South Coast - Northern Klamath Late-Successional Reserve Assessment

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Bureau of Land Management
Department of the Interior
and the
Mapleton Ranger District
Siuslaw National Forest
Department of Agriculture

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Table of Contents

III. Conditions of the LSRAs for Wildlife and Plant Species

IV. Criteria For Developing Appropriate Treatments

List of Tables

List of Maps

Appendices

Executive Summary

The South Coast - Northern Klamath Late Successional Reserve Assessment (LSRA) was developed to provide supplemental management guidance for all or portions of 10 mapped Late Successional Reserves (LSRs) and all unmapped LSRs within the southwest Oregon assessment area. LSRAs are required by the *Record of Decision for the Amendments to Forest Service and Bureau of Land Management Planning documents Within the Range of the Northern Spotted Owl* (ROD). This LSRA addresses management on 257,594 acres of federal lands in LSRs in three BLM Districts (Coos Bay, Roseburg and Medford) and the Mapleton Ranger District of the Siuslaw National Forest. The final LSRA has been modified to reflect the assumptions made by REO in their review memorandum dated May 20, 1998.

As established by the ROD, goals of LSRs are to: Protect and enhance conditions of late-successional and old-growth forest ecosystems; and Create and maintain biological diversity associated with native species and ecosystems. To meet these goals, this LSRA provides the Desired Future Conditions and criteria for developing appropriate treatments at the landscape and stand levels:

Landscape Level
LSR Priorities for Management Actions LSRs 261, 263 and 259 have the highest priority for management. Although it is expected that most emphasis will be focused on these LSRs, the ranking system does not imply that there will not be management activities in the Medium and Low Priority LSRs.

Management Priorities within LSRs Within LSRs, the following treatment priorities (not necessarily in order) are recommended: Enlarge existing interior late-successional habitat blocks, Improve habitat connections between LSRs, Maintain and improve connectivity habitat within LSRs, and Create additional large blocks of late successional habitat where they are absent.

Guidelines for Treatments This LSRA provides further guidelines to assist land managers in meeting LSR goals and objectives with specific recommendations in the following areas:

- Emphasizing treatments in plantations and thinned stands
- Maintaining connectivity habitat within LSRs
- Retaining interior habitat conditions
- Maintaining/improving Northern Spotted Owl habitat

Stand Level criteria for developing appropriate treatments include: **Salvage Guidelines, Risk Reduction and management.** A number of **silvicultural** and **non-silvicultural** actions are discussed to help attain late successional habitat conditions.

Implementation Based on application of the treatment guidelines, an estimate of treatment opportunities and projects costs of implementation is provided.

List of Acronyms used in this document

ACEC	Areas of Critical Environmental Concern
ACS	Aquatic Conservation Strategy
ATM	Access and Travel Management
BLM	Bureau of Land Management
C/DB	Connectivity/Diversity Blocks
CHU	Critical Habitat Unit
CWD	Coarse Woody Debris
dbh	Diameter breast height
EA	Environmental Analysis
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
FEMAT	Forest Ecosystem Management Assessment Team
FSEIS	Final Supplemental Environmental Impact Statement
GFMA	General Forest Management Area
GIS	Geographic Information System
GLO	General Land Office
HCP	Habitat Conservation Plan
JIW	Jobs in the Woods
LRMP	Land and Resource Management Plan
LS/OG	Late-Successional/Old-Growth
LSR	Late-Successional Reserve
LSRA	Late-Successional Reserve Assessment
LUA	Land Use Allocations
MLSA	Managed Late-Successional Reserve
NEPA	National Environmental Policy Act
NF	National Forest
NRA	National Recreation Area
NRF	Nesting, roosting, and foraging
NWTIC	Northwest Tree Improvement Cooperative
ODA	Oregon Department of Agriculture
ODF	Oregon Department of Forestry
ODFW	Oregon Department of Fish and Wildlife
OHV	Off Highway Vehicle
RD	Ranger District
REO	Regional Ecosystem Office
RMP	Resource Management Plan
ROD	Record of Decision
S&M	Survey and Manage
T&E	Threatened and Endangered
TMO	Transportation Management Objectives
TPCC	Timber Productivity Capability Classification
USDA	United States Department of Agriculture
USDI	United States Department of Interior
WEYCO	Weyerhaeuser Company

I. Introduction

This Late-Successional Reserve Assessment (LSRA) was developed to help facilitate implementation of appropriate management activities for the Late-Successional Reserve (LSR) and assure that these activities meet the LSR standards and guidelines and further LSR objectives. It presents sideboards for determining where and when to employ various management techniques.

LSRAs are required by the *Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl* (ROD) and the *Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl* (USDA et al. 1994). These assessments, for each LSR (or group of smaller LSRs), are to be developed prior to habitat manipulation activities.

Background

LSRs were created to provide a distribution of late-successional forests sufficient to avoid foreclosure of options for the management of late-successional species (ROD B-4, 5). The network of LSRs throughout the range of the northern spotted owl, are deemed to be sufficient over time, in quality and quantity, to provide habitat which supports viable populations of species that are associated with late-successional forests. The LSR network will help ensure that native species diversity will be conserved (Map 1).

Throughout this document, the term late-successional will be used to define both mature and old-growth seral stages of forest development (stands greater than 80-years of age). Unless noted, acres displayed and used for analysis in this document have been derived from Geographic Information System (GIS) data.

The following goals and objectives have been established for LSRs by the ROD:

Objective: To protect and enhance conditions of late-successional forest ecosystems, which serve as habitat for late-successional and old-growth forest related species. LSRs are designed to maintain a functional, interacting late-successional ecosystem.

Goals:
1. Protect and enhance conditions of late-successional and old-growth forest ecosystems.
2. Create and maintain biological diversity associated with native species and ecosystems.

In response to these goals and objectives, all management within LSR boundaries on federal lands must assure the protection and/or enhancement of conditions of late-successional forests. The standards and guidelines of the ROD govern all management activities in the LSRs. This LSRA is tiered to the ROD.

Area Included in This Assessment

This LSRA covers 10 mapped (LSRs 251, the portion of 255 not included in the Siskiyou National Forest, 257, 259, 260, 261, 263, 264, 265, and 267) and the unmapped LSRs on lands administered by the Bureau of Land Management (BLM) on the Coos Bay, Roseburg, and Medford Districts, and the U.S. Forest Service Siuslaw National Forest on the Mapleton Ranger District (Map 2). The assessment area ranges from about the Smith River drainage on the north to the California border on the south, west to the Pacific Ocean, and east approximately to Interstate 5. This grouping of LSRs into one assessment occurred due to their proximity and interdependence on each other. Although shown on Map 2, the assessment area does not include the Siskiyou National Forest. The LSRs on the Siskiyou National Forest and a portion of the BLM Medford District, have been covered in the *Southwest Oregon LSRA* (USDA, 1995). This LSRA also excludes LSR RO 267 on the Siuslaw National Forest and a portion of the BLM Coos Bay, Roseburg, and Eugene Districts which has been included in the *Oregon Coast Province - Southern Portion LSRA* (USDA, 1997). The LSRs to the north (RO 267), to the east on the Siskiyou National Forest, and to the south on the Six River National Forest (in California) of this assessment area tie to and influence the populations and dispersal of species within this LSRA.

Approximately 80 percent of the assessment area is within the Oregon Coast Range Province, 19.7 percent is within the Klamath Province, and 0.3 percent is within the Oregon Western Cascade Province.

The lands included in this LSRA are displayed in Table 1.

Context of this LSRA Within the Southern Oregon Coast and Western Klamath Provinces

Within the LSRA area, lands administered by the BLM and Forest Service would be managed under the Land Use Allocations (LUA) as described in the Northwest Forest Plan ROD. The major LUAs in the assessment area are LSRs, Managed LSRs, Administratively Withdrawn Areas, Riparian Reserves, and Matrix. The ROD provides the following guidelines for these LUAs:

> **LSRs** are identified with an objective to protect and enhance conditions of late-successional and old-growth forest ecosystems, which serve as habitat for late-successional and old-growth forest related species including the northern spotted owl. There are two components of LSRs, mapped and unmapped. Mapped LSRs include all LS/OG 1s and 2s within Marbled Murrelet Zone 1, and 100 acres around known spotted owl activity centers. Unmapped LSRs and Managed LSRs include areas around occupied marbled murrelet sites and certain Protection Buffer species. These reserves represent a network of existing old-growth forests that are retained in their natural condition with natural processes, such as fire, allowed to function to the extent possible. The reserves are designed to serve a number

Table 1. Acres Within Assessment Area by Province, District, and Individual LSR						
Province	BLM District			Siuslaw NF	LSR Number	Total Acres [1]
	Coos Bay	Roseburg	Medford	Mapleton RD		
Oregon Coast Range	2,478				260	2,478
	59,656	10,701			261	70,357
	28,048	32,511			263	60,559
		15,320			264	15,320
	19,362			25,531	265	44,893
	10,800	1,596			266	12,396
Sub Total	120,344	60,128	0	25,531		206,003
Oregon Klamath	1,869				251	1,869
	2,396				255 [2]	2,396
	2,592				257	2,592
		39,083	2,285		259	41,368
	2,319				260	2,319
		254			261	254
Sub Total	9,176	39,337	2,285	0		50,798
Oregon Western Cascade		793			264	793
Total	129,520	100,258	2,285	25,531		257,594

1 Acres are derived from GIS, does not include unmapped LSR acres
2 The majority of LSR 255 is on the Siskiyou National Forest and is included in the *Southwest Oregon LSRA*. This assessment excludes the acreage on the Siskiyou National Forest.

of purposes. First, they provide a distribution, quantity, and quality of old-growth forest habitat sufficient to avoid foreclosure of future management options. Second, they provide habitat for populations of species that are associated with late-successional forests. Third, they will help ensure that late-successional species diversity will be conserved.

Limited stand management is permitted within LSRs, generally in stands under the age of 80-years, subject to review by the Regional Ecosystem Office.

Managed LSRs are similar to LSRs but are identified for certain owl locations in the drier provinces where regular and frequent fire is a natural part of the ecosystem and for certain Protection Buffer species. Managed LSRs prohibit or limit activities that otherwise appear to be within the matrix, or some other land allocation. Certain silvicultural treatments and fire hazard reduction treatments are allowed to help prevent complete stand destruction from large catastrophic events such as high intensity, high severity fires; or disease or insect epidemics.

Administratively Withdrawn Areas are identified in current Forest and District Plans or draft plan preferred alternatives and include recreation and visual areas, back country, and other areas where management emphasis precludes scheduled timber harvest.

Riparian Reserves provide an area along all streams, wetlands, ponds, lakes, and unstable and potentially unstable areas where riparian-dependent resources receive primary emphasis. Riparian Reserves are important to the terrestrial ecosystem as well, serving, for example, as dispersal habitat for certain terrestrial species. Riparian Reserves are portions of watersheds where riparian-dependent resources receive primary emphasis and where special standards and guidelines apply. Standards and guidelines prohibit and regulate activities in Riparian Reserves that retard or prevent attainment of the Aquatic Conservation Strategy (ACS) objectives. Riparian Reserves include those portions of a watershed directly coupled to streams and rivers, that is, the portions of a watershed required for maintaining hydrologic, geomorphic, and ecologic processes that directly affect standing and flowing waterbodies such as lakes and ponds, wetlands, streams, stream processes, and fish habitats. Riparian Reserves include areas designated in current plans and draft plan preferred alternatives as riparian management areas or streamside management zones and primary source areas for wood and sediment such as unstable and potentially unstable areas in headwater areas and along streams. Riparian Reserves occur at the margins of standing and flowing water, intermittent stream channels and ephemeral ponds, and wetlands. Riparian Reserves generally parallel the stream network but also include other areas necessary for maintaining hydrologic, geomorphic, and ecologic processes.

As a general rule, standards and guidelines for Riparian Reserves prohibit or regulate activities in Riparian Reserves that retard or prevent attainment of the ACS objectives. Watershed analysis and appropriate National Environmental Protection Act (NEPA) compliance is required to change Riparian Reserve boundaries in all watersheds.

The Matrix consists of those federal lands outside the categories of designated areas listed above. The Matrix is an integral part of the management direction included in these standards and guidelines. Production of timber and other commodities is an important objective for the Matrix. However, forests in the Matrix function as connectivity between Late-Successional Reserves and provide habitat for a variety of organisms associated with both late-successional and younger forests. Standards and guidelines for the Matrix are designed to provide for important ecological functions such as dispersal of organisms, carryover of some species from one stand to the next, and maintenance of ecologically valuable structural components such as down logs, snags, and large trees. The Matrix will also add ecological diversity by providing early-successional habitat.

On BLM administered lands, two components of the Matrix LUA provide for different management strategies. The General Forest Management Area (GFMA) would be more intensively managed for commodity production, with final harvest occurring at the culmination of mean annual increment, generally between the ages of 60 and 110 years within the assessment area. The Connectivity/Diversity Blocks (C/DB) would be managed on a 150-year area control rotation, retaining 25 to 30 percent of each block in late-successional forest at any point in time.

Two major land owners within the assessment area, the Oregon Department of Forestry and the Weyerhaeuser Company, have committed management to occur under the terms of Habitat Conservation Plans. The following is a brief summary of each:

The Elliott State Forest Habitat Conservation Plan (Oregon Department of Forestry Coos District, 1995) divided the 93,564 acre State Forest into 17 management basins averaging approximately 5,500 acres each. The conservation strategy uses an ecosystem-based landscape management approach to provide and maintain habitat for the northern spotted owl and marbled murrelet that recognizes both the coarse and fine filter components. The strategy manages ecosystems to provide a range of habitat types and structural conditions at both the forest and stand level. This objective is accomplished through the manipulation of stand age, management unit rotation length, species composition, and stand heterogenity through creation of snags and retention of green trees. The strategy will develop the following landscape structures:

- Three successional forest types - older, late-successional forests; middle-aged, mid-successional forests: and younger, early-successional forests.
- Corridors linking the three forest types.
- Matrix conditions across the forest, ensuring a minimum mix of stand ages (minimizing fragmentation).
- Late-successional reserves to protect and enhance biodiversity and T&E species habitat.

Various blocks of forest habitat will be managed for non-commodity values. These reserve areas include zones adjacent to fish-bearing streams and areas with special interests, including Habitat Conservancy Areas. The Habitat Conservancy Areas are areas with a high present value for spotted owls, marbled murrelets, and fish, or areas that can become high valued areas, are protected. The Habitat Conservancy Areas are located in all management basins, and vary between 3 and 25 percent of the basins. A total of 6,961 acres are in Habitat Conservancy Areas. No clearcut harvesting will be allowed in Habitat Conservancy Areas. Only limited forest management activities will be allowed, to meet other forest management needs, or as necessitated by management of other stands.

Riparian reserves and protection buffers between 50 and 100 feet will be retained along both sides of fish-bearing and perennial non-fish-bearing streams. These riparian reserves will provide streamside protection, contribute to the protection of aquatic species, and link areas of older forest structure between and within management basins and Habitat Conservancy Areas. Approximately 5,889 acres, or 7.3 percent of the matrix lands, are in no harvest riparian reserves.

Other reserves within the forest have been designated for a variety of non-timber production goals. Examples include scenic conservancy, protective conservancy, and noncommercial forest. A total of 5,667 acres are in these non-timber land use classifications. All reserves combined total 18,060 acres, or 19 percent of the forest.

The remaining 74,794 acres or 81 percent of the Elliott State Forest will be managed as matrix lands. These lands will be managed for timber production in a way that allows other resource values to be emphasized. The 17 management basins will be managed at different rotation lengths, in order to reverse past timber harvest patterns that fragmented the forest, and to increase the development of superior habitat for owls and murrelets over time. Three basins (17,794 acres) will be managed on a 240-year rotation, and three basins (19,001 acres) will be managed on a 200-year rotation with management emphasis on late-successional forest. Three basins (14,363 acres) will be managed on a 160-year rotation with management emphasis on mid/late-successional forest. One basin (5,078 acres) will be managed on a 135-year rotation with management emphasis on mid-successional forest. Seven basins (36,618 acres) will be managed on an 80-year rotation with management emphasis on early/mid-successional forest.

The *Habitat Conservation Plan for the Northern Spotted Owl Millicoma Tree Farm Coos and Douglas Counties, Oregon* (Weyerhaeuser Company North Bend, Oregon 1995) committed management of the approximately 209,000 acre Weyerhaeuser Company Millicoma Tree Farm to develop a landscape conducive to the dispersal of juvenile spotted owls in the shortest time practicable. The desired landscape condition will be achieved by 2015, and will be maintained until 2045. This initial 50 years will be important to the maintenance of local owl populations due to depressed habitat conditions on adjacent federal lands. After 2045, standard forest management as practiced by Weyerhaeuser will tend to maintain the dispersal landscape at the 2015 level. The dispersal landscape will be created by adjusting the size and spacing of forest stands and the relative distribution of different forest age classes. Once the appropriate conditions are created through the measures described in the Habitat Conservation Plan, standard forest practices will tend to maintain them. Deviations from the optimum landscape condition would occur only if there were a significant change in forest technology or timber markets that caused Weyerhaeuser to substantially change its management practices.

Under the Habitat Conservation Plan Weyerhaeuser will use advanced forestry techniques to provide this dispersal habitat. The company will guarantee that 40 percent of its 209,000-acre tree farm will meet dispersal habitat standards within 20 years, and will sustain them for at least the 50-year term of the agreement. Further, virtually all, or 99 percent of the tree farm, will have no gaps greater than 3 miles in distance between stands meeting specified dispersal habitat conditions. These dispersal habitat standards will greatly increase survival rates for juvenile owls moving through the tree farm. Weyerhaeuser will also leave over 1,900 acres of existing mature forest to augment public land habitat needs until 2015, or until the dispersal habitat requirements are met in the younger forest, whichever is later.

Table 2 shows the current age class distribution by ownership within the assessment area. As each owner maintains their inventory data in a slightly different manner, some combining of age classes has been shown in the table.

Due to limitations in the GIS data sets, acres of BLM lands displayed as GFMA and C/DB in Table 2 are gross acres, that is, the acres of Riparian Reserves and Administratively Withdrawn areas are included within the totals for these two LUAs. For example, within the Coos Bay district approximately 89,600 acres of Riparian Reserves and 20,400 acres of Administratively Withdrawn lands are included in the GFMA and C/DB LUAs. The net GFMA in the Coos Bay district is approximately 55,300 acres, and the net C/DB is 6,600 acres.

Table 3 shows the proposed management rotations by ownership within the assessment area. The acres of GFMA and C/DB shown in Table 3 are net acres, that is the acres of Riparian Reserves and Administrative Withdrawals have been removed. Within the Coos Bay district, the net acres of GFMA is approximately 34 percent, and C/DB is approximately 30 percent of the gross acres. Within the Roseburg district the net acres of both GFMA and C/DB is approximately 51 percent of the gross acres. It is assumed that the net acres of Matrix lands on the Siuslaw National Forest is 34 percent of the gross acres, and that the net percentages for the Medford District is 51 percent.

If one assumes that most other ownerships within the assessment area have either converted forest lands to other uses or will manage their timber lands on less than a 80-year rotation, then only the lands managed as LSRs or other withdrawals by federal agencies and the longer rotation areas on the Elliott State Forest will continue to support late-successional habitat. Given this assumption, about 19.7 percent of the vegetation within the assessment area will be in the late-successional seral stage in the long-term.

How This assessment Will be Used

LSRAs are not decision documents. They are intended to establish criteria and recommendations which will provide managers with the necessary information to make informed decisions.

LSRAs provide a context at the landscape scale for such things as disturbance regimes, vegetative parameters and functional roles of different portions of the landscape. Finer scale assessments such as watershed analysis can use this information to understand the significance of local areas to the larger landscape.

Along with other planning documents, this LSRA provides a landscape strategy for implementation of restoration activities by prioritizing treatment areas and itemizing types of appropriate treatments. In doing so, the LSRA facilitates inter-agency working agreements about the type and timing of treatments across the landscape.

Table 2. Acres of Current Age Class Distribution by Ownership Within Assessment Area										
	BLM			Siuslaw National Forest			ODF [1]	WEYCO [2]	Other [3]	Total
Age Class [4]	LSR	C/DB [5]	GFMA [5]	LSR	Matrix [5]	Dunes NRA [6]				
0-39 years	87,222	18,171	121,384	2,977	1,950		(0-35) 36,569	171,517		439,790
40-79 years	16,258	6,439	38,716	456	193		(36-75) 4,420	25,147	1,785,519	1,877,148
80-200 years	49,237	13,918	49,198	22,090[7]	3,000[7]		(76-155) 43,772	8,727		189,942
200 +	76,657	10,658	24,293				(155 +) 307	2,727		114,642
Non-Forest/ Non-Productive [8]	2,689	237	4,212	8	226	29,545	8,496	882		46,295
Total	232,063	49,423	237,803	25,531	5,369	29,545	93,564	209,000	1,785,519	2,667,817

1 Oregon Department of Forestry within the Elliott State Forest Habitat Conservation Plan area
2 Weyerhaeuser Company within the Millicoma Tree Farm Habitat Conservation Plan area
3 Data for other ownerships not readily available, assumed to be less than 80 years of age
4 Age class, where different are shown in parentheses
5 See explanation in text
6 Age class breakdown not available for the Dunes NRA
7 Age class of unmanaged stands not available, assumed to be greater than 80 years
8 Non-productive relates to timber management

Table 3. Acres of Proposed Management Rotations by Ownership Within the Assessment Area								
	Federal				ODF [1]	WEYCO [2]	Other [3]	Total
Rotation	GFMA [4]	C/DB [4]	LSR	Other Withdrawls [5]				
Less than 80 years						203,550	1,786,229	1,989,779
60 to 110-years [6]	95,698				29,174			124,872
135-years					4,433			4,433
150-years		20,549						20,549
160-years					11,168			11,168
200-years					16,066			16,066
240-years					13,953			13,953
No final harvest proposed			257,594	205,893	18,060	5,450 [7]		486,997
Total	95,698	20,549	257,594	205,893	92,854	209,000	1,786,229	2,667,817

[1] Oregon Department of Forestry Elliott State Forest, Source Habitat Conservation Plan
[2] Weyerhaeuser Company Millicoma Tree Farm, Source Habitat Conservation Plan
[3] Assumed that all other ownerships will be managed on less than 80-year rotation
[4] See explanation in text
[5] Includes Riparian Reserves and Administrative Withdrawals and the Dunes National Recreation Area
[6] Varies by District, based on culmination of mean annual increment
[7] Reserves identified in Habitat Conservation Plan, assumed to be retained for at least 20 years

This is a broader perspective than provided by watershed analysis. Watershed analysis are finer scale assessments which enhance the ability to estimate direct, indirect, and cumulative effects of management activities. They are better able to show relationships between terrestrial and aquatic systems and prescribe specific type, location, and sequence of appropriate management activities within a watershed.

The Assessment Process

As specified in the ROD, LSRAs include eight components:

1. A history and inventory of overall vegetative conditions;
2. A list of identified late-successional associated species known to exist within the LSR;
3. A history and description of current land uses in the LSR;
4. A fire management plan;
5. Criteria for developing appropriate treatments;
6. Identification of specific areas that could be treated under these criteria;
7. A proposed implementation schedule tiered to higher order plans, and;
8. Proposed monitoring and evaluation components to help evaluate if future activities are carried out as intended and achieve intended results.

Reference and current vegetative conditions on the landscape were used to determine how the LSRs are functioning in relation to objectives established in the ROD. The best information was utilized to indicate a reference condition from which to evaluate current conditions of vegetation within the LSRA area. The effects on the populations of certain late-successional species was evaluated based on assessment of the changes in vegetative structure, pattern, and processes that have occurred on the landscape.

Landscape level criteria were developed to prioritize management treatments within individual LSRs to meet the objectives of: expanding existing large blocks of interior habitat; maintaining and improving connectivity habitat between and within LSRs; and creating future large blocks of interior habitat where it is currently lacking. Stand level criteria were developed to identify existing stand conditions which may benefit from a variety of management actions to put stands on a trajectory to meet future desired conditions and landscape level objectives.

The final component of the assessment, monitoring and evaluating management activities, helps identify those key features that need to be monitored to determine if the proposed activities are meeting LSR objectives as described in the respective RMPs and LRMP.

II. History and Inventory of Conditions

Physical Characterization

This LSRA area is primarily in the southern Oregon Coast Range Province and the western portion of the Oregon Klamath Province. The southern Oregon Coast Range is characterized by highly dissected low mountains that were shaped by debris slide processes on slopes of 20 to 120 percent. Incised valleys are distributed throughout the region. Elevations range from near sea level to about 3,900 feet. Most ridges and mountaintops are below 2,000 to 2,500 feet, although a few dominant peaks are above 3,000 feet. These include Bear Mountain 3,178 feet, Buzzard Rock 3,163 feet, Dutchman Butte 3,880 feet, and Bone Mountain at 3,661 feet. In the western Klamath portion, Grizzly Mountain is 2,339 feet, Bosley Butte is 3,431 feet, and Palmer Butte is 2,934 feet.

Soils generally developed from Cenozoic sedimentary rocks, i.e. sandstones and siltstones. There are also small, scattered basaltic intrusions. Typical soils are moderately deep and have both dark and light colored surface horizons and low to moderate amounts of humus in the surface horizons. Inceptisols (young soils) are the dominant soil order. In the western portion of the LSRA area these soils are moist (Udic) during most of the summer but in the eastern part some soils are excessively dry (Xeric) during the summer months. Mean annual soil temperatures are 0 to 15 degrees C. In the western Klamath portion of the LSRA area, soils are developing in Jurassic geologic formations that are much older, and they produce soils that are much less fertile than the younger Coast Range rocks. Geologic formations with serpentinitic rocks/soils are common in the Klamath portion.

The LSRA area has a maritime climate resulting from its proximity to the Pacific Ocean and influence of the Japanese current. Cool, wet winters and relatively warm dry summers are characteristic of the area. Low pressure systems feed a stream of cool, moist air from the north Pacific Ocean onto the Oregon Coast and Klamath Mountain ranges from November through March. The moist air rises over these ranges and drops large amounts of precipitation. Occasionally, Arctic air meets an on-shore flow, producing snowfall. In general, snow only persists for a few days or weeks except for the tops of the highest peaks.

Orographic effects are pronounced in this LSRA area. Major ridges receive substantially more precipitation than do nearby lowlands. Coastal areas average 65 to 80 inches of precipitation annually, and interior areas west of the crests of these mountain ranges receive 80 to 100 inches in the Coast range Portion and 100 to 130 inches in the Klamath portion. East of the Coast Range crest, precipitation drops off significantly and is typically 40 to 50 inches in the drier portions.

High potential evapotransporation and low precipitation during warm, sunny summers may produce moisture deficits where soil and bedrock have low water holding capacities. Moisture deficits are more pronounced east of the Coast Range crest and in the rocky soils of the western Klamath Province. Bedrock is mostly impermeable and has very low water storage capacity in the flat lying rocks of the southern Coast Range. Throughout the LSRA area, timber stands on sharp ridges and exposed south facing slopes with shallow, rocky soils can develop substantial plant moisture stress in late summer. This is especially true east of the Coast Range crest and in the Klamath portion.

Due to the geographic variability of soil and climate attributes in the Oregon Coast Range and Klamath Provinces, we have developed soil/climate zones to describe the physical environment. Each zone represents a unique combination of landforms, soils, geology, and climate. These groupings of physical factors, in combination with natural disturbance processes such as fire and wind, influence the vegetation characteristics of each area. Table 4 summarizes the differences between each soil/climate zone found in the LSRA area with regard to climate, soil physical characteristics, soil temperature and soil moisture regimes.

Aquatic Characterization

Physical

The geomorphic processes in the LSRA area affect the development and maintenance of the physical and biological characteristics of the aquatic systems. For the purposes of this assessment, the following characterizations are general in nature. Additional specific details on aquatic and riparian conditions can be found in the completed Watershed Analyses within the LSRA area.

In the Coast Range Province (LSRs 265, 266, 264, 263, 261 and the north half of 260) soils are shallow and hillslopes are steep and highly dissected. Streams are usually high gradient, confined by hillslopes and have narrow floodplains until the stream order reaches a large size (generally 5th order and larger). In these systems, landslide potential is high and surface and road erosion are generally low with the exception of natural (dirt) surfaced roads. Landsliding usually occurs in the form of slow moving rotational slumps, shallow, rapid debris avalanches, or debris torrents. This causes pulse-type inputs of sediment and wood into streams. Flow increases, bank scouring and sediment releases are evident during rain events and subside quickly once rains cease (this pattern is typically known as “flashy”). Turbidity levels rise with the increasing hydrograph, but decrease quickly with decreasing flows. Stream channels in the Coast Range Province are typically gravel-poor, which makes them highly dependent on the input of large wood for diversifying habitats and retaining substrates within the stream channels. The combination of wood, topography/geomorphology and landslides has generally led to a predominance of step pools and shallow scour pools, riffles and cascade-type habitats. Where land management has included such activities as stream cleaning and road building, streams are often devoid of large wood and are dominated by bedrock. Gravel and cobble sized substrates can remain deficient in these areas for many years, even decades, until woody debris is reintroduced. Stream temperatures generally remain cool throughout areas where riparian vegetation shades the channel. Where channels are directly exposed to sun (i.e. adjacent to unbuffered clearcuts or 6th order and larger streams) or to horizontal infiltration of heat through narrow riparian zones, stream temperatures increase and may exceed lethal limits for some aquatic organisms. The warmest air and water temperatures have been observed to occur from July through September.

Table 4. Soil Climate Zones Within the LSRA Assessment Area				
Soil/Climate Zone	Climate	Soil Characteristics	Soil Temperature	Soil Moisture
Oregon Coast Range - West of Coast Range Crest	Very high winter rainfall with high winds; fog and low clouds common. Warm summers.	Deep to shallow moderate textured soils. Gravels common. Impermeable bedrock characterized by Tyee/Flournoy geologic formations. Slopes 20 to 120 percent. Moderate accumulations of organic material.	Significant difference from summer to winter, (mesic) below 3,000 feet. Soils frigid above 3,000 feet.	High in summer (udic) except on a few shallow soils with south, west, or southwest exposures.
Oregon Coast Range - East of Coast Range Crest [1]	Wet winters and hot, dry summers. Occasional high winds in winter.	Same as above except for low accumulation of organic matter in surface soils. Many soils are light colored at surface. Slopes are 20 to 120 percent.	Somewhat colder winter temperatures, and warmer summer temperatures, but still within mesic range. Soil temperatures are frigid or cryic above about 3,000 feet.	Soils are dry in the summer. Many soils meet xeric criteria, especially shallow and/or rocky soils on south, west, and southwest slopes.
SW Oregon Klamath Province - Baker Creek and vicinity	High winter rainfall with high winds. Fog and low clouds common. Warm summers.	Much of this area has Whobrey and Etelka soils with wet, gray, clay subsoils. Soils are forming from Serpentine rocks of the Jurassic (very old) geologic formation. Much of this basin has gentle to moderate slopes.	Moderate difference between summer and winter but still in mesic range.	Moist to wet year round except some shallow and rocky south, west, and southwest facing soils. Many of these soils are in aquic subgroup or great group.
SW Oregon Klamath Province - southern Curry County	Extremely high winter rain fall with high winds. Warm and dry summers.	Deep to shallow, moderate and coarse (gravelly or rocky) textured soils forming in a wide range of geologic materials. Soil fertility is low and soil organic matter accumulations is very low. Timber site index is 20 points lower than Coast Range area.	Significant difference from summer to winter, (mesic) below 3,000 feet. Soils frigid or cryic above 3,000 feet.	Soils are moist in the summer except those shallow, rocky soils on south, west, and southwest exposures, and those probably meet xeric criteria.

[1] Although in the SW Oregon Klamath province, conditions in LSR 259 are similar to this description

The Klamath Mountain Province (LSRs 259, 257, 255, 251, and the south half of 260) contains soils that are coarser in texture, contain higher amounts of fine clay particles, and more prone to surface erosion compared to soils in the Oregon Coast Province. These characteristics lead to continuous inputs of sediment into the stream. Sediment laden runoff from roads is also very common. Consequently, turbidity levels remain higher for long periods of time after rains subside. These systems are gravel-rich and the preponderance of larger substrates creates habitats dominated by scour pools and gravel/cobble riffles. Large areas of bedrock are infrequent, even where land management activities have occurred. Accumulations of large amounts of gravel have resulted in the complete loss of surface flow (hyporeic flow only) in some areas during the summer months and a concomitant loss of useable summer rearing habitat for some aquatic organisms. Landsliding, high stream temperatures, and large woody debris deficiencies are also characteristic of Klamath Province streams.

There are approximately 1,755 miles of non-fish bearing and 859 miles of fish-bearing streams within the LSRA. Of the fish-bearing streams, 336 miles occur within the range of the Endangered Umpqua Basin cutthroat trout. The majority of all fish-bearing streams are within the range of the Oregon Coast coho salmon, a Threatened species, and Oregon Coast steelhead trout, which is proposed for ESA listing. (It should be noted that the mileages for non-fish bearing first and second order streams may be underestimated by as much as 40 percent as the result of district differences in contract specifications during initial database development. In addition, fish-bearing miles have, and will continue to increase as more information is collected regarding the current distribution of cutthroat trout.)

The ROD describes Key Watersheds as contributing “directly to conservation of at-risk anadromous salmonids and resident fish species. They also have a high potential of being restored as part of a watershed restoration program”. The 11 Tier 1 Key Watersheds within the LSRA area are listed in Table 5. There are no Tier 2 Key Watersheds within the LSRA area.

Biological

The LSRA area streams contain coho salmon, fall chinook salmon, winter steelhead and cutthroat trout, Pacific lamprey, brook lamprey, large-scale suckers, and a variety of sculpin and dace species. Runs of spring chinook salmon occur only in the South Coquille River. Other stream dwelling organisms include a large host of amphibian and aquatic invertebrate species. The majority of all native aquatic species are dependent on cool water temperatures and the presence of a variety of substrates including sand, gravel, cobble, boulder and wood. These components provide breeding and rearing habitat, as well as a foundation for food sources within the stream channel.

Riparian Reserve Characterization

The Riparian Reserve system within the LSRA area was calculated using a 220 foot width for non-fish bearing streams and 440 foot width for fish-bearing streams. The actual site potential tree heights will differ slightly by district and by province. Riparian acres were broken into four categories: early-seral, mid-seral less than 80-years old, mid-seral greater than 80-years old and late-seral. Early-, mid-, and late-seral categories correspond with tree diameters of 0-11 inches, 11-21 inches and 21+ inches, respectively. The available data used was not designed to distinguish between hardwood and conifer-dominated stands. It is assumed, however that stands over 80-years old are composed primarily of conifers with hardwoods as a partial understory.

Table 5. Tier 1 Key Watersheds within the LSRA			
Province	Watershed Name	Subwatershed Name	Key Watershed Name
Coast Range	Umpqua River	Smith River	Wassen Creek
			Upper Smith River
		Mainstem Umpqua River	Franklin Creek
			Paradise Creek
	Coos River	Tioga Creek	Tioga Creek
	Coquille River	North Coquille	North Fork Coquille River
		Middle Creek	Cherry Cree
Klamath Mountain	Umpqua River	South Umpqua River	West Fork Cow Creek
			Middle Creek
	Coquille River	Upper and Lower South Fork Coquille River	South Fork Coquille River
	Chetco River	North Fork Chetco River	North Fork Chetco River

Riparian Reserves within the LSRA area contain approximately 119,441 acres. Of that, 38 percent are early-seral, 5 percent are mid-seral less than 80-years, 5 percent are mid-seral greater than 80-years, and 52 percent are late-seral. The total acres are underestimates due to incomplete GIS data on many first and second order streams. Riparian Reserves withdrawn because of fragile soils (TPCC) total approximately 12,100 acres. Additional withdrawals may occur depending on future surveys.

Vegetative Characterization

Most of the land within the LSRs are included in recent vegetation mapping zones of the Natural Resources Conservation Service (formally the Soil Conservation Service). A vegetation zone may cover large areas but always has a single set of potential native plant communities repeated throughout the zone. The patterns are somewhat predictable since they are related to local landscape features such as aspect, soil, and landform. Microclimate should be relatively similar throughout a given zone. The vegetation mapping covering all of Curry and Douglas Counties is based on years of plot sampling and reconnaissance. Vegetation classification in Coos County is based on extending the Natural Resource Conservation Service mapping using information from adjacent Forest Service Districts or the BLM major plant groupings from the recent RMP. Vegetation Zones within the LSRA are shown on Map 3. Several zones are displayed on the map but are not within the LSRs, and are not described further.

Coastal Tanoak Zone

This zone is inland of the South Coastal Fog Zone where marine influence has a strong influence on the climate. The majority of LSRs 251 and 255 are within this zone. Older stands of Douglas-fir, tanoak, and madrone occur within these LSRs. Minor amounts of western hemlock, big leaf maple, red alder, golden chinkapin, and myrtle may also occur. Port-Orford cedar can occasionally be found on the moister sites in LSR 255. Rhododendron, salal, and ceanothus species can be found with or without evergreen huckleberry and Oregon grape. Western sword fern and beargrass is very common and nearly always present.

Interior Tanoak Zone

The interior tanoak zone occurs east of the coastal tanoak zone and represents the warmer and drier climatic zone of the Coast Range with longer periods of dry soil conditions. It is recognized by both an abundance of tanoak in the tree form on north aspects, and by tanoak in the shrub form on south aspects. Douglas-fir is the primary associate and usually dominates stands. This zone is similar to the Grand Fir Zone in species composition, except for the presence of tanoak. However, sugar pine, incense cedar, California black oak, madrone, and canyon live oak are more common. Grand fir, western red cedar, and red alder are much less common. Tree form golden chinkapin is a component on some north aspects. Shrub cover is much like that of the Grand Fir Zone except for the addition of evergreen huckleberry on north aspects.

Western Hemlock Zone

Acreage wise, there is more land in this vegetation zone within the LSRs than any other zone (Table 6). Douglas-fir is the dominate sub-climax species with western hemlock a significant understory species or overstory dominant in older stands. Western red cedar and grand fir is often an understory component. Red alder, big leaf maple, golden chinkapin also occurs. Port-Orford cedar and myrtle can be found the moister sites in LSRs 257, 260 and 261. Understory species include sword fern, oxalis, vine maple, salal, hazel, ocean-spray, salmonberry, rhododendron, and Oregon grape.

Cool Douglas-fir Hemlock Zones

These zones occupies high elevations (commonly above 1,800 feet) on mountain peaks and ridges. Precipitation is between 50 to 120 inches, occasionally coming in the form of snow. The cool hemlock zone supports both western hemlock and Douglas-fir. The cool Douglas-fir zone does not support western hemlock. Overstories may include occurrences of western red cedar, incense cedar, Port-Orford cedar in moist positions, sugar pine, Pacific yew, and/or grand (white) fir. Minor amounts of madrone and tanoak can occur on warmer positions but are not very common. Understory associated species include rhododendron, Oregon grape, salal, golden chinkapin, red huckleberry, western sword fern, and bracken fern. Evergreen huckleberry is absent because of the cooler climate.

Table 6. Percentages of LSRs Within Vegetation Zones										
Vegetation Zone	251	255	257	259	260	261	263	264	265	266
Coastal Tanoak	100	63								
Interior Tanoak				24						
Western Hemlock			100	12	97	64	64	68	51	96
Cool Douglas-fir		16					5			
Cool Hemlock				3	3	27				
Grand Fir				58		9	31	31		4
Douglas-fir/ Chinkapin				[1]						
Foothill				3		[1]	[1]	1		
North Coastal Fog						[1]			49	
South Coastal Fog		21								
Jeffrey Pine		[1]		[1]						

1 Minor inclusions occurring within these LSRs

Grand Fir Zone

This zone forms a transition between the moist hemlock forests and the drier central valley. Precipitation ranges between 40 to 55 inches. Douglas-fir dominates the older stands with grand fir common on north aspects and absent or a minor component on south aspects. Golden chinkapin is common on north aspects, with madrone common on the south aspects. Bigleaf maple, western red cedar, and incense cedar are often present. Hemlock and California black oak may also be present. Understory shrubs on north facing conifer stands include salal, Oregon grape, western hazel, ocean-spray, and red huckleberry. South slopes may support the same species but those requiring higher moisture such as red huckleberry, Oregon grape, and salal will be minor components.

Douglas-fir/Chinkapin Zone

Douglas-fir is the dominant climax species on all typical upland slopes except for areas of shallow soils and soils with high amounts of rock fragments where Oregon white oak, canyon live oak, or drought resistant shrubs occur. On south slopes, Douglas-fir may be joined by madrone, canyon live oak, ponderosa pine, or incense cedar. Grand fir is generally absent in the uplands but occurs frequently in the valleys.

Foothill Zone

This zone occupies the warmest and driest climatic zone within the assessment area. Uplands with the most favorable soils have coniferous forests of Douglas-fir and subordinate species such as madrone, bigleaf maple, California black oak, ponderosa pine, incense cedar, and sometimes Oregon white oak. More droughty soils in the uplands support hardwood dominated stands of madrone, Oregon white oak and sometimes California black oak, but may also contain minor amounts of Douglas-fir, ponderosa pine, and incense cedar.

North Coastal Fog Zone

The extreme western portion of LSR 265 is representative of this zone. Climate is mild with average precipitation ranging from 90 to 120 inches. Minor amounts of Sitka spruce may be found in the eastern portion of this zone. Douglas-fir, western hemlock, bigleaf maple, and red alder are the major tree components found in this zone. Understories are very dense and include rhododendron, evergreen huckelberry, sword fern, salmonberry, vine maple, and salal.

South Coastal Fog Zone

The extreme western portion of LSR 255 is within eastern portion of this zone. Climate is mild with average precipitation ranging from 70 to 90 inches. Forests are primarily Douglas-fir with some local areas of grand fir, Port-Orford cedar, western hemlock, tanoak, red alder, and bigleaf maple. Understories on both north and south slopes may be very dense sword fern and/or shrubs.

Jeffrey Pine Zone

This vegetation zone occurs only in portions of LSR 255 and 259 on ultramafic (serpentine) based soils. Vegetation in this zone is characterized by low biomass production, low stand densities and an unusually high number of rare or endemic plant species. These are areas are dominated by open, park-like stands of Jeffrey pine with a ground cover composed of numerous herbaceous plants. Historically fire occurrence in this zone is high while human disturbance is low compared to surrounding areas. Besides fire, the major disturbance agent appears to be wind, since these stands are open and the trees shallow rooted. This zone is not displayed on the map.

Successional and Structural Pathways

Successional Pathways

This section is a modification of the *Late-Successional Reserve Assessment, Oregon Coast Province - Southern Portion - (RO267, RO268)* (USDA, USDI 1996) and reflects conditions found in the area covered by this assessment. The locations correspond to the vegetation zones mapped by Gene Hickman in Curry and Douglas Counties, and projected for Coos County shown on Map 3.

The overall goals for management of the LSR is to protect, maintain and create late-successional forest ecosystems which serve as habitat for late-successional and old-growth related species. Management treatments will strive to reestablish connectivity of that habitat in the least amount of time to maintain functional, interacting late-successional forest ecosystems.

When attempting to accelerate attainment of late-successional characteristics, it is important to understand how successional pathways will affect proposed management activities. Successional pathways are defined by the typical dominant compositional and structural stages that can be expected as vegetative communities develop following a disturbance. They describe the dominant tree species, density patterns, regeneration and lower layer species development, and ground cover over time. The pathways are influenced by local environment, original stand composition, and type and intensity of disturbance. Sub-series vary in their pathways both in the variety of species supported and the number of individual plants of a given species that are present.

To use the successional pathways in evaluating proposed management treatments requires knowledge of the physical environment (soils, climate, landform, and slope position), the biological environment, and where the stand is in its successional development. This information would be used in addition to other concerns (ACS, wildlife habitat distribution, etc.) to determine if the outcome of a particular management activity was acceptable. There may be instances when the dominant vegetation development pathway are bypassed to create conditions desired for specific purposes. For example, a wet environment in the western hemlock series densely stocked with conifers would be an uncommon condition for that environment, but due to a deficiency of large woody structure in the stream system, it might be desired and maintained for the benefit of other ecosystem components.

In characterizing the vegetative communities, sub-series environments (which group plant associations and communities into broad biological environments from wet to dry) Table 7 and Map 3 were described and delineated. Sub-series environments were selected as the appropriate vegetation filter through which to assess possible management prescriptions.

The following is a hypothesis of successional pathways that would occur for three different climax vegetation series and their sub-series environments.

West side of North Coastal Fog Zone

Environments - Wet, Moist, and Dry
Stands with a mix of western hemlock, Douglas-fir, Sitka spruce, and varying amounts of red alder, are found across all environments. Sitka spruce and western hemlock are prevalent throughout all environments because they are prolific seeders and shade tolerant enough to compete in all environments. The primary intermediate disturbance is wind. Unlike fire, these non-stand replacing events favor regeneration of the shade tolerant conifers, such as western hemlock and Sitka spruce. Finer scale successional pathways, and refined differences between environments need to be explored.

Western Hemlock, Cool Hemlock, and Cool Douglas-fir Zones

Environment - Wet
The wet environments can be a dominant feature on some landscapes on the east side of the coastal fog zone. The wet environments most often occur on lower slopes and in riparian areas and as one moves west to east through the Coast Range the wet area becomes more restricted to narrow bands in the valley bottoms. Soils have a high water table. After disturbance, regeneration of conifers is sporadic, due to high vegetation competition. Salmonberry is the predominant understory shrub species. Red alder has a larger presence than conifer in early-seral stages and remains a large component in young and mature stages. This type has the lowest total trees per acre and the highest percentage of red alder of all the sub-series environments.

Three dominant tree communities occur in this environment. The first is a pure alder type, usually found in areas too wet for Douglas-fir, and in areas in which a significant amount of bare soil following a disturbance has created a desirable seed bed for alder. If undisturbed, the alder areas will begin to lose vigor and decay after 80 to 100-years of age. Shade tolerant conifer species (western hemlock, western red cedar) will become established, depending on seed source and occurrence of disturbance. These conifers will begin to occupy the overstory as the alder deteriorates. In areas on or near the flood plain which experience higher frequencies of flooding or debris torrents, the alder will constantly be regenerated and kept in the system.

Oregon myrtle is the second type of tree community and also occurs in areas too wet for Douglas-fir. Myrtle dominated flood plains may have a grand fir, red cedar, or Port-Orford cedar component. When Douglas-fir is found on a myrtle dominated flood plain, the fir is usually located on top of a mound. Myrtle leaves contain flammable oils that cause the tree to explode into a fire ball when ignited. Myrtle's habit of violently torching out when ignited may enable it to better compete with the taller conifers by transferring fire from the ground to the crowns of the conifer. Myrtle's ability to stump sprout allows it to rapidly capture the site following the fire.

The third type of tree community occurs where microsite conditions allow establishment of scattered Douglas-fir. A mix of red alder, in some places bigleaf maple, and Douglas-fir will predominate through the early and mid-seral stages. If no major disturbance occurs, alder will decline. The site will be dominated by scattered large Douglas-fir and variable amounts of shade tolerant conifers depending on overhead shade density, seed source and disturbance history.

Minor wet environment communities include salmonberry brush fields, Oregon ash flats and swamps, and cottonwood. Salmonberry brush fields under certain circumstances may be climax community (Hemstrom & Logan 1986). They can also be the result of failed reforestation efforts and may dominate unstable slopes in riparian zones. Most Oregon ash and cottonwood sites have been converted to agriculture and other non-forest uses.

Environment - Moist
The moist environments occur on deep, well-drained soils, usually mid slope. After disturbance, regeneration of conifers is predominant, with initial densities dependent on exposure of organic/mineral soil, density of competing vegetation and seed source.

Two dominant tree communities occur in this type. The first is a pure conifer type, usually found in areas following a disturbance which has created some exposed mineral soil seed bed that Douglas-fir prefers. Varying amounts of shade tolerant species, especially western hemlock may be present, depending on how much litter and duff survived in place following the disturbance and the presence of overhead shade at the time of stand initiation. In these areas, usually dominated by Douglas-fir, stands will develop at a variety of densities. Herbs and shrubs will occupy most of the growing space the first 10-years after a stand replacing disturbance. From age 11 to 80, Douglas-fir will dominate the growing space, in dense areas, going through intense inter-tree competition. By age 80, portions of these areas could be occupied by dense stands with slim tree boles and crown ratios less than 25 percent. Portions of stands with initial stocking levels of less than 100 trees per acre would have significantly larger diameters and crowns. Ground vegetation will begin to appear as these stands become more open. From age 81 to 150 mortality by inter-tree competition will continue, and tree density will be reduced. As the stand opens, shade tolerant conifer species will become established, or be released, depending on seed source tree suppression conditions and disturbance mechanisms.

The second type of tree community occurs in areas wet enough and with adequate seed source to favor some alder establishment. These areas could subsequently take two successional pathways depending on the disturbance regime. Areas with small disturbances, such as landslides will have frequent regeneration of alder. Without disturbance, the alder will begin to lose vigor and decay after 80 to 100-years of age, leaving more of an open Douglas-fir stand or establishment of shade tolerant conifer species, depending on seed source.

In all stands, after age 150, wind, root rot, and insects will continue to lower the overall density of Douglas-fir trees creating more variation in stocking.

Environment - Dry

The dry environments occur on upper slope positions which experience droughty conditions in the summer. Due to the dryness of this area, fires usually burn hotter, removing competing vegetation and providing a good seed bed for Douglas-fir. Pure Douglas-fir stands are predominately found in these areas.

Shrubs, such as salal, Oregon grape, and rhododendron will occupy most of the growing space the first 10-years after a stand replacing disturbance. Like the moist sites, from age 11 to 80, Douglas-fir will dominate the growing space and in dense areas will be going through intense inter-tree competition. The primary differences between the moist and dry areas are the higher proportion of dense stands and lower site productivity due to droughty soil conditions and lower available nutrients. This lowers the rate of stand development. By age 80, as in the moist areas, portions of these areas could be occupied by dense stands. From age 81 to 150 mortality will continue, and overall tree density would be reduced. As the stands open understory vegetation will increase in abundance and vigor. After age 150 wind, root rot, and insects will continue to lower the overall density of Douglas-fir trees creating more variation in stocking. The dry environment stands are the most dense of those found across the three environments.

Within the Cool Western Hemlock Zone, nearly pure western hemlock stands occupy some ridge top locations characterized by salal, rhododendron, or Oregon grape shrub layers. These stands regenerated following a fire that killed part of the previous stand leaving natural “shelterwoods” that favored establishment of shade tolerate hemlock over Douglas-fir. Many remnant overstory trees subsequently died from stress induced by their exposed condition.

Mid-Seral Disturbances - Moist and Dry Environments

Mid-seral fires create more diversity by creating growing space through opening the overstory allowing more light to reach the forest floor, and reducing understory vegetation competition. This results in a two or more layered overstory canopy.

Wind is a common intermediate disturbance causing blowdown patches along upper ridges and ridgetops. It may also accelerate late-successional structural characteristics if it occurs in mid-seral successional stages by removing overstory Douglas-fir and releasing shade tolerant western hemlock.

Grand Fir Zone

Environment - Wet

The wet environment for the grand fir zone occurs along creek bottoms that characterize the low elevations of the eastern slopes of the Coast Range.

After a major disturbance the successional pathway would start with the establishment of sedges and grasses. Western sword fern, common snow-berry, and vine maple are common ground covers in the early stages after disturbance. Co-dominant hardwoods are scattered in the early stages. Initially, conifers will be scattered due to high competition from the ground cover. As the hardwoods mature and the area begins to differentiate into different layers, scattered amount of grand fir regeneration underneath the hardwood canopy begins to emerge in increasing density. The ground cover will become less dense as the canopy begins to close due to less light reaching the forest floor. Grand fir, western red cedar, and western hemlock are found in and along the creek bottoms in this environment.

As the canopy cover begins to close, the shade tolerant grand fir would begin to increase in the understory, ground cover species would begin to thin out due to competition for available light filtered by the dense overstory. Eventually, as the forest reaches late-seral conditions, grand fir will become the dominant conifer species in the canopy layer.

Environment - Dry

The dry environment occurs on the slopes and rolling ridges that characterize the low elevations of the eastern slopes of the coast range.

After a major disturbance, the successional pathway would start with the establishment of sedges and grasses, from the valley, and a shrub layer of sword fern, salal, and common snow-berry. Most of the sedges and grasses would persist for 10-years and then decline. As ground cover becomes well established, seedlings of Douglas-fir, golden chinkapin, bigleaf maple, and lesser amounts of grand fir would dominate.

As the area begins to differentiate into understory and canopy layers, several other tree and shrub species would become dominant. These species include bigleaf maple, golden chinkapin, ocean-spray, and poison oak. The ground cover will become less dense as the canopy begins to close.

As the canopy cover begins to close, the shade tolerant grand fir and golden chinkapin would begin to increase in the understory. As the forest matures, the canopy would be co-dominated by Douglas-fir, Oregon white oak, and bigleaf maple. Grand fir would then become the dominant conifer understory species. If the forest were to reach its climax stage, grand fir alone, or grand fir in combination with Douglas-fir, would become the dominant conifer in the overstory. In an old-growth condition, Douglas-fir, grand fir, and hardwoods would occupy various strata within the stand and coarse woody debris would become common and scattered throughout the forest

Coastal and Interior Tanoak Zones

Environments-Wet
The wet environment can be a dominant feature on some landscapes on the east side of the Coastal Fog Zone. The wet environments can occur on slopes from 100 to 3,000 feet elevation where precipitation can range from 90 to 130 inches. Cloud or fog cover often occurs creating a moderating effect on summer temperatures. After disturbance, tanoak typically develops rapidly from pre-existing understory seedling-sprouts, and can interfere with the survival and growth of conifers. Regeneration of conifers such as Douglas-fir is sporadic due to high vegetation competition. Pacific madrone can often be found in this series. Scattered very minor occurrences of western hemlock, Port-Orford cedar, and golden chinkapin find there way, overtime, in some localities where environmental conditions are very favorable. Overtime Douglas-fir becomes the dominant conifer in the overstory with a presence of tanoak.

Environments-Dry
The dry environments occur further inland on the eastern side of the Coastal Tanoak Zone and south of the Grand Fir Zone. It represents the warmer and drier climate of the LSRA with longer periods of dry soil conditions. Following major disturbance by fire or cutting, tanoak develops rapidly from pre-existing understory, stump or seedling-sprouts, resulting in a competitive advantage over conifers. Tanoak develops slowly from seedlings and the establishment of new tanoak understories with the capacity for vigorous growth after disturbance may take over 100 years. Douglas-fir can seed into disturbed sites but receive heavy competition for light and moisture by tanoak. As the forest matures, Douglas-fir would become the dominant conifer in the overstory with the tree form tanoak on the north aspects and shrub form tanoak on the south aspects. Madrone often becomes established with tanoak and collective forms a mid-canopy or understory layer.

Management Implications of Successional Pathways

Specific prescriptions for management activities should consider what actions are possible and appropriate for a given site. Table 7 highlights some of the key components of late-successional forest habitat and evaluates the potential for a given environment to support that component or management objective. The relationships shown are general in nature.

As displayed in Table 7, not all management objectives occur equally in every environment. These conditions occur over a continuum throughout the various environments.

The wet environment for the western hemlock series has the highest probability of supporting:

- A low density of large conifers with a high variability in spacing due to vegetative competition and animal damage.
- A multi-storied canopy composed of multiple species including hardwoods.
- A good opportunity to grow and recruit large diameter snags and CWD for future aquatic structure.

Table 7. Potential for Sub-series Environments to Meet Key Structural Components When Considering Dominant Natural Successional Pathways

Management Objectives Relating to Late-Successional Structural Components	Sub-Series Environment								
	Western Hemlock			Grand Fir		Coastal Tanoak		Tanoak	
	Wet	Moist	Dry	Wet/Moist	Dry	Wet/Moist	Dry	Wet/Moist	Dry
Grow Large Trees	H	H	M	H	M	H	M	H	M
Establish Multiple Canopies of Conifer	M	H	M-L	H	M-H	H	M-L	H	M-L
Establish Multiple Canopies of Conifer/Hardwood or Hardwoods	M	H	M-L	H	M-H	H	M-L	H	M-H
Recruit Large Diameter Snags and CWD	M-H	H	M-L	M-H	M-L	H	M-L	M-H	M-L
Maintain High Stocking Levels	L	M	H	M	H	M-H	M-H	M-H	M
Provide CWD for Aquatic Structures	H	H	L	H	L	H	L	H	L
Provide Variable Spacing	H	H	M-L	H	M-H	H	M-H	H	M-H
Other Management Objectives									
Consider Windfirmness [1]	M	M	H	M	M	M	M	M	H
Consider Fire [1]	L	L	M	M	H	L	M	L	M

1 Risk of occurrence

Abbreviations used in this Table: H= High probability, M=Moderate probability, L= Low probability, CWD= Coarse Woody Debris

The moist environment for the western hemlock series has the highest probability of supporting:
- S Moderate densities of large conifers with a moderate variability in spacing.
- S A multi-storied canopy composed of multiple conifer species generally stratified by canopy layer, however, there will be fewer hardwoods than in the wet environment.
- S A good opportunity to grow and recruit a quantity of large diameter snags and CWD, both on site and for aquatic structure.

The dry environment for the western hemlock series has the highest probability of supporting:
- S The highest density of conifers and lowest density of hardwoods, except where myrtle is a major understory component. Variability in spacing would be lower than in the moist environment, however, fine scale disturbances would result in gaps in the canopy.
- S With the drier and more exposed environmental conditions, both windfirmness and fire management will be management considerations.

The wet/moist environments for the grand fir series has the highest probability of supporting:
- S A moderate to high density of large conifer with a high variability in spacing.
- S A multi-storied, multi species canopy of conifer and hardwoods.
- S A good opportunity to grow and recruit a quantity of large diameter snags and CWD, both on site and for aquatic structure.
- S With the drier environmental conditions, both windfirmness and fire management will be management considerations.

The dry environment for the grand fir series has the highest probability of supporting:
- S A high density multi-layered, multi-species conifer and hardwood overstory canopy.
- S With the warmer, drier and more exposed environmental conditions, both windfirmness and fire management will be management considerations.
- S A moderate to low probability to grow and recruit large diameter snags and CWD due to the higher fire frequency.

The wet/moist environments for both tanoak series has the highest probability of supporting:
- S A moderate to high density of large conifer with a high variability in spacing.
- S A multi-storied, multi species canopy of conifer and hardwoods.
- S A good opportunity to grow and recruit a quantity of large diameter snags and CWD, both on site and for aquatic structure.
- S With the drier environmental conditions, windfirmness will be management considerations for the coastal tanoak series. Both windfirmness and fire will be management considerations for the inland tanoak series.

The dry environments for both tanoak series has the highest probability of supporting:
- S A moderate to high density of large conifer with a high variability in spacing.
- S A multi-storied, multi species canopy of conifer and hardwoods.
- S With the drier environmental conditions, windfirmness will be management considerations for the coastal tanoak series. Both windfirmness and fire will be management considerations for the inland tanoak series.

Late-Successional Structural and Compositional Characteristics

The structure of natural Douglas-fir forests is extremely diverse because of numerous processes operating at different spatial and temporal scales. Stand development and succession are important processes that determine forest habitat. Differences in forest structure should be viewed on a continuum rather than in discrete classes (Spies and Franklin, 1991). No one condition is appropriate across the landscape. Knowledge of late-successional structural and compositional characteristics is key in identifying the desired future condition to strive for in management activities.

Differences In Forest Structure Young-Mature-Old

Changes in vegetation structure and composition occurs between young, mature, and old-growth that may influence late-successional forest function (Spies and Franklin, 1991). The condition of existing late-seral forests within the LSRs provides a reference point to compare younger stands when determining desired future conditions.

Tree density, mean stand diameter, and basal area are most important in discriminating among successional stages. Tree density is about twice as high in young stands as it is in mature and old-growth stands. Basal area increases with age, and mean tree diameter is highest in mature stands which lack the smaller diameter shade-tolerant trees common in the old-growth (Spies and Franklin, 1991).

Stand condition also is influenced by the time and intensity of the last disturbance. Percentages of snags with natural cavities, percentages of Douglas-fir boles with resinosis, and percent of tree crowns with broken tops all were higher in old-growth than in the younger age classes (Spies and Franklin, 1991).

Understory vegetation also changes with stand age. Herb and shrub cover tends to increase with stand age class. Density of shade-tolerant saplings is highest in old-growth, lowest in mature stands, and intermediate in young stands (Spies and Franklin, 1991). Understory vegetation is strongly influenced by the amount of light reaching the forest floor. Understory vegetation is extremely low during the stem exclusion phase.

General characteristics of old-growth forests that differ from mature include: inclusion of western hemlock in the overstory, diverse vertical distribution of vegetation, and large amounts of CWD.

Old-Growth Forest Structural Characteristics

Basal area of shade-tolerant tree species is an important characteristic of old-growth forests. In general, moist sites have higher basal areas of shade tolerant species than do moderate or dry sites. The density of large-diameter Douglas-fir decrease with increasing moisture in the Coast Range. The density of subcanopy trees generally decreased with increasing site moisture, probably as a result of increasing basal area of shade-tolerant trees in the upper canopy that creates low-light conditions unfavorable to understory trees (Spies and Franklin 1991).

Stand condition (snags, cavities, broken tops, etc.) did not seem to vary by moisture class in the work done by Spies and Franklin (1991).

Coarse Woody Debris

Perhaps the greatest difference between natural and managed stands is the lower number and volume of large snags and logs in managed plantations (Spies and Cline, 1988).

Differences in the amounts of CWD may or may not relate to the sub-series environments previously described due to the high variability across sites. Research has shown that levels of CWD is more closely associated with disturbance (Spies et al., 1988).

Woody debris attributes operate with a different cycle than overstory attributes. Woody debris amounts are highest in early-successional stands and lowest in mid-successional stands. Because natural disturbances typically do not destroy much of the debris biomass in large pieces of wood, these features are present to some degree in natural stands of all ages (Spies et al., 1988).

Tables 8 and 9 display different structural components of old-growth stands within the assessment area. Tables 10 and 11 display different stand components found in young and mature stands. Tables 8 and 10 are applicable to those plant associations within the assessment area where evergreen hardwoods are not a significant stand component. This would include the western hemlock sub-series and some associations of the white/grand fir and Douglas-fir sub-series. Tables 9 and 11 are applicable to the tanoak series and associations of the white/grand fir and Douglas-fir sub-series where evergreen hardwoods and oaks are major stand components.

Table 8. Average Values for Selected Structural Components of Old-Growth Stand in the Southern Oregon Coast Range [1]

Stand Component	Characteristic	Coast Range Dry	Coast Range Moderate	Coast Range Moist	Coast Range All Aspects
Live Trees [2]	Total Basal Area feet ^{2}/acre	283 (200-405)	305 (222-418)	314 (196-501)	n/a
	Basal Area of Tolerant Conifers	10 (0-48)	70 (26-139)	135 (44-274)	n/a
	Basal Area of Hardwoods	1 (0-156)	< 1 (0-35)	< 1 (0-131)	n/a
	Number of Douglas-fir per Acre 40 Inches and Larger dbh	12 (4-23)	10 (4-18)	7 (1-10)	n/a
	Number of Trees per Acre 40 Inches and Larger dbh	12 (4-23)	10 (4-21)	10 (2-25)	n/a
Down Wood [3]	Tons/Acre	18	28	28	24
	Feet ^{3}/acre	n/a	n/a	n/a	3,262 (1,382-5,141)
Snags	20 Inches and Larger in dbh and all heights [4]	n/a	n/a	n/a	7 (4-10)
	20 Inches and Larger in dbh and Greater than 16 Feet tall	n/a	n/a	n/a	4 (2-6)
	20 Inches and Less in dbh and all heights [4]	n/a	n/a	n/a	9 (6-12)
	Feet ^{3}/Acre	n/a	n/a	n/a	2,117 (229-4,006)
	Tons/Acre	10	21	25	n/a

1 Adapted from Spies and Franklin (1991) and Spies, Franklin and Thomas (1988). 95 percent confidence limits enclosed within parentheses. Tons per acre for snags and down wood are approximated from figure 3 in Spies, Franklin and Thomas (1988).

2 diameter greater than 2.5 inches

3 greater than 4 inches in diameter large end

4 greater than 4 inches in height

Table 9. Minimum and Average Standards for Selected Old-growth Stand Characteristics of Douglas-fir/Hardwood Forests [1]			
Stand Component	Characteristic	Minimum Standards	Average Standards
Live Trees	Hardwood Basal Area Percent of Total	≥ 10	30 ± 5
	Number of Conifers 35 Inches and Larger in dbh	≥ 6	12 ± 1
	Hardwoods 26 Feet and Taller Conifers 26 Feet and Shorter Percent of Total Cover	>10 for both species groups	25 ± 5 2 ± 1
Canopy	Number of Canopy Layers	2 distinct	2 distinct
	Percent Crown Closure	> 60	71 ± 3
	Conifers 130 Feet and Taller Number /Acre	Present	17 ± 1
	Conifers 40-130 Feet Tall Hardwoods 40-130 Feet Tall Number /Acre	Present Present	16 ± 6 89 ± 17
Snags	4 Inches and Larger in dbh Number /Acre	5	13 ± 2
	16 Inches and Larger in dbh and 13 Feet or Taller Number /Acre	0.1	2 ± 1
Down Logs	Tons/acre	1	12 ± 4
	17 Inches and Larger in Diameter and 50 Feet or Longer Number of Pieces	0.4	10 ± 2
	17 Inches and Larger Number of Pieces	0.1	2 ± 0.4

1 Adapted from Bingham and Sawyer (1991). Means and 95 percent confidence limits displayed for Bingham and Sawyer average standards. In the authors opinion average conditions are viewed as appropriate for identifying "optimal" old-growth.

Table 10. Selected Stand Definitions Criteria for Young and Mature Douglas-fir Forests in Oregon and Washington [1]

Stand Component	Characteristic	Young Stands 40-80 Years Old	Mature Stands 80-195 Years Old
Overstory Live Trees [2]	Mean Tree dbh Inches	8 (7-10)	13 (12-15)
	Total Basal Area $Feet^2$/Acre	191 (170-217)	257 (230-283)
	Douglas-fir 40 Inches and Larger in dbh Number /Acre	0.4 (0.1-0.3)	1 (0.4-1.9)
	Shade Tolerant Species Number/Acre	112 (66-168)	53 (26-90)
	Shade Intolerant Species Number/Acre	197 (134-290)	98 (69-140)
Understory Live Trees [3]	Shade Tolerant Saplings Number/Acre	92 (42-161)	34 (9-75)
Snags [4]	20 Inches and Larger in dbh All Heights Number/Acre	7 (3-31)	7 (0-14)
	20 Inches and Larger in dbh All Heights and 16 Foot Tall Number/Acre	2 (0-4)	3 (0-7)
	20 Inches and Smaller in dbh All Heights Number/Acre	48 (26-70)	53 (1-105)
	Total Volume $Feet^3$/Acre	1,230 (615-1,845)	1,488 (200-2,775)
Down Wood [5]	Total Volume $Feet^3$/Acre	1,102 (525-1,979)	1,731 (300-3,162)

1 Live tree data are adapted from Spies and Franklin (1991). Dead wood (down wood and snags) are adapted from Spies, Franklin and Thomas (1988). 95 percent confidence limits enclosed within parentheses.
2 diameter greater than 2.5 inches
3 diameter less than 2.5 inches
4 greater than 4 inches tall and 4 inches in dbh
5 greater than 4 inches in diameter large end

Table 11. Selected Stand Definitions Criteria for Young and Mature Stands in Douglas-fir/Hardwood Forests [1]

Stand Component	Characteristic	Young Stands 40-100 Years Old	Mature Stands 100-200 Years Old
Live Trees	40-130 Feet Tall; Number /Acre	conifers; 42-212 hardwoods; 65-266	conifers; 24-87 hardwoods; 48-133
	Greater than 130 Feet Tall; Number /Acre	n/a	conifers; 12-24
	Dominant Stems less than 18 Inches in dbh Number/Acre	conifers; 105-315 hardwoods; 91-490	hardwoods; 103-306
	Dominant Stems 18-35 Inches in dbh Number/Acre	n/a	conifers; 16-28
	Hardwood Basal Area Percent of Total	30-75	15-45
Canopy	Height Range	< 130'	< 180'
	Number of Canopy Layers	1	2, but indistinct
	Percent Crown Closure	65-80	65-80
Understory < 26' tall	Percent Cover	conifers; 2-10 hardwoods; 5-20	conifers; 1-5 hardwoods; 5-35
Snags	4 Inches and Larger in dbh; Number /Acre	18-54	14-50
	16 Inches and Larger in dbh and Greater than 13 Feet Tall Number/Acre	0-2	0-2
	Hardwood 4 Inches and Larger in dbh Percent of Total Snags	20-60	20-90
Down Wood	4 Inches and Larger in Diameter; Number /Acre	81-214	91-155
	Hardwood Log Density Percent of Total	20-65	45-75
	4 Inches and Larger in Diameter and Greater than 13 Feet Long Number/Acre	3-19	0-6
Dead Wood (snags & down)	Tons / Acre	22-112	11-67

[1] Adapted from Bingham and Sawyer (1991). Definitions are based on range of means observed.

Disturbance Processes

Human Related Disturbances - Historical and Current

Settlement Patterns

Human use of Western Oregon has been dated to 8,000 years ago. The earliest known sites on the coast lie within the assessment area at Blacklock Point and Cape Blanco on the southern coast. American Indian sites in the assessment area include villages, coastal and riverine fishing stations, shellfish and marine mammal hunting stations, religious sites, cemeteries, and inland hunting and gathering locations. The people of the assessment area lived in small tribes, usually within a watershed, and moved seasonally to harvest plants, animals and marine resources.

European and American interest in the area began in the late 18th century, although Captain James Cook had sailed and landed along the west coast earlier. The Lewis and Clark expedition, although ending north of the assessment area, opened the route to the coast, first for trappers and traders, then to permanent American settlers by the mid-19th century. By 1850, the American Indian population had declined drastically, and remaining tribal peoples were moved to reservations. The people of the assessment area were moved to the reservation at Siletz without consideration for tribal relationships or hostilities. During the latter half of the 19th century, the reservation was reduced in size as its inhabitants died from disease or despair, moved back to traditional areas, or as whites moved into the area. In the early 1950s, the reservation was terminated from federal control, but during the 1980s these tribes, primarily the Confederated Tribes of the Coos, Siuslaw, and Lower Umpqua Indians, the Coquille, Cow Creeks, Tolowa, and the Confederated Indian Tribes of the Siletz were restored to tribal status.

Mountain men, fur traders and missionaries were the first European and American inhabitants into the Willamette and Rogue valleys and the Coast Range mountains and rivers. Trading outposts as far away as Fort Vancouver on the Columbia River, eventually attracted settlers to Oregon, via the Oregon Trail and south through the Willamette Valley or via the Applegate cutoff to the Rogue and Umpqua basins. The Donation Land Act of 1850 and the Homestead Act of 1862 created the legal basis for settlement in the western Oregon river valleys and in the Coastal areas. Large tracts of timberland, and homesteads that never “proved up”, became incorporated in part of the National Forest system.

BLM ownership patterns in western Oregon were created in 1866 when Congress granted the Oregon and California Railroad Company all odd numbered sections of land 30 miles on either side of the railroad right-of-way. When the stipulations of the grant were violated, Congress revested the lands to the United States government. The Coos Bay Wagon Road Company was granted lands to construct a military road between Roseburg and Coos Bay, and when the stipulations of that grant were violated, Congress revested the lands to the United States government to be administered under the jurisdiction of the General Land Office (GLO). In 1946 the BLM was established by merging the GLO and Grazing Service within the Department of Interior. In addition to the revested lands, lands not disposed of by the GLO for homesteads or other purposes are being managed by BLM as public domain lands. This fragmented ownership pattern is displayed on Map 2.

Cultural resources of the historic period include cemeteries, trails and roads, homesteads, and agricultural sites (orchards and cranberry bogs). Because of the various federal homestead acts (e.g., Forest Homestead Act of 1906) and because of the early surveying done for land boundaries, timber harvesting, and road building, land records of farms, buildings, roads, land features and vegetation types provide insight into pioneer settlement and life ways as well as providing baseline data about the environment at the turn of the century.

Historic cultural resources in the assessment area date from the mid-19th century until the 1930s. Many of these sites have been recorded during inventories for timber sales, for land transfers, and by local historical societies. These records are housed in the various federal agency offices, and by the State Historical Preservation Office in Salem. Prior to any project in the LSR, these records should be consulted, and additional inventories will probably be required. In addition, human use of the area from the earliest American Indian through today, has created the current environment through the use of fire, timber harvesting, land clearing for agriculture, and other purposes. Knowledge of site locations and activities may enable a better understanding of current environmental conditions, and the cumulative impacts that helped create them.

Logging

Commercial logging operations in the assessment area began in the latter half of the 19th century. In much of the assessment area, stream channels were cleared and logs floated to the main channels for use by the sawmills or for shipment. Splash dams occurred on many tributaries of the Umpqua, Coos, and Coquille rivers. Timber patents significantly shaped the economy of the assessment area as local mills were granted patents by federal agents to harvest timber from a specific tract of federally owned land for a set fee. In the assessment area, many small mills were established and operated along the numerous rivers and streams that were being actively logged until the late 20th century. Some smaller mills were either closed or acquired by major timber companies by the end of the 20th century, and the towns that had grown up around many of these mills were losing population and jobs, (e.g., Powers).

Roads

Approximately 1,340 miles of road exist within these LSRs including BLM, Forest Service, private, and County roads which serve a variety of users including; federal personnel, general public, residential users, recreational users, and adjacent land owners. There are no large, well developed, quarry sites or communication sites within the LSRs. There may be some small "bank-run" type quarries adjacent to roads within LSRs which provide surfacing material. Consideration of the potential benefits from upgrading roads causing sedimentation problems needs to be balanced with the possible disturbance or minor loss of adjacent habitat.

Agriculture - Including Grazing

Agriculture occurs primarily in the western part of the assessment area in inland valleys and along the coastal plain. Livestock raising (sheep, dairy, and cattle), cranberry bogs, and some truck farming are the main agricultural activities. No agriculture or grazing activities occur within the LSRs.

Minerals

The assessment area is considered to have low to moderate potential for leasable minerals (oil and gas) based on indirect geological inference.

Locatable minerals exist in small quantities in the southern part of the assessment area. There are some mining claims currently being worked, and a moderate potential exists for other areas along streams.

Salable minerals often occur along remnant volcanic deposits, and several small “bank run” quarries exist within the assessment area. River bottoms have moderate potential for gravel extraction, and the dunes along the coast could provide sand quarries. However, existing quarries are not considered to have an overall effect on the integrity of LSRs, and future expansion is not expected to impact LSR objectives. (See the District Resource Management Plans (RMP) and Land and Resource Management Plans (LRMP) for a full discussion of mineral potential within the area.)

Recreation

Recreational uses include, but are not limited to, fishing, hunting, Off Highway Vehicle (OHV) use, mountain biking, boating of all kinds, sailing, wind surfing, watchable wildlife, hiking, sightseeing, and camping. Use occurs year round, with the heaviest use in the summer and early fall. Activities are spread throughout the area, with heavier use closer to the coast or to water. The District RMPs and LRMPs and District Recreation Management Plans detail existing and proposed recreation use within the LSRA.

Wilderness and visual qualities are generally compatible with LSR objectives. Mature and old growth trees occur in developed recreation sites within the assessment areas. The Doerner Fir hiking trail lies entirely within an LSR, and the Living Forest Auto Tour shows the public the development of a forest from harvest through old-growth stands.

Recreation activities that could affect LSR objectives include disturbance of wildlife species by human activities harassing wildlife or by changes in habitat through disturbance of vegetation. Mountain biking, increased OHV use, or an increase in the numbers of people using the area could affect the viability of wildlife or plant species. Additional impacts could include increased dumping of waste, illegal removal of trees or snags, road construction for access, or the construction and use of additional recreation sites in or near LSRA.

Administrative sites (electronic and communication sites, campgrounds, rights-of-ways, progeny test sites) may affect the ability to attain LSR conditions in certain areas because the sites are permanently cleared. However, most of the sites occur in already developed areas, and do not affect the overall ability to develop or maintain LSR conditions.

Areas of Critical Environmental Concern (ACECs) have been designated throughout the assessment area, primarily to protect certain characteristics of old-growth forests, and unique habitats such as serpentine bogs and plant communities. Because these areas are administratively withdrawn from most land disturbing activities, their presence should enhance existing LSRs and enable development of LSR characteristics in other areas.

Economic Values

The economic foundation of the area has been primarily timber (logging, milling, and shipping), commercial fishing, and agriculture. The larger communities of the Willamette, Umpqua, and Rogue valleys and those shipping and fishing towns along the coast have depended upon these activities for their continued existence. Of less economic significance are special forest products such as firewood; grasses, ferns and boughs; Christmas trees; mushrooms; and cedar bolts. With the decline of timber and its related industries, tourism has begun to be an economic force in the latter part of the 20^{th} century.

Natural Disturbances

Fire

Before the advent of logging, fire was the most important disturbance process affecting landscape pattern in the assessment area. Fire is both the primary stand replacing disturbance and an important shaper of the subsequent stand structure and composition. Topography strongly influences fire behavior. A model describing the interaction of topography and fire on landscape patterns is described in Appendix A.

As part of watershed analysis, fire histories were investigated for three subwatersheds within the assessment area, and a fourth subwatershed just north of the assessment area (USDI 1995a; 1995b; 1996a; 1996b). Fires, as indicated by scars and regeneration pulses, largely occurred in clusters or episodes separated by periods of low fire activity. Those periods were between the years 1404 to 1440, 1534 to 1621, 1735 to 1780, 1845 to 1855, and 1885 to 1942. Large stand replacement fires are associated with periods of severe regional drought (Heinselman 1983). Regional drought conditions could explain why several fires observed in the assessment area occurred about the same time as fires in Lake States, and in the Klammath, Cascades, Olympics, and Rocky Mountains (Agee 1991, Franklin & Hemstrom 1981; Heinselman 1983). The time since the last major stand replacement fire ranges from 31 years for the Oxbow Burn area to more than 439 years for one site in the South Tioga Creek headwaters. Except for the South Tioga Creek site, and the lower slopes in the upper end of the North Fork Coquille River, all sites where fire histories are documented were affected by the 1845-1855 and/or 1885-1942 fire episodes.

Based on the fire frequencies calculated for Tioga Creek in LSR 261, and considering data from the other fire histories, the average fire frequency before fire suppression at the drainage scale for LSR 261 was between 50 and 75 years. West Fork Smith River in LSR 267 had a 42-year average fire return rate at the drainage scale. The LSRs between LSR 261 and LSR 267 are all expected to have comparable fire frequencies. The other assessment area LSRs south of LSR 261, in the Western Hemlock Zone, have climates that are at least equal to if not warmer and drier than LSR 261, and therefore are expected to have similar fire frequencies. This assumption is supported by the estimated 65-year average fire interval reported for the Western Hemlock series and the 90-year average return interval reported for the tanoak series in the *Southwest*

Oregon Late-Successional Reserve Assessment (USDA & USDI, 1995). Additional findings from those fire histories are summarized in Appendix B.

Wind

Winter wind storms are a major disturbance agent in the Coastal Fog Zone. They are also a frequent cause of fine scale disturbances and on occasion are stand replacement disturbances in the rest of the assessment area.

Severe winter storms originating offshore regularly hit this region with heavy rains and strong winds. High wind warnings for wind speeds of 60 to 80 mph on the headlands occur most years. These winter storms generally come out of the southwest. If the winds come more from the west than from the south, the winds will be strongest on the coast and decrease in strength inland. This is due to the north-south orientation of the Coast Range that slows the wind through surface roughness. The most destructive winds are the ones out of the south that blow parallel to the ridges. At the most exposed ridges in the Coast Range, it is estimated that wind gusts to 150 mph and sustained winds of 110 mph occur at intervals of 5 to 10 years (PNWRBCMC 1968).

We are unable to predict the distribution or occurrence of blowdown beyond the following generalities. Blowdown usually occurs when soaking rains are followed by strong winds. Trees along stand edges facing the prevailing windstorms are more susceptible to windthrow than those that are at an angle of 90 degrees to the wind (Alexander and Buell, 1955). Corners and gaps, on the down wind side of clearcuts and canopy gaps are vulnerable to blowdown because the wind speed is accelerated as it funnels into constrictions (Smith 1962). Exposed clearcut boundaries on ridge tops where the opening is on the lee side will cause winds to eddy the same as on sharp ridges. Blowdown is most likely to occur on the lee side of sharp ridges and on the windward side of gentle slopes. Individual trees or small patches of widely dispersed blowdown are an annual occurrence. Infrequently, windstorms will cause blowdown individual patches greater than 100 acres. Blowdown, at that scale occurred inside the assessment area in 1951, 1962, and 1975.

Snow Damage

Snow accumulation is usually limited to above 1,800 feet elevation. Wet snows that fall before alders lose their leaves result in snow break of alders above 1,800 feet elevation. Repeated snow breakage has been observed to effectively release conifers from over topping red alder and may be a reason to why alder was a minor component in stands above 1,800 feet before there was much road construction or logging. Heavy wet snows can also cause considerable damage to recently commercial thinned stands. Most snow damaged stands are natural stands, which were not precommercial thinned, and therefore the trees had small branches and small stem diameters relative to their heights.

Insect and disease

These agents, often working in consort, tend to modify stands by initiating gaps or patches and only rarely cause stand replacement.

Laminated root rot (*Phellinus weirii*) and black stain (*Ceratocystis verticicladiella*) disease can kill patches of sapling and pole size trees. Laminated root rot is transmitted through root grafts and by root contact with infected debris. The laminated root rot causal agent can survive up to 50 years in buried debris and stumps. Black stain disease, stands out as an agent more closely associated with the managed forest than wild settings. Black stain disease kills patches of sapling and pole size conifers on inherently stressful sites impacted by compaction or loss of top soil. Black stain disease is a current management concern and is controlled by minimizing stress to plantations, and by timing plantation treatments to avoid attracting the insects that vector the disease. Armillaria is occasionally observed killing trees in westside forests. Within the Hemlock Zone of the assessment area, the few confirmed cases of Armillaria were on tractor damaged soils.

White pine blister rust, *Cronartium ribicola*, is present in LSR 259, and may affect whether or not sugar pine will continue to exist in stands.

Port-Orford cedar (*Chamaecyparis lawsoniana*) is affected by an introduced pathogen *Phytophthora lateralis* is probably the most commonly encountered and damaging forest disease agent in the analysis area. *Phytophthora lateralis* was first documented in wild stands in the Coos Bay district in 1952. The pathogen is found where ever Port-Orford cedar occurs including in LSRs 251, 255, 257, 259, 260, and 261. Port-Orford cedar generally comprises less than five percent of the stands. The spores of this pathogen are water borne and can be carried by water, and mud on animals, humans, equipment and vehicles. Because of the prolific seeding capability of Port-Orford cedar (Goheen 1996), the tree species will continue to be present in the ecosystem (Zobel 1985), although the population maybe at a reduced level.

Insect attack is a secondary disturbance in the Coast Range forest. The following discussion on insects is based on a personal communication with Don Goheen, who is with the S.W. Oregon Forest Insect and Disease Technical Center. Douglas-fir bark beetle (*Dendroctonus pseudotsugae*) and Douglas-fir engraver (*Scolytus unispinousus*) attack stressed trees and fresh blowdown. The Douglas-fir bark beetle attacks large trees and therefore is the economically more significant of the two. The Douglas-fir engraver attacks are limited to the tops and branches of large trees, and to small trees. Black stain disease is the primary cause of stress that predisposes small trees to Douglas-fir engraver beetle attack in the assessment area. Defoliator insects have not caused significant economic damage to Coast Range forests. Douglas-fir bark beetle attacks, in the Coast Range, are rare and are associated with large blowdown events. The two biggest bark beetle epidemics occurred in response to the 1951-52 windstorms and the 1962 Columbus Day Storm. The back to back blowdown events in 1951 and 1952, coupled with the lack of a road system to support aggressive salvage, resulted in the 1952-53 beetle epidemic being the larger than the beetle outbreak following the Columbus Day Storm. Douglas-fir bark beetles are not effective against live healthy Douglas-fir. It takes the beetles emerging from three to four wind thrown trees to successfully attack and kill a single standing green tree. The Burnt Mountain Unit Resource Analysis (USDI, 1978) describes normal bark beetle attacks as usually limited to clumps of a dozen or fewer trees widespread through the forest. It is now thought that those clumps were more likely to be laminated root rot centers. The Douglas-fir bark beetle is an opportunistic user of trees weaken by root disease and causing standing trees to die resulting in snag recruitment inside root rot pockets.

Landslides, Floods, and Earthquakes

Landslides and floods have influenced the formation of landforms, soils, streams, and fish habitat. They introduce sediment (including gravels necessary for spawning) and large trees that act as energy dissipaters and sediment storage sites into stream systems.

Logging and road construction altered landslide rates by destabilizing steep slopes within many watersheds in the LSRA area. Instead of a single short period of intense landsliding which would have normally been associated with large scale fires, repeated sliding results from moderately severe storms. Landslides from logged sites mainly introduce sediment without the large logs that control stream channel gradients and sediment load over several decades. The supplies of large trees to the stream channels has been greatly reduced or eliminated. Although no systematic studies of this effect have been conducted across the area, these activities are thought to have changed stream channel shapes and function. Instead of complex step/pool profiles with multiple slide channels produced by log jams, many channels in heavily logged watersheds have become simple bedrock chutes. The streams have been simplified and lack complex habitat. As a result, species richness, diversity, and reproductive capacity is reduced.

Landslides usually affect only small areas at a time but the severity of that disturbance can be very high. Landslides result in the loss of the top soil and organic layer at the point of origin and bury developed soil profiles, where they come to rest, with material that is predominantly subsoil and fractured rock. In extreme cases, all soil is lost down to bedrock. The loss of the organic layer and top soil to landslides sets back plant succession, and favors pioneer species. Red alder is particularly successful in occupying slide tracks and deposits because its small winged seed facilitates long distance disbursal, rapid juvenile growth, and its ability to fix nitrogen. From the stand point of red alder's regeneration strategy, fresh road cuts and fills provide the same conditions produced by landslides. Landslides that reach creeks can deliver structural material (woody debris, and boulders), gravel, fine sediment, and fine organic matter.

Like landslides, floods affect only a small part of the landscape but it too is a significant process. Flooding can kill or damage vegetation by burying small plants under sediment and breaking plants with brittle stems. Flooding affects the species composition on the flood plain by killing plants that do not tolerate saturated soils. This frees growing space for those plants that have mechanisms to survive saturated soil conditions or can regenerate on sediment deposits.

Periodic earthquake activity can result in large mass failures. The relationship of earthquake activity to slope movement has not been quantified.

Vegetative Patterns - Reference and Current Conditions

Current vegetative patterns are a result of natural succession and disturbance processes affecting a site’s progression towards its potential natural plant community. In the Coast Range, fire and wind-throw are significant disturbances which have helped shape current vegetative patterns. Based on a broad analysis of changes in forest stand age classes between 1850 and 1940 in the Oregon Coast Range, Teensma (1991) estimated that the percent of older forests (greater than 100-years old) during this period ranged from 49 percent to 68 percent (Table 12). The vegetative patterns he found were consistent with large, stand replacing fires occurring irregularly, at intervals from 150 to 350 years.

Teensma speculated that many of the fires were of human origin, both prior to and during European settlement.

Table 12. Forest Stand Age Classes of the Oregon Coast Range (percent by age class)

Year	Recently Burned [1]	Age Class Unburned				Total
		0-49	50-100	100-199	200+	
1850	34.5	1.3	2.2	22.0	40.0	100
1890	5.2	23.7	19.6	5.2	46.3	100
1920	6.1	4.4	19.8	19.8	49.9	100
1940	7.3	33.5	8.7	31.9	18.6	100

[1] In 1850 and 1890 recently burned signifies areas burned within the previous 2- to 50 years.

The current vegetative pattern is much more fragmented than even what occurred during the 1940s. As a result of further settlement patterns and extensive logging, patch size on the landscape has become much smaller, the number of patches has increased and there is an overall reduction in the percentage of older forests (greater than 100-years old).

Overall, vegetative patterns in the Coast Range have shifted from a fire regime which created large tracts with a significant amount of older forests to settlement and logging regime which has created a pattern of many small patches with a shift toward the younger age classes.

III. Conditions of the LSRAs for Animal and Plant Species

Late-Successional Forest Species

Late-successional forest species are those which exhibit a strong association with late-successional forests. These forests, as defined earlier, are stands greater than 80-years of age (mature and old-growth age classes). This definition was adopted for consistency with FEMAT and the ROD, however, from the standpoint of many species associated with late-successional forests it is not an accurate portrayal of their true habitat requirements. Many of these species have a strong association with old-growth forests (FEMAT) and require stands much older than 80-years of age to meet their life history requirements. This point should be kept in mind with regard to the following discussions of late-successional species and their habitat.

There are 57 late-successional forest species of wildlife known or suspected to occur within the assessment area (Appendix C) including 9 species of reptiles and amphibians, 28 species of birds, and 20 species of mammals. 19 of these species are Special Status Species, discussed later in this section.

Habitat requirements for the late-successional forest species can vary dramatically by species, so it is difficult to give an overall assessment of conditions for this entire group of species. For example, wide-ranging species, such as the northern spotted owl, rely on having larger blocks of late-successional forests available while species with smaller ranges, such as some of the amphibians, can survive adequately in smaller blocks.

One indication of habitat condition of the LSRs is amount and percentage of the LSR that is currently late-successional habitat. Overall, percentages of late-successional forest habitat in the 10 LSRs ranged from 41 percent for LSR 266 to 72 percent for LSRs 260 and 265 with a mean of 57.4 percent for all the LSRs (Table 13). Six of the 10 LSRs currently have 60 percent or more of their area in late-successional forest habitat.

Although this gives an overall indication of how much late-succesional habitat remains in the LSRs, an analysis of the current interior forest habitat acres is perhaps a better indicator of the condition of these reserves to support and maintain populations of late-successional species. Interior forest habitat is defined as that part of the late-successional habitat that is beyond the edge effect (Chen 1991as cited in the Oregon Coast Province LSRA 1997).

Estimates of interior forest habitat acres were derived for the LSRs using a buffer approximating edge effects for the provinces in this LSRA (Table 13). Map 4 displays graphically the proportions of the late-successional forest within the LSRs which are estimated to be functioning as interior forest versus the portions which are considered to be edge.

These estimates of interior forest habitat are likely somewhat conservative when considering only the microclimatic aspects of edge effect (Chen 1991, Spies 1994), since the analysis did not consider the ages of adjoining stands, topography, latitude, or the size of forest openings. But from the standpoint of the many negative consequences that edge effect and forest fragmentation has on the many wildlife species associated with interior forest habitat (Lemhkuhl and Ruggiero

1991, Noss and Cooperrider 1994) these estimates are probably overly generous especially considering the analysis was done for stands 80-years old and older versus old-growth stands. The negative impacts to wildlife associated with forest fragmentation and edge effect, include qualitative and quantitative habitat losses, increased risk of predation and increased competition between interior and edge species (Lemhkuhl and Ruggiero 1991, Noss and Cooperrider 1994).

It is estimated that the actual acres of interior forest habitat are substantially lower than the corresponding numbers for late-successional forest habitat (Table 13). Percentages of interior forest habitat range from 4 percent for LSR 251 to 32 percent for LSR 265. Some differences between LSRs in percent interior habitat are due to LSR size alone since smaller LSRs have a higher ratio of perimeter (edge) to total area. Another key factor accounting for differences between the LSRs is the degree to which the reserve is fragmented by public versus private ownership. The more fragmented the ownership pattern, the less interior habitat will be provided. Generally these estimates indicate that many of the LSRs in this study are presently in poor condition relative to maintaining populations of many late-successional forest species, especially those associated with interior forest habitat.

Table 13. Acres and Percentages of Late-Successional and Interior Forest Habitat Within LSRs.

LSR Number	Total LSR Acres	Late-Successional Acres	Percent of total LSR Acres	Interior Forest Habitat [1] Acres	Percent of total LSR Acres
251	1,896	1,001	54	79	4
255	2,396	1,529	64	479	20
257	2,592	1,567	60	731	28
259	41,368	25,091	61	7,063	17
260	4,797	3,441	72	1,509	31
261	70,611	35,583	50	9,646	14
263	60,559	32,176	53	8,299	14
264	16,113	10,027	62	2,534	16
265	44,893	32,486	72	14,183	32
266	12,396	5,083	41	1,146	9
Total	257,594	147,984	57.4 [2]	45,669	17.7 [2]

[1] Late-successional habitat buffered by 410 feet (Klamath and Cascade Provinces) and 500 feet (Coast Range Province)
[2] Average for all LSRs

Of the larger LSRs (greater than 30,000 acres) LSR 265, which is shared between the Siuslaw NF and Coos Bay BLM, has both the highest percentages of late-successional and interior forest habitats. The relatively high interior forest percentage is partially due to the relatively blocked nature of this LSR. Conversely, both LSRs 261 and 263, which have some blocked and checkerboarded areas, have less than half the percentage of interior habitat found in LSR 265.

Chen et al. (1992, 1995) describe the changes in microclimatic variables and vegetation response from recent (10-15 yr.) clearcut edges into old-growth Douglas-fir forests (Table 14). The effects of edge varies depending on the variable measured and the distance from the edge. For example, solar radiation generally does not reach beyond 200 feet into the late-successional stand, but the effects of humidity change can occur up to 800 feet into the stand, and even further under occasional severe weather conditions. Edge aspect was important in determining the depth of edge influence into the stand for many of the variables. For example, solar radiation reached much further into the stand on south facing aspects than on north facing aspects, and interior wind speed and depth of wind effects were more pronounced when the stand edge faced the prevailing wind direction. Thus, local variables such as aspect, topography or prevailing wind patterns should be considered when determining edge effects.

Table 14. General Effects of Early Seral Edges on Parameters of Interior Late-successional Habitat, based on Chen et al (1992) and Chen et al. (1995)

Distance within late-successional forest stand from edge of early seral	Effects of edge on physical and biological parameters of late-successional forest stands that reduce their suitability as interior forest
0-199 feet	Direct solar radiation into stand; much higher air temperature and consequent lower humidity; significant drying of understory and increases in soil temperature; increased growth of understory vegetation, significant blowdown, some tree death due to sun scald.
200-399 feet	Significant wind effects; increased temperature and lower humidity; significant blowdown occurs, resulting in fewer overstory trees and less canopy closure within this and previous band width.
400-599 feet	Measurable increases in wind speed and air temperature, and decreases in humidity, in forest stand as compared to optimal interior conditions.
600-799 feet	Limit of humidity and air temperature effects of edges.
800-1,300 feet	Slight differences in wind speed.
Greater than 1,300 feet	No detectable biological or physical condition affecting late-successional functions.

Some late-successional species are very closely affiliated with CWD and snags and these habitat features may define the quality of the habitat distribution more than the size of the particular late-successional stand. Appendix C indicates which of the late-successional wildlife species are especially dependent on CWD and snags.

Most BLM lands in the assessment area have been subject to harvesting, salvage, or theft over the years which has affected the amount of down woody material and snags. In addition, snags have been actively cut to reduce safety hazards in and around harvest units, along roads, and adjacent to recreation sites. Snags have also been systematically fallen to reduce the likelihood of lightning strikes and the spread of wild fire. Although we have no specific data, one could assume that the larger intact stands (greater interior habitat areas) have reduced human access and would generally have experienced less of these activities than areas with better access. This would further support the use of the interior forest habitat figures as an indicator of habitat quality, especially for species which rely on downed woody material and snags, and in particular those species with smaller home ranges.

Habitat connectivity within LSRs is another indicator of habitat quality for wildlife species especially those with limited dispersal capabilities (small terrestrial mammals, amphibians). LSRs with greater amounts of interior forest habitat would more likely have increased dispersal pathways for these species. LSRs with checkerboard land ownership patterns may offer special challenges to the dispersal of these species. Intact riparian zones and aquatic habitats, which can provide natural corridors for animal dispersal, are often seriously degraded on private lands which comprise every other section in LSR 259 and, on the average about every third section in LSRs 261, 263 and 264.

LSR network function

LSRs can be considered the backbone of the Northwest Forest Plan in that they were designed as a network of interconnected reserves to provide late-successional and old-growth ecosystems which serve as habitat for late-successional and old-growth related species. Two components necessary for a properly functioning LSR network include: self-sustaining population clusters of late-successional species; and adequate connection of late-successional habitat within and between LSRs to allow interaction among these population clusters and among individuals within a population cluster. Assessing and improving the functionality of the network requires addressing both of these components. Understanding the current and potential conditions of LSRs and their adjoining areas will help focus management strategies and treatment priorities between and within the LSRs.

LSRs were established to provide for a wide variety of late-successional associated species, from highly mobile vertebrate species like spotted owls to species with limited mobility and more restricted home ranges such as mollusks. Some of these species may not tolerate conditions found outside of late-successional habitat. For these species, movement between late-successional patches may be more dependent on contiguous connections of late-successional habitat or connections that develop through time allowing individuals to incrementally move through an area over successive generations.

Other species can move across habitat that is not late-successional and will not meet all of their food, cover, or water needs, but will provide at least one or more of these needs for a limited amount of time. This allows them to move from one late-successional patch to another. This type of habitat will be referred to as connectivity habitat in this document.

Thomas et al. (1990) listed 5 concepts on which to design a reserve network. Two of these concepts include: 1) the more similar connectivity habitat is to late-successional habitat, the more successful late-successional species will be in moving through it; and 2) the shorter the distance between late-successional blocks, the better. Rosenberg (1994) and Harrison (1992) indicate that less suitable conditions between habitat blocks may be tolerated by species if they do not have to spend much time between these blocks, thus inferring another general rule about connectivity habitat: the shorter the distance between late-successional blocks, the more dissimilar connectivity habitat can be from late-successional habitat (probably up to some threshold) and still function to allow individuals to pass through. For example, a late-successional species may successfully cross 100 yards of an area in an early-seral condition, but not 1,000 yards; whereas the same species may cross 1,000 yards of a stand in mid-seral condition.

The specific connectivity habitat components that allow an individual to move among late-successional patches is likely to vary among species and has not been quantified to any extent. It is assumed that at a minimum, connectivity habitat will provide some form of cover from predators and climatic extremes (e.g. temperature, humidity, wind, precipitation). Foraging opportunities may or may not be present, but it is assumed that late-successional species may remain for longer periods of time as connectivity habitat functionality increases and if foraging opportunities are present. In general, connectivity habitat for the northern spotted owl is believed to occur in stands 40-years of age and older in this assessment area. At this age the stands provide cover, and they may begin to provide some foraging opportunities. The age at which a stand functions as connectivity habitat for the many other late-successional species in the assessment area is unknown. Older stands which are likely to be more similar to late-successional habitat may be required for some species, while other species may be able to cross younger stands if some structural components such as large woody material are present in sufficient numbers. For this assessment we will assume that stands 40-years of age and older begin to exhibit characteristics of connectivity habitat.

Province context

The Coast Range Province comprises that portion of the analysis area roughly north of Highway 42 (see Map 1). The Northern Spotted Owl Draft Recovery Plan (USDI 1992 b) and the Northern Spotted Owl Critical Habitat Final Rule (USDI 1992 a) provide an overview of the provincial conditions with respect to owls and their habitat. This information is generally applicable when assessing conditions for most of the other late-successional species as well. The Coast Range Province was considered to be in a critical condition with respect to owl populations and habitat due to the low number of owl territories and the poor quality of existing habitat throughout much of the province. The southern portion of the province, encompassed in this analysis area, has a high proportion of known owl sites (at the time of Critical Habitat designation, 40 percent of the owls in the province were in the southern 20 percent of the province between Highways 38 and 42). However, most owl site home ranges within the province contain less than 40 percent suitable nesting habitat.

There is a high risk of the Coast Range Province becoming isolated due to the few weak and tenuous links to adjoining provinces. Natural boundaries to the west (Pacific Ocean), and east (Willamette Valley), and the presence of the Columbia River and vast tracts of private land in the Western Washington Lowland Province to the north restrict any possible links to adjoining provinces to the southern end of the Coast Range. The link to the Klamath Province is tenuous due to the natural fragmentation and the checkerboard nature of the federal ownership in this area. The link east to the Western Cascades Province is through another area of federal checkerboard ownership. A conservation objective identified in the spotted owl Critical Habitat process was to improve connectivity within the province and also to the adjoining Klamath and Western Cascades Provinces.

The Klamath Mountains Physiographic Province encompasses that portion of the analysis area roughly south of Highway 42. Particular areas of concern in this province are again the connections to adjoining provinces, particularly north to the Coast Range Province and east to the Western Cascades. These connections are tenuous due to the fragmented nature of the federal ownership. In fact, the fragmented nature of federal ownership throughout the northern tier of the Klamath Province is a concern. Conservation objectives identified in the spotted owl Critical Habitat process to address these concerns included: 1) develop and maintain well distributed and well connected population clusters; 2) establish large blocks of nesting habitat by reducing fragmentation and improving habitat quantity and quality; and 3) improve connectivity to the adjoining Coast Range and Western Cascades Provinces (USDI 1992 a).

Overall, federal checkerboard ownership in the majority of the area precludes development of large, contiguous stands of late-successional habitat as well as contiguous links of late-successional forest between LSRs.

Non-federal lands

The intervening private lands within and between LSRs are not expected to produce late-successional habitat, nor even much of the structural habitat components such as small late-successional patches, CWD, and snags, corridors and large riparian reserves that could help facilitate movement across an area that is primarily managed for early-seral conditions. However, Habitat Conservation Plans (HCPs) in place on the Elliott State Forest and Weyerhaeuser's Millicoma Tree Farm will provide habitat to facilitate movements of some late-successional species between federal LSRs.

In general, the Millicoma HCP is designed to provide only dispersal habitat for the northern spotted owl. Because corridors and remnant patches of late-successional habitat are not expected to occur on the tree farm in the long-term, opportunities for movement of low-mobility species across the tree farm are much more limited. In contrast, the Elliott State Forest will provide not only dispersal habitat for owls, but also suitable nesting habitat for owls and marbled murrelet. Individuals from the Elliott State Forest are expected to interact with individuals in the adjoining LSRs (265 and 263). The Elliott State Forest will also provide a system of reserves, long rotations, and structural components such as snag and down wood retention to help facilitate movement of low-mobility late-successional species across the landscape through time. A more detailed description of these two HCPs is found in Chapter 1.

Large and Small LSRs

All LSRs are designed to meet the objective of providing late-successional and old-growth habitat. However, due to their location, size, and surrounding landscape, some LSRs may have different capabilities of meeting the needs of different late-successional species. For this analysis, LSRs were categorized as either Large (larger than 30,000 acres) or Small (smaller than 30,000 acres). Large LSRs can accommodate self-sustaining population clusters of most late-successional species; exceptions may be large, mobile predators (e.g. mountain lion), migratory species (e.g. some neotropical birds), and rare, local endemic species which may not occur in the large reserves (FEMAT 1994). Movement of individuals between these population clusters, both within the LSR and between LSRs, is important to maintain genetic and demographic integrity.

Species with limited dispersal capabilities require relatively close spacing of suitable habitat. Thus, Small LSRs are scattered across the landscape to enhance the distribution of these species. In addition, Small LSRs facilitate movement of highly mobile species between population clusters within the Large LSRs. Further enhancement of connectivity is expected to occur through maintaining a Riparian Reserve network, retaining patches of late-successional habitat, and retention of structural components such as green trees, snags, and CWD in harvested areas. Continuous connections between LSRs becomes more imperative as species mobility decreases.

In the LSR analysis area, Large LSRs are present to provide for self-sustaining populations, or clusters, of most late-successional species (Table 15). The Small LSRs may be large enough to provide for self-sustaining populations of species with small home ranges and limited mobility such as plants, mollusks, and amphibians; however, for species with larger home ranges, Small LSRs are important in facilitating movement between the Large LSRs and in producing scattered individuals to supplement adjacent population clusters.

Province links

Province link LSRs are located on the edge of a province and adjoin an LSR in a neighboring province. The Coast Range is connected to the Klamath Province via LSRs 257, 259, 260, and 261, and to the Western Cascades Province via 264 and 263. LSR 259 connects the Klamath Province to the Western Cascades. These LSRs are key conduits for transferring organisms between provinces, and their loss could increase the isolation risk of a province. Possible isolation is of special concern in the Coast Range Province.

Redundancy in the network

Where possible, redundancy was incorporated into the LSR network to help compensate for the loss of an individual LSR to a natural event. Lack of redundancy in some areas highlights a weak link in the network where a potential loss may severely limit the connection and functionality of the network. For this analysis it is assumed an LSR lacked redundancy if its loss resulted in a gap greater than 12 miles between adjoining LSRs.

LSRs in the northern tier of the analysis area are relatively close together, with alternative avenues for species movement between LSRs should an individual LSR be lost. However, the level of redundancy diminishes greatly further south in the analysis area. If LSRs 259, 261, or 263 were removed from the network, a gap greater than 12 miles would result between adjoining LSRs (Table 15). Lack of redundancy is of special concern at the inter-provincial linkages, such as LSRs 261 and 259. Loss of LSR 259, 261 or 263 could severely diminish the ability of species to move through the LSR network.

Table 15. Condition of Late-Successional Reserves						
LSR	Acres	Late-Successional habitat	Large or Small [1]	Provincial. Link ? [2]	Redundancy ? [3]	Isolation Potential [4]
251	1,896	1,001	Small	no	yes	low-mod
255 [5]	267,899	122,042	Large	no	no	low
257	2,592	1,567	Small	no	yes	high
259	41,368	25,091	Large	yes	no	mod
260	4,797	3,441	Small	yes	yes	mod
261	70,611	35,583	Large	yes	no	high
263	60,559	32,176	Large	no	no	mod-high
264	16,113	10,027	Small	yes	no	mod-high
265	44,893	32,486	Large	no	yes	low
266	12,396	5,083	Small	no	yes	low

1 The LSR is a Large LSR if it is greater than 30,000 acres; otherwise it is a Small LSR
2 The LSR is a link between physiographic provinces if it is on the edge of the province and less than 12 miles from an LSR in the adjacent province.
3 Is there redundancy in the network in the vicinity of this LSR? Redundancy occurs when the hypothetical removal of this LSR would not result in a gap in the network greater than 12 miles between LSRs.
4 What is the potential for this LSR to become isolated from surrounding LSRs? This is a qualitative evaluation based on the proximity of other LSRs and the condition of the surrounding area outside of the LSR and its potential to provide connections of nearby LSRs.
5 Much of this LSR was analyzed in the Southwest Oregon LSRA. Only about 1 percent of this LSR falls within the analysis area.

LSR isolation potential

Isolation potential has to do with the degree to which LSRs are connected to their adjacent LSRs. This is a qualitative assessment based on: 1) the redundancy of the LSR network in the vicinity of the individual LSR; and 2) the condition of the surrounding land outside of the LSR and its potential to develop and maintain late-successional or connective habitat.

One rough measure of determining isolation potential was by developing a dispersal circumference to help quantify the likelihood that a species leaving a LSR in any given direction would encounter another LSR within 7 miles (for Small LSRs) or 12 miles (for Large LSRs). This was done by placing a point roughly in the geographic center of each LSR. A varying radius extended from this point and ultimately scribed a 360 degree arc around the point. The radius extended 7 miles from the border of Small LSRs to any other LSR, and 12 miles from the border of Large LSRs to any other LSR. The proportion of the circle circumference that intersected LSRs meeting these conditions is the dispersal circumference. This measure roughly indicates that of the 360 likely azimuths that an individual could depart from an LSR, the proportion of those azimuths that would reach another LSR within the above dispersal distances, assuming the individual traveled in a straight line.

LSR 261 had the lowest dispersal circumference (29 percent), with very limited opportunities for species to move between it and surrounding LSRs. Species moving north of this LSR must cross the Millicoma tree farm. Because late-successional habitat is not a management objective in the Millicoma tree farm, and existing remnant stands may not be retained after 20 years, there is likely a limited ability for small ranging, low-mobility species to successfully cross this area. Thus, only species that can survive in early to mid-successional habitat are expected to move across these areas. The checkerboard nature of federal lands south of LSR 261 limits the ability of species to move into the extensive LSR network on the Siskiyou National Forest.

LSR Conditions for Special Status Species

Northern Spotted Owl

Spotted owl inventories cover approximately 80 percent of the suitable habitat falling within the LSRA area.

Owl pairs in the Coast Range Province with less than 1,906 acres of suitable habitat (also known as nesting, roosting, and foraging (NRF)) within their median home range (1.5 mile radius circle) and those in the Klammath Province with less than 1,336 acres of suitable habitat within their median home range (1.3 mile radius) are considered to be marginally viable, based on the U.S. Fish and Wildlife Service definition of "incidental take". The above acreages represent the 40 percent threshold and any further removal of suitable habitat within the home range of these owl pairs may result in the loss of the pair site.

Of the 114 owl pairs within the LSRA area, 22 pairs (19 percent) are above the 40 percent threshold and the remaining 92 pairs (81 percent) are below the 40 percent threshold (Table 16). These figures exclude the 39 owl pairs in LSR 255, of which 15 pairs (38 percent) are below the 40 percent threshold (they have been analyzed in the Southwest Oregon LSRA).

Suitable NFR habitat (80-years and older), totals 146,455 acres (excluding LSR 255). The Large LSRs (259, 261, 263, 265) support the highest number of owl pairs and contain 125,336 acres (86 percent) of suitable habitat while the Small LSRs (251, 257, 260, 264, 266) contain 21,119 acres (14 percent) of suitable habitat (Table 16).

Dispersal habitat (age class 40 and older) totals 162,402 acres (excluding LSR 255). The Large LSRs (259, 261, 263, 265) contain 139,144 acres (87 percent) of dispersal habitat while the Small LSRs (251, 257, 260, 264, 266) contain 23,158 acres (14 percent) of dispersal habitat (Table 16).

For all known (as of 1 January 1994) owl sites outside the LSR boundaries located on federal lands in the Matrix, 100 acres of the best northern spotted owl habitat will be retained as close to the nest site or activity center. These core areas are intended to preserve an intensively used portion of the breeding season home range. Management activities within the core areas should comply with management guidelines for LSRs. Within the boundaries of the analysis area there are 74 - 100-acre cores, 3 of which have a portion of their acres within LSRs.

Although, the Large LSRs (larger than 30,000 acres) are expected to accommodate self-sustaining populations of many late-successional species such as the spotted owl, a recent demographic study conducted within the Coos Bay district boundary from 1990 through 1994 indicated the population was significantly declining at a rate of about 5.3 percent per year, mainly due to the low survivorship of females and juveniles (Zabel et al., 1994). Major causes of mortality are starvation and predation. During the years of this study, the population exhibited significant annual variation in reproduction. For a long lived species such as the spotted owl, reproductive activity over the short-term may have little effect on changes in population size and populations can probably persist through periods of low fecundity. 100 of the 114 owl pairs (88 percent) in the analysis area are associated with these Large LSRs.

Relationship of the LSR Network to Critical Habitat for the Northern Spotted Owl

Critical habitat was designated for the spotted owl in January 1992 (USDI 1992 a). Critical habitat is defined in Section 3(5) (A) of the Endangered Species Act as those areas which provide the physical and biological features that are “essential to the conservation of the species” and “which may require special management considerations or protection.” [16 U.S.C. 1532 (5) (A)].

The Fish and Wildlife Service determined that the primary constituent elements essential to the conservation of the spotted owl were those physical and biological features that support nesting, roosting, foraging, and dispersal (USDI 1992). The Fish and Wildlife Service’s Biological Opinion on the Northwest Forest Plan (Appendix G, FSEIS), which covered adoption of the plan and not implementation, was that destruction or adverse modification of critical habitat would not occur. However, the analysis supporting this opinion was done at a scale covering the entire range of the spotted owl, and the opinion notes that a more localized analysis should occur to ensure that the LSRs and other reserve areas are meeting the needs of the Critical Habitat network.

The analysis area covered Critical Habitat Unit (CHU) numbers 54-63 (Map 5). These are CHUs not covered under either the *Oregon Coast Province - Southern Portion* or the *Southwest Oregon* LSR Assessments. To determine if the LSR network met the needs of the CHU network in the analysis area, we did four comparisons: 1) total acreage; 2) degree of overlap between CHUs and LSRs; 3) distribution of the 2 reserves networks; and 4) ability of the 2 networks to provide for dispersal.

Table 16. Marbled Murrelet and Northern Spotted Owl Habitat within the LSRs										
LSR	Acres	Marbled Murrelet			Northern Spotted Owl					
		Suitable Habitat	Percent Suitable Habitat	Occupied Sites	Suitable Habitat	Percent Suitable Habitat	Dispersal Habitat	Percent Dispersal Habitat	Total Owl Pair Sites	Pair Sites Above 40 Percent Threshold
251	1,896	679	36	2	1,001	54	1,223	65	1	0
255	2,396	661	28	0	1,529	64	2,296	100	39	24
257	2,592	1,227	47	5	1,567	60	1,916	74	1	0
259	41,368	17,208	42	0	25,091	61	26,754	65	18	0
260	4,797	2,562	53	0	3,441	72	3,732	78	3	0
261	70,611	29,882	42	1	35,583	50	41,616	59	35	5
263	60,559	30,389	50	5	32,176	53	36,986	61	34	8
264	16,113	8,937	56	1	10,027	62	10,740	67	5	1
265	44,893	28,569	64	12	32,486	72	33,788	75	13	8
266	12,396	4,846	39	0	5,083	41	5,547	45	4	0
Total	257,594	124,960	49 [1]	26	147,984	57.4 [1]	164,698	63.9 [1]	153	46

[1] Average for all LSRs

Total acres: In the analysis area, there are 10 CHUs totaling 255,282 acres. Although there are the same number of LSRs, they cover a slightly larger area, totaling 257,594 acres. When analyzed by province, the Coast Range Province has 206,003 acres of LSRs and 197,186 acres of CHUs while the Klamath Province has 43,941 acres of LSRs and 58,096 acres of CHUs.

Overlap: Only CHU 63 does not overlap with an LSR. It lies in the Klamath Province midway between LSR 259 and Interstate 5. It is an important, yet tenuous link between the Klamath and the Western Cascades Provinces across the I-5 area of concern. Approximately 88 percent of this CHU is in Connectivity/Diversity Blocks, with the remainder in General Forest Management Area. The remaining CHUs overlap the LSRs substantially, ranging from 71 percent to 99 percent (Table 17). Likewise, similar or greater amounts of spotted owl habitat located within the CHUs are protected in the LSR allocation. Across the entire analysis area, 89 percent of the CHUs overlapped with LSRs. By province, 64 percent of the 2 CHUs in the Klamath Province overlapped LSRs, whereas 89 percent of the Coast Range CHUs overlapped LSRs.

Distribution: Critical habitat units were designed to be shaped as blocks on the landscape rather than long, thin units that snake across the landscape. The former design allows more opportunity to provide large blocks of habitat where individual owls have a greater chance for interaction. With the exception of CHU 63, the LSRs cover all of these CHU blocks. The LSR acres that are in addition to the CHU acres are found primarily in smaller units, some of which are elongated and not blocky (e.g. LSR 260). The primary difference in distribution between LSRs and CHUs is the lack of an LSR in the vicinity of CHU 63; where CHUs are not located, LSR allocations exist to increase the amount of reserve land between LSR 261 and the Siskiyou National Forest (e.g. LSRs 260, 257, and a small portion of 259) and to round out the network on the Siskiyou (e.g. LSRs 257 and 251).

Dispersal: CHU 63 supports a crucial link between 2 physiographic provinces that has not been duplicated through an LSR allocation. However, nearly 90 percent of this CHU is in a Connectivity/Diversity Block allocation, which requires longer rotation lengths and larger areas of late-successional forest retention than the GFMA allocation. While this allocation does not provide the benefits that an LSR designation would, it does have an objective to provide for connectivity between LSRs (Coos Bay RMP p.22). The adequacy of connective habitat in this vicinity should be considered during watershed analysis to assure that the area functions to facilitate movement between the provinces.

The Critical Habitat Rule assumed that owl dispersal needs would be met with either the 50-11-40 rule (Thomas et al. 1990) or some other scientifically acceptable approach. The 50-11-40 rule stated that half of the federal lands between reserves (in this case either CHUs or LSRs), on a quarter township basis, would have forested stands with an average dbh of 11 inches or greater and an average canopy cover of 40 percent or greater. Unmapped LSRs and non-LSR reserve allocations (e.g. Riparian Reserves, Administratively Withdrawn Areas) located in the Matrix will help to facilitate movement between LSRs and will develop habitat of much better quality than the 50-11-40 rule provided for. Within this assessment area, over 50 percent of the federal landscape between the LSRs are in Riparian Reserves or some other reserve Land Use Allocation.

Table 17. Comparisons of Northern Spotted Owl (NSO) Critical Habitat Units (CHU) with Late-Successional Reserves (LSR) in the Coos Bay LSR Analysis Area. Critical Habitat Units Are Grouped According to Physiographic Province.						
CHU Number	Associated LSR	Acres of LSR	Federal Acres of CHU	CHU Acres in LSR	Percent CHU in LSR	Percent CHU NSO habitat in LSR
Coast Range						
54	266	12,396	8,456	7,786	92	96
55	265	44,893	40,981	39,838	97	98
56	264	16,113	6,163	4,386	71	74
57	264	16,113	10,392	8,536	82	91
58	263	60,559	51,036	50,524	99	99
59	263	60,559	4,780	4,702	98	99
60	261	70,357	72,771	57,398	79	80
61	261	70,357	2,607	2,489	95	95
Klamath						
62	259	41,368	49,562	37,234	75	74
63	none	N/A	8,534	0	0	0

Adapted from Table G-11 in FSEIS

Conclusion: Given the amount of LSRs in the area, its similar overlap and similar distribution to CHUS, and that management in LSRs must be neutral or beneficial to the development of late-successional habitat, it is expected that the desired functions of critical habitat network will continue. Movement among the LSRs will be facilitated by reserves located in the Matrix; areas of connectivity concerns are highlighted in this document as areas to address during watershed analysis.

Marbled Murrelet

For the LSRA area 124,960 acres (49 percent) are marbled murrelet suitable habitat (Table 16). Marbled murrelet suitable habitat includes those BLM stands that are 130-years or older and USFS stands with an average diameter of 18 inches or greater. Additional suitable habitat is located outside the LSRs on federal Matrix lands that are part of this assessment area. Other suitable habitat is present on federal, state, and private lands that are adjacent to the LSRs but not included in the assessment area.

There are 128 occupied marbled murrelet sites on federal lands within the LSRA area. Occupied sites are those areas where at least one of the following has been noted: discovery of an active nest or a recent nest site as evidenced by a fecal ring or eggshell; discovery of a chick or eggshell fragments on the forest floor; birds flying below, through, into, or out of the forest canopy within or adjacent to a stand; birds perching, landing, or attempting to land on branches; birds calling from a stationary location within the stand; birds flying in small or large radius circles above the canopy (ROD). Of these, 28 occur in LSRs and 100 occur in the Matrix, mostly in the northern portion of the LSRA. Occupied sites have been located in 6 of the LSRs in this assessment area (Table 16). By physiographic province, there are 95 occupied sites in Oregon Coast Range, 33 in Oregon Klamath, and none within the Oregon Western Cascade portion of the assessment area. Other occupied sites have been located on adjacent federal, state, and private lands not included in this assessment.

The 100 occupied sites on Matrix lands are protected with a 0.5 mile radius buffer (ROD). Matrix acres within these 100 buffers total approximately 8,201 acres. Of this total approximately 5,422 acres (40 percent) would be managed as unmapped LSRs in the Matrix, as they are currently murrelet habitat or are within 25-years of becoming murrelet habitat (ROD). In addition to providing habitat for murrelets, these Matrix protection areas also will provide additional benefit for other late-successional dependent species, and additional connectivity between the LSRs. It is likely that more occupied sites will be designated on Matrix lands as a result of future survey efforts and if found they will also be managed as unmapped LSRs.

Marbled murrelet nests have been located in LSRs 261 and 263. Other murrelet nests have been located on the Elliott State Forest west of LSR 263 (Kim Nelson pers. comm).

All occupied sites and nest sites located on federal lands in the LSRA area and all of the LSRs except 259, occur in marbled murrelet Zone 1 (FSEIS, 1994). Zone 1 extends about 35 miles inland in Oregon and is a key area for murrelets since most occupied sites and all nests found in the state occur within it (ODFW). Most of the remaining late-successional and old-growth forest within Zone 1 occurs on federal lands. Since the LSRs in this assessment area contain a large amount of suitable habitat and the amount of habitat they contain is a significant part of the total habitat left within Zone 1, they are very important to the conservation of the species.

At present, the value of each LSR for murrelets is unknown since they have not been thoroughly surveyed. Within the assessment area, LSRs 265, 263 and 261 are probably the most important as they contain about 71 percent of the suitable habitat, have the largest contiguous habitat blocks, and are comparatively close to the ocean (Map 5).

Marbled murrelet Critical Habitat

The final rule for designating critical habitat for the marbled murrelet was published in the Federal Register May 24, 1996 (vol. 61, No. 102). Criteria used to select areas for inclusion in critical habitat were similar to criteria used in developing the LSR network of the Northwest Forest Plan. Most of the mapped LSRs within the range of the marbled murrelet were designated as Critical Habitat. In this assessment area, all of the mapped LSRs within approximately 35 miles of the ocean were designated as critical habitat. Almost all of LSR 259 lies outside of the 35 mile zone; only a small portion near the 35 mile boundary was designated as marbled murrelet critical habitat. Because Critical Habitat for marbled murrelets in the assessment area is expected to be managed under the LSR S&Gs consistent with the Northwest Forest Plan, desired functions of the critical habitat network should be achieved.

Bald Eagle

There are 74 bald eagle nest sites present within the assessment area of which 34 nest sites (46 percent) are on federal lands within the LSRA. The remaining 40 nests are on federal, private, county, or state lands outside the LSRA. The 34 nests are associated with 16 unique territories. Of these, 25 are in LSRs (Table 18) and the other 9 are on Matrix lands. By physiographic province, 33 nests occur in the Oregon Coast Range and 1 occurs in the Oregon Klamath Province. LSRs 263, 264 and 265 are probably the most important for bald eagles, due to their location along the Umpqua River and most of the territories in the assessment area occur within these LSRs (Table 18).

There are about 883 acres of federal land within the 0.25 mile buffers around bald eagle nests in the LSRA. Of these, 553 acres (63 percent) are in stands less than 80-years old and 329 acres (37 percent) are in stands 80-years or older. For the 9 nest sites in Matrix lands there are 343 acres of federal land within the 0.25 buffers around the nest sites. Of the federal acres in buffers for Matrix sites there are 54 acres (16 percent) in stands less than 80-years old and 289 acres (84 percent) in stands 80-years or older. In addition to providing eagle habitat, these Matrix protection areas provide additional habitat for other species associated with late-successional and old-growth habitat, and also additional connectivity between LSRs. Additional buffers will be designated in Matrix lands as new bald eagle nests are discovered.

Most of the LSRA area occurs in the Oregon Coast Recovery Zone (Washington Department of Wildlife 1990) of the Pacific States Bald Eagle Recovery Plan. In Oregon this Recovery Zone is second only to the Klamath Basin in the number of bald eagle breeding territories (Isaacs and Anthony 1996). Federal territories analyzed in this study represent 27 percent of the total breeding territories in this key Recovery Zone. Most (86 percent) occur along the Umpqua River corridor, which in a comparison of Oregon rivers is second only to the Columbia River in the number of associated breeding territories (Isaacs and Anthony 1996). In addition to providing a large amount of suitable federal nesting habitat, the lands in this assessment area provide additional protection for nests on adjacent private lands. They are also important in the production of fish species that all eagles along the Umpqua and other rivers in the assessment area utilize as a food source. Hence the federal lands in this assessment area are very important to the conservation of this species due to the significant amount of late-successional and old-growth forest and the high eagle nesting density.

Table 18. Number of Bald Eagle Nests and Territories for the Assessment Area LSRs		
LSR Number	No. of Bald Eagle Nests Within the LSR	Number of Bald Eagle Breeding Territories Within the LSR
251	0	0
255	0	0
257	0	0
259	0	0
260	0	0
261	2	1
263	11	5
264	8	2
265	4	2
266	0	0
Total	25	10

Umpqua Basin Cutthroat Trout (Federally Endangered)

Umpqua Basin cutthroat trout occur within 39 percent of the assessment area streams (LSRs 259, 263, 264, 265, and 266). While their range is thought to be wide, their population numbers are not known. ODFW counting facilities at the Winchester Dam on the North Umpqua River showed greatly declining numbers which resulted in the subsequent listing of the species. No other counting facilities occur, therefore information throughout the remainder of the basin is limited. It is likely that populations declines have occurred elsewhere and were most notably caused by land management activities on forested lands and by activities within urban areas. Salmonid species are highly sensitive to increases in water temperature, decreases in habitat availability and pollution. The removal of the riparian canopy and large wood from along and within streams has no doubt affected the species populations. Likewise, pollution from cities and factories along the Umpqua has assisted in the decline. Angler harvest was also a factor, but to a lesser extent.

The cutthroat trout is the most widely distributed of the salmonid species (salmon and trout) due primarily to its small size, thus allowing it to utilize small streams which are inadequate for it's larger bodied relatives. There are several forms of this species: anadromous (searun), fluvial (large river/estuary) and resident (freshwater only). It is thought that the resident and fluvial forms have the potential to contribute genetically to the anadromous form. Spawning usually occurs in third and fourth order streams, but many fish have been observed in second order streams as well. The life span of the species averages 5 years, of which most is spent in freshwater (even for the anadromous forms).

Coho Salmon (Federally Threatened)

Coho salmon in the southern Evolutionarily Significant Unit (ESU) were listed as Threatened under ESA. The southern ESU extends from the Pistol River south into California. A total of 3.5 stream miles within LSRs 251 and 255 contain these coho stocks. This species spawns in third through fifth order tributaries and generally lives one year in freshwater (as juveniles) and two years in the ocean before returning to spawn.

All salmonids require cool clean water for survival, growth, and reproduction. They also require complex habitats which include pools for resting, rearing and feeding, and gravel dominated riffles for spawning. It is likely that the conditions within the older stands of the LSRA area are providing those components necessary for salmonid survival. Over the short and long-term, these areas will continue to provide refuges for both cutthroat and coho populations. In the younger stands of the assessment area, time is required to return the streams to more properly functioning conditions. In some cases, restoration management activities will assist in the recovery of instream and riparian habitats. In all cases, the maintenance of downed wood, a variety of vegetative and tree species, streamside shade, and the protection of potential landslide areas within the Riparian Reserves will be required.

Other Special Status Animal Species

Special Status Species include federal endangered, threatened, proposed, and candidate species and BLM sensitive, assessment, and tracking species (Appendix D). There are 94 species known or suspected to occur in the LSRA assessment area that are Special Status Species (Appendix D), 32 are invertebrate, 9 are fish, 11 are amphibian, 4 are reptile, 24 are bird, and 14 are mammal. Many of these species are associated with late-successional forests (Appendix C) and past management activities had a negative affect on the habitats these species depend on. Their current status as listed species is a direct result of this habitat alteration. Future management activities in LSRs have the potential to impact Special Status Species in a negative or positive sense.

Other Special Status Species that formerly occurred in the LSRA assessment area but are now extirpated include the grizzly bear, gray wolf, and wolverine. Extirpation resulted from multiple factors including habitat alteration and overharvest and persecution by humans. The likelihood that these species would recolonize the LSRA assessment area in the next 100-years is low.

Other Species of Concern

Survey and Manage Species

Survey and Manage species along with standards and gudelines for management of these species were designated in the ROD. The ROD requires surveys be conducted, and the known site for many species located through these surveys will be managed. Many of these sites could be found on Matrix lands between the LSRs where management of these sites could provide additional habitat for late-successional species in the Matrix and additional connectivity between the LSRs. Of the many Survey and Manage species only a few are known or suspected to occur in the

LSRA.

The red tree vole (*Arborimus longicaudus*) occurs throughout the LSRA study area. A screening completed by the Coos Bay District, according to BLM Instruction Memorandum No. OR-97-009, indicated there is sufficient red tree vole habitat within selected watersheds to allow for the breeding and dispersal of this species from Matrix lands into the LSRs. Habitat conditions for this species is expected to improve within the LSRs as young stands age and canopy closure reaches 60 percent or more.

The Del Norte salamander (*Plethodon elongatus*), a category 2 species, is known or likely to occur in LSRs 251, 255, 257, 259 and a portion of 260. This species occurs in talus slopes protected by an overstory canopy that maintains cool, moist conditions on the ground. This species habitat is expected to improve within these LSRs as young stands age and begin to provide at least 40 percent canopy closure.

Northwest Forest Plan Protection Buffer Species

The ROD established protection buffers for several wildlife species. Species known or suspected to occur within the LSRA assessment area that would receive protection buffers when located include: great gray owl, black-backed woodpecker, flammulated owl, Del Norte salamander, Siskiyou Mountain salamander, and several bat species.

BLM District ROD-RMP Species

The Coos Bay, Medford, and Roseburg District ROD-RMPs included protection buffers for special habitats and several wildlife species. Protection buffers for special habitats and wildlife species vary somewhat between BLM Districts. Wildlife species that would receive protection buffers includes various raptors, great blue herons, and great egrets.

Protection buffers from either the Northwest Forest Plan Rod or the BLM District ROD-RMPs could occur in Matrix lands between the LSRs in this assessment area as species or special habitats are located. Protection buffers on Matrix lands would provide additional habitat for late-successional species outside the LSRs and additional connectivity between them.

Botanical Resources

Botanical resources include vascular plants, bryophytes (mosses, liverworts, and hornworts), lichens, and fungi. While there are few examples of vascular plants restricted entirely to late-successional and old-growth forests (Spies 1991), many bryophytes, lichens and fungi species appear to be closely associated with late-successional habitat characteristics (Norris 1987, McCune 1993, Neitlich 1993). Habitat characteristics that favor and provide more habitats and suitable microclimates for these species in late-successional and old-growth forests include: increased canopy complexity, higher diversity of tree and shrub species, and greater amounts of CWD. Table 1 In Appendix E includes a list of those species/species groups of fungi, lichens, bryophytes, and vascular plants which are thought to be closely associated with late-successional and old-growth forests.

Vascular plants are the most conspicuous species in these ecosystems creating the structure of the forest which provides habitat for numerous species and serves as the primary producer, capturing sunlight and converting its energy through photosynthesis for consumption by animals and fungi. Vascular plants provide the vertical structure in these late-successional forests creating numerous substrates and suitable microclimates for numerous canopy epiphytes (species occurring on live trees) and arboreal invertebrates and vertebrates.

Bryophytes, lichens, and fungi play critical roles in the maintenance of temperate forest ecosystems. Bryophytes occur on all substrates (rock, live trees, standing snags, large down wood), and although inconspicuous, they are important in maintenance of ecosystem stability.

The ecological roles of bryophytes, lichens, and fungi species include regulating water relations, nutrient cycling, providing food and habitats for numerous invertebrate and vertebrate (including marbled murrelets) species, maintenance of stream ecosystems, helping to provide soil stability, and providing a seed bed for many plant species.

Lichens also occur on all substrates, with the most important species (from an ecological standpoint) in forest ecosystems being epiphytic species. These species contribute to nutrient cycling, water retention through precipitation and fog interception, providing organic matter for other species from litterfall, increasing soil moisture holding capacity, and providing food and habitat for many invertebrate and vertebrate species.

Fungi profoundly affect nearly all ecological processes and events which occur in temperate forests, either directly or indirectly. Ecological roles of fungi include; mycorrhizal associations with most vascular plants, nutrient cycling (decomposers), soil aggregation, food for many invertebrate and vertebrate species, and diseases (which increase forest diversity).

While the succession of vascular plants has been well documented in temperate coniferous forests, bryophyte and lichen succession has been relatively overlooked. These species also have a definite successional pattern with the biomass and species diversity increasing with stand age. Various studies (Norris 1987, Goward 1992, McCune 1993, Neitlich 1993) have shown that the diversity and abundance of bryophytes and lichens is significantly greater in late-successional and old-growth forests.

Although stand age is important in the increase in biomass and diversity of bryophytes and lichens, it is not the direct cause, but rather the increased habitat complexity associated with these forests. Therefore, it may be possible to create these late-successional characteristics in younger aged stands. Neitlich and McCune (1995) showed that creating small forest gaps, leaving wolf trees (trees with large lateral branches close to the ground), and retaining hardwoods may create the habitat conditions suitable for epiphytes at an earlier stand age.

Although bryophytes and lichens are capable of reproducing by means of spores (sexually), many reproduce primarily asexually through fragmentation of stems, leaves, or specialized asexual propagules. Genetic diversity would be expected to be lower in species which are limited to the asexual mode of reproduction, but in most cases, the genetic diversity (at least for bryophytes) still exceeds that required for evolutionary change (Shaw 1991 cited from Christy and Wagner 1996). The viability of these species appears to remain high enough for evolutionary change even in isolated, disjunct populations. Therefore, it appears that connectivity between LSRs using dispersal corridors may not be all that important to maintain gene flow for a majority of the bryophytes and lichens species, although it still is important to maintain suitable habitat across the landscape regardless of land allocation.

While the distribution and habitats of most vascular plants is generally well known, very little information is known for bryophytes, lichens, and fungi. This is due primarily to not having formal inventories completed for these species, and that there are very few individuals trained in their identification. Many of these species are now managed under Survey and Manage and Protection Buffer Standard and Guidelines described in the ROD. Table 2 in Appendix E includes a list of known Survey and Manage species which occur within the LSRs. It is highly likely that many more of those species listed in Table C-3 of the ROD are present within these LSR's.

Special Status Plants

These are species which are given management priority and include federally listed, proposed, candidate, and Forest Service and BLM sensitive species. Table 3 in Appendix E includes a list of species which are known to occur or have potential habitat within the LSRs. The majority of these species do not occur in or require late-successional or old-growth forests, but occur in non-forested or unique habitats within these areas. In some cases the management of these species may conflict with late-successional objectives. For example, golden fleece (*Ericameria arborescens*), which appears to do best following fires, occurs in open chaparral where past and ongoing activities have converted these communities into coniferous forests. Maintenance of a variety of habitats required by the special status species is important in maintaining these species and overall biological diversity across the landscape.

All of the special status species locations occur within the LSRs in the Klamath Province or extreme southern portion of the Coast Range Province which have Klamath Province characteristics. The majority occur on serpentine soils, usually associated with pine and oak woodlands. The amount of these habitats is relatively small but may require management actions such as the use of prescribed fire to maintain. Of the 29 special status species listed in Table 3 in Appendix E, 13 occur within LSR 255, which has a high diversity of these serpentine habitats.

The remainder of the special status species occur in LSRs 251, 257, 259, and 261 (southern portion only).

Invasive Exotic Vegetation

These are species which include noxious weeds and other exotic vegetation that pose a risk to the development of late-successional characteristics. Noxious weeds are those species which have been officially determined by the State to be injurious to crops, public health, and property. Other exotic vegetation, although not listed as noxious weeds may, in some cases, be more detrimental to native plant communities and late-successional habitats. Table 19 includes a list of exotic species which may impact or hinder the achievement of late-successional characteristics.

Invasive exotic vegetation species are generally very successful competitors as they have no natural population controls and are closely associated with disturbed areas. They occur primarily in early-successional habitats following some sort of disturbance, usually logging or road construction. They quickly invade and become established on disturbed areas before native species can revegetate the site. Dispersal of these species is primarily from vehicles, and equipment which have been in infested areas. Invasive exotic vegetation pose a threat to the future development or increase the time it takes to develop late-successional and old-growth forests, since these species may dominate early-seral plant communities and inhibit the ability of the site to convert back to a forested ecosystem.

Due to a lack of locally adapted native plant materials, seed from non-native species will most likely be used when areas need to be revegetated. This may include forage seeding for wildlife and erosion control efforts. Many of the “native” species available from seed companies, may not have been collected from the local area, and thus would be considered “non-native species”. In most cases it may actually be better to use these non-native species in these situations to prevent resource degradation (sediment entry into streams) and to prevent potential gene dilution of existing native species populations.

Special Forest Products

Recently the demand for the harvest of special forest products (bryophyte and lichen harvest, mushroom collection, partial plant collection, Christmas trees, beargrass, ferns, etc.) has increased. This has led to a concern for the sustainable harvest levels of these products along with the protection of the resource. For some species, such as bryophytes and lichens, overharvest may actually impact late-successional characteristics. There is relatively little information regarding the amount of harvest of some of these species which is occurring within these LSRs.

Table 19. Noxious Weeds and Exotic Vegetation That May Impact Late-Successional Reserve Conditions or Hinder LSR Objectives		
Common Name	Scientific Name	Noxious Weed
bull thistle	*Cirsium vulgare*	Yes
Canada thistle	*Cirsium canadense*	Yes
French broom	*Genista monospessulanus*	Yes
Scotch broom	*Cytisus scoparius*	Yes
gorse	*Ulex europaea*	Yes
English ivy	*Hedera helix*	No
Himalayan blackberry	*Rubus discolor*	No
Australian fireweed	*Erechtites spp*	No
periwinkle	*Vinca minor*	No

IV. Criteria For Developing Appropriate Treatments

Desired Future Conditions

Goals for the LSRs within the assessment area are to: protect and enhance conditions of late-successional and old-growth forest ecosystems; and to create and maintain biological diversity associated with native species and ecosystems. Some of the important attributes which can be influenced by management actions include: stand composition (species, density, and size); legacy wood (snags and coarse woody debris (CWD)); and disturbance processes (fire, wind, or disease).

The following management actions will help achieve these goals:

Maintain and/or restore structural habitat complexity typically found in late-successional or old-growth forests with similar geomorphic and ecological attributes:

- Retain or restore key structural components (large trees, snags, and down logs) to mimic the abundance, condition and distribution of these structures.
- Maintain and/or restore canopy complexity.
- Maintain and/or restore variability of tree size.
- Maintain and/or restore tree spacing.
- Maintain and/or restore vegetative species composition.
- Maintain and/or restore vegetative species structural characteristics (vegetative form).

Protect and/or restore rare and key habitats (wetlands, cliff habitats, talus habitats, grassy balds or meadows).

Minimize habitat fragmentation

Maintain and/or reestablish natural disturbance processes and/or their effects to the greatest extent possible.

Minimize the frequency of management disturbance to late-successional wildlife populations.

This section of the assessment describes the criteria and the process for developing appropriate treatments to meet the goals and objectives within the LSRs. The process includes: identification of a condition on the landscape which would trigger a management recommendation by an IDT; determination of the seral stage of development; determination of the site specific issues based on appropriate management criteria and sideboards that guide implementation of the project through an integrated prescription: and finally, the proposal of an appropriate management activity.

Landscape Level Criteria

LSR Priorities for Management Actions

The LSRs within this assessment area have been ranked for management actions using the following priorities: High, Medium, and Low. Although it is expected that most emphasis will be focused on the High priority LSRs, the ranking system does not imply that there will not be management activities in the Medium and Low priority LSRs.

High Priority LSRs Of the LSRs in this assessment area, 261, 263, and 259 have the highest priority for management actions because they are Large, are key links in the LSR network (because they lack redundancy), and land ownership patterns in LSRs 261 and 263 provide greater opportunities to either increase or develop large (greater than 640 acre) contiguous stands of interior late-successional habitat. In addition, most of the acres of young intensively cultured forest plantations which could benefit the most from treatments occur in these LSRs (Table 20). Since LSRs 261 and 263 are the largest LSRs in the LSRA (70,611 and 60,599 acres) the development of large contiguous stands of late-successional habitat would have greater value. The existing checkerboard ownership of LSR 259 does not provide much opportunity to develop blocks of contiguous interior late-successional habitat larger than 640 acres. Because of this limitation, and its location in an area of concern for northern spotted owl movement between provinces, and because this LSR is a key link among three provinces, the emphasis would be to maintain or enhance existing connectivity habitat.

Medium Priority LSRs LSRs 257, 260, 266, and 264 are medium priority for management. Although 266 and 264 are still substantial in size (16,113 and 12,396 acres) they are significantly smaller than LSRs 261, 263, and 259, and have proportionately less opportunity to develop large blocks of contiguous interior late-successional habitat. LSRs 266 and 264 have substantial amounts of treatable stands (Table 20) which could either augment existing interior blocks of late-successional habitat or create future blocks. LSR 264 maintains a north-south LSR link in the Coast Range, and in conjunction with LSR 263, may also provide for some connection east to LSR 222 in the Cascades Province.

LSRs 257 and 260 are Small LSRs (2,592 and 4,797 acres) but both provide important connectivity between the Coast Range and the Klamath provinces. Although they have limited potential for developing sizeable blocks of interior late-successional habitat, they provide late-successional refugia in areas where future older forest habitat would otherwise be unlikely due to prevailing land use and ownership patterns.

Low Priority LSRs LSR 265 is Large (44,893 acres) and redundant with LSR 266 in connecting LSRs 263 and 267. LSR 265 has a much greater percentage in federal ownership than the other Large LSRs, and also has a larger percentage of late-successional interior forest habitat. It currently has the best potential to provide for late-successional species without intervening management. Although it contains many acres in young plantations, treatments in LSR 265 are considered to be less beneficial than in the other LSRs.

LSRs 255 and 251 are Small (2,396 and 1,869 acres) but are adjacent to Large LSRs on the Siskiyou National Forest. They play a very small role providing late-successional habitat and even less of a role in connectivity. However, they are important for species associated with the unique vegetation types and the habitat on which they depend are limited to these regions (e.g. Jeffrey pine, coastal tanoak, and south coastal fog zones).

Table 20. LSR Acres With Potential Treatment Opportunities

Age class	Administrative Unit	Acres by LSR Number										
		251	255	257	259	260	261	263	264	265	266	Total
0-10 years and brush conversion	Coos Bay	571	0	200		551	3,783	2,714		1,654	998	10,471
	Roseburg				3,883		612	1,453	1,775		9	7,732
	Mapleton									13		13
	Medford				14							14
	Subtotal	571	0	200	3,897	551	4,395	4,167	1,775	1,667	1,007	18,230
11-29	Coos Bay	75	0	410		496	15,077	9,238		4,052	3,317	32,665
	Roseburg				7,715		2,420	5,067	2,125		308	17,635
	Mapleton									2,812		2,812
	Medford				136							136
	Subtotal	75	0	410	7,851	496	17,497	14,305	2,125	6,864	3,625	53,248
30-49	Coos Bay	69	0	85		15	8,114	3,231		2,724	2,201	16,439
	Roseburg				1,689		1,689	3,362	1,709		243	8,692
	Mapleton									162		162
	Medford				0							0
	Subtotal	69	0	85	1,689	15	9,803	6,593	1,709	2,886	2,444	25,293
50-79	Coos Bay	153	867	330		291	2,386	751		525	192	5,495
	Roseburg				1,166		223	2,187	466		0	4,042
	Mapleton									446		446
	Medford				159							159
	Subtotal	153	867	330	1,325	291	2,609	2,938	446	971	192	10,142
Total		868	867	1,025	14,762	1,353	34,304	28,003	6,075	12,388	7,268	106,913

Management Priorities Within LSRs

The following priorities for treatment are recommended, however, they are not necessarily listed in order for each LSR. IDTs should consider the existing site conditions and biological treatment windows in the development of site specific project proposals.

Enlarge Existing Interior Late-Successional Habitat Blocks

Benefits: Larger, contiguous blocks of interior late-successional forests will provide habitat for a greater number of late-successional species, and individuals, than smaller blocks of similar habitat. This is particularly true for species with larger home ranges.

Stand Selection Criteria: Stands on the periphery of or within existing large contiguous blocks of late-successional habitat could be treated to enhance creation of late-successional habitat.

Desired Landscape Condition: Enlarged contiguous blocks of late-successional habitat, dispersal habitat, and habitat approaching functionality as late-successional habitat obtained with minimum adverse effects upon existing habitat for the northern spotted owl and other late-successional species with large home ranges.

Improve Habitat Connections Between LSRs

Benefits: Enhancing or restoring late-successional habitat on the perimeter of LSRs where they adjoin other LSRs would facilitate species movement between LSRs.

Stand Selection Criteria: Stands on the periphery of LSRs which are adjacent to another LSR could be selected for treatment.

Desired Landscape Condition: Greater late-successional habitat complexity and continuity in key areas within LSRs facilitating movement of species between LSRs.

Maintain and Improve Connectivity Habitat Within LSRs

Benefits: Enhancing or restoring late-successional habitat between existing late-successional habitat blocks within LSRs will facilitate species movements.

Stand Selection Criteria: Stands between late-successional blocks within the LSRs could be selected for treatment.

Desired Landscape Condition: Late-successional habitat within LSRs facilitating species movement within LSRs, and providing alternative connectivity pathways in the event of a natural disturbance.

Create Additional Large Blocks of Late Successional Habitat Where They are Absent

Benefits: Large blocks of late-successional forests provide habitat for a greater number of late-successional species and individuals than smaller, scattered patches of habitat.

Stand Selection Criteria: Stands within blocks of federal ownership could be treated to enhance or restore the creation of late-successional habitat.

Desired Landscape Conditions: Large contiguous blocks of late-successional habitat replacing fragmented or patches of late-successional habitat within LSRs, providing additional nesting habitat for the northern spotted owl and other species with large home ranges.

Maps 6 through 13 display examples of where the priorities described above are located within individual LSRs.

Special Habitats/Situations

There are areas across the landscape in the assessment area which are not expected to attain late-successional structural characteristics. Examples include natural meadows, wetlands, talus slopes and other habitats which often have unique species associated with them. Generally, these sites will be managed where they naturally occurred. Specific prescriptions for these areas will be addressed at the site level and should be consistent with maintaining the unique plant communities associated with them.

Guidelines for Treatments

These guidelines are provided to assist specialists, IDTs, and managers in making decisions on treatments within the LSRs. They are not intended to preclude a specific treatment where a management action would benefit late-successional species and their habitat and meet the objectives for management in the LSRs.

Emphasize treatments in plantations and thinned stands.

Rationale: LSR standards and guidelines ..."encourage the use of silvicultural practices to accelerate the development of overstocked young plantations into stands with late-successional and old-growth forest characteristics, and to reduce the risk to Late-Successional Reserves from severe impacts resulting from large-scale disturbances and unacceptable loss of habitat" (ROD B-1). (ROD B-2) states ... "Although the processes that created the current late-successional and old-growth ecosystems are not completely understood, they include: (1) tree growth and maturation, (2) death and decay of large trees, (3) low-to-moderate intensity disturbances (e.g., fire, wind, insects, and diseases) that create canopy openings or gaps in the various strata of vegetation, (4) establishment of trees beneath the maturing overstory trees either in gaps or under the canopy, and (5) closing of canopy gaps by lateral canopy growth or growth of understory trees..." (ROD B-3) states..."Because of limitations in knowledge of late-successional and old-growth forest processes and lack of silvicultural experience in old stands, it is not certain that old-growth ecosystems can be completely replicated." Page B-6 of the ROD states ..."The younger stands were usually established following fire or timber harvest. Some of these stands will develop old-growth characteristics without silvicultural intervention. However, current stocking and structure of some of these stands were established to produce high yields of timber, not to provide for old-growth-like forests. Consequently, silviculture can accelerate the development of young stands into multilayered stands with large trees and diverse plant species, and structures that may, in turn, maintain or enhance species diversity.

Stand management in Late-Successional Reserves should focus on stands that have been regenerated following timber harvest or stands that have been thinned. These include stands that will acquire late-successional characteristics more rapidly with treatment, or are prone to fire, insects, diseases, wind, or other disturbances that would jeopardize the reserve..."

Management Strategies in Connectivity Habitat [1]

Maintaining connectivity within and between LSRs is critical to their functionality. High fragmentation and isolation of late-successional blocks of habitat has been noted as a particular concern in this assessment area. Inadequate quality and quantity of connectivity habitat may play a role in the high levels of spotted owl predation and mortality mentioned in Chapter 3. The location and current condition of many LSRs in the assessment area make the retention of connectivity habitat within them important. Connectivity habitat is important in Small LSRs because they are distributed across the landscape among larger LSRs and provide important refugia for individuals that may be moving between Large LSRs. Province Link LSRs play a crucial role in allowing individuals to move among provinces, and retention of connectivity habitat will help facilitate this movement.

Within the home range of nesting spotted owls, connectivity habitat is important because it can provide contiguity between fragmented blocks of nesting habitat, can support prey species, and provide alternate foraging areas (E. Forsman, pers. comm.). Retention of high levels of canopy closure (greater than 60 percent) maintains an environment that is not as conducive to spotted owl predators such as great-horned owls (Johnson 1993), and provides preferred roosting habitat for juvenile owls (Miller 1989). This is particularly critical in LSRs with isolation concerns or which lack redundancy, increasing the importance of maintaining a self-sustaining owl population within these LSRs.

Because of the emphasis in treating younger managed stands that tend not to be connectivity habitat, treatment in connectivity habitat is expected to be less frequent. When it does occur, prescriptions should insure that the connectivity function of the area is maintained. Culturing individual trees and creating small gaps are examples of treatments that may create some structure, yet retain the connectivity function at the stand level. When connectivity is not maintained at the stand level, a site-specific analysis should indicate that connectivity habitat is not limiting in the surrounding area, and will not be limiting following treatment. IDTs should consider quality, quantity, and spatial arrangement of connectivity habitat when doing this analysis.

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[1] Connectivity habitat is defined as stands greater than 40-years in age. See discussion under LSR Network Function, p. 43.

Treatment Priorities by Age Groups

Table 21 shows general treatment priorities and the acres potentially available in each age group. Actual acres which may be treated in the next decade are probably less due to factors such as biological treatment windows, budget constraints, or stands being on an acceptable developmental trajectory.

Table 21. Treatment Priorities by Age Groups

Age Group (Years)	Treatment Priority [1]	Acres Currently Available in Age Group
less than 30	High	71,500
30-49	Medium	25,300
50-79	Low	10,100

[1] For the next decade, it is expected that the proportion of available acres treated within each age group would be consistent with the treatment priorities.

Rationale: Priorities are based primarily on the level of expected biological responses to treatment and the emphasis for treatment as specified in the ROD.

High Priority In the LSRA, stands less than about 30-years of age are at their maximum height growth rates (King 1966; Hann and Scrivani, 1987). Tree crown size and crown expansion rates are proportional to height growth rates. These high height/crown expansion rates coupled with a thinning treatment can result in high levels of diameter and tree bole volume increment (Oliver and Larson, 1990). Thinning of stands less than 40-years of age during the period of highest height growth rates provide the best opportunity for rapid diameter growth (Bailey and Tappeiner, 1996). The majority of acres available for treatment in this age group have been regenerated following timber harvest and are the focus of stand management in the LSRs.

Medium Priority This age group is transitional between the High and Low priorities. Many of the stands within this age group resulted from harvest operations conducted when economic recovery of logs was lower than in the previous age group, resulting in a greater amount of large CWD remaining on site. Some of these stands are also beginning to provide connectivity functions and may be on an acceptable developmental trajectory. Opportunities exist for treatments which maintain or accelerate stand development toward achievement of late-seral characteristics, especially diversity of canopy structure. Responses to thinning of both overstory and understory are most pronounced and consistent in stands less than 90-years old on poorer sites and less than 70-years old on the most productive sites (Bailey and Tappeiner 1996). This suggests the treatment priority becomes lower as a stand gets older.

Low Priority Most of these stands were not regenerated following timber harvest, and few have been thinned. Most of these stands are currently functioning as connectivity habitat and may be on an acceptable trajectory for late-successional habitat. Nonetheless, opportunities exist for treatments which maintain or accelerate stand development toward achievement of late-seral habitat or reduce the risk to LSRs from impacts resulting from large-scale disturbances and unacceptable loss of habitat.

Management Strategies to retain interior habitat conditions

Caution should be used when treating stands adjacent to late-successional forests when these stands allow interior habitat conditions to occur closer to the edge of the late-successional forest. For example, younger stands that are tall enough for their canopies to extend up to and connect with the canopy of the adjacent late-successional forest probably function to ameliorate the climatic extremes of temperature, wind, and humidity, allowing climatic conditions characteristic of interior habitats to occur much closer to, or at the edge of, the late-successional stand. The depth of edge influence for wind is closely related to vegetation type, structure and stand density (Reifsnyder 1955, Raynor 1971), so even young stands that are not tall enough to reach the canopy of adjacent late-successional stands would still be functioning to reduce the extent of edge influence into the late-successional stand.

The physical influence of edge can extend up to 800 feet into forested stands adjacent to recent clearcuts, and even further during severe weather conditions. However, the greatest effects seem to occur up to 400 feet into the stand from the edge of recent clearcuts, with some variation depending on aspect, topography, and local wind patterns. Thus, within 400 feet of late-successional stands, treatments should be carefully designed to not reduce the amount of interior late-successional habitat (Chen, 1995).

Stands tall enough to connect to the canopy of the adjacent late-successional stand are probably allowing interior climatic conditions to occur up to the edge of the late-successional stand. One goal in treatment is to retain this interior condition. Projects within 400 feet of late-successional stands should be designed to minimize effects (solar radiation, thermal, wind, etc.) on interior late-successional habitat conditions. Management treatments could include feathering the edge by varying cutting intensity near stand edges, avoiding or reducing the number of patch openings near edges, placement of unthinned patches adjacent to interior habitat, or combinations of these treatments (Chen et al.1992, Chen, 1995).

Stands not tall enough to connect to the canopy of the adjacent late-successional forest may not allow interior climatic conditions to occur up to the edge of the late-successional stand. However, this vegetation still provides some ameliorating effects which probably become more important as the stand gets taller. Treatment in these stands should be designed to increase growth and provide for stand closure. Intensity of treatments should decrease as the treatment gets closer to the late-successional stand. Treatments within these stands should not significantly impair the effectiveness of adjacent interior late-successional habitat.

Additional Landscape Guidelines for LSR Management

Consider both the timing and placement of treatments to minimize the disturbances to species and habitats. Often consolidating treatments in time and location can, in the long-term, reduce the impacts on species and habitat.

When treating larger areas, ensure that existing blocks of late-successional habitat continue to be connected. This is particulary important for stands that are 40-years and older which are currently providing connectivity habitat between blocks of late-successional forest. Whatever management action is considered in these areas a connectivity link between late successional habitat should be maintained. This could be accomplished by leaving untreated buffer areas in the stands to be treated, through reliance on intact riparian and other reserves, or by culturing individual trees and creating small gaps.

For LSRs that have a moderate to high likelihood of isolation (257, 259, 260, 261, 263, 264), watershed analysis and/or NEPA analysis should consider the effects of connectivity between these and the adjacent LSRs when considering adjusting riparian reserve widths.

Silvicultural enhancement treatments should not be necessary in unmapped LSRs (i.e. 100 acre owl core and occupied marbled murrelet sites) because they were established by design to contain existing suitable habitat for these species. Risk reduction treatments, however, may be appropriate within unmapped LSRs. Unmapped LSRs and MLSAs help increase the distribution of the LSR network, and provide stepping stones between the LSRs. Because they play an important role in providing islands of refugia in the Matrix, activities that increase disturbance in these areas, such as new developments or roads, should be avoided. Removal of existing developments or roads should be a focus of activity in these areas.

Treatment Guidelines for NSO Home Ranges

The management objective within the home range radius of any northern spotted owl site in a LSR is to maintain or enhance the ability of spotted owls to use their home range and to provide their life requirements to survive and reproduce. Any proposed treatments within the home range of spotted owl sites should be consistent with this objective and the overall objective for LSRs.

Prior to conducting any treatments within the home range radius of any northern spotted owl site(s) in an LSR, an analysis of existing habitat conditions should be completed. This analysis is important to assess the habitat status of the spotted owl site(s) in relation to the U.S. Fish and Wildlife Service threshold of 40 percent suitable habitat. The analysis should include both the amount and distribution of existing dispersal, suitable, and old growth habitat. Analysis results should be displayed on a map along with the home range radius so that IDTs can assess the effect of any proposed treatments on spotted owl home ranges.

Emphasis for treatment should be in managed plantations and thinned stands. Treatments, however, could occur in stands 40-79 years old within spotted owl home ranges and outside of the 0.5 mile core areas where they are consistent with spotted owl management and overall LSR objectives. When considering treatments of these stands the IDT should maintain the following habitat features:

- roosting and foraging habitat,
- connectivity habitat,
- nesting or potential nesting structures,
- snags,
- CWD.

To meet the objectives listed above the following should be considered:

- In treating stands, maintain an average canopy closure of at least 60 percent as it provides preferred roosting habitat for juvenile spotted owls, protection from predators, and provides tree to tree movement of the red tree vole, an arboreal prey species.

- Use caution in treatments of stands within the home range radius of spotted owl sites below the U.S. Fish and Wildlife Services 40 percent threshold for suitable habitat as these sites are deficient in suitable habitat. The lower the percentage of suitable habitat, the more caution that should be employed since the 40-79 year old stands then become increasingly important in providing owl habitat. Other factors to consider for owl sites deficient in suitable habitat include:

  - Acres of habitat and size of blocks. A home range with many acres in the 40-79 age class that occur in a large contiguous block should be managed with more caution than one where there are relatively few acres that occur mostly as small isolated stands.

  - Land ownership. Home ranges with more private ownership should be managed with more caution than those with greater federal ownership. On a landscape basis, the degree of private intermixed ownership affects the level of habitat fragmentation and the potential long-term amount of late-seral acreage.

  - Location of stands. Treatment of 40-79 year stands is generally more of a concern when they occur near the core than when they occur at the periphery of the home range. Stands adjacent to late-seral stands are more of a concern from the standpoint of potential treatments than those adjacent to younger stands. Protecting existing high quality habitat from the effects of windthrow and edge effects is a key concern in those areas.

  - All factors in combination. The amount, distribution, and location of these stands relative to the core area and other existing habitat should be evaluated in total. Management actions within a spotted owl home range should be undertaken with caution when there are low levels of suitable habitat, there are hundreds of acres of 40-79 year old contiguous stands, and a high level of private ownership. Conversely, management actions constitute a lower risk when home range is near the suitable habitat threshold, relatively few acres of 40-79 year old isolated stands exist, and percentage of federal ownership is relatively high.

Stands that are 40-79 years old and occur within a 0.5 mile radius of any LSR spotted owl site below the 40 percent habitat threshold should rarely be treated. These stands are within the core area for the spotted owl sites and are a very important part of the home range since the known nest trees and/or site centers occur here. Habitat management actions within the core area have the greatest potential to negatively impact spotted owls so greater caution is necessary within these areas.

Some stands in the 40-79 year old range have been designated as suitable spotted owl habitat by BLM in the GIS spotted owl habitat theme. These stands are already considered to be suitable habitat and should not be treated. The location and extent of these stands may change if supported by future evaluations. The GIS database would be updated following evaluations to reflect the changed classification.

Stand-Level Criteria for Developing Appropriate Treatments

Appropriate treatments can be divided into four categories: salvage, risk reduction, silvicultural treatments designed to accelerate the development of late-successional habitat conditions, and other non-silvicultural activities. Risk reduction efforts are encouraged where they are consistent with the overall recommendations in the Standards and Guidelines of the ROD. The ROD also encourages the use of silvicultural practices to accelerate the development of overstocked young plantations into stands with late-successional and old-growth forest characteristics.

Salvage Guidelines

Tree mortality is a natural process in a forest ecosystem. Dead and damaged trees are key structural components of late-successional forests. However, excessive numbers of dead and damaged trees may create a high risk for future stand-replacing disturbances. Management activities, such as salvage, following events creating excessive numbers of dead and damaged trees should be designed to reduce risk and accelerate or not impede the development of late-successional conditions.

Salvage involves the removal of some forest components (i.e. green standing trees not likely to survive, standing dead trees, trees blown down) after an event like fire, wind, insect or disease outbreaks, or other natural events. These stands may have various levels of trees blown down, scorched, standing live and dead, based on the intensity of the event. The goal here is not to list every possible salvage scenario but to outline the likely options that may help "protect and enhance conditions of late-successional and old-growth ecosystems" (ROD) after a disturbance. All proposed salvage projects should be evaluated by an IDT on a site specific basis applying the criteria described and possible actions listed below:

- Disturbed areas less than 10 acres in size, or disturbed stands where canopy closure remains greater than 40 percent should not be considered for salvage if the area is adjacent to late-successional stands and not substantially connected to a previous opening. Disturbed areas less than 10 acres may be salvaged only if a risk reduction evaluation indicates a need to salvage to meet LSR objectives, or if the disturbance event created openings that are substantially connected to recent previous openings, and canopy closure is less than 40 percent. (Also refer to "Management Actions for Risk Reduction" section).

- Individual or groups of trees along roads, trails, or recreation sites may be salvaged if it is determined that they pose a hazard to people or are blocking or obstructing the use of the area. All these opportunities should be evaluated by IDTs, to ensure meeting LSR objectives listed in the ROD and the Coos Bay, Roseburg, and Medford RMPs as well as the Siuslaw LRMP.

- S Salvage operations along roadways within Riparian Reserves has been extensive over the last several decades and continues today leaving most areas deficient in large wood. Where trees obstruct roads, all portions within the road prism could be removed.

- S Areas greater than 10 acres which have been disturbed by wind, fire, insect or disease, and having canopy closures below 40 percent as a direct result of the disturbance, may be considered for salvage. Any proposed salvage after such a disturbance would be evaluated on a site-specific basis by an IDT. The overall goal would be to conduct salvage operations, consistent with standards and guidelines in the ROD and the appropriate RMP or LRMP, as well as being consistent with LSR objectives. All green trees likely to survive, should be retained. The number of snags and down logs retained would vary based on plant community, seral stage of development, site conditions, risk of future disturbances, and other factors. Following salvage activities in response to large scale disturbances, at least 24 snags per acre of the largest diameter available on-site will be retained.

  Some options for salvage in those situations include:

  - S No salvage - consider the value to the site of not conducting salvage if such action aids in meeting LSR objectives. This evaluation could be based on the size of the disturbance, type of disturbance, location, etc.

  - S Partial salvage - leave forest components (standing or down trees) in the disturbed area to meet LSR objectives. This may include leaving on site variable numbers of snags and CWD components that would emulate the conditions in late-successional forests. It should include options like leaving all standing live trees, including injured trees that are likely to survive the event. Other general salvage guidelines are found in the ROD on pages C-13 to C-15.

Risk Reduction

The quantity and quality of late-successional habitat is changed through disturbance events such as wildfire, windstorms, disease, insects, and soil movement. Large-scale disturbance events can effectively eliminate or change late-successional habitat on hundreds to thousands of acres, while small-scale disturbance events cause habitat loss at the stand level. While the risk of habitat loss cannot be eliminated, risk management activities may reduce the probability that a major stand-replacing event or events that degrade habitat quality will occur. The primary purpose of risk reduction activities in these LSRs is to reduce the probability that large-scale late-successional habitat loss will occur. Following that, the purpose of risk reduction activities will be to reduce the probability of late-successional habitat loss in stands with important features such as nest stands for northern spotted owls, stands containing other key species, or stands containing larger blocks of interior habitat, or providing meaningful localized connectivity.

The risk of large-scale habitat loss from a wildfire event occurring within the LSRs in the eastern portion of the Klamath Province is relatively high. Fuels and ignition sources are present. The ROD recognizes that the Oregon Klamath Physiographic Province has an increased fire risk due to lower moisture conditions and rapid accumulation of fuels after insect outbreaks and drought. In LSRs 259, 264, and the eastern portions of LSRs 261, 263, and 266, there is presently a moderate to high fire hazard. Fine fuel levels are the primary concern. Fires have been suppressed for much of this century. Stand density and associated live and dead fuels have accumulated to a point that they are often outside the range of “historic” variability. For these LSRs, it appears that the “historic” fire return interval was on the order of 30-80 years (Agee 1993). Much of the private timberland, particularly small ownerships near the valley floor, has been recently harvested. Typically, very little slash disposal was done on these lands. Until decomposition occurs, this hazard will remain. Silvicultural activities such as density management, release, and stand maintenance have added to the fuel loadings. In general, fuels generated from these activities have not been treated.

In addition to increased fuels, there are numerous sources of ignition including rural residences, recreational activities such as dispersed camping and hunting, an extensive road system, and ongoing forest management (logging and silvicultural operations). Because these LSRs have relatively short fire return intervals, there is a concern that developing stands with late-successional characteristics and maintaining them over the long-term will be difficult. Stands with short fire return intervals (generally southerly aspects) are at greatest risk of loss. Characteristics of fires in these LSRs are changing. Before intensive fire suppression, fires tended to be of lower intensity and more frequent. Fire suppression as well as some management treatments have caused fuels to build up so fires now tend to be less frequent but burn at a higher intensity. High intensity fires are a greater risk for late-successional habitat loss.

Although many of the fuel conditions mentioned above exist in the remaining LSRs within the assessment area, climatic factors and the reduced probability of lightning result in a lower risk of stand replacing wildfires.

The risk of a major blowdown event occurring within the assessment area is highest in LSRs 251, 255, 257, 260, 265 and the western portions of the LSRs 261, and 263.

Risk of large-scale habitat loss from other disturbance events is relatively low. Loss of late-successional habitat to disease over large areas is not presently a concern. Diseases within stands are generally at or near endemic levels and provide for many of the desired characteristics of older forests such as occasional snags, stem decay, and recycling of nutrients. Disease can however, be an important concern for individual species and potentially may be a concern on a stand by stand basis. Port-Orford cedar (*Chamaecyparis lawsoniana*) is affected by an introduced pathogen *Phytophthora lateralis* is probably the most commonly encountered and damaging forest disease agent in the analysis area. The pathogen is found where ever Port-Orford cedar occurs, including in LSRs 251, 255, 257, 259, 260, and 261. White pine blister rust, *Cronartium ribicola*, is present in LSR 259. Maintaining a component of sugar pine in stands is greatly influenced by the rust. While not currently a major concern, laminated root rot, *Phellinus weirii*, and blackstain, *Ophiostoma wageneri* are also present within the LSRs. Several dwarf mistletoe species have been identified within the LSRs.

Insect activity within stands is generally at or near endemic levels. In some areas, however, stand characteristics are slowly changing. Larger conifers, particularly the pine, are dying out of stands. While insects are often involved, they are usually secondary, with stress from overcrowded stands being the primary cause of loss of vigor. In stands with limited initial numbers of pine, loss of a few individual trees may substantially affect stand function and diversity. Risk of late-sucessional habitat loss from other disturbance events exists but is not considered notable at this time.

The impacts of noxious weeds and other non-native plants on local plant and animal communities, and on meeting LSR objectives are not known. As a generalization, non-native/ noxious weeds are opportunistic. This implies they are early-seral species dependent on disturbance. Those non-native/noxious weeds that out-compete young trees, thereby affecting successional pathways, rate of succession, and species composition, may interfere with meeting LSR objectives unless release treatments are used. Where large late-successional plants are already established, they will likely shade out the early-seral non-native/noxious weeds in the absence of disturbance. In areas subject to disturbance like road right-of-ways, and landslide tracks, non-native/noxious weeds may be difficult to control. Both gorse and the broom species produce seeds that remain viable in the soil for long periods (up to 80-years) and germinate following fire or disturbances that result in sun light heating the soil. Therefore, decades of closed canopy disturbance free conditions must pass before gorse and broom are eliminated from a site. We do not have information on how long other non-native/ noxious weed species will remain viable on a site without disturbance.

Management Actions for Risk Reduction

Silvicultural activities to reduce risk would focus primarily on younger stands within the LSRs, and are generally done in conjunction with other activities. The objective of treatments would be to enhance the development of late-successional conditions while making the future stand less susceptible to natural disturbance. Activities for risk reduction in stands over age 80 may be appropriate if:

- proposed activities would result in long-term maintenance of habitat;
- the activities are needed to reduce risks;
- the activities will not prevent the LSRs from playing an effective role in the objectives for which they were established; and
- the specific project was reviewed by REO.

Risk reduction activities in both younger and older stands may introduce short-term increases of risk to the loss of late-successional habitat and may affect the habitat value for late-successional species. Short-term increases in risk and short-term loss of habitat value should be evaluated against long-term risk reductions and gains in habitat value.

Some salvage that does not meet the preceding salvage guidelines would be allowed if it is essential to reduce future risk of fire or insect damage to late-successional forest conditions. The focus should be on areas where there is a high risk of large scale disturbance. In these cases, the value of reducing the risk of future loss of late-successional habitat, or perpetuating a fuel condition that would put neighboring forests at risk, should be weighed against the value of snags or downed trees as habitat structures.

Wildfire - Wildfire presents the greatest risk of late-successional habitat loss within the LSRA area. The majority of risk reducing activities would be aimed at managing fuels and sources of ignition. Fuels and ignition sources may be actively managed by: reducing existing fuels, reducing fuels created by stand management operations by prescribed burning; or indirectly through treatments designed to maintain stand vigor, or pruning to reduce fuel ladders into the canopy. Access may be restricted during periods of high fire danger. Refer to the Fire Management Plan (Appendix F) for a more thorough discussion on risk reduction and how it relates to fire.

Other Disturbance Agents - Risk of large-scale habitat loss from disturbance agents other than fire or blowdown is relatively low. Risk reduction activities for these agents would have the objective of maintaining or enhancing stand vigor and resiliency. Management activities will focus on younger stands and would consist primarily of density management operations. Density management would also provide opportunities to create structural elements found in older forest stands. Fertilization may be done to improve stand vigor and resiliency where consistent with other resource objectives.

In most stands, vegetation would be managed so that diseases present are kept within what is judged to be endemic or "historic" levels. Density management and other treatments to improve stand vigor will be the primary treatments, fertilization may be done. For diseases such as blackstain, operations would be timed to minimize activity-related spread of the disease. Dwarf mistletoe would be managed so that their natural function in stands is retained. In stands that have important features, and stands that are important because of their connectivity, interior habitat, etc., risk reduction treatments will have an additional objective to reduce the effects of the disease over the long-term. Nonnative diseases would be managed to prevent the spread of the disease to uninfected areas and to maintain native stand components.

Management of Port-Orford Cedar is an exception to the discussion above. *Phytophthora lateralis*, has spread throughout much of the range of Port-Orford cedar. The disease is spread through water, grafted roots, and through the movement of soil containing fungus spores. Often the soil, containing spores, is attached to equipment used in logging, road construction, or mining operations. The disease has affected several drainages within the assessment area, killing large numbers of trees, particularly in the lower elevations in the central and southern portions of the assessment area. In these locations, management actions following selected Mitigating Measures based on site specific analysis for Timber Sale and Service Contracts included in the BLMs *Port-Orford Cedar Management Guidelines* (1994) would be appropriate.

Stand conditions would be managed so that insect population levels do not prevent LSR objectives from being attained. Density management and other treatments to improve stand vigor would be the primary treatments. Should a major windthrow event occur, large numbers of green downed trees may attract and allow insect populations to increase to a point where additional habitat is lost as nearby standing trees are attacked and killed is a major concern. Salvage of downed trees may be prescribed in these situations. In many cases, however, when there are no threats to stands with important features, or if the habitat function of the LSR is not threatened, no management action may be required.

Noxious weeds and other introduced species are known to exist within the LSRs. Treatments of noxious weeds would be designed to reduce or eliminate their effect on late-successional habitat and habitat formation. Treatment method will consist of those methods described in current BLM and Forest Service noxious-weed related decision documents.

Silvicultural Actions for Attainment of Late-Successional Habitat conditions

According to the ROD, silvicultural systems proposed for the LSRs have two principal objectives:

- development of old-growth characteristics including snags, logs on the forest floor, large trees, and canopy gaps that enable establishment of multiple tree layers and diverse species composition; and
- prevention of large-scale disturbances by fire, wind, insects, and diseases that would destroy or limit the ability of the reserves to sustain viable forest species populations.

Silvicultural treatments that have been exempted from additional REO review are included in Appendix G.

Stand management in LSRs should focus mainly on stands that have been regenerated following timber harvest or stands that have been thinned. The overall criteria for silvicultural treatment is that they are beneficial to the creation of late-successional-forest conditions. There are many acres in the LSRs that are currently not in a late-successional or old-growth condition, but are capable of developing into those conditions (Table 20). Silvicultural manipulation of younger stands can accelerate the development of desired stand characteristics. Depending on stand conditions, potential treatments could include reforestation, release, density management, pruning, fertilization, tree culturing, and stand conversion.

Proposed projects would be developed by an IDT to determine if they would result in achieving late-successional habitat conditions earlier than if the project were not implemented, or if negative short-term effects to late-successional forest related species are outweighed by the long-term benefits. Tree growth simulation models, such as the Stand Projection System or Organon, could be used to assess the desirability of applying a silvicultural practice to a stand. In these cases, stand examination plots would be taken, stand development would be projected, and the effects of the proposed action would be compared with stand development if the management action were not implemented. If it cannot be demonstrated that the action would enhance the development of late-successional character, the action would not take place.

The following treatments of early-seral stands will result in desired late-successional habitat conditions being attained earlier than if the action had not been taken.

Reforestation, Maintenance, and Release

Lands altered by a disturbance within the LSR may need artificial reforestation and/or subsequent maintenance or release treatments to more rapidly reach late-successional conditions, or to protect site quality. Depending on the severity of the disturbance, and the stand's ability to attain late-successional conditions, conifer and/or hardwood tree species may need to be planted or interplanted among existing trees. In instances where disease pockets exist, resistant or non-host species could be planted. Treatments would provide for the introduction and/or maintenance of a variety of species appropriate to the site. Site preparation by hand scalping, piling and burning, or prescribed burning may be necessary prior to reforestation. Maintenance, protection, and release of individual trees through treatments such as mulching, brush cutting, or animal damage control, may be necessary to ensure survival of the desired number and proportion of trees species. Generally, it will not be necessary to manage for the same level of free to grow stocking in the LSR as on the Matrix lands. Allowing modest levels of vegetation competition induced mortality would reduce plantation uniformity resulting in the creation of stand gaps.

Benefits: The probability that tree species will occupy the site quicker than if left solely to natural regeneration is increased. Species composition and stand uniformity can be modified to meet site specific objectives. Maintenance and release treatments provide for better survival probabilities and more rapid growth for selected trees. By varying reforestation species mixtures and subsequent maintenance/release treatments, stand differentiation into distinct shrub/ hardwood and conifer layers can be encouraged.

Stand Selection Criteria: Stands denuded of desired tree species by disturbance, such as fire, blowdown, or previous harvest, may be selected for reforestation treatments. Reforested stands where survival or growth of desired tree seedlings are being jeopardized by competing vegetation, animals, or other environmental conditions would be candidates for maintenance or protection treatments.

Desired Condition: Stands with varied spacing to provide for some large trees as quickly as possible, to create areas of heavy canopy closure, and to encourage the survival and growth of a variety of species appropriate to the site and late-successional objectives. Hardwoods and conifers over 8 inches dbh would not be removed. A portion could be converted into snags or CWD depending on site specific objectives.

Future treatments: Depending upon effectiveness of initial treatments, additional reforestation, maintenance, release, and/or density management treatments may be necessary.

Density Management - Precommercial Thinning (PCT) [2]

The purpose of precommercial thinning is to maintain or improve growth rates, manipulate species composition, and spatial arrangement. This is accomplished primarily by reducing stand density. In most cases, candidate stands are artificially reforested plantations. Snags are generally absent in these stands. Development of large trees for habitat, snags, and CWD recruitment can be accelerated by the reduction in stand density.

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[2] For the purposes of this document the terms precommercial and commercial thinnings and density management are used interchangeably. It is recognized that objectives for density management are different than those of the more conventional definitions of commercial or precommercial thinnings.

Benefits: Density management can accelerate the growth of trees by reducing the effects of competition. This will shorten the period of time needed to grow large diameter trees, snags, and large CWD; all key components of late-successional forests. In the long-term, the proposed treatment will be beneficial to the creation and maintenance of late-successional forest conditions.

The existing species composition of the stand can often be manipulated to better meet desired proportions. Areas containing *Phytophthora lateralis* could be treated in conjunction with density management to control the spread of this disease. Treatment would provide for retention of hardwoods and conifers in a mix appropriate for the vegetative zone.

Both the Riparian Reserve and upland portions of the stand could be treated. Site specific prescriptions could provide for untreated buffer strips along streams to provide bank stability and shade. Density management within the Riparian Reserve is consistent with the ACS objectives to accelerate development of large trees.

Stand selection Criteria: Potential stands for this treatment are typically plantations stocked with trees that are too small to support a commercial harvest operation. Structurally, these stands are usually even-aged, single canopied, with tree densities in excess of 300-400 trees per acre and are within reasonable biological treatment windows. The optimal biological window for PCT is when the trees are between 10 and 15 years old (commonly 8 to 13 years after planting); the average tree height is 10 to 15 feet tall, and before crowns close enough to cause the lower branches to die. Delaying treatment until after the optimum window has passed results in unrealized growth on the leave trees, longer post-treatment adaption periods before the stands become windfirm, heavier fuel loads, and higher treatment costs (Reukema 1975). Diminished, but substantial benefits are still obtained when stands from 15 to 30 feet tall are treated. The need to do early PCT is greatest on poor sites. Within the context of LSR objectives, stands on low sites past the optimum treatment window which are at risk of significant growth stagnation may be justifiably treated.

Other biological windows can also affect PCT timing. When release and PCT are combined into a single treatment, the optimum window for cutting red alder, and thereby reducing retreatment costs, is June 15 to July 15. Treating between May 20 and July 20 provides acceptable control (DeBell & Turpin 1989). Thinning after vectoring insects have flown, but early enough in the summer that fresh stumps can dry before winter, reduces the incidence of black stain disease on stressful sites (pers. comm. Don Goheen). Future research and field observation may identify additional biological windows.

Desired condition: Approximately 150-250 trees per acre would usually remain following the density management treatment. The species mix of hardwoods and conifers would be similar to that of late-successional and old-growth forests within that vegetative zone where current species composition allowed. Depending on the desired site specific characteristics, sprout form hardwoods could be maintained in that form, thinned to one dominant stem, or retained in a combination of forms. Trees over 8 inches in diameter would either be retained or turned into snags. Spacing of the leave trees would be variable, but the trees per acre would fall within the previous estimate. Areas of unthinned trees would be maintained for spatial diversity. Also see the fire management and risk reduction sections for possible fine fuel treatments.

Future treatments: Stands at the developmental stage when precommercial thinning is feasible lack most attributes of late-successional forests. Subsequent density management treatments may be necessary to insure adherence to the proper developmental path to for attainment of desired late-successional forest characteristics, such as multiple canopies, and large CWD or snags.

Fertilization could be employed post-PCT to further boost growth rates of retained trees.

Density Management - Commercial Thinning

The purpose of commercial thinning is to maintain or improve tree growth rates and vigor, manipulate species composition, and spatial arrangement. This is accomplished primarily by reducing stand density. Where necessary, active recruitment of snags/CWD and planting of an understory of appropriate tree species can be done concurrently.

This treatment will usually be implemented via an economical commercial harvest operation. Treatment prescriptions will depend on site and landscape specific objectives. Treatment will focus on shaping the overstory by maintaining or speeding diameter growth rates, and controlling crown depth and crown closure to meet site specific objectives. Besides shaping the overstory, density management may also focus on creating gaps, setting the stage for understory regeneration, and recruiting snags and CWD.

Benefits: Structural diversity is enhanced. The resultant stand will be more similar to late-successional forest due to variation in density and distribution of overstory and understory vegetation. The growth of leave trees at lower densities will decrease the time needed for the creation of large diameter trees.

Within the treatment area, where post-treatment densities are lowest, survival and growth rates of lower limbs will be sustained significantly longer. Maintenance and development of larger limbs on scattered trees may improve nesting conditions for marbled murrelets. Limbs that are larger and lower to the ground may improve habitat conditions for epiphytes.

Unthinned and lightly thinned areas will maintain a level of suppression mortality to provide for short term snag and CWD recruitment. Wide spacing of leave trees and canopy gaps will encourage understory vegetation development contributing to horizontal and vertical structural diversity. In the long-term, the proposed treatment will be beneficial to the creation and maintenance of late-successional forest conditions.

Species diversity is enhanced by providing for retention of hardwoods and conifers in a mix appropriate for the vegetative zone

Stand selection criteria: Potential stands for commercial thinning have tree diameter distributions which can support a commercial harvest operation under average market conditions. They are generally even-age, single canopy stands or those in the initial phase of understory reinitiation and less than 80-years old. The optimal timing for treatment is when crown ratios of the more dominant trees are approximately equal to or greater than 50 percent and height growth rates are high, usually when stand age is between 40-50 years and/or before the understory trees develop a flat top form (Oliver and Larson 1990).

Wider spacing may be prescribed to obtain rapid individual tree growth, a vigorous shrub layer, large limbs, very deep crowns, course tree form, and rough textured canopies. Closer spacings may be prescribed to reduce understory shrub layer development in anticipation of a future effort to regenerate an understory, to avoid radically altering the microclimate inside the stand, to develop clear boles in anticipation of future treatments that encourage epicormic branching.

The optimal biological window for a density management treatment in preparation for understory regeneration is when the overstory trees have shaded out most of the understory. Delaying the density management treatment in preparation for understory introduction will result in greater distinction and separation between the overstory and understory. Low leave tree densities/wide spacing may be necessary to provide the light levels necessary for understory initiation and growth. Alternately, prescriptions may call for gap creation and regenerating a younger cohort in these gaps. Site preparation may be needed before understory trees can be established in stands with a well-developed shrub layer.

Older stands may already have some understory shade tolerant trees. Density management applied to the overstory can provide more light to the understory trees thereby reducing suppression mortality, and either maintain or increase understory tree growth rates.

Prescriptions to recruit snags in the future suitable for nesting and roosting may include a preparatory density management entry to maintain or increase either individual or stand growth rates followed by an entry to recruit snags. The second entry would usually occur when the number of trees greater than 16 to 20 inches would allow for recruiting snags without adversely affecting the stand trajectory toward late-seral/old-growth conditions.

There are a limited number of stands in the LSRs older than 80-years of age that have similar stand conditions to those described above (single canopied, low within stand diversity) and should be considered potential treatment units. The lack of functional habitat of these stands for late-successional related species is more important than age of the stand. There are also older stands that, due to the exclusion of fire, have developed differently than natural stands would have when fire was still a part of the ecosystem. A hemlock and grand fir understory has developed in these stands due to the absence of fire. These stands could benefit from density management. Such a prescription would be supported by empirical information or modeling for the specific site that would indicate that achievement of late-successional conditions would be accelerated, and would be subject to REO review.

There may also be stands that would not benefit from density management. Stands that originated with lower densities may be developing adequately and are beginning to become valuable to late-successional species. Older stands which currently exhibit late-successional or old-growth characteristics should be retained without active management, unless they are identified as needing treatment as part of a risk reduction effort.

Desired condition: The resultant stand would exhibit significant within stand variation in tree density following treatment. At least 10 percent of the stand would remain in unthinned patches to retain processes and conditions such as thermal and visual cover, natural suppression and mortality, small trees, natural size differentiation, and undisturbed debris. Three to 10 percent of the stand would be in heavily thinned patches of less than 50 trees per acre, or in openings up to 0.25 acre in size to maximize individual tree development and initiate structural diversity by encouraging conditions which enhance the potential for understory initiation and growth. A percentage of the leave trees would be defective or broken top green trees. The trees removed would generally be in the intermediate and suppressed crown classes, although a range of diameters of the leave trees would be desirable. A species mix of hardwoods and conifers similar to that of late-successional and old-growth forests within that vegetative zone would be maintained where stand conditions permit. Douglas-fir would be the dominant overstory species in all the zones. In general, trees greater than 20 inches in dbh would not be cut. Remnant snags would be retained where they do not present a safety problem. Areas of unthinned trees around the snags could facilitate their retention and reduce the safety concerns. Stands would be managed to have at least 5 snags per acre greater than 20 inches in diameter and 16 feet tall on north facing slopes and at least 3 snags per acre greater than 20 inches in diameter and 16 feet tall on south facing slopes. To meet this desired future condition, at least 3 snags per acre on north facing slopes and 1 snag per acre on south facing slopes will be retained on completion of any density management treatment.

Treatment of Riparian Reserves would vary depending on the stand and landscape considerations. Prescription of treatment and designation of non-treatment areas within Riparian Reserves would be determined at the site level considering both stream and landscape conditions. Thinned portions of the Riparian Reserves would provide for development of future large trees for long-term structure and CWD inputs. Unthinned areas would provide for short term CWD inputs through suppression mortality.

Future treatments: Subsequent treatments, either commercial thinning, fertilization or snag/CWD recruitment may be required to maintain desired stand development trajectory. Treatments would seek to maintain overstory and understory growth rates, initiate additional understory trees and to create snags and CWD when and where necessary. Field units intend to examine treated stands within five years of treatment to assess attaining the desired future condition for snags. If the stand is deficient in snags (i.e., below the desired levels, based on the average for 40 acre blocks), the unit will create sufficient snags to equal or exceed the desired future condition.

Pruning

In young stands containing sugar pine, pruning could be done to reduce the risk of blister rust infection (pers. comm. Don Goheen).

Some young stands planted following harvest have been planted with a variety of species including sugar pine. This species is susceptible to blister rust which girdles and kills branches, tops, and stems. The disease, by itself, will generally not kill large trees, but it causes considerable mortality in young saplings and poles.

Planting seedlings that have been screened for blister rust resistance is the preferred method of dealing with this disease. Some established stands within the LSRs may have been planted with sugar pine planting stock that was not tested for disease resistance. In young plantations the risk of mortality can be reduced by pruning trees to a height of 10 feet. Moist, cool or foggy weather in the summer and fall favors spread of the disease. The spores are very short lived in warm dry weather. Knowledge of local weather and fog patterns aid in stand selection. Pruning and thinning alter the microclimate, making it less favorable for the pathogen by fostering drier conditions. Pruning also eliminates many of the most favorable infection sites, which are the lower branches and needles of the pines. To retain sugar pine as a component of future stands in the LSRs, pruning needs to be retained as a management option.

Benefits: Species diversity is enhanced. Pruning of sugar pine can reduce the risk of infection and possible death to young saplings and poles. This species is more likely to be maintained in young stands.

Stand selection criteria: Planted stands, generally in the 10-20 year age classes, containing a proportion of sugar pine would be candidates for pruning. Trees that are 20 feet tall with full crown would permit pruning to the recommended height of 10 feet and still retain at least 50 percent of the tree in a live crown to maintain tree vigor.

Desired condition: Potential infection sites (limbs) would be eliminated from at least 10 feet of the lower bole of sugar pines. Sugar pine would remain a component of future stands.

Future treatments: No other treatments for blister rust prevention would be necessary although other silviculture actions to develop other attributes of late-successional forests could be done.

Fertilization

The goals of fertilization is to accelerate individual tree and stand growth through improvement of stand nutrition. This increases the potential for earlier attainment of larger tree sizes which contribute to meeting late-successional conditions.

Fertilization may actually be detrimental to the retention or reclamation of natural grassy openings and other fire dependant low site habitats that add diversity to the landscape. Elimination of fire that removes accumulated nutrients and organic matter also favors the more common plants that thrive on average to nutrient rich sites over those plants that survive on sites too poor to support the faster growing and spreading species. If site fertility has been raised through fertilization, the task of recovering the former species diversity on grass lands has been made more difficult (various authors cited by Wedin, 1992).

Benefits: Fertilization increases the growth rate of individual trees so that they would reach larger size in a shorter amount of time. Fertilization results in accelerated tree growth for up to 8 to 10 years following treatment (Chappell, et al. 1992). Increases in both diameter and height growth have been noted. Canopy closure is accelerated through crown expansion and densification. Stands that were extremely overstocked prior to density management may experience thinning shock or a temporary reduction in growth following the thinning. The severity of the impact could be reduced by the application of fertilizer.

Little information is available on the effects of fertilization on understory components. The understory composition changes with stand history, age, and stocking. In young stands, fertilizer additions usually result in increased understory growth and hence increased competition. When the trees have outgrown the understory, increased shade effect may lead to larger understory plants with a higher nutrient content and a lower diversity.

Stand selection criteria: Stands that have relative densities (Curtis 1982) less than approximately 45 could be selected for treatment. Stands in moderate to low site classes would generally receive priority. Sites to avoid the application of fertilizer include: grassy balds or meadows, oak savanahs, rocklands, or special areas containing unique botanical species sensitive to changes in nutrient and light levels. Untreated buffer strips along designated streams and ponds could reduce the potential for direct application to water.

Future treatments: Fertilized stands could receive subsequent density management and/or fertilization treatments to maintain or redirect stand development towards desired conditions.

Tree Culturing

The objective tree culturing would be to maintain or create desired stand characteristics, including creating larger "wolf-type" trees with large branches, or maintaining large old pine trees within stands. As needed to meet stand structural objectives, individual trees or small groups of trees would be isolated from the remainder of the stand. Treatment would involve creation of small "holes" or openings in the stand with trees to be cultured situated in the openings. Tree culturing may also be done around selected "plus-trees", and other trees involved in research.

Benefits: Structural diversity is enhanced. Growth potential is concentrated into desired stems. The development of larger trees and the habitat they provide is enhanced. In the absence of other treatments, culturing individual trees may be a means of increasing stand structural components which would benefit marbled murrelet nesting habitat, epiphyte habitat, and the development of epicormic branching.

In stands where scattered large old trees are declining due to a complexity of factors including mountain pine beetle, overstocking, blister rust, and drought. Exclusion of fire has allowed an understory to develop contributing to the overstocking and stress on the large old trees. Clearing or culturing around these trees can maintain them in the stands.

Tree culturing around selected "plus-trees" or other trees involved in research allows the development and retention of fuller canopies and enhances cone production. Culturing of these trees also isolates them from the remainder of the stand. With the installation of squirrel guards, cone predation can be reduced.

Treatment Selection Criteria: Potential trees to be cultured include larger residual mature and old-growth conifers and larger hardwoods that exist within a stand of younger sapling and pole size trees. In some cases it may be desirable to culture individual larger trees that exist within stands dominated by hardwoods or within stands that are a mix of hardwoods, shrubs, and regeneration. It is anticipated, however, that the majority of treatments would occur in stands that have closed or nearly closed canopies in conjunction with density management. While structural diversity may be enhanced by culturing a variety of species, Douglas-fir and pines will be the principal species. "Plus-trees" to be cultured will be those that have been identified as having desired characteristics such as fast juvenile growth, frost hardiness, or those trees that have been identified as important in gene conservation. Individual trees involved in research to be cultured would be those that are a part of REO reviewed research.

Desired Condition: Large conifers and hardwoods would remain in LSR stands or would develop over time. Cultured trees would develop larger crowns than trees in the adjacent stand. Trees would have large branches that provide surfaces for nesting, roosting, and perching by late-successional species such as the northern spotted owl, marbled murrelet, or raptor species. In some areas, trees with large branches near the ground would exist to benefit epiphyte development. In other areas, the openings around culture trees could provide canopy gaps where multiple canopy layers would form.

Future Treatments: Additional and future treatments near cultured trees may be necessary. If the objective is to develop multiple canopy levels, underplanting may be desirable. In some cases follow-up protection and maintenance treatments may also be desirable. Culturing treatments designed to increase the vigor and resiliency of selected trees and "plus-trees" that have been treated may require follow-up treatments that reduce natural seedlings and resprouting shrubs and hardwoods. Follow-up treatments to reduce natural seedlings and resprouting shrubs or hardwoods may also be needed when retention of branches near the ground is desired. Underplanting with non-susceptible species followed by periodic roguing of infected naturals may be necessary to establish another canopy layer.

Stand Conversion

Past management practices and other disturbance events have, in some cases, resulted in stands that are lacking the desirable species components that will develop into a late-successional habitat condition appropriate for the site. Stand conversion of hardwoods and brush fields consists of removing a portion of the hardwood overstory or slashing the brush, preparing the site for regeneration, and planting a species mix appropriate to the site. For stands occupied with off-site species, reforestation by removal of the poorly adapted trees and planting of suitable species may be required. On all sites, where viable conifer regeneration is present in the understory, release of advanced reproduction may be used singly or in combination with reforestation.

Benefits: In the short-term, stand conversion will often set the seral stage of development back to an early-seral environment. Following disturbance on moist sites within the assessment area, alder quickly occupied many sites and if left untreated, eventually dominated the site, causing severe suppression and mortality of Douglas-fir and other conifers. Prior to disturbance, most of these sites contained a significant component of large conifers. Poor establishment of conifer regeneration and severe suppression by the hardwood canopy has put them on a different trajectory than was present prior to disturbance. Where conifer regeneration has failed, reforestation with a mix of conifer species and retention of some of the hardwood component would restore native plant communities similar to those present prior to the disturbance event or sequence of events. Stand conversion will restore the site leading to development of functional late-successional habitat conditions.

Stand Selection Criteria: These stands include plantations now occupied by hardwoods or brush, sites where conifer regeneration has been eliminated due to disturbance events, and sites where the regeneration is poorly adapted to the site and will not reach the potential natural community. These sites also include areas that were frequently burned resulting in an inadvertent favoring of stump sprouting hardwoods over conifer regeneration, and sometimes even the loss of local conifer seed source. Typically, the candidate conversion sites are occupied by red alder on moist to wet sites, salmonberry and thimbleberry in the coastal fog zone and riparian influenced areas, and tanoak and/or ceanothous on the warmer sites. IDTs will determine whether each candidate stand for conversion is on a site likely to support conifers that will live long enough to become old-growth, and will eliminate from consideration those sites that are potentially special habitats best managed as hardwood sites or meadows. Mixed conifer-hardwood stands may or may not be candidates for conversion in the conventional sense and will be assessed on a stand by stand basis. Mixed stands with 40 or 50 well spaced, established, free to grow conifers per acre may be on an acceptable trajectory to reach late-successional conditions without farther treatment. Other mixed stands, with many more conifers per acre that are poorly distributed, may need a treatment to obtain better conifer distribution. Individual tree release may be used to insure conifer survival in mixed stands with overtopped but releasable well-distributed conifers. Still other mixed stands may lend themselves to replacement of part or all the hardwoods with shade tolerant conifers.

Desired condition: Establishment of a species mix appropriate to the site which will restore the habitat characteristics existing prior to disturbance and potential plant community.

Future treatments: Manual release of competing vegetation will be required on most conversion sites. Density management, either precommercial thinning or commercial harvest, may be required to maintain species diversity, reach the desirable growth characteristics of individual trees, and provide for structural diversity.

Other Nonsilvicultural Activities

Nonsilvicultural activities located inside LSRs that are neutral or beneficial to the creation and maintenance of late-successional habitat are allowed. Most of the following activities are expected to have neutral or beneficial effects on late-successional habitat. Multiple-use activities other than silvicultural activities that may have potentially adverse impacts to the creation and maintenance of late-successional habitat must be reviewed by the REO if adjustments in standards and guidelines are to be made (ROD C-16). Other nonsilvicultural activities that may arise in the future should be analyzed following the standards and guidelines in the ROD.

Habitat Improvement Projects

The ROD states that habitat improvement projects designed to improve fish, wildlife or watershed conditions should be considered if they provide late-successional habitat benefits or if their effect on late-successional associated species is negligible. Projects required for recovery of threatened or endangered species should be considered even if they result in some reduction of habitat quality for other late-successional species.

Part of the LSRs are in Tier 1 Key Watersheds and should be given the highest priority for watershed restoration. Projects would be designed and implemented in a manner consistent with Late-Successional Reserve objectives. More detail would be available at the project level.

Management in Riparian Reserves (*including density management*)

Desired Condition: Riparian Reserves within the LSRA area would provide a variety of habitat components for terrestrial and aquatic organisms (fauna and flora) both in the short and long-term.

In general, stands within Reserves would contain a diversity of tree and vegetative species similar to those of natural occurring stands within that vegetation zone. Strings or patches of hardwoods would often occur in high disturbance sites, such as within slump areas, floodplains and along streams. On larger streams, hardwoods could potentially dominate the floodplain and only a few interspersed conifers may be present. The composition of shrubs and forbes would provide all habitat needs for wildlife species and would mimic that of unmanaged stands. The abundance, distribution, and condition classes of snags and downed logs would mimic those of unmanaged forests during all stages of stand development. Snags and downed wood would provide habitat for wildlife and plant species and would provide present and future structure into the aquatic system. Downed wood would also supply sites for seedling establishment and habitat for nitrogen-fixing nonsymbiotic bacteria (USDA, 1985).

The presence of a variety of overstory and understory vegetative layers and downed wood produces the typically cooler and moister microhabitats which some plant and animal species prefer. Thermal protection during both the summer and winter months would be maximized in stands with tall, dense overstories. Open stands with a dense shrub or understory layer would also provide thermal protection, but would typically undergo greater fluctuations in temperature and humidity. Standing trees and vegetation would regulate humidities at the different canopy layers while the downed wood component, in combination with the former, would help to maintain higher humidities at and near the ground level. In general, the trees and vegetation would provide shade and prevent wind dessication while the downed wood would act as a sponge to retain moisture. High relative humidities near, at, and below ground level are critical for the survival of many amphibian species. Moist microsites also play an important role in the establishment and maintenance of fungi (USDA, 1985) which provide food sources for forest organisms, assist in the decomposition of organic materials and help to maintain or improve site productivity.

Natural disturbances such as flooding, windthrow, and landslides would continue within Riparian Reserves.

Selection Criteria: Management actions undertaken within Riparian Reserves must be consistent with the ACS objectives, including the intended benefits to riparian-dependent and late-successional species. Any management actions proposed for Riparian Reserves should be preceded by analysis of the suitability of those activities with respect to ACS objectives and intended benefits to riparian-dependent and late-succesional species. The analysis should include the following elements:

- identification of important physical and biological features or characteristics of the Riparian Reserve network related to land form, vegetation, and species habitats,

- identify and evaluate regional and local species of concern that need to be analyzed when managing the Riparian Reserve network

- use the best available data to assess whether the current composition, condition, and extent of habitat within the Riparian Reserve network is adequate to meet ACS objectives and the needs of late-successional species intended to benefit from the management actions

Where watershed analysis has not specifically addressed the above issues in detail, further analysis would be required. Information and analyses collected during all Riparian Reserve evaluations should, at a minimum, be substantive and rigorous enough to satisfy the requirements of an appropriate level of NEPA analysis as well as help support implementation monitoring objectives. The analysis process described in the *Riparian Reserve Evaluation- Techniques and Synthesis* (Supplement to Section II of Ecosystem Analysis at the Watershed Scale: Federal Guide for Watershed Analysis. Version 2.2) is recommended.

In all potential management action scenarios, the protection of headwall areas, especially those classified as potentially unstable areas, would facilitate the natural processes necessary for the input of substrate and large wood into aquatic and riparian systems. Streams that provide high quality refuge areas for listed and proposed fish species should also be identified for protection. Management activities in and around these areas may be limited and would depend on further analysis as mentioned above.

Management activities for restoration could include, but is not limited to: instream restoration, riparian silviculture, CWD or snag recruitment, culvert replacement or removal, and road closures.

Stream Restoration

The identification of streams for restoration activities would be prioritized by field personnel on each district. A useful tool for determining potential project sites would include the Draft ODFW stream habitat survey analysis based on data taken throughout the Umpqua basin between 1993 and 1996. All data was collected on anadromous fish-bearing streams. The document summaries include specific treatable reaches and project type recommendations (i.e. add large wood, introduce beavers, plant conifers etc.). The Draft list is available through the ODFW office in Roseburg or through the ODFW Research Division office in Corvallis. This information could be used by agencies to locate reaches on lands within the LSRA. Surveys have been summarized outside the Umpqua basin, but treatable reach information has not been extracted. The data, however, can be analyzed by agency personnel using similar methods. Projects should be designed to mimic natural structures and input processes and would utilize natural structural components (wood/rocks) whenever possible.

Riparian Conversion/ Release

Riparian restoration should focus on restoring tree species appropriate for a particular site. For example, planting of conifers to areas characterized by frequent fluvial disturbance (floods, landslides) or a high water table may not be appropriate as these zones are generally dominated by moisture-tolerant and disturbance/colonizer species such as shrubs, low-growing woody vegetation (willow, vine maple) and hardwoods (alder, ash, maple, and myrtle). Alder and other hardwoods provide thermal protection to the stream and riparian areas where recent disturbances have left little vegetation. They also provide large organic inputs into typically nutrient-limited ecosystems through leaf litter or through the addition of nitrogen to soils. Bank stability through root strength, and instream and riparian habitat for fish and wildlife species are also provided by these trees and other vegetative species. Where conifers are appropriate, release or conversion opportunities could be pursued. It is recommended that treated coarse wood (alder, etc.) be left on site to at least achieve a minimum standard (Table 22). In areas where levels exceed the optimum for the site, or where necessary to assure project feasibility, wood may be removed.

Coarse Wood/ Snag Recruitment

Coarse wood and snags provide habitats for a large number of biotic species. In Riparian Reserves where levels of these components are below those of unmanaged stands, projects to increase the levels may be appropriate. Coarse wood may be obtained through the falling of trees, and snags could be created using topping or girdling techniques (for example). An assessment of current and potential future condition of coarse wood and snag levels should be completed in order to determine the appropriate amount of management.

Culvert Removal/Replacement

Culvert removal from closed roads within Riparian Reserves is recommended wherever possible. Due to the extensive road network present on the public lands, most perennial streams are crossed multiple times by roads, substantially affecting the quality and continuity of aquatic ecosystems. The lack of continuity impacts both the physical (landslides/debris torrents) and biological (fish/amphibians/invertebrates) components of the stream system. Roads and stream crossing structures function as dams that constrict flow through a single outlet and prevent the transportation of material down the channel. Roads and culverts also function as partial or complete barriers for upstream movement of many aquatic species. These barriers can isolate small populations, limiting or preventing genetic exchange between populations, and preventing recolonization of historic or recovering habitats. When roads cannot be closed, modification of existing culverts should be completed to allow for material transport and for upstream aquatic species (amphibian/invertebrate/fish) movement.

Road Closures

The ROD recommends assessing the potential effects of roads within Riparian Reserves in regards to ACS objectives while considering short and long-term transportation needs (C-33). Where roads are not needed for current or near future management activities (e.g. 5-years), closure should be considered. Roads should be left in a hydrologically stable condition (not actively eroding or adding mileage to the stream network) and culverts should be removed to allow for natural flow patterns. Where roads will be used in the near future and may be impacting ACS objectives, road upgrading may be appropriate and may include surfacing or the placement of additional drainage structures.

Density Management in Riparian Reserves

Density management may be a useful tool in attaining/accelerating desired stand characteristics in Riparian Reserves. Analysis of information collected during the Riparian Reserve evaluation process (previously described) would determine what level (if any) of density management is appropriate for a particular location.

One of the primary ecological functions of the Riparian Reserve system is to provide and maintain coarse wood for aquatic, riparian-dependent and terrestrial organisms. Maintenance and recruitment of down wood within the Reserves is essential in meeting ACS objectives for these areas. In general, down coarse wood is deficient in streams and Riparian Reserves throughout the LSRA where management activities have occurred. The guidelines shown in Table 22 are recommendations for the coarse wood levels that should exist at stand age 80.

Table 22. Recommended Range for Retention Levels of CWD (cu.ft./ac.)

Province	Within the First Site Potential Tree Height from Any Perennial Stream	Within the Second Site Potential Tree Height from Any Perennial or First Site Potential of Any Intermittent Stream
Coast Range	3,600 - 9,400 [1]	1,600 - 2,300 [3]
Klamath	650 - 1,300 [2]	650 - 1,300 [2]

[1] Ursitti, 1990. Includes all wood 4 inches in diameter and 1 meter in length and larger.
[2] Bingham, 1991
[3] Spies, 1988/1991

Prior to management activities, coarse wood surveys should be conducted in order to determine current wood levels. It is expected that in some stands, current levels will not meet the above guidance. Where this is the case, addition of wood during the proposed management activity may be necessary. It may not be possible, nor preferable, to meet the full guidance at the time of entry but rather to calculate the needs for the future stand. For example:

> The objective for the density management activity in a 40 year old stand is to end up with 80 trees per acre at age 80. The prescription is to remove trees down to 90 trees per acre at age 45. The current down wood levels are 3,000 cu.ft./acre and the desired level at age 80 is

5,000 cu.ft. In order to provide adequate down wood (to meet the above guidance) at age 80, it may be necessary to leave an additional 10 trees per acre over the prescribed 90 to contribute to future goals. It is recommended that at the time of initial treatment no more than 20 percent of the additional trees be felled/girdled. The remaining trees are expected to provide future down wood resulting from suppression mortality or future scheduled treatments (felling/girdling).

In most cases, no cut buffers would be required along streams to minimize disturbance and possible impacts to streams and the adjacent areas. Existing down material should be retained.

Precautionary Measures

Temperature
Any management proposed in or near streams must allow for adequate protection from potential increases in stream temperatures. These measures will prevent negative impacts to aquatic organisms and the further listing of streams on the Department of Environmental Quality's (DEQ) 303(d) list. In general, it should be noted that air temperatures are higher in the Klamath Province when compared to the Coast Range Province and that several of the Threatened coho salmon (southern ESU) and other sensitive fish species are at their southern extent or have depressed populations. Increases in streams temperatures may produce more dramatic effects to those populations when compared to the ones in the north.

Natural Disturbance

Management within Riparian Reserves should meet LSR objectives while allowing latitude for natural disturbances to occur. For example, density management activities should not reduce the density of trees within the Reserve below a point where a disturbance event such as a landslide or wind storm may reduce the density even further than was appropriate for the site.

Special Habitats

There are some areas within the assessment area which are not, and are not expected to be on the trajectory of attaining late-successional structural characteristics. These areas occupy a small (estimated to be less than one percent of the assessment area), but important component of the landscape and are considered unique and important for the contribution they add to diversity across the landscape. These include areas in a non-forested condition for a variety of reasons such as rock outcrops, wetlands, or meadows. Management activities will be employed to maintain these special characteristics.

On a few locations, mostly on the eastern and southern part of the assessment area, are plant communities that were once maintained by fire, which are now encroached on by conifers. These fire dependent communities include open oak stands and meadows, have become rare on federal lands in the LSRA and therefore are considered to be special habitats. These sites are usually found on south to west facing ridges and upper slopes, with shallow droughty soils. Reintroduction of fire (or treatments such as cutting and removal of trees encroaching on meadows) will be necessary if we are to maintain these habitats.

Management of Existing and Proposed Facilities

Non-silvicultural activities which manipulate vegetation may be proposed within the LSRs. These activities should be neutral or beneficial to the LSR. The ROD (C-16-18) provide good direction on these types of activities. Existing facilities such as campgrounds, trails, and electronic or communication sites are compatible with LSR objectives. The existing or planned facilities as described in the individual RMPs or LRMP within the LSR boundaries occupy such a small area, when looking at the whole LSR, that the function of the overall LSR will be maintained. There may be some site specific areas that are outside ACS objectives. These will need to be reviewed at a finer scale, either in a watershed analysis or project level NEPA analysis. All projects must meet ACS objectives over the long-term and meet Threatened and Endangered or Survey and Manage species guidelines as described in the ROD.

Research

The progeny test sites and seed orchards of the tree improvement program within the LSRs are considered existing research developments and will continue to be managed for their original purpose of genetic testing for growth and yield, and the production and collection of seed from selected parent trees. The sites are part of the Northwest Tree Improvement Cooperative (NWTIC) that coordinates all the test sites. The experimental approach was developed as a region wide standard in 1966 for this study. These sites exist on other land use allocations as well as private ownerships throughout the region.

Management of the progeny test sites and seed orchards in the short-term are in some ways inconsistent with the objectives of the LSRs. These sites will be managed similarly regardless of the land use allocation where they are located. Each cooperative unit has a schedule for data collection and analysis which is typically at 5, 10, 15, and 20 years of age. As measurement sequences are completed, the sites may be thinned in a manner to preserve selected genetic individuals. These future thinnings will not be to attain old-growth or late-successional characteristics but for retention of selected individual trees identified as the highest ranking trees for growth and yield. The pattern of thinning in the test sites will be systematic, or nearly so, to selectively maintain the desired trees. Resulting information will be useful for addressing genetics questions in the implementation of the Forest Plan. Test site thinning proposals are peer reviewed by the NWTIC. Sites are expected to be maintained for a 40-year period. Treatments at the conclusion of the study would be planned according to the land use objectives of the site. Even though the test sites will not be managed for old-growth characteristics or LSR objectives in the short-term, the results of the research will be to grow larger trees more quickly. Based on the number of trees to be cut and the small area within the progeny sites, the risk to the LSRs should be minimal.

To protect and maintain the vigor of the parent “plus trees”, especially the parents of the highest ranked trees in the progeny test sites and seed orchards, removing the competing vegetation around the trees may need to be accomplished. This could involve removing, topping, or girdling trees adjacent to the “plus trees”. Potential treatments of individual “plus trees” for cone stimulation and insect control could include fertilization or metasystox injections.

Any new research activities should be consistent with LSR objectives. New research activities which are potentially inconsistent with LSR objectives should only be considered if there are no equivalent opportunities outside of the LSRs and would be subject to review by the REO.

Special Forest Products

Special forest products collected in the LSRs include vegetative materials such as beargrass, salal, other forest greens, evergreen tree boughs, Christmas trees, burls, berries, mosses, ferns, edible mushrooms, and firewood (fuelwood). The management and/or sale of special forest products may occur when such an activity is neutral or beneficial to meeting LSR objectives and neutral or beneficial to the species itself.

Throughout the LSRs, harvest of special forest products will be done to insure viability of the species. As an example, the South River Resource Area in the Roseburg district has been divided into three areas for beargrass collecting to ensure sustainability of the resource. Only one area will be open for beargrass permits at an one time to allow the other areas two years to recover before allowing people to collect beargrass again.

Firewood cutting would be conducted to a lesser extent than beargrass picking. Firewood should be cut only in existing cull decks, where green trees are marked by silviculturists for thinning, where blowdown is blocking roads, or in recently harvested timber sale units where down material would impede scheduled post sale activities or pose an unacceptable risk of future large scale disturbance.

Bough collecting would be allowed to occur on a limited scale, mainly near existing roads. Bough cutting would not alter the upper two-thirds of a tree and would not be permitted on trees shorter than 15 feet. Any whole trees available for bough collection would be those felled as part of a silvicultural or risk reduction activities. Port-Orford cedar would not be available for bough collection except where trees are cut in roadside sanitation operations in accord with the Port-Orford cedar guidelines.

Cutting Christmas trees would be permitted on a limited scale in young stands or within the road prism.

Access and Road Management

Overall guidance for road management within LSRs is discussed in the ROD, the *Western Oregon Transportation Management Plan* (BLM, June 1996), and the *Siuslaw Access & Travel Management (ATM) Guide* (USFS, Sept. 1994). Management objectives for individual roads require detailed information that is beyond the scope of this assessment. However, as watershed analysis is conducted, transportation management objectives (TMOs) for individual roads are being developed. This ATM/TMO process attempts to balance land management access needs, as well as access to adjacent private lands, with the need to reduce the amount roads to meet the ACS, LSR road density goals, and other resource protection objectives.

Use of the roads system by through traffic and adjacent land owners will continue. Spur roads, initially constructed to support the timber program, will no longer be needed following reforestation, other silvicultural practices, or on completion of density management treatments. These roads will provide opportunities for road closure through active measures, such as installing gates or "tank traps", or by default as encroaching vegetation reclaims the roadway. In many cases, stream crossings and/or cross drain culverts may be removed.

Most of the LSRs have target levels for roads remaining open to unrestricted vehicle traffic listed in their respective District's RMP. The intent is to reduce the impacts from roads and vehicle traffic on wildlife, particularly big game. In addition, parts of LSRs 259, 261, 265, 266 and all of LSRs 251 and 257 are within Tier 1 Key Watersheds. Management guidance for roads within Key watersheds is to reduce the number of roads and to not allow a net increase in road miles (ROD B-19). Current road densities within LSRs are listed in Table 23. Some road closures have been identified for closure through the ATM/TMO process and have been, or soon will be, closed through the 'Jobs-in-the-Woods' (JIW) watershed restoration program. Table 23 also shows the resulting road density following these actions.

The above figures are from the 1992 GIS data base and do not reflect roads built since that time or roads closing themselves due to encroaching vegetation.

Table 23. Current Road Densities Within LSRs

LSR #	Road Miles	Road Density (mi/sq.mi.)	RMP Open Road Density Target [1]	JIW Road Closures (mi) [to date]	Open Road Density following JIW Road Closures
251	4.7	1.61	2.9	-	
255	3.3	0.88	2.9	-	
257	7.9	1.95	2.9	1.3	1.63
259	270.0	4.18	1.5 [2]	-	
260	20.6	2.75	1.1/2.9 max.	2.5	2.41
261	432.9	3.92	1.1/2.9 max.	-	
263	344.9	3.64	1.1/2.9 max	70	2.90
264	92.4	3.67	-		
265	87.6	2.90	2.9	17	2.33
266	73.2	3.78	2.9	-	

1 Coos Bay RMP cites an open road density target of 1.1 mi/sq.mi with a maximum of 2.9 mi/sq.mi within the ODFW Tioga Big Game unit and a target of 2.9 mi/sq.mi for the remainder of the District.

2 Medford RMP cites a target of 1.5 mi/sq .mi within elk management areas, which includes portion of LSR# 259.

Road Management Guidelines

In general, the following guidelines are designed to minimize the impact of roads to LSR objectives:

New road construction, which further fragments late-successional habitat, is generally not compatible with LSR objectives. The anticipated benefit from the project must be carefully weighed against the impacts to habitat (ROD C-16). Where possible, new road construction should be limited to temporary roads which can be rehabilitated following use.

- Road maintenance operations (ie., roadside brushing, cleaning ditches and culverts, surfacing repair, replacing culverts, repair of storm damage, etc.) should follow Best Management Practices. Fallen trees within the road prism could be removed.

- Road maintenance may also include felling of hazard trees or removing roadside trees. Leaving material on site which is located outside the road prism should be considered (ROD C-16). Trees within the road prism and those necessary to maintain a safe sight distance would be considered for removal.

- Access to non-Federal lands, existing right-of-way agreements, contracted rights, easements, and temporary use permits are considered valid uses (ROD C-19).

- Road closures to reduce disturbance and harassment to elk and other wildlife, erosion into streams, loss of snags and down logs to illegal cutting, refuse dumping, or to otherwise meet objectives for Key watersheds are compatible with LSR objectives.

- Operations within existing rock quarries generally would not be constrained. Any expansion of existing quarries in the future is not expected to inhibit attainment of LSR objectives. Rock obtained from the quarries may be used to help upgrade existing roads causing problems and help attain ACS objectives. The potential benefits of attaining ACS objectives may exceed the costs of habitat loss.

- Establish long-term road closures on the majority of spur and secondary roads not requiring immediate access by private landowners. Avoid construction of new roads or upgrading of naturally closed roads through large contiguous stands unless there are no feasible alternatives. Road closures that reduce the potential for human fire starts are a priority in LSRs.

Tailholds and Yarding Corridors

Another non-silvicultural vegetative manipulating activity which will occur within the LSRs is a result of the scattered BLM land ownership pattern. Occasionally adjacent land owners request permission to cut individual guy line trees, “tail hold” trees, or yarding corridors to facilitate harvesting on their lands. In most cases, the requests are to gain the necessary deflection to provide one-end or full-log suspension, to reduce or eliminate additional road construction, to reduce erosion, to meet State safety requirements, or permit “flying” logs over streams.

Typically the yarding corridor request are for corridors less than 30 feet in width spaced at intervals of about 200 feet with a length of less than 1,000 feet, or involve small wedge shaped areas less than an acre in size. Although these requests will result in cutting trees within a LSR, the resulting impact on the adjacent non LSR land will be reduced. Trees felled for “tailholds” or yarding corridors will be left on-site.

Nonnative species

Standards and Guidelines in the ROD state that nonnative species should not be introduced into LSRs. If introduction of a nonnative species is proposed, an assessment of impacts should be completed and any introduction should not retard or prevent achieving LSR objectives. The introduction of nonnative plant species has often been through management activities such as road construction, or activities that create disturbances. Stabilizing road banks by mulching or seeding with grasses has introduced nonnative grass species into the LSRs. However, this should not retard or prevent achieving LSR objectives. In the short-term, soil stabilization activities would continue utilizing non invasive grasses. Long-term objectives would be to collect and utilize native seed for use in these projects.

The BLM and the Oregon Department of Agriculture (ODA) have an agreement where the BLM identifies and monitors noxious weed locations and the ODA implements the control measures. Controlling or reducing the extent of noxious weeds, such as Scotch broom, would generally benefit LSR habitat as long as undesirable side effects do not degrade habitat

Land Exchange/Acquisitions

Land exchanges or acquisitions should be considered when they would provide benefits equal to or better than current LSR conditions. Land exchange actions would need to be carefully evaluated. The loss of some lands on the edges of some LSRs in order to create larger contiguous blocks within them may be appropriate. But exchanges that resulted in the loss of lands with late-successional or old-growth stands would probably not be an acceptable loss. Management agreements should be considered if exchanges or acquisitions are not possible.

For the LSRs in this assessment area the highest priority for this type of action would be LSR 259 because it is Large and highly fragmented with private sections. Another high priority would be to acquire additional lands for LSR 264 to improve the linkage of late-successional habitat east to the Cascades Province. Portions of the remaining Large, fragmented LSRs (261, 263) would be a lower priority. In contrast, land exchanges or acquisitions are not recommended for the Small LSRs (251, 257, and 260) as they currently provide important geographic distribution which would outweigh any potential gain associated with a strategy of trading a portions of their edges to create a larger blocked up ownership of core LSR habitat.

V. Implementation

This section is intended to provide an idea how the BLM and Forest Service intend to implement management actions. As conditions are constantly changing, this section should not be considered to be a complete listing of proposed management actions. Actual implementation of proposed management actions should be based on field analysis of existing conditions and biological treatment windows and the availability of funds. As with the entire document, this section should be continually updated as new management direction arises or needs change.

Watershed analysis documents for areas within the LSRs and management plans for ACECs also contain goals, objectives, and recommended management activities for a variety of resource management needs, which will need to be integrated into this LSRA at the site specific project level. NEPA analysis should be completed prior to implementation of site specific projects.

Implementation of treatments within the LSRs should be based on the appropriate treatment criteria developed to identify possible projects, treatments, and avoidance or no change areas. This includes treatments to:

- expand existing large blocks of interior mature and late-successional habitat;
- develop or expand blocks for connectivity of mature and late-successional habitat to other similar blocks within or between adjacent LSRs;
- maintain or develop connective links of blocks of 40-years and older stands within LSRs;
- develop future large blocks of interior habitat where it is currently lacking; and
- consider spotted owl or other special species habitat needs or special habitats or sites adding diversity across the landscape by determining where it is located, and its connectivity to other suitable habitat.

Maps 6 to 13 display examples of priority areas (to the extent they exist) for each LSR. Utilizing the landscape and stand selection criteria described in the previous section, individual stands (or units) within each individual LSR could be identified for a variety of treatments to put a stand on the trajectory to meet the desired future condition. For example, within LSR 261, stands aged 15-29 in a priority A area would have the highest priority for selection for a density management treatment. Stands aged 30-49 in a priority A area would be a lower priority, and stands aged 50-80 would have the lowest priority for selection for a density management treatment. Within a priority areas B or C, stands aged 15-29 would have the highest priority for selection for a density management treatment. Stands aged 30-49 would be a lower priority for selection, and stands aged 50-80 would have the lowest priority for selection for a density management treatment. Currently some of these treatments are tentatively proposed to be implemented within the first three years after the approval of this assessment.

Other projects may be implemented on a “when needed” basis, such as road construction in response to reciprocal right-of-way agreement requests, or a large scale (greater than 40 acres) salvage project should a major disturbance event occur. Still other projects or activities may be ongoing such as: harvesting of special forest product; riparian restoration projects; road closures;

or seed orchard, progeny test site, and plantation maintenance. Additional projects may be implemented after more information is gathered.

The following projections have been made to assist management in the development of budgets and provide an estimate of workloads that could result in implementation of the recommendations developed in this assessment. The acres projected for treatment are not intended to be used as goals or limitations. Selection of specific stands or sites for treatment should be based on field analysis of existing conditions and biological treatment windows. Site specific prescriptions should be developed to meet the desired future conditions described in Chapter 4.

Table 24 displays the approximate number of acres which could be available for treatment by various age classes. We anticipate all 600 acres of brush field conversion opportunities would be treated. For budgetary purposes only, we estimate the following treatment percentages by age class: ages 0 - 29, 80 percent of the available acres would be treated; age 30 - 49, 50 percent of the available acres would be treated; for age 50 - 80, 30 percent of the available acres would be treated.

Table 24. Estimated Treatment Opportunities and Projected Costs of Implementation

Treatment Opportunity (age class)	Acres available for treatment	Percent of acres to be treated	Estimated acres to be treated	Work month requirements to prepare projects [4]	Project contract costs [5]
Stand conversion/ site preparation/ planting (0-10)	600	100	600	 1 2.8 0.5	 $400 $500 $150
Maintenance/ release/ PCT [1 2 3] (0-29)	70,900	80	56,700	0.8 0.5 0.5	$250 $180 $170
PCT/ CT [1 2] (30-49)	25,300	50	12,700	0.5 8.5	$200 $0
CT/ Tree Culturing [2] (50-80)	10,100	30	3,000	9.5 0.3	$0 $80

1 Treatment of infected Port-Orford cedar areas could be included in the project when and where necessary. Additional cost for treatment is not considered to be significant.
2 Fertilization could be programmed after the initial treatment, no treatment estimates have been included.
3 Pruning could be programmed, no treatment estimates have been included.
4 Cost estimates based on 100 acres.
5 Cost per acre

In addition to Table 24, opportunities exist within the LSRs to conduct stream enhancement projects, to replace or remove culverts, and/or to close or obliterate roads. As these are specific projects which should be identified through the watershed analysis process, we have not attempted to include them in the implementation cost estimates.

VI. Monitoring and Evaluation Plan

Monitoring is an essential part of natural resource management to provide information on the relative success of management strategies. Monitoring should be conducted at multiple levels and scales. Monitoring should occur at the project level and at a broader scale throughout the LSRs. Monitoring should be conducted in a manner that allows localized information to be compiled and considered in a broader regional context. Future monitoring requirements driven by regional concerns may be added later.

The monitoring plans for the Coos Bay, Roseburg, and Medford RMPs and the Siuslaw Forest LRMP are tiered to the Monitoring and Evaluation Plan for the ROD, which has not yet been completed. As components of the Monitoring and Evaluation Plan are completed or refined, the RMPs, the LRMP and this monitoring plan would be updated to conform to the regional plan. Monitoring should follow the guidelines or directions set forth in the following documents:

- Standards and Guidelines (S&Gs) in the ROD,
- Management Actions/Direction in the Coos Bay, Roseburg, and Medford District RMPs, and the S&Gs in the, Siuslaw LRMP,
- Treatment recommendations in the LSRA,
- Management concerns raised during watershed analysis, and
- Mitigation measures included in project NEPA analysis.

Three types of monitoring (implementation, effectiveness, and validation) described in the ROD should be integrated in monitoring projects and/or activities within this LSRA. The goal of implementation monitoring is to determine if the plan is being implemented correctly. Effectiveness monitoring should determine if the objectives of the plan are being achieved. Validation monitoring is to determine if the underlying assumptions are correct or accurate.

Implementation monitoring for the BLM should answer the following questions pertaining to Late-Successional Reserves from the Coos Bay, Roseburg, and Medford District RMPs.

- What activities were conducted or authorized within the LSRA and how were they compatible with the objectives of the LSRA plan? Were activities consistent with ROD S&Gs, the LSRA and/or RMP management direction, and REO review requirements? Have the treated acres been in proportion to the priorities identified in Table 21?
- What is the status of development and implementation of plans to eliminate or control non-native species which adversely impact late-successional objectives?

- What land acquisitions occurred, or are under way to improve the area, distribution, and quality of LSRs?

Additional questions to address, due to the Tier 1 Key Watershed designations would be those concerned with fish habitat, including:

- Are at-risk fish species and stocks being identified?

- Are fish habitat restoration and enhancement activities being designed and implemented which contribute to attainment of ACS objectives?

- Are potential adverse impacts to fish habitat and fish stocks being identified?

Effectiveness monitoring should determine how successfully projects or activities have achieved the objectives, goals, and or desired future conditions in the LSRA. Some key items to consider may include:

- Is a functional, interacting, late-successional ecosystem maintained where adequate, and restored where inadequate?

- Did silvicultural treatments benefit the creation and maintenance of late-successional conditions?

- What is the relationship between levels of management and the health and maintenance of late-successional and old-growth ecosystems?

- Are desired habitat conditions for the northern spotted owl and for other late-successional forest associated species maintained where adequate, and restored where inadequate?

- Are desired habitat conditions for listed, sensitive, and at-risk fish populations maintained where adequate, and restored where inadequate?

- Are landscape level recommendations being met?

- Is the health of Riparian Reserves improving?

- Are management actions designed to rehabilitate Riparian Reserves effective?

Indicators for assessing these conditions include:

- land use data
- seral development across the LSRA
- locations and concentrations of disease and insect infestations
- fuel amounts by category

- riparian and stream habitat condition by stream class
- water quality
- retention of snags and CWD

Validation monitoring assesses the accuracy of underlying management assumptions. Most validation, and some effectiveness monitoring would be conducted through formal research. Existing research projects may be integrated to answer the validation monitoring questions.

New information gained through research, watershed analysis, or outside sources should be evaluated to determine whether changes or adjustments to recommendations should be made to this LSRA, including the monitoring plan. In addition, the BLM RMPs are scheduled to be formally evaluated at the end of every third year after implementation of the RMPs begins. The formal evaluation of the RMPs is to determine whether there is significant cause for an amendment or revision of the plans. This evaluation and/or revision to the plans may affect this LSRA, causing the need to revise this assessment. The LSRA may also need to be revised at other times when it has been determined that additional information is needed or that a change needs to be made concerning existing information.

Because this LSRA crosses three BLM district boundaries and involves two federal agencies, a periodic review should be conducted to evaluate management activities and future plans. This review should involve all four parties.

VII. List of Preparers

This Assessment was done in cooperation with the Bureau of Land Management Coos Bay, Roseburg, and Medford Districts and the Siuslaw National Forest Mapleton Ranger District.

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Appendix A. A Conceptual Model for Managing Landscape Level Diversity Based on Observed Disturbance and Stand Development

Landscape level diversity is the result of differences among the stands on the landscape. Between stand diversity is not random. It is the product of site conditions, disturbance history, and mechanics of recolonization. Applying a single management scheme to all stands across the landscape will reduce the contrast between stands. That, in turn will reduce the range of potential habitats across the landscape. We probably cannot identify, let alone consciously manage for, all possible habitats. What we can do is manage for a range of variation both within stands and between stands that is in context with the physical characteristic of the land and plausible disturbance patterns. This means some stands will be very complex while others are simple. The simple stands may not have the range of niches that the more complex stands have, but they will have some niches that do not exist in the complex stand.

Aspect and slope position can be used to stratify the landscape. Much of the naturally occurring variation on a landscape scale is a product of variations in temperature, moisture, available light, as locally modified by aspect and slope. In turn, they strongly affect fire regime, vegetation communities and to some extent soils.

The most severe fire, on the landscape scale, will kill all trees from ridge top to creek bottom and on all aspects. These stand replacement fires are probably a complex of burns and reburns that occur during periods of extreme drought. Scattered trees may escape dying during the fire and will instead die slowly from stress over the next few decades. This stress is the result of increased exposure to the drying affects of wind, sudden exposure of the entire crown to full sunlight, direct heat injury to the crown reducing photosynthetic surface, and loss of those fine roots consumed by the fire as it burned the organic layer. The stress is farther accentuated by the fact that large old trees consume most of their photosynthate through respiration leaving little for regrowth of fine roots, replacement of needles, or production of protective chemicals and pitch to ward off insect and disease attacks. Landscape level diversity, following this extreme event, will correspond to the interaction of physical site characteristics like:

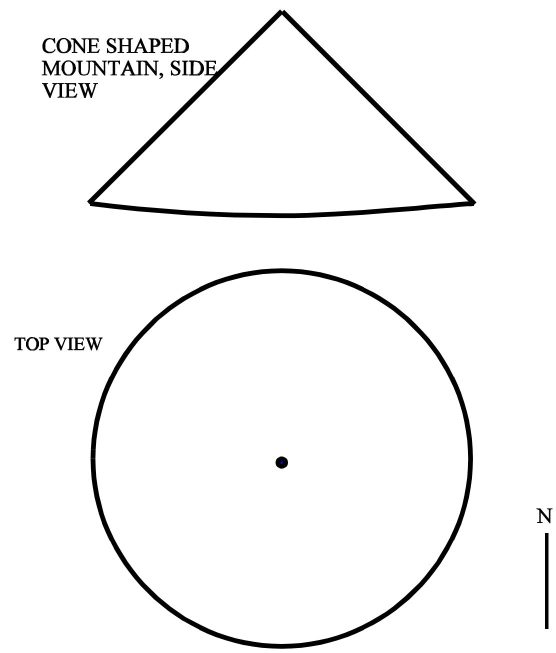
- aspect
- topographic position
- soil

and biological factors like:

- the presence and competitiveness of stump sprouting shrubs and hardwoods
- seed source and aggressiveness of light-seeded pioneer species.

This is not an exhaustive list. It is a list of readily observable characteristics that can serve as a basis for stratifying the landscape for purposes of developing prescriptions for managing on a landscape scale.

Diagram for Describing Landscape Level Patterns



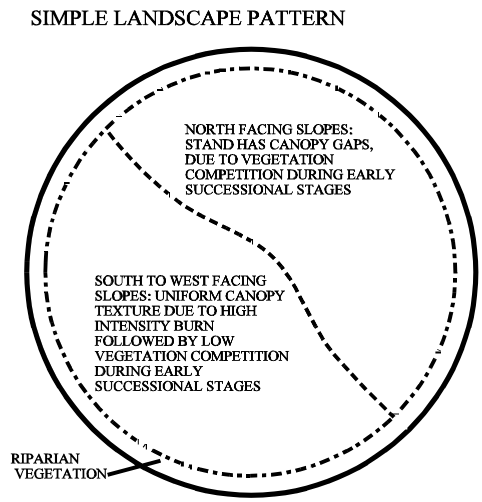
This model for managing landscape patterns uses aspect and slope position and their effect on wild fire to define the landscape patterns. These patterns can be diagramed by assuming the landscape occurrs on a perfect cone-shaped mountain. The patterns can then be mapped two dimensionally, as they would be seen from directly above the point of the summit, by using a circle with the center of the circle being the peak, and the perimeter representing the base of the mountain. The circle is oriented like a map with the north facing slopes on the top half of the circle. For the purpose of showing the riparian vegetation on the diagram, one needs also to visualize the cone-shaped mountain as an island in a stream. Forest stands, with different structural features, are then delineated relative to each other on the cone-shaped mountain. This way, forest stands are also shown relative to slope position and aspect. This can then show the different landscape patterns associated with different severity of burns and with multiple fire events.

The sequence of models used in the discussion below reflects progressive severity of the fires and should not be mistaken for a sequence of fire events. This model was formulated based on an Oregon Coast Range setting that is entirely inside the *Tsuga heterophylla* Zone. The model probably does not apply at the extreme south end of the Coast Range where tan oak is a major forest component on the south aspect.

The four levels of landscape complexity

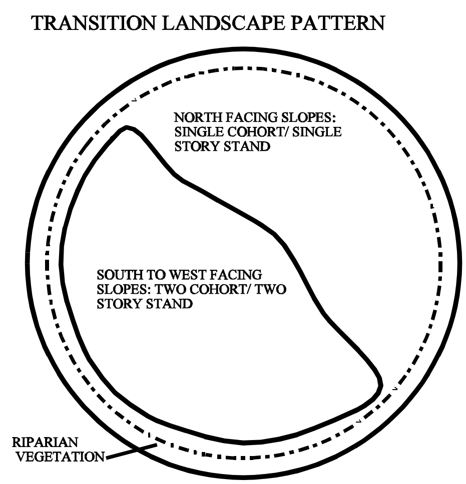
Simple landscape: All stands regenerated following a single landscape level stand replacement fire and its associated reburns. Landscape level diversity between stands comes from variations across the landscape attributable to:

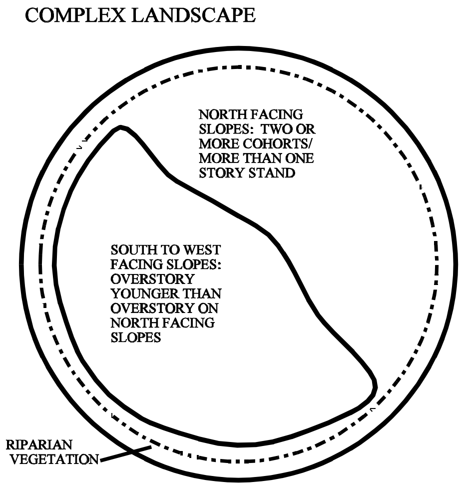
- variations in stand replacement fire intensity.
- differences in vegetation competition that limit regeneration success for the trees.
- site factors like soils.



None of the stands have been subsequently modified by under burns, except for small burns on southwest facing ridge tops. Section 19, T.26S., R.10W., Will. Mer., Little North Coquille Drainage, contains old growth stands characteristic of the simple landscape model.

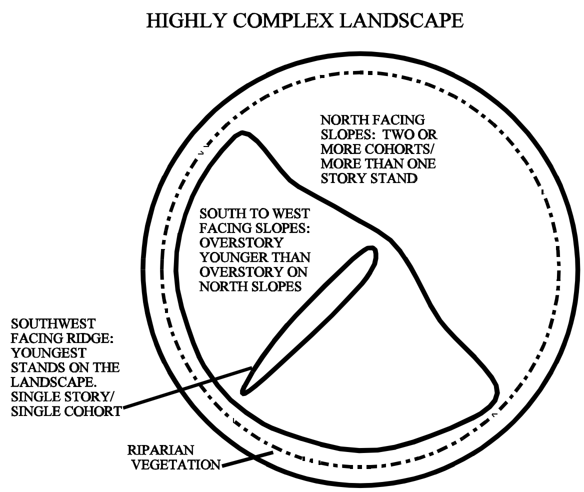
Transition Landscape: The overstory trees, excepting small areas on southwest facing ridge tops, regenerated following the last landscape level stand replacement fire. Low to moderate severity fires have lead to the regeneration of a second cohort of trees, which are found in the understory on the south to west aspects. The second cohort may also be found on the upper slopes of the other aspects. The North Coquille Drainage contains stands that are characteristic of a transition landscape.





Complex Landscape: The overstory on the north aspect, in the riparian zone and on the lower slopes, date from the last landscape level stand replacement fire. The overstory trees on the south to west aspect are younger having regenerated following an aspect restricted stand replacement event. Two or more cohorts are found on the north aspect. The younger cohort(s) came in following a low or moderate severity burn on the north aspect. If no subsequent stand level disturbances occur, the understory cohort on the north aspect and the overstory cohort on the south aspect may have originated from the same fire.

Highly Complex Landscape: This is a variation of the Complex Landscape in which stands on all aspects are modified by low or moderate fires. At least two cohorts are present on all aspects and usually three or more are detectable on the north aspect. The exposed southwest ridge top locations are prevented from supporting the late seral stages of stand development by frequent fire. Those southwest facing sites may be covered by open stands, or even be held in the grass or shrub stages of succession for decades if not centuries. Stands around Peevee Creek and Karl Creek in the East Fork Coquille Watershed are characteristic of a highly complex landscape



Components of the landscape using slope position and aspect as a basis for stratification.

Southwest facing ridge line: Southwest facing ridges are the most exposed sites on the landscape with respect to heat and evapo-transpiration stress. The warmer temperatures, lower moisture, and fire's tendency to move up hill makes the southwest facing ridge the most fire prone area in the landscape. Depending on fuel and weather conditions, mortality may be limited to fire kill on the ridge. The pattern of kill may be more complex with total kill at the ridge, partial kill on the margins. Most of the mortality in the partial kill areas would be among the fire intolerant species, like hemlock. Where fires modify vegetation and stand structures, the southwest facing ridges will tend to support the earliest seral stages, creating a mosaic pattern across the landscape. In the extreme, this may be a fire-maintained prairie or a brush field. In other landscapes, stand development on the southwest facing ridge may be repeatedly arrested before the trees in that area reach maturity. This results in periodic pulses of small diameter snags in those areas. Depending on the severity of the fire and the maturity of the surrounding stands, burns on these sites may also result in large diameter snag recruitment on the margins of the affected area. This pattern will be most pronounced in areas that are repeated burned by light to moderate severity fires, like in the east half of the Middle Creek Subwatershed.

South to west facing slopes and exposed higher ridge lines facing other directions: This is the second most frequently burned area. The overstory timber can reach maturity and old growth stages of succession. High severity burns on the southwest facing ridges may be accompanied by moderate or low severity burns on the south to west facing slopes. The moderate to low severity burns will kill most, and sometimes all, of the fire intolerant species while killing few or none of the Douglas-fir. This pattern of burning creates "natural shelterwoods" favoring the regeneration of even-aged understories dominated by hemlock. Some Douglas-fir may also be recruited. The percent of the understory in Douglas-fir will depend on the size of the hemlock seed source, the amount of shade from the overstory, and whether there are gaps in the overstory. Repeated low to moderate burns will tend to remove all evidence of previous hemlock stands, but some Douglas-fir may survive. Given that these are still warm sites that go through summer drought, stand replacement fires occur here at a higher frequency than on north slopes.

North Facing Slopes, and the Lower Slope Position: Only the riparian zone burns at a lower frequency than this slope position. Since these sites are cooler and more moist than the south to west facing slopes, weather and drought conditions dry enough to allow a stand replacement fire on the north facing slopes and lower slope position will also be a stand replacement event on all other aspects. Fires on the north facing slopes that do not result in stand replacement will cause a more severe burn on the south to west facing slopes if the fire event is large enough to encompass more than one aspect. A single fire event can be a low to moderate severity fire on the north aspect and stand replacement fire on the south to west aspects.

Protected Riparian Zones: These are the least likely areas to burn on the landscape. When fire does enter this area, it may be no more than a creeping ground fire. The protected riparian area drys out enough to carry a stand replacement fire only under conditions of extreme and prolonged drought. If a fire is severe enough to destroy the riparian trees, it probably killed all of the other trees on the landscape. Flood plains and riparian sites, subject to debris torrents and avalanches, are strongly affected by disturbances other fire and so are not accurately reflected by this model.

One Approach for Using Fire Patterns When Managing Stands so They Fit Within the Larger Context of the Landscape

Stands less than 30 years old:
During the regeneration, stand establishment, and precommercial thinning phases of stand development, select treatments to establish stands that fit in the simple landscape model. Based on wild stand development patterns, it is appropriate to manage for a predominance of shade intolerant trees (Douglas-fir) on open sites and shade tolerant trees (hemlock and cedar) where there is overhead shade. Tolerate vegetation competition to the extent it breaks up uniform distribution of conifers on moist sites but not to the point where the establishing a future conifer stand is compromised. Use precommercial thinning to accelerate the growth of future dominant and co-dominant overstory trees and at the same time to provide growing space for natural fill-in that will constitute the future intermediate and suppressed trees in the future overstory. Culture stump sprouting hardwoods so that they produce one to a few stems per stump. Consider leaving scattered red alders (up to 40 per acre) when present on sites where local experience shows they are unlikely to spread by seed. The alders will act as "place holders" and will leave a gap when they die. Retain hardwoods to the extent that they diversify the future stand, but not to the extent they compromise establishing the conifer component of the future stand.

Stands 30 to 80 years old on south aspect upland sites:
Manage for relatively uniform stands of mostly co-dominant trees on south aspects. If density management is applied around age 30 to 50, design the stand treatment to fit in the simple landscape pattern. Target spacing to achieve about a 40% crown length at age 80 to 100 years. Include sufficient site disturbance to allow a small seed catch of hemlocks and cedars. To emulate natural stands only a few hemlock and cedar, roughly five or less per acre, will be needed. Failure to establish understory trees at this time is also appropriate because that is within the natural range of variation.

Stands 30 to 80 years old on north aspect upland sites:
Manage for stands with gaps and high crown class variability. This can be achieved by leaving stringers and patches of alders next to draws and wet areas when doing density management. Gaps may be enlarged by concentrating snag creation efforts on the perimeter of existing gaps. Density management treatment can accomplish the same objective if the marking crew is instructed to increase the size of the gaps. This can be done by marking all but the largest co-dominant and the dominant Douglas-firs for removal on the edges of existing gaps, and decreasing the distance between leave trees as they get farther away from the gap. If few or no hemlocks or cedars are found beside the gaps, site preparation and planting around the edges of the gaps and back 50 to 75 feet into the stand will shift those areas into the range of natural variability for age structure and species distribution observed in reference stands.

Manage hardwoods as a component of the overstory during the sapling and pole stages of stand development. Allow the difference in growth rates between hardwoods and conifers to, over time, differentiate the stand into multiple stratums with the conifer above the hardwoods.

Stands 80 years and older on south aspect upland sites:
As these stands approach 80 to 100 years, manage the stands to shift the character of the landscape from simple, to that of a transition landscape. Either an underburn or treatments that emulate an underburn will be needed to prepare the stand and the site for regenerating an understory and recruiting snags. Apply this treatment working from the ridge top down. Break-off the first underburns where the sclerophyllous shrubs give way to a plant association characterized by swordfern, or oxalis, or salmonberry (or at the boundary of the Riparian Reserve, should these activities interfere with obtaining Aquatic Conservation Strategy objectives). For safety reasons the boundary for the underburn must be put in a logical location. A safe, defendable burn boundary takes precedence over boundaries keyed to plant association.

The underburn objectives include recruiting snags, creating small gaps, preparing a seed bed for recruiting understory trees, setting back vegetation competition so the understory trees can get established, and improving browse quality. There needs to be sufficient overstory stocking following the treatment to both function as a stand and to allow for an additional underburn treatment 50 to 75 years in the future. Carry out the underburn treatments so that new snags are recruited every year somewhere in the landscape. Most naturally occurring underburns were either isolated on a ridge top or covered large continuous areas along the ridge top and south face of large ridge systems. Some underburns should next to previous underburns so that over time they will become large continuous blocks of similar habitats[1].

A different approach may be prudent for stands on poor sites on southwest facing ridge tops. Wide spacing is recommended on those sites to reduce stress from root competition and to emulate the effects of frequent fire.[2]

Stands 80 years and older on north aspect upland sites:
Underburning may have a place in the future management of the north slopes. However, for the foreseeable future, we do not recommend prescribed underburning on the north facing slopes (beyond those incidental inclusions of north slopes found on predominantly south to west facing underburn project areas). Under wild conditions, underburns on north facing slopes occurred as part of a larger burn pattern that resulted in landscapes fitting the complex and highly complex

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[1] An analysis of patch size associated with low to moderate severity burns in Tioga Creek Subwatershed suggests that density management and/or underburning to open the canopy of selected stands with the objective of regenerating an understory and recruit snags from the overstory should strive for the following objectives if we are to stay within the range of natural variability: Treat about 2,000 acres over the next 20 years in that subwatershed. Leave between 20% and 75% canopy closure immediately after treatment (anticipating additional mortality will drop live canopy closure to between 15 and 70%). Approximately 75% of the treatment units should be less than 80 acres with most of the units falling in the 20 acres and less or in the 40 to 70 acre ranges. Approximately 65% of the treated acres should be in units containing at least 100 contiguous acres. This does not preclude additional acres of treatment but those treatments should not be sufficiently severes to leave a signature that will be visible on aerial photos 30 years after treatment. See Appendix C-2: The Range and Frequency of Stand Areas for Understory Stands Regenerated in the 1910s and 1920s inside the Tioga Subwatershed, for additional discussions.

[2] Under wild conditions, poor sites on the exposed southwest ridges may have only infrequently supported late-successional forests. Some sites may have been kept in the early successional stages by repeated fire. Others would have had scattered older trees. Such sites support flowering plants like fawn lily, and Indian paint brush. They are relatively common plants in other locations in the state but are rarely found on the resource area and thereby serve as indicators of a locally scarce habitat. Prescribed fire may be a necessary tool in managing these sites for their habitat value.

landscape model described above. Fully implementing either of those two models inside an LSR would require stand replacement disturbances on the south facing slopes and therefore would be in conflict with the current plan.

Hardwood management:
Manage long-lived hardwoods (bigleaf maple, myrtle etc.) so they remain as an understory component. Retain or reestablish long-lived hardwood on sites where they were previously favored by frequency disturbance. For example, where frequent fire on southwest aspects, and valley side sites once maintained oaks, madrones, or myrtles.   In riparian zones, subject to frequent flooding or debris torrents, mange for myrtles, bigleaf maples, willow, ash, or cottonwood on their respective sites.

Appendix B. Fire History, Patterns, and Stand Level Effects in the Hemlock Zone

The fire history for the western hemlock zone in the area covered by this LSR assessment was learned through watershed analyzes done for the Middle Creek, North Coquille, Tioga Creek and West Fork Smith River subwatersheds (USDI 1995a; 1995b; 1996a; 1996b). The West Fork Smith River Subwatershed is just north of the area covered by this assessment. Data from this subwatershed is included because it suggests the disturbance processes and fire effects observed in the Coquille and Coos Rivers area extended to the north end of the assessment area. The data from these analyzes suggests that fire was both the primary stand replacing disturbance and an important shaper of the subsequent stand structure and composition.

Fire Chronology

Fires, as indicated by scars and regeneration pulses, tended to occur in clusters or episodes separated by periods of low fire activity. The fire episodes, based on physical evidence (USDI 1995a; 1995b; 1996a; 1996b), are:

<1404 to 1440 (earliest birth dates, the extent of disturbance is unknown.)
1534 to 1621
1735 to 1780
1845 to 1855
1885 to 1942

The historically documented major fires (Walstad et.al. 1990) inside the assessment area:

1868	Coos Bay Fire	95,000 ac	Coos and Curry County coasts, and up the Middle Fork Coquille Watershed (Peterson & Powers 1952; USDI 199?)
1936	Bandon complex	145,000 ac	Bandon, fires near Powers, Sitkum, and Blue Ridge/Fairview.
1951	Vincent Creek Fire	30,000 ac	
1966	Oxbow Burn	43,000 ac	

The time since the last major stand replacement fire ranges from 31 years for the Oxbow Burn area to more than 439 years ago for one site in the South Tioga Creek headwaters. Except for the South Tioga Creek site, and the lower slopes in the upper end of the North Fork Coquille River, all sites where fire histories are documented, were affected by the 1845-1855 and/or 1885-1942 fire episodes.

Fire Frequency

Fire burned, on average, every 17 years somewhere in the Tioga Subwatershed from 1404 to 1923. These fires varied greatly in severity and included local stand replacement fires, regional scale stand replacement fires, reburns, and underburns. When fire frequencies were calculated for the individual drainages in the Tioga Creek Subwatershed, they ranged from averaging 23 years, based on the period from 1534 to 1923 for the Burnt Creek Drainage, to 75 years, based on the period from 1558 to 1918 for the Upper Tioga Creek Drainage. The fire history for the West Fork Smith River Subwatershed was developed from a data set, which based on a number of samples and distribution of sample points across the landscape, is most comparable to the drainage scale data subsets for Tioga Creek. The fire frequency for the West Fork Smith River Subwatershed averaged every 42 years. Extrapolating from the Tioga Creek fire history, and considering data from near by sites[1], the average fire frequency at the drainage scale for LSR 261, before fire suppression, is estimated to be between 50 and 75 years. The LSRs between LSR 261 and LSR 267, which contains the West Fork Smith River, are all expected to have comparable fire frequencies. The other assessment area LSRs inside the Western Hemlock Zone which are south of LSR 261 have climates that are at least equal to if not warmer and drier than LSR 261 are also expected to have similar fire frequencies. This assumption is supported by the estimated 65-year average fire interval reported for the Western Hemlock series in the *Southwest Oregon Late-Successional Reserve Assessment* (USDA & USDI, 1995).

The fire frequencies for the other plant series have not been determined for this assessment area but are expected to be similar to those reported in the Southwest Oregon Late-Successional Reserve Assessment (USDA & USDI, 1995).

Plant Series	Mean Interval Between Disturbances	Notes
Port-Orford-cedar series	150 years	This series tends to follow drainages on the Siskiyou NF, and Medford BLM. To the north, on the Coss Bay District, it is found up slope. At the northern end of its range, it is found on southwest facing upper slopes.
Tan oak series	90 years	
Jeffery pine	see note	Fire occurrence is high. The series is notable for showing the least degree of disturbance, regardless of agent.
White fir	< 30 years	

Timing of Stand Replacing Fires

The major stand replacement fires in the assessment area appear not to be random events but are rather the result of regional and even continental scale climatic conditions. Heinselman (1983) observed that large areas of forest, in regions characterized by infrequent high intensity fires, can be traced back to fires that burned in a few major fire years. Where weather information is

[1] Fire history surveys were done for North Coquille River and Middle Creek watershed analysis. The Middle Creek fire history data focused more on determining stand age and species structure than on identifying fire dates. However, the regeneration pulses suggest a similar frequency of fire as observed in Tioga Creek. The North Coquille River data suggests that 1735 to 1780 was a period of stand replacement fire(s) and reburns. The 1735 to 1780 fires destroyed all evidence for previous fires except for one site. Fire appears not to have revisited the stands on the lower protected slopes in the North Coquille since they were established. Upper slopes there were underburned 1847±2 years, and there have also been small local fires also on the ridges.

available, we know most of these major fire years are associated with periods of severe drought. For example, 1755-1759 were major fire years in both the Rockies and the Lake States (Heinselman, 1983). A 500-year age class is found throughout the Cascades, and the Olympic Mountains. That age class may have been initiated by fires associated with a drought period or even a short term climatic change (Franklin and Hemstrom 1981).

The 500-year age class in the Cascades, and the 400 to 450-year-old stands in Tioga Creek, Middle Creek, and East Fork Coquille River areas regenerated during the Little Ice Age. This was a period of cooler drier weather in the Northern Hemisphere. The weather pattern predisposing the Lakes States and the Rockies to fires from 1755 to 1759 may have been the same predisposing factor leading to the fires occurring from 1740 to 1780 in the assessment area, and to the 250-year age class found in both the Washington and Oregon Cascades. Agee (1991) identified 14 fire events in the Oregon Cave National Monument, of which 9 corresponded to fire scar dates or regeneration pulses observed inside the assessment area and in the West Fork Smith River Subwatershed. The 1845 to 1855 fires in the assessment area coincide with pioneer and early newspaper accounts of fires on the Oregon Coast from 1845 to 1849 (Morris, 1934). The largest of these fires was probably the 1849 fire that burned 800,000 acres between the Siuslaw and Siletz Rivers (Morris, 1934, Walstad et.al. 1990). This likely the same 1849 fire documented in the West Fork Smith River Subwatershed fire history.

Climatic differences over time may have affected growth patterns. The Douglas-fir growth ring patterns for nearly all trees regenerated in the 1735 to 1780s are sufficiently different from the pattern lain down by trees regenerated before 1700 that an experienced observer can identify trees in the 1735-1780 age class with a glance at the cut surface of a stump. The ring widths of a 1735-1780 age class tree show rapid growth for the first 80 to 100 years (3 to 4 rings/ inch initially tapering to 6 or 8 over time). Then the growth abruptly slows to where a magnifying glass is sometimes needed to get an accurate ring count. Trees regenerated before 1700 also tend to show rapid initial growth but their growth rates start to decline almost immediately, and continue to decline steadily for the life of the tree. These patterns were observed while looking at hundreds of tree stumps from Roman Nose Mountain to the East Fork Coquille River.

Stand Structural Development as Influenced by Low to Moderate Burns in Established Stands

Stands regenerated following a fire which killed all previously existing trees on the site, are even-age and predominantly Douglas-fir. If these stands experience subsequent low to moderate severity fires there may be one or more additional age classes. In multi-cohort[2] stands, Douglas-fir is usually the only species representing the oldest age class. Hemlocks and cedars, with their thin bark and shallow roots, are less fire tolerant than Douglas-fir and only survive very cool fires or in unburned patches left by those fires that burn in a mosaic pattern. On those sites where the subsequent fire killed most of the older age class of trees, the younger age class is dominated by

[2] A cohort is a group of trees regenerating after a single disturbance. A multi-cohort stand is a stand that arose after two or more disturbances. All but the first disturbance would be less than stand replacing in severity (Oliver; Larson, 1990).

Douglas-fir. Where the second fire kills only a few of the older trees, the resulting partial shade favored establishment of an even-age understory hemlock stand (Hofmann, 1924).

Most of the old growth stands included in the fire history had experienced underburns of sufficient severity to:

- eliminate the fire intolerant species that regenerated at the same time as the overstory Douglas-fir.
- reduce vegetation competition by setting back the herb and shrub layer and creating gaps in the overstory, which provides the partial shade conditions that favor hemlock and cedar over Douglas-fir.

As a result, the overstory and the understory stands not only occupy different canopy strata, they also are distinctly different ages and composed of different tree species. Extreme age differences are evident on the upper slopes above Tioga Creek, Park Creek, and East Fork Coquille River where the overstory Douglas-fir regenerated between 1535 and 1622 and the understory hemlock regenerated after underburn(s) between 1914 and 1919. Further more, these underburns were of sufficient severity to kill all the hemlock and red cedar that had been on those sites before 1914 excepting isolated individuals growing in moist protected draws.

Most of the understory hemlock stands, observed during the fire history work date from either the 1845-1855 fire episode or the 1891-1942 fire episode, and most of those trees regenerated during the 15 to 20 year period following the underburn. The understory hemlock stands regenerated from 1914 to 1942 either are in or starting to emerge from the stem exclusion stage. Their canopies are so tight as to exclude all but a few scattered ferns and shrubs.

The most complex landscapes support stands initiated during the 1534-1622 fire episodes. These stands were modified by moderate severity fire(s) during the 1735-1780 fire episode and further modified by low to moderate severity fires dating from the 1845-1855 and/or the 1885-1942 fire episodes. These landscapes are characterized by the following features:

- The southwest facing ridges often support stands that are a single age and single story. These are the most recently burned areas on the landscape, and appear to be more frequently burned than the rest of the landscape. Consequently, these are the youngest wild stands on the landscape.

- The south to west facing slopes, and the upper ridge locations on other aspects support two or three cohorts divided into two distinct canopy stratum. The upper stratum is occupied by older Douglas-fir. The most common overstory age class is younger than 300 years old. The lower stratum is occupied by younger even-aged hemlock with an occasional Douglas-fir.

- North facing slopes, and the lower slopes usually support three cohorts and sometimes a fourth cohort. The upper stratum is occupied by older Douglas-fir. (1535-1630 and/or 1735-1790 birth dates.) The lower stratum is occupied by younger even-aged hemlock with an occasional Douglas-fir.

Landscapes dominated by stands established as the result of the 1735-1780 fire episode and later subject to low to moderate severity fires are less complex:

- The south to west facing slopes, and the upper ridge locations on other aspects support two cohorts divided into two distinct canopy stratum. The upper stratum is occupied by older Douglas-fir dating to 1735-1790. The lower stratum is occupied by younger even-aged hemlock with an occasional Douglas-fir. On some sites, the understory is dominated by stump-sprouting shade tolerant hardwoods. There are a few small patches of young trees on south facing ridge tops that date to local fires after 1900.

- North facing slopes, and the lower slopes usually support a single story stands that show little evidence of underburns. These stands are described in detail below.

Stand Structural Development Where There Were No Underburns

Stands on the lower slopes in the North Coquille Subwatershed provided a unique opportunity to see how old growth stands develop where there were no underburns. The dominant and co-dominant trees are Douglas-firs that regenerated between 1760 and 1780. A small number of western hemlock and western red cedar came in following the disturbance. Ring counts show the western hemlock and western red cedar regenerating between 1779 and 1840. Hemlock and cedar regeneration appeared to peak between 1811 and 1831, after Douglas-fir regeneration tapered off. Today, those hemlock and cedar are found in the intermediate crown position, and are generally tall enough to reach the lower live limbs of the overstory Douglas-fir. These western hemlock and western red cedar have full crowns covering up to 70% of the boles.

Transects[3] were run through reference stands next to the North Fork Coquille in sect. 21, T.26S., R.10W., Will. Mer. and Little North Fork Coquille in sect. 19, T.26S., R.10W., Will. Mer. Illustrations 1, and 2 are the graphic representations of that data. The stand structural differences between the north and south facing slopes, shown in the illustrations, are probably due to differences in fire intensity, and relative growth rates of the shrubs typical for each aspect. Other factors affecting the difference between the aspects are mountain beavers, which are more common in north facing draws, and the greater tendency for red alders to establish on the more moist north aspects following disturbance. Both mountain beaver clipping and red alder competition limit the amount and distribution of conifer regeneration. The fire intensity will be greater on the south aspect. This will expose a more uniform expanse of mineral soil, and will be more effective at killing or severely retarding stump-sprouting hardwoods and shrubs. The shrubs found on the south facing slopes, evergreen huckleberry, rhododendron, salal, and Oregon grape have a slow growth rate. Myrtle, which is found on the south aspects, can vigorously resprout, but big game browsing usually holds myrtle in check during the grass/shrub successional stages. Vine maple and salmonberry aggressively resprout and effectively compete for growing space on north aspects. On moist protected areas in north facing draws and head walls these shrubs may even escape fire damage. Resprouting vine maple, like myrtle, can be

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[3] The surveyors mapped tree bole and shrub locations along the transects. They also recorded, DBH, relative tree heights, total crown depth, length of boles with epicormic branching, crown diameter, and shrub heights.

held in check by big game browsing. Our observation is big game prefer to use south aspects and subsequently will exert greater browse pressure on resprouting shrubs on those sites. In addition, mountain beaver, red alder, and shrubs can exclude conifers from moist areas, which over time results in the gaps in the forest canopy characteristic of the north aspect stands. A more detailed description of the differences between north and south aspects is provided below .

South facing slopes, where there is no indication of underburning have the following characteristics

The overstory is almost entirely Douglas-fir, and most of those occupy the co-dominant position. The few western red cedar and hemlock present are in the intermediate position. The stands are often single story. Some stands are two story with a Douglas-fir overstory and a myrtle understory. The few understory western hemlock and cedar are found next to gaps in the overstory.

The canopy is very uniform and the stands well stocked. The uniformity and density on the south slopes cause the tree crowns there to be 65% to 80% of the crown sizes on the north aspects, based on measurements made on aerial photos. When there are large openings, they are associated with salvage logging, root rot pockets, and nonforest ground. In mature stands, there is open space between the crowns, which is the result of the crown abrasion during high winds. That space allows enough light to reach the forest floor to support a moderate to a dense brush layer on most sites.

The branching pattern on the Douglas-fir suggests a past period of very high crown competition. The upper 30% to 40% of most Douglas-firs exhibit a normal branching pattern with the middle third often exhibiting fan-shaped epicormic branching. The fan shaped branching is stimulated on the boles of the surviving trees as light levels increase inside the stand following competition mortality of the less vigorous trees the stand. The fan shaped epicormic branches are of particular interest in that they provide nesting platforms and substrate for epiphytes. Shrubs, which are on most sites, exclude conifer regeneration in the understory. The shrub layer is usually dominated by sclerophyllous shrubs like salal and evergreen huckleberry. Vine maple and hazel may also be present and locally abundant. Patches of vine maple on upland south facing slopes are associated with moist areas like draws and head walls or are associated with shallow soils. In the later case, the bedrock under the shallow soil is holding the water running through the soil up close to the surface. Patches of understory regeneration are largely confined to disturbances associated with salvage logging, fire “slop-overs”, and road construction.

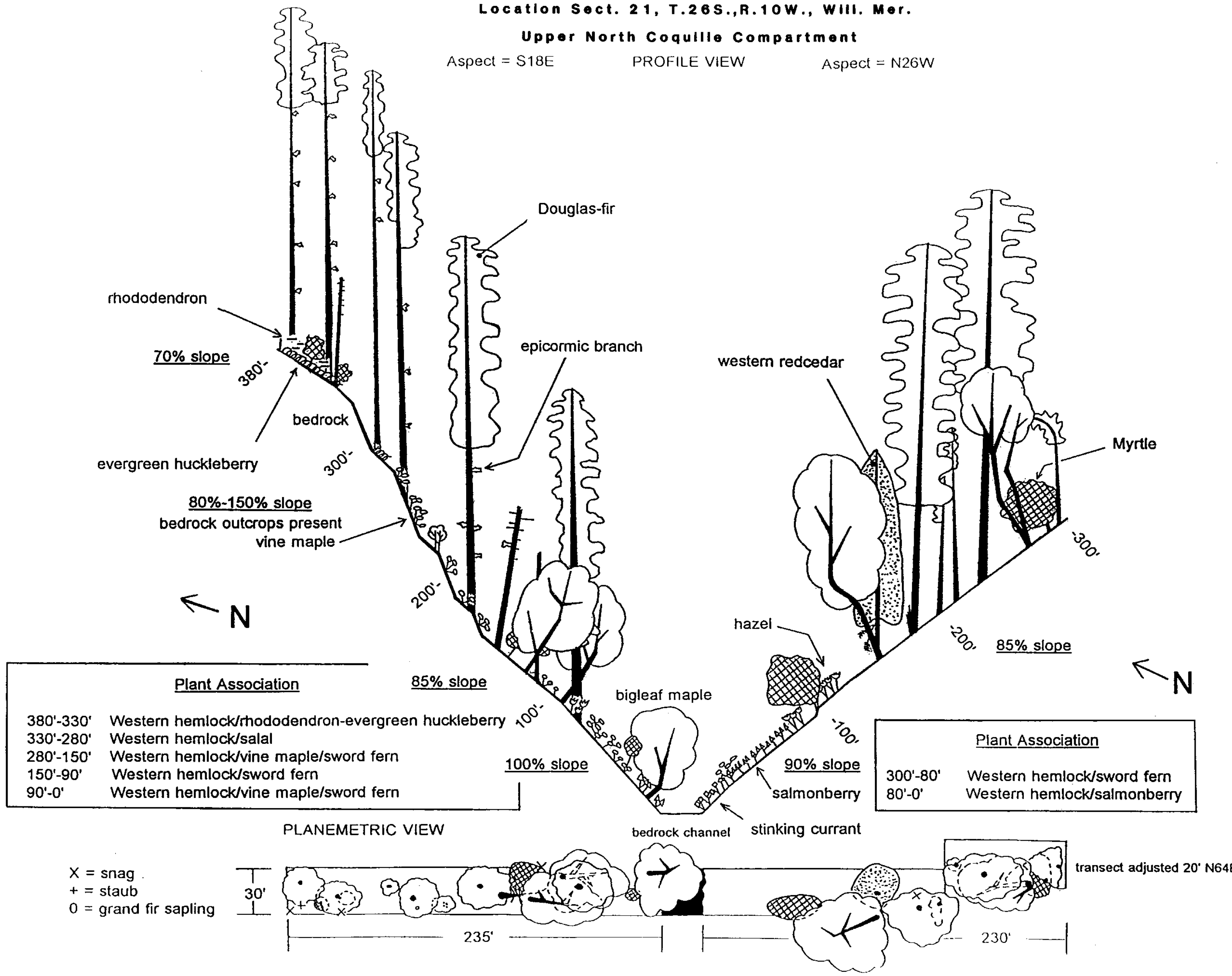

Illustration 1

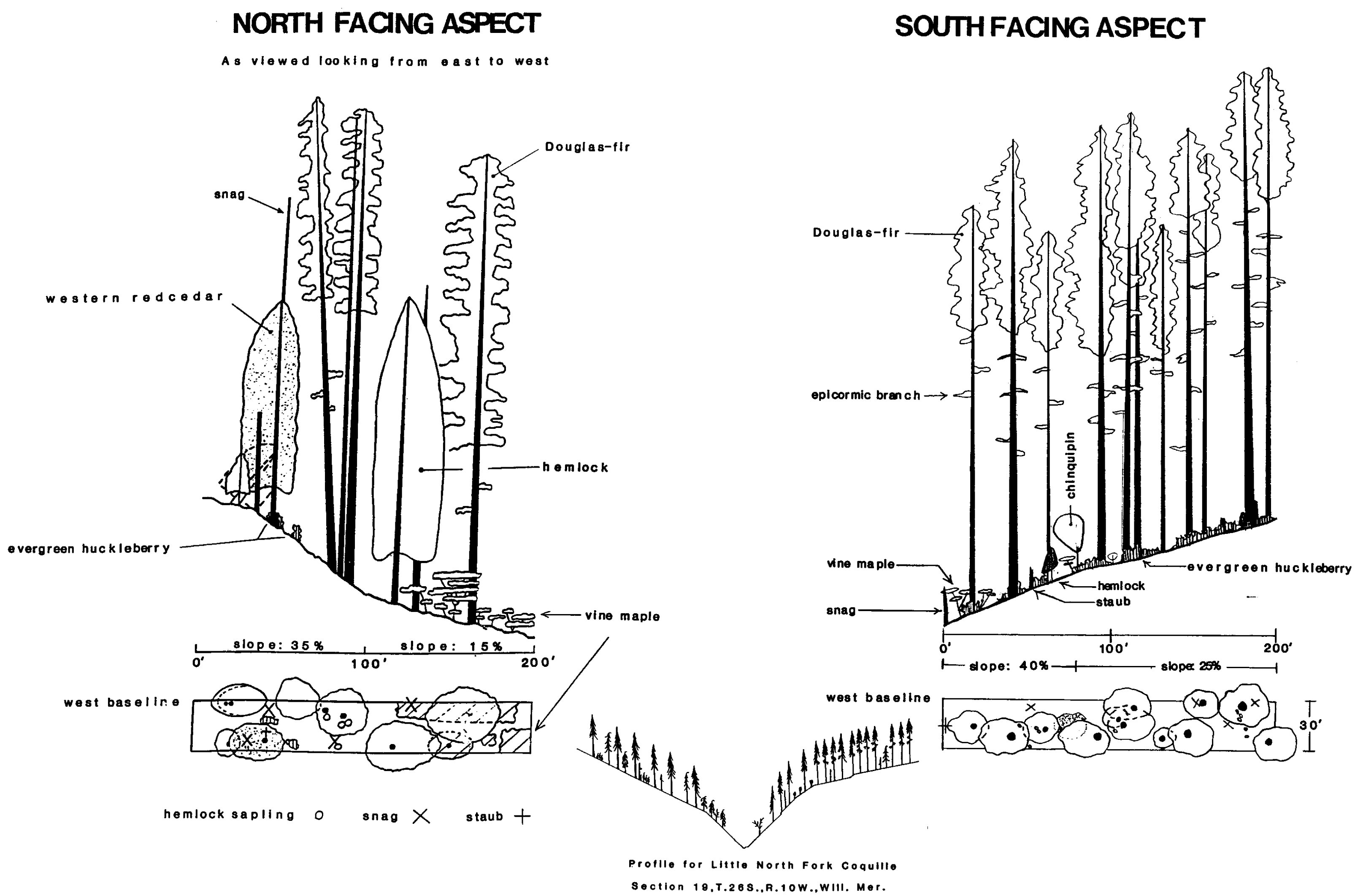

Illustration 2

North facing slopes, where there is no indication of underburning have the following characteristics

The forest canopy has a rougher texture than south facing stands as seen on the aerial photos. This is due to several factors. There are more gaps in the canopy. The overstory canopy closure is in 40% to 70% range. As viewed from the ground, the openings in the canopy sit over brushy areas (typically vine maple or salmonberry). The margins of the gaps are often occupied by red cedar, hemlock and sometimes bigleaf maple. There is a more pronounced differentiation of the Douglas-fir into crown classes, and a greater variation in crown lengths, when compared with Douglas-fir on the south facing slopes.

On the north and west sides of the assessment area, headwalls and steep ground next to first order draws often have vine maple and/or salmonberry brush layers and low conifer stocking. When these salmonberry and/or vine maple dominated sites exceed 95% slope, there is often no conifer stocking.

Crown gaps are occasionally observed on steep sloped north facing head walls with sword fern ground cover. Observations of the Douglas-firs next to these gaps (with respect to the height of the base of the crowns, branch size, and presence of epicormic branching on the exposed lower bole facing into the gaps) suggest the gaps supported red alder during the first 70 to 100 years following stand initiation.

Red cedar and hemlock are more common on the north than on the south aspect. Like on the south aspect, they are typically found in the intermediate crown position, and most often next to gaps between Douglas-fir crowns. Red cedar and hemlock become progressively more common as one comes closer to the riparian zone.

As on the south facing slopes, there is little conifer regeneration in the understory except where there is a disturbance.

Effects of the Combination of Stand Replacement Fires and Reburns

Many large stand replacement events in the assessment area are multiple burns. These include the 45-year 1735 to 1780 episode and the 88-year 1534 to 1622 episode. This reburning pattern affected future stand structures including age and structure of the overstory trees, snag and course woody debris (CWD) amounts, and woody debris in streams.

Where reburns skipped moist areas and/or burned through reproduction in a mosaic pattern, the resulting stands have a wider range of birth dates than would be expected based on regeneration lag alone. This process is most clearly observable in the West Fork Smith River where the 1849, 1885, and 1892 fires all burned the same site.

Spies et. al (199?) found Coast Range stands have lower levels of CWD compared with similar aged forests in the Cascades and attributed that difference to a higher incidence of reburns on the Coast Range.

The timing and amount of large woody debris input to streams depends on the stocking levels, and mortality patterns in the adjacent riparian stands. Streams that pass through young forest contain large woody material from the stand that existed before the last stand replacement fire and small woody debris from the current stand. The relative amount of material from the pre-fire and post-fire stands changes over time. When the pre-fire stand was old-growth, the change is gradual and may take more than a century. Where fire kills all of the old trees next to a stream and reburns consume the woody debris that those trees would have otherwise contributed to the site, the result is a deficiency of CWD and a long lag period before the new trees beside streams can contribute wood to the stream. The resident time of debris recruited from the pre-burn stand depends on the size distribution and species composition of that stand. If the pre-fire stand was young and the stream contains only small diameter material, the debris carried over to the post-fire conditions will decompose faster than old-growth size material. Under these circumstances, total stream debris loading will decline appreciably during stand reestablishment (Swanson & Lienkaemper 1978). Riparian zones impacted by stand replacement fire dating to the 1845-1855 fire episode, the 1868 fire, or the first fires in the 1891-1942 episode, which were subsequently reburned, are the sites most likely to be deficient in CWD.

Frequent reburns resulted in a stand type on some sites that is no longer maintained on today's the landscape. That stand type was called "timber scattering" by the land surveyors that encountered these stands during the last century. Timber scatterings could occur over a significant area on those landscapes frequented by fire, and are documented in the Middle Creek (Chapman, 1875), Tioga Creek (Lackland, 1898), and West Fork Smith River (Chandler, 1901a, 1901b) Subwatersheds. The old trees in the "timber scatterings" were highly resistant to fire because of their thick bark and the distance of their crowns above the fuels on the ground. The surveyors described timber scatterings as having dense brush or young tree regeneration. Superficially, a timber scattering on an aerial photo looks like an East Side open park like stand[4]. However, the dense brush and tree regeneration would have given the Coast Range timber scatterings a fundamentally different character when viewed on the ground[5].

Stand Level Management Implications:

Understory regeneration of shade tolerant trees occurred in pulses following underburns. Ground fires, which would harm few Douglas-fir, easily kill the hemlock and cedar that were on a site before the fire. Consequently, ground fires and prescribed underburns may reduce stand diversity

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4 Timber scatterings were still visible as a distinct type on aerial photos taken over the Tioga Subwatershed in 1943. An oblique view of a timber scattering in the Tioga Subwatershed can be seen in the background of the lower photo of Tioga Camp on page 136 in Swift Flows the River by Dow Beckham published 1990 by Arago Books, Coos Bay OR.

5 Photographs taken from Coos Mountain Lookout in 1936 show the steep south rim of Park Creek Drainage, in the Middle Creek Subwatershed, supporting an open stand (BLM 1995a). That stand has since filled in with a dense conifer understory. Walks through a recently cut unit on that rim suggest that the former open condition allowed large colonies of columbia tiger lily, fawn lily, and iris to establish there. These plants are favored by light or high shade, and well drain soils. The extent of available habitat for these plants has be reduced by the loss of open stands and timber scatterings. On the Umpqua Resource Area - Coos Bay District, the Columbia tiger lily is largely confined to road cut banks. The fawn lily is uncommon, and when it is found it is usually on the edge of rock bands or adjacent to rocky ridges. The iris is more wide spread, but it too is largely confined to exposed ridge top road right-of-ways and to plantations on Oregon grape or salal sites where big game browsing has slowed conifer seedling growth.

in the short-term. These fires would kill hemlock in the overstory creating gaps and kill understory hemlock decreasing species diversity and possibly eliminating the understory. This mortality will result in an increase of snags and CWD. In the long-term, gaps in the canopy will allow for regeneration of shade tolerant trees, shrubs and herbs.

Reforestation using a species mix that is heavy to fire intolerant species will predispose those stands to a correspondingly higher tree mortality in the event there is a low intensity fire or a prescribed underburn in the future. Whether this is a concern depends on the risk of fire and management objectives. On moist sites, like riparian areas and north slopes where fire is infrequent, the inability of a species to tolerate a ground fire may not be an issue. On hot, dry southwest facing sites, where there is a high risk of wild fire, managing for fire tolerant species to the exclusion of fire intolerant species makes both economic and ecological sense.

The fire intolerance of hemlock, and certain other species, should be addressed in cutting prescriptions where the intent is to emulate the effects of fire on a stand. If a density management prescription is to emulate the effects of a low or moderate intensity fire, then most of the hemlock near ridge tops, on south to west aspects, and where plant indicators signal droughty condition, should be marked for removal. This will reduce species diversity on those areas. The percentage of the fire intolerant trees marked for cutting should decrease as the marking crew moves around to the north aspect, moves down hill, and on benches. In the short-term, this will result in lower species diversity on some sites but will increase diversity on the landscape scale.

If a management objective is to increase species and stand structure diversification over the long-run, then treatment prescriptions must address the prerequisites for understory tree establishment, which include temporary reduction of understory brush and herb competition, seed bed creation, and providing sufficient light for the establishment of an understory stand. Regenerating trees in the understory may be accomplished, at the least expense, by selecting units with a dense closed canopy where there is little understory brush. On those sites there is no need to do site preparation to control brush following the treatment to open the overstory.

There are other types of disturbances that can also open the overstory canopy thereby increasing the light levels. These include pockets of blowdown and insect and disease caused mortality. Where there is advance tree regeneration that can respond to the increased light levels, then the openings will be occupied by trees. Not all advance regeneration is vigorous enough to stand the shock of sudden exposure to increased light levels and air movement. Where there is only brush in the opening created by mortality in the overstory, that brush will increase in vigor and mass often excluding new regeneration from seed.

Effects of Topography on Fire Patterns and Implications for Managing on the Landscape Scale

The size and magnitude of destruction of the great Coast Range fires have so captured our attention that we overlook the possibility that patchy light to moderate severity fires may also play a part in shaping stand structure and distribution. The rarity of large catastrophic fire events is pointed out through an analysis by Strauss et. al. (1989) that showed for the Fire Climate

Region 12, coastal Washington and Oregon, 1 percent of the fires resulted in 80 percent of the area burned. In their discussion on the effects of topography on fire patterns, Morrison and Swanson (1990) commented that gentle topography might facilitate extensive stand replacement fires under favorable weather conditions. Whereas, complex topography with many natural fire breaks, like creek bottoms, sharp ridges and associated changes in aspect and variability of plant community affect fuel loads and rate of spread. This complexity will favor patchy fires. The Coast Range is characterized by a complex topography consisting of short slopes, compared to the Cascades. High stream density and resulting multitude of sharp ridges, narrow draws, and many aspect changes over short distances makes the Coast Range landscape rich in natural fire breaks. These natural fire breaks act to steal a wild fire's momentum, rather than containing the fire, resulting in a mosaic of fire intensity, and in turn, a mosaic of stand structures across the landscape. Aerial photos, particular early photos from 1943 to 1952, show the most complex fire patterns occurring on complex broken topography. A particularly good example is the north facing slopes in the Park Creek Drainage. The 1943 aerial photos of that area show very complex fire patterns with sharp contrasts occurring over very short distances. The distances are so short and the areas of uniform fire severity so small that the variations are best viewed as within-stand diversity. The boundaries of these complex burn patterns correspond directly to an equally complex topography. The complex topography allowed trees to survive in small moist sites protected from all but the most intense fires. Those protected pockets are located a few hundred feet away from exposed ridges that burn during most fire events. Unstable north facing headwalls have scattered large open grown overstory trees, which have survived previous fires through a combination of discontinuous fuels, moist soils throughout the year, and a cool humid microclimate. Early twentieth century burns created (or maintained) open ground and young reproduction on ridge tops, and on exposed steep south to west facing aspects. Other stands with trees dating from 1540 to 1622 occupy the east end of the drainage and also protected sites next to the main stem of Park Creek, and north facing lower slopes, and benches.

In contrast, on less complex topography there is a correspondingly less complex fire pattern and the expression of fire severity as a function of aspect and slope position is obvious. The larger areas of uniform fire severity are stands of trees with relatively low in-stand diversity, as determined by uniformity of the canopy texture. Where there are topographic breaks and changes in aspect, there are pronounced boundaries between stands, and thus, diversity is expressed at the larger landscape scale as between-stand diversity.

The complexity of the fire patterns ties directly to the complexity of the topography. If the treatment objective for the Late-Successional Reserve is to reintroduce lost diversity, then prompts can be taken from the topography about whether it is more important to manage for high in-stand diversity over a large area or to manage for low in-stand diversity with the diversity expressed instead at the landscape level between stands.

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Appendix C. Species Associated with Mature or Late Successional Forests and Known or Suspected to Occur in the LSR Planning Area

Class	Common Name	Scientific Name	Comments [1]
Amphibian	Northwestern Salamander	*Abystoma gracile*	Uses underground burrows, rotting logs, moist crevices, lay eggs in slow water. (L)
Amphibian	Clouded Salamander	*Aneides ferreus*	Found under decaying logs and forest litter. Eggs laid in cavities in wood. (L)
Amphibian	Tailed Frog	*Ascaphus truei*	Cold, fast-moving permanent forest streams, hides under rocks. (L)
Amphibian	Pacific Giant Salamander	*Dicamptodon ensatus*	In streams during breeding season, can be found in moist forests. (L)
Amphibian	Dunn's Salamander	*Plethodon dunni*	Lungless, moist, shady, mossy rock areas, seeps, along perennial streams. (L)
Amphibian	Western Redback Salamander	*Plethodon vehiculum*	Under leaf litter, bark and other forest floor debris, talus slopes. (L)
Amphibian	Del Norte Salamander	*Plethodon elongatus*	Lives in moist talus or fractured rock outcrops, or in partially decayed logs. (L)
Amphibian	Southern Torrent Salamander	*Rhyacotriton variegatus*	Always in moist areas near flowing water (46-54 degrees F), mossy gravel.
Amphibian	Rough-skinned Newt	*Taricha granulosa*	Most commonly found in moist forests.
Bird	Northern Goshawk	*Accipiter gentilis*	Primarily forest dwellers, hunt from perch or while flying through forest.
Bird	Wood Duck	*Aix sponsa*	Nests in hollow cavities of large living or dead trees. (S)
Bird	Marbled Murrelet	*Brachyramphus marmoratus*	Prefer large conifer nest tree with large limbs/deformities, feeds in ocean.
Bird	Bufflehead	*Bucephala albeola*	Prefers forested water edges for breeding, nests in cavity in snags. (S)
Bird	Hermit Thrush	*Catharus guttatus*	Dense conifer stands with brushy understory, found in younger stands also.
Bird	Brown Creeper	*Certhia americana*	Cavity nester, feeds on bark insects. (S)
Bird	Vaux's Swift	*Chaetura vauxi*	Cavity nester, needs large snags, forages over open waters and meadows. (S)
Bird	Northern Flicker	*Colaptes auratus*	Cavity nesters, found near large trees in open woodlands, clearings. (L & S)
Bird	Hermit Warbler	*Dendroica occidentalis*	Common in all age conifer stands, prefers stands with large trees.
Bird	Pileated Woodpecker	*Dryocopus pileatus*	Feeds in younger forests also, if large snag component present. (L & S)
Bird	Pacific-slope Flycatcher	*Empidonax difficilis*	Well shaded forests, canyon bottoms w/flowing water, forages in openings.
Bird	Hammond's Flycatcher	*Empidonax hammondii*	Usually drier habitats, stream bottoms with deciduous trees, edges.
Bird	Northern Pygmy Owl	*Glaucidium gnoma*	Cavity nester, prefers edges/ecotones. (S)
Bird	Northern Bald Eagle	*Haliaeetus leucocephalus*	Nest in large conifer trees in close proximity to fish-bearing waterways. (S)
Bird	Harlequin Duck	*Histrionicus histrionicus*	Associated with forested streams, can be seen in estuaries, bays.
Bird	Varied Thrush	*Ixoreus naevius*	Dense, moist coniferous forests
Bird	Hooded Merganser	*Lophodytes cucullatus*	Wooded lakes, ponds, rivers, streams, nests in large tree cavities. (S)
Bird	Red Crossbill	*Loxia curvirostra*	Mature coniferous forests only.
Bird	Common Merganser	*Mergus merganser*	Rarely coastal bays, usually wooded lakes, ponds, rivers, streams, cavity nester. (S)
Bird	Chestnut-backed Chickadee	*Parus rufescens*	Cavity nester in snags, feed along shrubby edges. (S)
Bird	Hairy Woodpecker	*Picoides villosus*	Nest in large live trees in open conifer forests. (L & S)
Bird	Golden-crowned Kinglet	*Regulus satrapa*	Closed canopy stands of conifer to mix conifer/hardwood.
Bird	Red-breasted Nuthatch	*Sitta canadensis*	Coniferous to mixed coniferous forests, eats bark insects and conifer seed. (L & S)

Class	Common Name	Scientific Name	Comments [1]
Bird	White-breasted Nuthatch	*Sitta carolinensis*	Forests, woodlots, groves, shade trees, visits feeders. (S)
Bird	Red-breasted Sapsucker	*Sphyrapicus Tuber*	Feeds on sap from live deciduous trees and insects, nest in cavity. (S)
Bird	Northern Spotted Owl	*Strix occidentalis caurina*	Nests in cavities or sheltered platforms, snags, or broken top trees. (S)
Bird	Barred Owl	*Strix varia*	Increasing their range, prefer much the same habitat as the spotted owl. (S)
Bird	Winter Wren	*Troglodytes troglodytes*	Coniferous forests, shrubby undergrowth, nests in brush piles, logs, cavities. (L)
Mammal	Western Red-backed Vole	*Clethrionomys californicus*	Need rotting/punky logs, little ground vegetation, closed canopy conifer. (L)
Mammal	Big Brown bat	*Eptesicus fuscus*	Roosts in cavities made by other animals, crevices. (S)
Mammal	Townsend Chipmunk	*Eutamias townsendi*	Mostly riparian alder but upland conifer habitat as well. (L)
Mammal	Northern Flying Squirrel	*Glaucomys sabrinus*	Conifer forests, occasionally in riparian hardwoods. (L & S)
Mammal	Silver-haired Bat	*Lasionycteris noctivagans*	Coniferous forests, rest under loose bark and in cavities. (S)
Mammal	Hoary Bat	*Lasiurus cinereus*	Primarily conifer or mixed conifer/deciduous.
Mammal	American Marten	*Martes americana*	Need large amount of standing and down dead woody material near streams. (L & S)
Mammal	Pacific Fisher	*Martes pennanti pacific*	Prefer mostly dense conifer stands with some hardwood, require danse cover. (L & S)
Mammal	California Bat	*Myotis californicus*	Mature conifer to grasslands, riparian areas. (S)
Mammal	Long-eared Bat	*Myotis evotis*	Mature to immature conifer, salal.
Mammal	Little Brown Bat	*Myotis lucifugus*	Appear in all habitat types but affinity for conifer forests.
Mammal	Fringed Myotis	*Myotis thysanodes*	Roosts in caves, buildings, crevices.
Mammal	Long-legged Bat	*Myotis volans*	Mature to immature conifer and sometimes in riparian alder/salmonberry.
Mammal	Yuma Bat	*Myotis yumanensis*	Large streams/rivers, ponds and lakes, feed close to water's surface. (S)
Mammal	Shrew-Mole	*Neurotrichus gibbsi*	Most common in alder/salmonberry but upland forests and meadows also. (L)
Mammal	White-footed Vole	*Phenacomys albipes*	Prefers large amount of dead and down woody material. (L)
Mammal	Red Tree Vole	*Phenacomys longicaudus*	Nocturnal, highly dependent on Douglas-fir but utilize Sitka spruce and hemlock.
Mammal	Marsh Shrew	*Sorex bendirei*	Disperse to uplands in wet winters, skunk cabbage marshes small alder stream. (L)
Mammal	Pacific Shrew	*Sorex pacificus*	Alder/salmonberry, skunk cabbage marsh, less often in Douglas-fir stands. (L)
Mammal	Douglas' Squirrel	*Tamiascirius douglasi*	Conifer, sometimes riparian hardwoods, spruce/salal habitat. (L & S)

[1] L = Dependent on CWD, S = Dependent on snags

Appendix D. Special Status Animal Species Known or Suspected to Occur in the LSRs in the Assessment Study Area.

Animal Group	Scientific Name	Common Name	Status [1]		
			Federal	State	ONHP
Invertebrate	*Deroceras herperium*	evening fieldslug	BS	--	1
Invertebrate	*Vespericola columbiana columbiana*	Columbia hesperian (snail)	BA	--	1
Invertebrate	*Algamorda newcombiana*	Newcomb's periwinkle snail	BS	--	1
Invertebrate	*Monadenia fidelis minor*	Oregon snail	BS	--	1
Invertebrate	*Helminthoglypta hertleini*	Oregon shoulderband	BS	--	1
Invertebrate	*Lanx subrotunda*	rotund lanx	BS	--	1
Invertebrate	*Vespericola sierranus*	Siskiyou hesperian	BA	--	2
Invertebrate	*Prophysaon coeruleum*	blue-gray tail-dropper	BA	--	2
Invertebrate	*Prophysaon dubium*	papillose tail-dropper	BA	--	2
Invertebrate	*Megomphix hemphilli*	Oregon megomphix	BA	--	1
Invertebrate	*Anodonta californiesis*	California floater (mussel)	BS	--	3
Invertebrate	*Ceraclea (Athripsodes) vertreesi*	Vertree's ceraclean caddisfly	BS	--	3
Invertebrate	*Agapetus denningi*	Denning's agapetus caddisfly	BS	--	3
Invertebrate	*Rhyacophila haddocki*	Haddock's rhyacophilan caddisfly	BS	--	3
Invertebrate	*Rhyacophila fenderi*	Fender's rhyacophilan caddisfly	BS	--	4
Invertebrate	*Ochrotrichia veertreesi*	Vertrees’s ochrotrichian micro caddisfly	BS	--	3

Invertebrate	*Ochrotrichia alsea*	Alsea ochrotrichian micro caddisfly	BS	--	3
Invertebrate	*Eobrachycentrus gelidae*	Mt. Hood brachycentrid caddisfly	BS	--	3
Invertebrate	*Bombus franklini*	Franklin's bumblebee	BS	--	1
Invertebrate	*Acneus beeri*	Beer's false water penny beetle	BS	--	4
Invertebrate	*Acneus burnelli*	Burnell's false water penny beetle	BS	--	4
Invertebrate	*Driloleirus macelfreshi*	Oregon giant earthworm	BS	--	1
Invertebrate	*Cicindela hirticollis siuslawensis*	Siuslaw sand tiger beetle	BT	--	3
Invertebrate	*Bembidion tigrinum*	cryptic beach ground beetle	BT	--	3
Invertebrate	*Chloealtis aspasma*	Siskiyou chloealtis grasshopper	BT	--	3
Invertebrate	*Hoplistoscelis heidemanni*	Heidemann's nabid bug	BT	--	3
Invertebrate	*Platylygus pseudotsugae*	Douglas-fir platylygus	BT	--	3
Invertebrate	*Pinalitus solivagus*	true fir pinalitus	BT	--	3
Invertebrate	*Derephysia foliacea*	foliaceous lace bug	BA	--	2
Invertebrate	*Tanypteryx hageni*	montane bog dragonfly	BT	--	4
Invertebrate	*Incisalia polios obscura*	hoary elfin butterfly	BS	--	2
Invertebrate	*Plebejus saepiolus insulanus*	insular blue butterfly	BS	--	1
Fish	*Oncorhynchus clarkii clarkii*	coastal cuthroat trout	E [2]	SC	3
Fish	*Oncorhynchus kisutch*	coho salmon	T [3], BA	SC	1
Fish	*Oncorhynchus mykiss*	steelhead trout	BA	SV	3
Fish	*Oncorhynchus keta*	chum salmon	--	SC	2
Fish	*Oncorhynchus tshawytscha*	chinook salmon	--	SC	3

Fish	*Lampetra tridentata*	Pacific lamprey	BS	SV	3
Fish	*Lampetra ayresi*	river lamprey	BS	--	4
Fish	*Oregonichthys kalawatseti*	Umpqua chub	BS	SV	3
Fish	*Rhinichthys cataractae*	Millicoma dace	BS	SP	3
Amphibian	*Rana boylii*	foothill yellow-legged frog	BS	SV	3
Amphibian	*Rana aurora aurora*	northern red-legged frog	BS	SU	3
Amphibian	*Rana cascadae*	Cascades frog	BS	SV	3
Amphibian	*Ascaphus truei*	tailed frog	BA	SV	3
Amphibian	*Rana pretiosa*	spotted frog	C	SC	1
Amphibian	*Bufo boreas*	western toad	BT	SV	3
Amphibian	*Rhyacotriton variegatus*	southern torrent salamander	BT	SC	3
Amphibian	*Aneides ferreus*	clouded salamander	BT	SU	3
Amphibian	*Batrachoseps attenuatus*	California slender salamander	BA	SP	2
Amphibian	*Plethodon elongatus*	Del Norte salamander	BS	SV	3
Amphibian	*Plethodon stormi*	Siskiyou Mountains salamander	BS	SV	2
Reptile	*Clemmys marmorata marmorata*	northwestern pond turtle	BS	SC	2
Reptile	*Contia tenuis*	sharptail snake	BA	SV	4
Reptile	*Lampropeltis zonata*	California mountain kingsnake	BA	SV	3
Reptile	*Lampropeltis getulus*	common kingsnake	BA	SV	3
Bird	*Casmerodius albus*	great egret	BT	--	3
Bird	*Histrionicus histrionicus*	harlequin duck	BS	SU	2

Bird	*Haliaeetus leucocephalus*	northern bald eagle	T	T	1
Bird	*Accipiter gentilis*	northern goshawk	BS	SC	3
Bird	*Falco columbarius*	merlin	BA	--	2 -ex
Bird	*Falco peregrinus anatum*	American peregrine falcon	E	E	1
Bird	*Brachyramphus marmoratus marmoratus*	marbled murrelet	T	T	1
Bird	*Glaucidium gnoma*	northern pygmy owl	BT	SU	4
Bird	*Strix nebulosa*	great gray owl	BA	SV	4
Bird	*Otus flammeolus*	flammulated owl	BA	SC	4
Bird	*Strix occidentalis caurina*	northern spotted owl	T	T	1
Bird	*Aegolius acadicus*	northern saw-whet owl	BA	--	--
Bird	*Selasphorus sasin*	Allen's hummingbird	BT	--	4
Bird	*Melanerpes lewis*	Lewis' woodpecker	BA	SC	3
Bird	*Melanerpes formicivorus*	acorn woodpecker	BT	--	3
Bird	*Picoides arcticus*	black-backed woodpecker	BA	SC	4
Bird	*Dryocopus pileatus*	pileated woodpecker	BA	SV	4
Bird	*Sayornis nigricans*	black phoebe	BT	--	4
Bird	*Progne subis*	purple martin	BA	SC	3
Bird	*Sturnella neglecta*	western meadowlark	BA	--	--
Bird	*Pooecetes gramineus*	vesper sparrow	BT	SC	3
Bird	*Riparia riparia*	bank swallow	BT	SU	4
Bird	*Sialia mexicana*	western bluebird	BA	SV	4

Bird	*Lanius ludovicianus*	loggerhead shrike	BT	SU	4
Mammal	*Corynorhinus townsendii townsendii*	Pacific western big-eared bat	BS	SC	2
Mammal	*Myotis thysanodes*	fringed myotis	BS	SV	3
Mammal	*Myotis evotis*	long-eared bat	BT	SU	3
Mammal	*Myotis volans*	long-legged bat	BT	SU	3
Mammal	*Myotis yumanensis*	Yuma bat	BT	SU	3
Mammal	*Antrozous pallidus*	Pacific pallid bat	BA	SC	3
Mammal	*Lasionycteris noctivagans*	silver-haired bat	BT	SU	3
Mammal	*Arborimus albipes*	white-footed vole	BS	SU	3
Mammal	*Thomomys mazama helleri*	Gold Beach Western pocket gopher	BS	--	--
Mammal	*Thomomys bottae detumidus*	Pistol River pocket gopher	BS	--	--
Mammal	*Sciurus griseus*	western gray squirrel	BT	SU	3
Mammal	*Bassariscus astutus*	ringtail	BT	SU	3
Mammal	*Martes pennanti pacifica*	Pacific fisher	BS	SC	2
Mammal	*Martes americana*	American marten	BA	SV	3

[1] Abbreviations used in this table:

Federal Categories:
E = Endangered
T = Threatened
C = Candidate
P = Proposed

BLM Categories:
BS = Bureau Sensitive species
BA = Bureau Assessment species
BT = Bureau Tracking species

Bureau Sensitive Species - In Oregon, these are taxa which are eligible for federal listed, federal candidate, or state listed status. These taxa are from the Oregon Sensitive Species-Critical list and/or

Oregon Natural Heritage Program (ONHP) List 1.

Bureau Assessment Species - Species not included as FT, FE, FP, FC, State Listed or BS which are on the ONHP List 2 or species not eligible for BS status but that are on ONHP List 1.

Bureau Tracking Species - Taxa not included as FT, FE, FP, FC, State Listed, BS or BA which are State Sensitive (Vulnerable, Peripheral or Naturally Rare, or Status Undetermined) or on ONHP List 3 or 4.

The Oregon Natural Heritage Program maintains five lists of special status species:

List 1 contains taxa that are threatened with extinction or presumed to be extinct throughout their entire range.

List 2 contains taxa that are threatened with extirpation or presumed to be extirpated from the state of Oregon. These are often peripheral or disjunct species which are of concern when considering the floral and faunal diversity within Oregon's borders.

List 3 contains species for which more information is needed before status can be determined, but which may be threatened or endangered in Oregon or throughout their range.

List 4 contains taxa which are of concern, but are not currently threatened or endangered. This includes taxa which are very rare but are currently secure, as well as taxa which are declining in numbers or habitat but are still too common to be proposed as threatened or endangered.

The fifth category, Taxa Considered but Rejected, contains all taxa deleted from any of the above lists or nominated to these lists but rejected. (ONHP 1993)

State Categories:

E = Endangered
T = Threatened
SC = Sensitive- Critical
SV = Sensitive- Vulnerable
SP = Sensitive- Peripheral or Naturally Rare
SU = Sensitive- Undetermined Status

State Sensitive-Critical (SC) - Species for which listing as threatened or endangered is pending; or those for which listing as threatened or endangered may be appropriate if immediate conservation actions are not taken. Also considered critical are some peripheral species which are at risk throughout their range, and some disjunct populations.

State Sensitive Vulnerable (SV) - Species for which listing as threatened or endangered is not believed to be imminent and can be avoided through continued or expanded use of adequate protective measures and monitoring. In some cases the population is sustainable, and protective measures are being implemented; in others, the populations may be declining and improved protective measures are needed to maintain sustainable populations over time.

State Sensitive Peripheral or Naturally Rare (SP) - Peripheral species refer to Oregon populations on the edge of their range. Naturally rare species had low population numbers historically in Oregon because of naturally limiting factors. Maintaining the status quo for the habitats and populations of these species is a minimum requirement. Disjunct populations of several species which occur in Oregon should not be confused with peripheral.

State Sensitive Undetermined Status (SU) - Animals in this category are species for which status is unclear. They may be susceptible to population decline of sufficient magnitude that they could qualify for endangered, threatened, critical or vulnerable status, but scientific study will be required before a judgement can be made.

[2] Umpqua Basin Cutthroat ESU only
[3] Southern Oregon Coho Salmon ESU only

Appendix E. Table 1. Plant and Fungal Species Strongly Associated with Mature, Late-Successional, and Old-Growth Forests.

Form	Species Group/habitat [1]	Number of Species
Fungus	Boletes	16
Fungus	Boletes, Low Elevation	2
Fungus	Rare Boletes/False Truffles	3
Fungus	False Truffles	37
Fungus	Undescribed Taxa, Rare	29
Fungus	Truffles	11
Fungus	Chanterelles	5
Fungus	Chanterelles-Gomphus	4
Fungus	Coral Fungi	50+
Fungus	Phaeocollybia	13
Fungus	Gilled Mushrooms - Mycorrhizal	170
Fungus	Ecto-polypores	6
Fungus	Tooth Fungi	5
Fungus	Ecto-Resupinate Fungi	3+
Fungus	Ecto-puffballs	2
Fungus	Rare Zygomycetes	3
Fungus	Polypores	11
Fungus	Resupinate Fungi	14
Fungus	Rare Resupinates & Polypores	6
Fungus	Cup Fungi	29
Fungus	Branched Coral Fungi	3
Fungus	Gilled Mushrooms - Mycorrhizal	80
Fungus	Parasitic Fungi	9
Fungus	Cauliflower Mushroom	1
Fungus	Moss Dwelling Mushrooms	7

Form	Species Group/habitat [1]	Number of Species
Fungus	Club Coral Fungi	2+
Fungus	Jelly Mushroom	1
Fungus	Mushroom Lichen	1
Lichen	Rare Forage, Arboreal	1
Lichen	Forage	10
Lichen	Rare Leafy, Arboreal	2
Lichen	Arboreal, Leafy	17
Lichen	Nitrogen Fixing	26
Lichen	Decaying Wood	8
Lichen	Tree Boles	14
Lichen	Pin	16
Lichen	Soil Occurring	8
Lichen	Rare Rock	2
Lichen	Riparian	9
Lichen	Aquatic	3
Lichen	Oceanic Influenced	16
Bryophyte	Canopy Exterior	2
Bryophyte	Canopy Interior	2
Bryophyte	Tree Boles/Decaying Wood	29
Bryophyte	Shaded Mineral Soil	5
Bryophyte	Shaded Rock with Thin Soil	7
Bryophyte	Wet Shaded Humic Soil	5
Bryophyte	Shaded Duff/Humic Soil	3
Bryophyte	Aquatic (submerged)	3
Bryophyte	Splash Zone	5
Bryophyte	Flood Plain	13
Bryophyte	Species Rated Individually	3
Bryophyte	Rare Species	8

Form	Species Group/habitat [1]	Number of Species
Bryophyte	Species Not Rated	16
Vascular Plant	Ferns and Fern Allies	3
Vascular Plant	Herbaceous (non-woody)	46
Vascular Plant	Woody Trees and Shrubs	7
Vascular Plant	Mycotrophic, non-green plants	13

[1] For a detailed list of species, See FEMAT Appendix Tables IV-A-1, 2, 3, 4. This Table is based on limited distribution and habitat information therefore many of these species may not occur within these LSRs.

Appendix E Table 2. Survey and Manage and Protection Buffer Plant Species Present in the LSRs.

Form	Scientific Name	S&M Strategy [1]	Protection Buffer
Fungi	*Cantherellus cibarius*	3,4	no
Fungi	*Gomphus floccosus*	3	no
Fungi	*Hydnum repandum*	3	no
Fungi	*Endogone oregonensis*	1,3	no
Fungi	*Sarcosoma mexicana*	3	yes
Fungi	*Sarcosphaera eximia*	3	no
Fungi	*Helvella compressa*	1, 3	no
Fungi	*Sparassis crispa*	3	no
Lichen	*Lobaria oregana*	4	no
Lichen	*Lobaria pulmonaria*	4	no
Lichen	*Lobaria scrobiculata*	4	no
Lichen	*Nephroma bellum*	4	no
Lichen	*Nephroma helveticum*	4	no
Lichen	*Nephroma laevigatum*	4	no
Lichen	*Nephroma resupinatum*	4	no
Lichen	*Peltigera collina*	4	no
Lichen	*Pseudocyphellaria anomala*	4	no
Lichen	*Pseudocyphellaria anthrapsis*	4	no
Lichen	*Pseudocyphellaria crocata*	4	no
Lichen	*Sticta limbata*	4	no
Lichen	*Calicium sp.*	4	no
Lichen	*Chaenotheca sp.*	4	no
Lichen	*Usnea longissima*	4	no
Lichen	*Cetraria californica*	1, 3	no
Moss	*Antitrichia curtipendula*	4	no

[1] Survey Strategies:
1 = Manage known sites.
2 = Survey prior to activities and manage sites.
3 = Conduct extensive surveys and manage sites.
4 = Conduct general regional surveys.

Appendix E Table 3. Vascular Plant Species of Concern (Including Federally Listed Species, BLM Special Status and Forest Service Sensitive Species) Known or Suspected to Occur in the LSRs (ONHP 1995).

Scientific Name (LSR)	Common Name	ONHP List [1]	Habitat Description
Adiantum jordanii (260)	Jordan's maidenhair fern	3	moist woods and shaded banks
Allium bolanderi (255, 259)	Bolander's onion	3	open serpentine forests and meadows
Arctostaphylos hispidula (255)	Howell's manzanita	2	openings in forests, pine/oak communities
Astragalus umbraticus (259)	woodland milkvetch	4	dry, open woodlands
Bensoniella oregana (259)	Oregon bensoniella	1	margins of forest meadows
Carex gigas (255)	Siskiyou sedge	2	open Jeffrey pine forests, above 2,000 feet
Carex gymnodynama (255)	sedge	3	open seasonally wet meadows
Cimicifuga elata (261)	tall bugbane	1	lowland PSME forests
Cypripedium fasciculatum (261)	clustered lady's-slipper	1	fairly moist, shaded, old PSME forests
Cypripedium californicum (255)	California lady's-slipper	4	serpentine wetlands
Darlingtonia californica (255)	California pitcher-plant	4	serpentine wetlands
Dichelostemma ida-maia (259)	firecracker flower	4	open woods, forest edges
Ericameria arborescens (251)	golden fleece	2	open chaparral
Erythronium revolutum (251)	pink fawn-lily	4	streambanks, margins of wet areas
Gentiana setigera (255)	Waldo gentian	1	serpentine wetlands
Hieracium bolanderi (255)	Bolander's hawkweed	2	open serpentine meadows and forests
Iliamna latibracteata (257)	California globe mallow	2	streambanks, moist ground

Scientific Name (LSR)	Common Name	ONHP List [1]	Habitat Description
Lewisia cotyledon var. *howellii* (259)	Howell’s lewisia	4	rocky outcrops
Mimulus douglasii (259)	Douglas’ monkeyflower	4	rocky areas with thin soils
Monardella purpurea (255)	Siskiyou monardella	2	rocky outcrops
Pellaea andromedifolia (261)	coffee-fern	2	crevices in rocky outcrops
Phacelia verna (259)	spring phacelia	4	mossy covered rock outcrops
Poa piperi (255)	Piper’s bluegrass	2	open Jeffrey pine forests and meadows
Polystichum californicum (259)	California sword fern	2	open rocky areas, outcrops
Romanzoffia thompsonii (259)	Thompson’s mist-maiden	1	mossy banks on open slopes
Rosa spithamea (259)	ground rose	4	open forest, chaparral, especially after fire
Salix delnortensis (255)	Del Norte willow	2	streamsides, serpentine
Sidalcea malvaeflora ssp. *patula* (255)	coast checker mallow	1	dry forests
Trillium angustipetalum (255)	Siskiyou trillium	2	moist forests

[1] Oregon Natural Heritage Program List Definitions
List 1 Species which are threatened or endangered throughout their range
List 2 Species which are threatened or endangered in Oregon, but more common elsewhere
List 3 Species which more information is needed before status can be determined
List 4 Species which are currently not threatened or endangered but are of management concern

Appendix F. Fire Management Plan

Risk From Ignition Sources

The LSRs on the westside of the coast range have had an average fire occurrence of 2.5 fires per year burning 22.08 acres per year since 1980. The average annual number of fires on the east side of the coast range (LSRs 264, 263 and 259) is higher, at 15.7 fires per year and 72.3 acres burned. These fires were generally associated with logging, equipment use, and other human uses of the forests. Lightning caused fires are minimal. The Oxbow Fire at 42,000 acres in 1966 was the largest recent fire within and adjacent to Blocks 265 and 266.

The previous data do not include escaped prescribed burns which add an average of 4.9 fires and 49 acres per year. Escaped prescribed burns resulted from the burning of logging slash. Logging slash was burned throughout the spring, summer, and fall months in an effort to get the work done and to avoid dispersing smoke into the smoke sensitive areas of the State. Site preparation and hazard reduction were the primary objectives of this burning, and overall, it was a highly successful effort.

Management Strategies

Clearcutting and broadcast burning are not planned as management strategies for the future on federal lands within the LSRs, therefore, this source of ignition will be not be discussed further. Prescribed fire will continue to be used to reduce fire hazard from excess fuels resulting from density management operations, logging, windthrow, and natural accumulations. Prescribed fire will also be a means of achieving the desired stand structure and species mix in the target stands within the LSRs.

The Role of Prescribed Fire

Prescribed burning will be done under the canopy in most situations. This will necessitate a slower operation than previous broadcast burning of clearcut units, where smoke and heat vent into the upper atmosphere over a short period of time. The smoke from under-burning will not rise in a plume form, and will linger longer, before the burn is completed. Smoke will generally not reach the higher levels in the atmosphere which allow better dispersion. The volume of fuels to be burned and the resulting smoke under LSR objectives will be less than has taken place in the past with clearcutting and broadcast burning.

The use of prescribed fire within the LSRs will necessitate being a responsible neighbor, and forming cooperative agreements where possible, in the use and control of fire to accomplish projects near the boundaries. Consideration must be given to our neighbors land management goals where they are different than ours.

Wildfire Strategies

The first guiding principle of all fire management activities is to provide for firefighter and public safety. With the proximity of BLM and Forest Service lands in the study area to private and state lands, it is necessary to exercise a full suppression policy. Full suppression means to take immediate and aggressive action on all fires, other than those intentionally ignited for the purpose of accomplishing a resource objective within the LSR. Aggressive action allow for the protection of resources, and is not the suppression of fire with a disregard for the resources. Fire suppression on BLM lands has been performed by the Oregon Department of Forestry through an agreement or formal contract since the beginning of BLM management in western Oregon. The Oregon Department of Forestry performs full suppression on BLM as well as private lands. The Forest Service performs suppression on their own lands and has “closest forces” agreements with the Oregon Department of Forestry.

Fires escaping initial attack will be assigned a Resource Advisor to work with the Incident Management Team until control is achieved, and through the rehabilitation phase when applicable. The Resource Advisor will serve as the authority on all resource matters pertinent to the LSR, work with the Incident Management Team, have responsibility equal to other team members of the fire suppression organization, and report progress to the responsible line officer.

The Resource Advisor will be part of the team assembled by the line officer for development of the Escaped Fire Situation Analysis as described in Forest Service Manual 1532 and BLM Manual 9210.

Direction for fire suppression is found in Forest Service Manual 5100 Chapter 5130, Siuslaw N. F. Fire Management Action Plan, BLM Manual 9214, and the BLM RMPs.

Fire Suppression Considerations

1. Avoid the use of mechanized equipment in stream channels.

2. Avoid the application of retardants in riparian areas.

3. Waterbar firelines and catroads upon completion of the incident.

4. Develop a rehabilitation plan through the IDT process.

Prescribed Natural Fire

Prescribed Natural Fire is not considered to be a fire management option within the LSRA for the following reasons:

1 There are few lightning fires in this part of the State, therefore, it would take a long time to

accomplish any substantial amount of burning by relying upon natural ignitions.

2. The BLM lands in particular have a lot of neighboring land on their perimeter and therefore have greater potential to damage a neighbors property.

3. It is more practical and cost effective to use prescribed management ignited fire to accomplish LSR objectives.

Short-Term Risks

Density management and silvicultural treatments will create slash and coarse woody debris (CWD) that will pose a threat to the stands from fire. The fine fuels from these operations pose the most immediate threat to the residual stands from ignition sources and contribute to the rate of spread. The heavier fuels contribute to the resistance to control a fire once ignited. The finer fuels deteriorate quicker than the heavier fuels, but still pose a threat to the stands for a period of years before becoming benign.

Most fires in the LSRs occur near campgrounds, roads and other access points to the public. The younger stands in the LSRs are the most vulnerable to damage or destruction from fire due to thin bark and crowns nearer the ground and closer to under canopy fuels. Fuels along roads and in strategic positions, such as along ridges that would be used as fire control lines, need to be treated to reduce the rate of spread and resistance to control.

Risk Reduction Treatments

The following treatments would most likely provide the results needed to abate the risk of fire:

1. Hand Piling and covering debris for burning during the rainy season.

2. Chipping debris along roads, control lines, and private property lines.

3. Yarding tops and cull material not needed to meet CWD standards back into the treated area or off-site.

4. Underburning in stands having more mature trees with heavier bark.

Long-term Risks

The greatest risk to the stands (especially young stands) is the threat from wildfire during the hot, dry, summer months. Fires during drought periods occurring in young stands that have the base of crowns close to the fuel bed are at risk from crown fire. Drought conditions at this time of year also produces a lower foliar moisture content, which is one of the criteria for an independent crown fire. Crown fires in young stands are especially damaging, and often lethal, to all trees in the fire area. Controlling the fuel bed with proper fuel treatment of natural stands and after forest management activities is the key to managing the survivability of the LSRs from fire. Heavy ground fuels are also a threat to the survivability of a stand. CWD should be distributed throughout the area to avoid creating "jackpots", which would produce areas of intense heat, thereby producing lethal temperatures to the stand.

Appendix G. Letters of Exemptions From REO

April 20, 1995 Criteria to Exempt Specific Silvicultural Activities in LSRs and MLSAs from REO Review

YOUNG-STAND THINNING
RELEASE
REFORESTATION AND REVEGETATION, including incidental site preparation, release for survival, and animal damage control

July 9, 1996 Criteria to Exempt Specific Silvicultural Activities in LSRs and MLSAs from REO Review

Criteria Exempting Certain COMMERCIAL THINNING ACTIVITIES From REO Review

September 30, 1996 Amendment to "Criteria to Exempt Specific Silvicultural Activities in Late-Successional Reserves and Managed Late-Successional Areas from Regional Ecosystem Office Review" of July 9, 1996

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
Oregon State Office
P.O. Box 2965
Portland, Oregon 97208

In Reply Refer to:
1730-PFP (931)

April 27, 1995

Information Bulletin No. OR-95-285

To: District Managers: Coos Bay, Eugene, Lakeview, Medford, Roseburg, and Salem

From: State Director, Oregon/Washington

Subject: Exempting from Regional Ecosystem Office Review Specific Silvicultural Activities in Late-Successional Reserves and Managed Late-Successional Areas

Attached is a Regional Ecosystem Office (REO) memorandum exempting specific silvicultural activities within Late-Successional Reserves (LSRs) and Managed Late-Successional Areas from REO review. The Northwest Forest Plan Record of Decision (ROD) authorized the REO to develop criteria for exempting some activities from review.

Reforestation activities such as tree planting, maintenance, release, and young stand thinning (PCT) meeting the memo criteria, and previously reviewed, are now exempted from REO review. The administrative record for projects submitted to the REO for review indicates that the reviewed projects were routinely meeting the criteria protecting and enhancing late-successional/old-growth habitat and related species.

Silvicultural activities must still comply with the Standards and Guidelines in the ROD, and the exemption applies only to the REO review requirements found on pages C-12 and C-26. The reforestation prescriptions will continue to be modified as needed to meet the objectives of the LSRs. Silvicultural activities that do not meet the exemption criteria continue to be subject to REO review.

Your plan conformance determination should continue to include types of information such as record of consultation with the Fish & Wildlife Service and/or National Marine Fisheries Service, watershed analysis, initial LSR assessments, and appropriate NEPA compliance.

/s/ William L. Bradley

1 Attachment
1 - REO memo to Regional Interagency Exec. Comm.
dated 04/20/95

Distribution
WO-330 (Room 204 LS) - 1
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REGIONAL ECOSYSTEM OFFICE

P.O. Box 3623
Portland, Oregon 97208
(503) 326-6265
FAX: (503) 326-6282

MEMORANDUM

DATE: April 20, 1995

To: Regional Interagency Executive Committee
(See Distribution List)

FROM: Donald R. Knowles, Executive Director

SUBJECT: Criteria to Exempt Specific Silvicultural Activities in LSRs and MLSAs from REO Review

Pages C-12 and C-26 of the Record of Decision (ROD) for the Northwest Forest Plan state that "[t]he Regional Ecosystem Office may develop criteria that would exempt some activities from review." Enclosed are criteria that exempt certain young-stand thinning, release, and reforestation projects that are proposed in Late-Successional Reserves (LSRs) and Managed Late-Successional Areas (MLSAs) from review by the Regional Ecosystem Office (REO). These criteria were developed by an interagency work group and the REO based on the review of silvicultural projects, field visits, and discussions with agencies and technical specialists. The REO may expand the review exemption criteria as experience with additional forest management activities is gained. Please distribute the attached REO review exemption criteria to the field.

It is important to note that these criteria do not affect the kind of activities the ROD permits within LSRs and MLSAs. The criteria apply only to the requirement for REO review of silvicultural activities in LSRs and MLSAs and only to a specific subset of silvicultural treatments. It should also be noted that compliance with the ROD's standards and guidelines and other statutory and regulatory requirements is not affected by these exemption criteria. For example, requirements to do watershed analyses and Endangered Species Act consultation are not affected by the REO review exemption criteria.

Enclosure
cc:

IAC Members (See Distribution List)
362/ly

DISTRIBUTION LIST   Date: April 20, 1995

Subject: Criteria to Exempt Specific Silvicultural Activities in LSRs and MLSAs from REO Review

TO: **REGIONAL INTERAGENCY EXECUTIVE COMMITTEE**

Anita Frankel, Director, Forest and Salmon Group, Environmental Protection Agency
John Lowe, Regional Forester, USDA Forest Service, R-6
Stan Speaks, Area Director, Bureau of Indian Affairs
Michael Spear, Regional Director, U.S. Fish & Wildlife Service
William Stelle, Jr., Regional Director, National Marine Fisheries Service
William Walters, Acting Regional Director, National Park Service
Elaine Zielinski, State Director, Bureau of Land Management, OR/WA

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California
Francie Sullivan, Shasta County Supervisor
Terry Gorton, Assistant Secretary, Forestry and Rural Economic Dev., California Resource Agency

Oregon
Rocky McVay, Curry County Commissioner
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Washington
Harvey Wolden, Skagit County Commissioner
Amy F. Bell, Deputy Supervisor for Community Relations, WA Dept. of Natural Resources
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Federal Agencies
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Bob Graham, State Conservationist, Natural Resources Conservation Service (Alternate)
G. Lynn Sprague, Regional Forester, USDA Forest Service, R-5 (Alternate)
Thomas Murphy, Director, Environmental Research Laboratory, Environmental Protection Agency
Charles Philpot, Station Director, Forest Service, PNW
Tom Tuchmann, Director, Office of Forestry and Economic Development (Ex Officio)
Ed Hastey, State Director, Bureau of Land Management, CA (Alternate)

REO REVIEW EXEMPTION CRITERIA

BACKGROUND

Standards and Guidelines (S&Gs) in the "*Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl,* (referred to as the ROD) provide that silvicultural activities within Late-Successional Reserves (LSRs) and Managed Late-Successional Areas (MLSAS) are subject to review by the Regional Ecosystem Office (REO). The S&Gs also state that "REO may develop criteria that would exempt some activities [within LSRs and MLSAS] from review."

Based upon proposals submitted to REO for review, field visits, discussions with the agencies and technical specialists, and our understanding of LSR objectives, REO is hereby exempting the following types of activities from the REO review requirement stated on pages C-12 and C-26 of the ROD. Silvicultural projects meeting the following criteria arc exempted from REO review because such projects have a high likelihood of benefitting late-successional forest characteristics.

Activities must still comply with all S&Gs in the *ROD* (e.g., initial LSR assessments, watershed analysis, riparian reserves) and with other statutory and regulatory requirements (e.g., National Forest Management Act, Federal Land Management Policy Act, National Environmental Policy Act, Endangered Species Act, Clean Water Act). This exemption applies only to the REO review requirement found on pages C-12 and C-26 in the ROD. Silvicultural activities described in the S&Gs that do not meet the criteria listed below continue to be subject to REO review at this time.

Silvicultural treatments in LSRs and MLSAs are exempted from REO review (ROD, pages C-12 and C-26), where the agency proposing the treatments finds that the following criteria are met:

1. YOUNG-STAND THINNING, commonly referred to as TSI or precommercial thinning, where:

a. Young stands, or the young-stand component (understory) of two-storied stands, is overstocked. Overstocked means that reaching the management objective of late-successional conditions will be significantly delayed, or desirable components of the stand may be eliminated, because of stocking levels. The prescription should be supported by empirical information or modeling (for similar, but not necessarily these specific, sites) indicating the development of late-successional conditions will be accelerated or enhanced.

b. Cut trees are less than 8" dbh, and any sale is incidental to the primary objective.

c. Tracked, tired, or similar ground-based skidders or harvesters are not used.

d. Treatments promote a natural species diversity appropriate to meet late-successional objectives; including hardwoods, shrubs, forbs, etc..

e. Treatments include substantially varied spacing in order to provide for some very large trees as quickly as possible, maintain areas of heavy canopy closure and decadence, and encourage the growth of a variety of species appropriate to the site and the late-successional objective.

f. Treatments minimize, to the extent practicable, the need for future entries.

g. Cutting is by hand tools, including chain saws.

2. RELEASE, also commonly referred to as TSI, where:

a. There is undesirable vegetation (competition) which delays attainment of the management objective of late-successional conditions, or desirable components of the stand may be eliminated, because of such competition. The prescription should be supported by empirical information or modeling (for similar, but not necessarily these specific, sites) indicating the development of late-successional conditions will be accelerated or enhanced.

b. Cut material is less than 8" dbh, and any sale is incidental to the primary objective.

c. Tracked, tired, or similar ground-based skidders or harvesters are not used.

d. Treatments promote a natural species diversity appropriate to meet late-successional objectives, including hardwoods, shrubs, forbs, etc.

c. Cutting is by hand tools, including chain saws.

3. **REFORESTATION AND REVEGETATION**, including incidental site preparation, release for survival, and animal damage control, where:

a. No site preparation is required other than hand scalping.

b. Reforestation is necessary to quickly reach late-successional conditions, protect site quality, or achieve other ROD objectives.

c. Treatments promote a natural species diversity appropriate to meet late-successional objectives, including hardwoods, shrubs, forbs, etc.

d. Treatments, either through spacing, planting area designation, or expected survival or growth patterns, result in substantially varied spacing in order to provide for some very large trees as quickly as possible, create areas of heavy canopy closure and decadence, and encourage the growth of a variety of species appropriate to the site and the late-successional objective.

c. Treatments minimize, to the extent practicable, the need for future entries.

REGIONAL ECOSYSTEM OFFICE

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P.O. Box 3623
Portland, Oregon 97208-3623
Phone: 503-326-6265 FAX: 503-326-6282

MEMORANDUM

DATE: July 9, 1996

TO: **Regional Interagency Executive Committee** (RIEC)
Ken Feigner, Director, Forest & Salmon Group, Environmental Protection Agency
Robert W. Williams, Regional Forester, R-6, Forest Service
Stan M. Speaks, Area Director, Bureau of Indian Affairs
Michael J. Spear, Regional Director, U.S. Fish & Wildlife Service
William Stelle, Jr., Regional Director, National Marine Fisheries Service
William C. Walters, Deputy Field Director, National Park Service
Elaine Y. Zielinski, State Director, Oregon/Washington, Bureau of Land Management

FROM: Donald R. Knowles, Executive Director

SUBJECT: Criteria to Exempt Specific Silvicultural Activities in Late-Successional Reserves and Managed Late-Successional Areas from Regional Ecosystem Office Review

Enclosed are criteria that exempt certain commercial thinning projects in Late-Successional Reserves (LSRs) and Managed Late-Successional Areas (MLSAs) from review by the Regional Ecosystem Office (REO), pursuant to pages C-12 and C-26 of the Northwest Forest Plan (NFP) *Record of Decision* (*ROD*). These criteria were developed by an interagency work group and the REO based on review of silvicultural projects, field visits, and comments from agencies, researchers, and technical specialists.

We believe we are ready for these exemptions. Several versions of these criteria have been distributed to your agencies and others for review over the last several months. The comments received have been used to help clarify and focus the criteria. Use of the criteria will expedite implementation of beneficial silvicultural treatments in LSRs and MLSAs. We suggest that you transmit them to your field units at your earliest convenience.

It is important to note that these criteria do not affect the kind of activities the *ROD* permits within LSRs and MLSAs. The criteria simply exempt a specific subset of silvicultural treatments from the requirement for project level REO review of silvicultural activities within LSRs and MLSAs. Please also note that compliance with the *ROD's* standards and guidelines and other statutory and regulatory requirements is not affected by these exemption criteria. For example, requirements to do watershed analyses and Endangered Species Act consultation are not affected by the REO review exemption criteria.

We expect implementation monitoring procedures of the Northwest Forest Plan to select enough silvicultural projects within LSRs and MLSAs, both exempted and reviewed, to determine if actual projects meet standards and appropriate criteria. Obviously, if any of you have questions or comments about the attached, please call me directly at 503-326-6266, Dave Powers at 503-326-6271, or Gary S. Sims at 503-326-6274.

cc: IAC, RMC, LSR Workgroup
Enclosure
694/ly

Criteria Exempting
Certain Commercial Thinning Activities
From REO Review

Background

Standards and Guidelines (S&Gs) in the *Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl* (*ROD*) provide that silvicultural activities within Late-Successional Reserves (LSRs) and Managed Late-Successional Areas (MLSAs) are subject to review by the Regional Ecosystem Office (REO). The S&Gs also state that the REO may develop criteria that would exempt some activities (within LSRs and MLSAs) from review.

Based upon project proposals submitted to the REO for review, field visits, discussions with the agencies, researchers, and technical specialists, and our understanding of LSR objectives, the REO is hereby exempting certain commercial thinning activities (sometimes referred to as density management activities) from the REO review requirement (*ROD*, pages C-12 and C-26). Silvicultural projects meeting the criteria below are exempted from REO review because such projects have a high likelihood of benefiting late-successional forest conditions. Many of the commercial thinning proposals reviewed thus far by the REO have met these criteria.

In some cases the criteria refer to the "prescription." All silvicultural treatments within LSRs will be conducted according to a silvicultural prescription fully meeting agency standards for such documents. A description of the desired future condition (DFC), and how the proposed treatment is needed to achieve the DFC, are key elements in this prescription. The description of desired future condition should typically include desired tree species, canopy layers, overstory tree size (e.g., diameter breast height), and structural components such as the range of coarse woody debris (CWD) and snags.

Some elements of these exemption criteria may seem prescriptive, and reviewers suggested several changes to accommodate specific forest priorities. While such suggestions may have been within the scope of the S&Gs, there are several reasons they are not included here:

- These criteria are based on numerous submittals already reviewed by the REO and found to be consistent with the S&Gs. Other treatments, such as thinning with fire, may be equally appropriate. The REO simply has not had sufficient experience with such prescriptions within LSRs to write appropriate exemption criteria at this time. Agencies are encouraged to develop and submit such prescriptions for review. The REO will consider supplementing or modifying these criteria over time.

- These criteria apply range wide. It may be more appropriate to seek exemption at the time of LSR assessment review where specific vegetation types, provincial issues, or objectives do not fit within these criteria or where silvicultural prescriptions are needed other than as described below.

- These exemption criteria are not standards and guidelines, and projects meeting LSR objectives but not fitting these criteria should continue to be forwarded to the REO for review.

Four other key points about thinning are important to consider when developing thinning prescriptions:

1. We urge caution in the use of silvicultural treatments within LSRs. Silvicultural treatments within old habitat conservation areas (HCAs) and designated conservation areas (DCAs) were extremely limited, and many of the participants in the Forest Ecosystem Management Assessment Team/Supplemental Environmental Impact Statement (FEMAT/SEIS) process advanced good reasons for continuing such restrictions. Only high eastside risks and a case made that late-successional conditions could clearly be advanced by treatments in certain stand conditions led decision makers toward the current S&Gs. Note that the "examples" for the westside (S&Gs, page C-12) are for "even-age stands" and "young single-species stands." Agencies must recognize when younger stands are developing adequately and are beginning to become valuable to late-successional species. Such stands should be left untreated unless they are at substantial risk to large-scale disturbance.

2. Thinning can easily remove structural components or impede natural processes such as decay, disease, or windthrow, reducing the stand's value to late-successional forest-related species. Thinning prescriptions that say "leave the best, healthiest trees" could eliminate structural components important to LSR objectives.

3. While "historic" stand conditions may be an indicator of a sustainable forest, they are not the de facto objectives. The S&Gs require an emphasis toward late-successional conditions **to the extent sustainable.**

4. Treatments need to take advantage of opportunities to improve habitat conditions beyond "natural conditions." For example, exceeding "natural levels" of CWD within a 35-year-old stand can substantially improve the utility of these stands for late-successional forest-related species. Treatments must take advantage of opportunities to optimize habitat for late-successional forest-related species in the short term.

Relation to S&Gs and Other Exemption Criteria

Exempted thinnings must still comply with all pertinent S&Gs in the *ROD* (e.g., initial LSR assessments, watershed analyses, riparian reserves) and with other statutory and regulatory requirements (e.g., National Forest Management Act, Federal Land Management Policy Act, National Environmental Policy Act, Endangered Species Act, Clean Water Act). Interagency cooperation, monitoring, and adaptive management are key components of the *ROD* and were key assumptions underlying the development of these criteria. Additionally, field units are strongly encouraged to engage in intergovernmental consultation when developing projects. This exemption applies only to the REO review requirement (*ROD*, pages C-12 and C-26). Many treatments not meeting these exemption criteria may be appropriate within LSRs and MLSAs, and these treatments remain subject to REO review. These exemption criteria are in addition to criteria issued April 20, 1995, for Young Stand Thinning, Release, and Reforestation and Revegetation, and are in addition to exemption criteria adopted through the LSR assessment review process.

EXEMPTION CRITERIA

Silvicultural treatments in LSRs and MLSAs are exempted from REO review (*ROD*, pages C-12 and C-26) **where the agency proposing the treatments finds that ALL of the following criteria are met:**

Objectives

1. The objective or purpose of the treatment is to develop late-successional conditions or to reduce the risk of large-scale disturbance that would result in the loss of key late-successional structure. Further, the specific treatment would result in the long-term development of vertical and horizontal diversity, snags, CWD (logs), and other stand components benefiting late-successional forest-related species. The treatment will also, to the extent practicable, create components that will benefit late-successional forest-related species in the short term.

   Timber volume production is only incidental to these objectives and is not, in itself, one of the objectives of the treatment. Creation or retention of habitat for early successional forest-related species is not a treatment objective.

2. Negative short-term effects to late-successional forest-related species are outweighed by the long-term benefits to such species and will not lessen short-term functionality of the LSR as a whole.

3. The leave-tree criteria provide for such things as culturing individual trees specifically for large crowns and limbs and for the retention of certain characteristics that induce disease, damage, and other mortality or habitat, consistent with LSR objectives. “Healthiest, best tree” criteria typical of matrix prescriptions are modified to reflect LSR objectives.

4. Within the limits dictated by acceptable fire risk, CWD objectives should be based on research that shows optimum levels of habitat for late-successional forest-related species, and not be based simply on measurements within “natural stands.” For example, recent research by Carey and Johnson in young stands on the westside indicates owl prey base increases as CWD (over 4") within Douglas-fir forests increases, up to 8- to 10-percent groundcover south of the town of Drain, Oregon, and 15-percent groundcover north of Drain, increasing to 15 to 20 percent in the Olympic Peninsula and Western Washington Cascades. Other references that could help identify initial considerations involving natural ranges of variability in CWD include Spies and Franklin, for discussions on Washington Cascades, Oregon Cascades, and Coast Ranges; and Graham, et al., for east of the Cascades.

   If tree size, stocking, or other considerations preclude achievement of this objective at this time, the prescription includes a description of how and when it will be achieved in the future.

5. Agencies having an interest in LSR projects proposed under these criteria should continue to be given the opportunity to participate in project development.

Stand Attributes

1. The stand is currently **not** a complex, diverse stand that will soon meet and retain late-successional conditions without treatment.

2. West of the Cascades outside of the Oregon and California Klamath Provinces, the basal-area-weighted average age of the stand is less than 80 years. Individual trees exceeding 80 years in those provinces, or exceeding 20-inches dbh in **any** province, shall not be harvested except for the purpose of creating openings, providing other habitat structure such as downed logs, elimination of a hazard from a standing danger tree, or cutting minimal yarding corridors. Where older trees or trees larger than 20-inches dbh are cut, they will be left in place to contribute toward meeting the overall CWD objective. Thinning will be from below, except in individual circumstances where specific species retention objectives have a higher priority. Cutting older trees or trees exceeding 20-inches dbh for **any** purpose will be the exception, not the rule.

3. The stand is overstocked. Overstocked means that reaching late-successional conditions will be substantially delayed, or desirable components of the stand will likely be eliminated, because of stocking levels.

Treatment Standards

1. The treatment is primarily an intermediate treatment designed to increase tree size, crown development, or other desirable characteristics (S&Gs, page B-5, third paragraph); to maintain vigor for optimum late-successional development; to reduce large-scale loss of key late-successional structure; to increase diversity of stocking levels and size classes within the stand or landscape; or to provide various stand components beneficial to late-successional forest-related species.

2. The prescription is supported by empirical information or modeling (for similar, but not necessarily these specific sites) indicating that achievement of late-successional conditions would be accelerated.

3. The treatment is primarily an intermediate thinning, and harvest for the purpose of regenerating a second canopy layer in existing stands is no more than an associated, limited objective as described below under openings and heavily thinned patches.

4. The treatment will increase diversity within relatively uniform stands by including areas of variable spacing as follows:

   - Ten percent or more of the resultant stand would be in unthinned patches to retain processes and conditions such as thermal and visual cover, natural suppression and mortality, small trees, natural size differentiation, and undisturbed debris.

   - Three to 10 percent of the resultant stand would be in openings, roughly 1/4 to 1/2 acre in size to encourage the initiation of structural diversity.

   - Three to 10 percent of the resultant stand would be in heavily thinned patches (e.g., less than 50 trees per acre) to maximize individual tree development and encourage some understory vegetation development.

   The treatment does not inappropriately "simplify" stands by removing layers or structural components, creating uniform stocking levels, or removing broken and diseased trees important for snag recruitment, nesting habitat, and retention of insects and diseases important to late-successional development and processes.

5. To the extent practicable for the diameter and age of the stand being treated, the treatment includes falling green trees or leaving snags and existing debris to meet or make substantial progress toward meeting an overall CWD objective.

6. Snag objectives are to be identified as part of the DFC. Prescriptions must be designed to make substantial progress toward the overall snag objective, including developing large trees for future snag recruitment and retaining agents of mortality or damage. To the extent practicable for the diameter and age of the stand being treated, each treatment includes retention and creation of snags to meet the DFC. Publications useful in identifying snag-related DFCs include but are not limited to Spies, et al.

   To the extent snag requirements for late-successional species are known, one objective is to attain 100 percent of potential populations for all snag-dependent species.

7. The project-related habitat improvements outweigh habitat losses due to road construction.

Cited References:

Carey, A.B., and M.L. Johnson. 1995. Small mammals in managed, naturally young, and old-growth forests. Ecological Applications 5:336-352.

Graham, R.T., A.E. Harvey, M.F. Jurgensen, T.B. Jain, J.R. Tonn, and D.S. Page-Dumroese. 1994. Managing coarse woody debris in forests of the Rocky Mountains. Res. Paper INT-RP-477. USDA Forest Service, Intermountain Research Station, Ogden, UT. 12p.

Spies, T.S. and J.F. Franklin. 1991. The structure of natural young, mature, and old-growth Douglas-fir forests in Oregon and Washington. Pages 19-121 in: Ruggiero, L.F., K.B. Aubry, A.B. Carey, M.H. Huff (tech. coords). Wildlife and Vegetation on Unmanaged Douglas-fir Forests. Gen. Tech. Rep. GTR-PNW-285. USDA Forest Service, Pacific Northwest Research Station, Portland, OR.

REGIONAL ECOSYSTEM OFFICE

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MEMORANDUM

DATE: September 30, 1996

TO: Regional Interagency Executive Committee (RIEC)Mike Collopy, Center Director, Forest & Rangeland Science Center, National Biological Service Ken Feigner, Director, Forest & Salmon Group, Environmental Protection Agency Thomas Mills, Station Director, Pacific Northwest Station, Forest Service Thomas Murphy, Director, Environmental Research Lab, Environmental Protection Agency Stan M. Speaks, Area Director, Bureau of Indian Affairs Michael J. Spear, Regional Director, U.S. Fish & Wildlife Service William Stelle, Jr., Regional Director, National Marine Fisheries ServiceWilliam C. Walters, Deputy Field Director, National Park Service Robert W. Williams, Regional Forester, R-6, Forest Service Elaine Y. Zielinski, State Director, Oregon/Washington, Bureau of Land Management

SUBJECT: Amendment to "Criteria to Exempt Specific Silvicultural Activities in Late-Successional Reserves and Managed Late-Successional Areas from Regional Ecosystem Office Review" of July 9, 1996

On July 9, 1996, the Regional Ecosystem Office (REO) released criteria to exempt certain commercial thinning projects in Late-Successional Reserves (LSRS) and Managed Late-Successional Areas (MLSAs) from review. The memo stated, in part, that the "REO will consider supplementing or modifying these criteria over time." This memo contains the first amendment to the July 9 criteria.

After issuance of the July 9 criteria, members of my staff and the LSR Work Group continued to review current research, particularly that of Drs. Andrew Carey and Connie Harrington on commercial thinning in northwest Washington. Based on this additional review, it is apparent that although 1/4 to ½ acre openings will add structural diversity in some stands, they arc larger than needed to improve small mammal populations (forage species for northern spotted owls), and are larger than normal processes would typically create in the course of naturally developing late-successional forests. “Best guess" thinning studies currently being conducted by the researchers do not include openings this large. Therefore, the second and third bullets under Treatment Standard #4 in the July 9 Exemption Criteria are combined to now read:

> “Three to 10 percent of the resultant stand would be in heavily thinned patches (i.e.,, less than 50 trees per acre), or in openings up to 1/4 acre in size, to maximize individual tree development, encourage some understory vegetation development, and encourage the initiation of structural diversity."

Please implement this amendment at the earliest convenient time. However, projects already plained under the original July 9, 1996, version of the exemption criteria remain exempted from REO review. We suggest you transmit this amendment to your field units at your earliest convenience.

cc:
REO Reps
LSR Work Group
801/ly