these stands limits their functionality as dispersal habitat. While there is late-successional habitat between LSRs, current condition of LSRs makes connectivity in the Matrix even more important.

The HABSCAPES maps (see Map 4-3 through Map 4-6) indicate where habitat providing connectivity currently exists. TLMLT and TMMLT species guilds are mobile and thus travel fairly large distances between LSRs. Scattered habitat can provide stepping stones between LSRs for these species. TSGSL species utilize small tree habitat which is currently fairly well connected across the forest, with a couple of exceptions. Connectivity may be bigger problem for TSPLT species and other poor dispersers. These species are unlikely to move very far across non-habitat. Individuals are unlikely to move the full distance between LSRs so individuals must survive in the Matrix to provide connectivity between LSRs.

Connectivity between the LSRs in the north part of the Forest is weak. The Riparian Reserves between Lewis, Quartz, and Woods LSRs, and between Woods and Packwood, contain only 18 percent late-successional habitat. Late-successional habitat (large-tree structural stage) occurs in the Matrix at low levels; 9 percent of unsuitable lands outside Riparian Reserves and 17 percent of suitable lands are in the late-successional habitat.

The connectivity between the Lewis, Wind, Peterson, and Gotchen LSRs in the southern half of the Forest is better than connectivity in the north part of the Forest. Riparian Reserves between Gotchen and Peterson are 30 percent late-successional habitat. The percent of Riparian Reserves in late-successional habitat between Gotchen, Peterson, and Lewis LSRs ranges from 28 to 46 percent (depending on watershed). Between Gotchen, Peterson, and Wind LSRs, the Riparian Reserves ranges from 30 to 46 percent late-successional habitat.

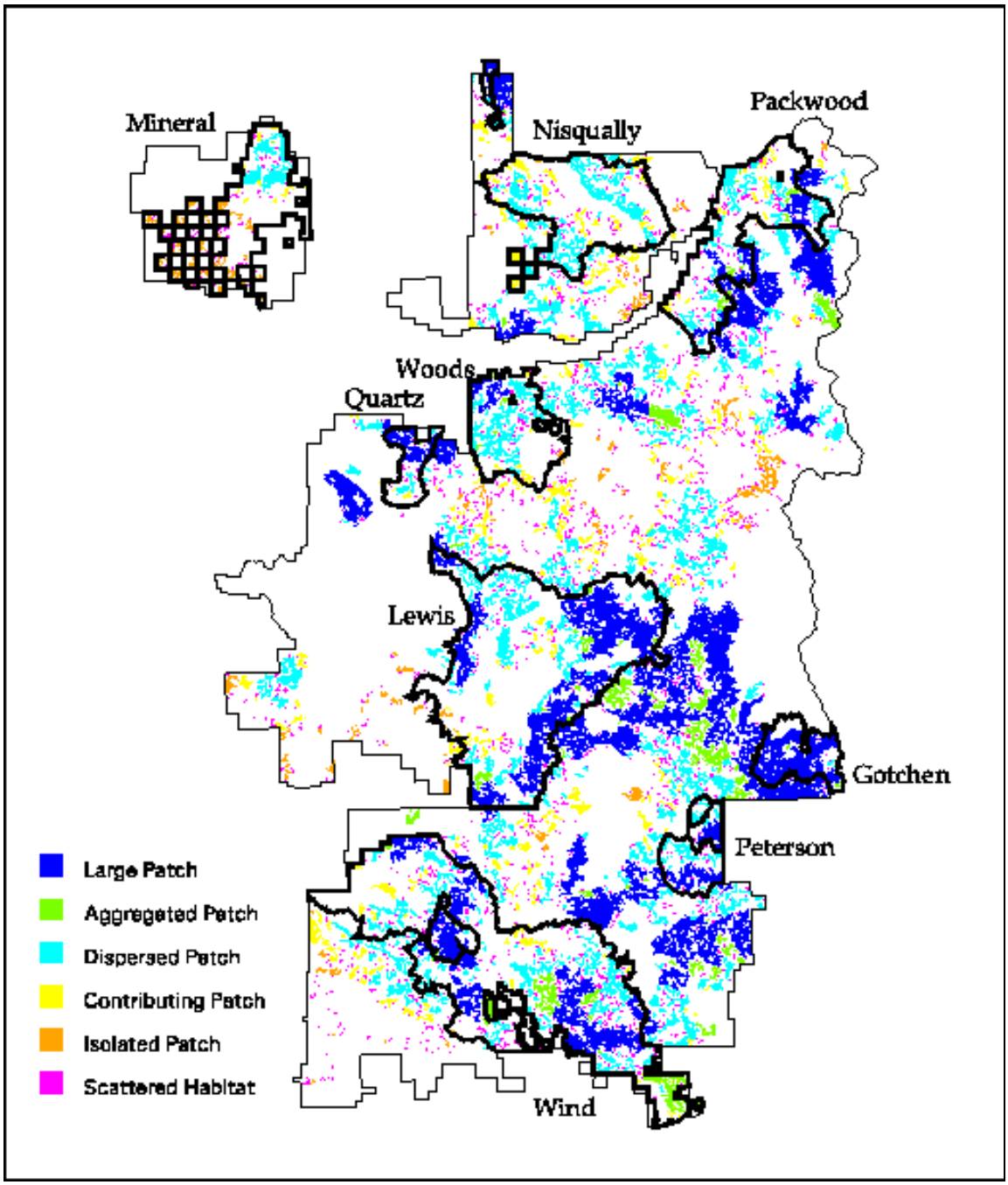
Connectivity between Wind and Lewis LSRs is weaker. Riparian Reserves between Wind and Lewis LSRs average between 20 to 22 percent late-successional habitat, which is below the regional average. Matrix lands between these two LSRs is also about 20 percent late-successional habitat.

There are essentially no linkages between the Mineral LSR and any of the others. The Nisqually LSR appears to be isolated from other LSRs, as well, especially for less mobile species such as amphibians and small mammals. The private, developed land along the Cowlitz River is a barrier to movement. An east-west linkage between the Nisqually and Packwood LSRs through the Tatoosh Wilderness is unlikely to be used by less mobile species because of the barrier formed by the Tatoosh Range.

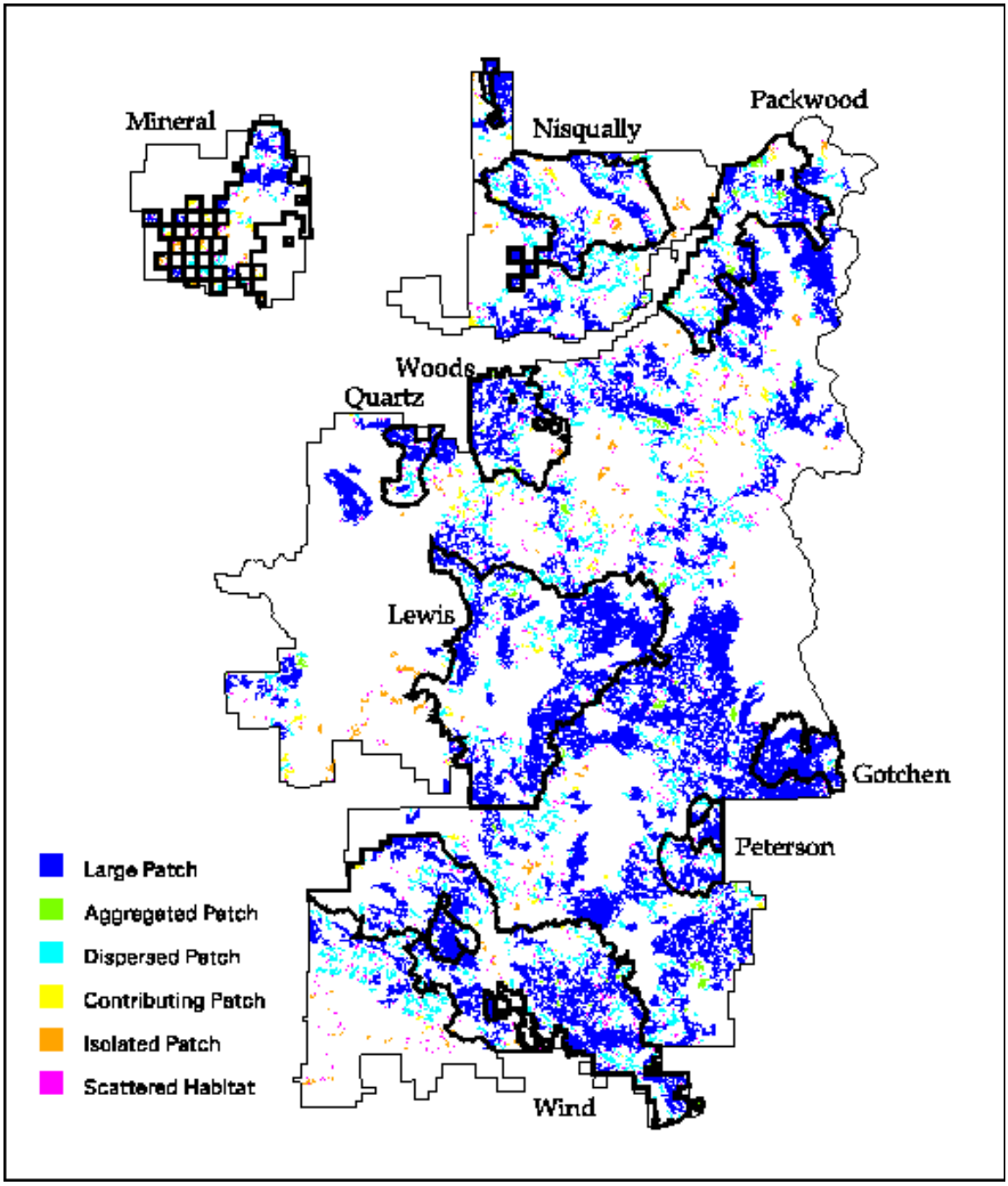
Roads can cause fragmentation of habitat for some species, resulting in isolated populations. This concern is highest for species with very low mobility such as amphibians, mollusks, and arthropods which rely on microhabitats. Mortality of dispersing individuals may be high on wide, well-traveled roads due to dehydration, increased predation or "roadkill." (Fahrig et al. 1995).

Major roads bisect LSRs and create barriers to movement between LSRs. Wind, Peterson, Lewis, Gotchen, Packwood, and Nisqually LSRs are all bisected by major forest roads. State highways present barriers between Nisqually and the other LSRs and Mt. Rainier National Park.

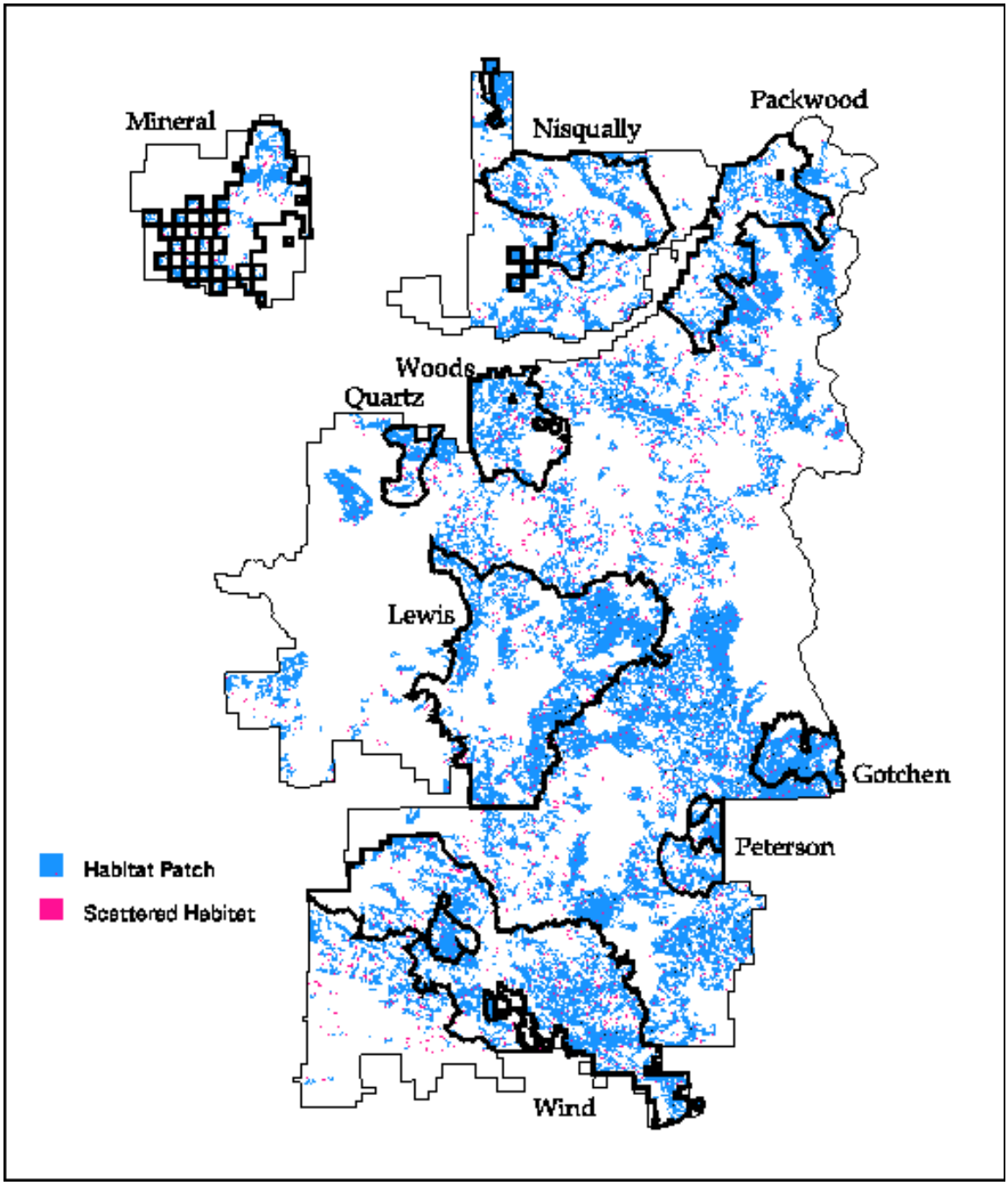
Map 4-3 **Habitat Conditions - Guild TLMLT**



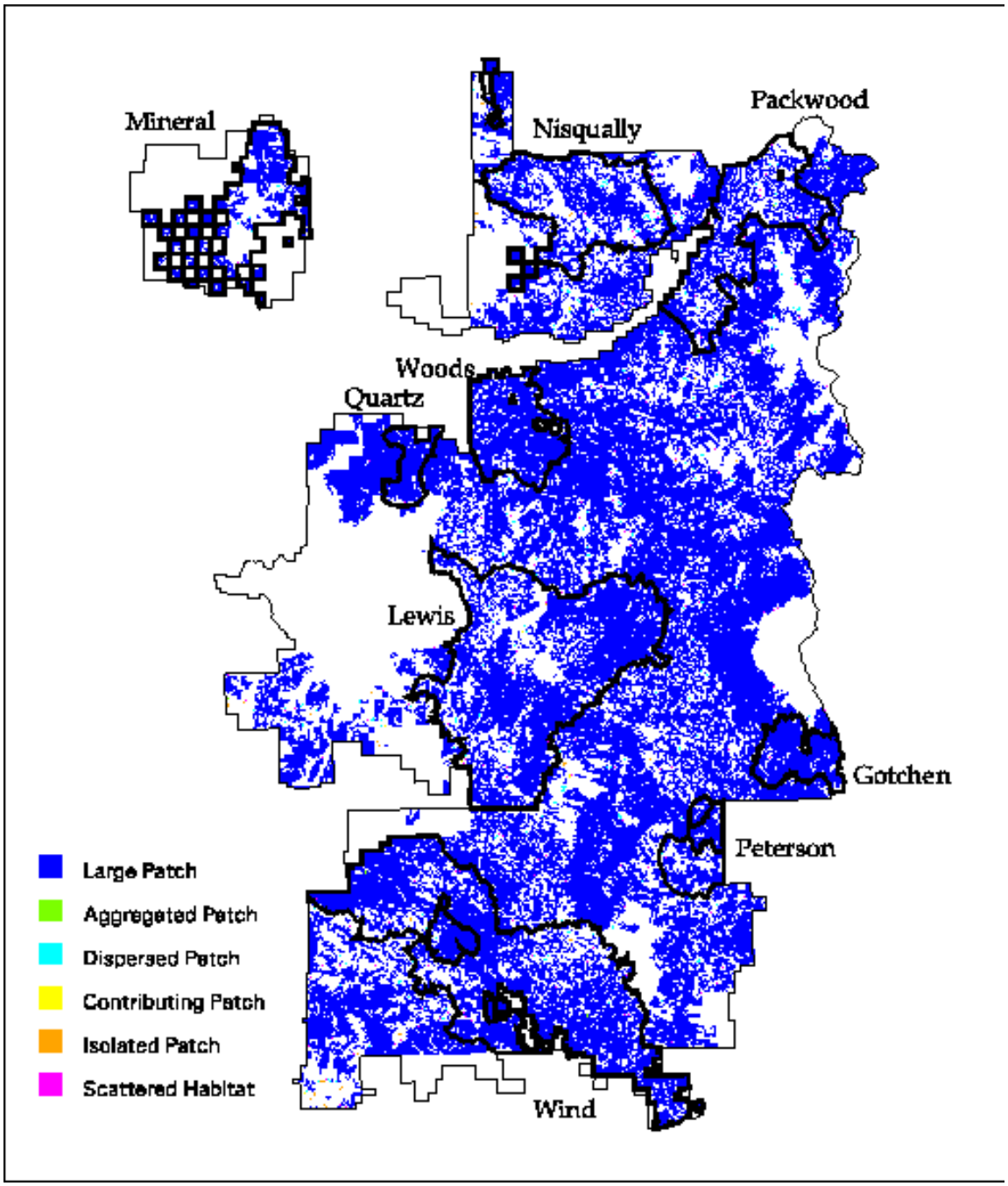
Map 4-4 **Habitat Conditions - Guild TMMLT**



Map 4-5 Habitat Conditions - Guild TSPLT



Map 4-6 Habitat Conditions - Guild TSGSL



Disturbance Regimes

LSRs on the Gifford Pinchot National Forest are subject to a wide range of biological and physical disturbance agents. Disease, insects, animals, and people are the biotic agents. Fires, floods, landslides, ice and snow, and wind are some of the common physical agents. With the eruptions of Mount St. Helens, we have witnessed one of the less common yet very dramatic physical agents.

Disturbance agents may act alone, but more often they act in concert with other agents. A lightning killed tree may brood bark beetles that attack neighboring trees the following spring. Grand fir defoliated by spruce budworm may succumb to Armillaria root disease. While the intensity of any one fire depends on many factors, the potential for destructive stand replacing fires can be enhanced by the build-up of dead and downed trees killed by insects and disease. On a stand level, disturbance regimes can either reset or advance succession depending on how many and which trees are killed. The following discussion focuses on insects, disease, wind, and eruptions. Fire is covered in Chapter 6.

Insects and Disease

In the west Cascade LSRs, insects and diseases typically cause the death of individual trees and groups of trees, and often work together on stressed trees.

Each conifer species has its own associated and indigenous root and stem fungi, mistletoes, rusts, and foliage and phloem eating insects. There are also introduced pathogens such as the white pine blister rust that has had a pronounced effect on native five-needle pines.

Important among the insects and disease west of the Cascade crest are Douglas-fir bark beetles and laminated root rot. Both are widespread and cause numerous gaps in mature forests dominated by Douglas-fir. Most mortality pockets from this insect and disease rarely exceed ten acres.

Other insects and disease have the potential to cross this threshold only when there are pure stands of host species. Overall, insects and diseases on the west side typically create fine scale disturbances that advance stand-level succession. They create small gaps in the overstory that characterize the transition and shifting-gap stages of old-growth forest development. They are also responsible for the development of essential structures (snags and downed logs) used by many late-successional wildlife.

The drier environments east of the Cascades place trees under greater moisture stress, while at the same time favoring some insects and diseases. Within the grand fir zone, the selective removal of large ponderosa pine and the exclusion of fire has led to greater tree densities, primarily grand fir and Douglas-fir, which further accentuates the problem. Consequently, insects and disease have a greater potential to degrade entire stands. Important pathogens include: laminated, Armillaria, and annosus root rots; mountain, fir engraver, and Douglas-fir beetles; and western spruce budworm of late.

Western spruce budworm (Choristoneura occidentalis Freeman) consume the foliage of a wide range of conifers, but there are four principal host species on the Gifford Pinchot; they include grand-fir, Douglas-fir, subalpine fir, and Engelmann spruce. Budworm occurs within the grand fir and subalpine fir/lodgepole pine zone. Stands

on the drier end of the grand fir type appear to be more vulnerable to severe damage by budworm, as are stands with high densities and high proportions of the principal host species.

Wind

Wind causes mortality at both small and large scales. Most mortality from wind is widely scattered throughout mature forests, toppling trees already structurally weakened often by root disease. Large acres of continuous windfall typically occur along created forest edges (cutting unit boundaries) where high water tables limit rooting depths, and/or the topography accentuates wind speeds. It seems most catastrophic blowdown events have occurred on the westside, as though the storm winds lessen after crossing the Cascade Crest.

Volcanic Eruptions

The presence of Mount St. Helens within this province introduces a unique disturbance agent. While major events occur at longer intervals than stand replacing fire, volcanic eruptions are the epitome of catastrophic disturbance. Ash fall from even minor eruptions can cause mortality. Following the 1980 eruption of Mount St. Helens, true firs beyond the blast zone were killed by the settling of volcanic tephra on the upper side of needles. Ash and pumice deposition from eruptions, several hundreds to several thousands of years ago resulted in widespread mortally. Late-successional and old-growth forest in the Lewis, Woods, and Quartz LSRs were affected.

Fire

Historically wildfires have been a major agent of natural change in the forest landscape. Fire has been an integral part of the forest ecosystem, affecting wildlife habitat, vegetation dynamics, soil properties and watershed hydrology. It appears that large, infrequent, high-intensity, stand replacement fires occurred throughout the area prior to European settlement in the mid 1800s. Historically, the Yakama, Klickitat, and Cowlitz Tribes set fire to logs for drying berries, and lingering fires sometimes spread. Fires may have also been set intentionally to maintain berryfields or keep hunting areas open. Non-Native American settlement around the area began in the 1850s, and many fires were set to clear land.

Fires are infrequent (50 to 400 year intervals) but can be catastrophic in their effects. Highly productive and long-lived tree species associated with Douglas-fir stands accumulate great quantities of intermediate to large class fuels. Fine fuels, the most readily ignitable, are present in a relatively small amount. Fine fuels reach their maximum dryness in July and August, while the larger fuels do not usually dry out until September. Most of the fires in any given year occur in July and August, but the majority of these are less than 10 acres in size. Most of the larger fires, and virtually all of the catastrophic fires, occur during September, or from late August to early October. Fire behavior, fuels conditions, fire risks and historic fire occurrences are discussed in Chapter 6, Fire Management Plan.

Human Uses

The following human uses are common within LSRs across the Forest. See individual LSR descriptions below for unique activities.

- **Administrative Sites:** Wind River Ranger Station, Wind River Nursery, seed orchards
- **Facilities and Recreation:** There are numerous facilities and trails currently in use within LSRs. They fall into the following categories:

  --Campgrounds
  --Interpretive Sites
  --Motorized and Non-motorized Trails
  --Trailheads and Sno*parks
- Hunting and fishing administered by Washington State
- Rock quarries
- **Utility Sites:** power lines, telecommunications installations, weather stations, etc.

Special Forest Products

Special Forest Products (SFP) encompass most vegetative materials removed from the forest with the exception of saw logs.

The four use categories of Special Forest Products allowed to be collected within the Late Successional Reserve include:

1. **Tribal Use:** Special forest products have been gathered by native peoples for thousands of years for important food, craft, medicinal, and cultural uses. Their right to gather these products is established by treaty with the federal government. Nothing in NWFP and Gifford Pinchot Forest Plan direction is intended to conflict with or restrict Treaty rights of the tribes. The Yakama, Nisqually, Puyallup, Squaxin Island and Steilacoom Indian Tribes have treaty rights on the Gifford Pinchot National Forest.

   Traditional non-commercial are gathered by American Indians affiliated with a recognized tribe for cultural, spiritual, and medicinal use. Known materials collected include huckleberry (*Vaccinium* spp.), bitter root (*Lewisia rediviva*), Cedar bark and *root (Thuja plicata*), Pacific Yew wood (*Taxus brevifolia*), poles from other evergreen trees and several ferns and grasses.
2. **Incidental Use:** On-site product consump-tion/use, usually associated with recreation activities. Items include edible berries, nuts and mushrooms, firewood, poles, and post. (Tribal and incidental uses are not regulated by a permit process. Personal and Commercial use are regulated).
3. **Personal Use:** Collection of materials for personal use/consumption, not to be sold. At this time, “free use” permits are issued for edible berries (huckleberries) and edible mushrooms. Mushroom gathering is limited to three gallons a day per person for ten days per calendar year. Other materials collected for personal use include Christmas trees, evergreen boughs and cones. Firewood is available at times along road right-of-ways or other designated sites. Brush harvest, cuttings, young trees and plants may also be removed along existing road right-of ways.

4. **Commercial Use:** Collection of materials for the primary purpose of sale, resale or use in a manufacturing process resulting in a finished product that will be sold. Commercial permits are sold for the collection of floral products that are harvested in a manner that does not kill or destroy the plant. Products collected at present include huckleberry (*Vaccinium* spp.), salal (*Gaultheria shallon*), western sword fern (*Polystichum munitum*), beargrass (*Xerophyllum tenax*), Oregon grape (*Berberis nervosa*), scotch-broom (*Cytisus scoparius*) and many species of evergreen boughs. Commercial permits are issued for edible berries (primarily huckleberries) and edible mushrooms. Major species of mushrooms collected include chanterelles (*Cantharellus* spp.), boletes (*Boletus* spp.), matsutake (*Tricholoma* spp.), and morels (*Morchella* spp.).

Commercial harvest by non-Native Americans of mosses, lichens and other plant species of concern (medicinal plants) that are killed during collection is not allowed within the LSR.

Special Forest Products Identified by Produced Type: (Floral Greens - cuttings or portions of plants materials that do not kill the plant.)

- Beargrass (*Xerophyllum tenax*)
- Christmas Ornamentals - these are Christmas trees, boughs and pine cones taken from most coniferous species.
- Dwarf Oregon Grape (*Berberis nervosa)*
- Huckleberry (V*accinium* sp.)
- Salal (*Gaultheria shallon*)
- Scotchbroom (*Cytisus scoparius*)
- Western swordfern (*Polystichum munitum)*

Wild mushrooms - there are many species of edible and non-edible mushrooms collected on the Forest. Know harvested species include:

- Bear tooth (*Hiericium abietis*)
- Boletus (*Boletus* sp.)
- Chanterelle (*Cantharellus* sp.)
- Chicken-of-the-Woods (*Laetiporus sulphureus*)
- Coral fungus (*Ramaria* sp.)
- Indian Paint Fungus (*Echinodontium tinctorium*)
- Lobster Mushroom (*Hypomyces lactifluorum*)
- Matsutake (*Tricholoma magnivelare*)
- Morels (*Morchella* sp. and *Verpa* sp.)
- Tooth fungus (*Dentinum repandum*)

Other products harvested include:

- Edible fruits, seeds, nuts and berries.
- Medicinal plants and roots.
- Fuelwood products from road prisms or other designated sites.
- Transplants of shrubs, trees and forbs from road right-of-ways.

Grazing

There are three allotments on the Forest: Twin Buttes Sheep and Goat Allotment, Mt. Adams Horse and Cattle Allotment, and the Ice Caves Cattle and Horse Allotment. These allotments overlap 100 percent of the Gotchen and Peterson LSRs and 8 percent of the Lewis LSR (see and Table 4-13). Current use of the allotments is a total of 1150 head of sheep and 716 head of cattle over a four-month period (June to September).

This area has a long history of sheep and cattle grazing. Records from 1890 indicate 100,000 head of sheep and 1,500 head of cattle grazed on the Gifford Pinchot National Forest. Most of this occurred in the Mt. Adams area, and would have included lands now within the Gotchen and Peterson LSRs. By 1968, 1000 head of sheep and 300 head of cattle were reported to have used the Forest.

Table 4-13 LSR and Grazing

LSR	Allotment	Allotment Ac in LSR	% LSR in Allotment	Allotment Head
Gotchen	Mt. Adams	15,154	100	516 Cattle
Peterson	Ice Caves	13,657	88	200 Cattle
Peterson	Twin Buttes	1,854	12	1150 Sheep
Lewis	Twin Buttes	9,263	8	1150 Sheep

Table 4-14 Current and Projected Levels of Transitory Range in LSRs.

LSR	Current Transitory Range	Projected Transitory Range (2005)
Gotchen	1056 (7%)	1069 (7%)
Peterson	2371 (15%)	684 (4%)
Lewis	1741 (19%)	469 (5%)

--Current range is plantations < 30 years old.
--Projected based on plantations < 20 years old except < 30 for Gotchen.

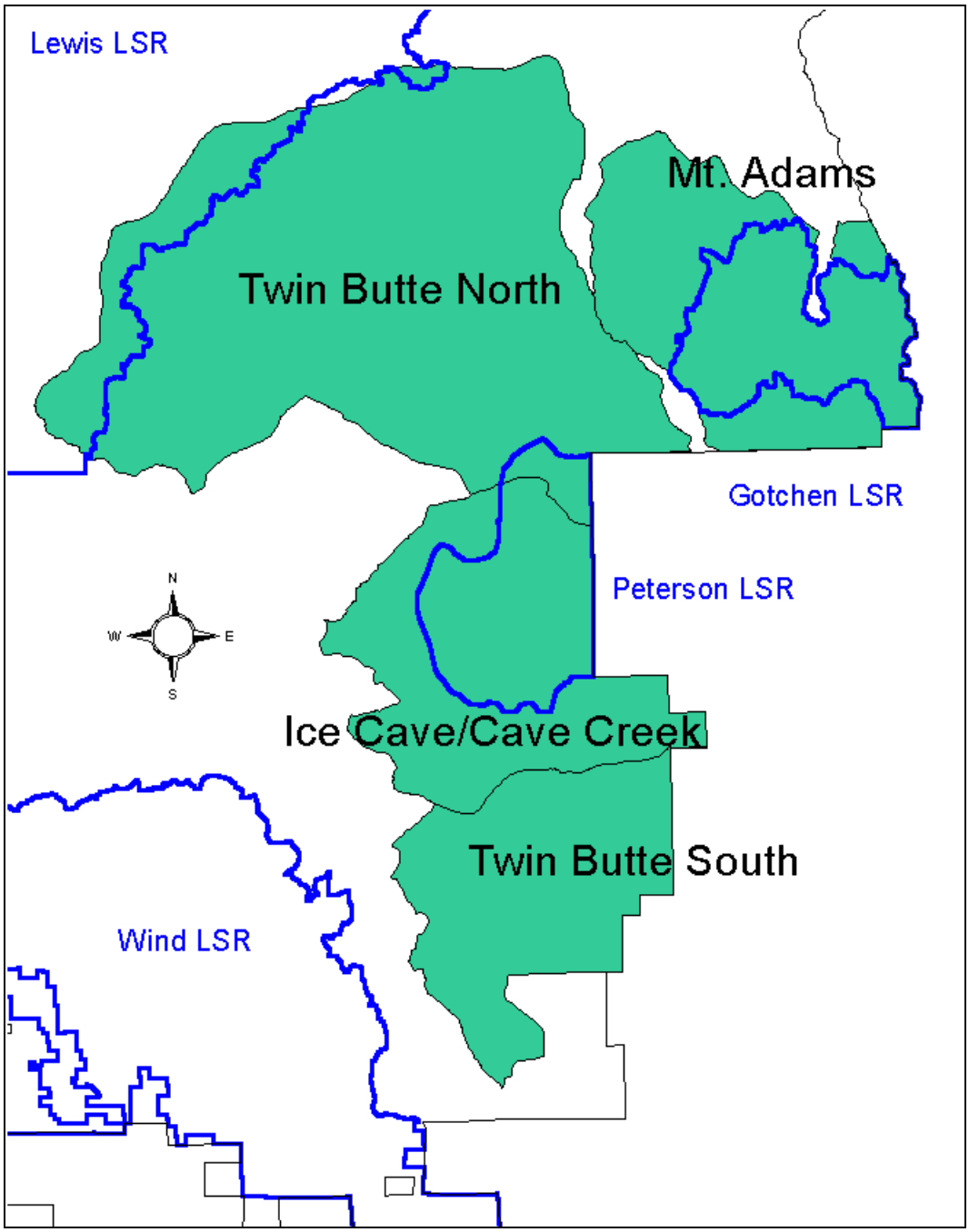
Plantation Management

Site preparation, reforestation, animal damage control, and sapling thinning are ongoing activities for recently harvested lands within the LSR.

Roads

Road densities within LSRs are listed in Table 4-39, page 4-120. Primary arterial roads that provide access to popular recreation sites have higher scenic standards along the road and its viewshed. Road maintenance is recurrent along the main arterials and as needed on secondary roads. Road closure, decommissioning, or obliteration has occurred on selected secondary roads in keeping with the Forest Access and Travel Management Plan.

Map 4-7 Gifford Pinchot National Forest Grazing Allotments



4-2 LSR Scale Existing Condition

The following is a description of existing conditions specific to individual LSRs. Aspects of the existing condition which are not described at the Forest-wide scale are emphasized here. To obtain a complete picture of the existing condition for an LSR, both sections must be reviewed. LSR descriptions follow in alphabetical order.

Gotchen LSR Riparian Conditions

Existing conditions and functions for riparian resources are described in the *Upper White Salmon Watershed Analysis* (1995) and not repeated here.

Unique Species and Habitats

The Gotchen LSR contains a high percentage of large patch habitat (see Map 4-3, page 4-31) which extends well beyond the LSR boundary on the south and west sides. The available habitat is relatively unfragmented. The LSR contains no isolated or scattered habitat patches, indicating that all of the suitable habitat is useable by the species in the TLMLT guild.

The structural stage map (Map 4-10, page 4-47) indicates that the central portion of this LSR is dominated by stands of small tree habitat. While these stands would not contain the same habitat qualities of large tree habitat, they serve to reduce the effects of fragmentation of the large tree habitat (edge effects).

Unique botanical areas include Smith Butte (proposed RNA) and Gotchen Creek Meadows. Quaking aspen, which is limited on the Forest, is present in these meadows and surrounding forests.

Pine broomrape, a sensitive parasitic species, also occurs in this eastside environment. Fringed pinesap, a sensitive species present throughout the Forest, also occurs in this LSR.

Ponderosa pine habitat for protection buffer species, flamulated owl, pygmy nuthatch and white-headed woodpecker, occurs in this LSR.

Goshawk nests, a heron rookery, and northern spotted owl nests are the known wildlife special sites.

The Gotchen LSR contributes to 12,414 acres or 35 percent of Critical Habitat Unit WA-42. (See Map 4-1, page 4-22.)

There are 6 northern spotted owl nest sites within this LSR and 6,700 acres of nesting, roosting, and foraging habitat.

Vegetation Conditions

The Gotchen **LSR is** almost entirely described by the grand fir plant zone. Late-successional stands in the Gotchen LSR are composed primarily of grand fir, Douglas-fir, and ponderosa pine, with a few western white pine, western larch, and lodgepole pine present. Old-growth, where present, is usually ponderosa pine or Douglas-fir, with a few western larch. Grand fir and Douglas-fir make up a second stand canopy layer that has been established since fire exclusion. The number of trees in this second canopy layer exceeds the number of old-growth trees. In many stands, older ponderosa pine and Douglas-fir have been removed, leaving primarily younger (80-100 years old) Douglas-fir and grand fir.

Stands are much more dense, for the most part, than in the past. Historically, many stands were composed of older ponderosa pine and Douglas-fir, with less grand fir understory than is now present. Today, many stands today exceed 200 trees per acre in smaller grand fir and Douglas-fir stems. Patch clearcuts, created in the past 20 years or so, are primarily composed of planted ponderosa pine, Douglas-fir, and minor amounts of western larch and other species.

Stands are likely at or near the upper end of their range of variation, in terms of stand density. In the past decade or more, increased tree mortality from agents such as fir engraver, Armillaria root disease and, more recently, spruce budworm are partly the result of changing stand composition toward tree species susceptible to these agents, and increased stand density.

Snags and Down Wood

Data from the Forest's Continuous Vegetation Survey shows the following averages for snags and down logs in stands over 80 years old. The sample size for this data was small and observations contained a great deal of variability.

Table 4-15 Down Wood - Gotchen LSR

Large end Diameter	Pieces per acre	Cumulative Length per Acre	Percent Ground Cover
9 inches	213	3,392 feet	6

Table 4-16 Snags - Gotchen LSR

Average DBH	Snags per Acre
14 inches	41

Disturbance History

Fire

Fire behavior, risk and occurrence is described in Chapter 6, Fire Management Plan.

Because this LSR borders on wilderness areas it may be at a greater risk from wildfire because we are limited in our ability to aggressively suppress wildfire in wilderness areas.

Insects and Disease

The Gotchen LSR is in the midst of spruce budworm outbreak. Noticeable defoliation began in 1994. The affected area now includes most all of the Gotchen LSR along with Yakama Indian Nation, Washington State Department of Natural Resources, and private lands to the east in the Glenwood area. Spruce budworm outbreaks occur periodically lasting for approximately 10 years. However, there are no historical records (since 1947) of budworm outbreaks on the Gifford Pinchot National Forest (Dolph 1980), nor has it been detected in the regional cooperative annual aerial detection surveys 1980-1993. The severity of the current outbreak is light, defoliation and some top kill. Being on the western edge of the outbreak area, a slightly higher moisture regime may temper the ultimate impact of this outbreak on the Gotchen LSR. However, there are many stands that are very susceptible. Their structure and density carries a high hazard potential to spruce budworm. To the extent standing dead and down fuels increase, the hazard potential for catastrophic fire also increases.

Historic Uses

In the 1940s, timber management began in this area. At that time, early seral tree species were still quite dominant. In 1942, stand volumes in the White Salmon working circle (which included the Gotchen LSR) were still over 50 percent ponderosa pine, and over 80 percent either ponderosa pine or Douglas-fir. Early railroad logging in the Gotchen LSR area emphasized selective removal of ponderosa pine, accelerating the changes in species composition brought on by fire exclusion. Timber management into the 1980's emphasized maximizing wood fiber yield. Silvicultural prescriptions proposed thinning of stands, along with removal of ponderosa pine and Douglas-fir overstory, to favor growth of grand fir understories. Clearcutting increased in the 1980s, partly as a result of mortality or loss of vigor in maturing grand fir stands. Clearcuts were regenerated primarily with ponderosa pine and Douglas-fir.

Current Human Uses

Facilities

Morrison Creek Campground, Morrison Creek Horse Camp, Whicky Shelter, Gotchen Guard Station, Cow Camp and Smith Butte Sno*Park are developed recreation sites located within the Gotchen LSR.Trails

Popular trails are Pinway (#71), Snipe (#11) Cold Springs (#72), Gotchen (#40), and Morrison (#39). Winter use (skiing and snowmobiling) originates from Smith Butte and Pineside Sno*Parks and is primarily along existing roads.

Roads

Forest Road 80 provides access to the popular Mt. Adams South Climb trailhead and three campgrounds. Road 82 provides access to Bird Creek Meadows on the Yakama Indian Reservation, and the Smith Butte Sno*Park. Scenery along both roads is maintained at higher standards (retention VQO). Road density at 2.5 miles per square mile is in the mid-range of road densities within LSRs on the Forest. (See Table 4-39, page 4-120 and Map 4-53, page 4-115.)

Winter Recreation

The Gotchen LSR is a popular destination for snowmobilers and cross-country skiiers. Portland/Vancouver area skiiers favor the Smith Butte area for its dryer eastside snow conditions.

Special Forest Products

Gotchen LSR is one of the few areas on the Forest where morel mushrooms are harvested each spring. Matsutake are also collected in the fall months. Huckleberries are generally of high quality in this area. Demands for other special forest products is minimal as compared to other LSRs but a few permits have been issued in past years for personal use firewood, poles, post, and transplants.

Special Uses

The only special use permit in effect in the Gotchen LSR is for occupying a government-owned residence.

Grazing

The entire LSR is overlapped by the Mt. Adams Cattle and Horse Grazing Allotment. The LSR comprises 46 percent of land base in this allotment. Approximately 516 head use this allotment from June to September. A developed water system including eight troughs dispense water for permittee cattle. Cow Camp, an administrative site used primarily by the permittee, is also located within the LSR. With this allotment, the Forest Service participates in the King Mountain Coordinated Resource Management Plan, the local grazing cooperative which includes the Mt. Adams Cattle Association members, Yakama Indian Nation, Champion International, Washington State DNR and DFW, and the U.S. Natural Resources Conservation Service. This area covers 73,822 acres, with about half being on National Forest land.

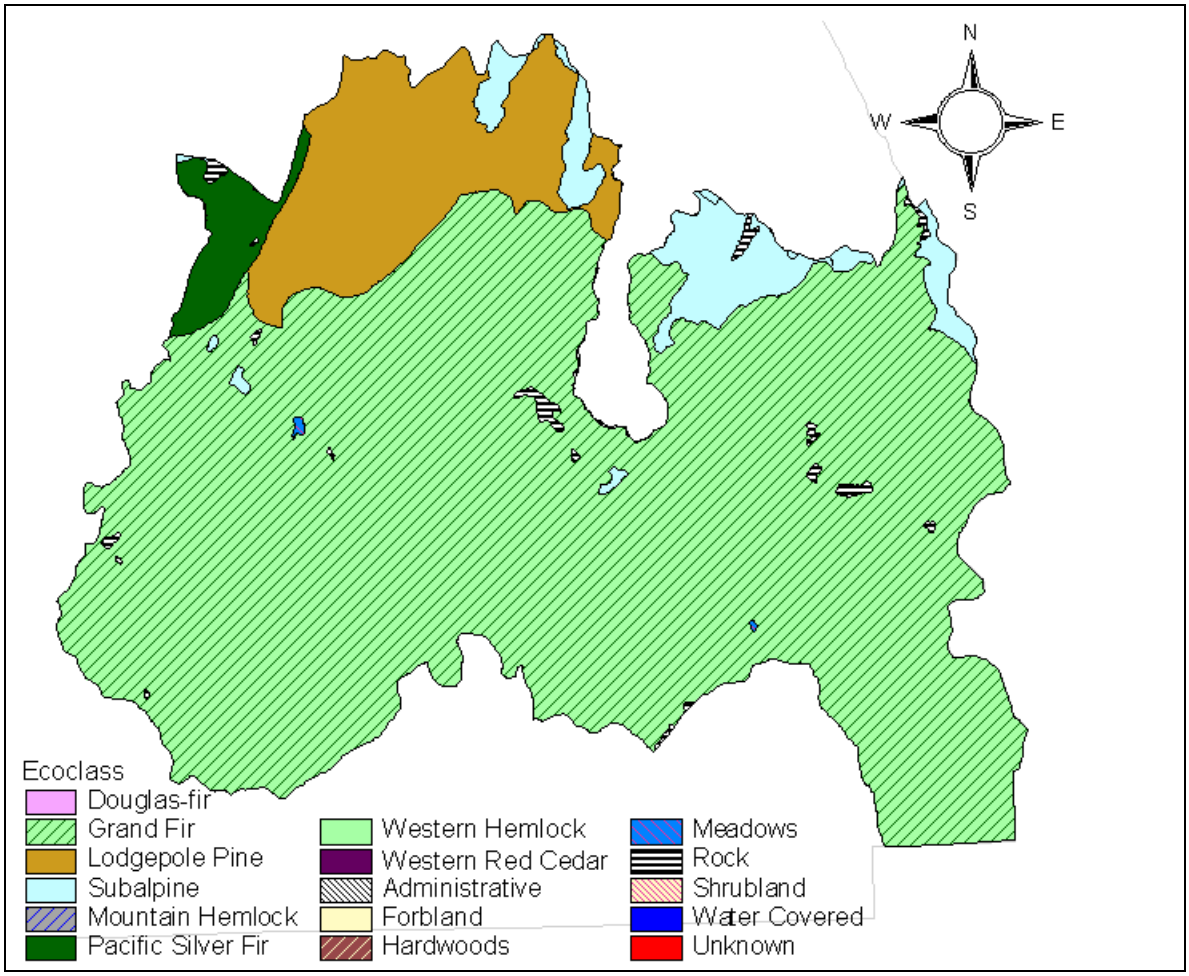
Social Significance

The entire LSR was ceded to the U.S. under the 1855 Yakama Indian Treaty. Per this treaty, the Yakama Indians retained the rights to traditional uses.

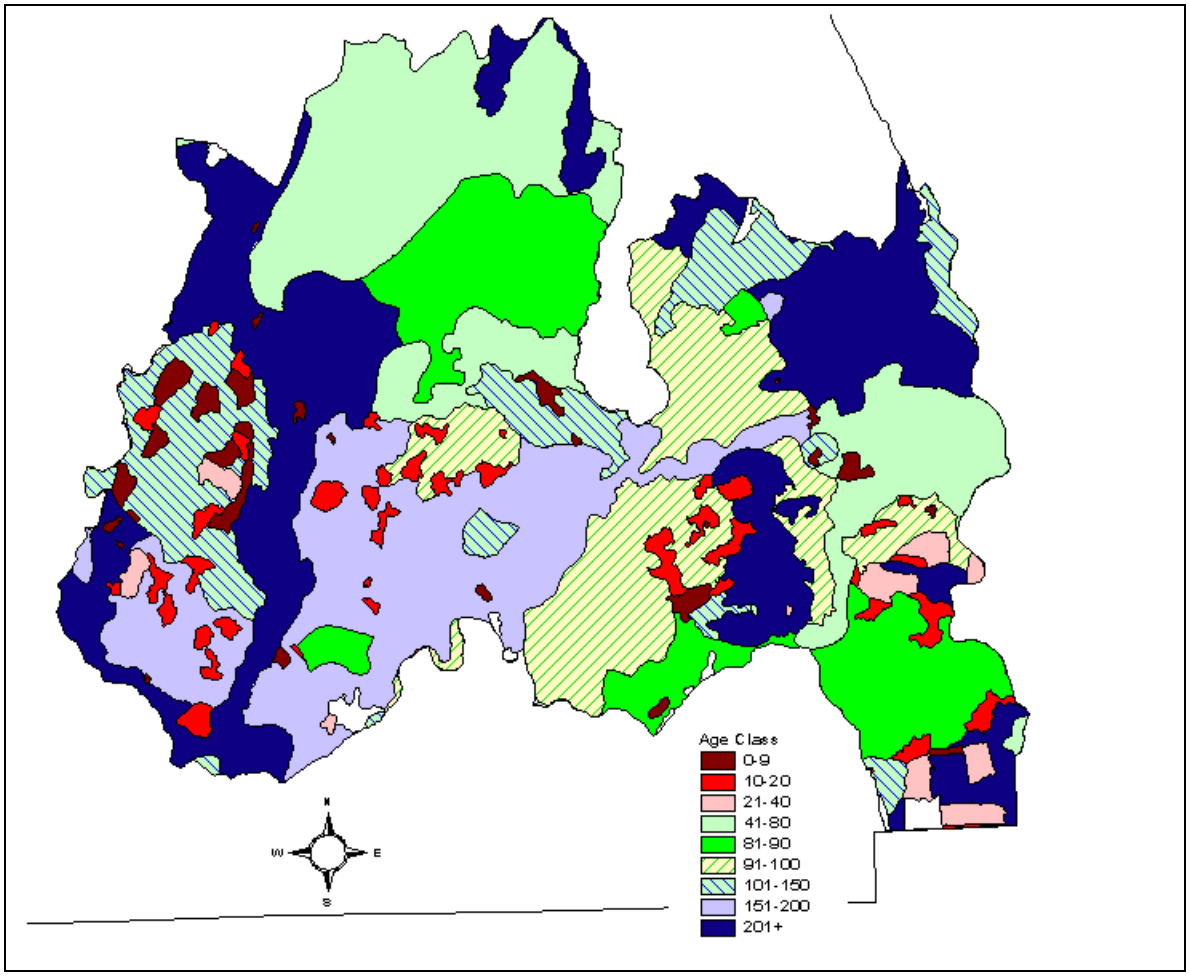
The north half of the LSR lies within the 6600 acre Gotchen Creek RARE II roadless area. Gotchen Creek Guard Station and Wicky Creek Shelter are managed as Special Interest/Historic Sites.

A portion of the White Salmon River, which is the southwest boundary of the Gotchen LSR has been recommended as a Wild and Scenic River with a “Scenic” designation. Forest Plan direction provides for protection of the values which contributed to this recommendation until eligibility studies and Congressional designations are completed.

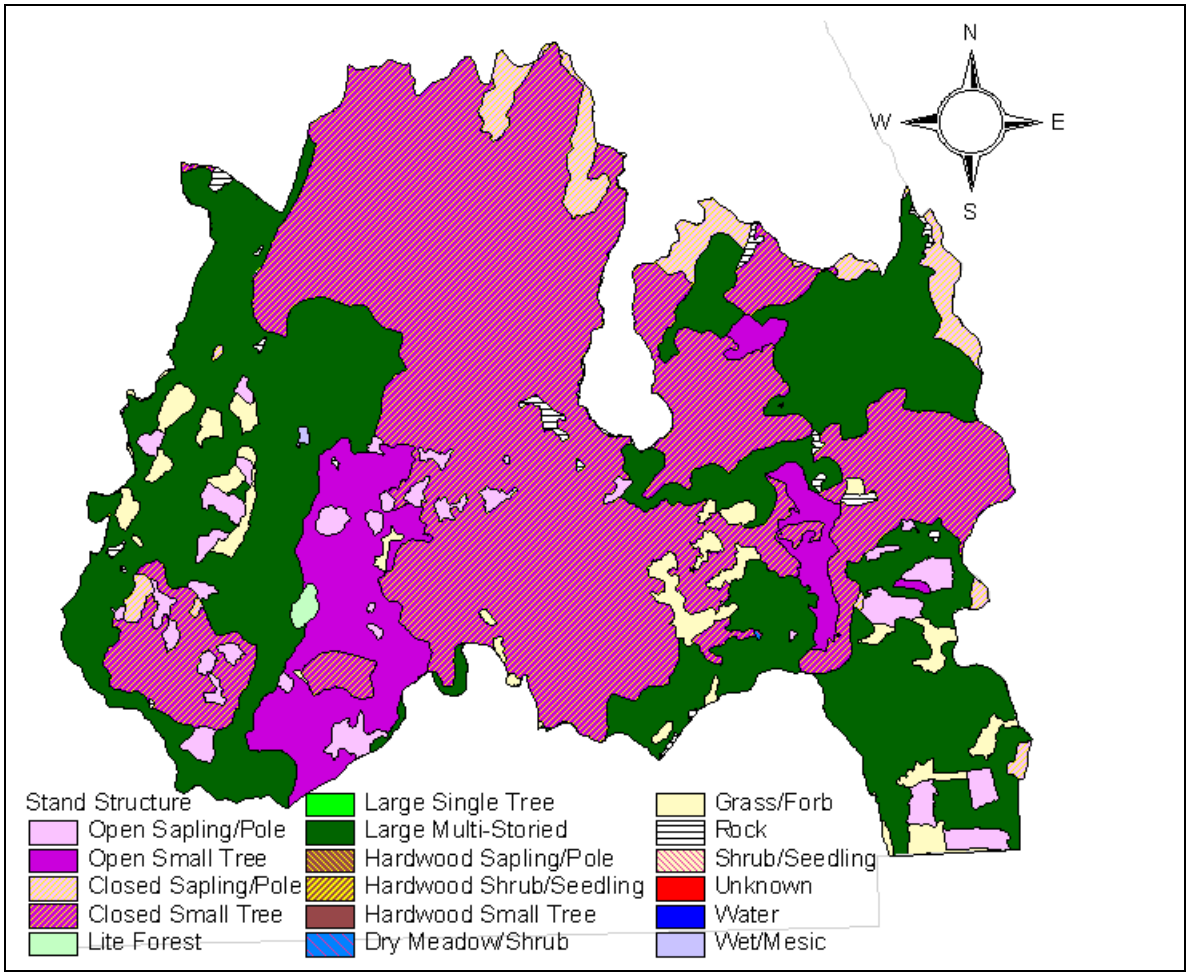
Map 4-8 Gotchen LSR Ecoclass



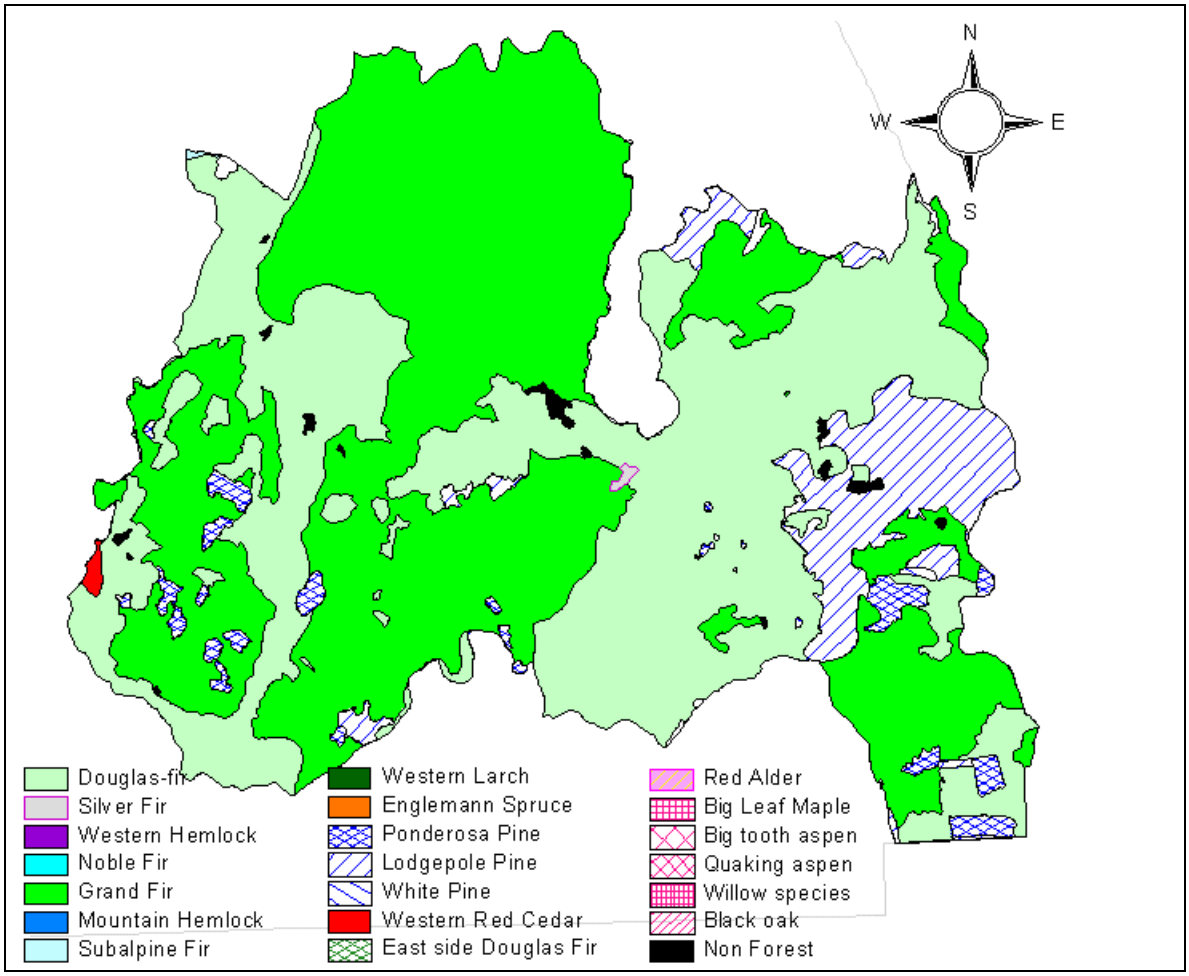
Map 4-9 Gotchen LSR Age Class



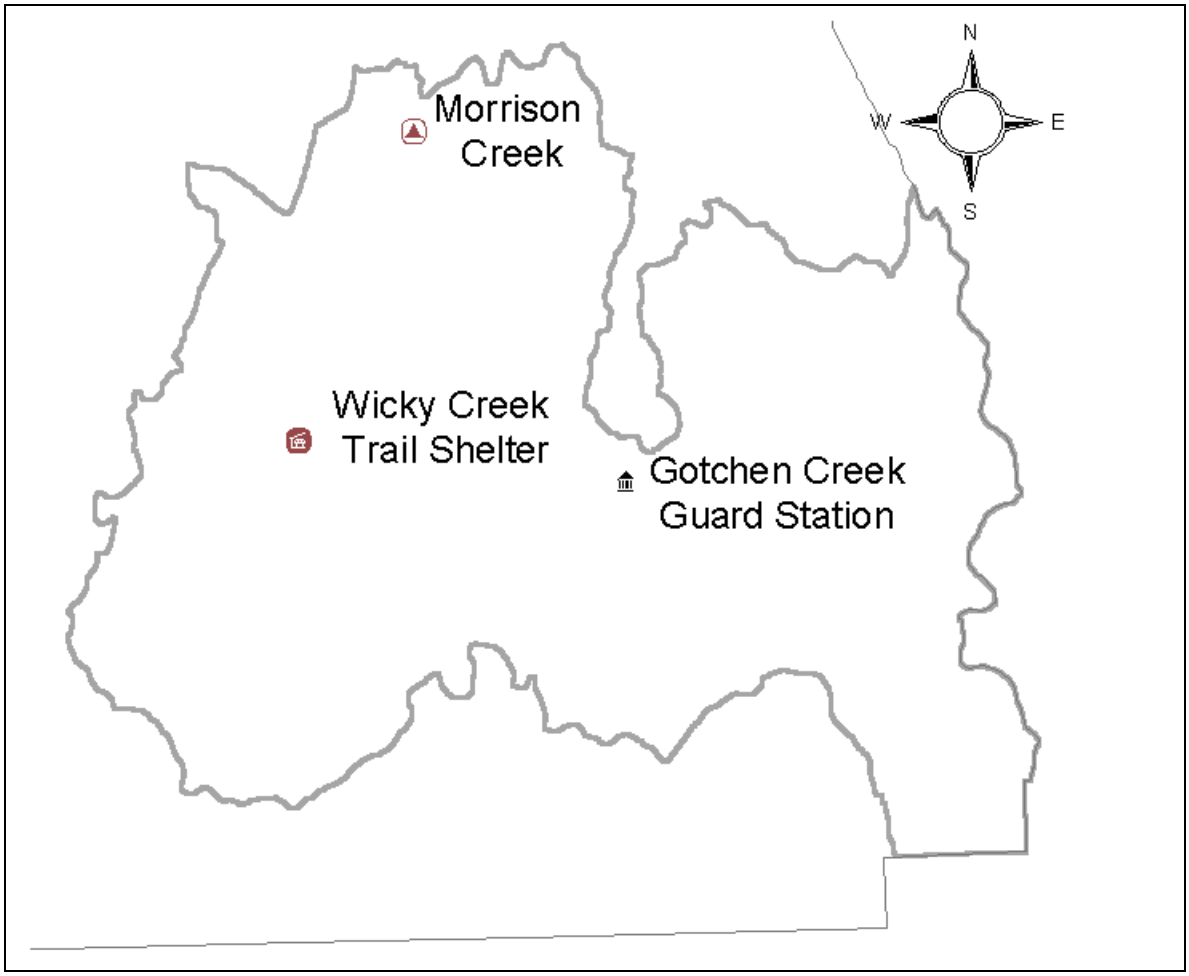
Map 4-10 Gotchen LSR Stand Structure



Map 4-11 Gotchen LSR Dominant Tree Species



Map 4-12 Gotchen LSR Special Sites



Lewis LSR

Riparian Conditions

Existing conditions for riparian resources and functions are described in the *Upper North Fork Lewis River, Middle North Fork Lewis River, and Muddy River Watershed Analyses* are not repeated here.

Unique Species and Habitats

The Lewis LSR has a relatively large expanse of younger habitat in the middle of the LSR. Most of this habitat is in the small-tree structural stage and should develop into late-successional habitat in the next 50 years or longer. Silvicultural treatment that accelerates the development of late-successional habitat would be beneficial in these areas. Some of these are 80-100 years of age and would benefit from thinning. Many of the less mobile species are small mammals, terrestrial amphibians and terrestrial mollusks which use down wood. Increasing the level of down wood in these areas should result in increased habitat connectivity for these species.

The Lewis LSR contains large tree, large patch habitat that extends for most of its length along the east side. (See Map 4-5, page 4-33). There is additional large patch habitat on the west side. However, the central portion is dominated by non-habitat, and dispersed and scattered habitat patches. While this LSR contains a large amount of large patch habitat, east-west movement across the LSR for species in the TLMLT guild is somewhat restricted (See Map 4-3, page 4-31).

The Lewis LSR contains about 21 thousand acres of biological deer and elk winter range.

The only verified population of bull trout, listed as a Regional Forester's sensitive species, inhabit the North Fork Lewis River within the LSR. It is a population which migrates to and from Swift Reservoir, east of the LSR.

The Lewis LSR contains the largest population of Larch Mountain salamander on the Forest.

A hibernacular cave for Townsends big-eared bat is located within the LSR.

The Lewis LSR shares Critical Habitat Unit WA-38 with the Quartz and Woods LSRs. However, the Lewis LSR covers 102,845 acres or 61 percent of the unit. All three LSRs cover approximately 79 percent of Critical Habitat Unit WA-38. See Map 4-1, page 4-22. There are 45 northern spotted owl nest sites within this LSR and 37,000 acres of nesting, roosting, and foraging habitat.

Vegetation Condition

Coniferous forest covers 120,600 acres of the Lewis LSR. The Pacific silver-fir, a mid level zone between 3,000 to 4,300 feet, makes up the largest portion of forest within the LSR - 86,400 acres. The western hemlock zone covers 25,200 acres.

Stands within the LSR range in age from less than 10 years to well over 200 years. Nearly 70 percent (84,420 acres) of the LSRs forest stands are older than 80 years and serve in some capacity as late-successional/old-growth habitat. However, these mature forest stands were fragmented by roads and clear-cut harvesting methods. This resulted in large patches of late-successional forest existing mostly on the west-side and east-side of the LSR, while the central portion is dominated by young forest and scattered late-successional forest patches.

Historically, fire played an important role in shaping the stand structure and distribution. These fires burned large swaths sometimes impacting hundred of thousands of acres. In some areas only small pockets of late-successional forest remains intact on ridgetops and in wet areas. The regeneration harvesting and related activities that has occurred over past the 40 years have altered stand structure, composition, and distribution across the landscape by creating numerous openings containing little if any structural diversity.

Snags and Down Wood

Data from the Forest's Continuous Vegetation Survey shows the following averages for snags and down logs in stands over 80 years old. The sample size for this data was small and observations contained a great deal of variability.

Table 4-17 Down Wood Lewis LSR

Large end Diameter	Pieces per acre	Cumulative Length per Acre	Percent Ground Cover
14 inches	264	3,767 feet	6

Table 4-18 Snags Per Acre Lewis LSR

Average DBH	Snags per Acre
14 inches	27

Disturbance History

Fire is the primary disturbance agent in the Lewis LSR. Since 1930 very little of the LSR area has burned due to wildfire. Fire behavior, risk and occurrence is further described in Chapter 6, Fire Management Plan.

Human Uses

Trails

There are 33 trails, totaling 94 miles within the Lewis LSR. Each trail is assigned a management level with associated standards and guidelines for management (1990 GPNF Forest Plan). Development of the Mount St. Helens National Volcanic Monument and improvement to National Forest Service Roads 25, 51, and 90 has resulted in an increase in use of these trails.

Developed Sites

Facilities and developed recreation sites in the Lewis LSR are shown on Map 4-17, page 4-57.

Roads

Primary access through the LSR is via National Forest Roads 25, 51 and 90. There are 2.2 miles per square mile of road within the Lewis LSR. This road density is somewhat high for species such as the gray wolf and grizzly bear which are highly sensitive to human disturbance. Road access from the town of Cougar is primarily by Road 90 which is an east to west link across the forest. Washington Department of Transportation is constructing and relocating the Curly Creek Road 51.

Special Forest Products

Lewis River LSR is a high use mushroom gathering area. Post, poles, and firewood are also collected from the road right-of-ways and other designated sites. Beargrass and huckleberries are harvested in the summer months in the higher elevation areas. Christmas trees, boughs, and cones are also harvested.

Special Uses

There is one telecommunications site and two data telemetry installations operated under special use permit in the Lewis LSR. There are four lode mining claims located in the Lewis LSR.

Grazing

Sheep were introduced to the this area during the 1890s in the search for suitable summer range. Historically, 100,000 ewes plus lambs ranged over the area.

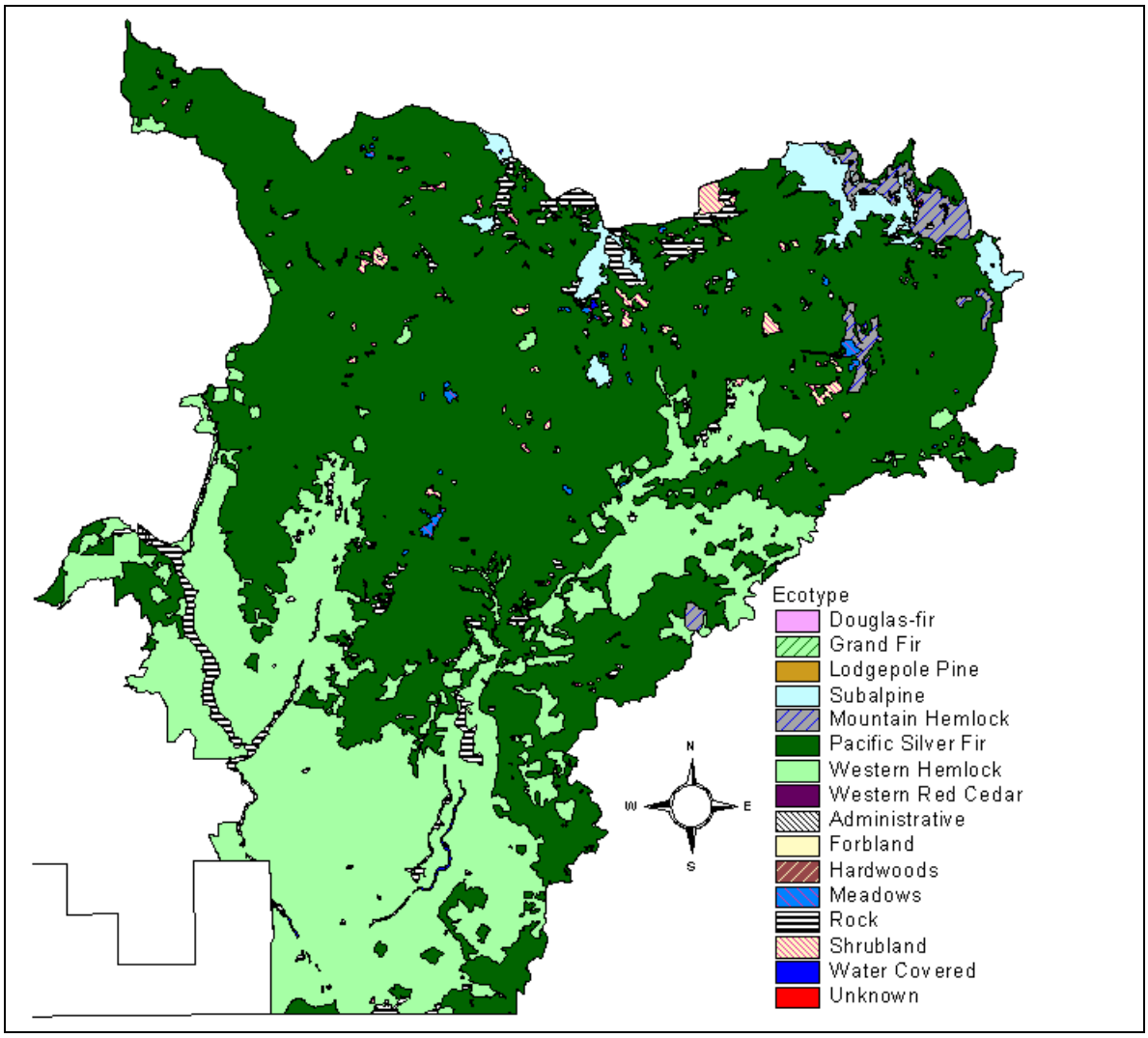
A portion of Lewis LSR is part of the Twin Buttes Sheep and Goat Allotment. The Allotment Management Plan was revised in 1991 to bring management into compliance with the Gifford Pinchot National Forest Land and Resource Management Plan. The allotment plan permits utilization only within present grazing capacity. The present capacity is estimated at 10,437 animal unit months. Today, use is at 14 percent of capacity.

Social Significance

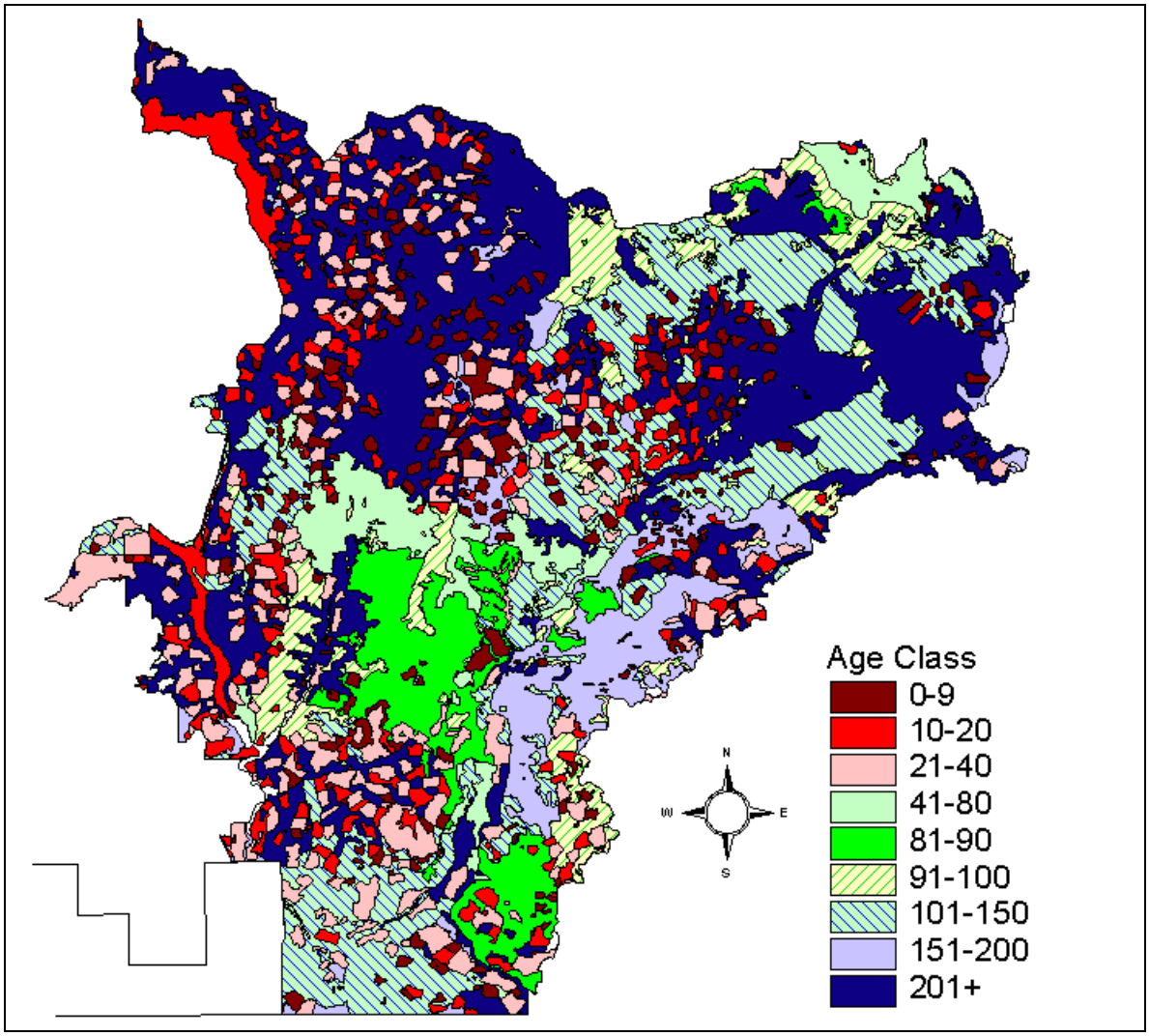
The Lewis LSR contains the Spencer Ridge and southern portions of the Dark Divide RARE II roadless areas.

Two segments of Clear Creek, two segments of Quartz Creek and one segment of the East Fork Lewis River in this LSR are “Further Study Rivers” to be evaluated for suitability for Wild and Scenic designation in a future study. Forest Plan direction provides for protection of values contributing to their potential for classification until the studies are complete. The Forest Plan recommended the portion of the Lewis River which flows through the Lewis LSR for designation by Congress as a Scenic River.

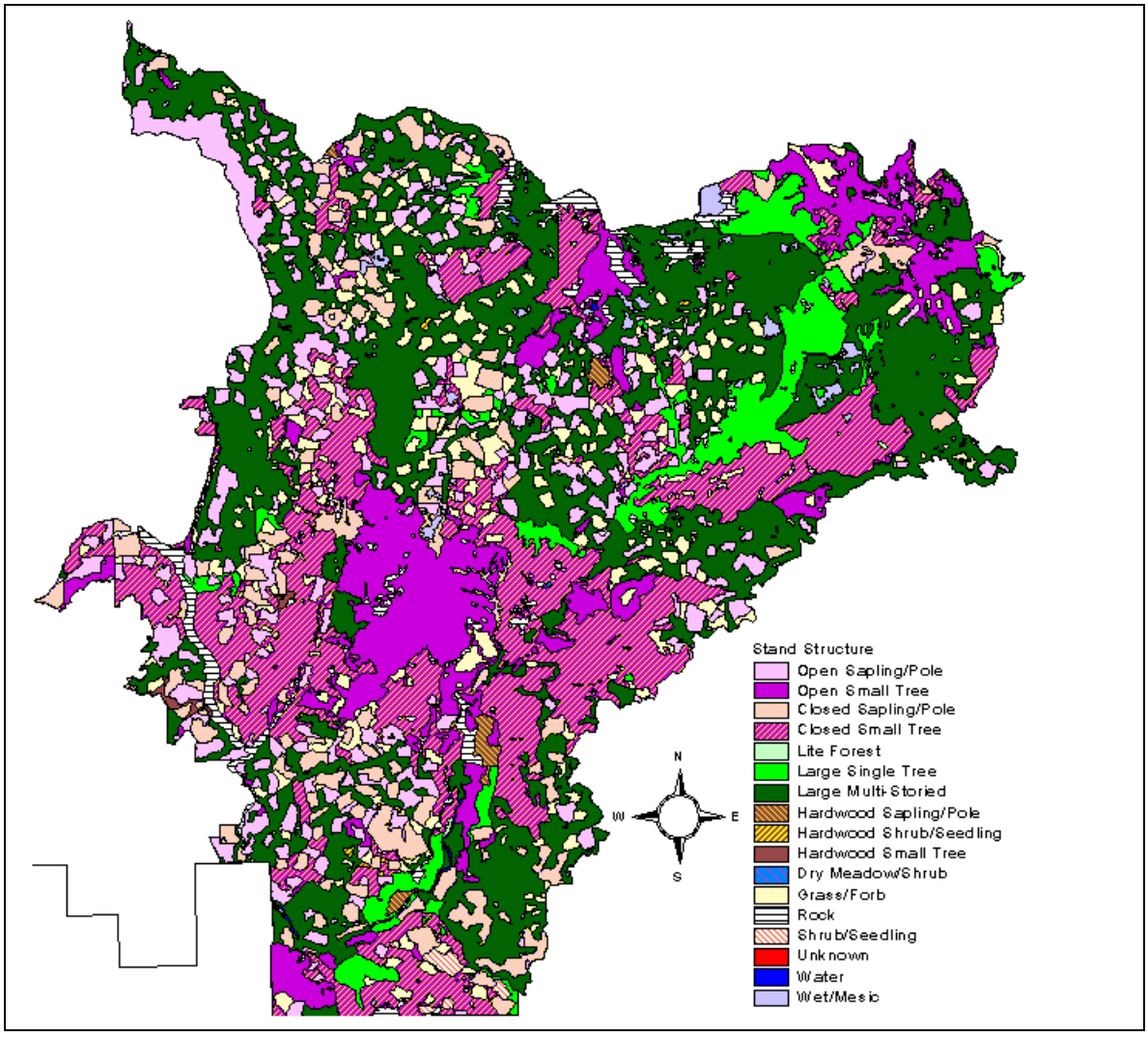
Map 4-13 Lewis LSR Ecoclass



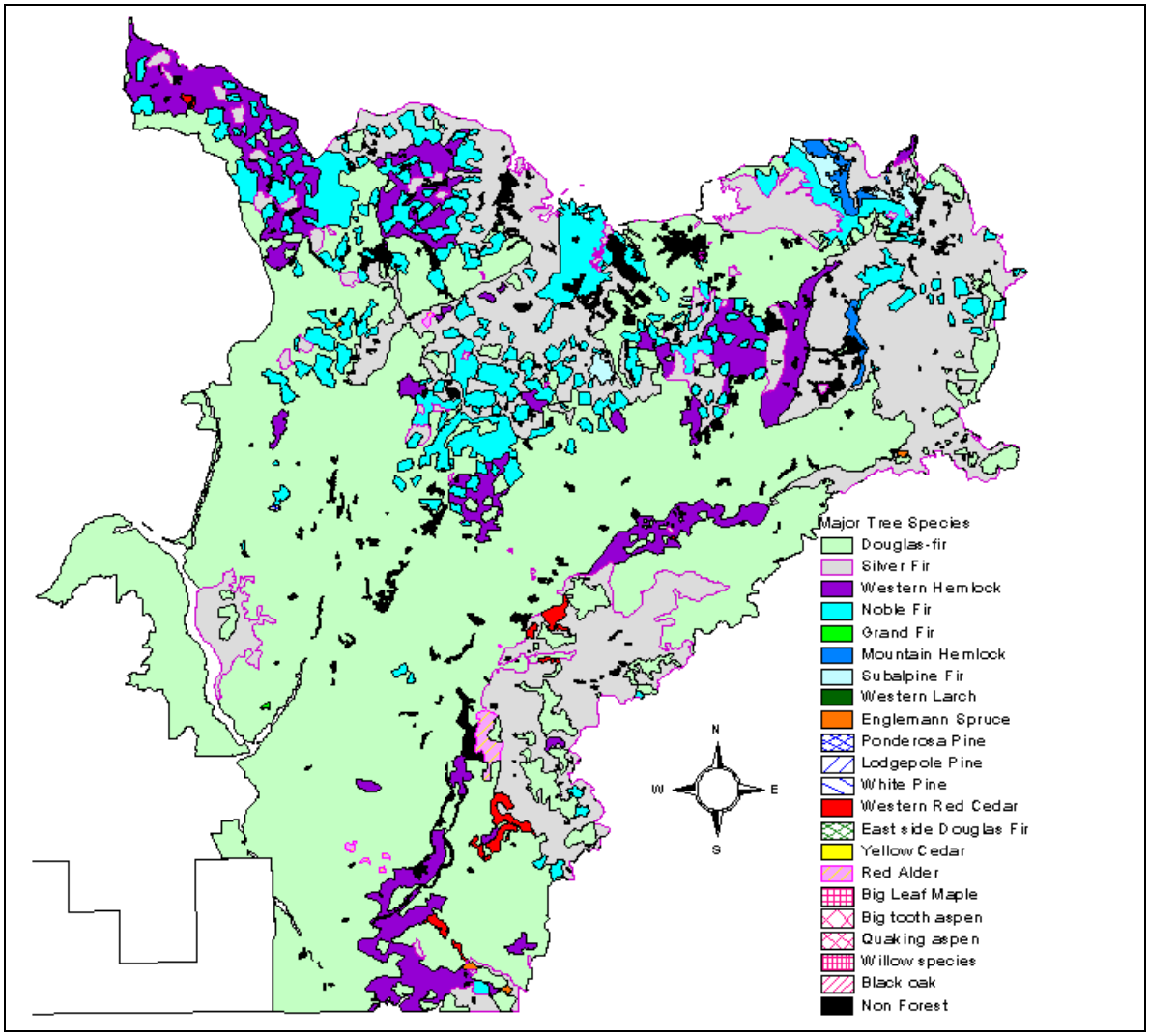
Map 4-14 Lewis LSR Age Class



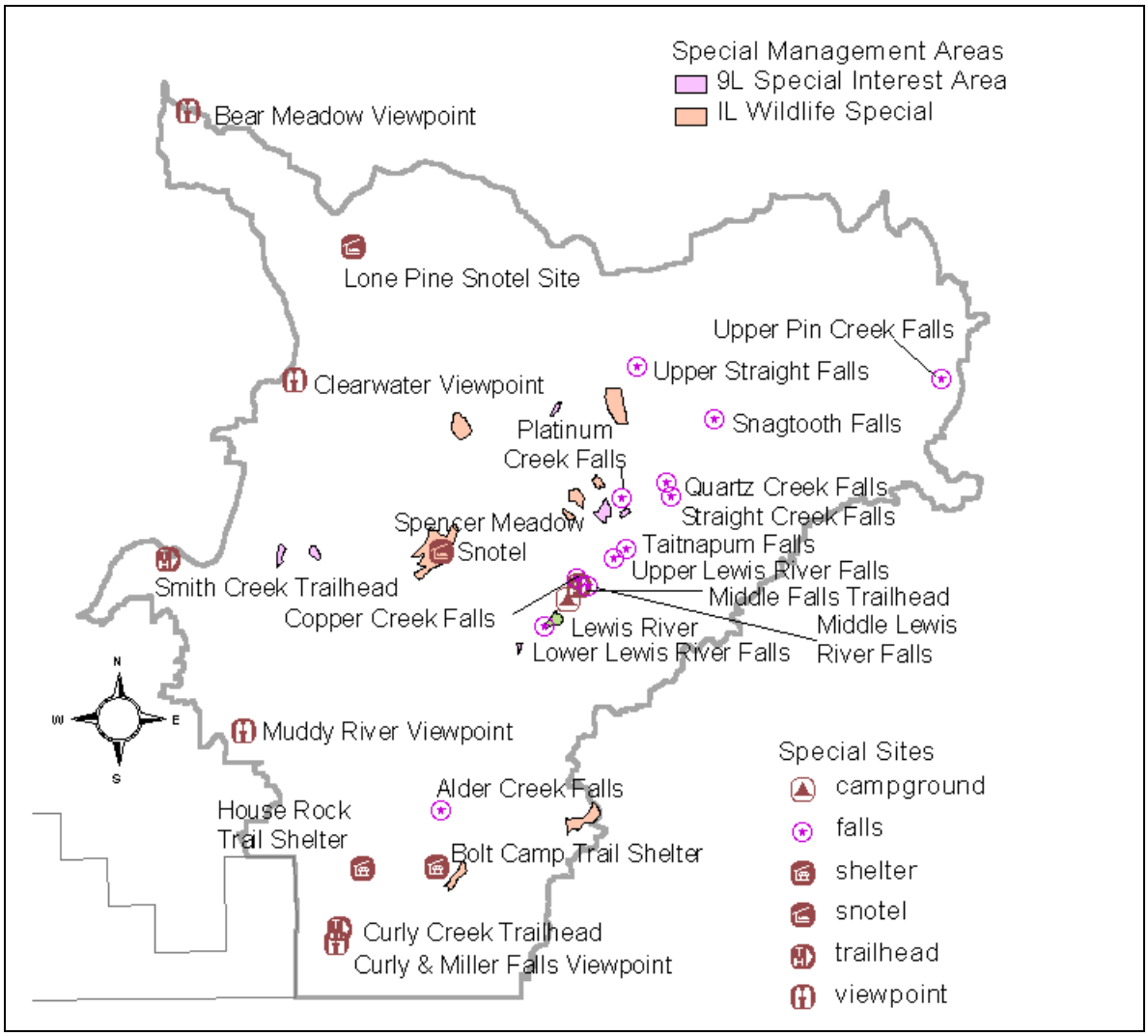
Map 4-15 Lewis LSR Stand Structure



Map 4-16 Lewis LSR Dominant Tree Species



Map 4-17 Lewis LSR Special Sites



Mineral LSR

Riparian Conditions

Existing conditions for riparian resources and functions will be described in the Nisqually (FY-97) and Tilton River/Quartz Creek (FY-98) watershed analyses and are not developed here.

Unique Species and Habitats

The Mineral LSR has a relatively large expanse of younger habitat in the middle of the LSR. Most of this habitat is in the small-tree structural stage and should develop into late-successional habitat in the next 50 years or longer. Silvicultural treatment that accelerates the development of late-successional habitat would be beneficial in these areas. Some of these are 80-100 years of age and would benefit from thinning. Many of the less mobile species are small mammals, terrestrial amphibians and terrestrial mollusks which use down wood. Increasing the level of down wood in these areas should result in increased habitat connectivity for these species.

The Mineral LSR contains no large tree, large patch habitat, and very minor amounts of aggregated patch. The only block of late-successional and old-growth forest is around Newaukum Lake and above Scatter Creek in the northern portion of the Block. (See Map 4-3, page 4-31). While large tree habitat exists, the land ownership pattern has resulted in fragmented conditions. As a result, movement by species in the TLMLT guild within the LSR is restricted. The alternate ownership pattern in the western portion of this LSR limits the opportunity to provide large patch habitat.

The Rockies, a botanical special interest area that has unusual flora endemic to the area and has been proposed as a Research Natural Area, is located in this LSR.

This is the only area where marbled murrelets are known to nest on the Forest.

The entire Mineral LSR is designated as a critical habitat unit for the spotted owl and marbled murrelet.

There are 25 northern spotted owl nest sites within this LSR and 12,600 acres of nesting, roosting, and foraging habitat.

Little Nisqually, Tilton, Deschutes, and Wallanding Creeks provide foraging and roosting habitat for wintering bald eagles.

It is one of two places on the Randle Ranger District that a Townsend's big-eared bat is known to roost.

Vegetation Conditions

Forty-seven percent of this LSR (17,774 acres) is in age classes up to 80 years old, most of which are young plantations which originated from past clearcutting 20-40 years ago, and are stocked at levels (300-400 trees per acre) considered to be appropriate for rapid growth through age 40 to 50.

At least 13 percent of the LSR (5,160 acres) is in the 10-20 year age range. Most of these plantations have not had any stocking control treatment (thinnings), and are stocked at levels ranging from 500 to 1500 trees per acre. Heights of these trees range from 10 feet in the youngest stands to 30 feet in the older stands. Some stands may have very uniform stocking of only the trees which were planted, while others may have a great variety of species and sizes of trees due to natural seeding which followed the planting.

Most of these early seral stands are dominated by Douglas-fir. Higher

elevations were planted to mixes of Douglas-fir and noble fir. Minor amounts of Pacific silver fir, western hemlock, white pine, western redcedar, and Engelmann spruce have been planted in this LSR.

The remainder of the LSR is occupied by mature stands (100+ years old) of Douglas-fir, western hemlock, noble fir, Pacific silver fir, and minor amounts of associated conifers and hardwoods. Douglas-fir is the dominant tree, and these stands have rich understories of other shade-tolerant tree species, shrubs and herbs. The higher elevations have a smaller representation of Douglas-fir, and many more true fir species with smaller tree sizes.

In the oldest stands (200+ years), many of the desired old-growth characteristics are present in varying degrees - standing snags, large woody material on the floor, very large diameter trees, multiple layers of tree canopies, and gaps.

Disturbance History

Large portions of this LSR were burned about 150 years ago in a pattern that suggests that about half of this area was burned over. Most of that has since been harvested.

This LSR is fragmented by private land ownership boundaries. There are about 13 sections of private timber company land within the boundary of this LSR. All of these sections are in young-aged stands (less than 20 years old).

Snags and Down Wood

Data from the Forest's Continuous Vegetation Survey shows the following averages for snags and down logs in stands over 80 years old. The sample size for this data was small and observations contained a great deal of variability.

Table 4-19 Down Wood Mineral LSR

Large end Diameter	Pieces per acre	Cumulative Length per Acre	Percent Ground Cover
10 inches	280	4,820 feet	9

Table 4-20 Snags Per Acre Mineral LSR

Average DBH	Snags per Acre
13 inches	72

Human Uses

Facilities

There are no developed campgrounds or other Forest Service facilities in this LSR. Dispersed campsites are numerous.

Trails

There are no system trails in the Mineral LSR. There are some abandoned trails.

Special Forest Products

Permits for special forest products have been limited in this area due to its remoteness and alternate landownership pattern. Firewood, post, and poles are removed from road right-of-ways and other designated sites.

Special Uses

Because of the alternate ownership pattern in the Mineral LSR there are numerous road easements granted to adjacent landowners. There are also easements for two powerlines, a telephone line and a water transmission line. There are two placer mining claims in the Mineral LSR.

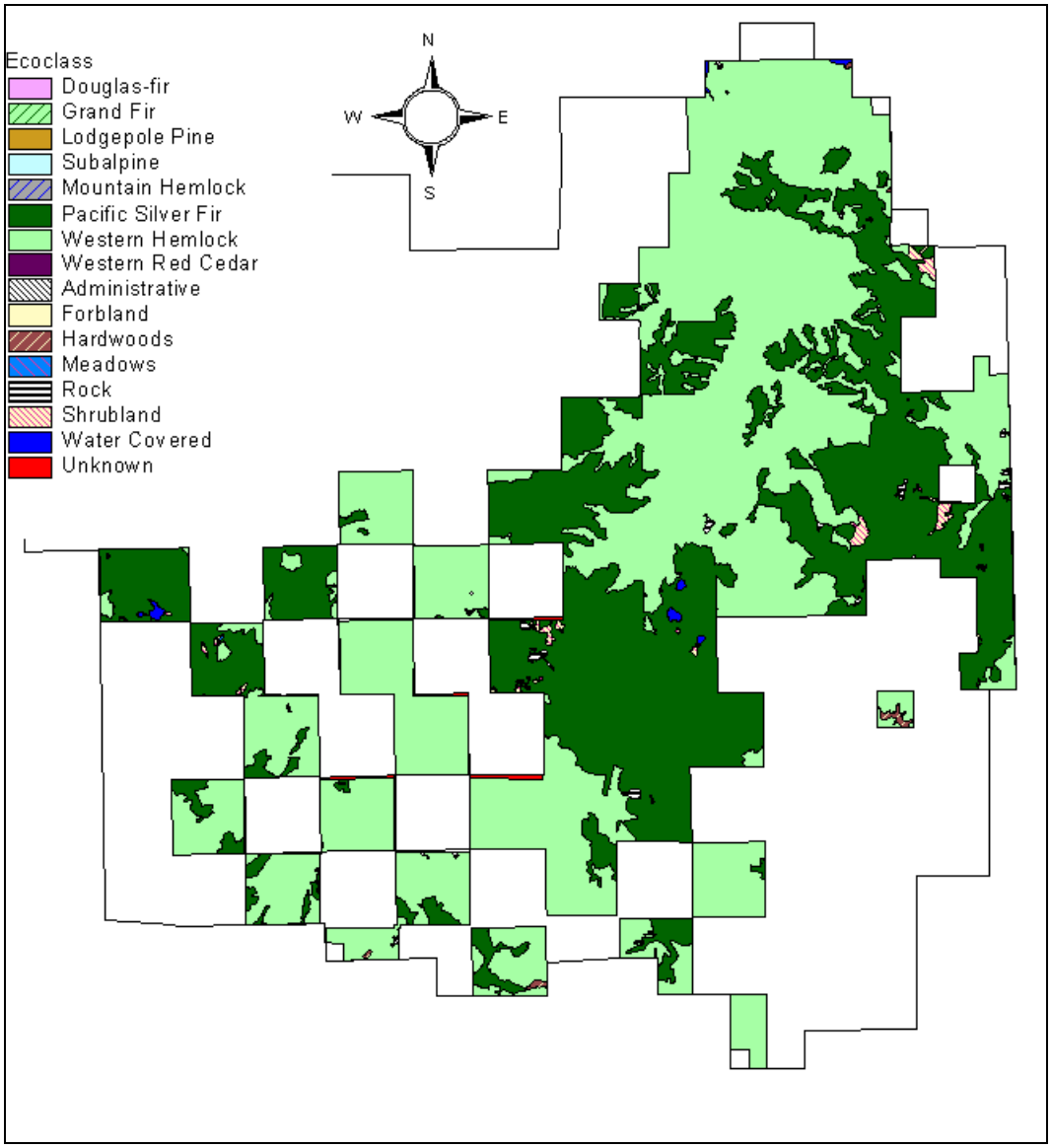
Roads

The open road density in this LSR is the highest on the Forest at 3.6 miles per square mile. The high road density is attributed to the alternate ownership pattern, and dissected terrain.

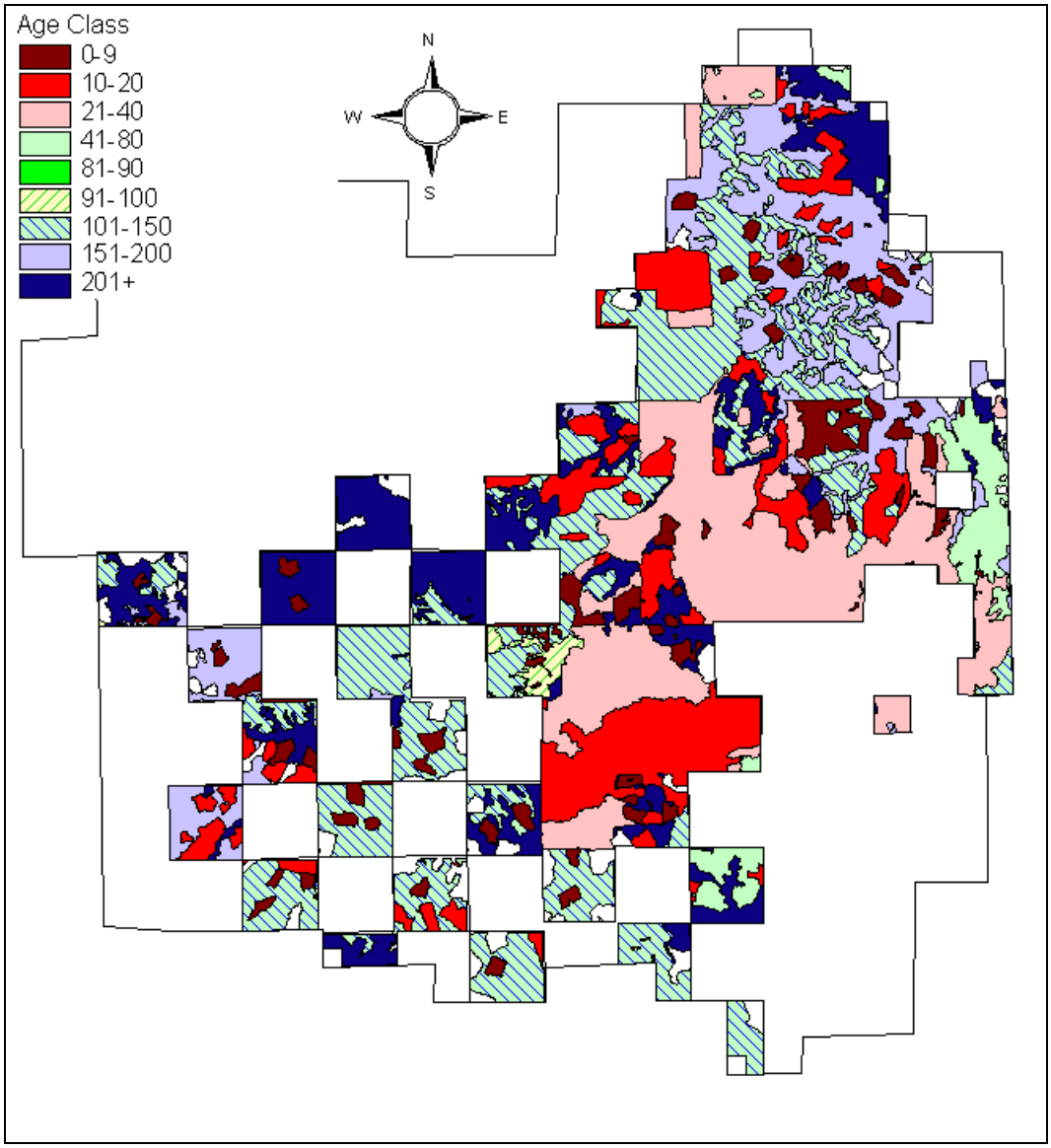
Historic Uses

Much of the cut-over portion of this LSR was acquired from private owners after it had been harvested. The mineral rights were retained by the original owner.

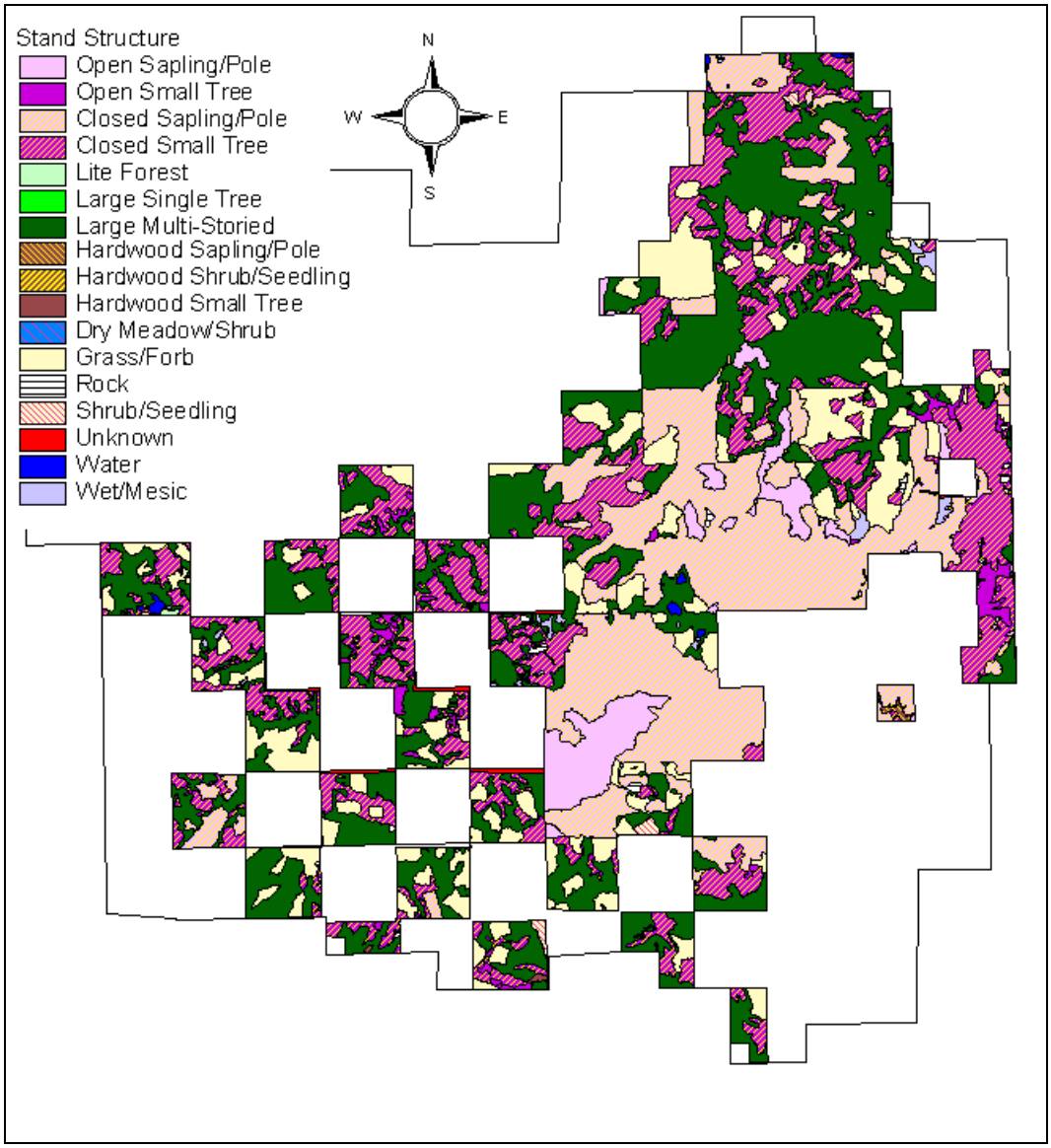
Map 4-18 Mineral LSR Ecoclass



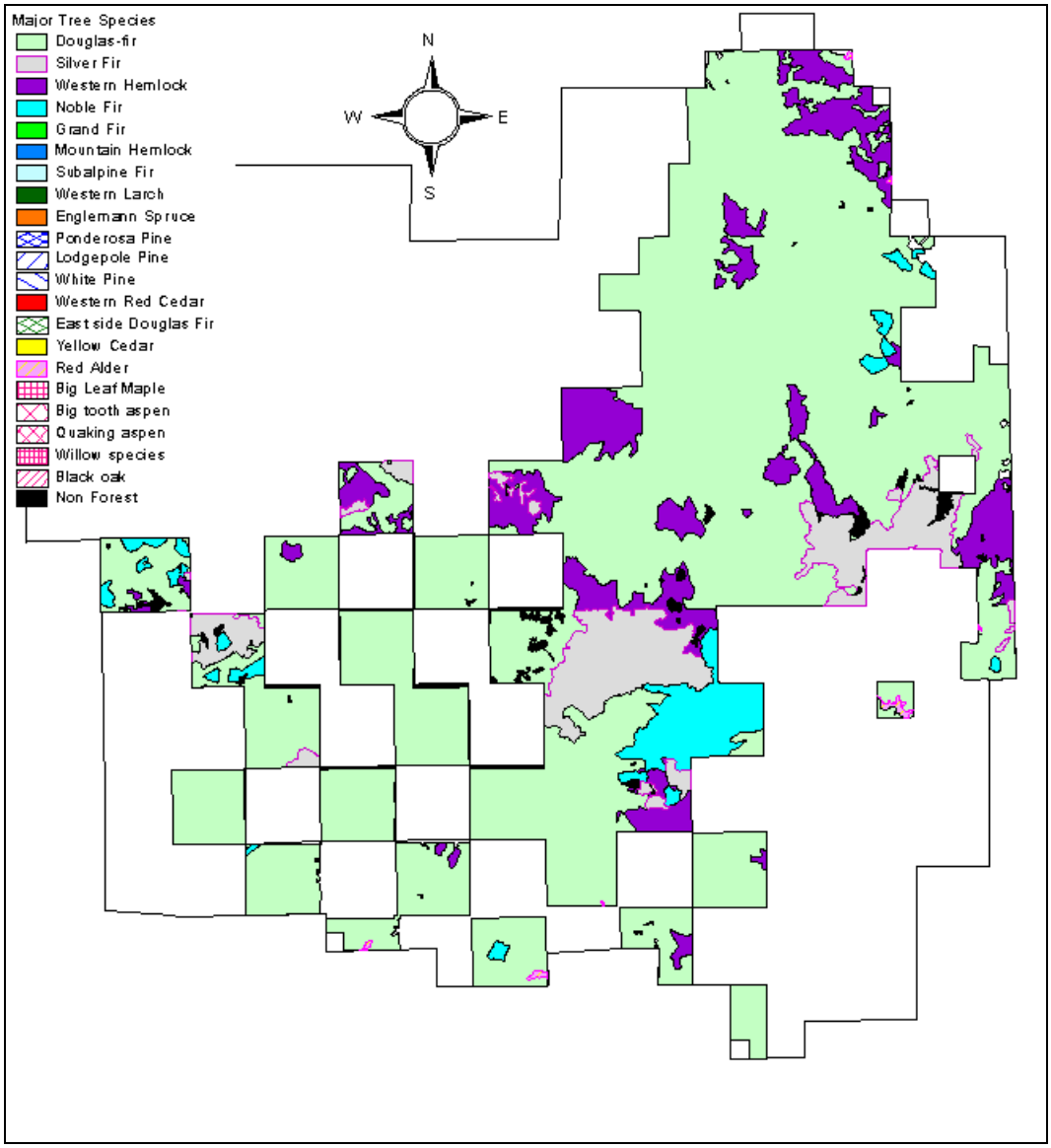
Map 4-19 Mineral LSR Age Class



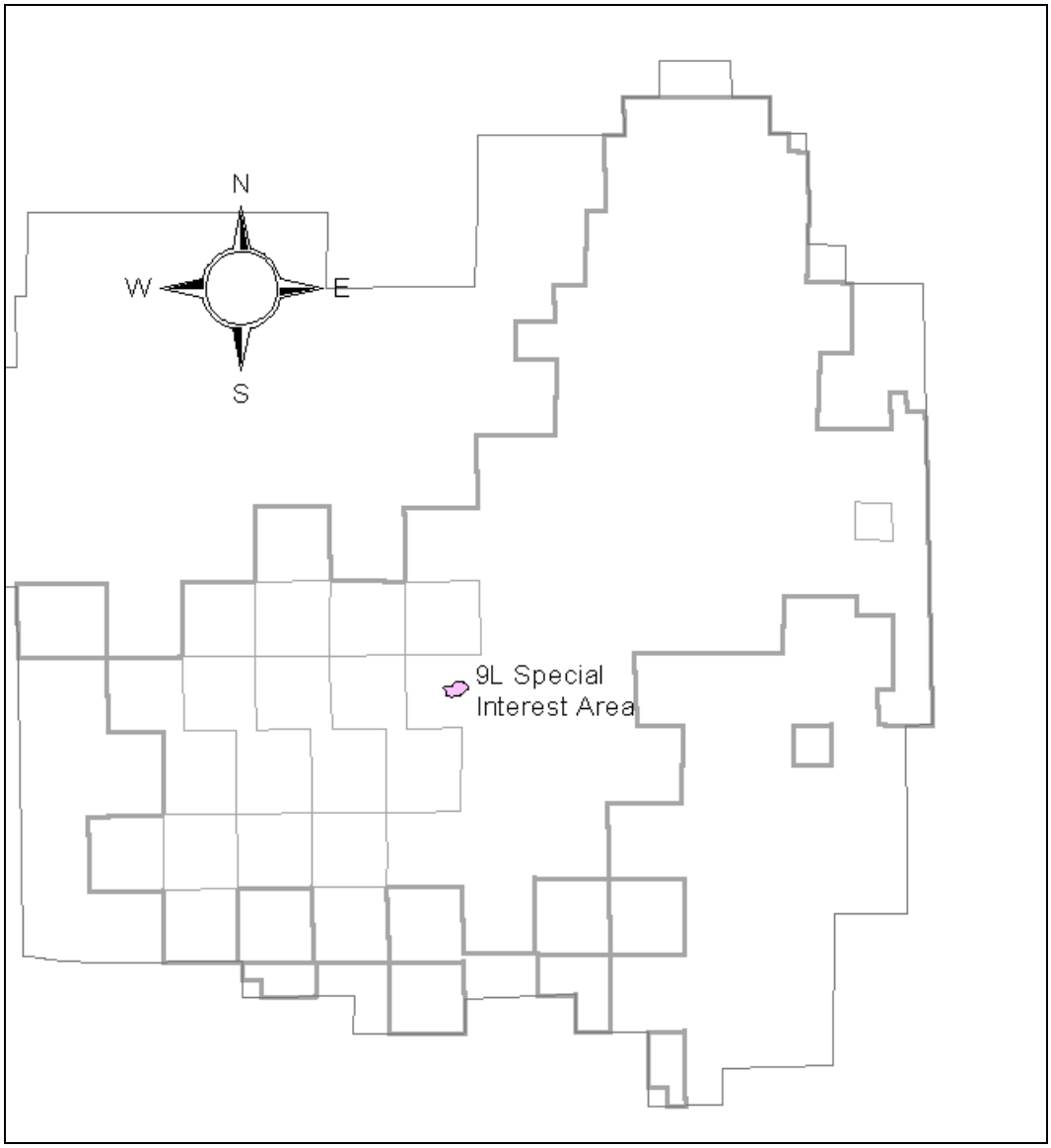
Map 4-20 Mineral LSR Stand Structure



Map 4-21 Mineral LSR Dominant Tree Species



Map 4-22 Mineral LSR Special Sites



Nisqually LSR

The Nisqually LSR is a complex of six separate blocks, three of which are alternate sections separated by Matrix.

Riparian Conditions

Existing conditions for riparian resources and functions will be described in the Nisqually (FY97) and Puyallup River (FY98) watershed analyses and are not developed here.

Unique Species and Habitats

The Nisqually LSR has a relatively large expanse of younger habitat in the middle of the LSR. Most of this habitat is in the small-tree structural stage and should develop into late-successional habitat in the next 50 years or longer. Silvicultural treatment that accelerates the development of late-successional habitat would be beneficial in these areas. Some of these are 80-100 years of age and would benefit from thinning. Many of the less mobile species are small mammals, terrestrial amphibians and terrestrial mollusks which use down wood. Increasing the level of down wood in these areas should result in increased habitat connectivity for these species.

The Nisqually LSR contains very little large tree, large patch habitat. (See Map 4-3, page 4-31). The existing large patch habitat is in the northern piece of this LSR and probably extends into Mount Rainier National Park. Relatively large blocks of unfragmented mid- to late-successional forest are also found along Skate Creek. It is likely that there is additional suitable habitat in the park that is adjacent to habitat within the LSR. This LSR contains a large amount of closed small tree habitat, which reduces the effects of fragmentation (edge effects).

Non-forest vegetation types incapable of supporting late-successional habitat, including rock, shrublands and meadows are concentrated in the eastern portion of the LSR near Skate mountain and Dixon mountain (Table 4-34, page 4-116 and Map 4-23, page 4-69).

Bear Prairie is located in this LSR, an 80 acre seasonally flooded wet meadow with human-created potholes and small ponds. It is an important area for nesting and migratory waterfowl, shorebirds, mammals such as beaver and river otter, amphibians and many other species.

This LSR contains cliffs such as Stonewall Ridge, and other rocky outcrops that provide both summer and winter ranges for mountain goats.

There are alpine and subalpine habitats at Dixon, Skate, and Lookout mountains.

Skate Creek runs through the LSR, a larger stream that provides habitat for harlequin ducks, wintering bald eagles and other species.

Butter Creek RNA and Mount Rainier National Park provide habitat for species such as the gray wolf, wolverine, grizzly bear and other wide-ranging species.

The Nisqually LSR contains Cora, Bertha May, Pothole and Granite lakes which are higher elevation, mid-size lakes.

The Nisqually LSR has 44,357 acres of spotted owl Critical Habitat Unit WA-36. This approximates 59 percent of the unit. The entire Nisqually LSR is designated a marbled murrelet critical habitat. (See Map 4-1, page 4-22.)

There are 13 northern spotted owl nest sites within the Nisqually LSR and 12,700 acres of nesting, roosting, and foraging habitat.

Vegetation Conditions

Twenty-nine percent of this LSR (14,796 acres) is occupied by forest stands in age classes up to 80 years old, most of which are young plantations which originated from past clearcutting 20-40 years ago, and are stocked at levels (300-400 trees per acre) considered to be appropriate for rapid growth through age 40 to 50.

About 8 percent of the area (3,900 acres) is in the 10-20 year range. Most of these plantations have not had any stocking control treatment (thinnings), and are stocked at levels ranging from 500 to 1500 trees per acre. Heights of these trees range from 10 feet in the youngest stands to 30 feet in the older stands. Some stands may have very uniform stocking of only the trees which were planted, while others may have a great variety of species and sizes of trees due to natural seeding which followed the planting.

The composition of these young stands is similar to that described for the Mineral LSR.

The remainder of the LSR is occupied by mature stands (100+ years old) of Douglas-fir, western hemlock, noble fir, Pacific silver fir, and minor amounts of associated conifers and hardwoods. Douglas-fir is the dominant tree, and these stands have rich understories of other shade-tolerant tree species, shrubs and herbs. The higher elevations have a smaller representation of Douglas-fir, and many more true fir species with smaller tree sizes.

In the oldest stands (200+ years), many of the desired old-growth characteristics are present in varying degrees - standing snags, large woody material on the floor, very large diameter trees, multiple layers of tree canopies, and gaps.

Disturbance History

Very distinct age classes are mapped across this LSR, and they reveal a pattern of fire history and intensities for the older age classes. (See Map 4-11b). About 24 percent of the area (12,365 acres) is in age classes greater than 200 years old, and is located mostly in the western half of the LSR. Another 20 percent (10,147 acres) is from 100-150 years old, and is located mostly in the northern part of the LSR. Ten percent of the area (5,197 acres) is about 90-100 years old, and is all located in the eastern part of the LSR.

Because this LSR borders on wilderness areas it may be at a greater risk from wildfire because we are limited in our ability to aggressively suppress wildfire in wilderness areas.

Fire

There have been no large stand replacement fires for over 200 years in the Nisqually LSR.

Because this LSR borders on wilderness areas it may be at a greater risk from wildfire because we are limited in our ability to aggressively suppress wildfire in wilderness areas.

Snags and Down Wood

Data from the Forest's Continuous Vegetation Survey shows the following averages for snags and down logs in stands over 80 years old. The sample size for this data was small and observations contained a great deal of variability.

Table 4-21 Down Wood -Nisqually LSR

Large end Diameter	Pieces per acre	Cumulative Length per Acre	Percent Ground Cover
16 inches	212	3,606 feet	11

Table 4-22 Snags - Nisqually LSR

Average DBH	Snags per Acre
16 inches	37

Human Uses

Campgrounds

There are no developed campgrounds but many dispersed sites in the Nisqually LSR.

Trails

There are 30 miles of system trails, 7 of which allow motorized use, in the Nisqually LSR.

Recreation

The Nisqually LSR, particularly the area accessed by the Skate Creek Road, is a popular recreation area for hunting, fishing, dispersed camping, horseback riding, and mushroom gathering.

Special Forest Products

The area of the Nisqually LSR receives the highest use by special forest products collectors of any area on the Randle and Packwood Ranger Districts. Products collected include Matsutake mushrooms, Christmas trees, beargrass, salal; there are stewardship contracts for bough cutting.

Special Uses

Within the Nisqually LSR, there are special use permits for a powerline, a telephone line, and a water transmission line. There are also special use permits for road maintenance with Lewis County and Mount Rainier National Park. There are three placer mining claims in the Nisqually LSR.

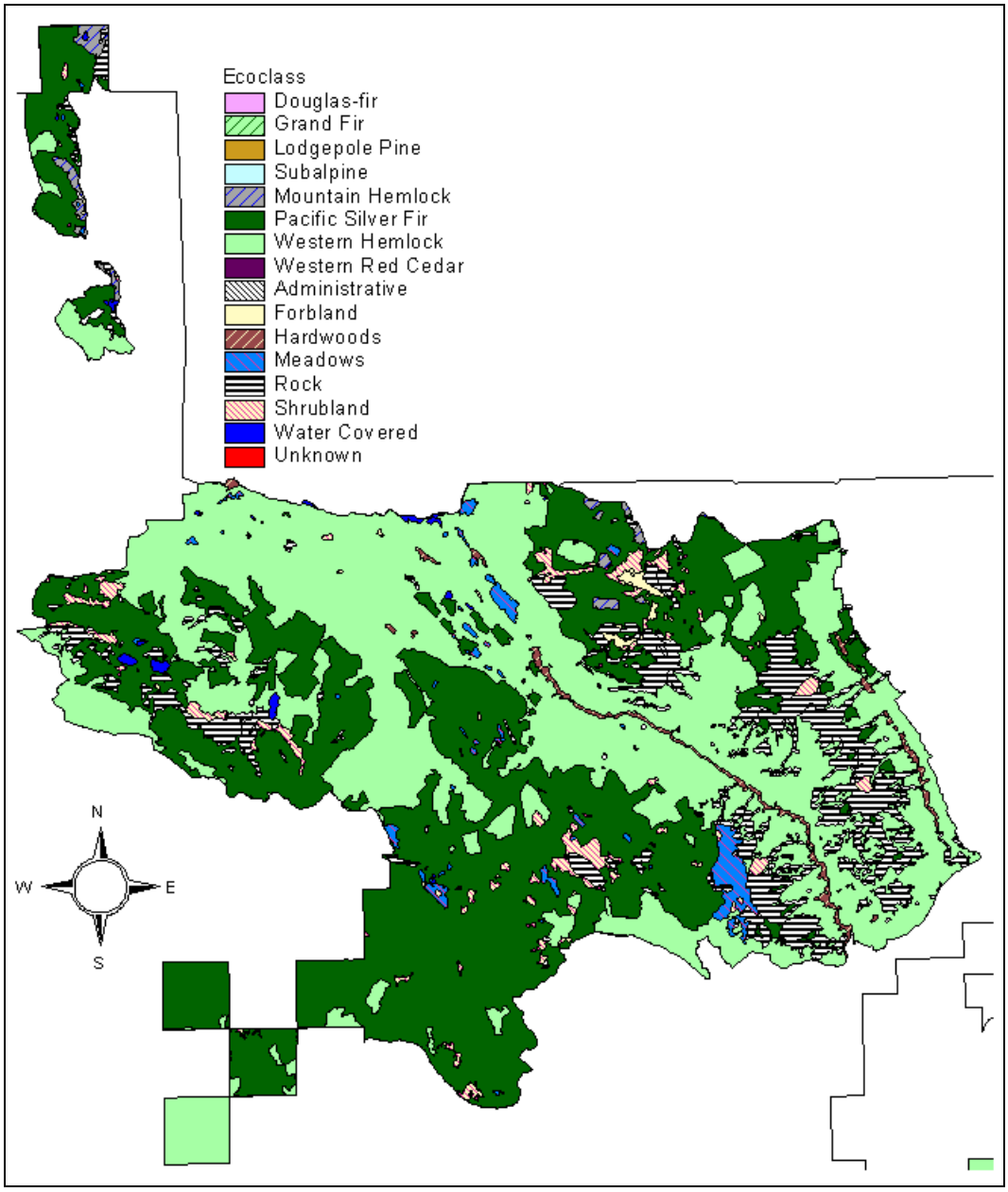
Social Significance

Portions of this LSR are adjacent to the Glacier View and Tatoosh Wildernesses.

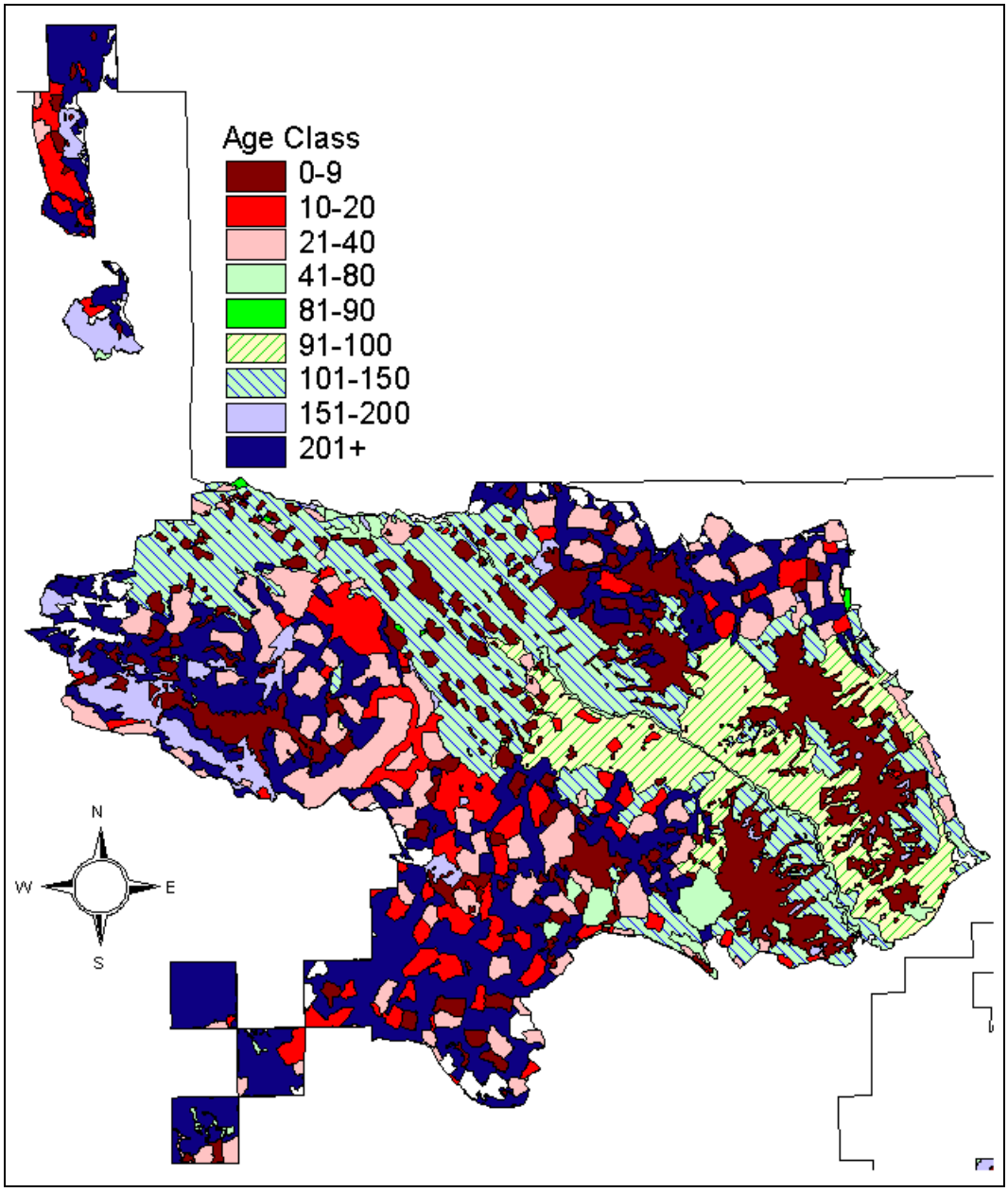
The Deer Creek RARE II roadless area lies in the north tip and the Dixon Mountain RARE roadless area lies in the southeast corner of the Nisqually LSR. RARE II roadless areas are described in detail in Forest Plan EIS Appendix C.

One of three fire lookouts on the Forest, High Rock, is located in the Nisqually LSR.

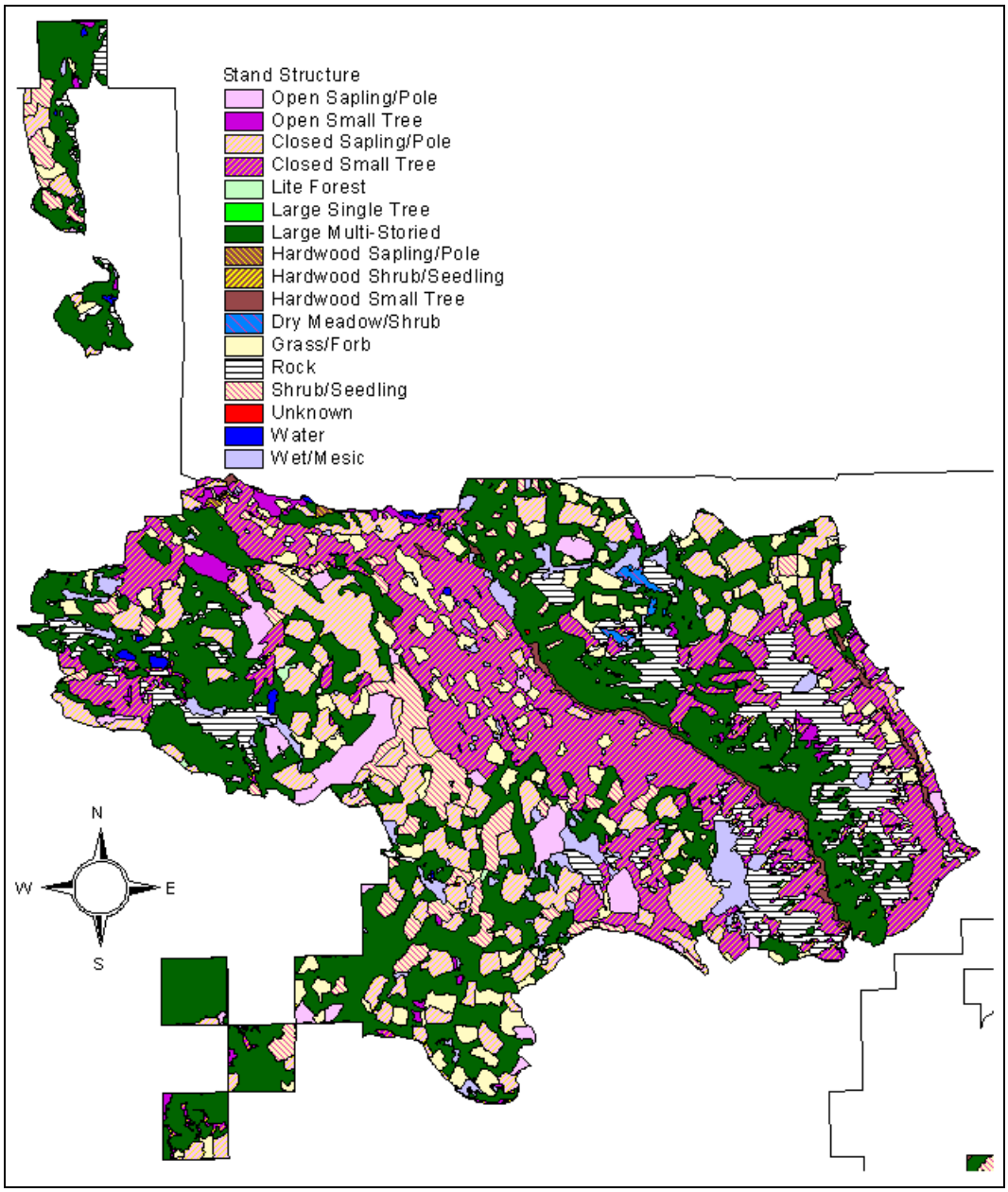
Map 4-23 Nisqually LSR Ecoclass



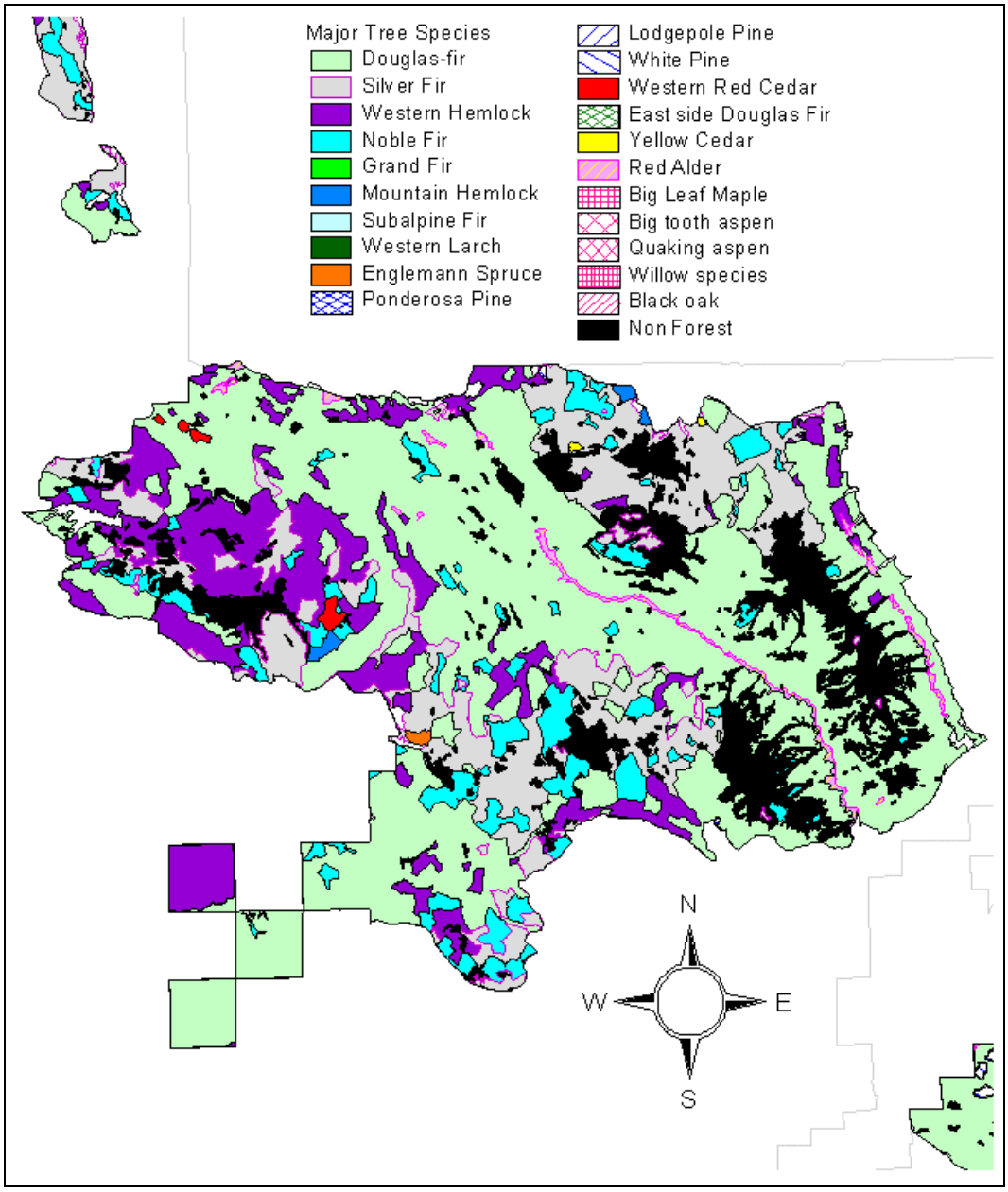
Map 4-24 Nisqually LSR Age Class



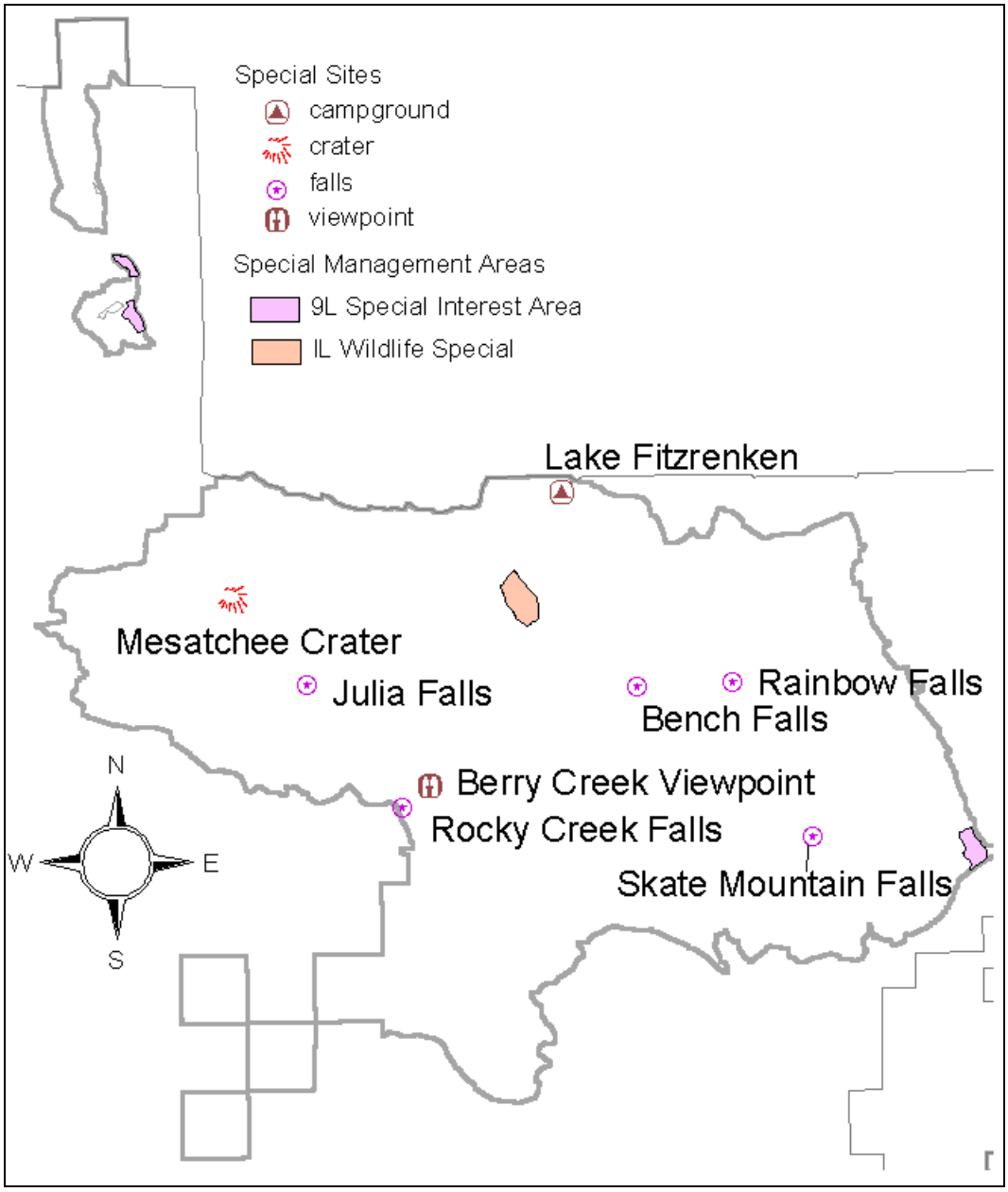
Map 4-25 Nisqually LSR Stand Structure



Map 4-26 Nisqually LSR Dominant Tree Species



Map 4-27 Nisqually LSR Special Sites



Packwood LSR

Riparian Conditions

Existing conditions for riparian resources and functions will be described in the Clear Fork Cowlitz River (FY98) and Upper Cowlitz (FY97) watershed analyses and are not repeated here.

Unique Species and Habitats

The Packwood LSR contains little large tree, large patch habitat. (See Habscapes Map 4-3, page 4-31) but there is a large amount in the adjacent wilderness area. Large tree habitat within the LSR is highly fragmented, however, this LSR contains a large amount of closed small tree habitat, which reduces the effects of fragmentation (edge effects).

The Packwood LSR contains mountain goat summer and winter range.

There are two special interest areas (9L) mapped in the southern portion of this LSR.

The Packwood LSR contains an abundance of cliffs, rocky outcrops, and steep, broken terrain which is important mountain goat winter range.

Some white oak "balds" are present.

The Cowlitz River (including the Muddy Fork and Clearfork branches, and the Ohanapecosh River) runs through the LSR and provides a migration corridor for waterfowl and other species, harlequin duck nesting habitat, bald eagle winter habitat, and nesting ospreys habitat.

The Packwood LSR borders the Goat Rocks and William O. Douglas Wildernesses and several unroaded areas which provide habitat for wolves and other wide ranging species.

The Packwood LSR contains two known Larch Mountain salamander sites.

It contains several small lakes and ponds such as Snyder and Hager Lakes and borders Packwood Lake which provides habitat for eagles, loons, ospreys, and otters.

Critical Habitat Unit WA-37 contains 38,077 acres of the Packwood LSR. This LSR covers 56 percent of the unit. (See Map 4-1, page 4-22.)

There are 11 northern spotted owl nest sites within this LSR and 18,700 acres of nesting, roosting, and foraging habitat.

Vegetation Conditions

Twenty-nine percent (13,311 acres) of this LSR is in age classes up to 80 years old, most of which are young plantations which originated from past clearcutting 20-40 years ago. They are stocked at levels (300-400 trees per acre) considered to be appropriate for rapid growth through age 40 to 50.

About 7 percent (3,007 acres) is in the 10-20 year class. Most of these plantations have not had any stocking control treatment (thinnings), and are stocked at levels ranging from 500 to 1500 trees per acre. Heights of these trees range from 10 feet in the youngest stands to 30 feet in the older stands. Some stands may have very uniform stocking of only the trees which were planted, while others may have a great variety of species and sizes of trees resulting from natural seeding which followed the planting. There is a shift to dominance by the trees and away from shrubs, herbs and grasses in these stands.

Forty-two percent (18,801 acres) of this LSR is in stands over 200 years old. Even though the distribution of this age class looks fairly even on Map 4-29, the vegetative structure and composition changes as the plant zone changes from western hemlock to Pacific silver fir. Large Douglas-fir dominate stands in the hemlock zone and decrease in size and numbers in the silver fir zone.

Other stands ranging in age from 100 to 200 years old are well distributed throughout the LSR.

Like the Nisqually LSR, there is a moderate percentage of non-forest (12 percent - 5,331 acres), and it is mostly located in the northern portion of the LSR.

Snags and Down Wood

Data from the Forest's Continuous Vegetation Survey shows the following averages for snags and down logs in stands over 80 years old. The sample size for this data was small and observations contained a great deal of variability.

Table 4-23 Down Wood - Packwood LSR

Large end Diameter	Pieces per acre	Cumulative Length per Acre	Percent Ground Cover
12 inches	206	2,767 feet	6

Table 4-24 Snags - Packwood LSR

Average DBH	Snags per Acre
14 inches	38

Disturbance History

Fire

There have been no large stand replacement fires for over 200 years in the Packwood LSR.

Because this LSR borders on wilderness areas it may be at a greater risk from wildfire because we are limited in our ability to aggressively suppress wildfire in wilderness areas.

Insects and Disease

The southern half of the Packwood LSR has a high incidence of *Phelinus weirii* root rot and many of the young plantations which were planted to Douglas-fir trees 15-30 years ago may be delayed in reaching the desired future condition if they need to be replanted with less susceptible species.

Human Uses

Recreation

State Highway 12 crosses the LSR between Packwood and White Pass. The Ohanapecosh entry to Rainier National Park, La Wis Wis campground and the Palisades picnic area attract many recreationists. Packwood Lake, adjacent to the Goat Rocks Wilderness, is another popular recreation destination in the LSR.

Facilities

Within the Packwood LSR there are three developed campgrounds, La Wiss, Summit, and Soda.

Trails

There are 50 miles of system trails in the Packwood LSR, none allow motorized use.

Special Forest Products

There is a moderately high level of special forest products collection in the Packwood LSR. Activities include stewardship bough sales, beargrass, salal and mushroom collecting.

Special Uses

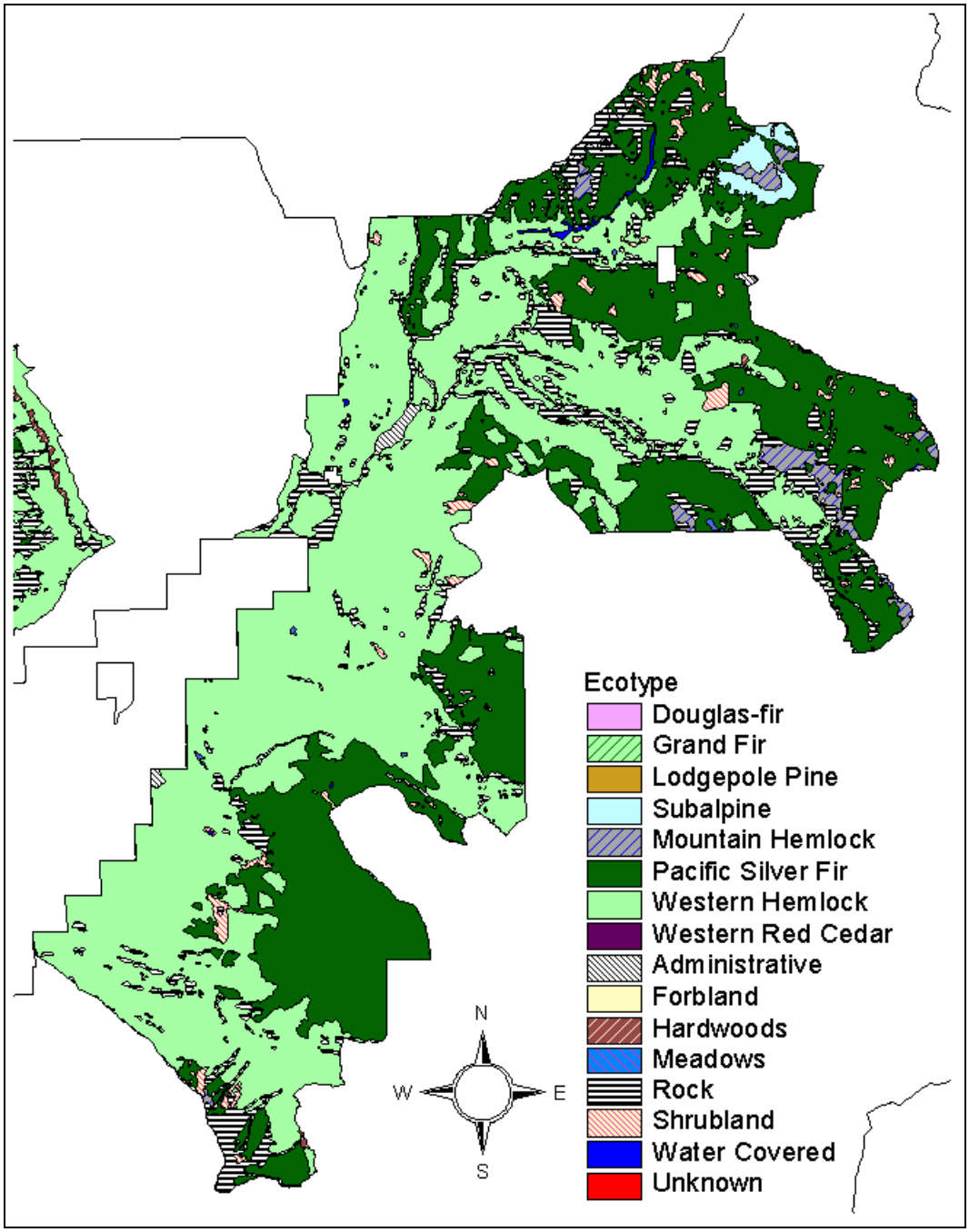
There are several special use permits related to the operation of Packwood Lake hydro power plant. There are also other permits related to road maintenance and easements, a powerline, and a water transmission line.

Social Significance

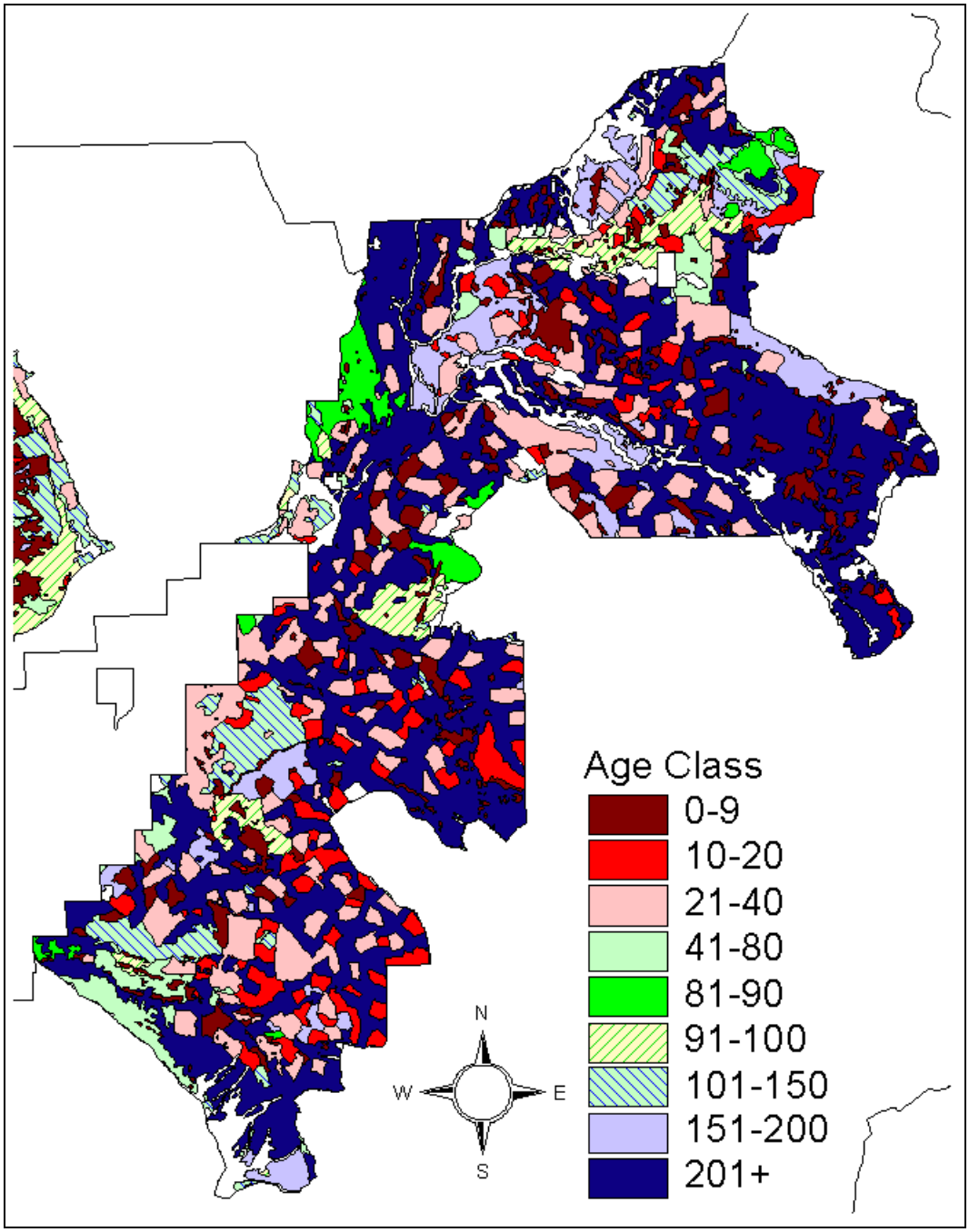
The Packwood LSR contains six RARE II roadless areas: Laughing Water, Carlton Ridge, Backbone, Cortright, Coal Creek Bluff and Packwood Lake. State Highway 12, a major travel route over White Pass and a designated State Scenic Highway traverses the LSR from east to west.

Portions of the Muddy Fork and Clear Forks of the Cowlitz River in the Packwood LSR have been recommended to Congress as National Scenic Rivers. Portions of Ohanapecosh River in the LSR have been designated as “Further Study Rivers” and will be managed to protect scenic values pending the completion of suitability analysis.

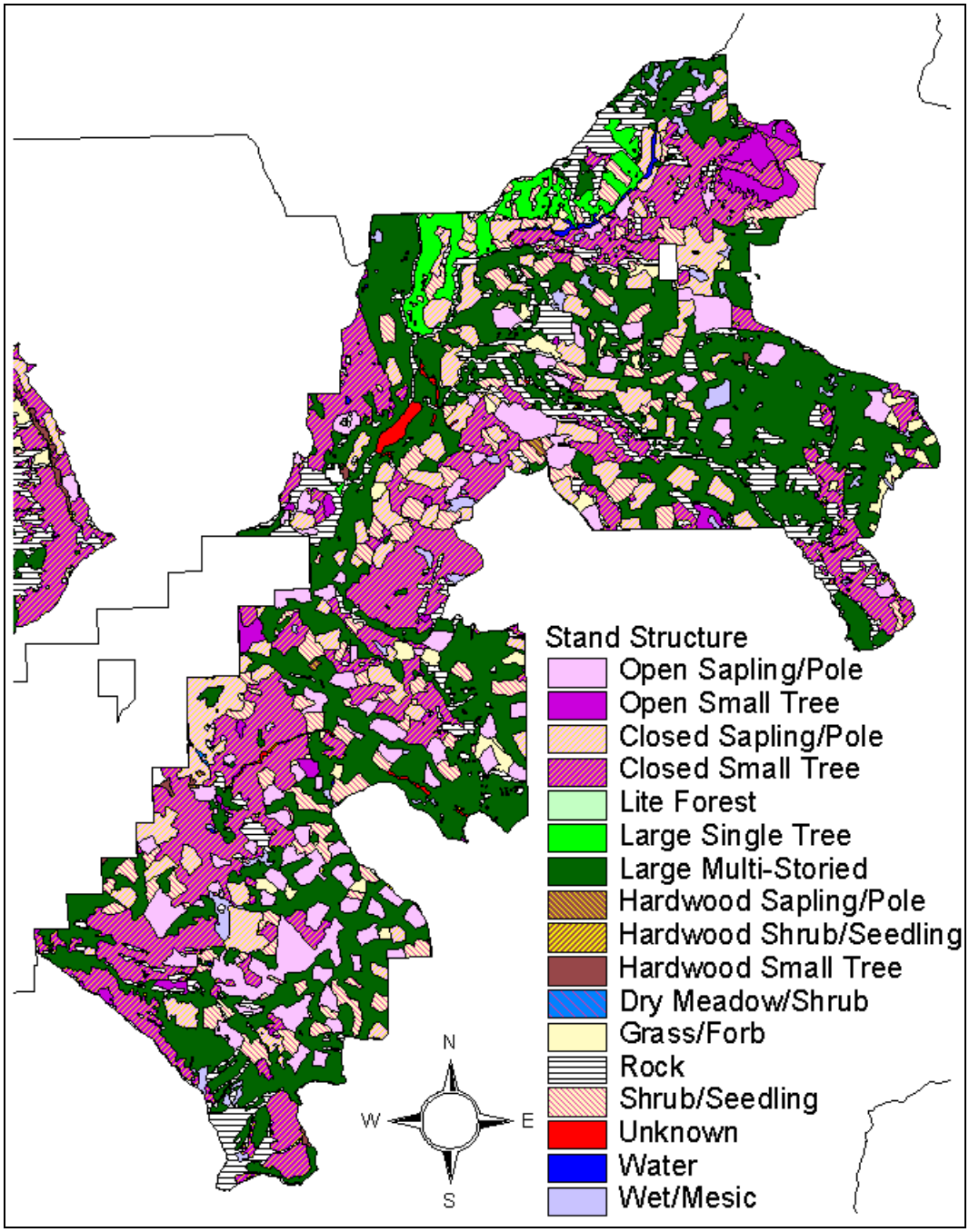
Map 4-28 Packwood LSR Ecoclass



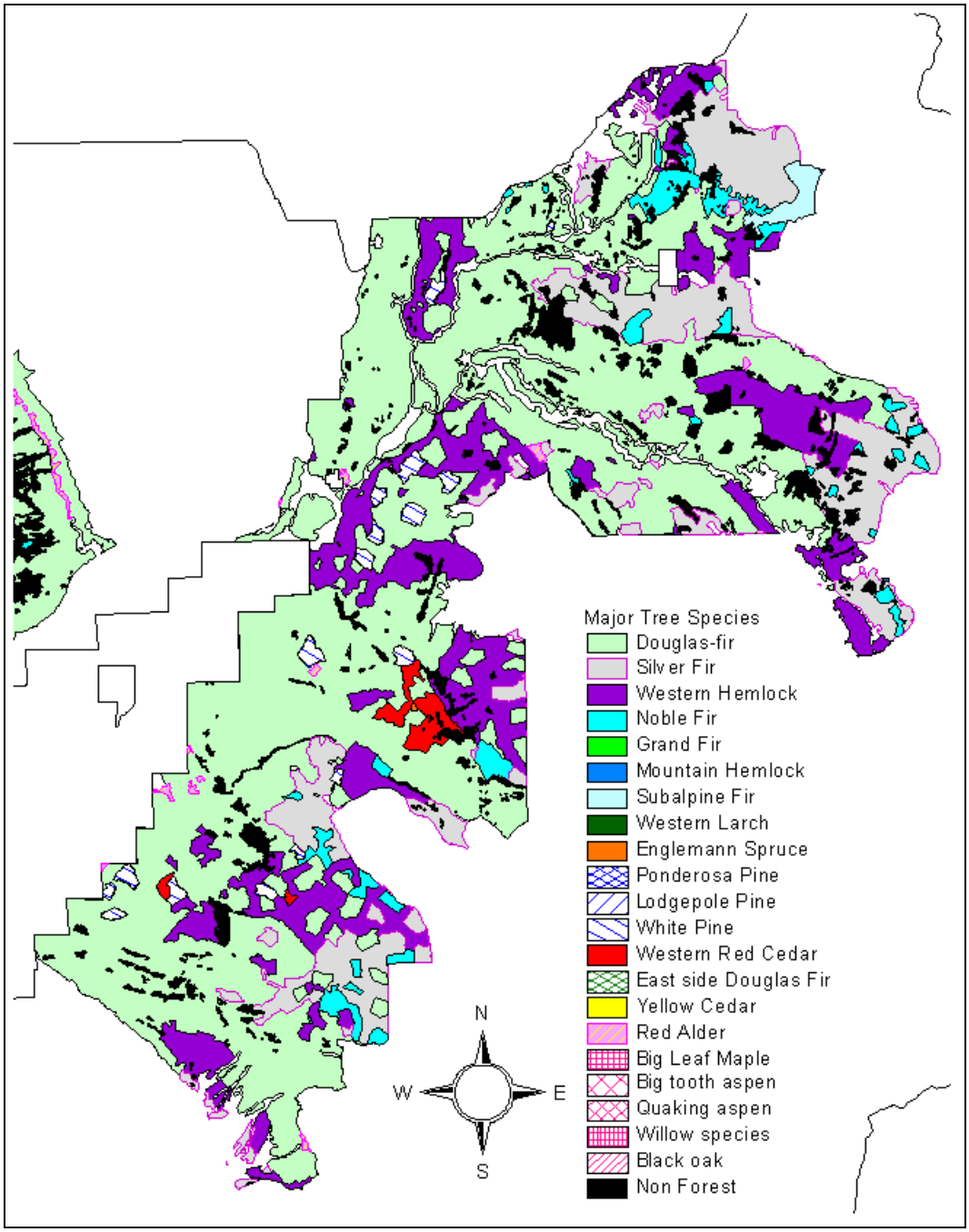
Map 4-29 Packwood LSR Age Class



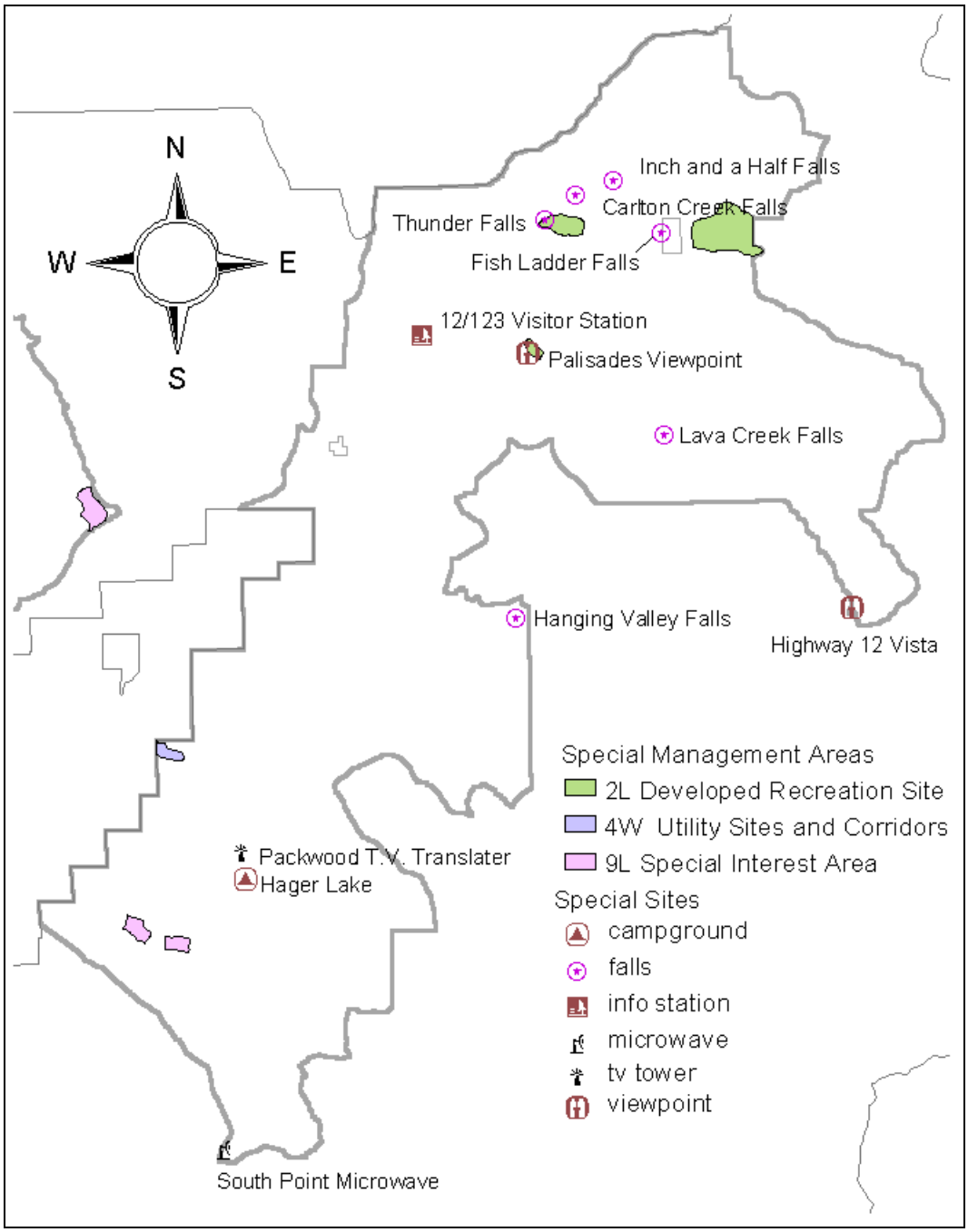
Map 4-30 Packwood LSR Stand Structure



Map 4-31 Packwood LSR Dominant Tree Species



Map 4-32 Packwood LSR Special Sites



Peterson LSR/MLSA

For the purposes of this assessment, we have combined LSR 151 with the Managed Late-Successional Area. Field review of these areas shows they are similar in climate, vegetation, wildlife, terrain, and historical uses.

Riparian Conditions

Existing conditions for riparian resources and functions are described in the *Trout Lake Creek* (FY96) and *Cave/Bear Creek* (FY97*) Watershed Analyses* and are not repeated here.

Unique Species and Habitats

The Peterson LSR contains large amounts of large tree, large patch habitat with dispersed habitat linking these patches. (See Map 4-3, page 4-31). Indications are that this LSR is only moderately fragmented, and movement through the LSR by these species is probably not severely restricted.

Peterson Prairie is a unique meadow opening, sustained historically through burning.

Numerous caves are present in this area. These caves are generally shallow lava tubes. Caves form unique plant habitat at their entrances, and may be used as roosting sites by bats, including the sensitive Townsend's big eared bat.

There are populations of sensitive plants fringed pinesap and pale blue-eyed grass in the LSR.

The Peterson LSR is within Critical Habitat Unit WA-41. A portion of the Wind LSR is also within this unit. The Peterson LSR only makes up 11,927 acres or 7 percent of the unit. The Peterson and Wind LSRs together comprise 96,725 acres or 57 percent of WA-41. (See Map 4-1, page 4-22.)

There are 6 northern spotted owl nest sites within this LSR and 6,500 acres of nesting, roosting, and foraging habitat.

Vegetation Conditions

The Peterson LSR lies primarily within the Grand Fir and Pacific silver fir zones, with a minor amount in the Mountain Hemlock Zone. Currently, the Peterson LSR is comprised of a matrix of late-successional forest and younger forest stands, with patch clearcuts dispersed throughout. Late-successional stands are composed of Douglas-fir, grand fir, Pacific silver fir, and western hemlock, with lesser amounts of western redcedar, ponderosa pine, western larch, mountain hemlock, Engelmann spruce, and lodgepole pine. In most stands Douglas-fir dominates the upper canopy layer, shade-tolerant Pacific silver fir or grand fir, mountain hemlock and western hemlock compose the understory.

In the eastern portion of the LSR, which is in the grand fir zone, fire exclusion has allowed increased development of the shade-tolerant tree understory. Stand thinning and partial removal of the early seral overstory has not been common in the Peterson LSR. Plantations are primarily composed of Douglas-fir, with minor amounts of ponderosa pine, Engelmann spruce, western larch and other species.

Snags and Down Wood

Data from the Forest's Continuous Vegetation Survey shows the following averages for snags and down logs in stands over 80 years old. The sample size for this data was small and observations contained a great deal of variability.

Table 4-25 Down Wood - Peterson LSR

Large end Diameter	Pieces per acre	Cumulative Length per Acre	Percent Ground Cover
7 inches	187	1,142 feet	3

Table 4-26 Snags - Peterson LSR

Average DBH	Snags per Acre
12 inches	16

High road density and gently sloping terrain facilitated the past removal of down trees for firewood in the southern half of the LSR. This has noticeably reduced the down log component in stands that otherwise meet the criteria for late-successional or old-growth. Since the designation of the LSR and elimination of firewood cutting, the down-wood component is increasing.

Disturbance History

Fire

Peterson Prairie area, which is in the Grand Fir Zone, historically experienced longer fire return intervals and fewer light ground fires than the drier Gotchen LSR, also located east of the Cascade crest. The Peterson Prairie area may have been maintained in a more open condition by Native American burning, to maintain small meadows and for ease of travel. The first exploration party in this area noted the change in forests on the east slope of the Cascades, changing from dense forest of the western slope to open forests with grassy understories.

Insects and Disease

The Peterson LSR has the potential to suffer from spruce budworm, mainly within those stands in the Grand Fir Zone. Although small amounts of spruce budworm have been detected within the LSR, it has not experienced the outbreak that is affecting the Gotchen LSR, which is four miles to the northeast.

Other insect and disease activity is occurring primarily at the sub-stand scale, creating small canopy gaps. Windthrow has been confined to individual trees or small groups.

Historic Uses

Timber management began in the 1930s or 40s, with removal of individual ponderosa pine and Douglas-fir from the Cave Creek area, which includes the southern portion of the LSR. The primary method of timber management has been clearcut harvest, most of which has occurred since the 1950s. Shelterwood harvests have been a common practice in the past 20 years in the southwestern corner of the LSR. About 800 acres within the LSR consist of old shelterwood harvests, with partial overstory stocking still intact.

Human Uses

Facilities

Facilities within the Peterson LSR include: Peterson Prairie Guard Station and Campground, Ice Caves and Natural Bridges interpretive sites, Atkisson Sno*Park, Flattop Mountain utility site, and Coyote Seed Orchard.

Roads

Forest Roads 24 and 60 are main Forest arterials and are managed for high quality scenery (partial-retention VQO). At 3.5 miles of road per square mile, the road density in the Peterson LSR is the second highest of LSRs on the Forest.

Special Forest Products

Mushrooms, huckleberries, beargrass, and vine maple transplants are common products collected from the Peterson LSR. This LSR contains some of the most productive huckleberry areas on the Forest.

Special Uses

Within the Peterson LSR is a camp operated under permit to a club and a communication site.

Grazing

Two allotments occur within the Peterson LSR. The Ice Caves Cattle Allotment covers most of this LSR. The LSR provides 41 percent of the land base for the Ice Caves Allotment. Approximately 200 head use this allotment from June to September. A water diversion (Lost Creek Ditch) provides additional water during the grazing period.

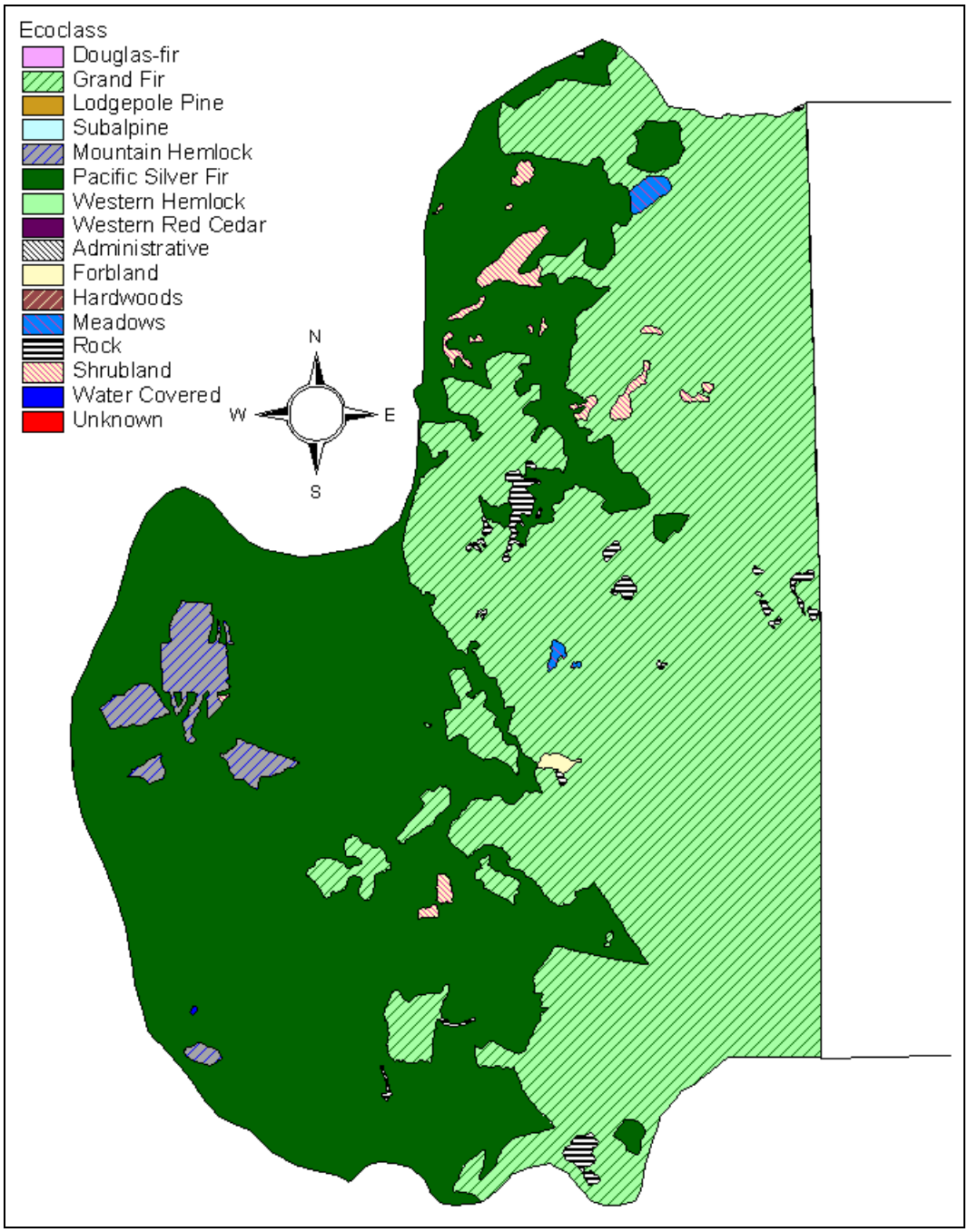
The Twin Buttes Sheep and Goat Allotment covers the remaining 1,854 acres in the northern tip of the LSR. Only 2 percent of this allotment is within the LSR. Up to 1,150 head of sheep are permitted for this allotment; however, the Peterson LSR portion of this allotment is not often used.

Social Significance

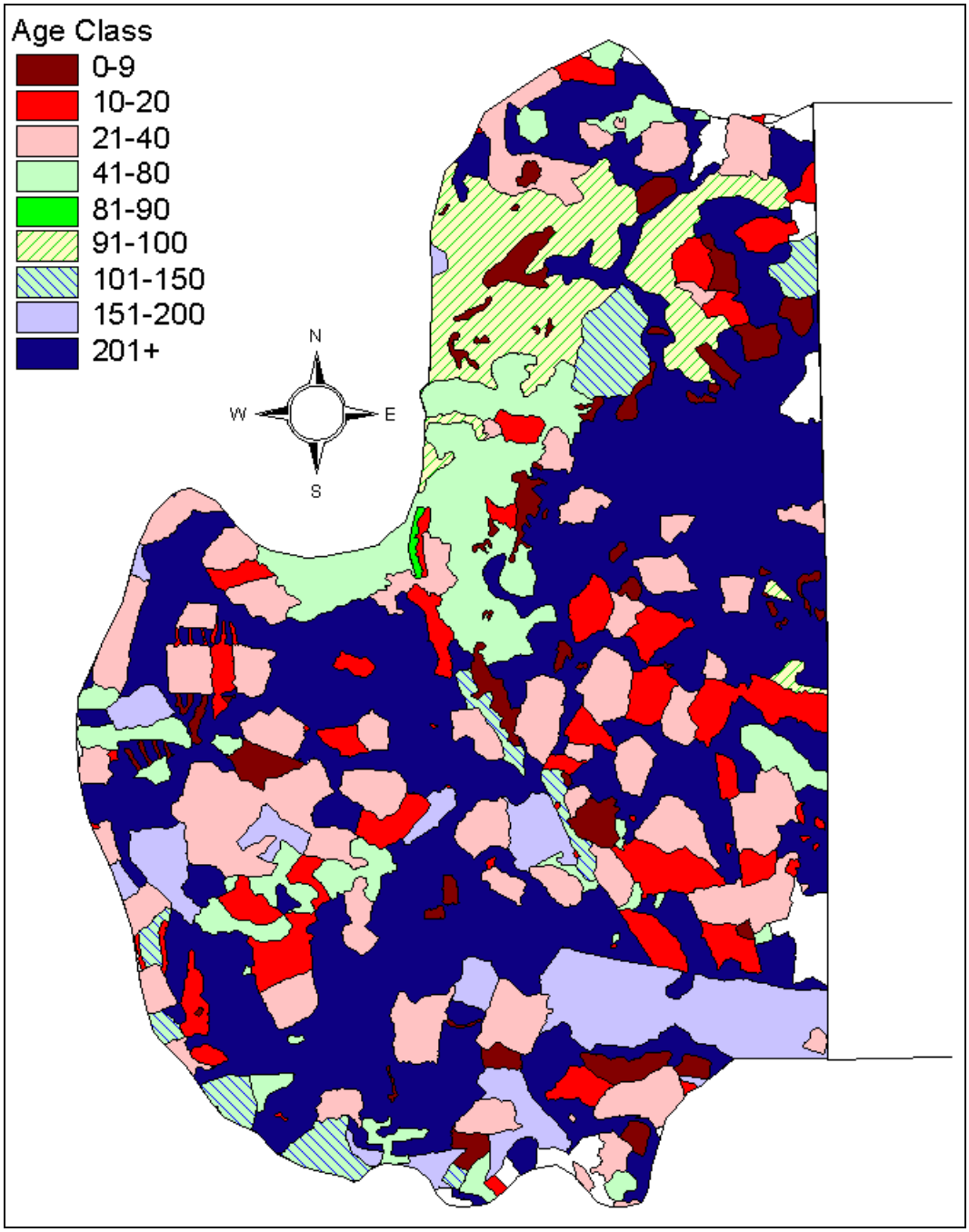
This is land ceded by the Yakama Indian Nation and is subject to the Yakama Indian Treaty of 1855.

The McClellan expedition in the 1880's documented their travels through this area in detail. They noted forests that were much more open than those of today. Interpretive signs in the vicinity of Peterson Prairie display the changed conditions to Forest visitors.

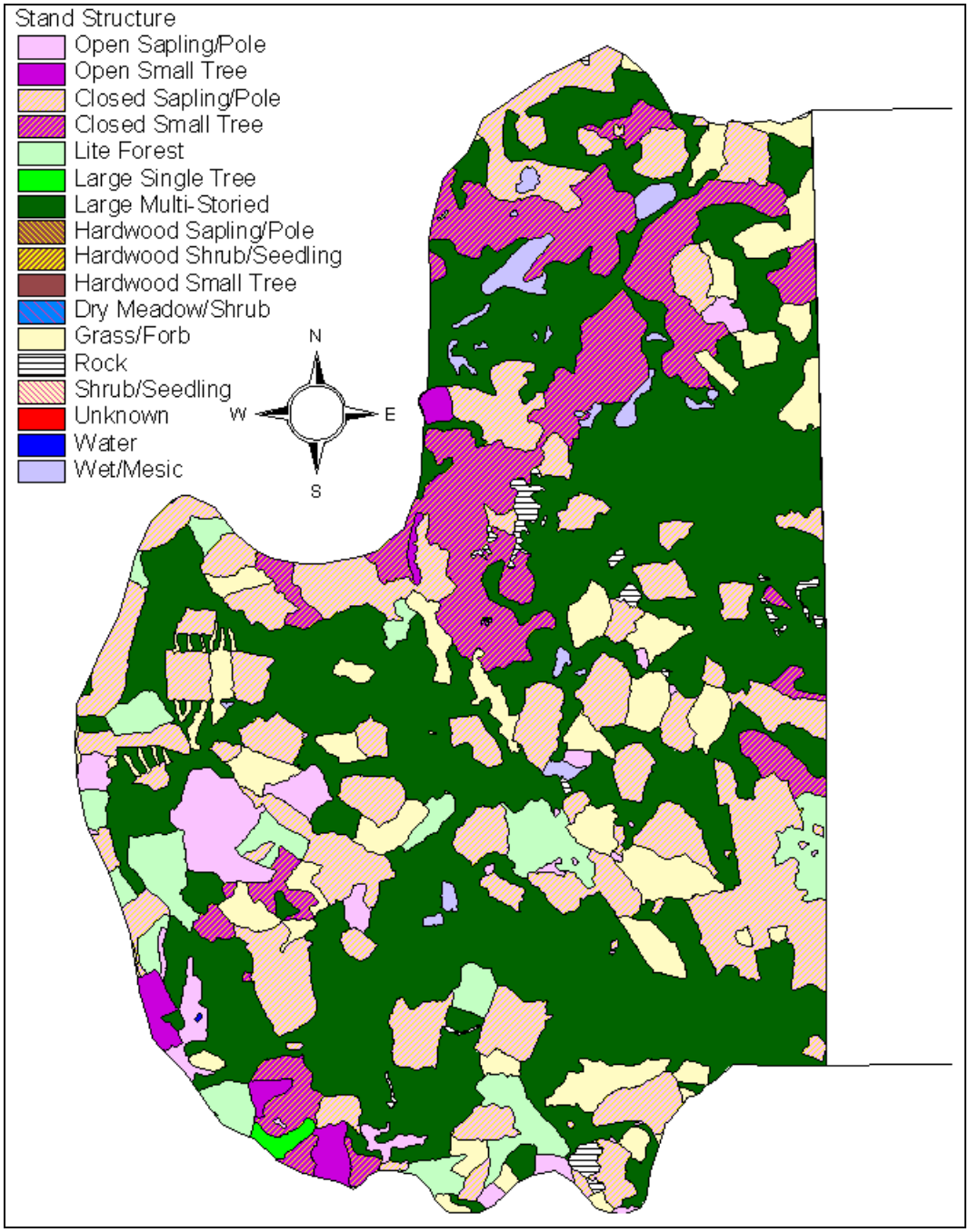
Map 4-33 Peterson LSR/MLSA Ecoclass



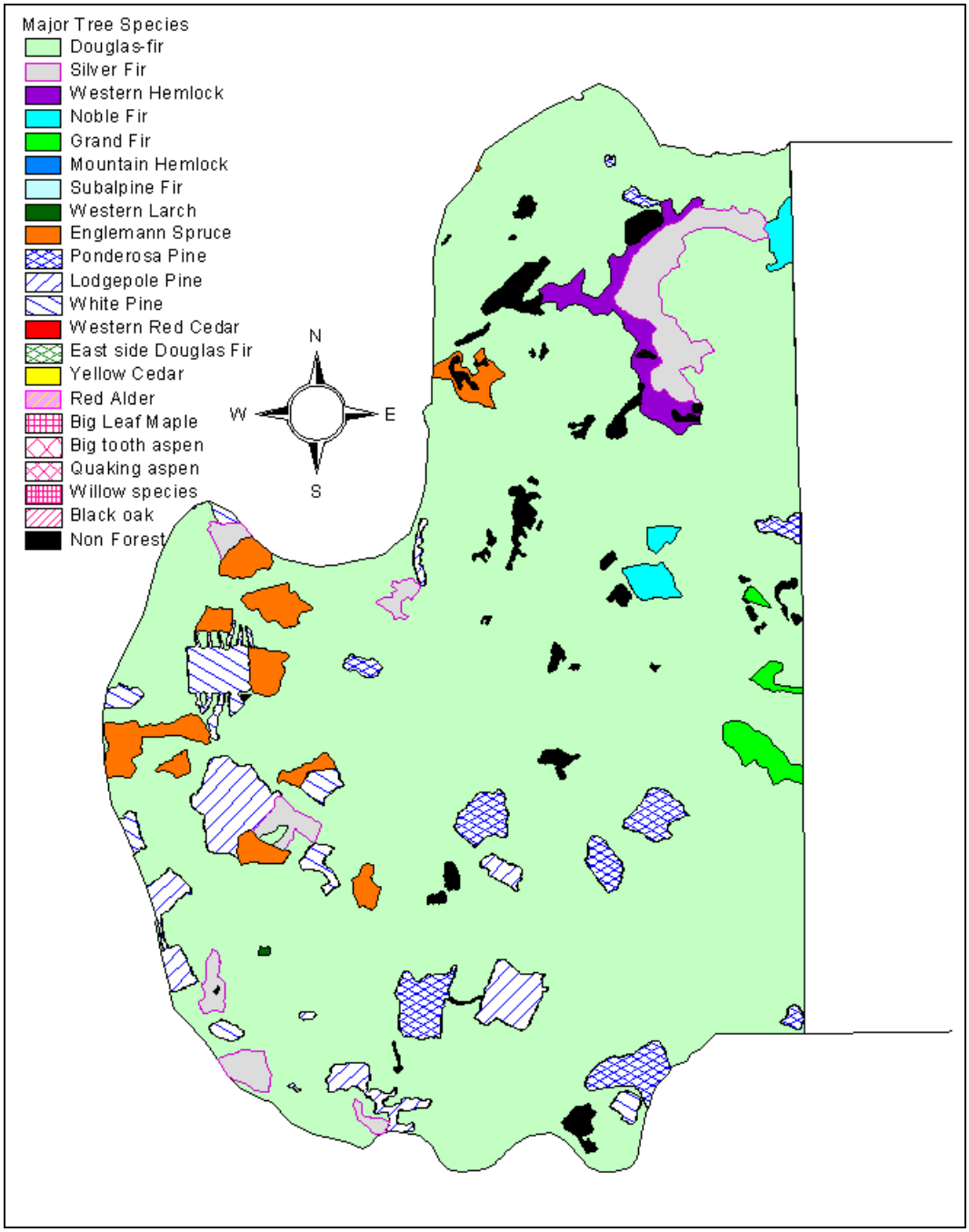
Map 4-34 Peterson LSR Age Class



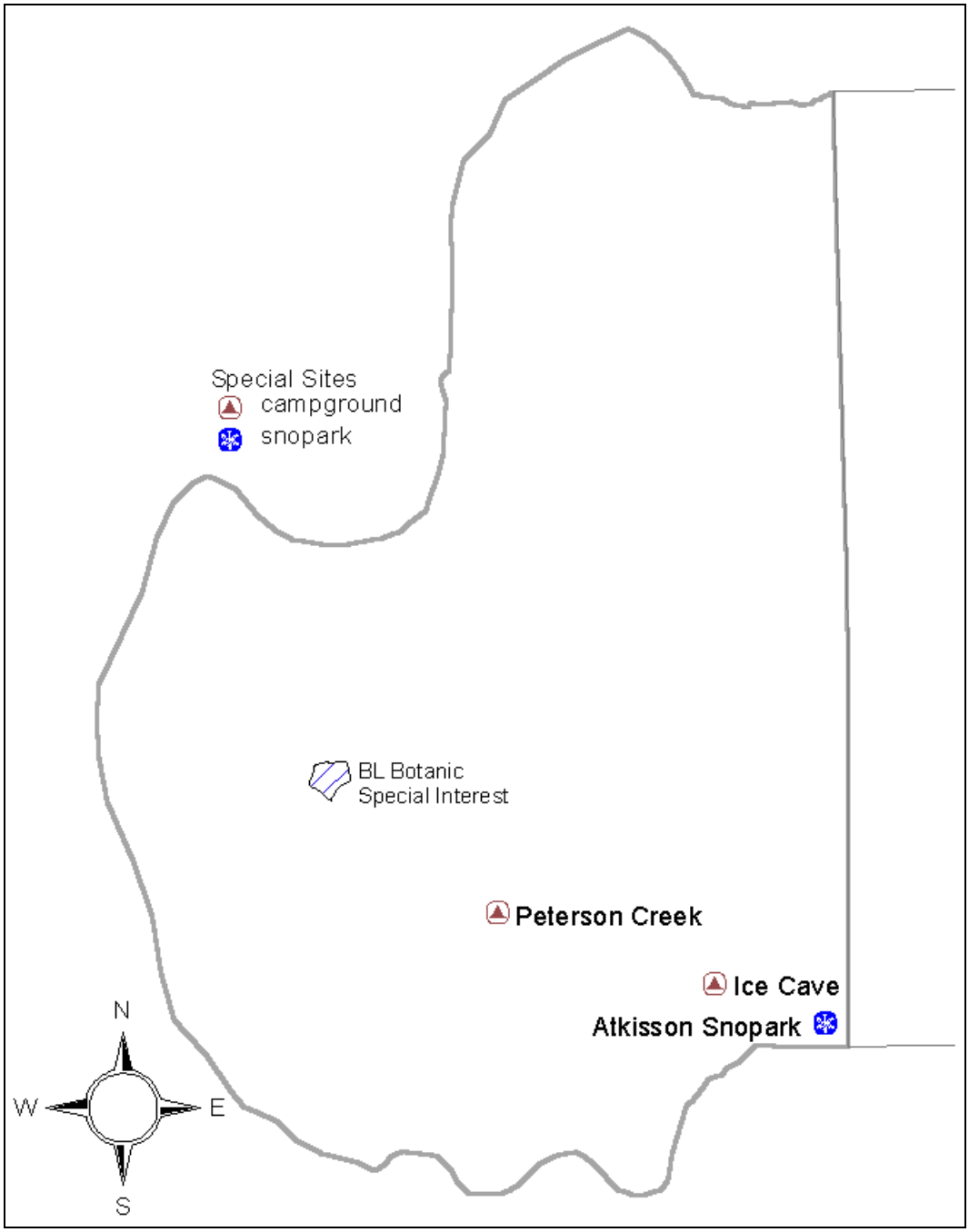
Map 4-35 Peterson LSR Stand Structure



Map 4-36 Peterson LSR Dominant Tree Species



Map 4-37 Peterson LSR Special Sites



Quartz LSR

Riparian Conditions

Existing conditions for riparian resources and functions are described in the *Lower Cispus West Watershed Analysis* and are not repeated here.

Unique Species and Habitats

A large percentage of the LSR is unfragmented late and mid-seral habitat, but little effective habitat exists between this LSR and any other LSR due to fire history, volcano activity, and timber harvesting. The northern half of the Quartz LSR contains primarily large patch habitat, with additional large patch habitat adjacent to the east. (See Map 4-3, page 4-31.) The southern half is highly fragmented.

The Quartz Creek Big Trees grove is a special interest area (BL) located along the southeastern edge of the LSR.

The Quartz LSR is bordered to the north and west by private and state land; most of the adjacent ownerships have been logged.

Critical Habitat Unit WA-38 encompasses the Lewis, Quartz, and Woods LSRs. The Quartz LSR comprises 6,636 acres or 4 percent of the unit. All three LSRs cover approximately 79 percent of Critical Habitat Unit WA-38. (See Map 4-1, page 4-22.)

There are 4 northern spotted owl nest sites within this LSR and 5,500 acres of nesting, roosting, and foraging habitat.

Vegetation Conditions

Quartz LSR is close to desired conditions, having over 70 percent of the area in mature and older age classes. It is a productive area capable of producing high quality late-successional habitat.

Eleven percent of this LSR is in age classes up to 80 years old. Most of these stands are young plantations which originated from past clearcutting 20-40 years ago, and are stocked at levels considered to be appropriate for rapid growth through age 40 to 50 (300-400 trees per acre).

About 400 acres of the area is in the age 10-20 year range. Most of these plantations have not had any stocking control treatment (thinnings), and are stocked at levels ranging from 500 to 1500 trees per acre. Heights of these trees range from 10 feet in the youngest stands to 30 feet in the older stands. Some stands may have very uniform stocking of only the trees which were planted, while others may have a great variety of species and sizes of trees due to natural seeding which followed the planting. There is a shift to dominance by the trees and away from shrubs, herbs and grasses in these stands.

Most of the remainder of this LSR is split between two other age classes. About 32 percent is in the 100-150 year class, and about 39 percent is in the 200+ year class. Most of these stands are considered late-successional or old-growth, and contain most of the desired characteristics for LSR stands - very large trees, standing snags, multiple tree canopy layers and gaps, and large woody material on the forest floor.

Snags and Down Wood

Data from the Forest's Continuous Vegetation Survey shows the following averages for snags and down logs in stands over 80 years old. The sample size for this data was small and observations contained a great deal of variability.

Table 4-27 Down Wood - Quartz LSR

Large end Diameter	Pieces per acre	Cumulative Length per Acre	Percent Ground Cover
13 inches	450	4,820 feet	12

Table 4-28 Snags - Quartz LSR

Average DBH	Snags per Acre
22 inches	13

Disturbance History

The age class pattern in the Quartz LSR (Map 4-39) shows a history of stand-replacing fires. There has been little disturbance from timber harvesting activities.

Human Uses

Facilities

There are no developed campgrounds. There is one developed day-use site, Quartz Creek Big Trees.

Trails

In the Quartz LSR there are 35 miles of system trails, none permit motorized use.

Special Forest Products

Because of its relative remoteness, there is very little special forest products collection in the Quartz LSR.

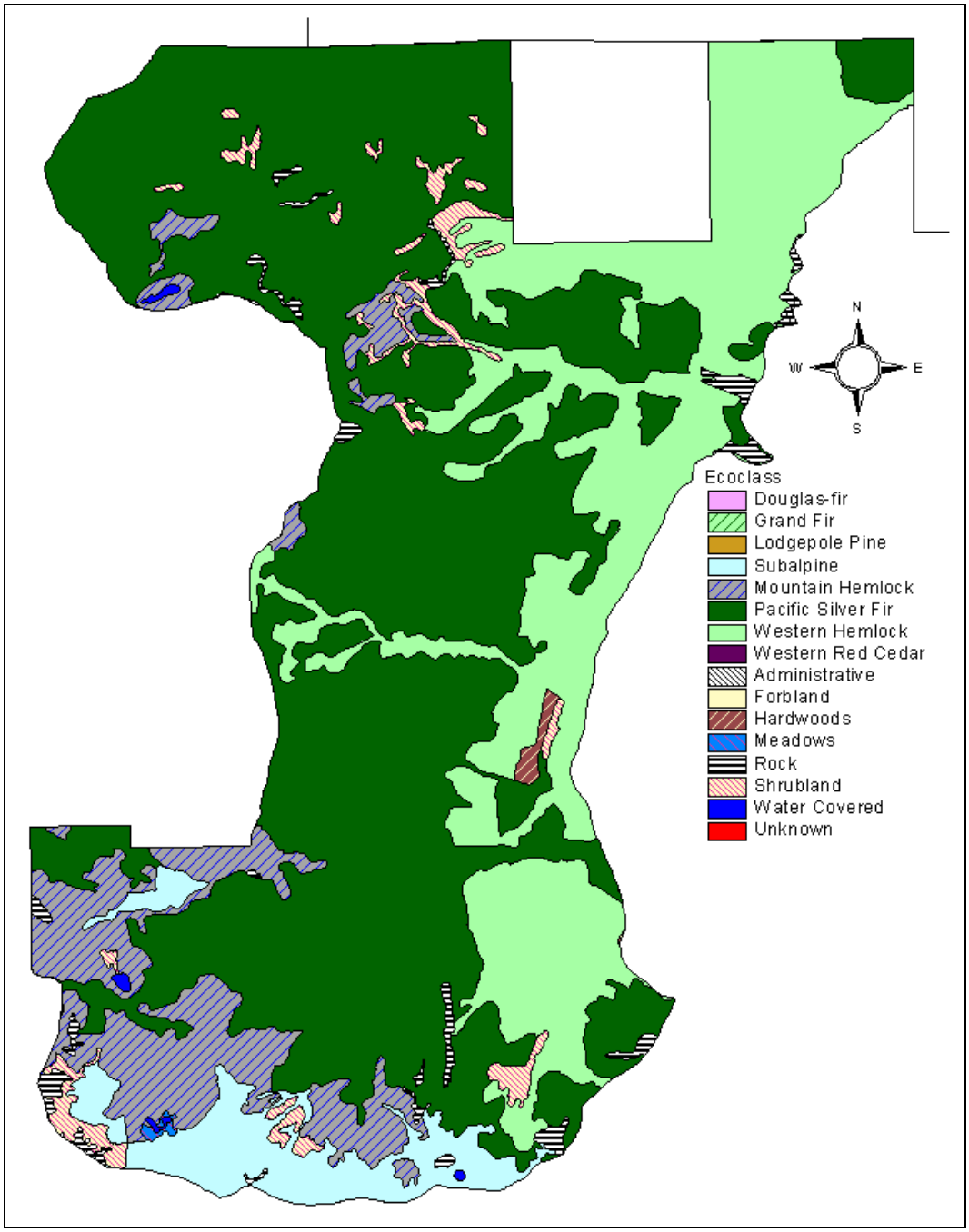
Special Uses

There is one road maintenance agreement with an adjacent landowner and a permit for a tailhold granted to a timber company. There is one placer mining claim in the Quartz LSR.

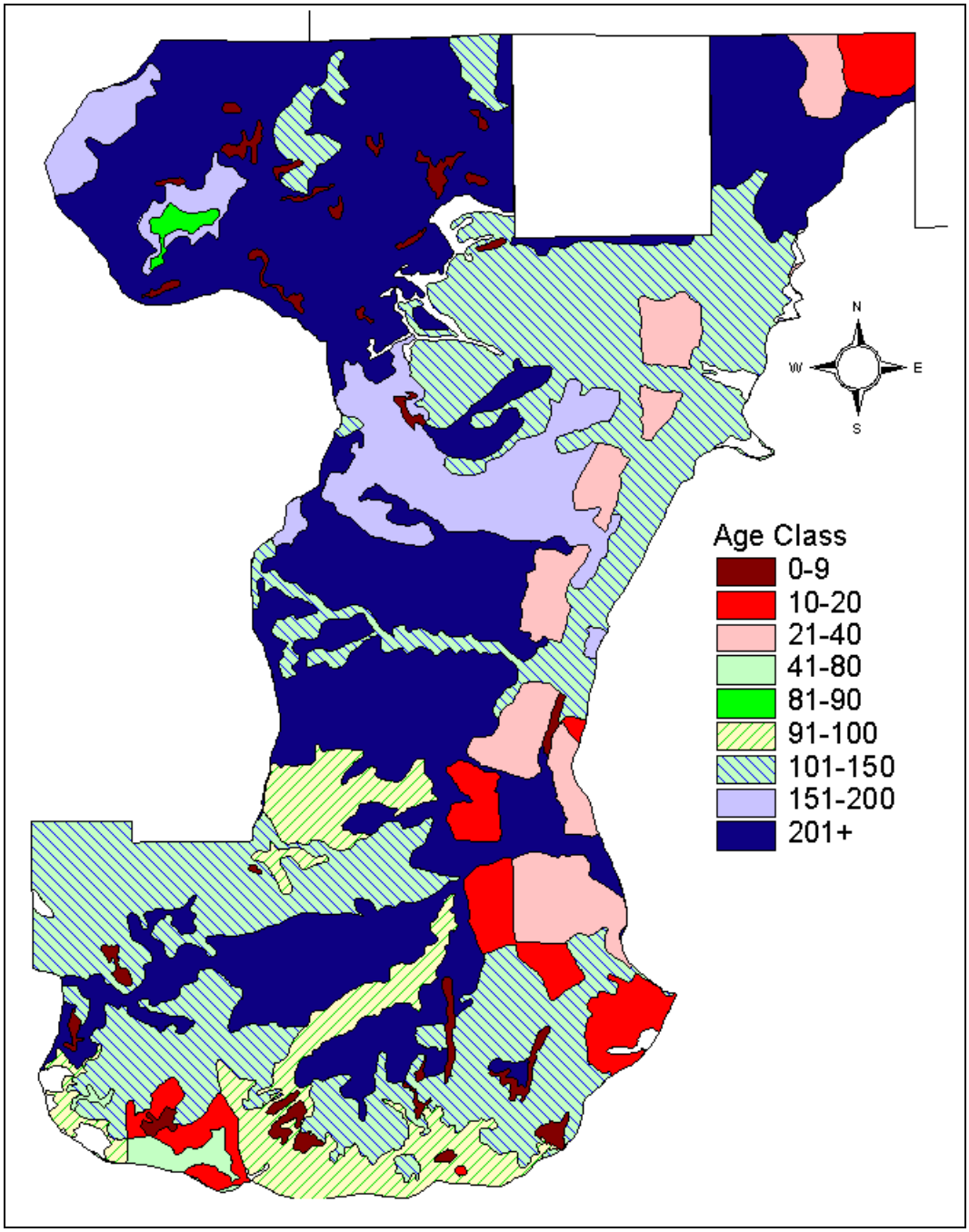
Social Significance

Most of this LSR is within the Tumwater RARE II roadless area.

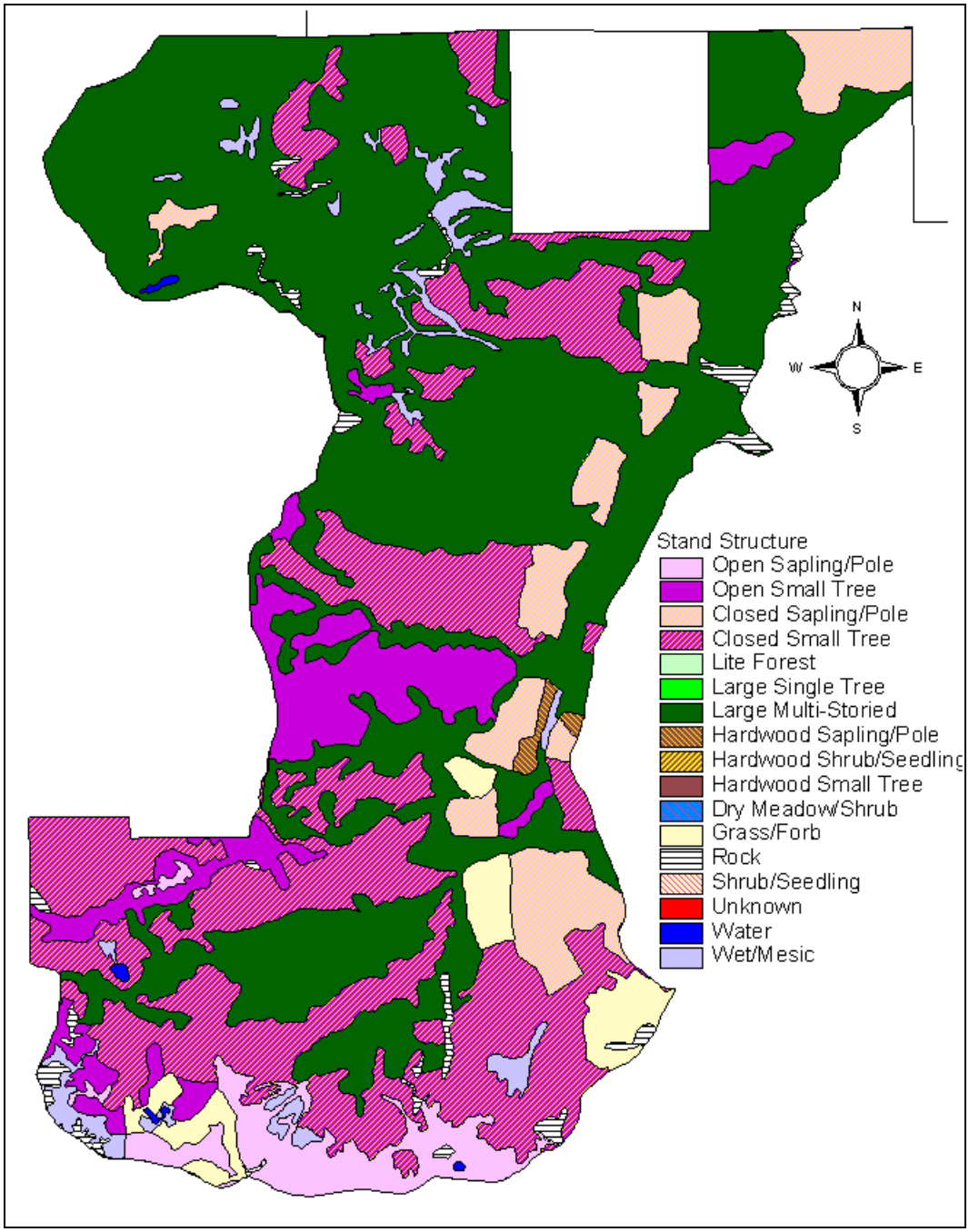
Map 4-38 Quartz LSR Ecoclass



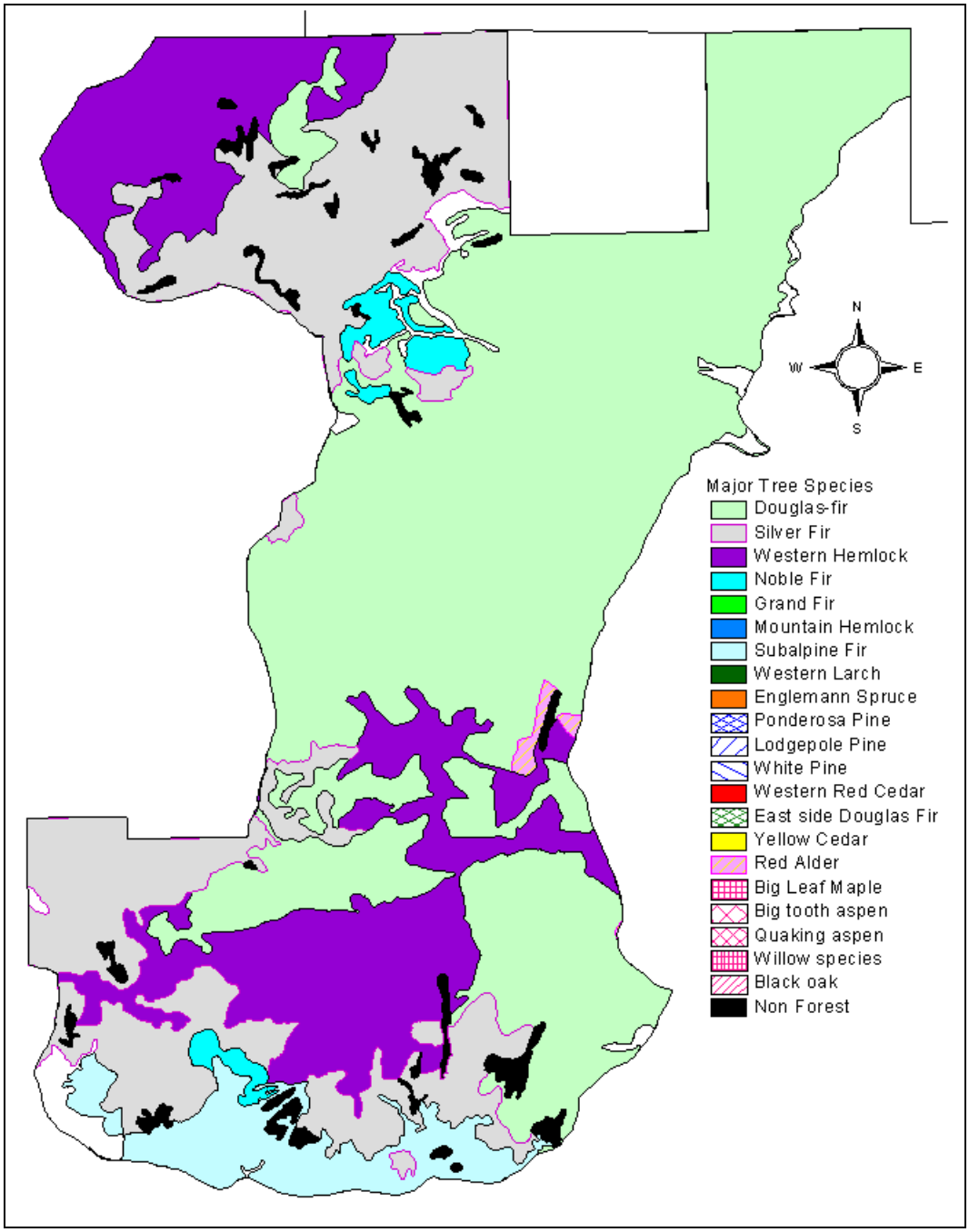
Map 4-39 Quartz LSR Age Class



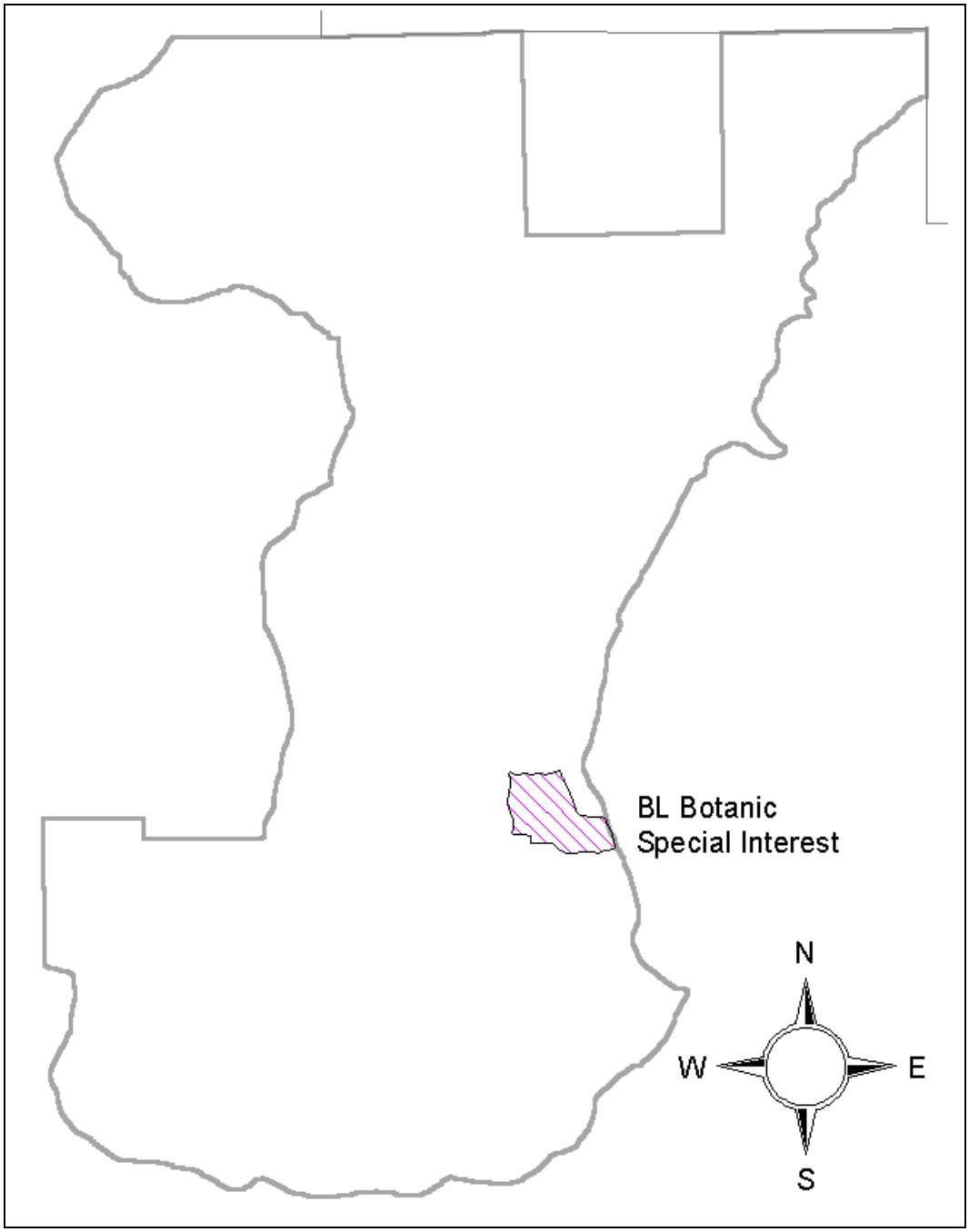
Map 4-40 Quartz LSR Stand Structure



Map 4-41 Quartz LSR Dominant Tree Species



Map 4-42 Quartz LSR Special Sites



Wind LSR

Riparian Conditions

Existing conditions for riparian resources and functions are described in the Wind, Little White Salmon and Lower North Fork Lewis River Watershed Analyses and are not repeated here.

Unique Species and Habitats

The Wind LSR has a relatively large expanse of younger habitat in the middle of the LSR. Most of this habitat is in the small-tree structural stage and should develop into late-successional habitat in the next 50 years or longer. Silvicultural treatment that accelerates the development of late-successional habitat would be beneficial in these areas. Some of these are 80-100 years of age and would benefit from thinning. Many of the less mobile species are small mammals, terrestrial amphibians and terrestrial mollusks which use down wood. Increasing the level of down wood in these areas should result in increased habitat connectivity for these species.

The Wind LSR contains extensive large tree, large patch habitat throughout that is fairly well connected by aggregated and dispersed habitat. (See Map 4-3, page 4-1.) The Trapper Creek Wilderness also contributes a large amount of large tree, large patch habitat to the middle of the LSR landscape. Large amounts of closed small tree habitat within the LSR reduce the effects of fragmentation (edge effects).

Important connectivity areas adjacent to the Wind LSR include the Big Lava Bed (east), Indian Heaven Wilderness (northeast), and Trapper Creek Wilderness (middle).

To the south, the Columbia River serves as a natural barrier to most species. The area around Dog Mountain is the primary connection to the Columbia River which is within federal jurisdiction. The area to the Columbia River is in the dryer portion of the Western Hemlock Zone and contains some Douglas-fir plant associations. Oak balds are common.

The high elevation of Paradise Hills, north of Wind LSR in Matrix, breaks the link between the Wind and Lewis LSRs.

Special habitats unique to the Wind LSR are varied and distributed across the landscape:

- Very old forest stands (greater than 300 years) exist within 15 Wind LSR subwatersheds and range in size from 67 to 2,341 acres. T.T. Munger RNA and Government Mineral Springs are examples.
- Scattered populations of Oregon white oak include Weigle Hill (proposed RNA) and Carson Depot. This species is the only oak in Washington state and has undergone dramatic decline in the last 150 years.
- Upland ridgetop meadows include Grassy Knoll and Big Huckleberry Mountain.
- Wetlands include Black Creek Swamp, Oregon Ash Forest at Whistle Punk trail, Cold Springs, and Tyee Springs.
- Caves, lava beds, and bridges provide foraging, roosting, hibernating, and maternity habitat for bats.
- Cliffs (Dry Creek subwatershed) and talus provide nesting habitat for raptors, including the peregrine falcon.

- This is the only LSR within the range of a number of Survey and Manage molusk species. Molusks are found in riparian areas near the Columbia River. (See Table 4-8, page 4-1.)
- The Wind LSR contains two Critical Habitat Units; WA-40 and WA-41. The LSR covers 9,998 acres or 83 percent of WA-40 and 84,798 acres or 49 percent of WA-41. Critical Habitat Unit WA-41 also contains the Peterson LSR. Thus, 96,725 acres or 57 percent of WA-41 is designated as an LSR. (See Map 4-1, page 4-1.)
- There are 28 northern spotted owl nest sites in this LSR and 33,500 acres of nesting, roosting, and foraging habitat.

Vegetation Conditions

The Wind LSR is characterized by large areas of even-aged coniferous forest that range in age from 65 to 150 years old, interspersed with remnants of older forest up to 500 years old and patch clearcuts less than 40 years old. Stands below 3000 feet elevation are in the western hemlock plant association. Most stands above 3000 feet elevation transition into the Pacific silver fir zone.

Early-successional stands are generally stocked with young trees and provide forage and openings for wildlife. Young stands tend to be overstocked and over crowded with young trees. Early-successional stands that occur in riparian areas are generally lacking in large trees that provide woody debris, bank stability, and shade for streams. Young stands that originated after harvest and recent wildfire are lacking in many of these components. There are over 70,000 acres of young stands within the LSR that are lacking in one or more of the components mentioned above, much of which resulted from the Siouxon and Yacolt burns.

Mid-successional stands are developing characteristics and attributes of late-successional stands (large diameters, layering, species diversity, and woody debris). Late-successional stands occur mainly along the drainage bottoms in the western hemlock zone with some above 3,500 feet elevation in the true fir zone. Forest stands in the late-successional category contain the full range of plant species, tree sizes, tree ages, and woody debris the make up a diverse forest ecosystem.

Over the past 40 years, the practice of regeneration harvest by patch clearcutting has created an even distribution of openings across the landscape. Over 30,000 acres of patch clearcutting has occurred since 1955. Individual patches range from 10 to 60 acres and are comprised of early-successional young stands. Outside of the Wilderness Area and the Research Natural Areas very little contiguous late-successional forest remains in the LSR.

Snags and Down Wood

Data from the Forest's Continuous Vegetation Survey shows the following averages for snags and down logs in stands over 80 years old. The sample size for this data was small and observations contained a great deal of variability.

Table 4-29 Down Wood - Wind LSR

Large end Diameter	Pieces per acre	Cumulative Length per Acre	Percent Ground Cover
14 inches	252	4,309 feet	12

Table 4-30 Snags - Wind LSR

Average DBH	Snags per Acre
15 inches	24

Disturbance History

Fire

In 1902, the Siouxon and Yacolt Burns occurred within the LSR. The Siouxon fire consumed almost all of the stands in the Siouxon drainage except the upper eastern portion. The Yacolt fire only burned a small area within the Wind LSR.

Because this LSR borders on wilderness areas it may be at a greater risk from wildfire because we are limited in our ability to aggressively suppress wildfire in wilderness areas.

Disease

Forest diseases for the most part are within endemic levels within the Wind River and Siouxon drainages. The types of diseases of concern are root diseases, stem diseases, and branch diseases.

Two principal root diseases are Phellinus and Armillaria. Phellinus root disease is widespread and is not considered a serious problem if infestation is less than 15 percent of an area. There are a few areas in Trout Creek and Dry Creek where the rate of infestation exceeds 15 percent. Armillaria root disease is also widespread but is not considered a threat to forest health.

Of the several stem diseases white pine blister rust is the most widespread. Managers are enhancing white pine survival by planting genetically resistant stock and pruning lower branches on white pine.

Hemlock dwarf mistletoe is the most prevalent stem disease throughout the range of western hemlock in the Wind LSR. In multi-story stands with an infected overstory, the disease can be especially damaging because young trees are continually re-infected from the overstory. Areas of heavy infection occur in the old-growth stands of Trout Creek and Dry Creek drainages. These stands will remain infected until a stand replacement event occurs.

Windthrow damage has been a major concern throughout the watershed. The amount of windthrow increased as the amount of clearcutting increased. Most damage occurred along the exposed edges of newly harvested cutting units. Ridge lines and ridge saddles are also areas prone to windthrow damage. In the future, the incidence of windthrow in the LSR should decrease as stands mature and develop wind firmness.

Insects and losses to insects are a part of the natural processes taking place within the forest ecosystem. Many insects occur in the basin at endemic levels. The most damaging insect is the Douglas-fir beetle which colonizes dead and dying Douglas-fir. Windthrow and logging slash provide a prime habitat for this beetle. The beetle will also invade stands weakened by drought and/or root disease. When populations build up in dead or weakened trees, adjacent live healthy trees can often be killed. Salvage logging was employed in the past to remove beetle killed trees. In the future, the amount of beetle activity will depend on contributing factors like drought and windthrow. Trees killed by beetles will provide for snags and coarse woody debris.

Historic Uses

After settlement, vegetative patterns were influenced by roading and timber harvesting. The first timber harvesting in the Wind River watershed occurred when the area began to be settled in the 1870s. The first sawmills were built in the 1880s while logging began in the lower Wind River valley bottoms.

By 1900 human activity began to have a noticeable effect on vegetation within the watershed.

The first Forest Service timber sale was made in 1912 to Wind River Lumber Company. The sale enabled the company to invest in railroad logging equipment and access timber that had been inaccessible. Until 1925 numerous sales were made to the Wind River Lumber Company and the railroad extended up the Wind River to Paradise Creek. The company was forced out of business after the Wind River valley burn of 1925 consumed logging equipment plus 4.5 million board feet of felled and bucked timber. Until about 1948 subsequent timber harvest occurred primarily on private lands within the LSR. Beginning in 1948, timber sales were again being offered in the Wind River watershed. In the ensuing years large investments were made into forest road systems, fire protection, reforestation, timber stand improvement, and forest genetics in the watershed. To meet congressionally mandated harvest levels, the Wind River Ranger District sold between 40 million and 100 million board feet of timber annually from 1950 to 1993. A large portion of this timber came out of the Wind LSR area. The preferred harvest method was regeneration patch clearcuts followed by planting. By 1995 over 30,000 acres of mature forest within the Wind LSR had been regenerated and converted to early-successional plantations.

Human Uses

Facilities

The Wind LSR contains the Crest, Panther Creek, and Beaver Campgrounds, Hemlock Lake day-use area, and Panther Creek Falls interpretive site. A natural gas line and a BPA transmission line cross the LSR. Also located in the Wind LSR are the City of Carson domestic water supply pipeline, Government Mineral Springs and Craven's Crag repeater installation. The Forest Service maintains a guard station, Wind River Ranger Station, Planting Creek Seed Orchard and the former Wind River Nursery. The Wind River Experimental Forest is located in this LSR.

Special Forest Products

Bough sales, Christmas trees, beargrass, mushrooms, and transplants are harvested from this area. Mushrooms are the most sought after. Firewood and huckleberries are also collected.

Special Uses

The Wind LSR contains a summer home tract near Government Mineral Springs. About 30 summer are authorized under transferable 20 year special use permits. (Lots are typically 1/4 acre.) Structures are owned by the permittees. There are also ten water pipelines, one powerline, and one telephone line under permit in the LSR. There are also several permits related to road easements and maintenance agreements. There is one apiary authorized under a one-year permit.

Social Significance

A portion of the LSR is land ceded by the Yakama Indian Nation and subject to the Yakama Indian Treaty of 1855.

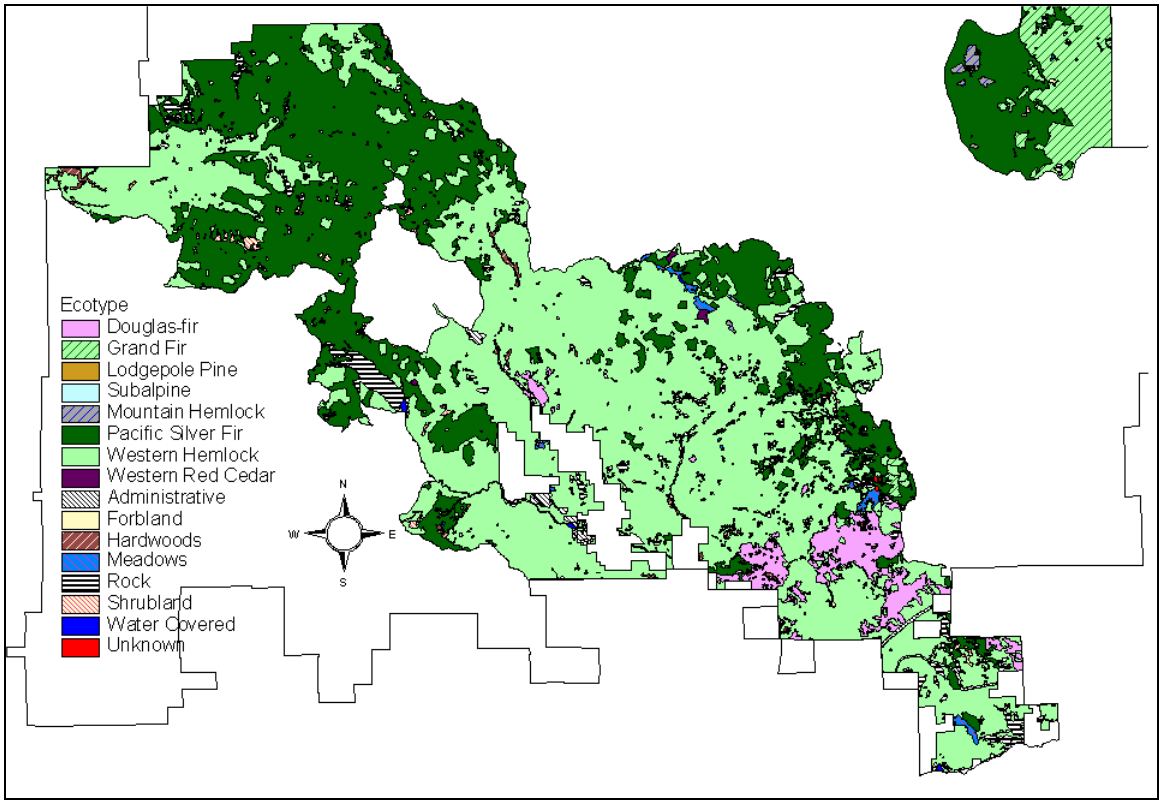
Two segments of Siouxon Creek and one segment of the Wind River in this LSR are "Further Study Rivers" to be evaluated for suitability for Wild and Scenic River designation in a future study. Forest Plan direction provides for protection of values contributing to their potential for classification until the studies are complete.

T.T. Munger and Sister Rocks RNAs are in this LSR. Weigle Hill is a proposed RNA.

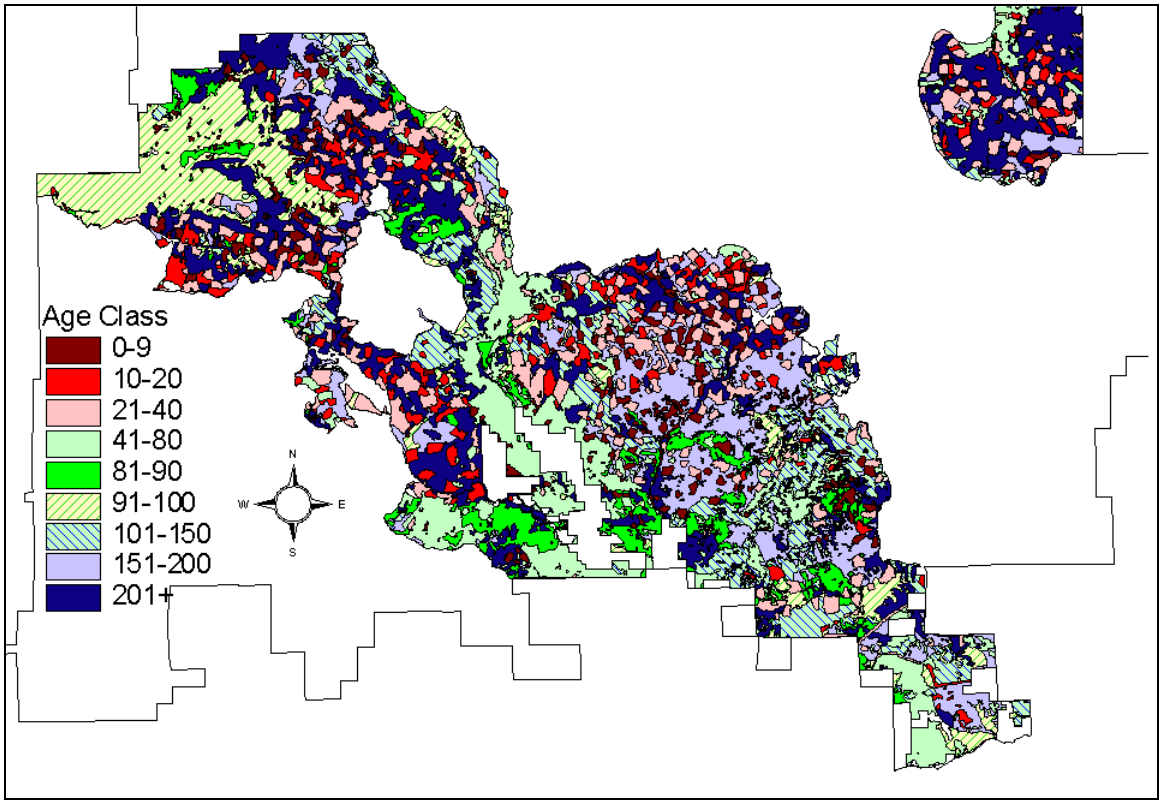
Bear Creek, Siouxon, Big Lava Bed, and Bourbon Roadless Areas were evaluated for wilderness in RARE II.

The Pacific Crest Trail traverses the southeast portion of the LSR.

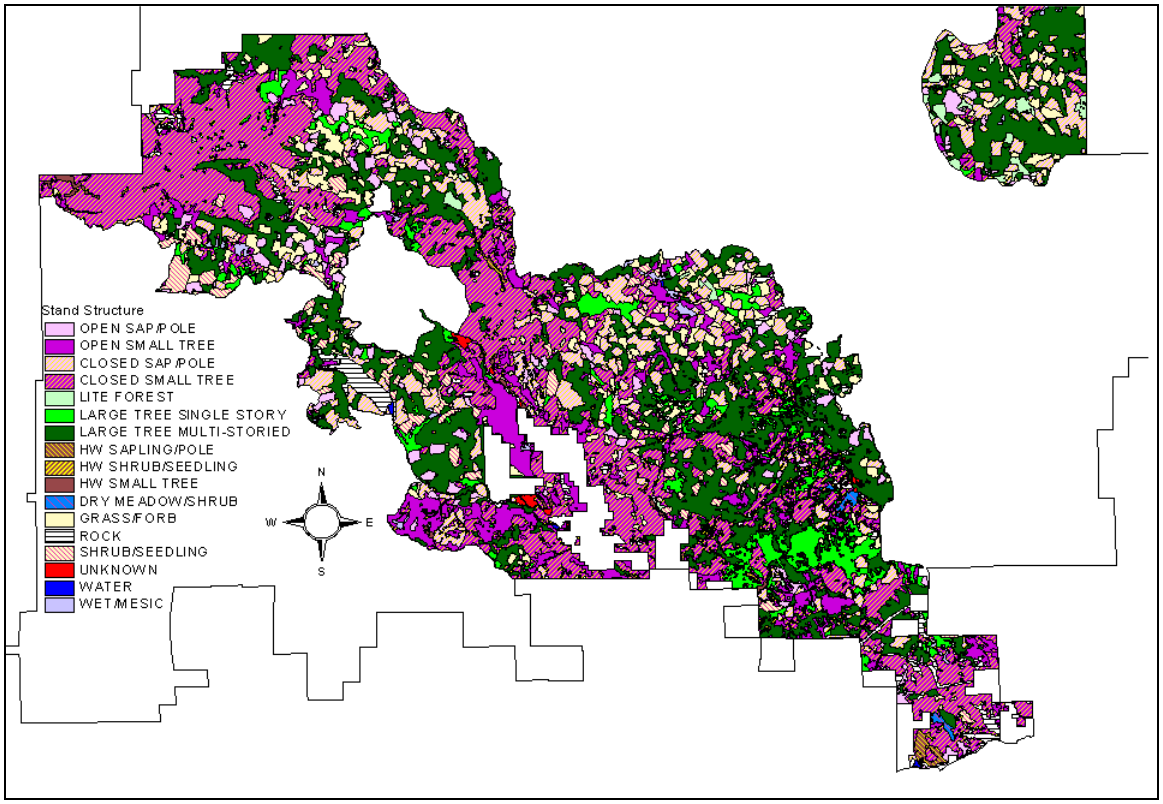
Map 4-43 Wind LSR Ecoclass



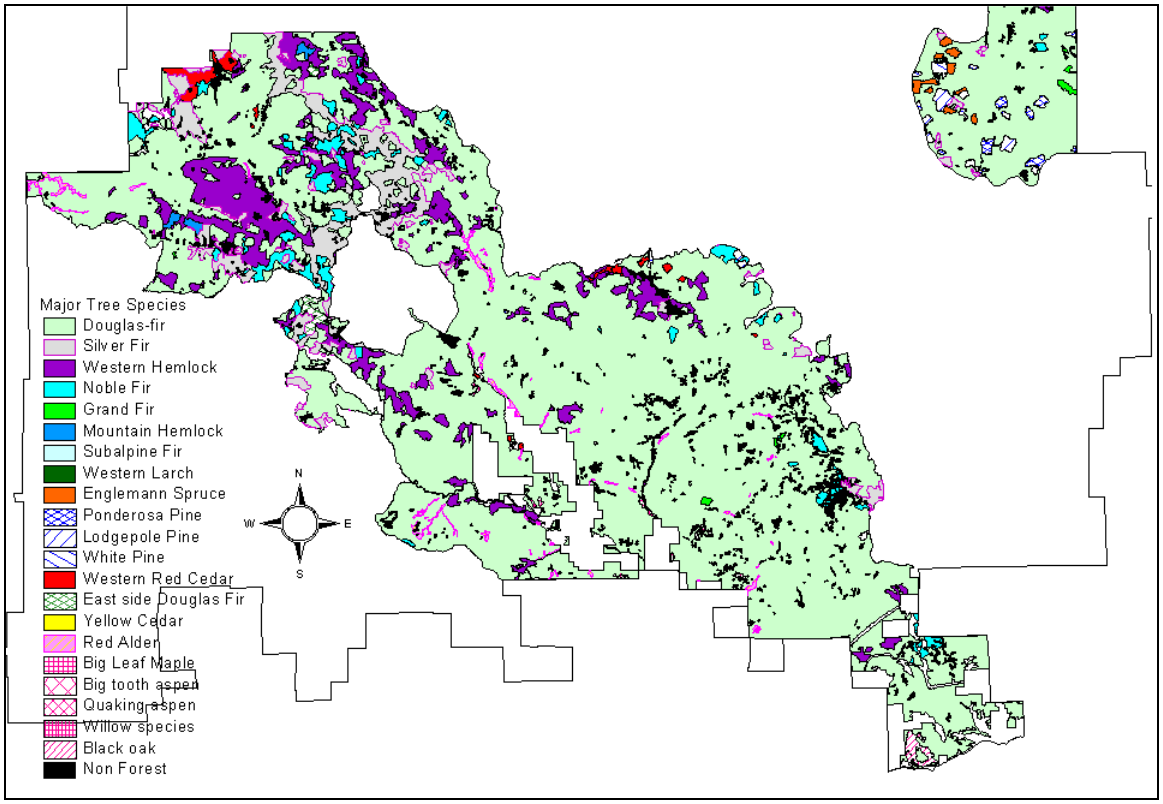
Map 4-44 Wind LSR Age Class



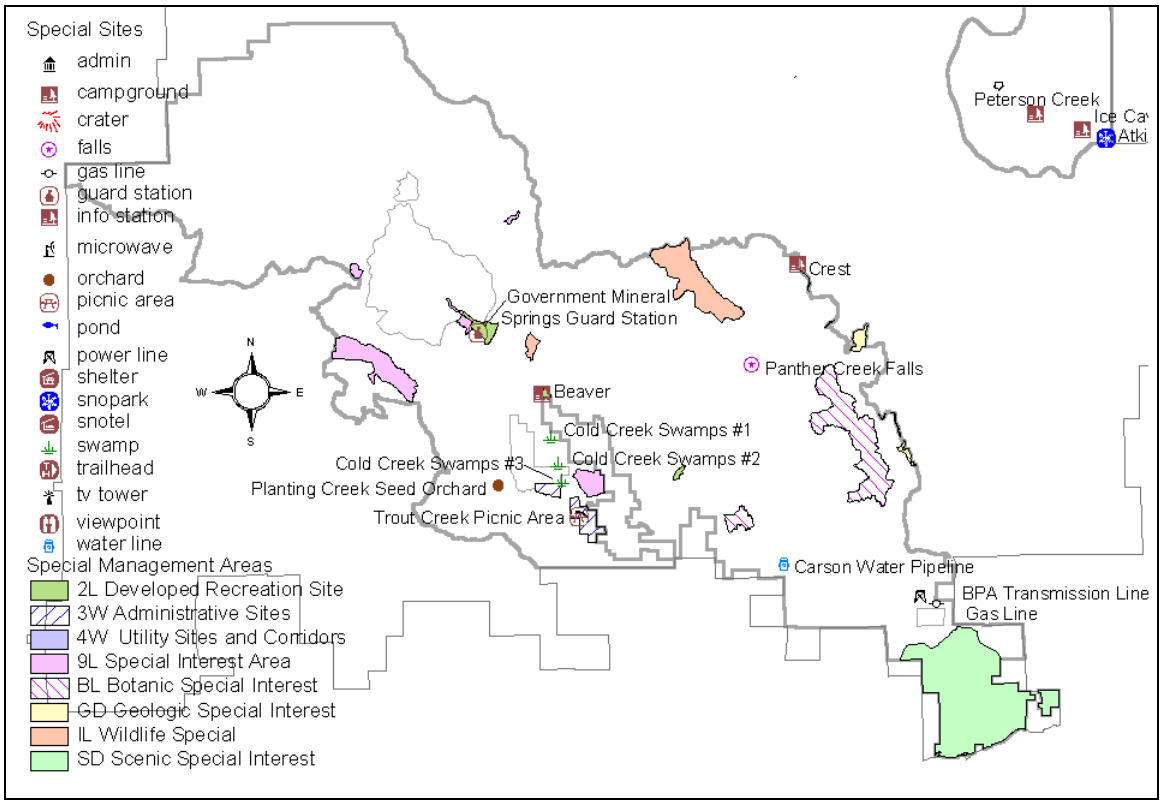
Map 4-45 Wind LSR Stand Structure



Map 4-46 Wind LSR Dominant Tree Species



Map 4-47 Wind LSR Special Sites



Woods LSR

Riparian Conditions

Existing conditions for riparian resources and functions are described in the *Lower Cispus East Watershed Analysis* and are not repeated here.

Unique Species and Habitats

The Woods LSR contains large tree habitat that is fairly fragmented. The majority of large tree habitat is in dispersed patches. (See Map 4-3, page 4-31.) Relatively large blocks of second growth unmanaged forest at the southern end of the LSR resulted from the Cispus Burns at the turn of the century.

Woods LSR contains low elevation coniferous forest with small blocks of classic western hemlock and Douglas fir old-growth forest interspersed. Because of its low elevation it provides winter ranges for deer and elk. Numerous small ponds and streams scattered throughout are important habitat for nesting and migratory waterfowl, shorebirds, mammals, such as beaver and river otter, amphibians, a blue heron rookery, and many other species.

The Cispus River runs through the LSR, and provides habitat and a corridor for harlequin ducks, wintering bald eagles, ospreys, and other species.

The Woods LSR contains Tower Rock, a local landmark and cliff habitat for raptors.

Frequent salvaging and firewood cutting has depleted down woody debris and snags.

Three Survey and Manage mollusk species are suspected and a goshawk pair are known to inhabit the LSR.

Critical Habitat Unit WA-38 encompasses the Woods LSR. The unit also contains the Lewis and Quartz LSRs. The Woods LSR covers 22,978 acres or 14 percent of WA-38. All three LSRs cover approximately 79 percent of Critical Habitat Unit WA-38. (See Map 4-1, page 4-22.)

There are 7 northern spotted owl nest sites within this LSR and 14,800 acres of nesting, roosting, and foraging habitat.

Vegetation Conditions

Forty-five percent (12,689 acres) of this LSR is in stands less than 80 years old. About one third of these acres is in stands between 70 and 80 years old which originated after wildfire in 1918, and is mostly located in the southeastern portion of the LSR. These are even-aged stands of Douglas-fir with moderate amounts of western hemlock in the understory. They are at elevations bordering on the upper limits of the western hemlock zone.

The other two-thirds of this age range is in young plantations which originated from clearcuts over the past four decades. Almost all of them were planted solely with Douglas-fir, but presently show moderate amounts of western hemlock, western redcedar, and associated hardwood species. Most of these plantations are in the 20-40 year age range, and are stocked at levels (300-400 trees per acre) considered to be appropriate for rapid growth through age 40 to 50.

About 6 percent (1,600 acres) are in the 10-20 year class. Most of these plantations have not had any stocking control treatment (thinnings), and are stocked at levels ranging

from 500 to 1500 trees per acre. Heights of these trees range from 10 feet in the youngest stands to 30 feet in the older stands. Some stands may have very uniform stocking of only the trees which were planted, while others may have a great variety of species and sizes of trees due to natural seeding which followed the planting. Forty percent (11,297 acres) of this LSR is in stands over 200 years old. This component is well distributed through the LSR except for the southeast portion which shows evidence of more recent stand-replacing fires. These old stands contain most of the desired characteristics of late-successional stands (i.e., very large trees, multiple layered tree canopies and gaps, standing snags, and large woody material on the forest floor).

Snags and Down Wood:

Table 4-31 and Table 4-32 developed from the Forest's Continuous Vegetation Survey show the following averages for snags and down logs in stands over 80 years old. The sample size for this data was small and observations contained a great deal of variability.

Table 4-31 Down Wood - Woods LSR

Large end Diameter	Pieces per acre	Cumulative Length per Acre	Percent Ground Cover
15 inches	239	4,874 feet	14

Table 4-32 Snags - Woods LSR

Average DBH	Snags per Acre
16 inches	22

Disturbance History

The southeast portion was subjected to stand-replacing fires early in the century. Harvest activity has occurred throughout the LSR.

Human Uses

Facilities

The Woods Creek Watchable Wildlife Area provides visitors wheelchair accessible opportunities to view beaver, waterfowl, deer and elk. A portion of the trail through an old-growth stand also provides opportunities to see old-growth associated wildlife. A Mount St. Helens visitor information center is located on the 25 Road, which is one of the major travel routes for visitors to the Monument.

Popular developed sites within the LSR include the Iron Creek campground and picnic area, Burley Mountain Fire Lookout, and the Cispus Learning Center, a large education and conference center.

The Woods LSR contains an established 32-acre Douglas-fir seed orchard which will provide genetically improved seed into the future. It is uncertain whether it will be a permanent facility.

Special Forest Products

Woods LSR has a wide variety of special forest products collected. The area is accessible year round and has a high demand for salal and fern cutting during the winter months. Other products include personal use firewood, beargrass, mushrooms, boughs, Christmas trees, and transplants.

Special Uses

Within the Woods LSR, there are four water pipelines, a telephone and powerline, and a communications site authorized by special use permit. There are also several easements and road maintenance agreements. The Cispus Learning Center, a popular retreat operated by the Association of Washington Schools is located within the Woods LSR.

Social Significance

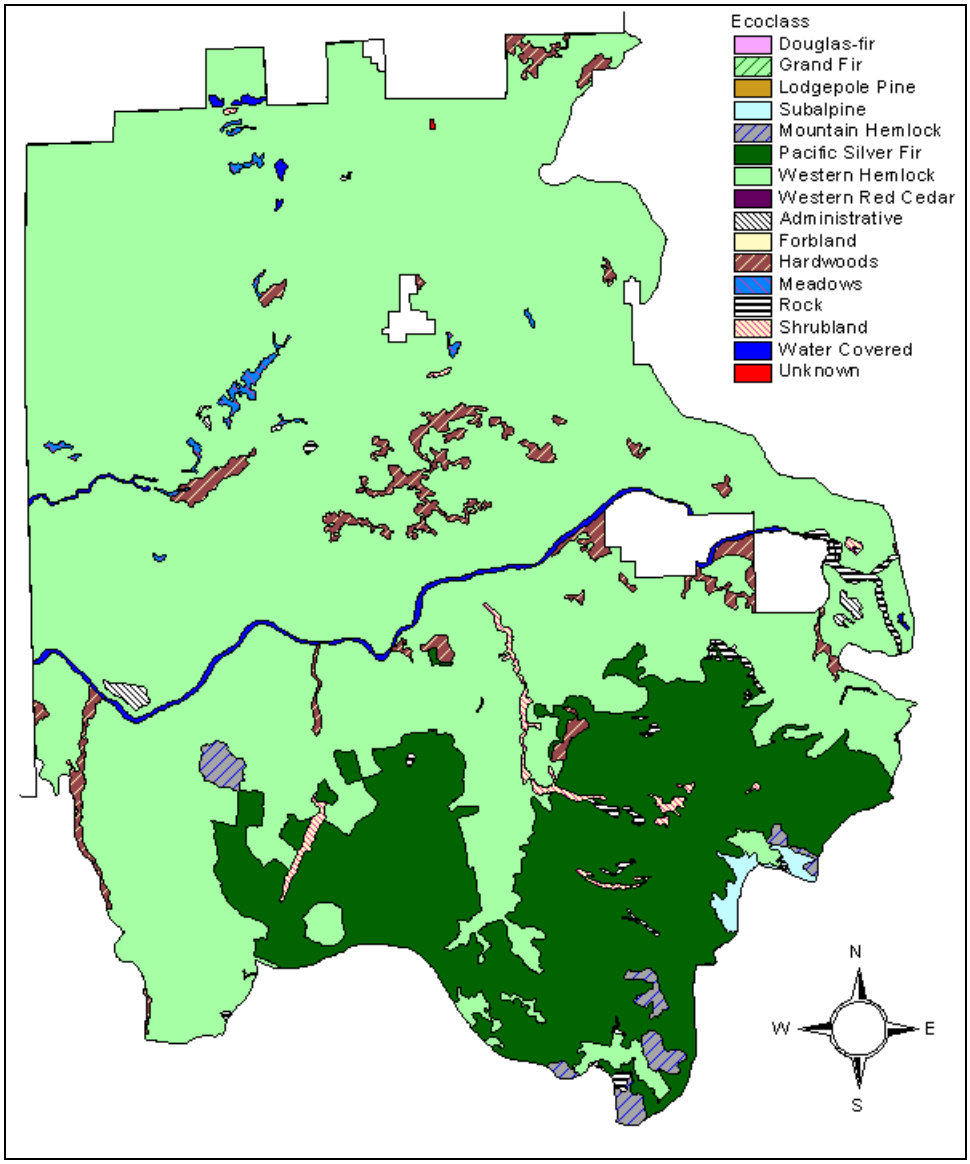
Burley Mountain contains popular huckleberry fields which have a long history of use.

Four blocks of other ownerships are included within the boundary of the Woods LSR.

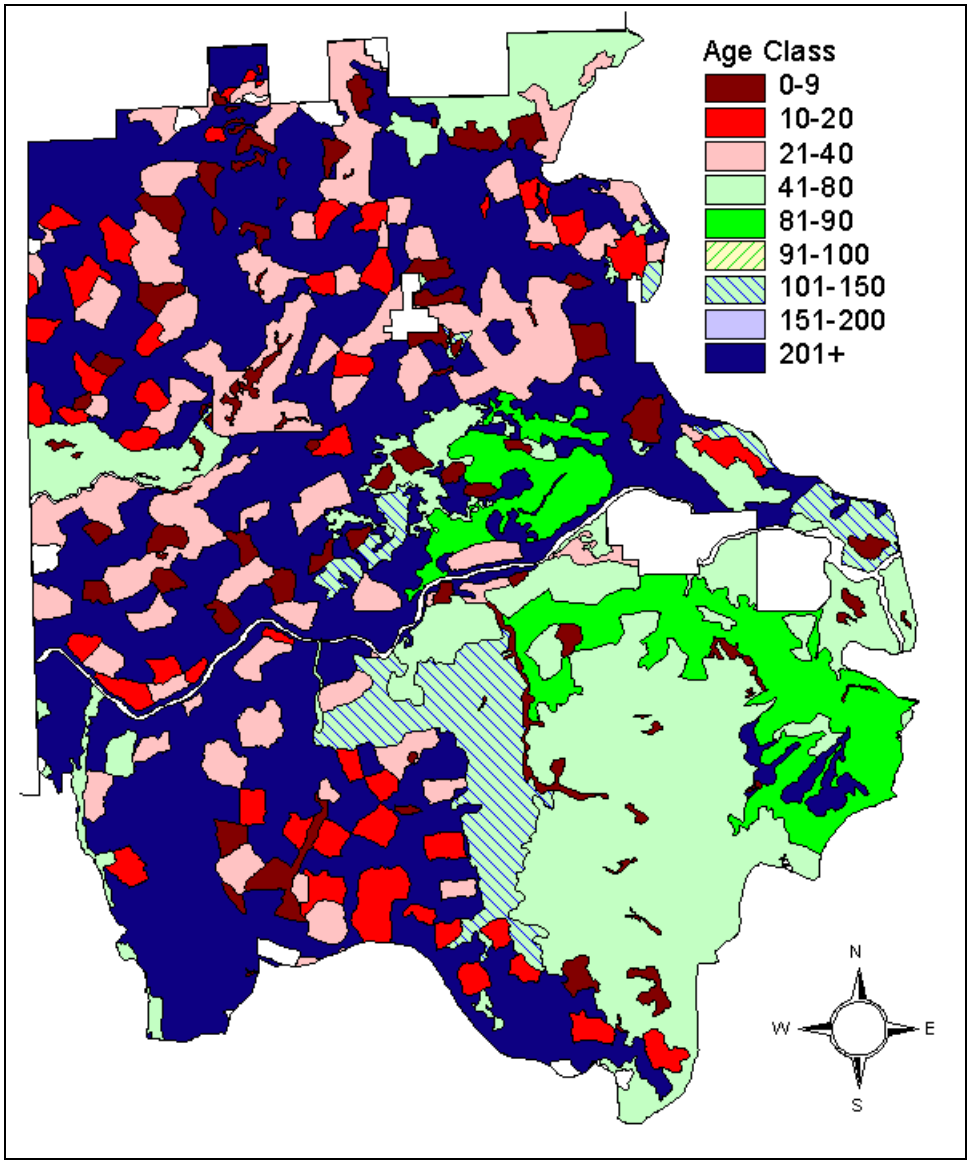
A short segment of Yellowjacket Creek in this LSR is a “Further Study River” to be evaluated for suitability for Scenic River designation in a future study. Forest Plan direction provides for protection of values contributing to their potential for classification until the studies are complete.

The segment of the Cispus River in the LSR was recommended to Congress for Scenic River designation by the 1990 Forest Plan.

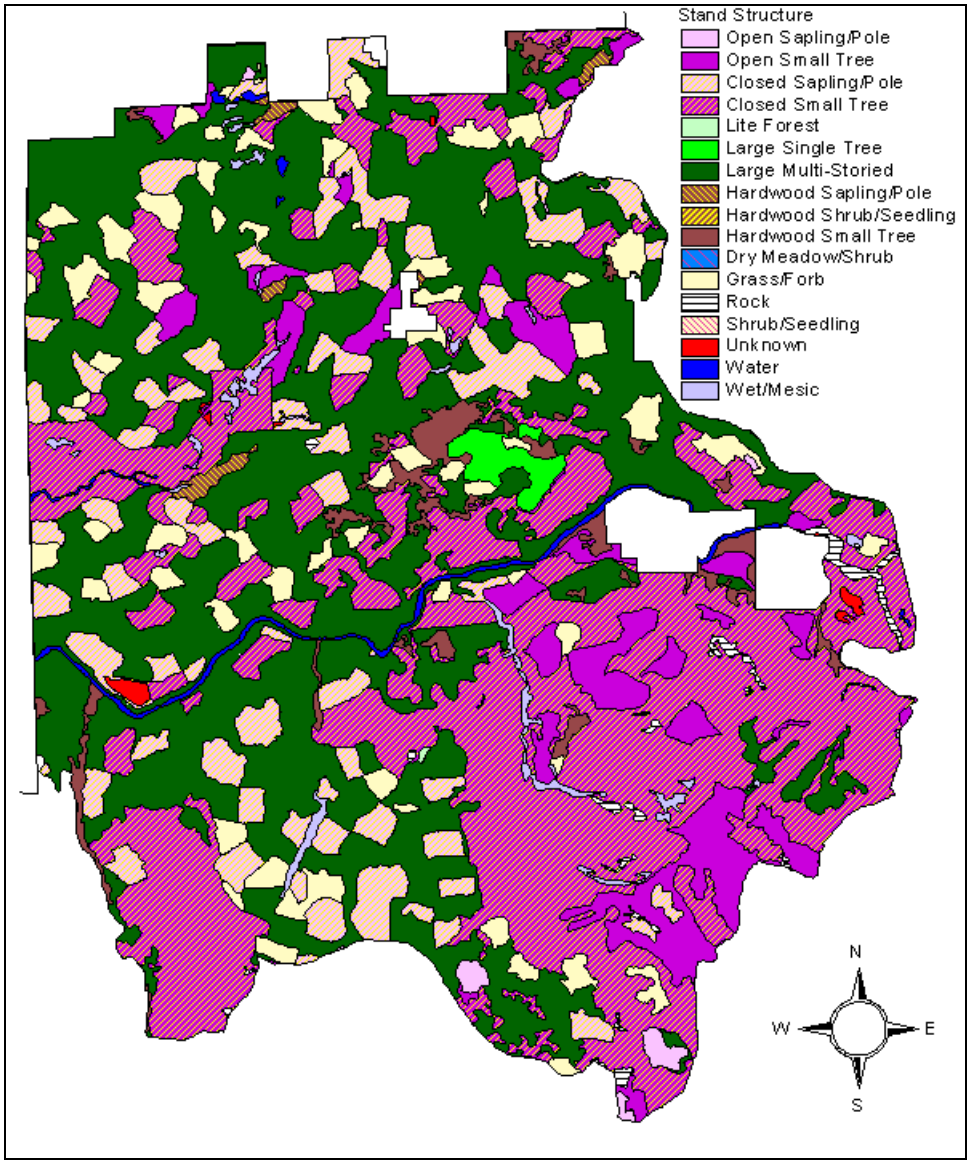
Map 4-48 Woods LSR Ecoclass



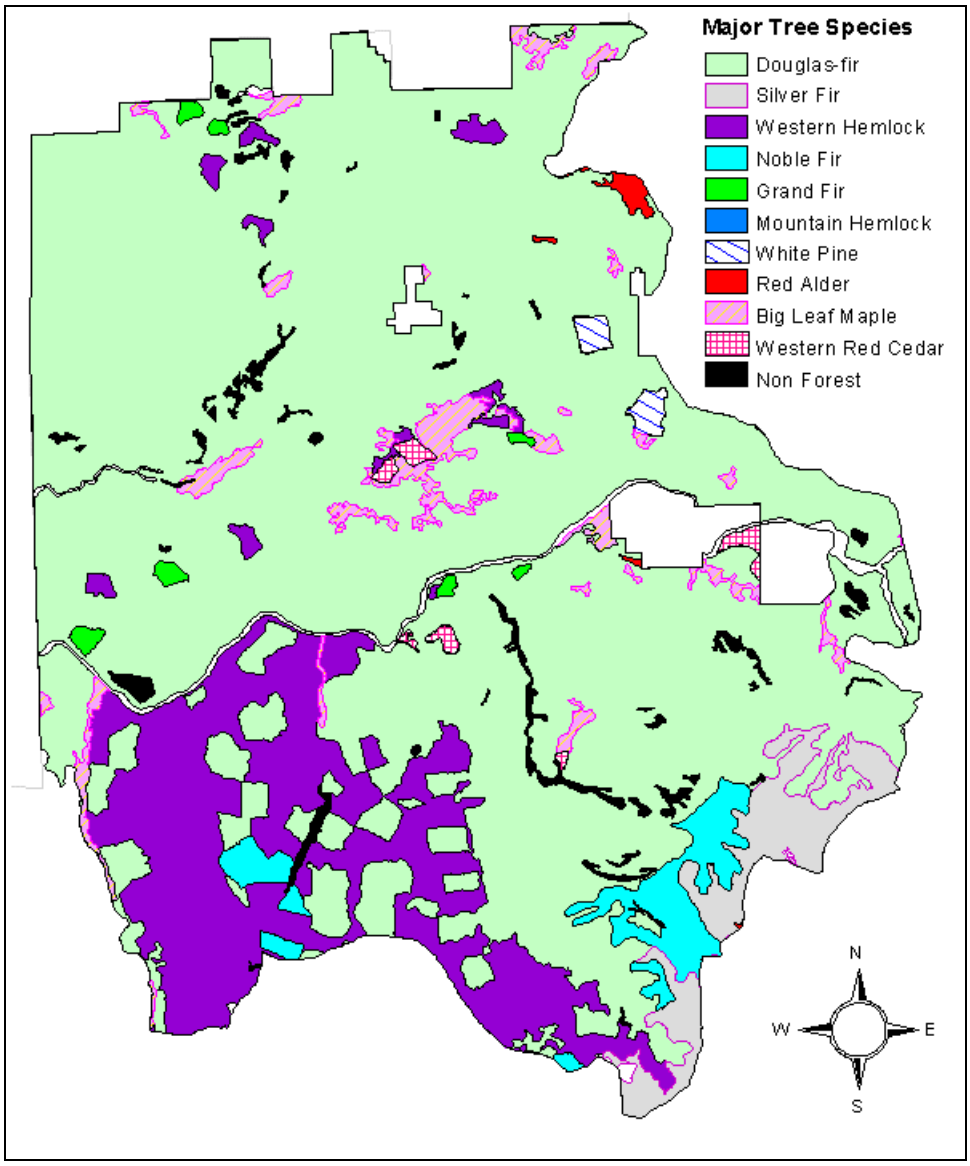
Map 4-49 Woods LSR Age Class



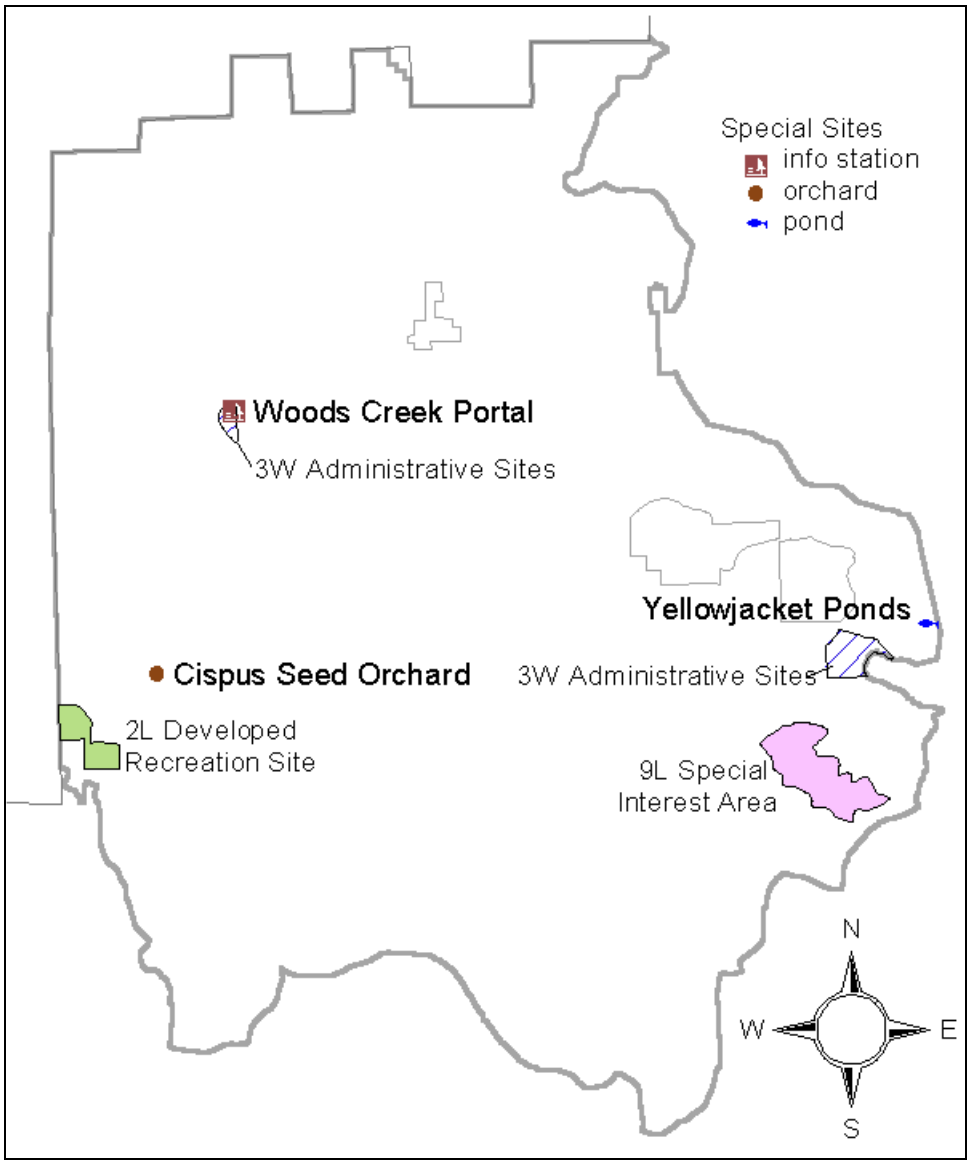
Map 4-50 Woods LSR Stand Structure



Map 4-51 Woods LSR Dominant Tree Species



Map 4-52 Woods LSR Special Sites



Map 4-53 LSR Road Network

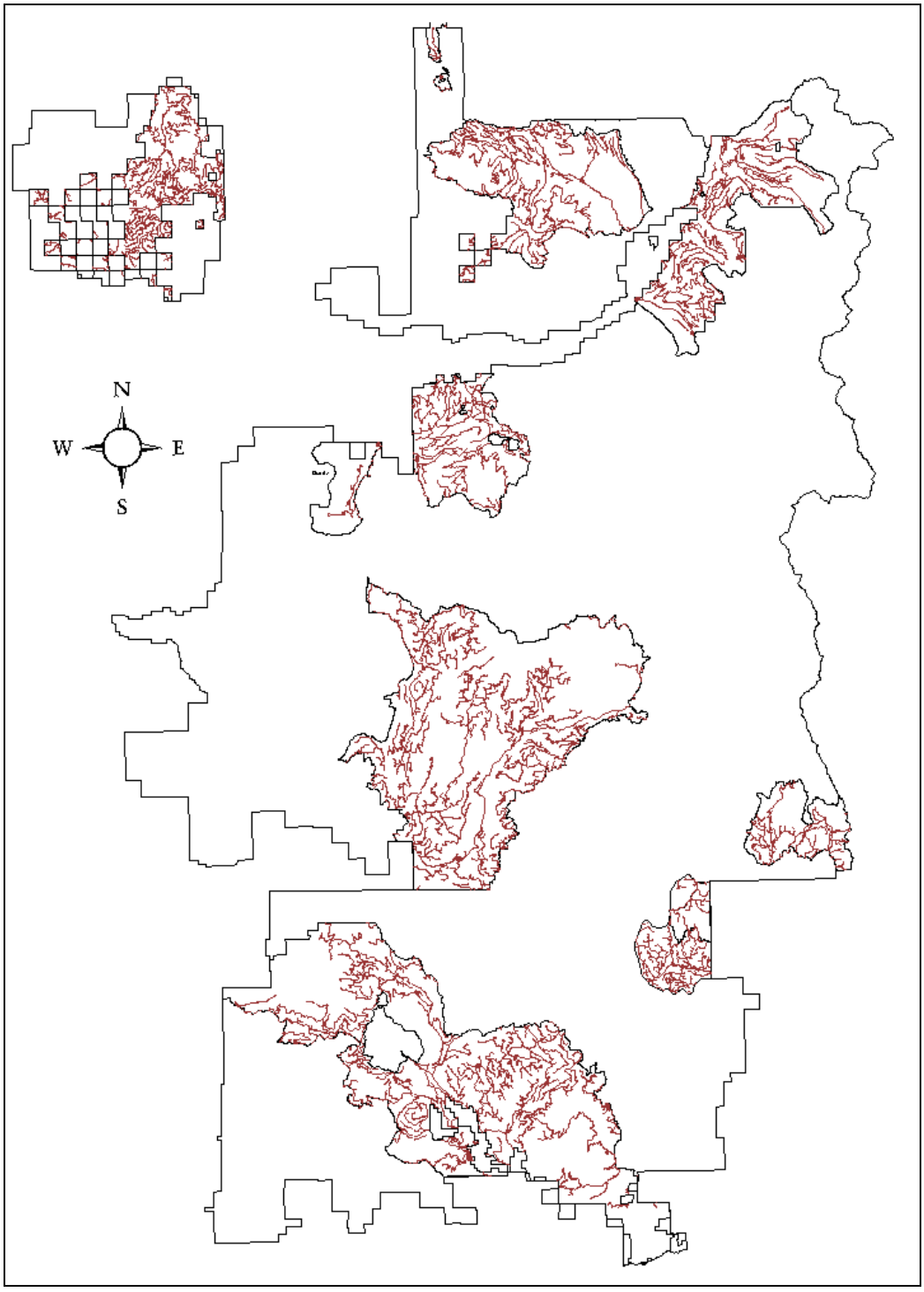


Table 4-33 Plant Zone by LSR

ZONE	Total Acres	LSRs								
		Gotchen	Lewis	Mineral	Nisqually	Packwood	Peterson	Quartz	Wind	Woods
Unknown	2			2					0	
Silver fir	211,510		86,274	8,408	30,910	24,165	6,644	4,592	46,351	4,165
Grand fir	27,690	13,143					8,870		5,677	
Subalpine fir	75	75				0				
Western hemlock	183,964		25,200	29,180	14,636	16,393		1,648	72,977	23,928
Mountain hemlock	24,258	1,955	9,168		5,813	4,552		2,619		150
Total Acres	447,498	15,173	120,642	37,590	51,360	45,110	15,514	8,860	125,006	28,244

Table 4-34 Ecotypes by LSR

Ecotype	Total Acres	LSRs								
		Gotchen	Lewis	Mineral	Nisqually	Packwood	Peterson	Quartz	Wind	Woods
Unknown	663	1	0	523	2	5	1	0	120	11
Admin. Site	988				4	220			706	58
Douglas fir	4,595								4,595	
Forblands	137				117		13		7	
Grand fir	20,544	12,402					7,914		228	
Hardwoods	2,077			55	428	20		21	856	695
Meadow	1,907	7	361	4	736	41	36	7	614	101
Mountain hemlock	5,488	1,612	1,546		291	643	285	818	51	242
Silver fir	185,911	325	76,433	15,131	21,522	15,613	7,019	5,061	39,383	5,424
Subalpine	4,105	722	2,452			386		444		102
Water	711		101	70	155	97	1	12	76	200
West Red Cedar	108								108	
Western Hemlock	197,674		35,110	21,474	22,150	23,018		2,153	72,683	21,085
Total Acres	447,498	15,173	120,642	37,590	51,360	45,110	15,514	8,860	125,006	28,244

Table 4-35 Deer and Elk Winter Range

Winter Range Age Groups	Total Acres	LSRs								
		Gotchen	Lewis	Mineral	Nisqually	Packwood	Peterson	Quartz	Wind	Woods
Unknown	17		0	4	0	1			7	4
0-20 years	9,957	20	2,464	1,148	279	1,174		75	3,063	1,733
21-70 years	20,779		3,580	590	600	2,557		201	8,734	4,518
71-120 years	27,734		4,696	84	1,742	1,678		20	17,155	2,360
121+ years	48,039	330	9,920	4,295	1,537	5,981		860	16,374	8,741
Total Winter Range Acres	106,526	351	20,660	6,121	4,158	11,391		1,157	45,332	17,356
Not Winter Range	340,973	14,822	99,982	31,469	47,201	33,720	15,514	7,703	79,674	10,887
Total Acres	447,499	15,173	120,642	37,590	51,360	45,110	15,514	8,860	125,006	28,244

Table 4-36 Age Classes by LSR

Age Class	Total Acres	LSRs								
		Gotchen	Lewis	Mineral	Nisqually	Packwood	Peterson	Quartz	Wind	Woods
NonForest or Unknown	18,930	109	618	322	6,951	5,331	282	306	4,403	607
<10years	25,915	334	8,069	4,057	3,487	1,910	685	0	6,098	1,276
10-20 years	31,979	521	8,955	5,160	3,900	3,007	1,295	391	7,150	1,600
21-40 years	55,175	269	13,566	7,172	6,254	7,060	2,753	508	13,728	3,865
41-80 years	35,116	2,696	6,112	1,385	1,155	1,334	1,409	52	15,026	5,948
81-90 years	21,210	1,874	8,033		50	1,152	13	25	7,971	2,093
91-100 years	34,392	1,952	7,863	254	5,197	1,544	1,065	585	15,932	
101-150 years	63,418	1,498	21,096	8,991	10,147	2,026	487	2,845	14,771	1,558
151-200 years	39,527	2,375	8,354	4,887	1,855	2,945	1,076	645	17,389	
201+years	121,837	3,545	37,975	5,364	12,365	18,801	6,449	3,502	22,539	11,297
Total Acres	447,498	15,173	120,642	37,590	51,360	45,110	15,514	8,860	125,006	28,244

Table 4-37 Structural Stage Distribution

Structural Stage	Total					LSRs				
	Acres	Gotchen	Lewis	Mineral	Nisqually	Packwood	Peterson	Quartz	Wind	Woods
UNKNOWN	1,660	1	5	526	6	225	1	0	826	69
CLOSED SAP/POLE	47,866	474	8,906	9,137	6,650	4,186	3,370	618	11,789	2,738
CLOSEDSMALL TREE	113,908	7,064	24,854	8,368	11,005	9,491	1,791	2,216	39,623	9,496
DRY MEADOW/SHRUB	459	2	21		117	7			313	
GRASS/FORB	28,459	521	8,608	5,006	3,331	757	1,392	246	6,917	1,683
HWSAPLING/POLE	1,322		476	33	49	41		27	574	122
HW SHRUB/SEEDLING	101		72						30	
HWSMALLTREE	2,126		166	24	423	54		0	810	648
LARGE TREE MULTI-STORIED	144,828	5,277	39,465	12,007	18,134	16,199	7,211	4,434	31,354	10,746
LARGE TREE SINGLE STORY	15,421		6,946			1,039	30		7,211	195
LITE FOREST	1,350	25	69	17	48	1	795		390	5
OPEN SAP/POLE	25,621	550	12,929	1,504	1,559	3,764	471	327	4,409	108
OPEN SMALL TREE	28,703	1,150	12,763	479	570	715	158	630	10,432	1,805
ROCK	18,352	104	3,690	128	4,823	4,368	108	134	4,828	168
SHRUB/SEEDLING	10,798		285	84	2,623	3,439			4,367	
WATER	711		101	70	155	97	1	12	76	200
WET MESIC	5,816	6	1,288	208	1,868	727	186	216	1,059	259
Total Acres	447,498	15,173	120,642	37,590	51,360	45,110	15,514	8,860	125,006	28,244

Table 4-38 Dominant Tree Species

Dominant Tree Species	Total Acres	LSRs								
		Gotchen	Lewis	Mineral	Nisqually	Packwood	Peterson	Quartz	Wind	Woods
Douglas fir	283,567	6,141	67,930	28,114	24,483	24,315	12,922	4,374	94,319	20,970
Pacific silver fir	53,794	10	25,746	3,042	8,674	5,836	453	1,927	7,238	867
Western Hemlock	42,876		9,254	3,886	6,767	6,905	178	1,627	10,383	3,876
Non Forest	26,853	111	5,100	921	6,966	5,426	295	362	6,981	691
Noble fir	21,302		10,738	1,562	3,668	1,297	103	136	3,068	730
Grand fir	7,695	7,404	11				97		69	114
Red Alder	2,379		307	56	474	96		27	714	705
Western Red Cedar	1,866	21	536		118	370	0		756	64
Lodgepole pine	1,614	1,129					422		63	
Subalpine fir	1,160	4	486			264		406		
White pine	1,021	13	12		16	585	254		35	104
Mountain hemlock	842	463		127	5			247		
Ponderosa pine	739	338				3	392		6	
Engelmann spruce	499		60		41	4	394			
Black Oak	482								482	
East side Douglas fir	373								373	
Big leaf maple	227								109	118
Unknown	144	1	0	9	2	5	1		120	6
Willow species	29								29	
Yellow Cedar	22				22					
Big tooth aspen	8								8	
Quaking aspen	4								4	
Western Larch	2						2			
Totals Acres	447,498	15,173	120,642	37,590	51,360	45,110	15,514	8,860	125,006	28,244

Table 4-39 Road Densities by LSR

Road Densities	LSRs								
	Gotchen	Lewis	Mineral	Nisqually	Packwood	Peterson	Quartz	Wind	Woods
Miles	59	415	213	218	201	86	12	427	134
Acres	15,173	120,642	37,590	51,360	45,110	15,514	8,860	125,006	28,244
Road Mi/Sq. Mile	2.5	2.2	3.6	2.7	2.8	3.5	0.9	2.2	3.0

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Chapter 5

Treatments

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Chapter 5

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 grazing, trail management and quarry development are included to disclose the conditions under which they would be consistent with LSR objectives. Activities are described in detail. Criteria describing conditions or areas where the activities might occur are described. Many of these criteria can be traced back to the maps and acre summary tables in Chapter 4. Most activities contain a projection of the scale of activity in LSRs across the Forest.

Habitat manipulating activities not addressed in this chapter are subject to REO review prior to their implementation. The reader should also review the REO exemption letter included at the end of Chapter 1 for further information regarding REO review requirements.

5-1 Young Stand Thinnings

This treatment involves thinning very young (10-20 year-old) stands of trees, most of which were planted after regeneration harvests. Trees were planted at a density which assured full stocking of desired tree species within five years after 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, though, natural seeding has increased the stocking far beyond the original planting density, some as high as 1,500 stems per acre or more, by the time the plantation is ready for thinning.

These 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.

Need for Change

The desired condition for most of these young plantations, as described in Chapter 3, is to have large diameter trees, multiple layered canopies, standing snags, large woody material on the forest floor, and canopy gaps. Nature has provided these characteristics in existing old-growth stands after many hundreds of years. Attainment of old-growth characteristics is very slow, because these stands tended to grow at maximum density. Diameter growth is very slow, and there is little understory development until canopy gaps formed late in the life of the stands.

With no thinning, the tree canopy in these stands quickly shades out any existing vegetation and limits establishment of new vegetation to only the most shade-tolerant species. The live crown of the trees begins to decline at this time, as the lower branches are shaded out. As the live crown of the trees diminishes over time, individual tree growth and total stand development slows, and remains slow if not thinned. 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 of the desired late-successional characteristics will proceed 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). In addition to increasing diameter growth, thinnings can also improve resistance to insects and diseases, reduce fire ignition hazard, increase windfirmness, and control species composition.

Treatment Criteria

The following conditions will identify a young plantation for young stand thinning in the LSRs:

1. The average height of the trees in the plantation should be at least 10-15 feet.
2. The density of the trees is high enough to interfere with rapid development of the stand. In general, this level is typically 400 trees per acre or more for westside plantations.

Treatments Description

Uniform Thinning vs. Mixed Treatments:

A wide range of treatments are available in each individual plantation. There are also situations which make it desirable to combine a mixture of treatments - thin, no thin, and gap creation. In deciding which treatment or combination of treatments to use in each plantation, the following guidelines should be considered:

1. The existing diversity of the landscape surrounding the plantation. Will the area benefit from a mixed treatment, or would a uniform thinning contribute more to diversity in an area which already has diverse structure in the surrounding stands?
2. Consider the size of the plantation and the cost of implementing a mixed treatment. It may be more cost effective to implement mixed treatments only in the largest plantations (e.g., greater than 20 acres).
3. Utilize existing microsites of diversity within each unit, such as hardwood patches, understocked areas or openings caused by root rot, or other factors, in deciding whether mixed treatments are needed.
4. When prescribing a mixed treatment, consider the logistics of implementing a subsequent commercial thinning when locating unthinned patches or other treatments which are not intended to be thinned again.

Specifications for Thinning

In the portions of young plantations which will be thinned, the following guidelines should be considered.

1. The prescribed spacing should be determined by the timing of the next thinning and by the expected average stand diameter at the time of the next treatment. Opportunities for extending the availability of forage in deer and elk winter range is another consideration in deciding the spacing.

   Past thinnings have implemented target spacing ranging from as close as 11 feet by 11 feet (about 360 trees per acre) to as wide as 20 feet by 20 feet (about 110 trees per acre).

2. Existing species diversity within the thinned acres of a plantation should be maintained or increased. Certain tree species which are minor in composition and which contribute to species and structural diversity should be favored as leave trees. For example, western redcedar usually exists as a small percentage of the composition in westside Cascade plantations. Since it does not compete with Douglas-fir in height growth, and it is considered valuable in the long-term for habitat structure, it should be left uncut in many plantation thinnings.

3. Mixed treatments in intermediate (commercial) stands have been recommended by the Regional Ecosystem Office to promote development of late-successional conditions and to exempt the projects from REO review. In plantations where this is considered appropriate, the following guidelines should be considered:

   a. Ten to fifteen percent of the area should be left in unthinned patches. The sizes and locations of these should consider future management needs.

   b. Three to ten percent of the area should be in openings roughly ¼ to ½ acre in size.

   c. Three to ten percent of the area should be left in heavily thinned patches (e.g. less than 50 trees per acre).

   d. The remaining 65-70 percent of the area should be thinned to a spacing considered appropriate for future management objectives.

Schedule of Activities

Based on Table 4-34 Age Classes by LSR, there are almost 32,000 acres of stands in the 10-20 year age class inside the LSRs of the Gifford Pinchot National Forest (see Maps 4-8b, 4-9b, … 4-16b). Some of these stands have been thinned, and some are stocked at levels that would not need thinning. However, the majority of these stands remain as potential thinning opportunities. At least 75 percent of the stands (24,000 acres in this age class) presently meet the criteria for young stand thinning.

In addition to the stands described above which presently meet the criteria for thinning, potentially one half of the stands in the less than 10 year age class will grow to meet the criteria for thinning in the next five years. This adds another 13,000 acres.

In summary, the combined totals for the two youngest age classes that would meet the criteria for young stand thinning is 37,000 acres in the next five year period. If scheduled evenly over the next five years, this would average about 7,400 acres per year within the LSRs.

Priorities for Treatment

There has been no young stand thinning in the LSRs for six years. Highest priority stands for immediate treatment would be the oldest stands in this age class at the lower elevations. These stands have grown the fastest, and are reaching the upper limits of diameters suitable for young stand thinning. They are also on the most productive sites and should show the greatest response to this treatment. Other considerations in allocating limited funds for this activity include choosing plantations in areas where there is greatest fragmentation, and big game winter range areas which would benefit from extended forage production.

Table 5-1 shows the number of acres considered available for young stand thinning by LSR. As described above, it assumes that about 75 percent of the total acres in the 10-20 year age class and 50 percent of the 0-10 year age class would be available in the next five year period. The total acres for both of these categories are allocated evenly over the five year projection. Additional acres of thinning will continue to come on line at the rate of about 2600 acres each year after 2001, until 2006.

Table 5-1 Five-Year Young Stand Thinning Opportunities

LSR	Acres
Gotchen	555
Lewis	10,750
Mineral	5,900
Nisqually	4,670
Packwood	3,210
Peterson	1,315
Quartz	295
Wind	8,410
Woods	1,840
Totals	36,390

Monitoring

Implementation monitoring of young stand thinning activities should be done at the time of inspection of the project contracts. Typically, no other formal stand exams are performed in these young stands until they approach the age for a commercial thinning (35-45 years old). At the time of the contract inspection, an estimate of the residual trees per acre and species composition can be assessed and compared to the projected stocking level in the prescription. This should be done on a sample basis, one in every five stands.

In mixed treatment stands, it will be important to get the same information, but stratified by the different treatments within the stand. This information will be valuable in future effectiveness monitoring.

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5-2 Commercial Thinning

Need for Change

The intent of this treatment is to thin densely stocked stands to enhance structural diversity and accelerate development of late-successional characteristics. Many younger stands developed following timber harvest, stand-replacement wildfires, and other disturbances. Many of the older stands originated from wildfire and are structurally very similar to younger stands. The cost of this treatment would limit its application if it were not subsidized by commercial extraction of a portion of the trees cut.

Large portions of these stands are fully stocked with young trees, primarily Douglas-fir. Because of high existing stand density, a long time may be required to grow very large trees, an important component of old-growth forests. Franklin and others note:

> Many existing old-growth stands may have regenerated slowly, growth patterns of individual trees suggest growing conditions essentially free from competition for a century or more. If initial densities of stands are moderate - at current recommended levels for managed stands - precommercial and commercial thinnings will be necessary during the first 100 years of a long-rotation forest management cycle. (Franklin, et al. 1981)

High densities of younger stands may limit or delay the attainment of large, old-growth trees, a key characteristic of the desired future condition.

Thinnings can provide faster attainment of large-diameter individual trees than would otherwise be possible in young, fully stocked forest stands. In addition, structural and species heterogeneity can be enhanced by thinning in areas that are relatively uniform in stocking, species composition, and tree size, by not applying the thinning treatment uniformly.

Stand Development With Thinning

Following a commercial thinning, several individual tree characteristics develop that would not with no thinning.

1. The process of self-pruning, in which the lower limbs of the tree die from too much shading, slows or stops. This allows the tree to develop deep live crowns and a higher percentage of live crown for a given tree height. When the live crown of the trees is maintained or increased, the tree responds with increased growth in diameter and root strength. The bark gets thicker faster.
2. When the branches of the trees are kept alive for a long time, they grow thicker and become stronger which can be beneficial for snow interception or perches for bird habitat.
3. The root system of the trees left standing after a thinning are allowed to occupy the space made available by those which were removed. A stand of trees which has been thinned is likely to be more resistant to windthrow than one which is unthinned.

From a stand level perspective, thinnings present the opportunity to increase species diversity and structural diversity.

1. Species diversity can be increased by selecting certain species which are under-represented to be left uncut. For example, western redcedar typically is present in small numbers in many Douglas-fir stands. Since it does not compete in height growth with Douglas-fir, yet it is valued for its

wildlife habitat contribution, it can be left uncut to develop in the understory. Its relative numbers and its growth rate would be increased.

2. Structural diversity can be increased with thinnings because the increased light to the forest floor allows the shade-tolerant trees to grow more rapidly in height and diameter. When unthinned patches are left in the stand, there will be more diversity in average diameters, live crown heights, and understory development.
3. Thinning provides the opportunity to create snags and down wood where they are deficient.

Consequences of No Action. If no thinning is carried out within LSRs, attainment of some aspects of the desired condition will be delayed. Young forest stands will develop at higher stocking levels, and will develop large trees later in life.

Franklin and others (1981), discuss impacts of not thinning on the potential for developing large, old-growth trees. They note:

> Growth rates of individual trees will be too low at high densities, or at moderate densities on less productive sites to produce desired sizes of stems even after 200 years.

Stand Development With No Thinning

Stands that are never thinned reach maximum density very early - about age 20-25. At maximum density, the lower branches get shaded and quickly die, reducing the live crown percent of each tree. When live crowns are reduced, all of the benefits mentioned above from thinnings are lost or delayed for a long time.

1. Unthinned stands develop very slowly because of the competition for limited resources on the site. The individual crowns are maintained at a minimum size, sometimes as little as 10 percent of the height of the trees. The branches are never allowed to grow large until neighboring trees die out.
2. Diameter growth is always slow because live crowns are kept small. The achievement of large diameters which are beneficial for snags and down wood takes a very long time.
3. Root system growth is small when the site is fully occupied.
4. Understory development of shade-tolerant tree species and related shrubs is very slow or nonexistent until enough overstory trees die and drop out of the overstory. The number of different species is kept to a minimum until very late in the life of the stand.

Treatment Criteria

NWFP direction proposes timber harvest only in stands less than 80 years old; therefore, candidates are those stands within LSRs that are less than 80 years old, that are composed mostly of poles and/or small trees (GPVEG size classes 5-8). Approximately 90,000 acres within the LSRs are between the ages of 20 and 80 (see Maps 4-9, 4-14, 4-19, 4-24, 4-29, 4-34, 4-39, 4-44, and 4-49).

The Forest contains large contiguous acreage in stands from 75 to 100 years old which originated from stand replacement fires near the turn of the century. The Yacolt, Cispus, Siouxon, and Lewis River fires burned in this time period. These stands, are very similar in structure to younger forests. They are quite even in age and size, and consist primarily of Douglas-fir.

Criteria. Candidate stands are those so dense that individual trees are growing slowly. As these stands stagnate, they may

be naturally thinned by mortality caused by insects and disease. Various stocking guides can be used to assess stocking levels. For example, relative density can be used to estimate stand density for Douglas-fir (Curtis 1982). Thinning is most appropriate when relative density equals or exceeds 50-55; this describes a stand with about 175 15-inch trees per acre, or one with about 105 21-inch trees per acre.

Since early seral tree species have the greatest potential for longevity and attaining large size, stands with components of Douglas-fir, noble fir, western white pine, ponderosa pine, and western larch would have highest priority. Young, even-size, even-age, single-species stands are also high priority; thinning may help to develop a more varied stand structure and species composition in these stands.

Very young plantations (i.e., 35-45 years old) will often be highest priority for treatment. These stands will generally benefit most from treatments; they grow very fast at these ages. In addition, many stands in that age class may be relatively uniform, and could benefit from increased stand diversity. Other criteria for identifying high priority stands are crown ratio of greater than 40 percent, good access (to minimize road construction), and high density of tree stocking.

On a landscape scale, consideration should be given to stands that are important in providing connectivity (such as the Dog Mountain area and the large blocks of young stands in Woods, Wind and Lewis LSRs), or in areas where reduction of fire risk is important. Conversely, some areas, such as occupied spotted owl activity centers, will be low priority or avoided.

Many stands should not require treatment. Stands that currently have a diversity of tree sizes and species, areas of wide tree spacing, and that are developing late-successional or old-growth forest characteristics are low priority candidates for thinning. Stands with ongoing mortality due to pathogens (i.e., laminated root rot disease in Douglas-fir stands) may thin themselves, and develop added structural diversity as the disease progresses in the stand. On a landscape scale, we may want to leave stands untreated for added diversity.

Scale of Activities. Approximately 500 acres per year of thinning (primarily existing plantations) would enable us to evaluate practices. This would amount to about 1/2 of 1 percent of the gross acreage in these age classes within LSRs on the Forest.

Treatments Description

The objective of the thinning treatment is to help develop conditions meeting the desired conditions described in Chapter 3. Treatments should result in the long-term development of large individual trees, diversity of stand structure and species composition, snags, and down logs. Treatments should also develop structure and functions that may benefit late-successional related species. Some considerations suggested by the Regional Ecosystem Office, in their July 9, and September 30, 1996 letters exempting certain commercial thinning activities from REO review include:

> Ten percent or more of the resultant stand would be in unthinned patches.
>
> 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 ¼ acre in size, to maximize individual tree development, encourage some understory vegetation development and to encourage the initiation of structural diversity.

The remainder of the stand should be thinned to a spacing appropriate for future management objectives. For example, a relative density of 35 (Curtis, 1982) will maximize growth on residual trees following thinning, yet will allow for future suppression mortality as stands grow and competition increases. This amounts to about 40 30-inch diameter trees per acre, or 67 21-inch trees per acre. Other guides or growth simulators may be used to estimate stand development following thinning.

The scale of activities should be considered in project planning. A small plantation might be treated uniformly when it adds diversity to the large-scale landscape. For example, a small plantation may be heavily thinned within a landscape that already contains unthinned patches and open areas.

Criteria for leave trees should be site-specific, but should provide for development of large crowns and limbs in some trees, maintaining minor species and structural diversity in stands, and maintenance of some trees with damage or disease, consistent with LSR objectives. While development of future large, old-growth individuals requires retention of large, healthy trees in the stand, a diversity of leave tree conditions is desirable.

Thinning should favor trees in dominant and co-dominant crown classes, although trees in all crown classes should be maintained to provide structural diversity. Thinning should not reduce tree species diversity.

In young stand commercial thinning (30-60 years) the key benefit is in maintaining fast individual tree growth. Trees can get big very quickly at this age. Also, it is a good time to get a second cohort started for future layering. Down logs and snags are not as important, given that they would be small in diameter and not last long. In thinning older stands (60-80 years) more emphasis should be placed in providing structure, snags, and down logs. Potential down logs and snags in older stands would be larger and more valuable as habitat. There is also likely to be intermediate trees and saplings to maintain and promote for canopy layering.

Snags and existing down wood will be retained, especially large snags or down logs, that may be remnants from previous stands of large trees. These late-successional forest features add structural diversity to the forest. They may be included within non-thinned or lightly thinned portions of stands.

Additional down wood will usually be required from existing live trees in thinning operations (see 5-6 Down Wood Management, page 5-26). Larger trees should generally be favored (see Size of Down Wood, page 5-27), it may be desirable to reduce leave-tree stocking in some portions of stands, particularly areas thinned to be small openings or heavily thinned patches, to utilize some larger trees as large down logs. An option may be to leave these trees standing, and monitor down wood added by windthrow in the first few years after thinning.

Related Activities

Other activities may be appropriate to conduct in conjunction with thinning to develop late-successional or old-growth forest characteristics. Thinning operations should include development of snags within thinned stands, from existing green trees, where current levels are deficient, or safety considerations require felling of snags during thinning operations. Some trees may be left to provide for down wood. See 5-5 Snag Management, page 5-23 and 5-6 Down Wood Management, page 5-26 for details.

Underplanting may be used to accelerate development of secondary tree canopies and to increase species diversity. Generally, underplanting should be accomplished with shade-tolerant tree species, such as western hemlock or Pacific silver fir.

Development of secondary tree canopies can also be accomplished on sites with existing small understory trees by protecting regeneration during thinning operations. Trees that survive the thinning will benefit from increased light and moisture, and develop more quickly.

A large percentage of big game winter range on the Gifford Pinchot National Forest lies within LSRs. Practices that enhance forage production, yet do not detract from LSR objectives, should be considered. For example, temporary roads in commercial thinnings might be seeded with native forage species to allow for some increased forage production while the thinned stand is more open.

Monitoring

Implementation monitoring should be conducted following treatment activities (including follow-up work such as snag and down wood creation). Formal or informal stand examination should be conducted to estimate stand density, and snag and down wood levels in thinned areas. Small openings and unthinned areas should be estimated by walk-through examination and review of maps or photos. If projects cover large areas, subsampling (i.e., 20 percent) may be adequate.

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5-3 Structural Enhancement in Older Stands

Need for Change

Many stands over age 80 contain little, if any, structural diversity (see Map 5-1, page 5-13 and Table 5-2). Many of these stands originated following wildfire around the turn of the century and have closed canopies of a single species. Stands of this type will develop late-successional/old-growth attributes very slowly. Minor, non-extractive treatments to these stands will promote or accelerate the development of structural diversity.

Treatment Criteria

Stands most likely to receive treatment range in age from 80 to 150 years, are relatively even-aged, consist of a single or few overstory species and lack vertical diversity. Candidate stands also lack structural components such as large snags, large down logs, multiple canopy layers and understory patches. Treatments will be applied to stands where natural pathogens are not present nor predicted to play a significant role in the near future.

An estimate of the extent of candidate stands was made by querying the existing vegetation database for the structural stage of stands older than 80 years. Table 5-2 illustrates the results. The location of these possible treatment opportunities is shown on Map 5-1.

There are many opportunities to promote structural diversity, especially in the closed small tree structural stage. These stands probably contain the least diversity since canopy closure is high and species diversity is likely low. These stands were probably initiated following wildfire around the turn of the century. Promoting structural diversity in these stands may also help to accelerate the development of larger overstory trees.

Table 5-2 Candidate Stands for Structural Enhancement

Structural Stage	Age >80 Acres
Closed sapling, pole (<9" dbh)	1,870
Open sapling, pole (<9" dbh)	716
Open small tree (9"-21" dbh)	18,978
Closed small tree (9"-21" dbh)	91,431
Lite forest (usually >21" dbh)	1,345
Large tree, single-story (>21" dbh)	15,420
Total	129,840

Treatments Description

Proposed treatments include the creation of snags, falling green trees or snags, underplanting shade-tolerant tree species and creating small openings in the overstory canopy. Treatments that include killing green trees should be applied only to stands that have sufficient live trees to meet required levels of large overstory trees as described in Chapter 3. Amounts of snags and down logs will be determined based on site-specific analysis and levels recommended in the Snags and Down Wood Treatments in this chapter (page 5-23).

Snags may be created by introducing heart rot organisms or blasting tops off of live trees with explosives. Both methods have certain advantages in promoting habitat for snag-dependent species, so both will be considered based upon site-specific analysis. Girdling may be employed if other treatment alternatives are not feasible. Down logs may be added to the forest floor by falling live trees or, where abundant, snags. Falling by blasting with explosives near the ground is desired to provide a ragged edge to the log which will accelerate colonization by decomposing organisms. Falling may be used if blasting is not feasible. Where applicable, snags and down logs may be created simultaneously by blasting at intermediate heights.

Multiple canopy layers may be developed by planting shade-tolerant trees, appropriate for the site, in open understory areas. It is desirable to integrate this underplanting with the creation of snags and down logs, where small openings would be created to facilitate the underplanting.

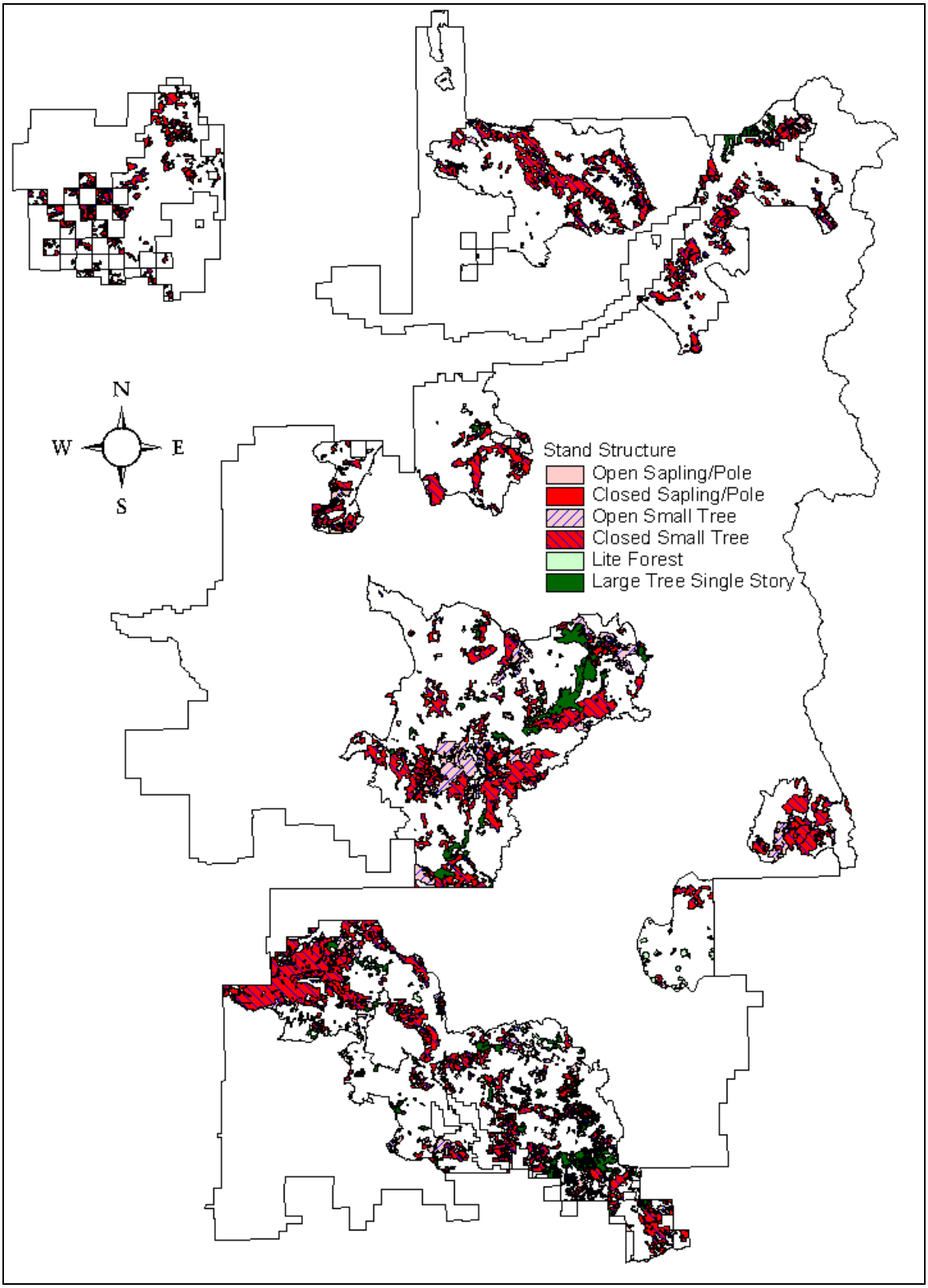
Created canopy gaps should mimic natural gaps in size and extent - average width of about 30 feet, maximum width of about 60 feet; no more than 15 percent of the stand area. In the grand fir zone, some stands that are dominated by grand fir may be enhanced by providing openings that range in size from ¼ to 5 acres to allow regeneration of ponderosa pine and Douglas-fir. Creation of small gaps in the forest canopy may be necessary for some late-successional and old-growth associated plant species, including tall bugbane (*Cimicifuga elata*) which requires small openings in the canopy to maintain viable, reproducing populations.

Understory shrubs, forbs and other organisms may be introduced in created openings, especially those that are limited in number or distribution.

Most of the above-described treatments may also be accomplished by allowing natural or prescribed fire to burn in these stands. The extent of such burning will be confined to opening sizes described above, for prescribed burns, and to ten acres if naturally occurring.

Scale of Activities. In spite of the large pool of candidate stands (see Table 5-2), funding may limit this treatment to less than 50 acres per year for the forseeable future. Some activities may be funded from K-V generated by projects in nearby Matrix areas.

Map 5-1 Older Stand Enhancement Opportunities



5-4 Treatments to Reduce Fire Risk and Maintain Late-Successional Forest in Gotchen LSR

Need for Change

Desired Condition. Twentieth century management in the Gotchen area has allowed multiple-canopy forests to develop and be maintained through fire exclusion. Old-growth that once dominated the landscape have been removed through partial timber harvest. Stands today are generally more dense and differ in species composition. These stands, primarily grand fir, are generally less fire tolerant and have a greater susceptibility to insects and other pathogens than the historic stands. One of the consequences of the change in stand composition is the continuing spruce budworm infestation.

The west portion of the LSR has been historically dominated by grand fir at lower elevation and subalpine fir at the higher elevations. However, prior to fire exclusion, the dry grand fir zone in the east portion of the LSR was comprised of open park-like stands of ponderosa pine and Douglas-fir. In the past few years stands in the Gotchen LSR have been infested with spruce budworm, with the most defoliation, mortality and resulting fuels accumulation occurring in the south and east areas of the LSR.

The desired condition within the moist grand fir zone in the west portion of the Gotchen LSR is to maintain the current large acreage of late-successional forest. (See Gotchen LSR Desired Condition, p. 3-15.)

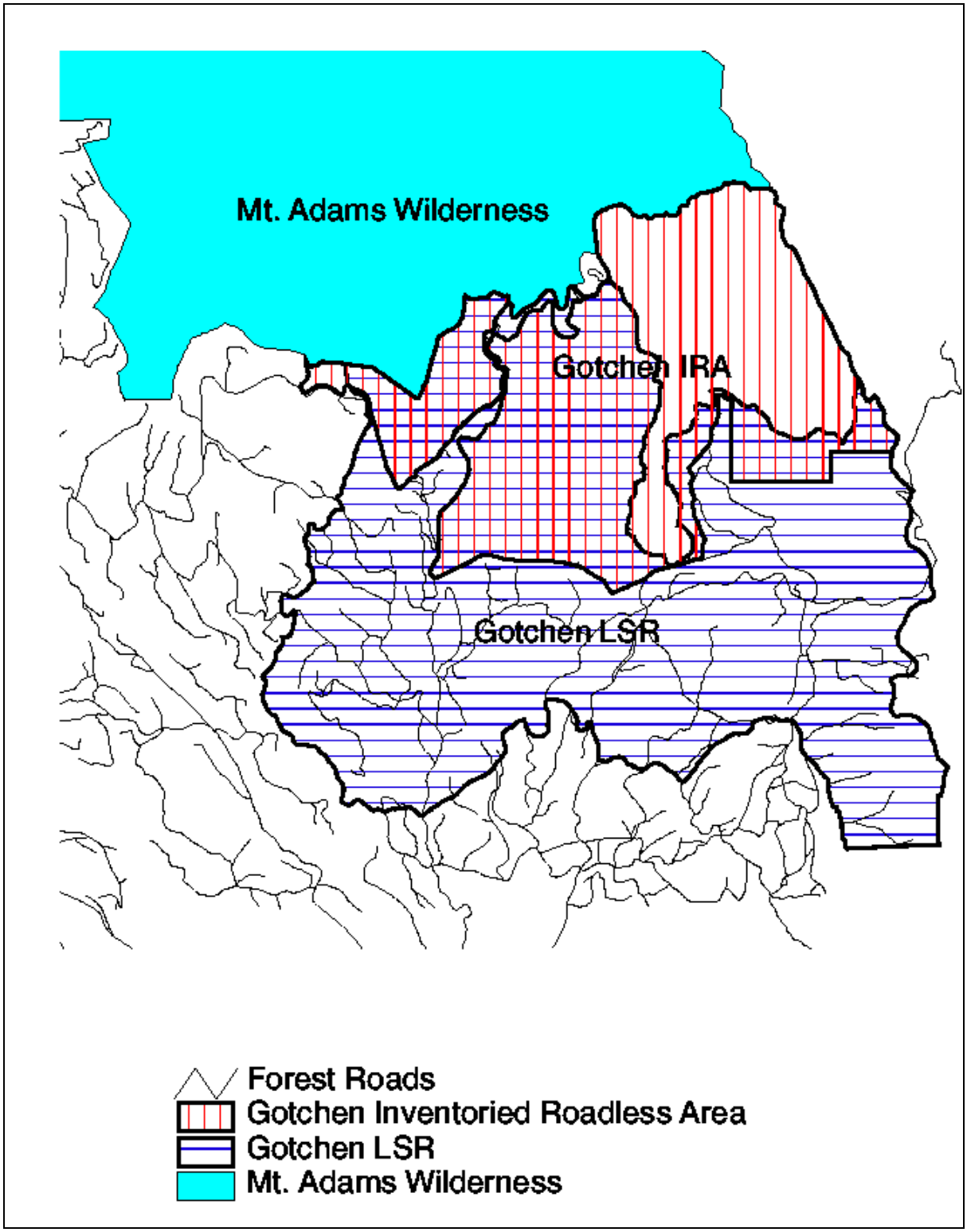
In the easterly portion where the grand fir stands are more at risk of loss from insects and disease, and thereby subjecting the entire LSR to loss from fire, the desired condition is a mosaic of stands containing fire tolerant, and more insect and disease resistant species intermingled with the healthy grand fir stands. This could be accomplished in the eastern portion of the LSR by increasing the amount of single-story, large-tree forests comprised of early-seral tree species (ponderosa pine, western larch, Douglas-fir) that are maintained by underburning or similar fuel treatments. These early-seral species typically comprise eastern Cascade old-growth forest.

Probability of catastrophic loss to fire will be reduced throughout the LSR by developing a central fuel break. An east boundary fuel break will be developed if conditions warrant.

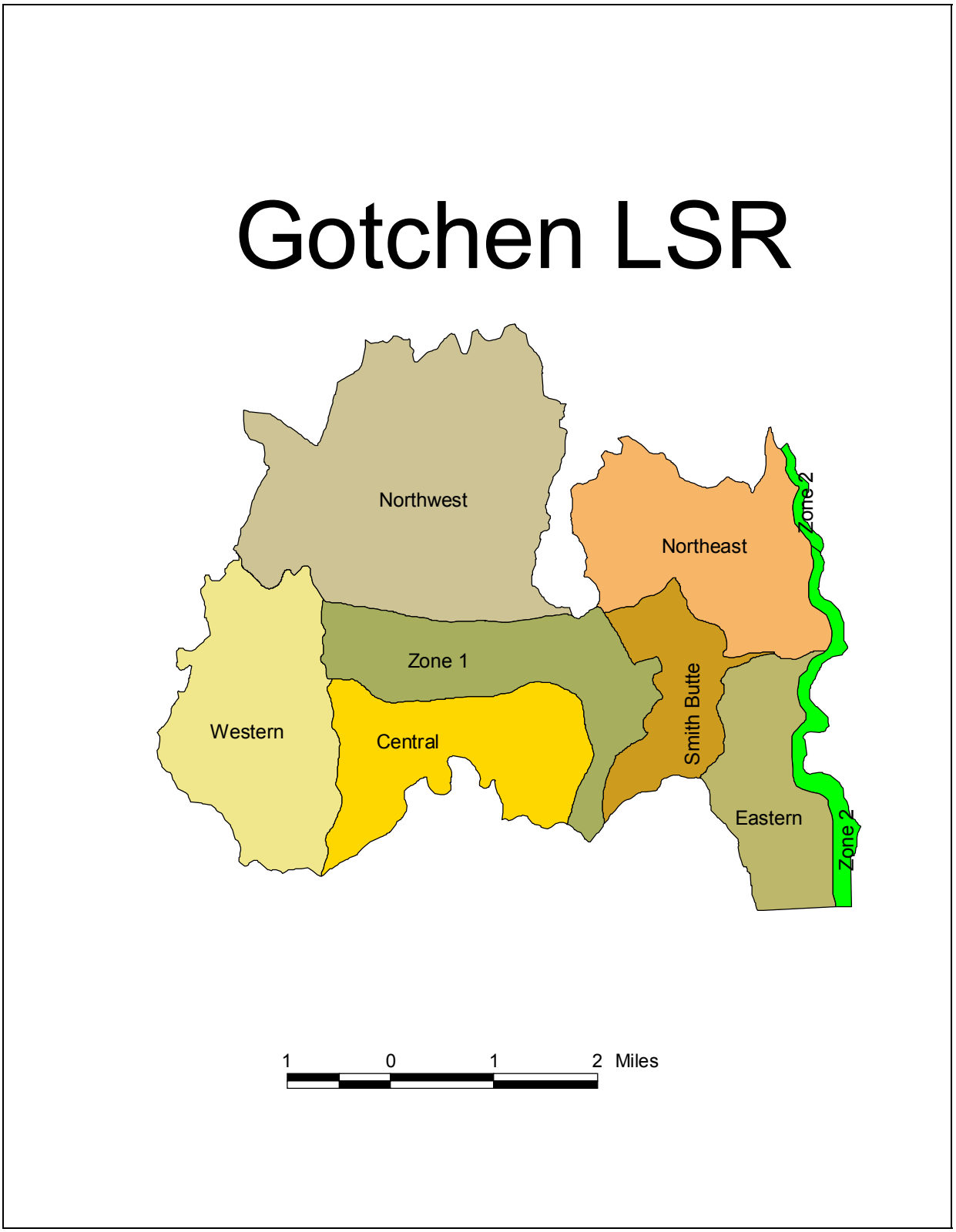
Existing Condition. The northern portion of the LSR overlaps the Gotchen Creek Inventoried Roadless Area. The southern portion of the LSR is heavily roaded (See Map 5-2, page 5-15.

Many of the current stands in the Gotchen LSR have developed following fire exclusion and selective removal of ponderosa pine and Douglas-fir during the 20th century. Large portions of these stands are now stocked with 80-100 year old stands of grand fir and Douglas-fir, with some residual overstory of old-growth ponderosa pine, Douglas-fir, and western larch. These stands are late-successional, but they may not be sustainable in the long-run. In the past 10 years, increasing amounts of insect and disease activity has caused a decline in tree health. Because of current insect and disease activity, forest stands have become increasingly susceptible to large-scale stand replacement fire. Even without fire, we are losing old-growth ponderosa pine and Douglas-fir. These older trees are under increasing stress, brought on by competition in today's more dense conifer stands.

Map 5-2 Gotchen LSR and Inventoried Roadless Areas



Map 5-2A Gotchen LSR Assessment Areas



In general, stands in the dry grand fir zone function as dispersal habitat for spotted owls. The more moist grand fir stands in the west function as nesting, roosting and foraging habitat.

In 1997, when the LSRA was initially prepared, spruce budworm were present in the LSR but not viewed as an imminent threat of a stand replacing disturbance. Insects and disease had caused widespread pockets of defoliation. Aerial and field reconnaissance in 1998 determined the budworm population was expanding in severity and extent, resulting in defoliation, top kill and fuel accumulation. The risk of stand replacing fire had become moderate to high in all but the westerly portions of the LSR as Fuel Model 10 (heavy fuel concentration) became more prevalent across the landscape.

The LSR is partitioned into two fuel break treatment zones and six forest health assessment areas, see Map 5-2A, page 5-16. The two treatment zones were areas included in the 1997 LSRA to reduce the risk of a large-scale, stand-replacing fire by providing fuel breaks along the easterly boundary and through the middle of the LSR. The six assessment areas were added to address fuels and declining stand conditions associated with the spruce budworm infestation. See REO exemption letter, page 5-21.23.

Existing conditions and management options specific to each of the treatment zones and assessment areas are summarized by area beginning on page 5-19 and in Table 5-3B, page 5-21.17 and

Table 5-3C, page 5-21.18.

FIRE HAZARD AND PROBABILITY

Chapter 6 assesses fire risk for the LSRs Forestwide. Table 6-1 indicates a fire frequency of one fire per 16 years per thousand acres or about one fire in the Gotchen LSR each year.

The potential sources of fire occurrence within the Gotchen LSR include the following:

Dispersed campsites. Due to topography and vegetation, there are many dispersed sites throughout the LSR. These sites are not inventoried, and are difficult to regulate. Many of these sites, which are often located along user-made roads, are used during the summer and autumn months. Unattended campfires, and fire starts from automobile exhaust systems coming in contact with cured grass on high clearance, primitive wheel tracks are potential causes for fire.

Other recreational use. The area attracts many day-use recreationists including hunters, hikers, berry pickers, bikers, and sight seers. Smoking may be the primary fire risk from these recreationists.

Travel corridors. Many forest visitors drive on the LSR's numerous primitive roads during the summer and early fall. Cured grass, which is highly flammable, is often encroaching on the road or growing between the wheel tracks.

Lightning. Thunderstorms are a common summer occurrence. These storms are accompanied by lightning, erratic winds, and, most often, precipitation. Although rain can limit the actual number of ignitions, the main factor that determines whether a fire starts is the fuel loading in the area that the lightning strikes. When lightning strikes areas of high fuel loading, fires are likely, regardless of precipitation.

Each assessment area was given an adjective rating of high, moderate or low based on fuels accumulation and historic occurrence of

lightning (See the Existing Condition for each assessment area beginning on page 5-21.17).

Fire Behavior. While the probability of occurrence may not have changed significantly, fuels loading and thus the consequences of a fire start has increased in much of the southern portion of the LSR from a Fuel Model 8 to Fuel Model 10. Maps 6-6 and 6-8 on pages 6-14 and 6-16 depict expected fire rate of spread and fire flame length for potential fire occurrence during the warmest, driest period of late summer - early fall, based on an analysis conducted in 1997. As depicted on these maps, many of the areas in Gotchen where a high rate of spread and long flame lengths are expected lie outside of the two fuel break treatment zones. Map 5-2B Fuel Model 10 Locations, page 5-21.1, portrays distribution of Fuel Model 10. When compared to Map 6-6, page 6-14 and Map 6-8, page 6-16, Map 5-2B gives an indication of how the risk of high-intensity fire increased throughout the LSR between 1997 and 1999.

Fire will occur in the LSR. The probability of fire occurrence by lightning or human causes is estimated for each assessment area in Table 5-3B, page 5-21.17.

With the help of the *BEHAVE* fire behavior model, fire behavior and resistance to control can be predicted. This program uses fuel models, topography, and weather models to predict and rate fire behavior in terms of *low*, *moderate*, or *high*. These ratings are good indicators of fire line intensity and resistance to control, and/or rate of spread as follows:

- **Low** - Fires can be attacked and controlled directly with ground crews building fire line and will be limited to burning in understory vegetation.
- **Moderate** - Hand built firelines alone would not be sufficient in controlling fires. Heavy equipment and retardant drops would be more effective.
- **High** - The most hazardous conditions in which serious control problems would occur i.e., torching, crowning, and spotting. Control lines would have to be established well in advance of flaming fronts, and heavy equipment and backfiring might be necessary to widen control lines.

Management Strategy. Twelve distinct stand conditions have been identified in the LSR (nine stand types, two fuel models, and one habitat type). Management treatment is recommended for each stand condition. These treatments would be applied in keeping with a five part strategy to maintain the LSR on a path toward the desired future condition.

First, the development of early seral tree species will be promoted throughout the LSR by managing stocking within existing plantations and future plantations that result from salvage (see Treatment Description, Groups 1-3). This stocking control should lower the risk of stand disturbance now and in the future. Also, the occurrence of stands managed in this way on the landscape should reduce the overall risk of the LSR to large stand replacement fires.

Second, mature stand treatments (see Treatments Description, Groups 4-7, page 5-21.2) are proposed to reduce fuel hazard by salvaging dead and dying trees, treating ground fuels, and, particularly in the eastern areas, promoting the development of fire and insect resistant tree species. The intention is to maintain the late-successional attributes where they exist, so that stands remain suitable habitat for late-successional species

Third, high fuel levels (Fuel Models 8 and 10) would be treated by mechanical methods and underburning. See Map 5-2B, page 5-21.1.

Fourth, two fuel break zones have been identified to reduce the likelihood of a large-scale fire in the LSR. Zone 1 was delineated to break up the concentration of fuels across the LSR by taking advantage of natural fire barriers, roads and thinned plantations. Zone 2 is a fuel break up to ¼ mile wide adjacent to the Forest boundary on the east side of the LSR. Within these zones, the combination of the proposed treatments will create a mosaic of stands with reduced fuel loads and stand densities in which crown fire is unlikely. Consequently, these

zones would slow advancing fire and provide opportunities to control a fire.

Fifth, budworm infected owl nest sites may be sprayed with the pesticide Bt to preempt loss of critical owl nesting habitat.

In summary, this approach seeks to accomplish the following:

- Maintain current late-successional forests.
- Foster future stability by managing the species composition of younger stands so that they develop into more ecologically stable late-successional forest.
- Apply treatments that promote more ecological stability in late-successional forests that have a structure prone to disturbance.
- Reduce the threat of stand replacing fire in the LSR as a whole.

This approach recognizes that the current risk of stand replacement disturbance rose from low to moderate between 1997 and 1999 and has the potential to increase rapidly.

Treatment Criteria and Stand Conditions

Candidate stands and conditions for treatments to minimize the risk of large-scale disturbance and loss of late-successional habitat are comprised of nine Stand Groups, two Fuel Models and owl nest sites.

Group 1 - Young Plantations. A mosaic of plantations occurs throughout the southern portion of the Gotchen LSR. They are generally healthy stands, are currently not late-successional habitat, and have low amounts of fuels. They present good opportunities as areas to maintain in a low-risk category as they grow and develop. They also serve as potential "anchors" for adjacent treatments to minimize disturbance risks.

Group 2 – Maturing Plantations. These are primarily densely stocked, Douglas-fir dominated stands less than 80 years old. Like the Young Plantation in the southern portion of the LSR, they would also be maintained in a low risk category and would serve as potential "anchors" for adjacent treatments to minimize disturbance risks.

Group 3 - Lightly Stocked Stands. These are very open, lightly stocked stands (less than 40 percent canopy closure), primarily grand fir. Often, root diseases or insects have caused mortality and resulted in the open condition. Since they are already open, these stands no longer function as late-successional habitat, and are excellent candidates to be reforested with early seral ponderosa pine and Douglas-fir. These stands are typically Fuel Model 10.

Group 4 - Dead and Dying Stands. These are partially stocked stands (less than 40 percent canopy closure) with mortality from insects and diseases (root disease, spruce budworm, fir engraver beetle and others). These are stands that have continuing mortality from insects and diseases, and may soon resemble the open stands mentioned in Group 3, above. Typically, a combination of root diseases, high stem density and insects are causing a decrease in tree vigor and eventual mortality, especially in grand fir. As with Group 3, these stands no longer function as late-successional habitat. These stands are often Fuel Model 10.

Group 5 - Declining Stands. These are partially stocked stands (greater than 40 percent canopy closure) with mortality from pathogens (root disease, spruce budworm, fir engraver beetle and others). These are stands that have continuing mortality from pathogens, similar to Groups 3 and 4. Typically, a combination of root diseases and insects are causing a decrease in tree vigor and eventual

mortality, especially in grand fir. These stands still function as late-successional habitat, but will lose that function in the future 5-10 years. These stands are often Fuel Model 10.

Group 6 - Remnant Old Growth. These stands contain at least a partial stocking of large, old-growth ponderosa pine and Douglas-fir, with secondary canopies composed primarily of grand fir. These ecologically valuable legacy features are at risk from competition from dense understory grand fir. These stands are typically Fuel Model 8.

Group 7 - Mature Grand Fir. These are stands fully stocked with grand fir, containing few overstory old-growth trees. These stands may be candidates for creation of small openings (group selection), to initiate development of early seral species without sacrificing their current status as late-successional, suitable owl habitat. These stands are typically Fuel Model 8.

Group 8 - Boundary Grand Fir. These are grand fir stands along the Forest boundary in the LSR. Stands subject to treatment within this group are those within one-quarter mile of the LSR boundary. This area may be important in providing connectivity to late-successional habitat on Yakama Nation lands to the east. These stands are typically Fuel Model 8.

Group 9 - Dense Lodgepole Pine located north and east of Smith Butte. Mature lodgepole pine stands are susceptible to mountain pine beetle, although little is present today. Significant mountain pine beetle mortality would increase fire hazard, threatening adjacent late-successional stands. Younger, harvested lodgepole pine stands have areas of heavy slash. Lodgepole pine stands provide important habitat for northern 3-toed and black-backed woodpeckers. The black-backed woodpecker is a rare/locally endemic species. Dense, unthinned stands provide habitat for snowshoe hares which are the prey base for lynx. These stands may be Fuel Model 8 or 10.

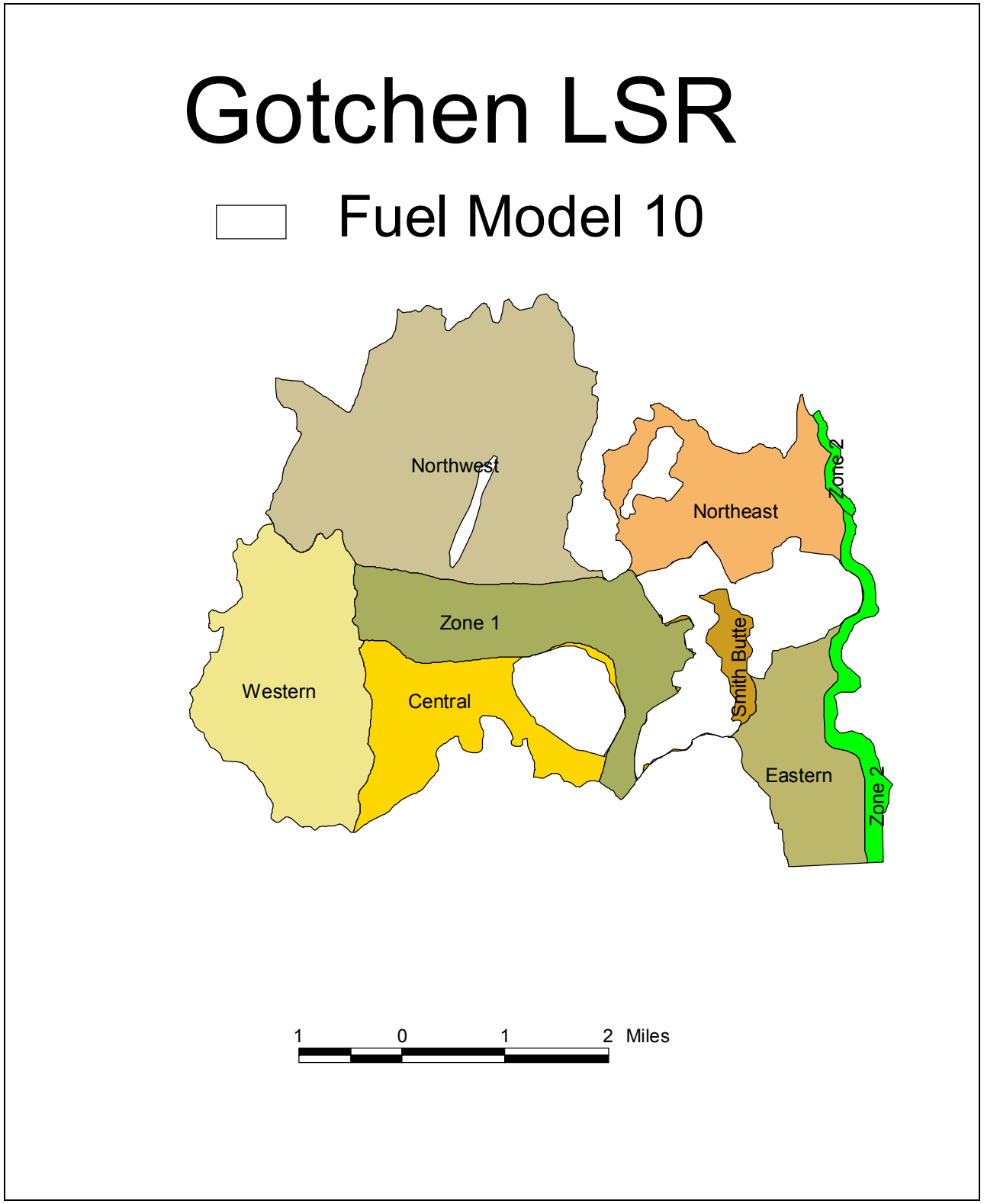
Fuel Models 8 and 10. The majority of the LSR falls into either Fuel Model 8 or Fuel Model 10 as described in *General Technical Report INT-122 Aids to Determining Fuel Models for Estimating Fire Behavior, April 1982.* In the northern most portion of the LSR, moss is the primary conveyor of fire. Moss has not been described in a fuel model.

Fuel Model 8 generally produces slow-burning ground fuels with low flame lengths. An occasional jackpot may be encountered. Usually, these fuels only pose fire hazards under severe weather conditions involving high temperatures, low relative humilities, and high wind speeds. Fuel Model 8 is most often associated with Stand Groups 6 through 9.

Fuel Model 10 generally has fires that burn in the surface fuels and ground fuels with greater intensity than the other timber litter models such as Models 8 and 9. Crowning, spotting, and torching of individual trees are much more frequent in this model. Controlling fires in this fuel model is difficult. Fuel Model 10 is most often associated with Stand Groups 3 through 5 and portions of Stand Group 9.

Spotted Owl Nest Sites are located throughout the LSR. Of the six known sites, five are presently occupied. The best 100 acres surrounding the nest site is a high priority for protection from budworm and fire.

Map 5-2B Fuel Model 10 Locations5-1



Treatments Description

Table 5-3, page 5-21.4, summarizes the treatment prescriptions, resulting fire hazard, suitability as late-successional habitat, particularly for the northern spotted owl and whether each is exempt from REO review.

Stand Group 1 - Young plantations. This treatment is described in detail in section *5-1 Young Stand Thinnings*, page 5-1. Thinning these stands should not only promote growth, but should help to maintain the sites in a low fire-risk situation. Young stand thinning may be applied in young stands throughout the Gotchen LSR. This treatment is exempt from REO review.

Stand Group 2 - Maturing Plantations. This treatment is described in detail in section *5-2 Commercial Thinning*, page 5-6. Commercial Thinning may be applied to candidate stands less than 80 years old wherever they occur in the LSR. This treatment is exempt from REO review.

Stand Group 3 - Lightly Stocked Stands. These stands should be reforested with primarily ponderosa pine and Douglas-fir to provide an early seral component for future stands. Pathologists should be consulted to determine presence of root diseases, and for advice on reforestation tree species to use. Since the objective is to provide long-term growing space for these trees, wide spacings of planted trees should be used. Exact spacing guidelines should be based on individual site characteristics. This treatment would be applied throughout the LSR. This treatment is exempt from REO review.

Stand Group 4 - Dead and Dying Stands. These stands will be harvested, consistent with NWFP Salvage Guidelines, to remove dead and dying trees not needed to meet LSR objectives and to reduce the risk of large-scale, stand-replacing fire. Harvested areas will be reforested with early seral tree species, as discussed under Stand Group 3. Early seral tree species should be maintained.

These stands do not function as late-successional habitat; reforestation should help to regrow a late-successional stand that is more resistant to large-scale disturbance. This treatment could be applied throughout the LSR, although the initial focus should be in and adjacent to Treatment Zone 1. Treatments in Stand Group 4 are subject to REO review.

Stand Group 5 - Declining Stands. These stands should be treated to remove dead and dying trees to reduce fire risk, and reforested as described for Stand Group 3.

Group 5 stands still function as late-successional habitat, but may not in the near future, because continued tree mortality may reduce the stands below minimum stocking levels. Treatment should only be in stands where an interdisciplinary team, including biologists, determines that the stand will not function as late-successional habitat within the next 5 years. At present, most candidate stands for this treatment are in Treatment Zone 1 and the southern portions of the LSR. Stand Group 5 Treatments are subject to REO review.

Stand Group 6 - Remnant Old Growth. In these stands, it would be beneficial to thin in the immediate vicinity of individual old-growth trees, removing understory and mid-canopy grand fir and western hemlock. This would lessen competitive stress on the older trees, and reduce risk of mortality from crown fires by removing ladder fuels. This treatment should remove approximately ½ of the shade-tolerant trees that are in the immediate vicinity (within 2 crown widths), and should not be applied to more than ½ of the old-growth trees in an area. This treatment should be applied throughout the LSR. This treatment is exempt from REO review.

Stand Group 7 - Mature Grand Fir. Two treatments may be applied in these stands,

and both may be applied in a given stand where appropriate.

First, to add structure and provide an early seral species component, small openings (approximately 1 tree length by ½ tree length in size) may be created and reforested with ponderosa pine, Douglas-fir, and western larch seedlings. No more than 20 percent of the acreage on a landscape should contain these small openings.

Second, stands may receive a light thinning to enhance stand resilience after insect attack. Thinning should concentrate on removing mid-canopy trees, and should harvest no more than 25 percent of stand basal area. At least 40 percent canopy closure of conifers should remain to allow stands to continue to function as spotted owl dispersal habitat. Any large early-seral trees will be retained. This treatment is exempt from REO review.

Stand Group 8. Boundary Grand Fir. Treatment in these stands consists of thinning to approximately 40 percent canopy closure, to provide a partial fuel break, yet maintain connectivity with the Yakama Nation lands to the east. This treatment is exempt from REO review.

Stand Group 9. Dense Lodgepole Pine Stands. Slash in young managed stands with heavy fuels concentrations should be hand piled, as necessary, to reduce fire risk.

Mature stands should be monitored for mountain pine beetle. A 3-step monitoring procedure is recommended by specialists at the Westside Insect and Disease Technical Center:

1. Apply risk-rating to lodgepole pine stands. This risk-rating gives an estimate of potential for mountain pine beetle outbreaks.
2. Track occurrence of nearby mountain pine beetle activity, annually, by monitoring annual insect and disease detection flights.
3. If risk-rating indicates high potential for outbreak of mountain pine beetle, and if monitoring shows mountain pine beetle in the vicinity or in stands in the LSR, contact entomologists at the Westside Insect and Disease Technical Center for a field review. If, in their opinion, there is a high likelihood that a mountain pine beetle outbreak is imminent or beginning, consider timber harvest and/or fuels treatments to manage fuel levels at an acceptable risk to the LSR.

Stand Group 9 Treatments are subject to REO review.

Fuel Models 8 and 10. Fuel models overlay the stand conditions described by the stand groups. Areas with Fuel Models 8 and 10 may be treated based on either the stand conditions, as described above, or the fuels conditions. Areas of Fuel Model 8 would be treated primarily by handpiling and machine piling along roads in the northern two assessment areas within Stand Group 7. Areas of Fuel Model 10 larger than 10 acres in size would be treated by removing dead and dying fuels, handpiling, machine piling or chipping. Roadside areas would be highest priority for treatment to expand the effectiveness of a road's function as a fuel breaks and reduce the risk hazard from human caused fire starts along roads.

Fuel Model 10 Treatments, other than those along key roads as described in the Three-Year Action Plan, are subject to REO review. Roads identified in the Three-Year Action Plan are:

80, 8040, 8040020, 8020, 8020021,
82, 8200060, 8200181, 8225, 8225101

Table 5-3 Treatment Summary

Stand Group, Fuel Model, or Treatment Area Component	Prescription	Late-Successional Forest Function		Potential Location of Treatment	Fire Hazard Post Treatment	Fire Tolerant Late Successional Forest in the Future	Exempt from REO Review
		PRE TREATMENT	POST TREATMENT				
Young plantations (SG 1)	Young stand thinning	No	No	Within plantations throughout LSR	Low	Yes	Yes
Maturing Plantations (SG 2)	Commercial thinning	No	No	Throughout LSR w/in dense stands of Douglas-fir	Low	Yes	Yes
Lightly Stocked Stands (SG 3)	Retain existing early seral spp., reforest with ponderosa pine and Douglas fir	No	No	Throughout LSR except Boundary	Low	Yes	Yes
Dead and dying Stands (SG 4)	Salvage and Reforest	No	No	Throughout LSR except Boundary	Low	Yes	**No**
Declining Stands (SG 5)	Salvage/reforest when mortality will result in loss of late successional habitat within 5 years.	Yes/No	No	Throughout LSR except Boundary	Low	Yes	**No**
Remnant Old Growth (SG 6)	Thin shade-tolerant spp. from immediate vicinity of individual remnant old growth	Yes	Yes	Throughout LSR	Moderate to Low	Yes	Yes
Mature Grand Fir (SG 7)	Create small openings, regen with early seral spp. Thin to enhance tree resilience	Yes	Yes	Treatment Zone 1, Smith Butte, Central and Northeast	Moderate to High	Difficult to determine; depends on future stand health	Yes
Grand fir along the Forest Boundary (SG-8)	Create partial fuel break with thinning to 40% canopy closure	Yes	Yes	Treatment Zone 2	Moderate Low to	Yes	Yes
Lodgepole Pine (SG 9)	Remove suppressed, dying fuels. Pile existing slash concentrations Consider treatments if mt. pine beetle outbreak is likely.	No	No	Lodgepole pine stands east and north of Smith Butte	Moderate to Low	No	No
Fuel Model 8	Chip, handpile, machine pile underburn	Yes	Yes	Throughout LSR	Moderate to Low	Yes	Yes
Fuel Model 10	Remove suppressed, dying fuels, chip, handpile, machine pile	Yes	Yes	Throughout LSR	Moderate to Low	Yes	Yes along key roads identified in the 3-year Action Plan. No for rest of LSR.
Known Spotted Owl Nests	Spray best 100 acres of habitat with Bt	Yes	Yes	Throughout LSR	Moderate to Low	Yes	Yes

Assessment Area Objectives

The ID Team assessed ecological functions at the landscape scale and attributed functions to each assessment area. The purpose of this assessment was to ensure that risk reduction activities would not jeopardize ecological functions. Management objectives were formulated to address the functions provided by each assessment area.

Table 5-3A Management Objectives by Assessment Area, describes the objectives of each assessment area. The objectives define the limits of silvicultural and risk reduction activity that could occur within the given assessment area. For example, one of the objectives of the Eastern Assessment Area is to maintain connectivity for spotted owl dispersal. Treatment activity would be permitted only to the extent that the connectivity function would not be diminished.

Objectives for Treatment Zones l and 2 are not included in Table 5-3A. The objective for Treatment Zone 1 is to provide a central fuel break, which would serve as an anchor from which to suppress wildfires. The objective of Treatment Zone 2 is to serve as a shaded fuel break that provides dispersal quality habitat for spotted owls and other late-successional species.

Table 5-3A Management Objectives by Assessment Area

Eastern	Smith Butte	Central	Western	Northwest	Northeast
Maintain connectivity for spotted owl dispersal (primary function)	**Maintain** connectivity for spotted owl dispersal (primary function)	**Maintain** connectivity for spotted owl dispersal (primary function)	**Maintain** NRF function (primary function) for existing pair	**Maintain** NRF function (primary function) for existing pair	**Maintain** connectivity for spotted owl dispersal (primary function)
Maintain NRF function for *King Mt.* pair home range.	**Maintain** NRF function for *Smith Butte* pair home range.	**Maintain** NRF function for existing owl pair home range.	**Maintain** connectivity for spotted owl dispersal	**Maintain** connectivity for spotted owl dispersal	**Maintain** NRF function for existing owl pair home range.
Maintain lodgepole community in 10% of the treatment area at 33% in each successional stage.	**Maintain** lodgepole community in 10% of the treatment area at 33% in each successional stage.				**Maintain** lodgepole/sub alpine community at 33% in each successional stage.
Reduce volatility and spread potential to prevent fire spreading to adjacent areas.	**Reduce** volatility and spread potential to prevent fire spreading to adjacent areas.	**Maintain** low volatility and spread potential	**Maintain** low volatility and spread potential	**Maintain** low volatility and spread potential	**Reduce** volatility and spread potential to prevent fire spreading to adjacent areas.
Decrease likelihood of human caused fire starts	**Decrease** likelihood of human caused fire starts				**Maintain** upland meadows from conifer encroachment
			Protect potential bull trout habitat	**Protect** potential bull trout habitat	

Application of Treatments on the Landscape

The composition of each area in the LSR was considered with respect to the management objectives, stand groups and treatment criteria to identify management options in each of the eight areas in the LSR. This section discusses the unique features of each area and the management options they provide.

Existing conditions for each Assessment Area are summarized in Table 5-3B, page 5-21.17. Management Options are summarized in Table 5-3C, page 5-21.18.

TREATMENT ZONE 1 (1,800 ACRES)

EXISTING CONDITION

Stand Group	Percent
SG-1 Young Plantations	25%
SG-2 Maturing Plantations	
SG-3 Lightly Stocked	
SG-4 Dead and Dying	15%
SG-5 Declining	20%
SG-6 Legacy Old Growth	10%
SG-7 Mature Grand Fir	30%
SG -9 Dense Lodgepole	

This fuel break area, located in the center of the LSR, has large acreage of existing open forest (mostly plantations), and ties in with other areas of low risk, such as existing roads and the Aiken Lava Bed. Treatments within this area should increase the percentage of area in early seral/open forest condition, while maintaining connectivity of late-successional forest across the LSR.

The fuel loading along roads in the area is high. Treatment Zone 1 was located to take advantage of the network of existing roads and plantations. Since the intent is to utilize these roads and plantations as anchors for controlling fire, any future road closure would be by gate and legal closure order rather than obliteration or a more permanent barrier.

This is a historically fire prone area which is subject to lightning. The likelihood of a lightning caused fire is considered moderate. The likelihood of a human caused fire, especially during hunting season, is considered to be moderate because the area is popular with hunters in the fall.

The potential for fires within this area to spread to other portions of the LSR is considered to be moderate.

Although nesting, roosting and foraging habitat (NRF) are present, the primary habitat function for the spotted owl is as connectivity and dispersal habitat

MANAGEMENT OPTIONS

The area lends itself to underburning. It is relatively flat, contains large trees, several plantations, and is roaded. Reintroducing fire into the ecosystem would not only treat fuels to reduce the risk of catastrophic fire, but would also retard succession to grand fir dominated stands. There is a need for silvicultural treatment prior to re-introduction of fire into Stand Groups 4 and 5. Removal of dead and dying trees within Groups 4 and 5 would reduce fuels enough to allow underburning followed by under-planting with budworm resistant species such as ponderosa pine and western larch. Typically after treatment, the Group 4 and 5 stands would retain about 20 percent to 25 percent canopy closure.

Approximately 15 percent of the assessment area (about 270 acres) contains Group 4 stands, and an additional 20 percent contains Group 5

stands. These collapsing stands contain heavy fuel loads, which pose a high threat to the entire assessment area as well as adjacent areas of the LSR. These stands would be treated by removing the dead and dying trees, and reforesting with more sustainable early-successional species such as larch, Douglas-fir, and ponderosa pine. Reducing the fire risk by removing dead and dying trees, treating existing fuels, and establishing more stable early successional species would move these acres towards a more sustainable condition.

In the western portion of Treatment Zone 1 there are opportunities to thin around legacy trees (SG-6) to relieve them of stress from competing grand fir.

TREATMENT ZONE 2 (400 ACRES)

EXISTING CONDITIONS

Stand Group	Percent
SG-1 Young Plantations	10
SG-2 Maturing Plantations	10
SG-3 Lightly Stocked	0
SG-4 Dead and Dying	0
SG-5 Declining	0
SG-6 Legacy Old Growth	0
SG-8 Mature Grand Fir	70
SG-9 Dense Lodgepole	10

These are lands within ¼ mile of the Forest boundary running the full north - south length of the LSR. All the mature grand fir stands within this area would be managed as Group 8 stands.

The northern half of the treatment zone is adjacent to Yakama Nation lands, the southern half is adjacent to state and private lands.

There are several user-made roads in the southern portion of the treatment zone. These roads provide access to the Forest from the private lands to the east.

The Yakama Nation, whose lands lie to the immediate east of the Forest boundary, have taken an aggressive policy towards treating the spruce budworm infested stands and the resultant fuels on their side of the line. The Yakama are harvesting grand fir stands, treating activity fuels, and regenerating to budworm resistant species.

The Group 8 stands are stocked with budworm susceptible species. At present, they are relatively healthy, and the adjacent landowners - especially the Yakama Nation and Campbell Group - are aggressively treating their budworm infested stands and resultant fuels.

The treatment zone is primarily stocked with grand fir. Prior to fire exclusion, the area was stocked with ponderosa pine and Douglas-fir. Grand fir stands within areas where grand fir was not historically present appear to be more susceptible to budworm infestation.

Approximately 25 percent of the grand fir stands have been thinned, and are relatively healthy.

Except for pockets of Fuel Model 10, fuel loading is at acceptable levels (Fuel Model 8).

The likelihood of ignition of fire from natural causes is unknown. This is the eastern-most portion of the Forest, and is subject to lightning. The likelihood of a lightning-caused fire start on either side of the Forest boundary is considered moderate.

The potential for fire to affect adjacent areas of the LSR is moderate.

MANAGEMENT OPTIONS

The creation of a shaded fuel break along the Forest boundary would give the LSR protection from off-Forest disturbance. We would not implement the fuel break unless the current conditions change. The triggering events would be:

- Fuels accumulation to Fuel Model 10 on lands adjacent to the Forest
- The Group 8 stands start to show evidence of decline and fuel build-up.

Managing this area as Treatment Zone 2 gives us the flexibility to create a fuel break along the entire length of the Forest boundary should the triggering events occur sometime in the future.

EASTERN ASSESSMENT AREA (1,300 ACRES)

EXISTING CONDITIONS

Stand Group	Percent
SG-1 Young Plantations	15
SG-2 Maturing Plantations	10
SG-3 Lightly Stocked	0
SG-4 Dead and Dying	10
SG-5 Declining	5
SG-6 Legacy Old Growth	0
SG-7 Mature Grand Fir	50
SG-9 Dense Lodgepole	10

The assessment area is primarily stocked with grand fir. Grand fir stands are less resistant to fire than the ponderosa pine stands which dominated the area prior to fire exclusion. It is believed that grand fir stands within areas that were historically stocked with ponderosa pine are more susceptible to budworm infestation than those that have been continuously dominated by grand fir.

Fuel loading is high (Fuel Model 10) within about 30 percent of the area. The fuel loading along Forest Road 82, the main travel route through this area, is high (Stand Group 9 with Fuel Model 10).

The assessment area contains a network of existing roads and plantations. Since the intent is to utilize these roads and plantations as anchors for controlling fire, any future road closure would be by gate and legal closure order rather than obliteration or a more permanent barrier.

The probability of a lightning caused fire is moderate; this was historically a fire-dominated ecosystem. The fire cycle in this area is from 5 to 45 years. Because the area is popular with hunters, the likelihood of ignition from people, especially during hunting season, is considered to be moderate.

The potential of fires within this area to spread to other portions of the LSR is considered moderate, particularly in the fall when prevailing winds are from the east.

Although nesting, roosting and foraging habitats (NRF) are present, the primary habitat function for the spotted owl is as connectivity and dispersal habitat.

MANAGEMENT OPTIONS

The area lends itself to underburning. It is relatively flat, contains large trees, several plantations, and is roaded. Reintroducing fire into the ecosystem not only treats fuels to reduce the risk of catastrophic fire, but also retards succession to grand fir dominated stands. There is a need for silvicultural treatment prior to re-introduction of fire into Stand Groups 4 and 5. Removal of dead and dying trees within Groups 4 and 5 would reduce fuels enough to allow underburning followed by under-planting with budworm resistant species such as Douglas-fir, ponderosa pine and

western larch. Typically, after treatment, the Group 4 and 5 stands would retain about 20 percent to 25 percent canopy closure.

The Group 7 stands, which are comprised of budworm host species (80 percent grand fir, 20 percent Douglas-fir and other), are candidates for budworm infestation. However, many of these stands have recently been thinned, have low fuel loading, are relatively healthy, and are currently functioning as late-successional habitat. These stands would not be subject to silvicultural treatment unless they decline to Stand Group 4 and 5.

SMITH BUTTE ASSESSMENT AREA (1,000 ACRES)

EXISTING CONDITION

Stand Group	Percent
SG-1 Young Plantations	0
SG-2 Maturing Plantations	25
SG-3 Lightly Stocked	0
SG-4 Dead and Dying	15
SG-5 Declining	15
SG-6 Legacy Old Growth	0
SG-7 Mature Grand Fir	35
SG -9 Dense Lodgepole	10

The assessment area is primarily stocked with grand fir and lodgepole pine. Prior to fire exclusion, the area was stocked with ponderosa pine and Douglas-fir. Grand fir stands within areas historically stocked with ponderosa pine are quite susceptible to budworm infestation.

Fuel loading is extremely high (Fuel Model 10) within about 70 percent of the area. Stands in this area have suffered the heaviest level of damage and mortality from insects and disease. Due to mortality and dead tops on defoliated trees, the fuel buildup will continue even if the budworm infestation subsides. Fire volatility would be very high due to heavy/flashy fuels.

Due to the assessment area's fuel loading, stand conditions, topography, and location, the risk of a fire start in this area consuming a large portion of the LSR is high.

This assessment area also has several hundred acres of lodgepole pine stands with heavy fuel concentrations.

The area contains a network of existing roads and plantations. As in the Eastern Assessment Area, the intent is to use these roads and plantations as anchors for controlling fire.

The assessment area is a historically fire prone area. There are numerous snags present, a prominent topographic feature (Smith Butte), and the area is subject to lightning. For these reasons, the probability of a lightning caused fire is considered high.

Although there is a known owl nest within the assessment area, the primary habitat function for spotted owls is as connectivity and dispersal habitat.

Approximately 200 acres of the assessment area are being considered for possible establishment of a Research Natural Area. The two hundred contiguous acres of unmanaged grand fir is considered to be unique.

MANAGEMENT OPTIONS

Approximately 15 percent of the assessment area (about 150 acres) contains Group 4 stands, and an additional 15 percent contains Group 5 stands. These collapsing stands contain heavy fuel loads, which pose a high threat to entire assessment area as well as adjacent areas of the LSR. These stands would be treated by removing the dead and dying trees, and

reforesting with more sustainable early-successional species such as larch and ponderosa pine. Reducing the fire risk by removing dead and dying trees, treating existing fuels, and establishing more stable early successional species would move these acres towards a more sustainable condition.

The Smith Butte Assessment Area contains about 350 acres of Stand Group 7. These stands would not be treated unless they begin to decline to Stand Group 5.

Portions of the Smith Butte Assessment Area are suitable for underburning. These are the flat, roaded areas containing stands of large trees as well as plantations. Reintroducing fire into the ecosystem will serve to treat fuels and suppress succession to grand fir dominated stands.

CENTRAL ASSESSMENT AREA (1,800 ACRES)

EXISTING CONDITIONS

Stand Group	Percent
SG-1 Young Plantations	5
SG-2 Maturing Plantations	0
SG-3 Lightly Stocked	0
SG-4 Dead and Dying	15
SG-5 Declining	15
SG-6 Legacy Old Growth	20
SG-7 Mature Grand Fir	45
SG-9 Dense Lodgepole	0

The northeastern third of the assessment area is primarily stocked with grand fir. Prior to fire exclusion, the area was stocked with ponderosa pine and Douglas-fir. The western two thirds of the assessment area contains about 350 acres of grand fir stands with a relatively large component of old-growth ponderosa pine.

The assessment area is a dry, historically fire-prone area. Fuel loading is high (Fuel Model 10) within about 30 percent of the area.

The northeastern portion of the assessment area has suffered insect and disease damage and mortality. Heavy fuel loads (Fuel Model 10) are present within about 30 percent of the Central Assessment Area (about 560 acres). Due to mortality and dead tops on defoliated trees, the fuel buildup will continue even if the budworm infestation subsides. Due to the assessment area's fuel loading, stand conditions, and location, the risk of a fire start in the northeastern portion consuming a large portion of the LSR is high.

The probability of a lightning caused fire is moderate; this was historically a fire-dominated ecosystem. The fire cycle in this area is from 5 to 45 years. The risk of human caused fires is believed to be moderate based on its popularity as a recreation destination.

The potential for fires within this area to spread to adjacent areas of the LSR is high if the fire occurs within the northeastern third of the assessment area because of heavy fuels. It is relatively low for the remaining two thirds.

The assessment area contains a network of existing roads and plantations. As in the Eastern and Smith Butte Assessment Areas, the intent is to use these roads and plantations as anchors for controlling fire. Road closures should provide for easy access for fuels management and fire suppression.

The area provides spotted owl NRF, connectivity and dispersal habitat.

MANAGEMENT OPTIONS

The Stand Groups 4 and 5 in the northeastern third of the Assessment Area contain heavy fuel loads, which pose a high threat to entire assessment area as well as adjacent areas of the LSR. The Group 4 and 5 stands in this assessment area are intermixed and, for practical purposes, would be treated as one stand type comprising almost a third of the treatment area. There are opportunities to enhance the stability of these stands by removing the dead and dying trees, and reforesting with more sustainable early-successional species such as larch and ponderosa pine.

The Central Assessment Area contains over 850 acres of Stand Group 7. Although relatively healthy at present, the Group 7 stands in the western portion of the assessment area are stocked primarily with budworm host species. If pathogen or insect activity increases within these stands, they should be assessed for treatment to increase stand resilience, reduce fuel loads, stand densities, and the risk of catastrophic disturbance.

With approximately 340 acres of Stand Group 6, and relatively good access, the Central Assessment Area provides the opportunity to thin around legacy trees to relieve them of stress from competing grand fir. The Central Assessment Area lends itself to underburning. It is relatively flat, contains large trees, and is roaded. In some areas there will be a need for silvicultural treatment to reduce ladder fuels prior to re-introduction of fire into the landscape. Reintroducing fire not only treats fuels and reduces the risk of catastrophic fire, but also suppresses succession to stands dominated by grand fir.

WESTERN ASSESSMENT AREA (2,400 ACRES)

EXISTING CONDITIONS

Stand Group	Percent
SG-1 Young Plantations	15
SG-2 Maturing Plantations	5
SG-3 Lightly Stocked	0
SG-4 Dead and Dying	0
SG-5 Declining	0
SG-6 Legacy Old Growth	30
SG-7 Mature Grand Fir	50
SG-9 Dense Lodgepole	0

The stands in the Western Assessment Area are primarily stocked with grand fir having Douglas-fir and ponderosa pine components. Although the Western Assessment Area is a transition zone to cooler moister conditions, and therefore not as dry as the more easterly assessment areas, it is still within the relatively dry grand fir zone. Prior to fire exclusion, the area was stocked with ponderosa pine, Douglas-fir, and grand fir. Grand fir stands that were historically stocked with a grand fir component are somewhat less susceptible to budworm infestation than those historically stocked with ponderosa pine.

With the exception of pockets of Fuel Model 10, most of the assessment area is Fuel Model 8.

The Western Assessment Area contains a network of existing roads and plantations. Since the intent is to utilize these roads and plantations as anchors for controlling fire, road closures should provide for easy access for fuels management and fire suppression.

Because it is somewhat more moist than the easterly assessment areas, the probability of a lightning caused fire is low. This was historically a fire-

dominated ecosystem. The fire cycle in this area is from 70 to 250 years. The popularity of the area with recreationists earns it a moderate risk of human caused fire.

The potential of fires within this area to spread to other portions of the LSR is considered to be low.

The Western Assessment Area provides the spotted owl with nesting roosting and foraging habitat.

MANAGEMENT OPTIONS

The assessment area contains over 1,400 acres of mature grand fir stands. The Group 7 stands are stocked with budworm host species (60 percent grand fir, 20 percent Douglas-fir), and are susceptible to budworm infestation. However, many of these stands have recently been thinned, have low fuel loading, are relatively healthy, and are currently functioning as late-successional habitat. If these stands remain healthy, they would not be considered for silvicultural treatment.

If the trigging events do occur, small-scale thinning to enhance stand vigor would be considered as a test of its efficacy in maintaining stand health.

With approximately 960 acres of Stand Group 6, and a relatively good access, the Western Assessment Area provides the opportunity to thin around legacy trees to relieve them of stress from competing grand fir.

There is a need for silvicultural treatment prior to re-introduction of fire into the landscape. The area lends itself to underburning. It is relatively flat, contains large trees, several plantations, and is roaded.

NORTHWESTERN ASSESSMENT AREA (4,300 ACRES)

EXISTING CONDITION

Stand Group	Percent
SG-1 Young Plantations	0
SG-2 Maturing Plantations	0
SG-3 Lightly Stocked	0
SG-4 Dead and Dying	0
SG-5 Declining	0
SG-6 Legacy Old Growth	40
SG-7 Mature Grand Fir	60
SG-9 Dense Lodgepole	0

The Northwestern Assessment Area's stands are stocked with grand fir, Douglas-fir and ponderosa pine components. Like the Western Assessment Area, this area is a transition zone to cooler moister conditions, and therefore not as dry as the more easterly assessment areas. The southern three-quarters of the assessment area is within the grand fir zone. The northern quarter of the assessment area is within the mountain hemlock zone. Prior to fire exclusion, the area was stocked with ponderosa pine, Douglas-fir, and grand fir. Stands historically stocked with a grand fir component are somewhat less susceptible to budworm infestation than those historically stocked primarily with ponderosa pine.

The stands within the mountain hemlock zone are stocked with lodgepole pine and subalpine fir. These stands are 80 to 90 years old, are approaching the end of their life cycle, and are starting to decline.

Except for pockets of Fuel Model 10, the majority of fuels within the grand fir zone portion of the assessment area is at Fuel Model 8. In the mountain hemlock zone, moss in addition to foliage, is a significant contributor to crown fire.

As stands start declining in the mountain hemlock zone, fuels (in addition to moss) will start to build up and transition into Fuel Model 10.

The western third of the assessment area contains a small network of roads and plantations. These roads and plantations will be utilized as anchors for controlling fire. Any future road closure would be by gate and legal closure order rather than a more permanent barrier. The majority of the Northwestern Assessment Area is unroaded.

Because it is somewhat more moist than the easterly assessment areas, the probability of a lightning caused fire is low. This was historically a fire dominated ecosystem. The fire cycle in this area is from 70 to 250 years. Because of its limited access, the risk of a human caused fire is considered low.

The potential of fires within this area to spread to other portions of the LSR is considered to be low. However, suppression would be difficult since most of the Northwestern Assessment Area is unroaded.

From a landscape perspective, maintaining the stand health and reducing fire risk in the Northwestern Assessment Area would help protect late-successional habitat within the adjacent Mt. Adams Wilderness where management options are restricted.

The Northwestern Assessment Area provides the spotted owl with nesting roosting and foraging and dispersal habitat.

MANAGEMENT OPTIONS

The Northwestern Assessment Area contains over 2,200 acres of Stand Group 7. About 75 percent of the stocking consists of budworm host species (grand fir, and Douglas-fir), and are susceptible to budworm infestation. However, most of these stands have low fuel loading, are relatively healthy, and are currently functioning as late successional habitat.

Commercial thinning is not considered appropriate for the following reasons:

1. Although comprised of budworm host species (mostly grand fir), the stands are considered to be somewhat less susceptible to budworm infestation relative to the dry site grand fir stands within the LSR. The Northwest Assessment Area is within the moist grand fir zone.
2. The analysis area functions as NRF habitat for the spotted owl. The mature grand fir stands are functioning as late-successional habitat. A minor amount of budworm-induced mortality could improve the structural complexity of the stands.

Risk reduction salvage would not be considered in these stands unless the following triggering events occur to change the current situation:

- Fuel buildup increases to where Fuel Model 10 occurs on a minimum of 10 contiguous acres.
- Budworm activity increases to level *BS 2* for 2 years, or *BS 3* for 1 year.
- Stands show a marked evidence of stand decline.

While the Northwestern Assessment Area contains approximately 1,500

acres of Stand Group 6, opportunities to thin around legacy trees will be limited by access.

NORTHEASTERN ASSESSMENT AREA (2,100 ACRES)

EXISTING CONDITION

Stand Group	Percent
SG-1 Young Plantations	0
SG-2 Maturing Plantations	0
SG-3 Lightly Stocked	0
SG-4 Dead and Dying	0
SG-5 Declining	5
SG-6 Legacy Old Growth	35
SG-7 Mature Grand Fir	50
SG-9 Dense Lodgepole	10

Approximately 85 percent of the stands within the assessment area are stocked with budworm host species. These stands are less resistant to fire than the ponderosa pine stands which characterized the area prior to fire exclusion. The Northeastern Assessment Area is primarily stocked with grand fir. Other species present include Douglas-fir, lodgepole pine, subalpine fir, and remnant ponderosa pine. Prior to fire exclusion, the area was stocked with ponderosa pine, Douglas-fir, and lodgepole pine. Grand fir stands within areas historically stocked with ponderosa pine are more susceptible to budworm infestation.

The southern three-quarters of the assessment area is within the grand fir zone. The northern one-quarter of this assessment area is within the mountain hemlock zone. The stands within the mountain hemlock zone are stocked with lodgepole pine and subalpine fir. These stands are around 90 years old, are approaching the end of their life cycle, and are starting to decline. Between 15 percent and 30 percent of the trees in these stands have dead tops, which ultimately contribute to fuel buildup.

Fuel loading is high (Fuel Model 10) within about 20 percent of the Northeastern Assessment Area. The lodgepole stands within the grand fir zone are overstocked and contain a large amount of ladder fuels. Within the mountain hemlock zone, moss is the primary carrier of fire. There is no fuel model to describe moss carried fire.

The Northeastern Assessment Area is mostly unroaded; the existing network of roads and partial cut units is quite limited. There are no plantations within the assessment area. The intent is to utilize the few roads and partial cuts as anchors for controlling fire. Road closures would be by gate and legal closure order rather than a more permanent barrier. Due to the more uneven topography, location, and existing use patterns, gates would be a more effective tool for road closure than within the other five assessment areas.

The probability of a lightning caused fire is moderate; this was historically a fire-dominated ecosystem. The fire cycle in this area is from 5 to 45 years. Because of limited accessibility, the risk of a human caused fire is considered low.

The potential of fires within this area to spread to other portions of the LSR, particularly in the fall when the prevailing winds are from the east, is considered to be moderate.

There is a known spotted owl activity center on the south side of Snipes Mountain. The stands in this area contain small (one acre) patches of large (≥ 30”dbh) Douglas-fir, grand fir, and subalpine fir. The understory is

relatively clear and open. Fuels are relatively light. The owls, which are banded, have moved out of the site, and are known to nest on Yakama lands to the east. The site, which is probably the highest elevation nest site on the Forest (4,400'), is presently unoccupied. There has been no modification of the habitat, and the reasons for the nest abandonment are unknown.

The Northeastern Assessment Area may contain lynx habitat.

From a landscape perspective, maintaining the stand health and reducing fire risk in the Northeastern Assessment Area would help protect late-successional habitat within the adjacent Mt. Adams Wilderness where management options are restricted

MANAGEMENT OPTIONS

About one-half of the assessment area contains Group 7 stands. These stands are relatively healthy, and are currently functioning as late-successional habitat. However, their age (80-90 years), species composition (grand fir, subalpine fir, and lodgepole pine) place them at risk of declining into Group 5 stands. These stands would not be treated unless the following triggering events occur to change the current condition:

- Fuel buildup increases to where Fuel Model 10 occurs on a minimum of 10 contiguous acres.
- Budworm activity increases to level *BS 2* for 2 years, or *BS 3* for 1 year.
- Stands show a marked evidence of stand decline.

If the trigging events do occur, small scale thinning to enhance stand resilience may be considered, as well as risk reduction salvage and fuel treatment.

Table 5-3B Existing Condition by Assessment Area

Assessment Area Attribute	Eastern 1,300 acres	Smith Butte 1,000 acres	Central 1,800 acres	Western 2,400 acres	Northwest 4,300 acres	Northeast 2,100 acres)
Potential for fire to affect other areas	Moderate due to patchy fuels	High	High in SE portion, low in rest of the treatment area	Low	Mod. potential to spread into Wilderness due to moss component	Moderate
Risk of fire from other area	Low to Mod. from off Forest via east winds	Moderate	High from Smith Butte via east wind	Low	Low	Low to Mod from off Forest via east winds
Fuel Model 8 (% treatment area)	70%	25%	70% but at risk to go to FM 10 due to BS 3	95%	95%	85%
Fuel Model 10 (acres)	30%	75%	30% but at risk to increase	5%	5%	15%
Fire Volatility	High due to flashy fuels	Very High due to heavy/ flashy fuels	Low	Low	Moderate	Moderate
Rate of Spread	Moderate	High	Low, but at risk to go to high due to BS 3	Low	Moderate	Moderate
Probability of ignition a) **Lightning** b) **Human**	 a) Mod b) Mod	 a) High b) Mod	 a) Mod b) Mod	 a) Mod b) Mod	 a) Mod b) Mod	 a) Mod b) Mod
% SG 4 (Loss of LS Function)	10%	15%	15%	0	0	0%
% SG 5, (Loss of LS function)	5%	15%	15%	0	0	5%
% SG 6 (Fully Stocked w/Old Growth	0	0	20%	30%	40%	35%
% SG 7 a) **suscept. to budworm** b) **benefit from resilience thin**	50% a) High b) Low, already thinned	35% a) High b) Mod, some areas need thinning	45% a) High b) Low, already thinned	50% a) High b) Low, already thinned	60% a) Mod due to spp. b) Mod. due to age	50% a) High b) Mod. due to age
% SG 9 (Mature lodgepole pine)	10%	10%	0	0	0	10%
Spotted Owl function	Primarily connectivity, some NRF	Primarily connectivity, some NRF	Primarily NRF, also provides connectivity	Primarily NRF	Primarily NRF	Primarily connectivity, some NRF
Presence of legacy groves	Low	Low	Low	Moderate	High	Moderate
Lynx Function a) **denning** b) **forage**	a) Low b) Moderate	a) Mod. b) Mod.	a) Mod. b) Mod.	a) Mod. b) Mod.	a) High b) High	a) High b) High
Potential Bull Trout Habitat	No	No	No	Yes	Yes	No
Special Features	Lodgepole	Meadow, Bats, Lodgepole	Sub alpine fir, wet meadows	Oak groves		Lodgepole

Table 5-3C Management Options by Assessment Area

Assessment Area Attribute	Treatment Zone 1	Eastern	Smith Butte	Central	Western	Northwest	Northeast
Underburning	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Risk Reduction Salvage Groups 4 and 5 and underplant.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Thin Group 7 Stands to enhance resilience.	Yes	No	Yes	Yes	No	No	Yes
Legacy Tree Culturing	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Roadside Fuel Reduction	Yes	Yes	Yes	Yes	No	Yes	Yes
Lodgepole Pine Mgt	No	Yes	Yes	No	No	No	Yes

Triggers

In the context of this Assessment, triggers are the criteria that lead to further analysis under NEPA, which in turn, may result in a decision to implement a management activity.

Table 5-3D, page 5-21.19, summarizes, by assessment area, the criteria that may lead to a proposal for silvicultural activity within the LSR. Management activities exempted from further REO review are summarized in Table 5-3 (page 5-21.4).

Three-Year Action Plan

Table 5-3E, page 5-21.19, is a three-year action plan of risk reduction activities. Some of these activities require REO review prior to implementation (see Table 5-3). This action plan is a projection of activities the Forest may implement in and adjacent to the Gotchen LSR over the next three years. Silvicultural treatments in the adjacent Matrix land allocation are not subject to REO review.

Matrix activities shown are those believed to contribute to the sustainability of the LSR by reducing risk in surrounding lands. For some activities funded through timber sales, it may be necessary to bundle LSR activities with adjacent Matrix activities to assemble commercially viable sales. If budworm or other pathogen activity intensifies and risk increases beyond that which is anticipated, this tentative schedule would be adjusted to respond to the situation within the framework established by this assessment. Decisions to implement any of these activities will be made with public involvement through the NEPA process.

The action plan was developed in pursuit of the objectives described in Table 5-3A. In developing the plan, the Forest placed the highest priority on those actions which reduce the risk of large scale stand replacing fire. The lowest priority for action are those activities which do little to reduce the risk of fire

throughout the LSR, and/or those activities for which the required triggering event has yet to occur.

Table 5-3D Triggers

Assessment Area Component	Treatment	Eastern, Smith Butte, Central, and Western Assessment Areas, Treatment Zone 1	Northeast and Northwest Assessment Areas	Treatment Zone 2 (Forest Boundary)
SG-4 Dead and dying stands	Risk Reduction Salvage Reforest w/ non-host species	Where SG-4 occurs	Where SG-4 occurs	N/A
SG-5 Declining stands	Risk Reduction Salvage Reforest w/ non-host species	Where SG 5 occurs in TZ 1, ≥ 20% of Assessment Areas	≥ 20% of treatment area	N/A
SG-6 Remnant Old Growth	Old Growth Culturing	Where SG-6 occurs	Where SG-6 occurs	N/A
SG-7 Mature grand fir stands	Thin from below to increase stand resilience and/or small group selection. Maintain 40% canopy cover.	Fuel Model 10 ≥ 10 acres, or stand can benefit from resilience thin East, Smith Butte, Central only	Northeast only: Fuel model 10 ≥ 10 acres. Budworm @ BS 2 in 2 years, or BS 3 for 1 year. Fuel models exceed FM 8. Evidence of stand decline. Resilience thin or group select adjacent to roads as test	N/A
SG-8 Boundary grand fir stands	Thin from below, maintaining at least 40% canopy cover	N/A	N/A	Fuel buildup on adjacent non-National Forest lands
SG-9 Dense Lodgepole pine stands	See SG-9, page 5-3	Applicable to Eastern and Smith Butte. Where it occurs.	N/A	N/A
FM 8	Treat fuels, underburn	No need to act except Treatment Zone 1	SG 7 showing signs of decline and fuels starting to build	Where it exists.
FM 10	Treat fuels, remove dying and suppressed trees	≥ 10 acres	≥ 10 acres	Where it exists
Aerial Spray	Aerial Spray Bt.	Within best 100 acres adjacent to owl nest	Within best 100 acres adjacent to owl nest	N/A

Table 5-3E Three-Year Action Plan

Project Description	Year 1 Acres	Year 2 Acres	Year 3 Acres
Roadside Commercial thinning as a fuel treatment within the LSR	450	400	0
Young stand management (Thinning and fuels treatment	200	200	200
Fuels treatment along key roads and small wood removal (hand piling and chipping)	100	100	0
Salvage and reforestation (Group 4 and 5 stands).	400	0	0
Bt spraying of selected sites inside LSR (100 acre owl cores) Forest boundary area (Matrix)	600 (Nests) 800 (Matrix)	0	600 (Nests) 800 (Matrix)
Underburning	400	400	400
Regeneration harvest in Matrix	150	0	0
Legacy tree culturing throughout LSR (Clearing around selected trees)	100	0	0
Commercial thinning timber sale (LSR & Matrix).	550	0	0
Commercial thinning within Boundary Treatment Area (TZ 2)	0	0	0

CRITERIA

The following describes the stand and landscape level criteria used to prioritize activities for the three year action plan portrayed in Table 5-3E. All activities discussed in the Management Options section are not necessarily priorities for the near future. For more detail on the treatments see Treatments Description, page 5-21.2.

Roadside stand and fuel treatments These treatments include roadside commercial and precommercial thinning, and roadside fuel treatments such as cutting and piling fuels for chipping. Highest priority for fuels reduction and silvicultural treatments are areas which are described by the following four attributes.

- Presence of Fuel Model 10 or SG 9
- High fire volatility
- Moderate to high risk of ignition
- Moderate to high potential for the fire to affect other areas
- Along key roads

Treatment of these fuels reduces risk of human caused fires from roadside ignitions while increasing the effectiveness of roads as fuelbreaks.

Young Stand Management would include pre-commercial thinning, pruning and fuel reduction throughout the LSR to promote the development of late-successional habitat. Management of lodgepole pine plantations would be considered separately from other plantations to optimize habitat for snowshoe hare, the prey base for lynx.

Risk Reduction Salvage of collapsing Group 4 and 5 stands, and reforestation with non-budworm host species will occur primarily in Treatment Zone 1, the extreme southwest portion of the Smith Butte Assessment Area, and the southeastern portion of the Central Assessment Area. The stands identified for risk reduction salvage in the Smith Butte and Central Assessment Areas are, for the most part, adjacent to Treatment Zone 1. The salvage of these collapsing stands would, in effect, increase the size and effectiveness of the original central fuel break (Treatment Zone 1).

Targeted spraying the best 100 acres of habitat adjacent to the known spotted owl nests with Bt would protect nesting/roosting habitat from possible budworm defoliation. Targeted spraying such as this has been shown to be an effective short-term (1-2 year) treatment. Population sampling of spruce budworm will be used to determine the necessity of spraying. Only those owl nests with high budworm populations would be sprayed. Spraying along the Matrix south of the LSR will also be assessed.

Underburning would occur within the Eastern Assessment Area and within the western portion of the Central Assessment Area. These underburns would occur in areas with low potential for catastrophic fire, and where there is a low to moderate risk of fire spreading in from other areas. The primary purpose of the underburns would be to reintroduce fire on the landscape to maintain low fuels levels and suppress succession to grand fir.

Regeneration harvest within the adjacent Matrix is a part of the overall landscape level strategy for reducing the risk of catastrophic fire within and around the LSR. Matrix stands exhibiting budworm damage would be proposed for harvest and conversion to non-host species such as ponderosa pine.

Legacy tree culturing will occur primarily in the Central, Western, and Northwestern Assessment Areas. These treatments would likely be packaged with harvest in the Matrix as well as roadside commercial thinning to make an economically viable sale. As described in the treatment for Stand Group 6, the understory within the immediate vicinity of individual legacy trees would be thinned to lessen the competitive stress to these trees, and, to reduce the chance of mortality from crown fires by removing ladder fuels.

Commercial thinning timber sale within the LSR, but away from key roads is considered a low priority for action. However, commercial thinning within the adjacent Matrix, would, in all likelihood, be coupled with legacy tree culturing, roadside commercial thinning, and Matrix regeneration in order to make a viable timber sale.

Many of the mature grand fir stands within the LSR have already been commercially thinned. The majority of the non-thinned mature grand fir are located within the Northwest and Northeast Treatment Areas. Within the Northwest Assessment area, commercial thinning would not be prescribed for the following reasons:

1. Although comprised of budworm host species (mostly grand fir), the stands are considered to be somewhat less susceptible to budworm infestation relative to the dry site grand fir stands within the LSR. The Northwest Assessment Area is within the moist grand fir zone stocked with pine.
2. The analysis area functions as NRF habitat for the spotted owl; the mature grand fir stands are functioning as late successional habitat. Some budworm-induced mortality would improve the structural complexity of the stands.

Within the Northeast Assessment area, commercial thinning is considered to be low priority for the following reasons:

1. At present, the mature grand fir stands are relatively healthy; there is evidence of only minor amounts of budworm activity.
2. The mature grand fir stands are functioning as spotted owl dispersal habitat. Some budworm induced mortality would only improve the structural and complexity of the stands.

Commercial Thinning within Treatment Zone 2 to create a forested fuel break is at present not a high priority for action. The Yakama Nation has been aggressively treating budworm infested stands and the resultant fuels on the tribal lands adjacent to the Forest boundary. This has greatly reduced the potential for catastrophic damage to the LSR from fire originating on the tribal lands. If fuels start building on the tribal lands in the near future, we would schedule a commercial thin to create a fuel break as the need arises.

Other Activities Conducted In Conjunction With Treatments

Treatments should consider development of snags and down wood. See *5-5 Snag Management* and *5-6 Down Wood Management*, which follow, for details. It may be possible to partially cover snag and down wood requirements by existing mortality, or anticipated future mortality from live trees with poor vigor. Designing treatments to include untreated patches of forest, in which snag retention may be more feasible, may help in maintaining adequate existing snags.

Where possible, utilize K-V funds from projects for precommercial thinning of adjacent plantations.

Treatments should provide for management of fuel conditions through use of prescribed fire or mechanical/hand treatment methods as described in Chapter 6.

Monitoring Plan

Declining Stands (Stand Group 5) The health of Stand Group 5 should be monitored to validate our ability to predict their decline to nonsuitable habitat within 5 years.

Underburning within the LSR or in similar stands in the matrix should be monitored to assess its effectiveness in reducing fuels, suppressing grand fir regeneration, and effects on residual stand mortality.

Spotted Owl Nest Sites should be monitored to determine occupancy and fecundity. Nest sites should also be monitored to assess the effects of Bt spraying on owl behavior.

Implementation monitoring should follow treatment activities (including follow-up work such as snag creation). Formal or informal stand examination should be conducted to estimate stand density, snag, and down wood levels in treated areas. Area of small openings and untreated areas should be estimated by walk-through examination and review of maps or photos. If projects cover large areas, sampling of a portion of the area or a portion of stands (i.e. 20 percent) may be sufficient.

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MEMORANDUM

DATE: September 1, 1999

TO: Nancy Graybeal, Acting Regional Forester, Forest Service, Regions 6

FROM: Donald R. Knowles, Executive Director

SUBJECT: Regional Ecosystem Office Review of the Amendment to the Gifford Pinchot 1997 Forestwide Late-Successional Reserve Assessment for Risk-Reduction Treatments in the Gotchen Late-Successional Reserve

Summary

The Regional Ecosystem Office REO) and the interagency Late-Successional Reserve Work Croup have reviewed the amendment to the Gifford Pinchot 1997 Forestwide Late-Successional Reserve Assessment (LSR) for risk-reduction treatments in the Gotchen Late-Successional Reserve (LSR). The REO finds that the LSRA, as amended, provides a sufficient framework and context for future risk-reduction projects within the LSR. In addition, future risk-reduction activities described in the amended LSRA that meet its criteria and objectives, and which are consistent with the Standards and Guidelines (S&Gs) of the Northwest Forest Plan (NFP) are exempt from future REO review, except for those projects noted below, which would remain subject to REO review. In addition, based on new information and changed conditions within and surrounding the LSR (see below), REO has also withdrawn our previous exemption for reviewing treatments in SG-4 stands.

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. 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 it may identify topics or areas for which additional information, detail, or clarity is needed. The findings of the REO 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 LSR criteria and NFP S&Gs. The REO authority for developing criteria to exempt these actions is found in the S&Gs (pages C12, C-13, and C-18). If such activities are not described in the LSRA and exempted from future review in this memorandum, they remain subject to future REO review.

Scope of the Assessment and Description of the Assessment Area

The Gifford Pinchot National Forest submitted a document titled "Gotchen LSR Proposal for Amendment of the Forest Wide Late-Successional Reserve Assessment." Additional supporting information included: (1) a 'white paper', titled "Thinning and the western spruce budworm," which described effects of certain silvicultural manipulations on the spruce budworm and helped support some of their treatment rationale, (2) a document prepared by the fire/fuels planner dated July 26, 1999, titled "Addendum of fire/fuels inputs for the Gotchen LSR Amendment"; and (3) a topographic map of the LSR showing the key roads where fuel reduction activities would occur in the LSR. In addition, members of the LSR work group made two field trips (October 23, 1998 and July 27, 1999) to look at conditions described in the assessment and discuss some of the proposed treatment areas.

The Gotchen LSR is a 15,000 acre LSR and the driest LSR on the Forest, with much (86%) of it being in the grand fir vegetation zone. The LSR is described in a Forest-wide LSRA that has already been reviewed by REO (November 18, 1997 REO memo) and certain activities described in that assessment have been exempted from future REO review. Since that review, a spruce budworm outbreak that was originally described as light has increased in extent and severity within and outside of the LSR. The Forest is amending their original LSRA to address these changed conditions. This amendment modifies the original LSRA in the following ways: (1) additional treatments would occur in stands typed as fuel models 8 & 10; (2) Bacillus thuringiensis (Bt) would be sprayed in the immediate vicinity (the best 100 acres of habitat) of known spotted owl nests to reduce canopy loss to spruce budworm; (3) treatments originally limited to certain zones would occur in other portions of the LSR; and (4) fuels reduction, including commercial thinning, would occur in dense, mature lodgepole pine stands as part of roadside fuel reduction projects. Except for this treatment in dense lodgepole pine stands, the stand groups, stand prescriptions, and anticipated effects described in the original LSRA remain unchanged.

Review of the Assessment

The REO reviewed the amended LSRA in light of the eight subject areas identified in the S&Gs (page C-1 l) and finds that the amended LSRA provides a sufficient framework and context for designing future actions. The following treatments described in this amendment (as summarized

in Table 1 of the amendment) are exempt from future REO review: (1) treatments in fuel model 8 along roads within the northern two assessment areas in SG-7 stands; (2) treatments in fuel model 10 that are along key roads as identified in the supplemental map provided to REO (3) treatments of mature grand fir (SG-7) in the Smith Butte, Central, and Northeast portions of the LSR; (4) spraying of Bt in the immediate vicinity of known spotted owl nests (5) the expansion of Treatment Zone 2 to create a fuel break in grand fir stands along the eastern LSR boundary (SG-8); and (6) the treatment of dense, mature lodgepole pine stands along key roads, as identified in the supplemental map provided to REO, to reduce fuels.

Projects not exempted from REO review

Treatments in mature lodgepole pine stands, SG-9, not described above, remain subject to REO review as per the 1997 LSRA. In addition, the following treatments are subject to future REO review. Criteria describing these projects sufficiently to exempt them from further review may be developed and submitted to REO at a later date. Examples of factors that could be considered in developing these criteria include topography, aspect slope, distance from a high-risk area, location on the landscape as part of a landscape wide fuel break, potential to protect valuable late-successional habitat, ability to meet assessment area objectives, etc.

Dead and Dying Stands (SG-4): This treatment would remove dead and dying trees from those stands that are partially stocked and declining and have less than 40% canopy closure. The original LSRA stated, “this treatment could be applied throughout the LSR, although the initial focus should be in the proposed treatment zone." However, the condition of the LSR has changed greatly since the original review. The 1997 LSRA described the spruce budworm condition of the Gotchen LSR on page 4-42 as, "The severity of the current outbreak is light, defoliation and some top kill. Being on the western edge of the outbreak area, a slightly higher moisture regime may temper the ultimate impact of this outbreak on the Gotchen LSR. However, there are many stands that are very susceptible...To the extent standing dead and down fuels increase, the hazard potential for catastrophic fire also increases." The 1999 amendment states that the budworm outbreak in and around the LSR has increased in extent and severity, markedly increasing defoliation and fuels buildup with a corresponding increase in the probability of a large-scale stand-replacing fire. Because the extent and amount of this stand type has significantly changed since the original review, REO would like to review this treatment or see more specific criteria before exempting this activity from future review. While reducing fuel loads may be warranted in portions of the LSR to help reduce the risk of large-scale disturbances, small areas of disturbance are valuable components of late-successional systems and retention of some of these pockets is valuable to late-successional species.

Declining Stands (SG-5): This treatment would occur in partially stocked and declining stands with greater than 40% canopy closure where it is determined that these stands will cease to function as late-successional habitat within the next 5 years. The purpose of this treatment is to reduce the potential fuel buildup and subsequent risk of a large-scale, stand-replacement event. The amendment proposes to consider treating these stands throughout the LSR. While the reduction of existing and potential fuel buildup may be warranted in places throughout the LSR, these stands also provide interim value to late-successional species that would be lost if treated.

Fuel Model 10 treatments: This treatment would treat suppressed, dying fuels throughout the **L**SR via removal, chipping, handpiling, or machine piling. This treatment would be primarily applied along roadsides. Treatments in stands meeting the condition of fuel model 10 that are not along key

roads as identified on the supplemental map provided to REO and part of an integrated roadside fuels reduction treatment remain subject to REO review.

Conclusions

This amendment to the 1997 Gifford Pinchot Forestwide LSRA is specific to risk-reduction treatments in the Gotchen LSR Based on the review of the documentation and discussions with Forest staff, the REO finds that the LSRA, as amended, provides a sufficient framework and context for decision makers to proceed with project development and analysis. In addition, activities described in this amended LSRA are exempt from future REO review with the following exceptions: treatments in fuel model 10 stands that are not part of fuel treatments along key roads as identified on the supplemental map provided to the REO, treatment of SG-4 stands, and treatment of SG-5 stands. Additionally, treatments in mature lodgepole pine stands, SG-9, not described above, remain subject to REO review as per the 1997 LSRA.

cc:

REO RIEC, LSR Work Group

Mt. Adams and Wind River Acting District Ranger, Mary Gibson

Forest Supervisor, GIP

Lisa Freedman, FS

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5-5 Snag Management

Need for Change

Snags are an important component of late-successional forest ecosystems. They provide important habitat for many late-successional related plants and animals, and function as down wood after they fall. The NWFP (p. B-5, B-7) notes the importance of snags as a key element in late-successional forests. Table J2-8a-k indicates that many late-successional species benefit from snags (Mitigation 12, Appendix J-2 NWFP FEIS).

Data on existing snag levels from inventory plots on the Gifford Pinchot are summarized in the Table 5-4. Data are from plots that had at least 1 tree greater than 200 years old.

Table 5-4 Existing Snags per Acre (from old-growth inventories)

Plant Zone	Snags Per Acre	
	15-25"dbh	> 25"dbh
Western Hemlock	7	5
Silver Fir	9	6
Grand Fir	4	3
Mountain Hemlock	11	5

Standards and guidelines for salvage and silvicultural activities in LSRs require that adequate levels of snags be maintained after the activities. The NWFP (ROD p. B-5) states that moderate-to-high accumulations of large logs and snags are desired characteristics of late-successional and old-growth habitats. In a letter dated 7/9/96 the REO noted that for projects, one objective is to attain 100 percent of potential populations for snag-dependent species.

Neitro et al. (1985) describe requirements for snag-dependent wildlife species, and procedures for calculating numbers of snags required to maintain different population levels for westside forests. The Snag Recruitment Simulator Model (SRS) (Marcot 1992) is based on the model in Neitro et al. (1985). The model indicates that 4.34 snags per acre greater than 15 inches dbh are required to maintain 100 percent population levels of primary cavity excavators for the westside of the Cascades. For the east side of the Cascades, 5.26 snags per acre are required. The difference between east and west of the Cascades is based on differences in species of primary cavity excavators found in each area.

Results of validation monitoring that has occurred since publication of Neitro et al. (1985) indicate that some of the assumptions of the model are not valid. Work by McComb et al. (1992) and Schreiber (1987) indicates that secondary cavity nesters may be more sensitive to snag density than primary cavity excavators. The model calculates snag densities by determining the number of snags needed for nesting and roosting. However, Lindquist and Mariani (1991) and Bull (pers. comm.) have concluded that managing for nest and roost snags may not provide adequate numbers of snags for foraging habitat in western Washington and eastern Oregon. In addition, the model does not account for different types of snags used by species such as bats and Vaux's swift. This indicates that the above numbers may be inadequate for maintaining populations of all snag dependent wildlife species.

Information on snag densities from studies on snag dependent wildlife may be more appropriate to use in managing snags in LSRs. In the Oregon Coast Range, Mellen (1992) found snag densities at Pileated woodpecker nest sites to average 6.5 snags per acre greater than 16 inches dbh. In grand-fir stands of northeast Oregon, Bull (1980) found densities of snags greater

than 16 inches dbh at nest sites of flickers to average 6 per acre and at nest sites of hairy and black-backed woodpeckers to average 3.2 per acre. Bull (1993) found snag densities (greater than 20 inches dbh) in stands used by Vaux's swifts to be 16 per acre in northeast Oregon.

Treatments Description

Since information suggests that some current guidelines may be conservative, the goal is to manage for number of snags present in old-growth stands. Existing levels, appear to moderately exceed both models' outputs and research results.

Trees considered to be snags are dead, or dying, decayed trees which have dead or broken tops (see Neitro et al. 1985, pg. 154).

Snag numbers. The density and size of snags remaining after treatment should resemble natural stands of the same stand diameter and age. When stand diameter is greater than 15 inches dbh, manage for desired (inventoried from stands older than 200 years) levels of snags within LSRs by vegetation zone, per Table 5-4.

When treating smaller diameter stands the numbers and sizes of snags shown in Table 5-4 may not be practicable. These younger stands do not naturally contain the density and sizes of snags that are found in 200-year old stands. Killing a number of the largest trees in the stand to create snags would be counter to the objective of accelerating the growth of large trees for future habitat. The minimum snag numbers for smaller diameter stands is shown in. These figures were derived from forest inventory plots.

Table 5-5 Snags in Small Diameter Stands

Plant Zone	Number of Snags 11-17 in dbh
Western Hemlock Pacific Silver Fir Grand Fir	3
Mountain Hemlock	5.5

Distribution. Snags should be left in clumps during harvest operations. This should address safety concerns, and mimics the irregular distribution of snags on landscapes. Partial compensation of snag loss by leaving green trees for conversion is acceptable.

Treatments in young stands (11-21 inch dbh) should seek to preserve all existing snags greater than 15 inches dbh, as well as remnant green trees and snags from the previous stand by locating unthinned clumps where existing shags are present.

Timing. Implement snag creation within 5 years following salvage and thinning operations to utilize K-V funding. Assess natural mortality before creating snag from green trees. Tree mortality may partially satisfy needs.

Snag size. - (Neitro et al. 1985):

dbh - 1/2 of snags should be the largest available. All should be greater than 15 inches dbh, if available.

height - the taller the better but at least 1/2 over 40 feet tall and the rest over 10 ft. tall.

Species composition. Within the Grand Fir Zone, give preference to ponderosa pine and western larch.

Within the Pacific silver fir and western hemlock zones, give preference to Douglas-fir.

Otherwise, generally reflect the existing stand composition.

When converting green trees, make sure to maintain minor species as stand components. For example, if ponderosa pine is a minor component of a stand, it should not be converted.

Decay stage distribution. Maintain about 50 percent hard snags (stages I and II, Neitro et al 1985) and about 50 percent soft snags (stages III, IV, and V). This approximates the decay class distribution of mature/old-growth stands as indicated in Spies et al. (1988) and summarized in Table 5-6.

Table 5-6 Decay Class Distribution

Stage	Percent of Biomass		
	Young Stands	Mature Stands	Old-Growth Stands
I	5	8	20
II	19	38	41
III	26	33	25
IV	31	17	11
V	19	4	3
TOTAL	100	100	100

Consider down wood availability. Where down wood is deficient, leave additional snags to provide future high-quality down wood (see Treatment 5-6, page 5-26).

Distribution over time. Use Snag Recruitment Simulator model (Marcot 1992) to determine needs for future snag recruitment, where necessary.

Snag creation. Snags may need to be created over time or in stands currently lacking sufficient numbers of snags dead and dying trees. Snag creation techniques include:

- Blasting Out The Tops - this method leaves a jagged top that is readily invaded by decay causing organisms - the tops can be left on site to count towards down log requirements.

  Cutting Out The Tops - similar to blasting but less inviting to decay causing organisms.

- Girdling - girdling should be done at the point where breakage is desired. Trees girdled at the ground tend to break at the ground fairly quickly, limiting the life of the snag.

- Inoculation With Decay Organisms - this method is experimental but looks like it may be promising - any trees inoculated should be monitored closely to see if the desired results are accomplished.

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5-6 Down Wood Management

Need for Change

Down logs are an important component of late-successional ecosystems. They are an important pool of energy, carbon, and nutrients in ecosystems and thus can have effects on site productivity (Harmon et al. 1986). Down logs and their associated microenvironments and structure provide habitat and/or food critical for maintaining populations of fungi, arthropods, bryophytes, some vascular plants and many vertebrates (ROD p. C-40, Harmon et al. 1986). The CWD (coarse woody debris) field in Table 4-6 indicates those wildlife species that rely on down logs. In addition, NWFP FEIS Tables J2-8a-k indicate many late-successional associated species that benefit from down logs (Mitigation 11). For this reason the NWFP (ROD p. B-5) states that moderate-to-high accumulations of large logs is a desired late-successional characteristic in LSRs.

Data on existing down wood levels from inventory plots on the Gifford Pinchot are summarized in Table 5-7. These data are from plots that had at least 1 tree greater than 200 years old.

Standards and guidelines for salvage and silvicultural activities in LSRs require that adequate levels of down wood be maintained after the activities. In a letter dated 7/26/96, the REO recommends using research results on the biological needs of species using down logs as a basis for determining appropriate levels to retain. Existing levels of down wood could be misleading due to past harvest activities, salvage, firewood collection, or fire.

Table 5-7 Down Wood Ground Cover

Zone	Avg. % Cover	Maximum % Cover
Western Hemlock	6	25
Silver Fir	6	24
Grand Fir	3	5
Mountain Hemlock	1	14

There is a limited amount of biological information available on down logs as wildlife habitat. Available data is expressed in terms of percent cover of down wood. On the Olympic Peninsula, empirical data suggest that 15-20 percent cover of coarse woody debris on the forest floor, well distributed across the site, would be adequate for most small mammals (Carey and Johnson 1995). This is a level of down wood which is higher than would be expected to normally occur in most late-successional stands in the Western Cascades (Carey, pers. comm.). However, inventory data from the Gifford Pinchot indicates that some older stands can reach levels as high as 25 percent cover of down logs (Table 5-7).

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 about 5 percent cover of down logs (Andrew Carey, pers. comm.). This data is probably more reflective of typical down wood levels in the Western Cascades than the Olympic data (Andrew Carey, pers. comm.).

In southwest Oregon, down logs covered 7 percent (range 5-12 percent) of the home ranges of California red-backed voles (Tallmon and Mills 1994). The drier sites of southwest Oregon probably more closely reflect conditions on the east side of the Gifford Pinchot than from the Coast Range or Olympics.

The amount of CWD needed to maintain mycorrhizal fungi and site productivity is lower than that indicated for small mammal habitat as described above (Graham, et al. 1994). Graham, et al. (1994) report CWD in terms of biomass. Calculations from this data indicate a percent cover of 2 to 6 percent for the Grand fir Zone is adequate to maintain mycorrhizal fungi and site productivity.

Percent Cover. Because information on down wood as small mammal habitat is expressed in percent cover, guidelines below for each vegetation zone and activity are also expressed in percent cover.

The percent cover recommended will vary by vegetation zone and treatment. The cover goals should be met within 5 years after the stand manipulation treatment. This will allow for trees or snags that will normally fall soon after a treatment occurs to contribute to percent cover goals. This 5-year window will allow K-V funds to be used to create logs if necessary.

Treatment standards on the following pages vary for different activities. Salvage treatments in older stands have higher requirements for retaining down wood than do commercial thinning activities. For salvage activities in older stands, standards should allow for leaving an optimum level of down wood. For commercial thinnings, standards prescribe leaving lessor amounts, that are still in the range suggested by research. This should increase the likelihood of implementing thinning projects, and providing future large trees on those acres.

A simple method to calculate the percent cover of down wood is to use a linear transect. The length of transect intercepted by down wood is recorded and compared to the total transect length. For example, if a 100 foot transect intercepts three logs, and the total length of the transect that crosses the down wood is 10 feet, the transect samples 10 percent ground cover (10 feet transect crossing down wood divided by 100 feet total transect length). Logs less than 6 inches in diameter and 5 feet in length should not be counted.

Spatial Distribution. The percent cover guidelines do not need to be met on every acre but the average over a treatment area or stand should meet the guidelines. Avoid excessive jackstrawing of logs. Also avoid creating large areas with no down logs.

Size of Down Wood. In general, the larger the log, the better, in terms of longevity, fuel load concerns, and habitat (microsites). Most logs should be at least 20 feet long. Logs less than 5 feet long do not count toward the percent over goal. Size distribution of logs will depend on availability but smaller logs should make up a small proportion of the total and should primarily consist of decayed logs (Classes III, IV, V).

In general, down logs should be counted only if they are greater than 6 inches in large-end diameter, and material less than 6 inches in diameter (10 inches east of Cascades) should be avoided due to fire concerns and relatively low value of smaller logs. The percent cover of down wood reported in the above studies includes logs down to 10 cm (4 inches) in diameter. Less than 10 percent of the total down wood cover is generally between 3 to 6 inches in diameter (based on inventory data) and thus counting only logs greater than 6 inches in diameter has a small impact on total percent cover. In some cases, such as commercial

thinning, a 6 inch minimum may be hard to meet. If trees need to be felled to create down wood, the whole tree to the tip may be counted if it is at least 6 inches dbh. Project planners should work closely with a fuels specialist to minimize problems with fuel loading that may be caused by leaving smaller diameter wood on the ground.

Species Composition. Species composition of down logs should reflect the species composition of the stand.

Decay Class Distribution. Table 5-8 shows the distribution of logs by decay classes in terms of percentage of total down wood biomass occurring in each decay class in forests of the Washington Cascades (Spies et al. 1988).

Based on this data, amounts of down wood cover in sound (Classes I and II) and decayed (Classes III, IV, V) logs are given below for each vegetation zone.

Table 5-8 Percents of Down Wood by Decay Class

Stand Age Decay Class	Mature	Old Growth
I	3	2
II	16	14
III	32	43
IV	26	29
V	23	14
Total	100	100

Managing Down Logs Through Time. The goals for maintaining down logs as outlined below will require managing for some replacement logs as existing logs decay through time. A coarse woody debris decay and recruitment model is currently under development by the Area 7 Ecology Program. Completion of the model is expected in summer of 1997. This model should be used on a site-specific basis to determine the number of standing trees and/or snags needed to replace logs as they decay, before the stand is producing coarse woody debris.

Treatments Description

Mature Stand Treatments and Salvage

High Down Wood Levels

Western Hemlock and Pacific Silver Fir Zones

The goal is to maintain at least 20 percent cover in down logs greater than 6 inches in diameter. This percent cover is based on research by Carey and Johnson (1995) which indicates that 15-20 percent cover of coarse woody debris is adequate for most small mammals. The minimum diameter is to mitigate concerns for fuel loading.

Salvage areas are to be managed for the high end of down wood levels because in natural systems these are the areas that would provide high density pockets of coarse woody debris.

Distribution by decay class should be at least as follows to mimic natural conditions in old-growth stands (Spies et al. 1988):

- 4 percent cover sound logs (decay classes I and II)
- 16 percent cover decayed logs (decay classes III, IV, and V)

If decayed logs are deficient (i.e. after fire consumes down wood) compensate by leaving additional sound logs up to 10 percent cover. If total cover of down logs is still below 20 percent, compensate further by leaving enough standing dead and dying trees to equal the amount deficient. Decayed logs cannot compensate for sound logs.

Grand Fir Zone

The goal is to maintain at least 10 percent cover in down logs greater than 10 inches in diameter. This percent cover is based on the fact that current down wood levels in the Grand Fir Zone are about 1/2 the levels in western hemlock and silver fir zones and the NWFP Standards and Guidelines for down wood in Matrix lands east of the Cascades require leaving 1/2 the down logs required for the west side. Managing for high levels may increase risk of fire. In addition, research on flying squirrels (Carey, pers. comm.) and California red-backed voles (Tallmon and Mills (1994) was utilized. The larger minimum diameter is to mitigate higher concerns for fuel loading on the east side of the Cascades.

Distribution by decay class should be at least as follows to mimic natural conditions in old-growth stands (Spies et al. 1988):

- 2 percent cover sound logs (decay classes I and II)
- 8 percent cover decayed logs (decay classes III, IV, and V)

If decayed logs are deficient (i.e., after fire consumes down wood) compensate by leaving additional sounds logs up to 7 percent cover. If total cover of down logs is still below 10 percent, compensate further by leaving enough standing dead and dying trees to equal the amount deficient. Decayed logs cannot compensate for sound logs.

Mountain Hemlock Zone

The goal is to maintain at least 10 percent cover in down logs greater than 6 inches in diameter. This percent cover is based on the fact that current maximum down wood levels in the Mountain Hemlock Zone are about 1/2 the levels in Western Hemlock and Silver Fir Zones. In addition research on flying squirrels (Carey, pers. comm.) and California red-backed voles (Tallmon and Mills (1994) was utilized. The minimum diameter is to mitigate concerns for fuel loading.

Distribution by decay class should be at least as follows to mimic natural conditions in old-growth stands (Spies et al. 1988):

- 2 percent cover sound logs (decay classes I and II)
- 8 percent cover decayed logs (decay classes III, IV, and V)

If decayed logs are deficient (i.e. after fire consumes down wood) compensate by leaving additional sounds logs up to 7 percent cover. If total cover of down logs is still below 10 percent compensate further by leaving enough standing dead and dying trees to equal the amount deficient. Decayed logs cannot compensate for sound logs.

Intermediate Stands Treatments - Commercial Thinning

Moderate Down Wood Levels

While providing optimum levels of down wood in young stands can substantially improve the utility of these stands for late-successional forest-related species, it is one of several objectives which will lead to the creation of late-successional forest conditions. Other objectives include opening the stand to encourage the development of a diverse understory and releasing suppressed trees to grow more quickly into large trees typical of late-successional forests.

In some cases leaving the suggested levels of down logs may not be practicable. Felling a large number of trees to be left on-site may result in a sale that is not economically feasible. If the sale is not sold, none of the benefits to the development of late-successional conditions will be realized. The amount of down wood in the

undisturbed stands surrounding the treatment area is a key consideration in determining the minimum level of down wood needed in the harvested area.

The following guidelines should be met where possible. See the "Implementation Considerations" for suggestions on balancing conflicting objectives on economically marginal sales.

Western Hemlock and Pacific Silver Fir Zones

The goal is to maintain at least 10 percent cover in down logs greater than 6 inches in diameter. This percent cover is based on research on amount of down logs in flying squirrel habitat (Carey, pers. comm.) The minimum diameter is to mitigate concerns for fuel loading. See the discussion on Size of Down Wood, page 5-27.

Distribution by decay class should be at least as follows to mimic natural conditions in old-growth stands (Spies et al. 1988):

- 2 percent cover sound logs (decay classes I and II)
- 8 percent cover decayed logs (decay classes III, IV, and V)

If decayed logs are deficient (i.e. due to past fire or harvest) compensate by leaving additional sounds logs up to 5 percent cover. Decayed logs cannot compensate for sound logs.

Grand Fir Zone

Maintain at least 7 percent cover in down logs greater than 10 inches in diameter. This percent cover is based on research on amount of down logs in red-backed vole habitat in SW Oregon (Tallmon and Mills, 1994). The minimum diameter is to mitigate higher concerns for fuel loading on the east side of the Cascades. See the discussion on Size of Down Wood**,** page 5-27.

Distribution by decay class should be at least as follows to mimic natural conditions in old-growth stands (Spies et al. 1988):

- 1 percent cover sound logs (decay classes I and II)
- 6 percent cover decayed logs (decay classes III, IV, and V)

If decayed logs are deficient (i.e. due to past fire or harvest) compensate by leaving additional sounds logs up to 3 percent cover. Decayed logs cannot compensate for sound logs.

Implementation Considerations for Commercial Thinning. The intent is to meet the down wood goals within the 5-year K-V funding window and not necessarily at the time of harvest. Extending the time frame for implementation of the down wood goal acknowledges that down wood is often provided by windfall following harvest operations. The project area should be monitored for down wood accumulation in the third year after harvest and remaining down wood needs provided by non-extractive treatment funded by K-V.

In some stands, meeting the above down wood guidelines for commercial thinning at the time of harvest or within the 5-year window of K-V funding opportunity could jeopardize the economic feasibility the sale. In these cases the interdisciplinary planning team should balance the reduction of down wood benefits with the objectives of accelerating the development of other late-successional characteristics.

When down wood goals can not be met, the NEPA document should disclose the rationale for balancing downed wood, other late-successional, and economic objectives of the project. The silvicultural

prescription should include a description of how and when down wood goals will be achieved in future treatments. The following guidelines should be helpful in balancing late-successional objectives with sale economics.

Stands Over 15 Inches in Diameter

In stands where the average diameter is greater than 15 inches, meeting the "moderate" down wood guidelines should be a high priority. These sales should be more economically viable because of the larger tree size. The objective is to meet the above commercial thinning down wood guidelines by the time of the last treatment and this is likely to be the last management entry and opportunity to create down logs. Down logs of this size are of higher value to wildlife and will last longer. See Figure 5-1 Down Wood Decision Tree, page 5-33.

Stands Less Than 15 Inches in Diameter

In smaller diameter stands, the "moderate" down wood level should be met where feasible. In stands where average stand diameter is less than 15 inches, the benefits of opening up the stand to increase diversity and tree growth may outweigh the benefits of providing relatively small diameter down wood levels described in the "moderate" level goals beginning on page 5-29. If the project is not feasible at "moderate" levels of down wood, a lower level of down wood may be acceptable under conditions described below. Data from Spies et al. (1988) indicates that young stands typically have fewer down logs in the sound decay classes than older stands

Low Down Wood Levels

If half of the treatment unit area is within 230 feet of untreated stands having at least the "moderate" level of down wood or two-thirds of the treatment unit perimeter is adjacent to untreated stands having the "moderate" level of down wood, a "low" level of down wood is acceptable. See Figure 5-1, page 5-33.

Leave additional sound logs to provide a total of 3 percent cover (compared to the "moderate" level of 5 percent), or 2% in the Grand-fir zone (compared to the "moderate" level of 3%). Provide these percent covers of down wood on at least half of the harvest unit**.** Manage for the down wood goal (from crop or harvest trees) on at least 50 percent of the acres in the harvest unit, and distributed across the unit. This means 50 percent of the acres meet the reduced down wood goal (not 50 percent of the goal averaged over all acres). This distribution should provide suboptimal but useable down wood habitat. (The concept of providing useable habitat on 50 percent of a landscape was the basis for the 50-11-40 rule for spotted owl dispersal habitat.)

If the project is not feasible at the "low" down wood level and is beneficial to LSR objectives, it is subject to REO review prior to implementation.

Other Considerations. When selecting trees for down wood, consider selecting some from the larger (crop) trees as well as the smaller trees which would normally be harvested in a thinning. The larger trees will create better habitat and longer lasting down logs. Felling crop trees as down wood would also result in wider crop tree spacing which would promote larger crowns.

Commercial thinnings will involve relatively small logs. To maximize the habitat value of these small logs on the forest floor, down wood should be left in groups, rather than evenly distributed.

Ideally, decayed logs should make up about 80% of the down wood component.

Since we cannot create decayed logs, except to leave sound logs to decay, care should be taken to leave as many decayed logs on site and as undisturbed as possible. See Carey and Johnson (1995) for suggestions on minimizing disturbance of existing logs during harvest operations.

Literature Cited

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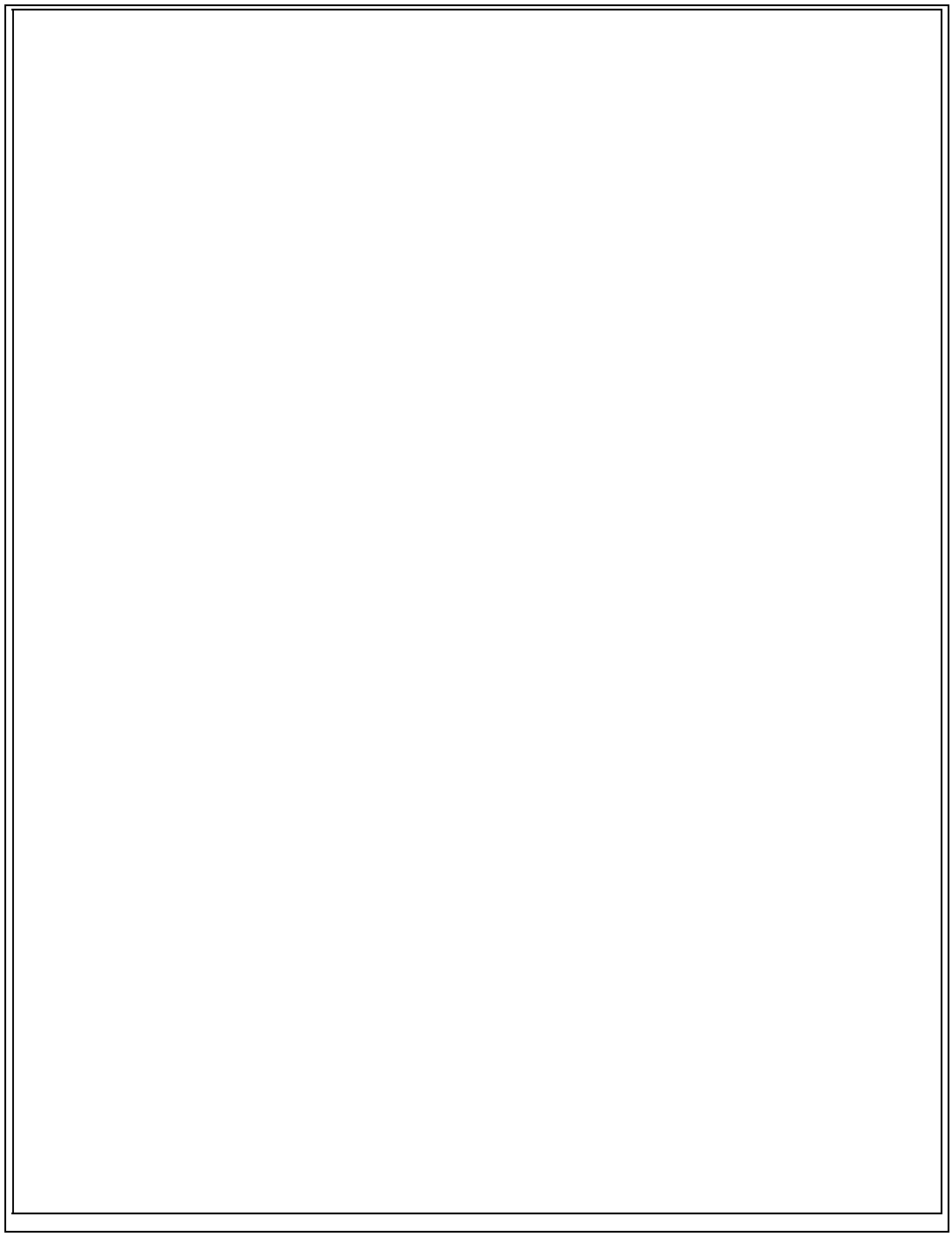
Tallmon, David, and L. Scott Mills. 1994. Use of logs within home ranges of California red-backed voles on a remnant of forest. J. Mamm. 75:97-101.

Figure 5-1 Down Wood Decision Tree



5-7 White Pine Blister Rust Treatments in LSRs

Need For Change

Western white pine is an indigenous species that suffers from white pine blister rust (*Cronartium ribicola*), a non-native fungal disease. The disease is widespread, and young western white pine (less that 30 feet tall) are most susceptible to infection and mortality. Genetically resistant white pine planting stock has only recently become widely available. Thus, there are many established plantations (10-30 years old) with western white pine that are highly vulnerable to the disease. Eventual mortality depends on the rust hazard of the site; the suitability of a particular site for the development of the rust fungus. The ultimate impact could be a delay in the development of some plantations to the late-successional condition, and a reduction in species diversity.

Treatment Criteria

Candidate stands would be in the 10-20 year age class with either planted or naturally seeded western white pine that are 5-20 feet tall. Candidate stands should also meet one of the following conditions:

1) Plantations where western white pine is a major component and rust hazard is moderate to very high. Gains in white pine survival will assist in meeting overall stocking objectives.
2) Plantations where western white pine is a minor component and rust hazard is moderate or lower. Treatment is likely to retain the western white pine component of this stand.

A method of determining blister rust hazard has been described by Petrick (1996), and considers rust index (Rice 1991), ribes level (the rust's alternative host), and environmental conditions.

There are approximately 100 to 200 acres of candidate stands that could be treated each year over the next decade. The majority of these stands are located in the Peterson LSR.

Limits to Application

Candidate stands describe a fairly narrow range of conditions for LSRs within the Gifford Pinchot. These treatments are not needed in candidate stands where the predicted rate of western white pine mortality would result in adequate stocking and species diversity, and even negate the need for precommercial thinning. It also would not be warranted in stands with very low levels of western white pine and high rust hazard because we are likely to loose these white pines regardless of treatment. The need for treatment is expected to decline substantially after ten years, as existing plantations pass through the window of opportunity for treatment and any new plantations should include rust resistant western white pine equal to the rust hazard present on the site.

Blister rust treatment will be dependent on availability of timber stand improvement funding and demand for stewardship contracts.

Treatments Description

Pruning and Excising.

Young trees are susceptible to rust because of the high percentage of young foliage in a high humidity environment close to the ground. Rust infections and cankers that develop on the bole or on branches within two feet of the bole have the potential to eventually girdle the tree. Thus, pruning the lower branches reduces potential infection sites, and the spread from already infected branches.

If the bole of the tree already has a canker and the tree is large enough, the canker may be excised. Canker excision consists of scribing a circle in the bark around the canker, thus creating a gap in the sapwood between diseased and healthy tissue (Hagle 1989).

Practice in Detail. Within candidate stands, pruning may be accomplished in two entries: the first when trees are about 5-8 feet in height, and the second when trees are 15-20 feet in height. The secondary treatment may target only infected branches and include excising bole cankers within 6 feet of the ground. Typically, all branches on the lower half of the tree are removed. Pruning only occurs on the western white pine. Pruned boughs may be removed as a commercial product (floral greenery), thus lowering the cost of treatment.

Pruning and excising would follow precommercial thinning if it is anticipated. Precommercial thinning has been shown to increase blister rust infections in pure stand of western white pine. This increase in infections can be negated by pruning (Hungerford 1982).

Literature Cited

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Petrick, John A. 1996. White pine blister rust hazard rating. Unpublished report. Cottage Grove, OR. U.S. Department of Agricultury, Dorena Tree Improvement Center. Cottage Grove, OR.

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5-8 Road Management

Need for Change

A goal for LSRs is to provide large blocks of unfragmented late-successional habitat. Roads fragment habitat. Public access provided by open roads is believed to disrupt the behavior of certain wildlife species. The current road system in the LSRs is an artifact of pre-NWFP management which required high road densities to provide access for timber management. Many roads are either no longer needed or their future use does not warrant year-around access or past maintenance standards. Some decommissioned roads may be maintained as trails.

New permanent road construction will be rare within the LSRs. Where road access is needed for silviculture or salvage, they will usually be temporary roads which are obliterated at the completion of the project. See 5-14 Noxious Weed Treatment, page 5-48 for a discussion of road management strategies to reduce the spread of noxious weeds.

Consequences of No Action. Failure to close and decommission unneeded roads could result in continued wildlife harassment and fragmentation of habitat. Forgoing road construction when needed for stand manipulation activities would result in the loss of opportunities to enhance late-successional habitats.

Treatment Criteria

The *Forest Access and Travel Management Plan* (ATM) describes desired future conditions for roads throughout the Forest. The ATM was assembled prior to the Northwest Forest Plan and most desired conditions were developed based on the 1990 Forest Plan. However the ATM was intended to be an iterative process, updated frequently by watershed analysis and through the project planning process. There is a need to review the DFCs in light of changes in management direction brought by the NWFP, especially within the LSRs.

Under the ATM most arterial and collector roads will remain open and be maintained to provide safe access to the public, and protect soil and water resources. Most road closures are in response to Forest Plan management objectives such as providing recreation opportunities and wildlife habitat. Map 4-53, page 4-115, displays the existing road system in each LSR. Table 4-39, page 4-120, summarizes road mileage in each LSR.

Treatments Description

Roads needed for future management activities or fire suppression access may be closed by barriers or gates. The roads to be barricaded would be closed to vehicular traffic, thereby reducing the vulnerability of wildlife to harassment during breeding, feeding and resting periods.

Watershed analyses have recommended road maintenance and storm proofing to reduce drainage problems before fill failure or gullying occurs. Since these activities will be confined to the road prism or clearing limits, their effects on late-successional habitat should be negligible.

Within right-of-way clearing limits, encroaching vegetation may be cut to maintain visibility. Hazard trees will be felled along roadways and developed campgrounds. Felled trees may be removed if coarse woody debris in the area is adequate. Snag creation away from the road or campground should be considered if hazard tree falling results in a snag deficit. Desired levels of snags and down wood are discussed by plant association in Treatments 5-5 Snag Management and 5-6 Down Wood Management.

Roads to be decommissioned are permanently closed and removed from the transportation system. Some decommissioned roads may be maintained as trails. Decommissioning involves removing culverts, ripping the road surface, and installing waterbars and dip drains. All disturbed sites that will not naturally reseed within one growing season should be revegetated. Grass, forbs, shrubs and trees material may be used as the site dictates. Erosion matting may be used on unstable slopes. The decommissioned road prism will be returned to a vegetated condition and, in some cases, resemble the natural contours of the landscape. Over time, the plant community would consist of many local, native species, developing structure and biodiversity benefiting late-successional associated species; however, many initial seed sources for the plant material will not be local. As per Regional Forester's memo (April 14, 1994, file code 2600), regarding Use of Native and Nonnative Plants, nonnative, short-lived annuals and perennials should be seeded; expectations are that the native species would become established within 1 to 2 years.

Presently there are few road construction projects within the LSRs. Some road realignment is underway to repair damage from the 1996 storms. Road construction should be planned to avoid or minimize impacts on late-successional habitat. Road construction should generally only be planned where potential benefits exceed the costs of habitat impairment (ROD p. C-16). Salvage and stand manipulation projects should minimize the amount of new road required. Alternate access methods, such as helicopter logging should be considered as an alternative to road construction. Any new roads built for stand management activities should be closed or decommissioned upon completion of the project.

5-9 Watershed Restoration

Need For Change

The purpose of the watershed restoration activities is to restore and enhance ecosystem function, and watershed conditions in particular. These projects will have negligible effects on late-successional habitat. Watershed restoration is one of the four cornerstones of the NWFP Aquatic Conservation strategy. The goals may include reduction of sediment yields to streams, reduction of maximum water temperatures, restoration of riparian vegetation, and establishment of bank and channel stability. Other projects are designed to repair roads damaged by heavy rain and high run-off during winter, and to prevent future erosion. Some roads will be decommissioned and closed to vehicular use. Most of the restoration work related to roads is confined to the road prism, will have negligible effect on late-successional habitat and will not be addressed in this Assessment. See *Programmatic Biological Assessment for Forest Management* (Armstrong et al. 1996) for details of these projects.

Implementation of watershed restoration projects should result in an accelerated, although gradual, improvement of aquatic habitats through stabilization of chronic sediment sources and increased biodiversity of riparian ecosystems.

Consequences of No Action. Watershed damage would heal at a slower rate. The duration of adverse effects such as sedimentation and elevated water temperatures would be extended.

Treatment Criteria

Candidates for treatment are limited to areas damaged by past management actions or natural events.

Map 5-3 Watershed Restoration Opportunities and Appendix 1 display identified watershed restoration opportunities within LSRs.

Treatments Description

Slope Stabilization and Rehabilitation

The objective of these projects is to enhance upslope stability by revegetating these sites using a grass/forb or shrub mix interplanted with conifers, native hardwoods or shrubs. On sensitive slopes erosion control blankets may be installed.

This work involves treating landslides and unstable slopes where vegetation is generally lacking. It includes hand planting of deep rooted species, including shrubs and trees; in some cases this is followed by hand- or aerial-seeding and fertilization, using a forb/grass/shrub mix.

When access is available to areas treated, planting and seeding is done by hand. In areas without road access, helicopters may be used to complete the seeding. Helicopter seeding generally occurs in the early fall season, and less often in the spring. On any particular road segment, use of helicopters will be limited. There will be few passes of a helicopter within 200 feet of the ground to deliver seed (and in some cases, fertilizer) to the disturbed site.

Up to 200 acres may be seeded each year and will vary with the extent of storm related damage. Within the deer and elk biological winter range forage species should be considered in seed selection.

Riparian Restoration

A riparian restoration project would interplant coniferous trees among homogeneous stands of deciduous trees. On some sites existing coniferous tree seedlings would be released from hardwood competition. The long-term objective of the project is to provide shade for the streamcourses, provide bank stability, biodiversity, and develop a potential source for high-quality, large woody debris in stream and riparian reserve areas. The need for riparian restoration must be balanced against the contribution that pure hardwood stands make to biological diversity at the landscape scale. The only site preparation necessary is the scarification of a planting site for the individual tree seedlings. There are 1,288 acres of hardwoods in stream associated riparian reserves within LSRs. Forestwide, up to 50 acres of riparian hardwood stands might be interplanted or released each year.

Seed Collection

Collection of seed and plant materials native to the Forest should allow the Forest to reduce use of non-native species. The Late-Successional Standards and Guidelines (ROD p. C-19) recommend that non-natives (plant and animal) should not be introduced into LSRs.

A short-term impact would be a small reduction of seed source for natural regermination of collected species at selected sites. The amount of seed collected will be so small as to have negligible effect on local populations.

Instream Stabilization and Fish Habitat Restoration

These projects are planned to help restore or enhance in-stream channel conditions. Projects would utilize large boulders and logs to stabilize banks and the channel. Streambank stabilization should decrease the width-to-depth ratio of streams, provide greater channel stability and improve habitat for native fish stocks. The boulders and logs could be transported to the site and placed by wheeled and/or tracked vehicle or by helicopter. Where down wood is surplus, it may be relocated for use in stream channels within the LSR. Soil bioengineering techniques would be used along streams to increase lower-bank vegetation. Riparian hardwood stands would be underplanted with conifers which will have the long-term benefits of:

a) reducing maximum water temperatures to acceptable levels for salmonids;

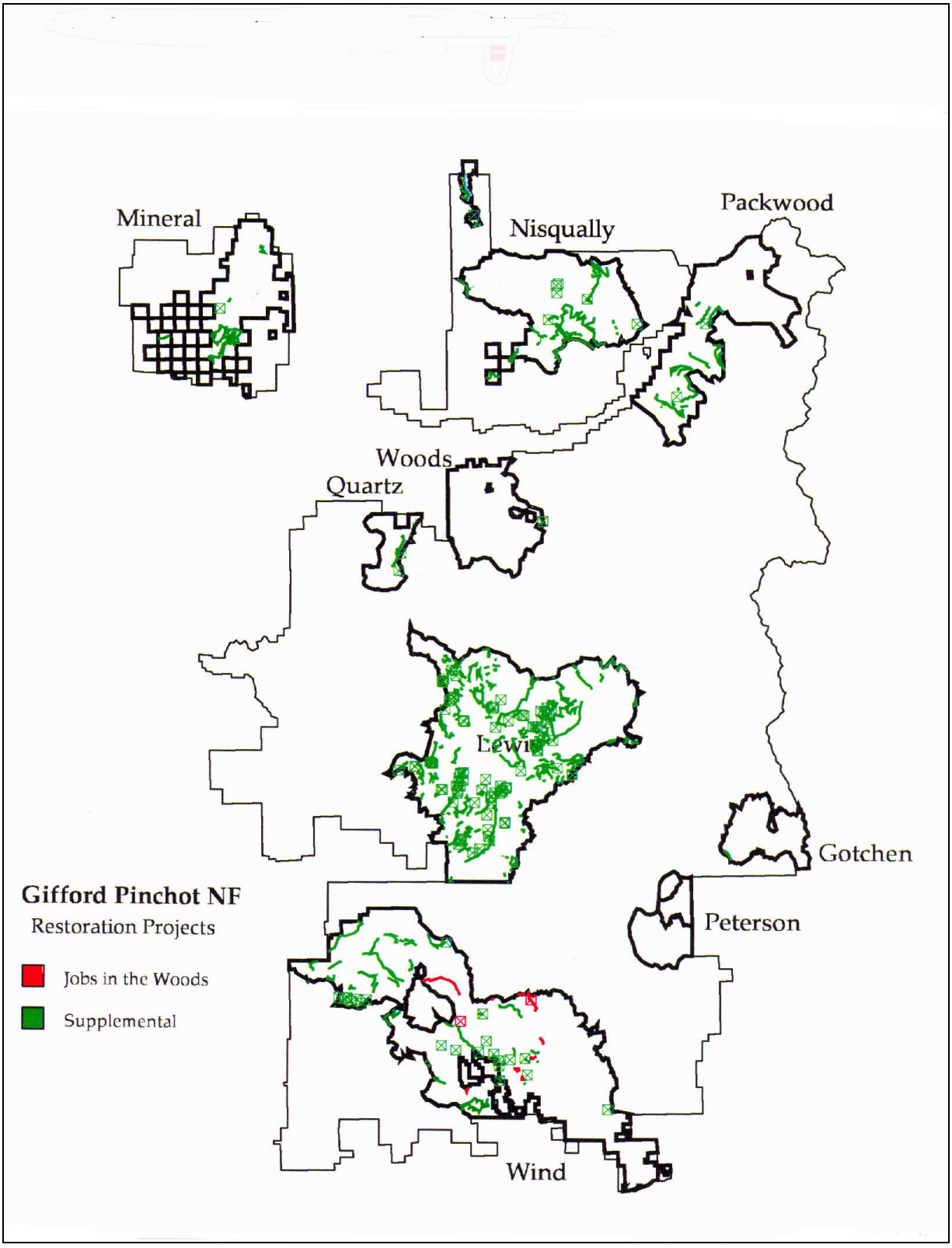
b) increasing stream shade; and

c) increasing in-stream large woody debris. Work involves the use of hand tools, including rock drills, in addition to heavy machinery, depending on access. In inaccessible areas, materials will be delivered to the site by helicopter. This activity should occur during the low-flow period, typically June 15 through September. These projects can occur throughout the Forest, usually in third- or fourth-order streams. Some second-order streams may also be treated.

Literature Cited

Armstrong, K., C.Cash, and R.Scharpf. 1996 Programmatic Biological Assessment for Forest Management. August 1996 revised.

Map 5-3 Watershed Restoration Opportunities



5-10 Trail Management

Need for Change

Demand for hiking, horseback riding, and ORV recreation opportunities is expanding. Use of many existing trails exceeds Recreation Opportunity Spectrum standards. Overuse diminishes the recreation experience and leads to resource damage. There are opportunities to accommodate the growth in demand by expanding the trail system within the LSRs, as well as other areas of the Forest. The Forest Plan projected 340 miles of trail construction and reconstruction and 1,250 miles of trail maintenance in the first decade. Because of funding shortfalls, accomplish-ments are far short of this projection.

Within the LSRs are designated cross-country ski trails which are part of a trail system accessed from Sno-Parks. The best snow conditions for these trails occurs when there is an opening in the tree canopy about the width of the trail corridor (20 to 30 feet). An adequate opening results in less interception of snow by tree crowns, and provides deeper, fresher snow on the ski trail surface. While many ski trails already have these semi-open crown conditions (most are located on existing single lane single lane roads) some trails would benefit from removal of individual trees along the trail to improve snow conditions on the ski trail. It is also desirable to remove roadside reproduction (alder and small conifers), which under the weight of snow, bend over and crowd the trail. Some of this brushy vegetation is routinely removed by roadside brushing.

Consequences of No Action. The primary effect of not implementing these projects would be the loss of recreation opportunities and continued congestion of the existing trail system.

Treatment Criteria

The trail construction and reconstruction projects in Table 5-9 have been proposed within LSRs over the next 5 years. The trail program has been under funded in recent years. Limited funds for trail maintenance has resulted in an emphasis on trail reconstruction in preference to new construction.

Cross-Country Ski Trail Maintenance. High priority candidates include about three miles of existing trails located on Forest Roads 8225 (from spurs 181 to 101) and 8225081 (from 8225 intersection to 110) in the Gotchen LSR. Also in the Gotchen LSR, approximately seven miles of trail have been suggested for potential future development through various scoping and planning processes, much of which is described in the King Integrated Resource Analysis (1991).

Another high priority is about three miles of trail along Road 7605 and 7605-086 that provide winter access to Burley Mountain Lookout in the Woods LSR.

Table 5-9 Planned Trail Construction and Reconstruction

Project Name	Project Length	Year	LSR Affected	Type of Use
Valley Trail Connection to Kraus Ridge Tr.	7 mi.	1998	Woods	Motorcycle, Mt. bike, horse, hiker
Burley Mt. Tr. Connection	3.5 mi.	1999	Woods	Hiker
Allen Mt. *RTT	3 mi.	1998	Nisqually	Motorcycle, Mt. Bike, horse, hiker
Lake Christine Trail Recon-struction	1.8 mi.	1997	Nisqually	
Puyallup Trail Reconstruction	2.5 mi.	1998	Nisqually	Hiker, horse
Carlton Creek Trail Recon-struction	4.0 mi.	1997	Packwood	Hiker, horse
Tatoosh Trail Reconstruction	9.0 mi.	1998	Nisqually	Hiker, horse
Bypass Trail Relocation/ Reconstruction	1.0 mi.	1997	Packwood	Hiker, horse

*RTT - Roads to Trails

Treatments Description

Trail construction and reconstruction projects can require the use of chainsaws, small power tools, hand tools, and trail machines such as small excavators, tractors, and compactors. Some understory clearing, including the removal of small trees less than 2 inches in diameter, may occur. Even though trails are designed to minimize the removal of larger trees because of their aesthetic value, a few larger trees or snags may need to be removed. Trail construction or reconstruction may involve the use of blasting.

Activities should be scheduled to minimize impacts to wildlife.

Construction and use on trails will be managed to be consistent with LSR objectives.

Cross-Country Ski Trail Maintenance. In areas where total canopy cover results in poor snow conditions, overstory trees will be removed to allow more snowfall on the trail. Removal of single trees, opening a maximum of a 25 to 30 foot corridor (about the width of a road right-of-way) is desirable.

5-11 Salvage and Risk Reduction

Although the objectives of traditional salvage practices often include an element of risk reduction, the NWFP makes an important distinction between salvage and risk reduction. Salvage guidelines are described in the NWFP on pages C-13 to C-16, and guidelines for Risk Reduction are described on pages C-12 to C-13. Salvage guidelines may be relaxed when salvage is used as a tool to reduce the risk of large-scale disturbances.

Refinements to NWFP Salvage Guidelines

The following is intended to clarify the application of three of the eleven salvage guidelines in their application to the Gifford Pinchot LSRs; the 10 acre minimum disturbance size and 40 percent crown closure threshold are not modified.

Timber salvage may be proposed to remove dead and dying trees from an area following a stand-replacing event due to wind, fire, insects, and/or diseases. At present, salvage operations are only being considered for hazard trees and windthrow within road prisms and within the Gotchen LSR.

Disturbances can be considered to occur in three size categories; small, those under 10 acres; moderate, those of 10 to several hundred acres; and larger disturbances. Salvage activities will not be conducted in small disturbances, unless needed to reduce risk of large scale disturbances. Salvage in disturbances larger than several hundred acres are not addressed in this assessment and will be subject to REO review. The following is intended to apply to disturbances in the "moderate" size range. This would typically include wind driven fire events spanning one or two burning periods.

Larger scale disturbances covering thousands of acres, which could occur from fires or volcanic eruptions, would require consideration of landscape issues specific to each disturbance and would be subject to REO review.

Guideline 2 (NWFP S&G p. C-14)

When managing standing live trees within salvage areas, consider potential interactions with insects and disease. In most cases insects and disease will aid in the development of desirable structures (snags and down wood). However, the threat of insects and pathogens to cause additional loss of adjacent late-successional forest or retard the development of younger stands may warrant the immediate conversion of green trees to snags or even the removal of some infected live trees.

The following three situations may be encountered:

1) Douglas-fir bark beetle populations may increase following fire or windthrow. We can expect some level of attack on adjacent green trees, given the desired level of down wood to be left on site. The total impact to green trees can be reduced by minimizing brood habitat. Brood trees (visible signs of boring dust) or potential brood trees (less than 20 percent of live green crown ratio remaining due to fire scorch and greater than 50 percent bark circumference or 50 percent of roots killed on greater than 14" dbh tree) are likely to succumb to attack. These trees may be credited toward the snag total. They may be removed if snag levels are in excess of the desired level for both snags and downed logs (Guideline 7, ROD p. C-15). They should not be removed if either snags or downed logs are deficient.

2) Stands warranting salvage in the Gotchen LSR (see Gotchen treatments Group 4) may have been affected by not only western spruce budworm, but probably fir engraver beetle and/or laminated, Armillaria, and annosus root rots. Management of the future stand to favor early seral species (e.g. ponderosa pine, western larch, and Douglas-fir) in most cases provides a long-term solution to minimize landscape impacts from insects and disease. In the short-term within salvage units, remaining live grand fir are likely to succumb to the insects and diseases mentioned, providing a flow of snags and downed logs, perhaps well above desired levels. Thus, deliberations on leaving live trees and snags (mainly grand fir) within salvage units should also consider the resultant fire hazard and the ability to establish and maintain early seral species.

3) Laminated root rot and dwarf mistletoe will rarely exceed the ten acre disturbance size threshold. Large laminated root rot and dwarf mistletoe infections can spread to adjacent stands and deteriorate a developing conifer understory. In most cases infection centers can be restricted to discrete areas by favoring disease tolerant and non-host species within and around infection centers during understory treatments (reforestation, sapling thinning). Where planting disease intolerant and host species is needed to meet LSR objectives, consider converting live trees to snags if they are infested with dwarf mistletoe or occur on the perimeter of laminated root rot pockets.

Guidelines 3 and 4

Coarse woody debris and snags will be left on site so that in the future it will contain amounts similar to naturally regenerated stands. These levels vary by plant zone and the stage of stand development prior to the disturbance. Snag and down wood guidelines for salvage are provided in 5-5 Snag Management and 5-6 Down Wood Management.

5-12 Grazing

Effects of Grazing on Ecosystem Function

On the Gifford Pinchot grazing impacts have been a part of the ecosystem for about 100 years; and early grazing was much more intense than present. All three range allotments are open range allotments, in that there are no fenced pastures. (See Chapter 4 - Grazing) There are, however, some features that are fenced to exclude livestock (Cave Creek wetland, Glacier Springs, Pinetree Springs, Peterson Campground).

LSRs primarily provide transitory range. Animals graze on grass, forbs and shrubs in cutover or otherwise disturbed forests. Roadsides which are maintained in an early seral condition and meadows provide persistent forage, and typically more forage per acre than disturbed forests.

As early seral vegetation matures, forage production for domestic animals drops. Within the Lewis and Peterson LSRs, transitory range provided by young plantations may be reduced by 25 percent by the end of the decade (see Table 4-11). In the Gotchen LSR transitory range may remain near current levels through this decade, as trees within plantations are managed at wider spacings and further stand disturbance is expected from western spruce budworm.

Grazing in early-successional forest appears to have little direct impact on tree development. Direct negative impacts include trampling of seedlings or their being browsed. These impacts are minimal, widely dispersed, and are largely avoided by managing the movement of sheep herds and the placement of cattle salt licks.

Domestic livestock use of late-successional/ old-growth forest rarely occurs. The exception would be forests within the grand fir series in Gotchen LSR. Past partial cutting has created numerous skid roads and landings, many of which were seeded with grass. These conditions, along with a gentle terrain, permit cattle to graze throughout many late-successional stands.

Cow Camp serves as a handling facility for the Mt. Adams Allotment. It is located within a late-successional forest stand adjacent to Gotchen Creek. Cow Camp is allocated as an administrative site and is eligible for inclusion in the National Register of Historic Places. Cow Camp was used by the permittee to corral and hold large numbers of livestock, it is currently used as a staging area for the permittee's trucks, trailers, and horses. Cattle are either driven directly into trailers or driven directly off national forest land toward the permittee's land. The decision document for the Mt. Adams Grazing Allotment Plan found that given its current use, Cow Camp does not prevent attainment of late-successional reserve objectives.

Indirect effects, both positive and negative, occur from changes in the forb and shrub community and soil biota. Sheep grazing has been used to reduce tree competition from shrubs. In general, forage preferences may alter species composition. Soil compaction and feces accumulation where animals congregate has many known and unknown impacts on plant and animal biota.

Of the mollusks and one vascular plant listed for protection from grazing (ROD p. C-6), none have been documented and most are not suspected to occur on the Gifford Pinchot National Forest. The Lewis LSR is within the historic range of several Survey and Manage mollusks, one of which is suspected to occur (see Table 4.7). Effects to riparian ecosystems are discussed in each watershed analyses.

The continuation of grazing activity at the established levels of use should not have an affect on the four components of stand structure and composition of late-successional and old-growth forests (e.g., the number of living old-growth trees per acre, the number of standing snags per acre, the amount of down woody debris present on both forest floor or in streams, or multi-layered canopy characteristics).

Likewise, the five ecological processes described in the NWFP, p. B-2 should not be affected with the continuation of grazing at present levels to a degree that would preclude achievement of the objectives for the LSR. This conclusion is supported in part by the field review in July, 1994, by Fred Hall, Regional Plant Ecologist.

At the levels that are currently permitted, the degree of disturbance to the ecosystem from grazing activity is extremely low and is not a risk factor in maintaining a healthy ecosystem to achieve the objectives of the LSR.

Conclusions

On a coarse scale, the degree of use by domestic livestock within the LSR is low and likely to decrease over time as early-successional forests mature. The overall impact is neutral to LSR objectives.

Fine scale concerns remain for specific Survey and Manage species and sensitive plants. Areas of concern are where high animal use sites overlap likely habitat (i.e., riparian zones and meadows). Current allotment management plan monitoring efforts focus on these sites (Cave Creek Wildlife Special Area and Upper Gotchen Meadows). These are also the sites where limited fencing to exclude livestock has occurred. Consequently, adjustments have been made in grazing practices, and monitoring is occurring to determine if further adjustments are warranted.

Existing handling facilities do not interfere with LSR objectives. The only potential conflict is with Cow Camp, and the NEPA document extending the grazing permit makes the finding that it is consistent with LSR objectives.

5-13 Meadow Treatment

Need for Change

The National Forest Management Act and federal Endangered Species Act directs the Forest Service to maintain biological diversity. Many plant and animal species inhabit meadow habitats, including some which are candidates for federal listing and on the Regional Forester's sensitive species list. Because of fire suppression, some of our meadow-inhabiting species may have declined in abundance and may be rare, in part, due to loss of habitat. In cases where meadow habitat within LSRs is critical to the viability of these species, treatments to maintain or restore meadow should be proposed. This treatment includes but is not limited to pale blue-eyed grass habitat maintenance in the Peterson LSR.

In the *Trout Lake Creek Watershed Analysis* (which includes the Peterson LSR), it was recommended that small upland meadows within forest matrix (0.5 acres) be maintained and conifer succession rates in meadows be controlled to maintain landscape diversity and habitat (p. 93).

Consequences of No Action. If sufficient meadow habitat is not maintained, a decline in population viability is likely. For species which are limited geographically, loss of important populations could ultimately lead to federal listing.

Treatment Criteria

Candidates for treatment include areas with federal candidate, listed, or sensitive species which are intolerant of shade. Examples include:

- Grassy Knoll
- Peterson Prairie
- Gotchen Meadows

Treatments Description

Treatment to restore or maintain meadow habitat could be accomplished using fire or mechanical removal of trees through girdling or cutting.

5-14 Noxious Weed Treatment

Need for Change

Noxious weed populations within the LSRs include, but are not limited to, tansy ragwort, spotted knapweed, black knapweed, yellow hawkweed, and scotch broom. They compete with native species for limited resources and spread into adjacent areas.

Consequences of No Action. Noxious weeds alter the species composition, structure, and diversity of a site. They are generally most invasive in disturbed areas with high light levels. As the forest canopy closes, noxious weed populations of upland species often decline. In younger stands, noxious weeds compete with native

vegetation reducing biological diversity of plants and animals that depend on them. Noxious weeds may also compete with conifer plantings for light, nutrients, and water. Growth rates may be reduced where noxious weed density is high. Purple loose strife may eliminate nesting sites and nesting material for wetland-inhabiting birds.

Treatment Criteria

Map 5-4 displays known areas of noxious weed infestations within LSRs.

Treatments Description

The objective of the noxious weed treatment is to reduce competition and limit spread into adjacent areas.

Treatments for noxious weeds vary by species. Methods include mechanical, chemical, and biological. Chemical controls are discouraged under the Mediated Agreement. Handpulling, mowing, and the use of biological control insects are tools that can reduce populations of certain noxious weeds and are aligned with LSR objectives. Biological control methods have a high level of host specificity. Biological control insects are available for controlling of tansy ragwort, Canada thistle (*Cirsium arvense*), diffuse knapweed (*Centaurea diffusa*), spotted knapweed (*Centaurea maculosa*), and St. Johnswort (*Hypericum perforatum*). Biological control releases will be performed based on accepted protocols, with respect to density of insects, timing, and species selection.

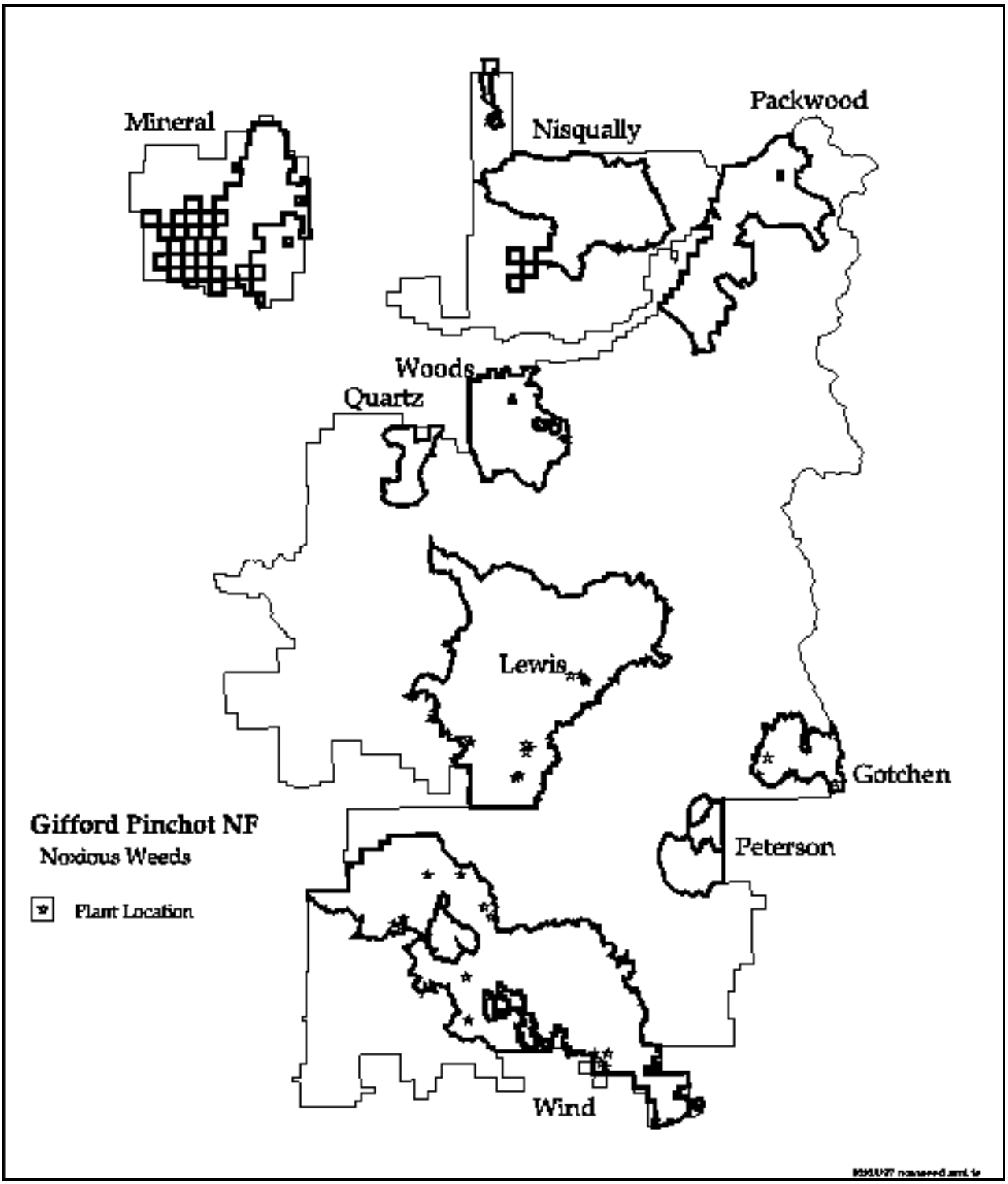
The treatment plan will rank noxious weed projects using the following criteria:

a) Class of noxious weed
b) Density of population (degree of competition)
c) Proximity to suitable habitat for further spread (level of risk)
d) Availability of cooperative funding and assistance.

Table 5-10 Biological Control Opportunities

Noxious Weed	Biological Control Insect
Tansy ragwort	Root boring flea beetle (*Longitarsus jacobaeae*) Cinnabar moths (*Tyria jacobaeae*)
Canada thistle	Stem mining weevil (*Ceutohynchus litura*)
Knapweed	Seed head gall flies (*Urophora affinis, U. quadrifasciata*)
St. Johnswort	Klamath weed beetle (*Chrysolina quadrigemina*)

Map 5-4 Nxious Weed Treatment Opportunities



5-15 Quarry Operation

Rock quarries typically impact from 1 to 5 acres per site with 1 to 2 acres being most common. Development of the quarry results in removing vegetation and soil overburden. Most rock requirements for road maintenance and flood damage repair will be met by existing and previously utilized quarries. However, new sites will be needed to limit transportation costs and provide economical sources of rock.

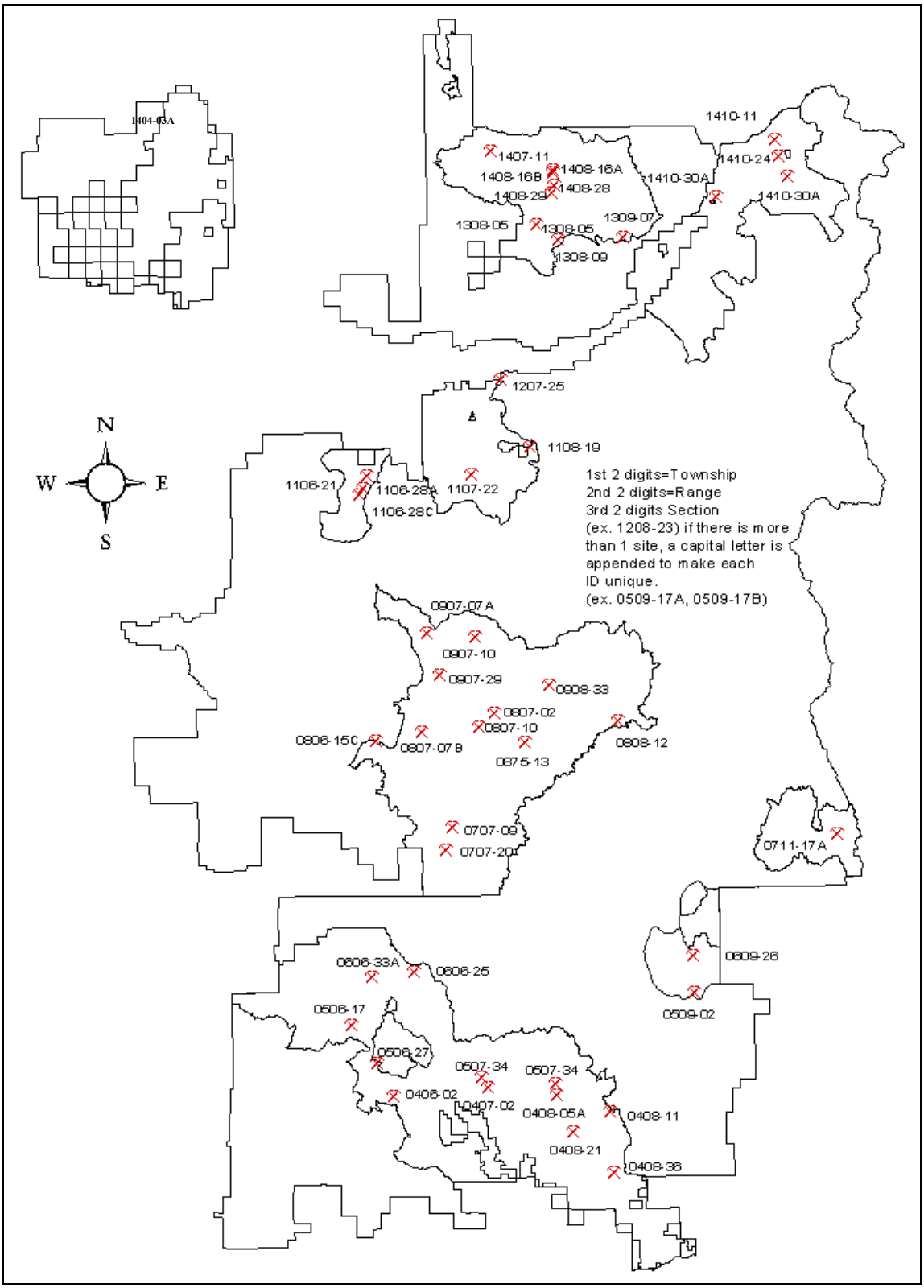
New quarries should be sited to minimize the impact on late-successional habitat. For example, quarry sites in early or mid-successional vegetation should be preferred to those requiring clearing of late-seral vegetation. Quarry development and operation with the potential to impact spotted owl habitat is subject to consultation with the USFWS.

An inventory of current and potential quarry locations is shown in Table 5-11 and Map 5-5. Quarries needed for 96 flood damage repair are marked in Table 5-11 with an asterisk.

Table 5-11 Quarries in LSRs

ID Number	Quarry Name	Status
1106-21	Nilast	Possible use in repair of 26 Road, then rehab.
1106-28A	Red Springs	Possible use in repair of 26 Road, then rehab.
1106-28C	Squires Folly	Possible use in repair of 26 Road, then rehab.
1107-22	Iron Mountain	Future use expected; clearing in plantation.
1107-01*	Ames	Current & future use; important rock source.
1108-19*	Squatter	Current & future use; important rock source.
1207-25	Siler M	One more entry will require clearing of about¼ acre; then close and rehab.
1410-11	Carlton Creek	Possible future use.
1410-14	Summit Creek	Possible future use.
1410-24	Yellowjacket	Future development requires clearing <1/2 acre.
1410-30A	Ohana	Current & future use; some clearing may be needed.
1309-07	Willame	Possible future use
1308-09	Boundary	Future use expected; important rock source.
1308-05	Siltstone	Within a plantation.
1408-28*	Road Apple	Already cleared; future use expected.
1408-29*	Skate 3	Will need clearing of about ½ acre; important rock source.
1408-16A/B	Switchback	Little future development expected, but will be used as a stockpile site.
1407-11	Mesatchee	Clearing of ~1/4 acres needed for future use.
1408-30	Silver Pass	Possible future use.
1504-35	Wildcat	Clearing of ~1/4 acres would be needed.
707-09	Upper House Rock	Fed. Hwy.) Good long term source for area. May need some clearing of reprod (20+ years old). Could also rehab some of the stockpile areas.
807-7B	125	Large centralized pit. Expected use for resurfacing 25 road and other roads in the area.
807-10	Upper Cussed Hollow	Limited amount of rock. Could use and rehab under 1 contract.
807-02	Trail D	Large quarry. North part should be rehabbed as it is now causing sediment problems to stream. South part should be retained for use in the area.
875-13	Alec Creek	Long term use. Should not require future clearing.
907-7A	Lower Spur	limited volume. May want to rehab
907-10	Upper Hungry	Long haul to area from other sources. Prime use in road repair and restoration.
606-25	Dry Creek	Excellent long term site with little to no clearing needed for future use.
506-17	Slab	Good rock but could utilize Soda Peak for needs in the area.
506-27	Soda Peak	Good long-term talus source. No clearing needed.
407-02	Carson Guler	Could rehab most of the site. Use as waste area. Backup source to Big Butte.
408-36	Brushy Bear	Limited amount of rock. Could use and rehab on 1 contract.
509-02	Mann Butte	Large source of marginal quality rock. Very light colored which has been a concern. Use as spot rock and level C and D roads.
609-26	Lower Peterson	Undeveloped source but good quality for the area. Would require clearing before development.
711-17A	Bunnell Butte	Cinder cone. Some potential use in the future and possible source for Bureau of Indian Affairs uses in the western portion of the Yakama Reserve. Also potential geologic interest area showing cross section of a cinder cone.
1404-03A*	Sound View	Proposed for use for 1996 Flood damage repair. Utilizes existing roads and landings located within an existing plantation. Not in GIS.

Map 5-5 Quarry Sites in LSRs



5-16 Special Forest Products Collection

Regulation of commercial harvest is an option to be considered under the Northwest Forest Plan if these activities conflict with LSR objectives. The NWFP states that special forest product activities must be evaluated to determine whether these activities have adverse effects on LSR objectives. Sales of these products must ensure resource sustainability and protection of other resource values, such as special status plant and animal species. Where these activities are extensive, we are directed to evaluate whether they have significant effects on late-successional habitat (ROD p. C-18).

Need for Change

Many wild mushrooms, mosses, lichens and medicinal plants found on the Forest are considered "species of concern". Many of these products are also of high economic value in the Pacific Northwest. Issuance of permits for these products should be based on supporting scientific information with consideration to local species abundance and distribution. Some studies (Liegel et al. 1996) indicate harvesting of morels and chanterelle appear to have minimal effect on the resource. However, increased intensity of harvest for other high value species may be reaching the point of valid concern with possible degradation to the resource. The Forest and others resource agencies have ongoing matsutake studies (Pilz et al. 1996) that will be considered as new and conclusive information becomes available.

Mushroom Harvest

Impacts to the food web. The greatest concern from mushroom harvest focuses on impacts to the food web. Diets vary among mammal species, and many species have documented preferences for certain fungi. Chanterelles are not a favored species. Matsutake are sought after by large and small mammals, including bear, deer, and elk. Truffles, which fruit underground, emit odors that attract mammals. Some mammals prefer these species to above ground fruiting species (Maser et. al 1985).

Small mammals, such as the northern flying squirrel (*Glaucomys sabrinus*), rely on mycorrhizal fungi (primarily those which fruit underground, e.g., truffles) for over 90 percent of their food supply (Maser et. al 1978, 1985). In turn, these mammals are primary prey for species such as the northern spotted owl.

Sustainability of mushroom harvest. Based on long-term and short-term studies and anecdotal evidence, it does not appear that repeated harvest of mushrooms has a significant negative effect on productivity in subsequent years. However, removal of forest litter, coarse woody debris, and other water-holding substrates can inhabit fruiting. Exposure of mycelium (underground, vegetative part of the mushroom) during raking or other ground-disturbing activities can reduce productivity or cause local mortality of mycelial mats. Avoiding compaction associated with trampling and minimizing removal of moss, leaf litter, and substrate around mushrooms is critical to maintaining microclimate and sustained harvest.

A long-term study on the Mt. Hood National Forest suggests there is not a marked reduction in mushroom productivity after harvest of chanterelles (Novelle 1995). This study is based on data collected over a ten year period. Precipitous declines in mushroom production in Europe have been thought to be correlated to air pollution and associated acid rain, rather than harvest (Gulden et al. 1992).

Individual mushroom species vary in their degree of association with seral stage; some species are only found in late-successional and old-growth forests, while others colonize earlier and reach peak abundance in younger stands. Chanterelles and matsutake fruit in abundance in mid-age stands (Pilz, pers. comm.). The inclusion of these species in the Survey and Manage component of the Northwest Forest Plan (ROD Table C-3, Strategy 4) reflects concern with varieties that may be closely associated with late-successional and old-growth forests. Harvest of these species (especially chanterelles) in earlier seral stages is unlikely to have a significant negative impact on the prey base of mammals associated with late-successional forests.

While truffle harvest occurs on the Forest, commercial harvest of these species is thought to be limited, due to a relatively small commercial market at this time. The price per pound to pickers of Oregon black truffle (*Leucangium carthusiana*) averaged $75 in 1992; with harvests that year totaling over 4,000 pounds in Oregon alone. About 7,000 pounds of the Oregon white truffle (*Tuber gibbosum*) were harvested in Oregon and Washington in 1992 (Amaranthus and Pilz 1996). These values are small relative to other species which may range over a million pounds harvested annually in the Pacific Northwest (e.g., chanterelles, Novelle 1995). However, they may represent a growing market, with greater potential impacts to small mammals and a higher level of ground disturbance associated with harvest. Raking the forest floor is the conventional method of harvest of truffles in the Pacific Northwest. At one site, raking an areas two years in a row appeared to virtually eliminate truffle production the third year (Trappe 1990). While some species of truffle occur in late-seral stands, the Oregon white truffle is associated with Douglas-fir, usually in stands between 8 and 65 years (Arora 1986).

Incidental harvest and impacts to species of concern. Other concerns include incidental harvest of NWFP Table C-3 Strategy 1 species; these include truffles and other species that may be collected during commercial or personal use harvest. Some of these species are known from only one or very few sites; many are located in recreational sites, especially campgrounds (O'Dell, pers. comm.). The likelihood of incidental harvest of these extremely rare species may be low. Monitoring harvest activity and identifying areas of potential concern may be appropriate to minimize this risk.

Effects of thinning on mushroom production. Silvicultural treatments, such as thinning may affect mushroom productivity. According to Trappe and Cholgan (unpublished data, 1995), forest thinning can reduce productivity of below-ground fruiting fungi in 60 to 70 year old Douglas-fir stands. Little information exists on how other mushroom species respond to thinning treatments. However, several studies are underway to investigate the effect of silvicultural treatments on mushrooms. On the Olympic Peninsula, a study initiated in 1993 is in progress to compare chanterelle production in 60-year

old stands, thinned and unthinned (Amaranthus and Russell 1995). On the Umpqua National Forest, a study is planned to do silvicultural treatments to enhance matsutake production. Information from these studies may lead to opportunities to manage for larger sustained yields, if these treatments also accomplish other LSR objectives.

Other concerns. Restrictions on mushroom harvest in LSRs on adjacent forests could lead to increased demand in harvest on the Gifford Pinchot National Forest.

Special Forest Products Management Recommendations

Native American Indians having treaty rights will continue to exercise those rights on lands now designated as late- successional reserves.

Monitoring of use rates, products purchased by buyers, and long-term research projects should continue.

Products considered low-risk or where removal is neutral to LSR objectives include floral and Christmas greenery and harvest of berries. Incidental uses associated with recreational activity, and gathering of plants and firewood from road right-of-ways are also considered low risk.

Permits (commercial and personal use) should continue to be utilized as a management tool to ensure special forest products harvest is consistent with LSR objectives.

Because available information indicates they may be an important food source for small mammals, commercial permits may not be issued for matsutake and boletes mushroom harvest within LSRs. Restrictions on harvest should adapt to the findings of research and monitoring of mushroom-wildlife relationships.

Numerous studies are underway that should provide valuable information on appropriate management for harvest of fungi in late-successional reserves. These studies should be continued, be expanded where possible, and results incorporated into adaptive management of the LSRs.

Personal and recreational use permits should be given preference over commercial permits for products where little or conflicting information exists concerning species abundance, distribution and ecological role.

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5-17 Special Uses

Special uses, authorized under special use permits, in each LSR are described in Chapter 4 at the LSR scale. Current uses within LSRs can be grouped into four categories.

Linear developments include roads, power and telephone lines, water pipelines and a water diversion. The NWFP recognizes existing uses in these categories as valid uses (ROD p. C-19). Permits for new easements will be granted only after it is determined that the proposed route is consistent with LSR objectives, minimizes impacts to late-successional habitat and that alternate routes which avoid the LSR and late-successional habitat within the reserve have been considered.

Electronic sites operated under special use permit in the LSRs include radio repeater sites and data telemetry installations. These are small sites affecting one-quarter acre or less. The NWFP considers these sites valid existing uses. Permits to operate new sites will be granted after it is determined that they are consistent with LSR objectives.

Residences and facilities under permit within LSRs range from a caretaker's residence to a 46 unit summer home tract in the Wind LSR. The Cispus Learning Center in the Woods LSR also falls in this category. The NWFP allows this type of existing development to remain. Routine maintenance, including felling hazard trees is allowed. Developments of new residences and facilities in LSRs will be considered on a case-by-case basis. They will be planned to have the least possible adverse impact on late-successional habitat and related species (ROD p. C-17).

There is one apiary (beehives) situated in the Wind LSR under an annual permit. Risk to native bee populations will be considered through the NEPA process prior to renewing the permit.

There are **mining claims** in Lewis, Nisqually, Mineral, and Quartz LSRs. These include placer claims which involve operation of suction dredges in stream channels and lode claims which usually involve tunneling into the hillside. Gold is the mineral being sought in all claims in LSRs. The impacts of ongoing and proposed mining actions will be assessed and mineral activity permits will include appropriate stipulations related to all phases of mineral activity (ROD p. C-17). Exploration and mining activities will be conducted consistent with the General Mining Act of 1872 and applicable Forest Service regulations.

5-18 Element 4 LSRs - Owl Activity Centers

Owl activity centers are considered by the NWFP as unmapped Late-Successional Reserves. There are 123 owl activity centers within the Matrix and AMA. Within the Matrix and AMA, Forests are directed by the NWFP to retain 100 acres of the best northern spotted owl habitat as close to the nest site or owl activity center as possible (ROD p. C-10).

Interim owl activity centers were established by placing 100 acre circles centered on known owl nests or activity centers. When habitat manipulating activities are planned within one mile of the activity center or nest site, the circular configuration will be refined to identify and include the best 100 acres of spotted owl habitat as close to the nest site or activity center as possible. The refined configuration will be stored in the Forest's GIS system.

Since these are one of the five categories of LSRs, NWFP standards and guidelines will apply to owl activity centers. Like mapped LSRs, their boundary will not be buffered, although management around these areas will be designed to reduce the risk of stand replacing disturbances.

Treatments Description

Thinning and other structure enhancing treatments should be infrequent since the selection of the best spotted owl habitat will usually result in the designation of functional late-successional habitat. Where there is a premium on internal habitat, plantations and younger stands may be included within the refined owl activity center. In these situations Young Stand Thinning (p. 5-1) and Commercial Thinning (p. 5-6) may be appropriate.

Salvage within the owl activity centers will conform to the standards prescribed by the NWFP (ROD p. C-13 to C-16) and Treatment 5-11 Salvage and Risk Reduction.

Chapter 6

Fire Management Plan

Chapter 6
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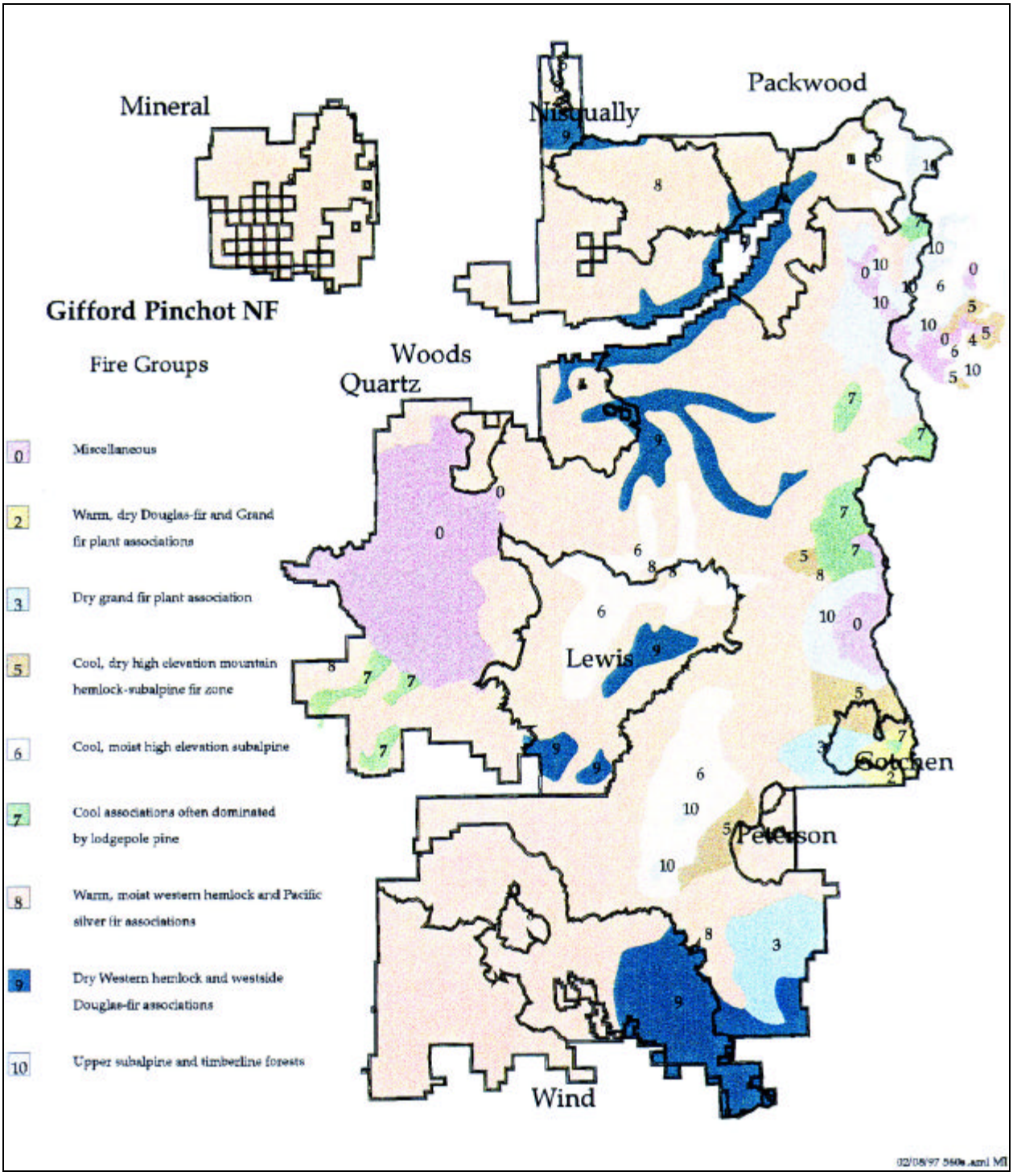


Chapter 6

Fire Management Plan

6-1 Fire History

Early History

Historical fire records document extensive fires that occurred on the Forest as early as 1764. The Cowlitz Indians refer to a big fire that occurred about 1830 which crossed over from the Lewis River. The *Oregonian* reported on large fires "northeast of Vancouver" in late August 1857. The *Oregonian* also has accounts of many large fires burning "north/northeast" of Vancouver from mid-August to the end of September 1868. A large fire swept the plateau north and northwest of Mt. Adams about 1874 or 1875 and again in 1892 (See Map 6-2 and Map 6-3).

Since 1902, about one-fourth of the Forest has been burned by six fires:

- the Yacolt Fire burned approximately 480,000 acres, on and near the Forest,
- the Lewis River Fire was approximately 30,000 acres,
- the Siouxon fire was estimated to be at least 30,000 acres, and
- the Cispus Fire burned approximately 50,000 acres.

Both Yacolt and Cispus have reburned at least once since 1902. The name "Cispus": is a name of American Indian origin meaning "vast burned over area," which implies that the Cispus watershed had been burned many years before recorded history.

Fire history of the Gifford Pinchot National Forest indicates that wildfires were frequent until approximately 1933.

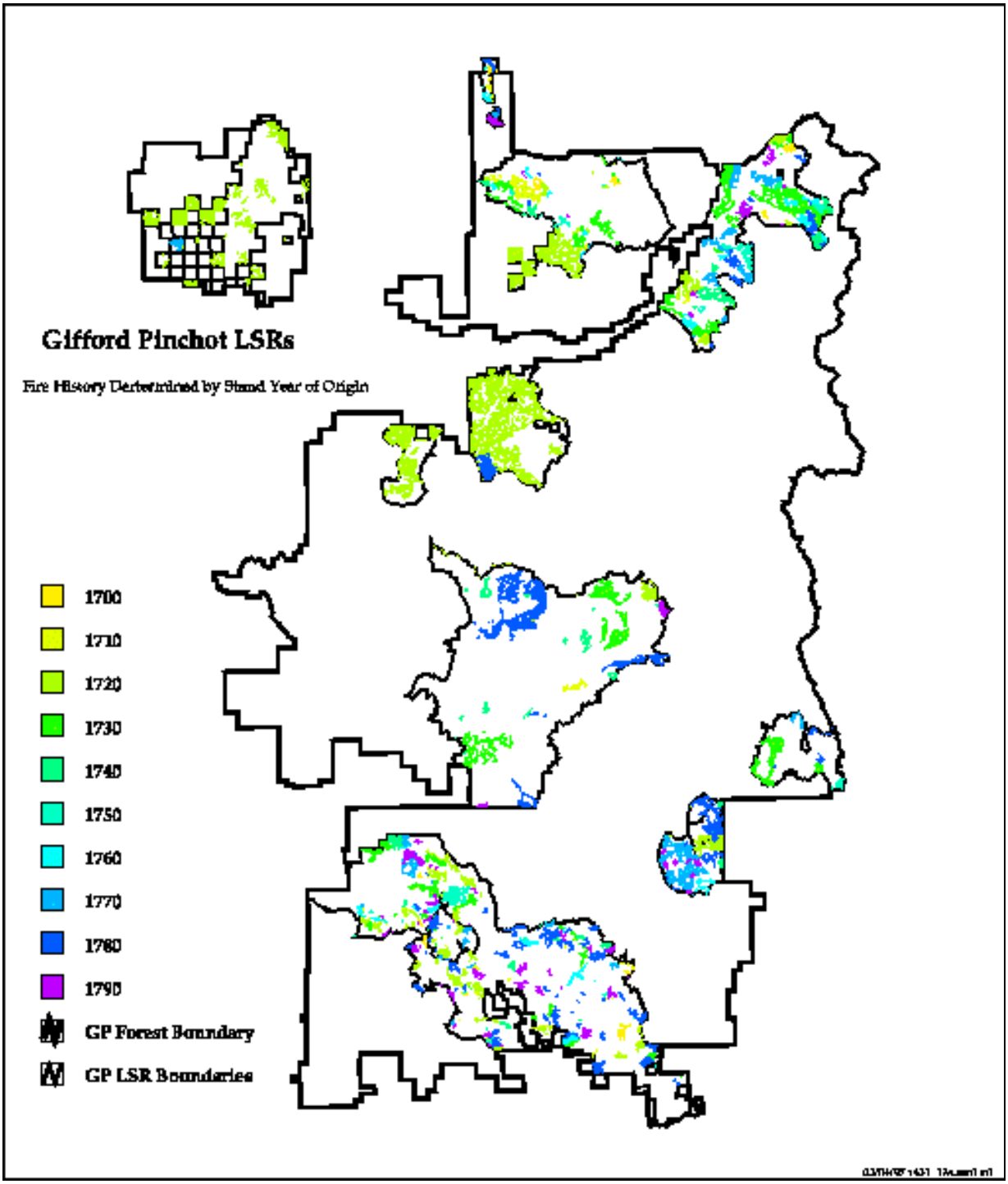
Post 1930's

Suppression efforts became more effective by the end of the 1930's. More than 25 lookouts were built on the Forest between 1913 and 1935, and fire detection was greatly improved. There was better access and more organized methods of suppression. Forest use declined in the 1940's due to the war and fire starts declined. After the war, as timber cutting expanded, slash disposal was recognized as a serious fire hazard. Throughout the 1950's and 1960's, experience was gained in controlled slash burning to reduce fire risk and aid in site preparation for reforestation.

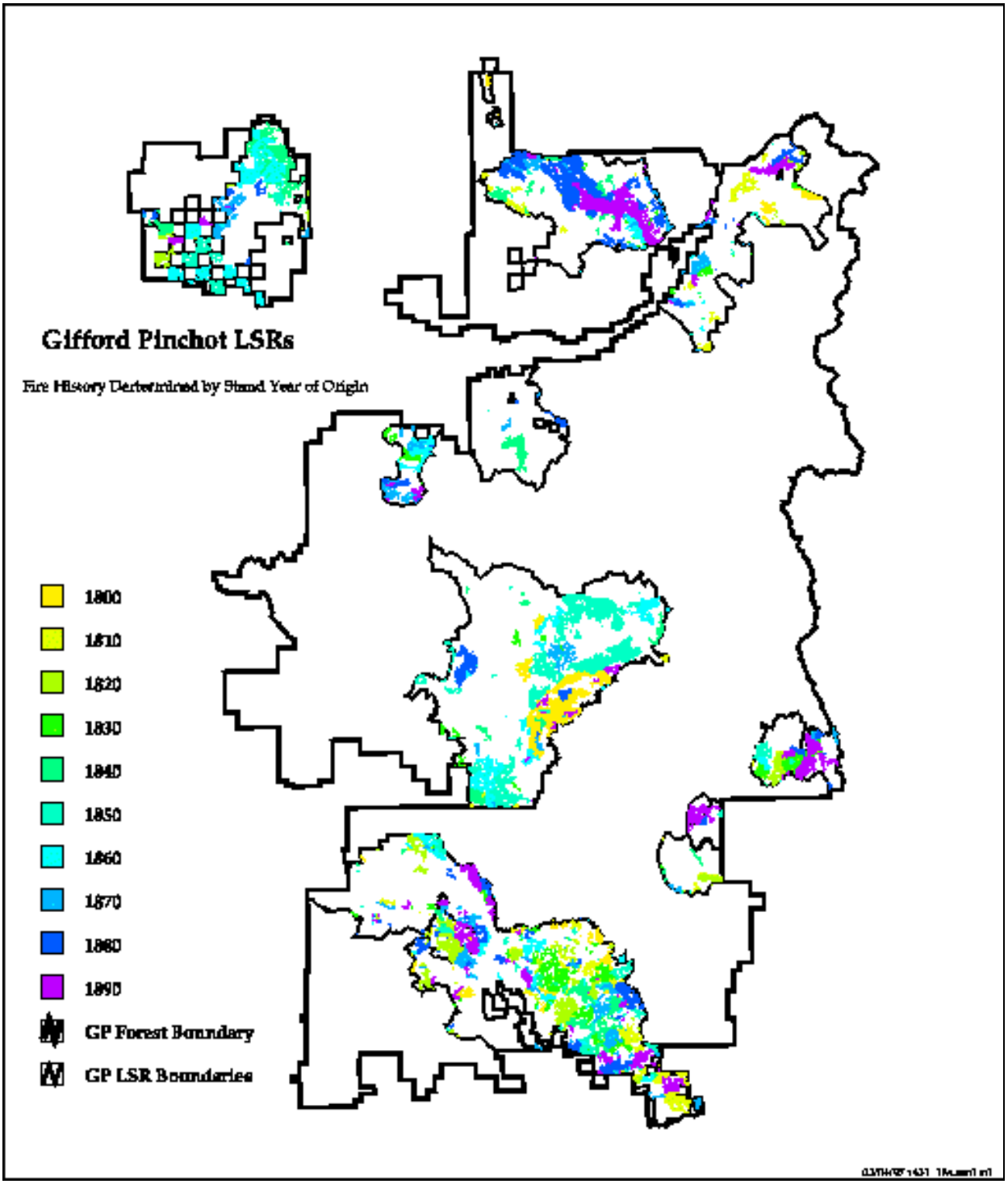
By the 1970's, fire and fuels management were becoming more sophisticated. A better understanding of how weather, topography, fuels composition and fire behavior led to prescribed fire plans and strategic/tactical plans for wildfire suppression. See Map 6-4.

The role of fire on the Gifford Pinchot has changed in the last one hundred years. Land managers today are still dealing with a landscape that has been modified by approximately 60 years of effective fire suppression. This has resulted in a change of species composition (plant and animal), their spatial distribution over the landscape, and has altered (and in some cases, created) disturbance patterns which effect insect, disease, and fire risk.

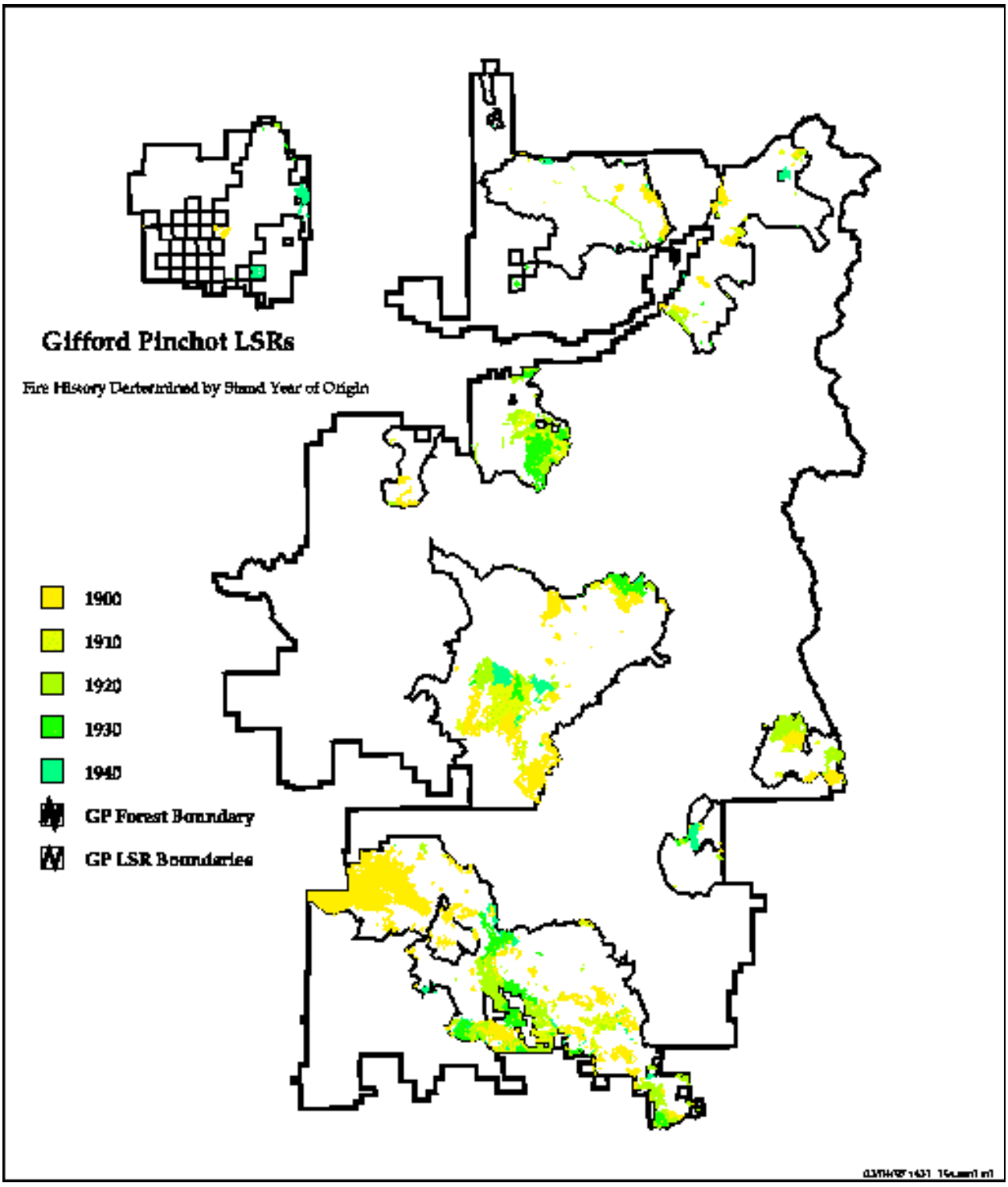
Map 6-2 Gifford Pinchot Fire History - 1700's



Map 6-3 Gifford Pinchot Fire History - 1800's



Map 6-4 Gifford Pinchot Fire History 1900's



6-2 Existing Conditions

Twelve fire groups were developed based on vegetation, its response to fire and successional pathways. Because differences in fire behavior and successional pathways can result from small differences in fuel, temperature, moisture sunlight, topography, and seed availability, it is possible for stands in the same plant association to be described by different fire groups.

Fire Group 9 - Dry Western Hemlock and Westside Douglas-fir

Fire Group 9 occurs primarily on north and south aspects of the Cowlitz, Cispus, and North Fork Cispus Rivers on the Gifford Pinchot National Forest. Typical site characteristics include 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. Three conifers and two hardwoods tend to dominate the overstory within this fire group - Douglas fir, western hemlock, western redcedar, big-leaf maple and Oregon white oak. White oak is not found within this zone on the Gifford Pinchot. The western redcedar tends to grow primarily in draws and other locations with deeper soils that hold more moisture. Shrubs rather than forbs, tend to dominate the most common Fire Group 9 associations found on the Gifford Pinchot.

Forest Fuels

Fuel loadings in this fire group are highly variable, depending on individual stand and site conditions. Generally, Fire Group 9 does not contain duff as deep as that found in Fire Group 8. On the Gifford Pinchot, fine fuel loadings range from 2.2 to 4.0 tons per acre with a weighted average of 3.5 tons per acre. Fuel loadings for material larger than three inches in diameter show a wide range of variability, from a low of 2.5 tons per acre to 57 tons per acre.

Fire Ecology/Fire Effects

Coast Douglas-fir is more fire resistant than many of its associates and can survive moderately intense fires. Thick, corky bark on the lower bole and roots protects the cambium from heat damage. Crown scorching from summer fires is more damaging than late summer or fall fires because more buds are killed. During late summer the buds are set and subsequent year needles are well protected. Moderately severe underburns in 50 to 60 year-old mixed and pure stands near Mount Rainier caused little cambial damage to Douglas-fir, but killed most of the thin-barked western redcedar.

Widely distributed as a canopy dominant in lower and middle elevations forests throughout the Pacific Northwest, Douglas-fir occupies forests with varied fire regimes. In general, the size and severity of natural fires tend to decrease, while fire frequency increases, southward. In western Washington, Douglas-fir is a primary component of moist forests experiencing infrequent, widespread, stand-replacing fires that occur at perhaps 400 to 500 year intervals. Where Douglas-fir is seral, its great longevity allows it to maintain itself as a canopy dominant until the next stand-replacement fire occurs.

Current Fire Behavior

Prolonged fire exclusion probably has allowed development of denser stands. Stand-replacing crown fires can develop and do not necessarily depend on the combination of prolonged drought and east wind conditions typical of Group 8. In the absence of east winds, topography and rockiness tend to control fire size and shape. In the presence of east winds, Group 9 may no longer serve as a break in fuels for crown fire spread. Most often, low to moderate rates-of-spread and fireline intensities dominate fire behavior. Because Group 9 is generally found on the lower third of slopes, fires starting within the group can potentially spread further before fuels conditions change. On the Gifford Pinchot, thick growth of salal and dwarf Oregon grape mixed with a lesser amount of grasses often significantly increases the fine fuels (litter), accelerating rates of-spread.

Fire Group 8 - Western Hemlock/ 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.

Forest Fuels

This group generally lacks fine fuels through most of the stand history. The 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.

Fuel loadings build rapidly once the overstory begins to die from insect and disease attack and the canopy breaks up. Conditions become drier in these canopy gaps and can easily provide a suitable fuelbed for fire starts.

Fuel loading in the 0 to 3 inch diameter fuel ranges from 1.4 to 5.0 tons per acre.

Fire Ecology/Fire Effects

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 regime is generally between 150 to 400 years or more.

Large fires within these plant zones generally tend to be stand replacing. Due to both species having low fire tolerance, even a light surface fire is damaging because the shallow roots are scorched.

Fire in this group serves to prepare mineral soil seedbeds, produces a mosaic of stand structures and age classes across the landscape, and affects within-stand species diversity. Fire history maps and recent wildfires suggest that most fires are either very small (less than 10 acres) or very large (greater than 1000 acres). Mid-sized fires are not unknown but appear to depend on a combination of dry conditions and light to moderate winds.

Conditions which result in large fires, prolonged drought and strong east winds, occur approximately every 30 years, based on fire history studies of the forest and similar locations in the Region (Pyne 1982). Big fires occurred on the Mt. Hood and Gifford Pinchot in 1902, 1933, 1967, and 1991 primarily within this fire group and Fire Group 6 (Cool, moist lower Subalpine).

Current Fire Behavior

Under current stand conditions stand replacement fire will dominate during a large fire (1000 acres) event. Most of the active burning occurs during one burning period, although it can occur over several burning periods. Low rates-of-spread and fireline intensities dominate; prolonged smoldering can create a high severity burn. High intensity fires depend on extreme winds, prolonged drought, or both. The highest fire danger occurs from mid-September through October.

Fire Group 7 - Cool Associations often dominated by Lodgepole Pine

Fire Group 7 occurs on higher elevation plateaus subject to frost, which are found primarily on the north and east edges of the Gifford Pinchot. The lowest elevation example lies in a natural cold pocket on the south slopes of Mt. Adams. Another large area lies on the south slopes of Mt. St. Helens. A third large area lies just north of Mt. Adams and bordering the Yakama Indian Reservation.

Most stands occur in the mountain hemlock zone although some stands appear to fall within the Pacific silver fir zone and at least one location lies in the grand fir zone.

Forest Fuels

Within this fire group, Lodgepole pine generally comprises more than 50 percent of the overstory. Other species that may be present include western white pine, subalpine fir, noble fir, Douglas-fir, Engelmann spruce, western hemlock, mountain hemlock, and Pacific silver fir. Huckleberries and beargrass dominate the understory vegetation, although trace amounts of others species typical of cold, moist conditions are present. Sites within this group lie within the subalpine zone on severe sites (frost pockets) or poor soils (coarse-textured or very thin). Some sites may occur in areas with fluctuating water tables, such that soils are saturated in the spring and very dry by fall.

Low productivity characterizes this group. These sites generally do not produce very heavy downed woody loadings or deep duff. Fuel loadings increase when the overstory of lodgepole breaks up from disease related mortality and snow breakage. When fuels do build up, fire can burn very rapidly through the area under dry conditions. Wildfire risks 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.

Fire Ecology/Fire Effects

Large, stand replacing fires probably occur every 100 to 300 years. Occasional low to moderate intensity fires may thin the stands or otherwise rejuvenate it without doing serious damage to large areas of the overstory. Fire in lodgepole pine stands has been described as an "all or nothing" proposition. That is, fires either (1) go out after a day or two or smolder in the duff for extended periods or (2) develop into rapidly spreading wildfires. Smoldering fires are common in lodgepole forests because understory fuels are sparse. Furthermore, fire spread to the crowns is difficult because they are elevated well above the forest floor. However, lodgepole pines stands become more flammable as they age because dead woody fuels accumulate on the forest floor, These fuels result from past fires, insect and disease outbreaks, and overmaturity.

Fire serves to perpetuate the dominance of lodgepole 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 lodgepole pine is established, it does not favor rapid fire spread or uniform burning except under extreme burning conditions. Following a stand replacing fire shrubs and forbs dominate for a short period of time. Lodgepole seedling quickly establish and overtop the undergrowth.

Current Fire Behavior

Currently, most lodgepole pine stands that have not been harvested generally support light fuel loadings. Those that have had harvesting activity within them have variable fuel loadings and could support a low to moderate intensity fire. Many of our stands are approaching 80 to 100 years of age, and without some type stand manipulation will become more susceptible to insect and disease attacks which creates a fuel bed suitable to fire starts.

Fire Group 6 - Mountain Hemlock Zone

Fire Group 6 incorporates the wetter portion of the transition zone between eastside and westside as well as cooler sites on the westside. This fire group occurs only at the highest elevations, if at all, east of the Cascades, and at a mix of higher and mid-elevation sites west of the Cascade crest. This fire group is common in the Dark Divide roadless area in the center of the forest. It occurs on the lower slopes and northeast of the Mt. Adams Wilderness, in areas adjacent to Sleeping Beauty and Echart Mt., and within the Indian Heaven, William O. Douglas and Goat Rocks Wilderness areas, and in the northern most part of the Forest, north of the Nisqually River and west of Mt. Rainier National Park. Fire Group 6 also occurs along the two major ridgelines running north from the Dark Divide (McCoy Peak and Juniper Ridge).

The typical environment for Fire Group 6 includes heavy snowpacks, short growing seasons, frequent frost, and cold, moist soils.

Forest Fuels

A deep duff and litter layer are common within this fire group. Most down woody fuel loading is in the greater than 3 inch diameter class. Associations in Fire Group 6 are warm enough that most smaller dead woody fuel decays rapidly. The abundant shrubs also provide a very large heat sink under normal conditions, greatly reducing the rate of fire spread. During prolonged drought, the shrubs and forbs can provide a significant fuel load.

Much of the large diameter woody fuel tends to be rotten. The higher moisture holding capacity of these rotten logs also reduces fire risk through 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, an understory of extensive 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

Tree species generally found within the Mountain Hemlock zone are not fire tolerant. Generally speaking, 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 pre-settlement fire regime in mountain hemlock forest types is over 600 years. Fires in these cool wet forest types generally occur as infrequent crown fires. When fires do occur in mountain hemlock forests, they are often severe stand-replacing fires.

Current Fire Behavior

Recent fires on the Gifford Pinchot in Fire Group 6 have generally been crown fires with relatively limited surface fire. Aerial fuels, such as lichens, have been the main carriers of the fire, since down woody fuels are relatively light. In most cases, these fires have been wind-driven events. Once the winds died, burning became limited to snags and larger surface fuels.

Fire Group 5 - SubAlpine

Fire Group 5 occupies drier, colder sites than Fire Group 6. Generally these stands have a diverse overstory, containing Douglas-fir, noble fir, western white pine, subalpine fir, Pacific silver fir, and mountain hemlock. Subalpine fir and mountain hemlock tend to be present in all the above plant associations, and one of them dominates.

Shrubs tend to dominate the understory. Big huckleberry is the most common species in most associations.

On the Gifford Pinchot this group is found primarily on the eastern slopes of Indian Heaven Wilderness.

Forest Fuels

The fuel structure in subalpine-fir dominated stands promotes highly destructive stand-replacing fires. Fuel loads in subalpine fir stands are greater than in lower elevation montane stands because the cool, moist environment slows the decomposition of organic matter allowing fuels to accumulate more rapidly. Fuel beds tend to be irregular, with over twice as much fuel accumulating under the narrow-crowned trees as between them.

Fire Ecology/Fire Effects

Evidence indicates that these stands experience two types of fires. Low to moderate intensity fire helps maintain seral species, such as Douglas-fir, western white pine, and lodgepole pine. Often these fires consist of smoldering fires that creep through the duff. Fuel concentrations and/or low canopies favor torching of individual trees or groups of trees. Which in turn cause spot fires, smoldering and creeping until reaching another fuel concentration, and starting the cycle over again.

High intensity fires occur during prolonged drought, lasting 3 or more years. The resulting stand-replacing fire would prepare a mineral soil seedbed and favor lodgepole pine. Stand replacing fires east of the Cascade crest tend to occur in August and early September under strong west wind conditions. Similar fires west of the Cascade crest tend to occur more in October and early November under strong, dry east winds.

Relatively dry lower elevation subalpine fir habitat types have more frequent and less intense fires than moist middle and upper elevation subalpine fir habitat types. Moist, middle, and upper elevation subalpine fir habitat types generally experience high intensity stand-replacing fires at intervals of 100 years or more.

Current Fire Behavior

Under current stand conditions, most fires tend to remain either very small, less than 10 acres, or become very large, over 1000 acres. Large fire development depends on prolonged drought and high winds.

Fire Group 4 - Moist Grand Fir

Fire Group 4 lies east of the Cascade crest. This group occurs at the bottom of steep narrow canyons along perennial streams and in cool, moist air drainages. It also occurs at higher elevations having fairly moist and cold sites that receive substantial snowpacks.

Douglas-fir is the primary seral species. Other seral conifers include western larch, lodgepole pine, western white pine, and noble fir. Grand fir is climax or coclimax with Engelmann spruce, western hemlock, or western redcedar in conifer dominated riparian areas. Mountain hemlock and Pacific silver fir appear in trace amounts.

Forest Fuels

Fuel loadings in Fire Group 4 can be very high. Many stands contain numerous down logs, the result of deadfall and natural thinning. Despite these loadings, the high humidity and cooler temperatures typical of these sites and low fuel loadings in the less than 3 inch size classes significantly reduce the fire hazard. Most of the fuel load results from blowdown, insect and disease related mortality, and natural thinning and pruning. Young stands and older open-canopy stands often support a lush understory. Dense canopies allow little sunlight to reach the cool, moist forest floor.

Fire Ecology/Fire Effects

On moist grand fir habitat types, fires are infrequent with the fire return intervals ranging from 70 to 250 years. Fire can provide a mineral seedbed suitable for both seral and potential climax species. The bark of mature trees is thick and can provide protection against low to moderately severe fires. However, trees that survive a fire are very susceptible to bole rot caused by Indian paint fungus (Echinodontium tinctorium) entering the fire scars.

Prolonged drought will allow fires to burn through these stands. Severe burning conditions may result in crown fires, replacing the stand.

Current Fire Behavior

Aggressive initial attack and generally high fuel moistures keep most fires very small within the fire group. Fire starts are rare due to the moist conditions, and these fires tend to creep and smolder in the light fuels and duff. Under the right stand and weather conditions, large crown fires can develop and probably account for any large fires. This fire group faces a larger risk of crown fires that originate in drier stand sites and burn into these stands. Most fires only last for one burning period.

Fire Groups 2 & 3 - Warm, Dry Grand Fir and Douglas-fir

Fire Group 2 occurs east of the Cascade crest. Within the Gifford Pinchot it lies mostly in the White Salmon and Little White Salmon River drainages. Fire Group 3 also lies primarily east of the Cascade crest but can occur on the westside, north of the Columbia River.

Fire Group 2 consists of Douglas-fir and grand fir plant associations where ponderosa pine is the major seral species. Plant associations included within Fire Group 3 are generally more moist than those found in Fire Group 2. Common seral conifers include ponderosa pine, Douglas-fir, lodgepole pine, and western larch. Grand fir appears both in the understory and overstory. Lesser amounts of western white pine and western hemlock may appear in the grand fir/twinflower associations.

Forest Fuels

Fuel loadings in Fire Group 2 tend to be less than 10 tons per acre. The fuel loadings within Fire Group 3 will range from approximately 10 to 18 tons per acre with tonnage difference primarily related to differences in the greater than 3 inch size classes. Stand development determines fuel conditions and the associated fire hazard. Fire history and past harvest activity, in turn, influence stand development. Generally, fuel loads tend to increase with stand age due to accumulated downfall from insect and disease damage, blowdown, and natural thinning. Dwarf mistletoe can cause rapid fuel accumulation.

Dense thickets of Douglas-fir or grand fir regeneration may become established during fire-free periods. This regeneration provides a fuel ladder into the overstory, greatly increasing the probability of a stand replacing fire.

Fire Ecology/Fire Effects

Fire strongly influences grand fir's ecological role. On many Pacific Northwest sites, grand fir is able to dominate as the climax species only if fire is excluded. Grand fir is never seral on sites with frequent fires.

In relatively dry grand fir habitat types, underburns appear to have occurred at a 6 to 45 year return interval. The thick bark of mature trees can provide protection against low to moderately severe fires. However, trees that survive a fire are very susceptible to bole rot caused by Indian paint fungus entering the fire scares.

Current Fire Behavior

Fire exclusion and timber harvest practices have greatly increased the chances for a stand replacing crown fire. Stand densities have increased and species composition has changed toward the more fire sensitive grand fir. Underburning that does occur tends to be lethal since grand fir has a greater tendency to dominate both the overstory and understory. Aggressive initial attack tends to limit fires to 10 acres or less. Those not caught during the first burning period generally are wind driven events and grow to more than 1000 acres.

6-3 Risk Assessment

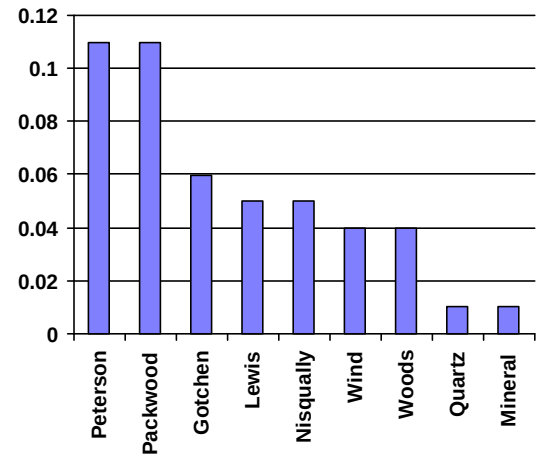
Fire occurrence and fire frequency based on fire data for 1972-1995 is displayed in Figure 6-1 and Table 6-1.

Table 6-1 Fire Frequency

LSR	No. of Fires	Acres in LSR	*Fire Occur./ Yr	**Fire Frequency
Peterson	38	15,514	1.7	0.11
Packwood	71	43,110	3.1	0.11
Gotchen	22	15,173	0.95	0.06
Lewis	140	120,642	6.1	0.05
Nisqually	53	51,360	2.3	0.05
Wind	111	125,006	4.8	0.04
Woods	25	28,244	1.1	0.04
Quartz	1	8,860	0.04	0.01
Mineral	7	37,590	0.30	0.01

*Fire Occurrence is the number of fires divided by the number of years (23).
**Fire Frequency is the number of fires per 1000 acres divided by number of years.

Figure 6-1 Fire Frequency



Levels of catastrophic risk were assessed from four natural disturbance agents in the West Cascade Subregion for Northern Spotted Owl (Agee and Edmonds 1992) as shown in Table 6-2.

Map 6-5 through Map 6-7 are the products of a specific risk assessment for fire which was determined using current vegetation classes, and assigning as NFDRS fuel model (fuel based on large scale planning area); overlaid with average slope classes (i.e., 0, 30, 60, and 90 percent) and aspect (N,S,E,W). This information was combined with the historical fire weather information (50th - average case and 90th percentile - average worst case) and a fire behavior analysis was prepared for each fuel model. Rate-of-spread and flame length was determined for each fuel model based on the historical weather parameters.

Table 6-2 Risk of Natural Disturbance

Disturbance Agent	Risk Level
Fire	Low
Wind	Moderate-Low
Insects	Low
Diseases	Low

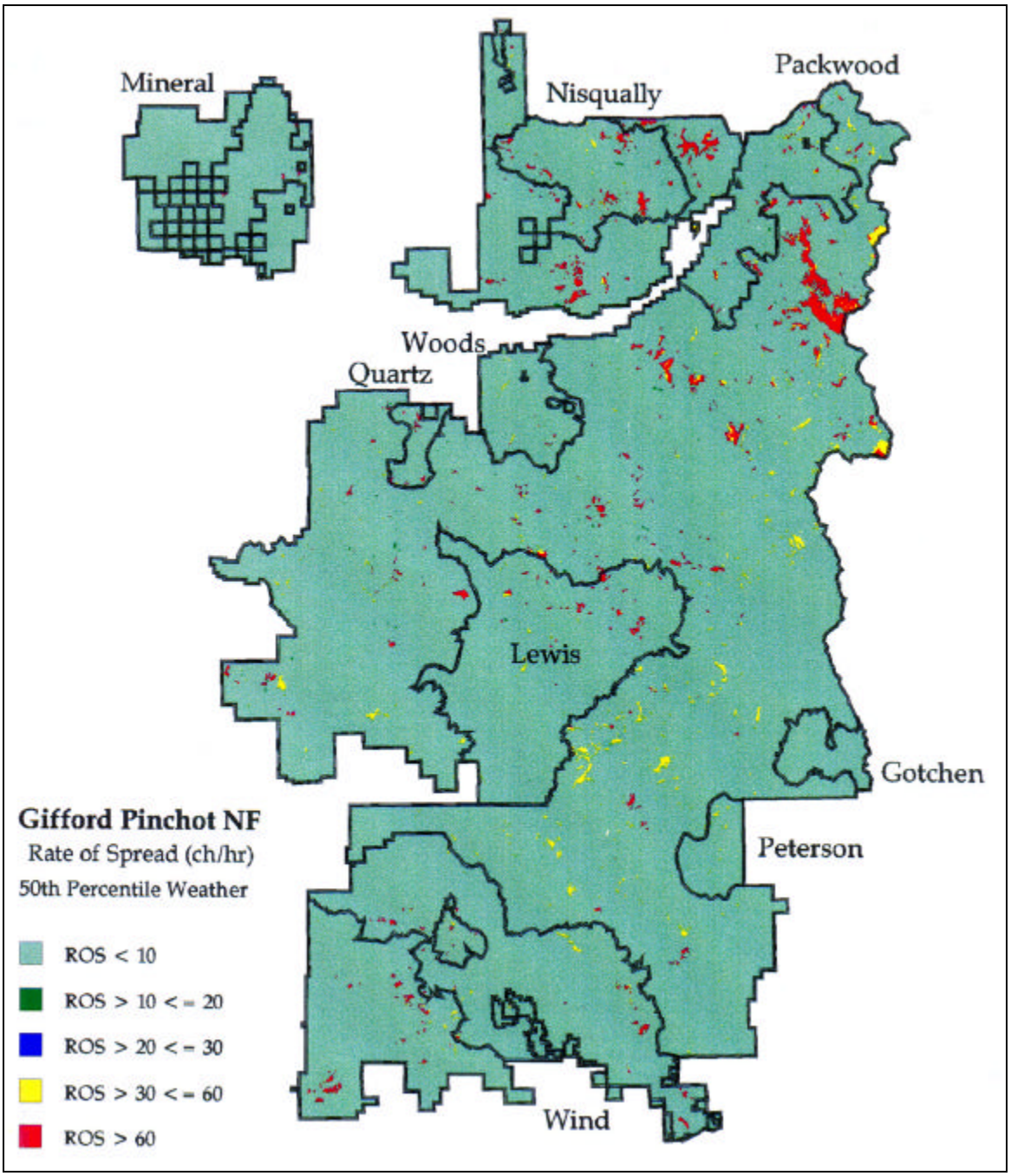
The effectiveness of fire suppression over the last 60 years has had major effects across the landscape in modifying and altering spatial distribution of species (vegetative and animal), and in disturbance pattern regimes. Fire suppression and reduction or elimination of grazing in our westside ecosystems has allowed overstocking of herbaceous, and woody (including early and mid-seral) species. On many sites, this overstocking has led to an increase in rates of spread and fire intensity. This is characteristic of many of our managed stands and the Forest in general. Wildfire and grazing used to maintain many of our meadow/grass associations which are now being encroached by invading tree species. These openings provided for natural fire breaks as well as providing for diversity of unique wildlife and plant species.

Map 6-5 and Map 6-7 depict the average conditions (50th percentile). During these average conditions, with few exceptions,

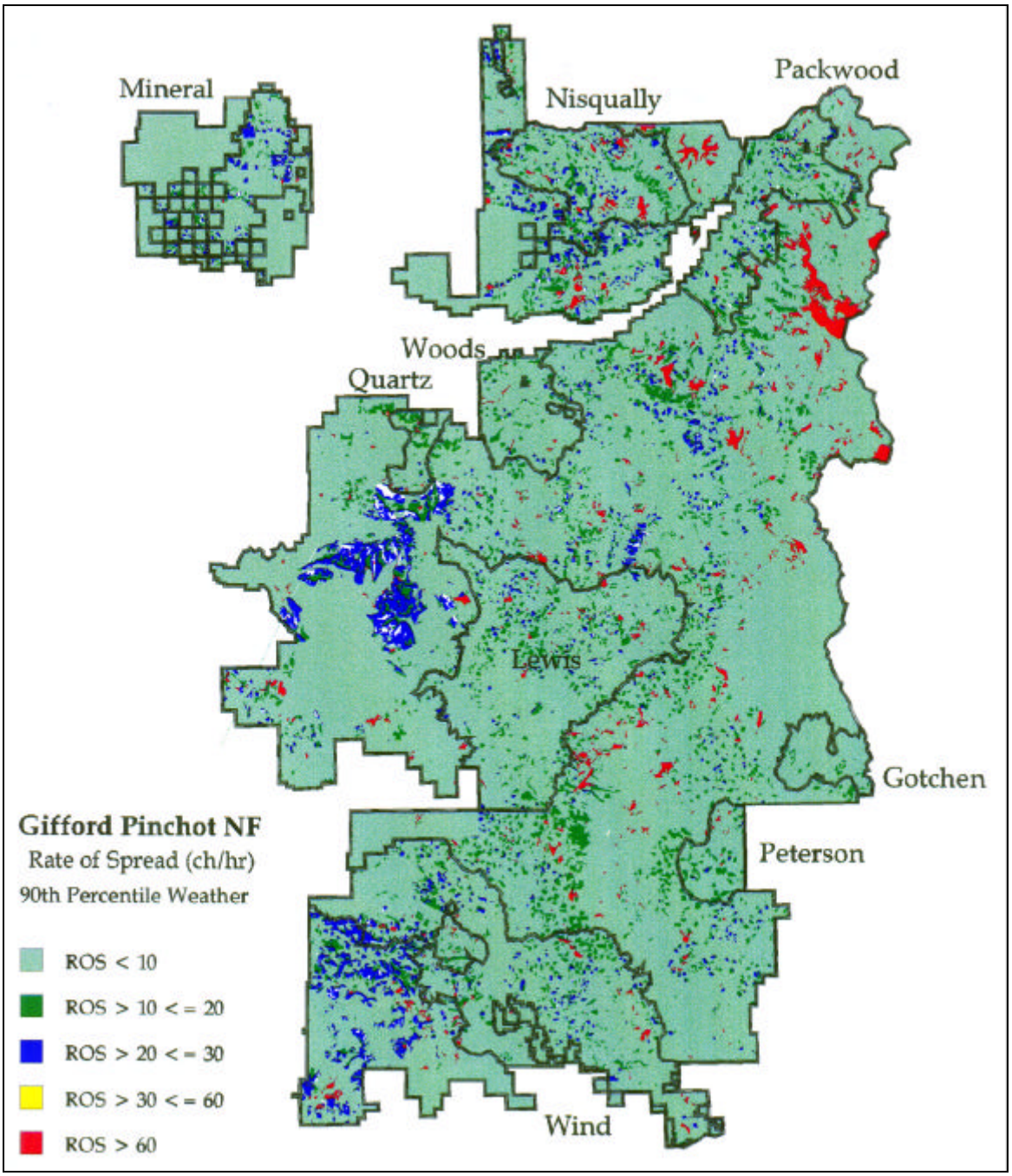
most wildfires should be able to be contained during the first burning period.

Map 6-6 and Map 6-8 depict the worst case scenarios (90 percentile). Those areas that indicate greater than 8 foot flame lengths and rates-of-spread exceeding 30 feet per minute will require that the fire management organization formulate how to provide protection to these stands and/or adjacent stands. This may include targeting these areas, or the adjacent stands, for stand manipulation to reduce possible overstocking and fuel loadings that have occurred in these high risk areas. If stand manipulation is not a viable treatment to reduce risk, there may be a need for extra-protection during high risk periods.

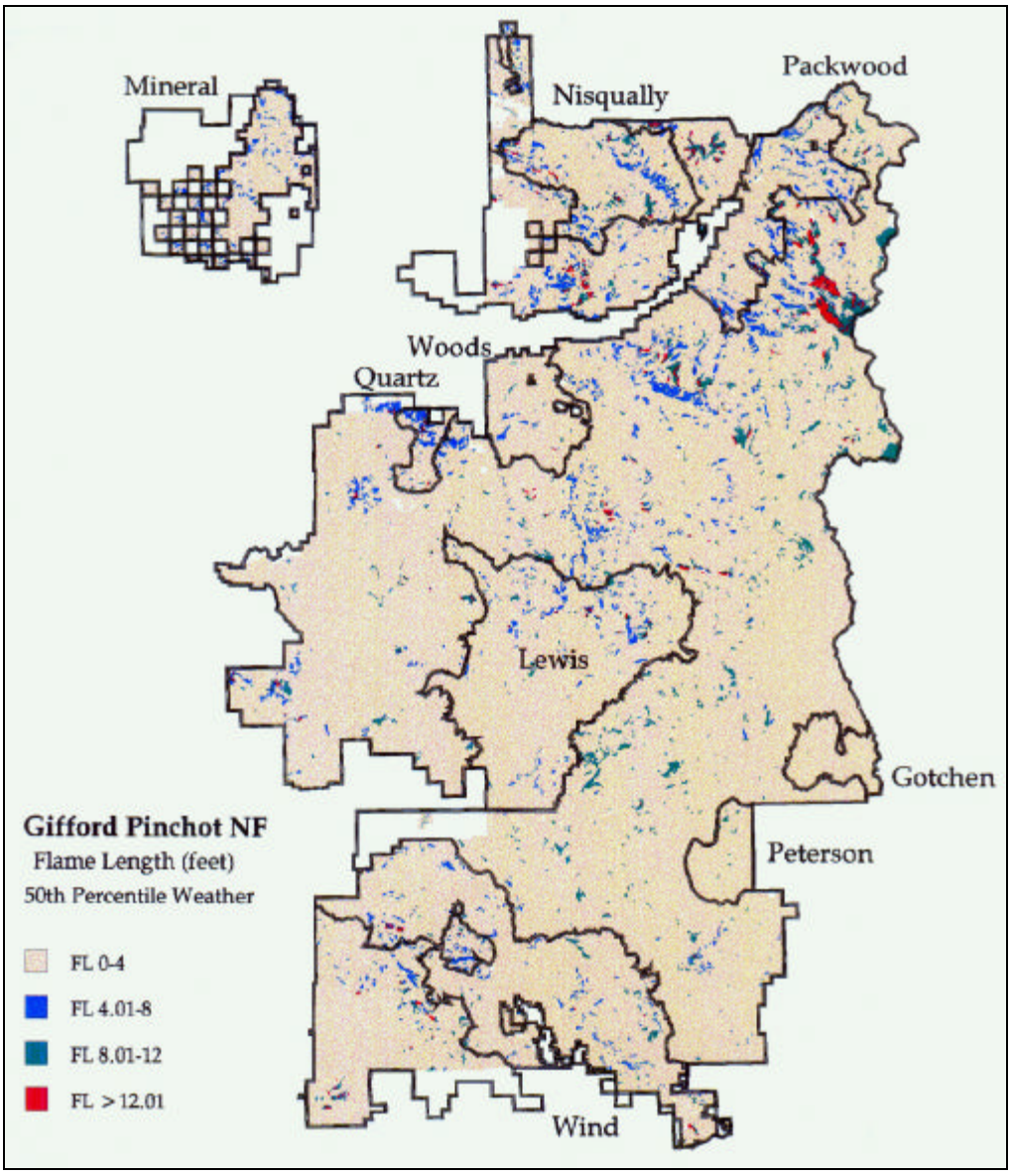
Map 6-5 Rate of Spread at 50th Percentile



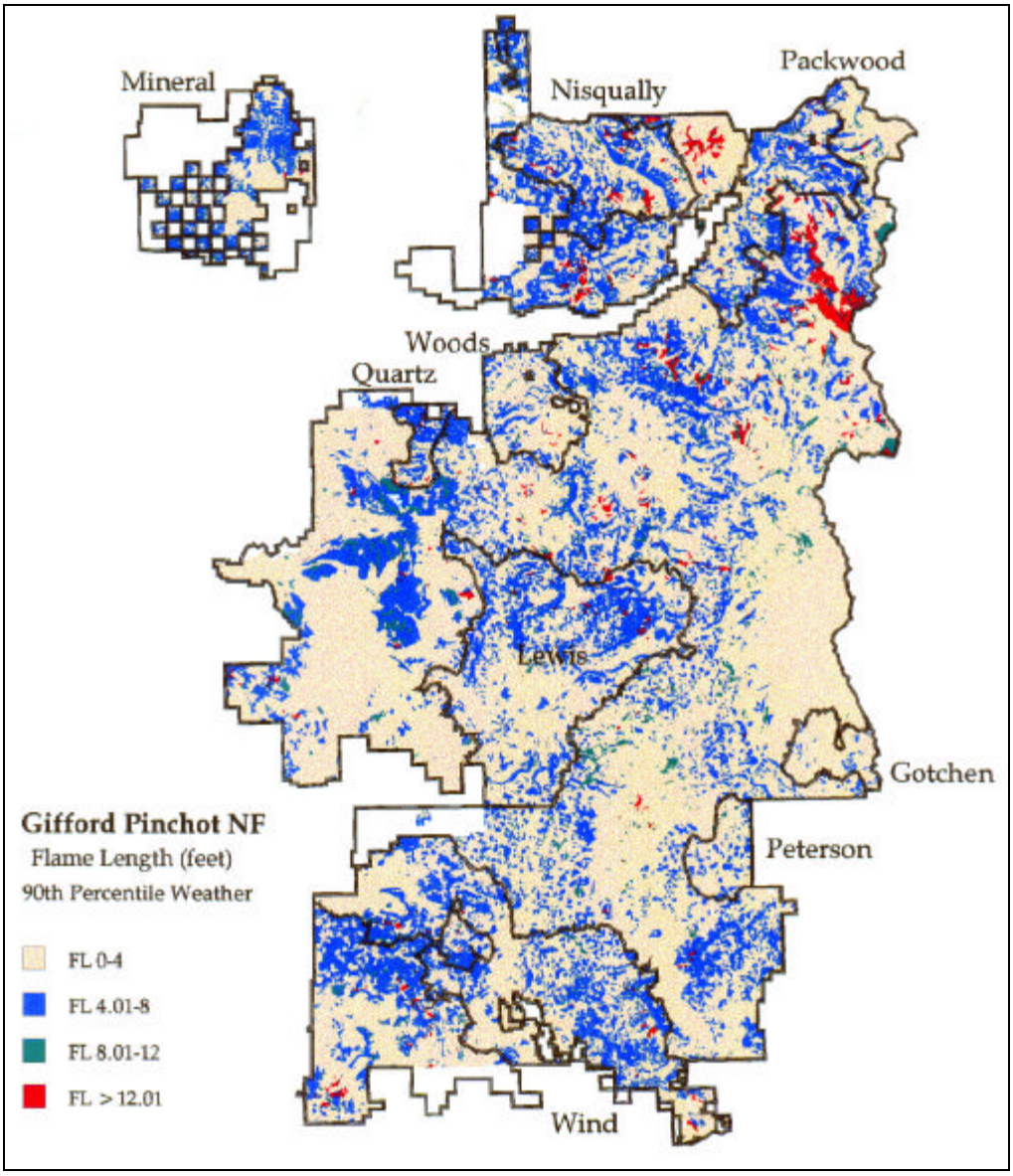
Map 6-6 Rate of Spread at 90th Percentile



Map 6-7 Flame Length at 50th Percentile



Map 6-8 Flame Length at 90th Percentile



6-4 Opportunities to Reduce Fire Risk - Treatment Alternatives

A number of viable options are available to the fire manager for wildfire hazard reduction measures which relate to proposed management activities.

Depending on stand age, stand condition and type of management activity prescribed, any of the following would be appropriate.

Risk assessments should be conducted on all proposed projects to determine wildfire hazard reduction commensurate with determined risk. Risk assessment needs to assess not only area being immediately effected by some type of treatment manipulation but also must take into account adjacent stand conditions. The goal of risk reduction treatments would be to provide protection and allow for the promotion of late-successional habitats.

Careful consideration for long-term planning needs to be done within Fire Groups 2 and 3. These are the warm, dry grand fir and Douglas-fir sites. Conditions currently are low to moderate, but the LSR (Gotchen) within these fire groups will have a higher susceptibility to insect and disease attacks creating potential pockets of high risk hazard. This LSR also has the highest potential for fire entry from outside, as it lays adjacent to private ownership which is currently experiencing an outbreak of spruce budworm. Consideration needs to be given to creating fuel breaks throughout the LSR to lessen the impact of a wildfire event.

Commercial Thin

Mechanical Treatment

Stand age 30+; minimal defect in bole wood; less than 40 percent crown ratio; minimize ground disturbance.

a. Whole tree yard - do not sever top from tree bole, do not buck tree in the woods.

b. Yard top with last log - tree may be bucked to acceptable log lengths. The top remains attached to the last log and is yarded to the landing.

Stand age 30+; defect and crown percent not a factor; minimal soil disturbance acceptable.

a. Machine pile - loader

b. Machine pile - dozer: Avoid disturbing large coarse woody debris. Dozer piling may result in excessive soil disturbance. Its use should be coordinated with the Forest soil scientist.

Prescribed Fire

Stand age 30+; Fire tolerant species (Douglas fir, ponderosa pine, western larch).

Use prescribed fire, where possible, to maintain fire climax conditions. Prescribed fire may increase viability of

Cypripedium fasciculatum
(Clustered lady's slipper),

Cyripedium montanum
(Mountain lady's slipper), and

Allotropa virgata
(Sugar stick).

Area Fire**.** Use prescribed fire over an area to reduce fine fuels (0-3 inch material). Since this treatment may have a short-term adverse impact on mycorrhizal systems, invertebrates, and small mammal populations, prescribed fire managers should consider use of a cool, spring burn to lessen impacts.

Jackpot Burning. Burn only those areas where fuel concentrations occur, generally small pockets.

Handpile and Burn. Pile concentrations of fuel residues that are generally less than 6 inches in diameter and burn during a period that would minimize risk of escape or extensive spread between piles.

Pile Burning. Determine if mechanically treated piles need to be burned. If they present little risk, they may remain on site. Piles may provide habitat for small mammals.

Lop and Scatter. Delimb boles that are to remain on the ground, and scatter limb material to avoid creating fuels concentrations.

Young Stand Thinnings

Type of hazard reduction, amount of treatment and type of treatment will vary depending upon roading and amount of human activity in proximity to young stand thinnings.

Mechanical

a. Use of smaller grapple/articulated thumb loader to create fuel breaks along adjacent skid trails, and/or roads.

b. Use of chipper - felled residue is pulled a specified distance from within the treated unit and chipped. Material may be sold or left on site. If left on site, it should be dispersed to avoid spontaneous combustion.

Other

a. Stewardship contracts - contractor may remove felled saplings, and prune remaining saplings for bough usage.

b. Lop - cut felled stems into specified length to promote faster decay of limb and bole.

c. Hand pull/pile and burn - generally applied within a given distance from road prism to create a fuel break.

d. Close access to area until wildfire risk is reduced by felled sapling decomposition and the fine fuels no longer present a fire risk.

Gap Creation, Structural Manipulation, Salvage

Due to limited harvesting within these type of activities, the fire manager needs to assess the risk, and need to treat fuels based on the fuelbed composition of adjacent areas.

Mechanical

a. Use a grapple/articulated thumb loader to pile residual slash.

Prescribed Fire

a. Use a “spring-like” underburn to reduce fine fuels and retain large, coarse woody material.

b. Jackpot burn pockets of high fuels concentrations.

c. Handpile and burn - pile residue less than 6 inches in diameter and burn.

Other

a. Lop and scatter - delimb remaining boles and scatter limbs to avoid creating fuel concentrations.

Other Treatment types

Meadow Restoration

Prescribed Fire: Use prescribed fire to retard seed/sapling reproduction and enhancement of grasses, sedges, flora and fauna related to this ecosystem.

Other: Lopping of seed/sapling to retard reproduction encroachment.

6-5 Ignition Management and Wildfire Suppression

Ignition Management

An analysis of statistical causes of ignition was completed for all the LSRs based on historical fire data for the period of 1972 - 1995 (Table 6-3). This assessment will assist the Forest and Districts in making LSR specific ignition management plans to reduce unwanted human ignitions. Ignition management plans will include specific actions to reduce these human caused ignitions (i.e., fire prevention signing and group/campground prevention programs), in conjunction with hazard risk reduction. The Ignition Manage-ment Plan is found in Chapter 20 of the *Fire Management Action Plan*.

Table 6-3 Number Of Fire Occurrences By LSR, Statistical Fire Cause And Decade.

			LSRs								
Description	**DECADE**	**Total**	**Gotchen**	**Lewis**	**Mineral**	**Nisqually**	**Packwood**	**Peterson**	**Quartz**	**Wind**	**Woods**
Arson	1972-1979	**7**		2			1			4	
Arson	1980-1989	**6**		1			1			4	
Arson	1990-1995	**3**		1		2					
Campfire	1972-1979	**52**	7	9		8	8	9		8	3
Campfire	1980-1989	**19**				5	6	2		5	1
Campfire	1990-1995	**22**		3	1	8	5	2		2	1
Children	1972-1979	**1**								1	
Children	1980-1989	**1**								1	
Children	1990-1995	**2**				1	1				
Debris Burning	1972-1979	**33**		12		4	4			13	
Debris Burning	1980-1989	**14**		7	1	1				4	1
Debris Burning	1990-1995	**4**		1			1	1		1	
Equipment Use	1972-1979	**10**	1	3	1	1		1		2	1
Equipment Use	1980-1989	**5**		1		1	1	1		1	
Equipment Use	1990-1995	**2**		1							1
Lightning	1972-1979	**100**	3	45	2	6	13	2		22	7
Lightning	1980-1989	**57**	6	12		10	6	8		15	
Lightning	1990-1995	**46**	3	29		2	5	2	1	2	2
Misc.	1972-1979	**14**		1		1	6			3	3
Misc.	1980-1989	**17**		2	2	2	3			8	
Misc.	1990-1995	**4**		1			1			1	1
Smoking	1972-1979	**21**		4			3	5		6	3
Smoking	1980-1989	**21**	2	3		1	4	3		7	1
Smoking	1990-1995	**7**		2			2	2		1	
Totals		**468**	**22**	**140**	**7**	**53**	**71**	**38**	**1**	**111**	**25**

Table 6-4 Acres Burned By LSR, Statistical Fire Cause And Decade.

Description	DECADE	Total	LSRs								
			Gotchen	Lewis	Mineral	Nisqually	Packwood	Peterson	Quartz	Wind	Woods
Arson	1972-1979	**2**		0			2			0	
Arson	1980-1989	**0**		0			0			0	
Arson	1990-1995	**0**		0		0					
Campfire	1972-1979	**0**	0	0		0	0	0		0	0
Campfire	1980-1989	**8**				8	0	0		0	0
Campfire	1990-1995	**1.7**		0.1	0.1	1.1	0.1	0.1		0.1	0.1
Children	1972-1979	**0**								0	
Children	1980-1989	**0**								0	
Children	1990-1995	**1**				0	1				
Debris Burning	1972-1979	**3678**		87		42	71			3478	
Debris Burning	1980-1989	**403**		144	0	0				259	0
Debris Burning	1990-1995	**12.1**		4			0.1	0		8	
Equipment Use	1972-1979	**0**	0	0	0	0		0		0	0
Equipment Use	1980-1989	**8**		0		7	0	1		0	
Equipment Use	1990-1995	**0**		0							0
Lightning	1972-1979	**21**	1	15	5	0	0	0		0	0
Lightning	1980-1989	**29**	2	2		3	1	0		21	
Lightning	1990-1995	**7.5**	0	1.3		0	0	0	6	0.1	0.1
Misc	1972-1979	**1**		0		0	0			1	0
Misc.	1980-1989	**18**		0	12	2	2			2	
Misc.	1990-1995	**4.1**		0			3			0.1	1
Smoking	1972-1979	**3**		1			0	0		2	0
Smoking	1980-1989	**0**	0	0		0	0	0		0	0
Smoking	1990-1995	**0.3**		0.2			0	0.1		0	
Totals		**4197.7**	**3**	**254.6**	**17.1**	**63.1**	**80.2**	**1.2**	**6**	**3771.3**	**1.2**

Wildfire Suppression

A wildfire is any wildland fire that does not meet management objectives, and therefore requires an appropriate suppression response. The appropriate suppression response on a wildfire most efficiently meets fire management direction under current and expected burning conditions. The response ranges from a strategy of prompt control at the smallest acreage possible to one of containment or confinement.

Fire as a natural disturbance agent may either set back the elements desired within the late-successional forests or have a beneficial influence on the forest's future resiliency, depending on current stand conditions and fire behavior. Our goal is to protect and promote late-successional habitat, while allowing important processes to continue.

Table 6-5 Appropriate Suppression Response Guideline (See Glossary for definition of terms)

LSR	Stand Diameter (inches)	FIRE BEHAVIOR CONDITION		
		Smoldering/Creeping	1 - 2 ft. Flame Lengths	>2 ft. Flame Lengths
Mineral	< 12	control	control	control
	> 12	confine/contain to < 5 ac.	contain/control to < 5 ac.	control
Nisqually	< 12	control	control	control
	> 12	confine/contain to < 5ac.	contain/control to < 5 ac.	control
Packwood	< 12	control	control	control
	> 12	confine/contain to < 5 ac.	contain/control to < 5ac.	control
Woods	< 12	control	control	control
	> 12	(1)confine/contain (2)confine/contain to < 5ac.	(1)confine/contain (2)contain/control to <5 ac	control
Quartz	< 12	control	control	control
	> 12	confine/contain to < 5 ac.	contain/control to < 5 ac.	control
Lewis	< 12	control	control	control
	> 12	confine/contain to < 5ac.	contain/control to < 5ac.	control
Wind	< 12	control	control	control
	> 12	confine/contain to < 5 ac.	contain/control to < 5ac.	control
Peterson	< 12	control	control	control
	> 12	(3)confine/contain (2)contain/control to < 5 ac.	(3)confine/contain (2)contain/control to <5 ac	control
Gotchen	< 12	(3)confine/contain (2)control	control	control
	> 12	(3)confine/contain (2)confine/contain to <5 ac.	(3)confine/contain (2)contain/control to <5 ac	control

(1) Those stands which are primarily even-age Douglas-fir
(2) All other stands
(3) Those stands which are primarily Ponderosa pine, Douglas-fir, Western Larch

The Appropriate Suppression Response Guideline was developed to help the Line Officer and Fire Management determine potential appropriate suppression strategy based on a current and/or expected fire behavior condition and diameter size classes within the given LSRs. First Order Fire Effects Model (FOFEM) was used to help determine effects on tree/stand mortality thresholds.

These are to be used as guidelines. The fire manager will make on-the-ground decisions based on their knowledge of current and expected conditions.

Five acres was chosen as upper acreage limit to maintain neutral or benefiting effects. This will allow for the creation of patch openings and canopy gaps.

Areas of Exception. Within all of the Late-Successional Reserves there will be areas designated high priority for suppression protection. In general, these will be older forest patches and connections with interior habitats, spotted owl/marbled murrelet activity centers, sensitive plant populations, and riparian areas in watersheds with high anadromous fish populations.

Minimum Impact Suppression Tactics (MIST)

Late-Successional Reserves standards and guidelines require the use of MIST designed to minimize the size of the wildfire while producing the least possible impact on late-successional and old-growth habitat. Elements of particular concern are late-successional and old-growth stands, snags, downed woody material, and duff. Moody and Mohr (1988) developed a guide for MIST, which is recommended for use on both wildfire suppression and mop-up of prescribed fires within LSRs and Riparian Reserve boundaries. Minimum impact tactics include such practices as:

- Minimize constructed fireline and fireline width, consider use of fireline explosives (FLE), cold-trailing, and wet line to lessen impacts from constructed line.
- Minimize bucking and felling 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 felling them, provided they do pose a significant safety risk to firefighters or pose a significant risk of spotting outside the fireline.
- Limit use of bulldozers to slopes or less than 25 percent.
- Minimize bucking during mop-up; instead attempt to roll logs to extinguish the fire.
- Extinguish smoldering logs as soon as possible.

MIST guidelines may be found in the *Fire Management Action Plan*, Chapter 30.

Post Fire Rehabilitation

Needs should be quickly identified and associated work should be ecologically appropriate for the site and completed in the prescribed time frame.

6-6 Monitoring

The following monitoring questions will be used in assessing risk reduction and fire suppression activities within LSRs.

- Have the risk reduction measures and appropriate suppression response guidelines provided for firefighter and public safety?
- Have risk reduction measures been sufficient in reducing loss of habitat?
- Has the use of the appropriate suppression response guideline aided the Fire Manager in the use of strategies appropriate for the fire behavior and stand conditions encountered?
- Has the use of Minimum Impact Suppression Tactics been successful, given the constraints for LSR and Riparian Reserve management?
- Has the Escaped Fire Situation Analysis (EFSA) provided clear direction to the Incident Management Team (IMT) on meeting LSR and Riparian Reserve objectives?

Literature Cited

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Hogfoss, Robert Draft “Fire History of the Gifford Pinchot” 1984.

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Moody and Mohr 1988. “MIST” Guidelines.

Siskiyou National Forest “Southwest Oregon Late-Successional Reserve Assessment” 1995.

Wenatchee National Forest “Wenatchee National Forest LSR Assessment” 1996.

“Gifford Pinchot Fire Management Action Plan” Chapter 20 and 30.

Glossary

Appropriate Suppression Response - The kind, amount and timing of suppression resource dispatch to a wildfire which minimizes cost and meets fire management direction under current and expected burning conditions. It may range from the dispatch of resources to implement suppression strategies confine, contain, or control.

Confine strategy - to utilize natural or pre-constructed barriers, or environmental conditions, to restrict fire spread within a predetermined area. Suppression action could be minimal, and may be limited to surveillance under appropriate conditions.

Contain strategy - to surround a fire, and any spot fires therefrom, with a control line as needed, which can reasonably be expected to check the fire's spread under prevailing and predicted conditions.

Control strategy - to complete the control line around a fire, any spot fires therefrom, and any interior islands to be saved; burn out any unburned area adjacent to the fire side of the control line; cool down all hot spots that are immediate threats to the control line, until the line can reasonably be expected to hold under foreseeable conditions.

Crown fire - A fire burning into the crowns of the vegetation, generally associated with an intense understory fire.

Fire frequency - The return interval of fire.

Fire intensity - Intensity will vary depending on fuel loading and distribution, and site weather and moisture conditions at the time of the fire.

Fire regime - The combination of fire frequency, predictability, intensity, seasonally, and extent characteristic of fire in an ecosystem.

Fire severity - The effect of fire on plants. For trees, severity is often measured as percentage of basal area removed.

Flame length - The distance along the slant of the flame from the midpoint of its base to its tip

Fuel size classes - Dead fuels are divided into size classes based on diameter: less than ¼ inch, ¼ to 1 inch, 1 to 3 inches, and greater than 3 inches. Fuel size is related to the rate at which moisture is gained or lost.

Prescribed fire - A fire ignited under known conditions of fuel, weather, and topography to achieve specified objectives.

Rate of spread - The rate at which a fire moves across the landscape, usually measured in feet/minute or chains/hour.

Chapter 7

Monitoring

Chapter 7
Monitoring

Monitoring is an essential component of natural resource management because it provides information on the relative success of management strategies. (ROD p. E-1) Monitoring will determine if standards and guidelines are being followed, verify if they are achieving the desired results and determine if underlying assumptions are correct. The following items were identified as important monitoring questions in the NWFP, Gifford Pinchot Forest Plan, or the treatments proposed in Chapters 5 and 6. These questions will be considered by managers formulating annual monitoring programs. This list is not all inclusive:

1. Are projects consistent with standards and guidelines and with Regional Ecosystem Office review requirements? (ROD p. E-5)
2. What kinds and scales of management activities are implemented within LSRs?
3. Are management activities consistent with the recommendations of this Assessment? (ROD p. E-5)
4. Were the stocking density and species distribution goals achieved in young stand thinnings? (p. 5-1)
5. Are stocking control treatments accelerating the development of late-successional characteristics? (p. 5-1, 5-2)
6. Were objectives for snags, down wood, stand density and diversity met in silvicultural activities? (p. 5-3)
7. What is the trend in fire hazard associated with insects and disease in the Gotchen LSR? (p. 5-14)
8. Are risk reduction treatments for the Gotchen LSR effective in reducing risk and restoring resiliency to insect and disease. (p. 5-14)
9. Are the snag numbers displayed Table 5-4 present in treatment areas? (p. 5-22)
10. Are partial cut and salvage treatments meeting goals for down wood described in Down Wood Management? (p. 5-26)
11. Are treatments to reduce white pine blister rust effective in reducing blister rust and related white pine mortality? (p. 5-34)
12. Is new road construction consistent with LSR objectives and does it minimize impact to late-successional habitat? (p. 5-36, ROD p. C-16)
13. Is salvage of disturbances with greater than 40 percent canopy cover confined to the fuel management zone in Gotchen LSR? (p. 5-43)
14. Is habitat for meadow-inhabiting TES plant species at risk from encroaching vegetation? (p. 5-47)
15. Are noxious weed treatments effectively eradicating or controlling their spread? (p. 5-48)
16. Are quarries being developed to minimize their impact on late-successional habitat? (p. 5-50)
17. What kinds and amounts of special forest products are being gathered for personal and commercial use within LSRs? (p. 5-53)
18. Are Native American's trust resources perpetuated and their access to these resources unimpaired? (p. 5-55, ROD p. 54)
19. Have risk reduction measures and appropriate suppression response guidelines provided for firefighter and public safety? (p. 6-17)