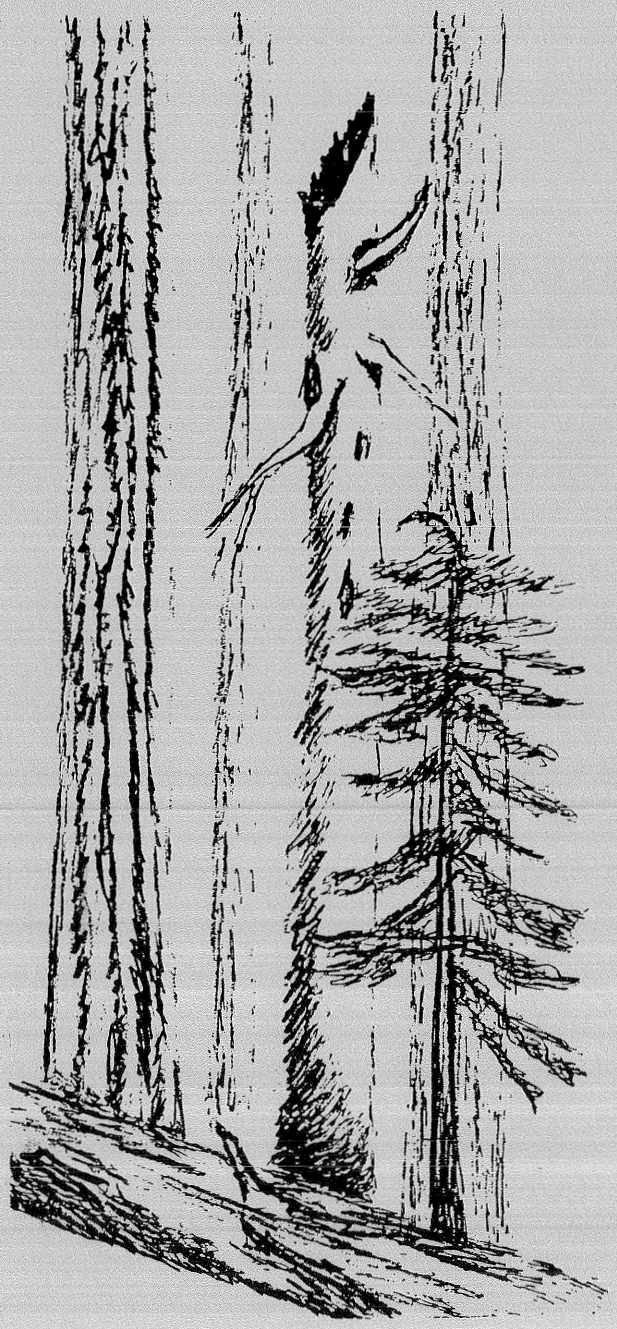
LATE-SUCCESSIONAL RESERVE ASSESSMENT

for Oregon's

Northern Coast Range

Adaptive Management Area



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January, 1998

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Original data for this analysis was compiled from multiple sources and may not meet the U.S. National Mapping Standards of the Office of Management and Budget. For specific data source dates and scales, or for additional digital information, contact the Forest Supervisor, Siuslaw National Forest, 4077 Research Way, Corvallis, OR 97333. The maps in this document have no warranties to their content and accuracy.

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MEMORANDUM

DATE: November 13, 2006

TO: Forest Supervisor, Siuslaw National Forest

FROM: /s/Anne Badgley, Executive Director

SUBJECT: Clarification of Memo #940 and Memo # 1058

This letter concerns two memos issued from this office which are in need of clarification. The Regional Ecosystem Office memos, #940 (dated June 6, 1997) and # 1058 (dated December 17, 1997) each contain the following paragraph:

> *"Projects meeting the criteria in the REO memoranda "REO Review Exemption Criteria" (dated April 20, 1995) and "Criteria to Exempt Specific Silvicultural Activities in Late-Successional Reserves and Managed Late-Successional Areas from Regional Ecosystem Office Review" (July 9, 1996 and amended September 30) continue to be exempted from the REO review. In addition, silvicultural activities described on, and consistent with the criteria listed on, Table 7 (as supplemented by April 22, 1997 documentation) and consistent with NFP S&Gs are exempt from subsequent project-level REO review."*

Through this letter, this paragraph in both memos is corrected with the following change noted in bold.

> *"Projects meeting the criteria in the REO memoranda "REO Review Exemption Criteria" (dated April 20, 1995) and "Criteria to Exempt Specific Silvicultural Activities in Late-Successional Reserves and Managed Late-Successional Areas from Regional Ecosystem Office Review" (July 9, 1996 and amended September 30) continue to be exempted from the REO review.* ***Alternatively****, silvicultural activities described on, and consistent with the criteria listed on, Table 7 (as supplemented by April 22, 1997 documentation) and consistent with NFP S&Gs are exempt from subsequent project-level REO review."*

Projects need to meet either the REO exemption memo criteria or the Late-Successional Reserve Assessment criteria that has been reviewed by the REO, but do not need to meet both.

If you have any questions, please contact Shawne Mohoric, 503-808-2175.

cc: Shawne Mohoric, Region 6, FS (LSR Workgroup)
Frank Davis, Region 6, Siuslaw NF

2232/SMo

REGIONAL ECOSYSTEM OFFICE

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MEMORANDUM

DATE: December 17, 1997.

TO: Robert W. Williams, Regional Forester, Region 6, Forest Service
Elaine Y. Zielinski, State Director, Bureau of Land Management OR/WA

FROM: Donald R. Knowles, Executive Director Don Knowles

SUBJECT: Regional Ecosystem Office Review of the Northern Coast Range Adaptive Management Area Late-Successional Reserve Assessment

Summary

The Regional Ecosystem Office (REO) and the interagency Late-Successional Reserve Work Group have reviewed the Northern Coast Range Adaptive Management Area Late-Successional Reserve Assessment (LSRA). The REO finds that the LSRA, as supplemented by a December 1, 1997 LSRA revision document, provides a sufficient framework and context for future projects and activities within the LSR. Future silvicultural activities described in the supplemented LSRA (as discussed below) that meet its criteria and objectives, and that are consistent with the Standards and Guidelines (S&Gs) in the Northwest Forest Plan (NFP), are exempted from subsequent project-level REO review. Future salvage and risk-reduction activities that follow the assumptions noted in this letter, that meet criteria and objectives in this LSRA, and are consistent with the S&Gs in the NFP, are also exempted from project-level REO review, with one exception and one condition, described below.

Basis for the Review

Under the S&Gs for the NFP, a management assessment should be prepared for each large LSR (or group of smaller LSRs) before habitat manipulation activities are designed and implemented. As stated in the S&Gs, these assessments are subject to the REO review. The REO review focuses on the following:

1. The review considers whether the assessment contains sufficient information and analysis to provide a framework and context for making future decisions on projects and activities. The eight specific subject areas that an assessment should generally include are found in the NFP (S&Gs, page C-11). The REO may find that the assessment contains sufficient information or may identify topics or areas for which additional information, detail, or clarity is needed. The findings of the review are provided to the agency or agencies submitting the assessment.

2. The review considers potential treatment criteria and treatment areas addressed in the LSRA. When treatment criteria are clearly described and their relationship to achieving desired late-successional conditions are also clear, subsequent projects and activities within the LSR(s) may be exempted from the REO review, provided they are consistent with the LSRA criteria and NFP S&Gs. The REO authority for developing criteria to exempt these actions is found in the S&Gs (pages C-12, C-13, and C-18).

Scope of the Assessment and Description of the Assessment Area
The REO reviewed the LSRA for conformity of the eight subject areas identified in the NFP S&Gs (page C-11) and sought additional information regarding some of these subject areas. Supplemental information was submitted to the REO on December 1, 1997.

The LSRA addresses three large LSRs on the Salem BLM District and the Siuslaw National Forest, totaling 186,000 acres, with 66% of the acreage within the boundary of the North Coast Adaptive Management Area (AMA). These LSRs are in the northern half of the Oregon Coast Province. This assessment considers the LSR in the context of surrounding LSRs.

Review of the Assessment
The REO reviewed the assessment's description of the process to be used, and elements to be included in the desired future conditions, current conditions, objectives, treatment criteria, possible treatments, and identified projects, including the location of forest types to which they may be applied. The assessment provides a clear framework for designing future actions. The descriptions of current conditions, disturbance processes, successional pathways, and landscape level treatment priorities were particularly illustrative in providing a framework for future interdisciplinary teams to identify specific management needs and prescriptions.

Projects meeting the criteria in the REO memoranda "REO Review Exemption Criteria" (dated April 20, 1995) and "Criteria to Exempt Specific Silvicultural Activities in Late-Successional Reserves and Managed Late-Successional Areas from Regional Ecosystem Office Review" (July 9, 1996 and amended September 30, 1996) continue to be exempted from the REO review. In addition, silvicultural activities described on Table 21 of the MLSA that are consistent with these exemption criteria as revised under the Density Management section (page 100) and are consistent with NFP S&Gs are exempt from subsequent project-level REO review.

Risk reduction activities described in Table 21 (as supplemented by December 1, 1997 documentation) that are consistent with the NFP S&Gs are exempted from future project-level REO review with the following assumption:

> Treatment to reduce the risk of disease would not occur in stands >110 years old, and will be consistent with silviculture enhancement treatment criteria described in the LSRA, with the addition of emphasis on retention of disease resistant or non-host species.

Salvage activities described in Table 21 and on page 99 (both supplemented by December 1, 1997 documentation) that are consistent with the NFP S&Gs, are exempted from future project-level REO review.

However, there is another salvage activity described in the LSRA that is not exempted from future REO review. This is:

Conflict with ACS strategy: The December 1, 1997 documentation provides supplemental language under the Salvage section (page 99) of the LSRA, stating that high levels of coarse woody debris (CWD) would be retained during salvage treatments "unless the interdisciplinary Team identifies a conflict with Aquatic Conservation Strategy objectives (i.e., blowdown on steep, unstable slopes above streams in which increased sedimentation is a concern), and recommends leaving moderate levels of CWD." The REO has not seen any information to support the idea that retaining the high CWD levels in the situation described in the LSRA would conflict with Aquatic Conservation Strategy Objectives. Thus, REO cannot exempt from review these salvage projects that do not retain high levels of CWD. Such projects should be submitted for project-level REO review.

We have chosen to provide a conditional exemption from REO project-level review for another type of lvage activity proposed in the LSRA. The December 1, 1997 supplemental documentation described iggering conditions and criteria for removal of down trees along roads when the risk of theft was considered too high. The rationale behind the proposal was that removal of the wood to a point far enough from the road surface to hide the remaining wood from potential thieves may result in retaining more wood in the LSR in the long term. Also, removing visible wood from areas of active theft will reduce overall theft activity. As the Work Group discussed with you in the field, this proposal is not consistent with the Record of Decision (ROD) and, therefore, appropriate Forest and District plan amendments will be required. Moreover, the issue of how best to prevent road side theft has been raised from various units throughout the NFP area, and this proposed approach may have the potential for widespread application in LSRs beyond those covered by this assessment.

The proposal has several additional uncertainties: its ecological effects; the effectiveness of reducing wood theft; and the magnitude of the treatment (though expected to be small). Given the possibility of ultimately retaining more CWD in the LSR by adopting the proposal than would be retained if theft occurred, the REO exempts this project in this assessment area from review for calendar year 1998, with the following understanding.

At the end of 1998, the LSR work Group and REO staff would like to visit with your staffs to discuss several points, including:
(a) the frequency and magnitude of potential theft situations,
(b) the ecological effects of the treatment,
(c) the effectiveness of the treatment in meeting management objectives for managing wood theft, and
') the potential for broader application of this type of treatment.

To facilitate these future discussions, we understand that you plan to assemble the following types of information:
(a) number and locations of situations where the proposed treatment was and was not applied,
(b) related documentation, including evidence of theft, and
(c) your staff's conclusions on the effectiveness of the treatment.

The REO believes this information and review will help us in a determination of whether the proposed treatment should continue to be exempted from review, whether modifications may be necessary to the proposed treatment, and whether the proposed treatment or modified treatment may have applicability in areas outside this assessment area.

The REO is working with the Research and Monitoring Committee (RMC) to ensure that projects within LSRs, including projects exempted from the REO review, are considered in the development of the Implementation, Effectiveness, and Validation Monitoring Programs. We also expect the local units to continue their long-standing partnership with key researchers regarding management of late-successional stands, particularly in the area of young-stand management. Specific to the proposed treatment to remove down wood subject to theft along roadsides, the REO will ask the RMC to investigate the issues involved in balancing the needs to manage theft against the ecological benefits of CWD.

Most of the LSR acreage in this assessment is also within the boundaries of the North Coast AMA. As ited in the supplemental documentation, LSR S&Gs and objectives will be met until such time as an .MA plan (supported by NEPA) is developed and approved, and which specifies changes in the land allocations or standards and guidelines of LSRs within this AMA (S&Gs, page D-15). Any changes in these S&Gs would require REO review.

The REO recognizes that silvicultural enhancement treatments may occur within LSRs in the North

Coast AMA in stands up to 110 years old (S&Gs, page C-12) and exempts these treatments, as described within the LSRA and consistent with the NFP, from future project-level review. We refer your staff to field notes compiled by the REO LSR work group members during a site visit on October 2 & 3, 1997. These notes, which we have retained in our files and which document our considerations for such types of treatments, were recently sent to your staff.

Conclusion

Based on documentation found in the LSRA and the amended information, the REO finds that the LSRA provides a sufficient framework and context for future projects and activities within the LSR. As identified above, silvicultural activities and specific projects identified in amended Table 21 and further described in the LSRA which are consistent with the NFP S&Gs and the treatment criteria identified in the assessment, and meet the above assumptions and exceptions, are exempted from subsequent project-level REO review. When it is completed, please send a final copy of the LSRA to REO for our files.

cc:
REO,RIEC
Clark Tiecke, BLM-Salem
Wayne Patterson, Hebo RD

1058/ly

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LATE-SUCCESSIONAL RESERVE ASSESSMENT

for Oregon's

Northern Coast Range Adaptive Management Area

(Late Successional Reserves RO269, RO270 & RO807)

I. INTRODUCTION

The Northwest Forest Plan (USDA and USDI 1994b) Record of Decision (ROD) requires that a Late-Successional Reserve Assessment (LSRA) be completed for each Late-Successional Reserve (LSR) or group of LSRs before habitat manipulation activities are designed or implemented. The assessment provides a broad scale description of the resources and issues which affect late-successional habitat, and describes management objectives and a desired future condition, providing a context for future decision making. This assessment concludes with recommendations for a variety of management activities considered to be appropriate for achieving the goals and objectives outlined in the Northwest Forest Plan.

Of the LSRs assessed in this report, all of LSR RO270 and most of LSRs RO269 and RO807 lie within the Northern Coast Range Adaptive Management Area (AMA). Approximately 70 percent of the AMA is classified as LSR, primarily designated for marbled murrelets. The management emphasis for this AMA is "management for restoration and maintenance of late-successional forest habitat" (ROD D-15). This is substantially the same management goal prescribed for the LSRs. However, the AMA has additional objectives related to social and economic contributions. All management activities in LSRs must meet the LSR standards and guidelines established in the ROD (ROD D-9), except that the designation and/or standards and guidelines for LSRs within the Northern Coast Range AMA may be reconsidered in an AMA plan (ROD D-15). Thus, appropriate management activities in the LSRs are those that tend to have a higher degree of certainty of meeting the objectives of protecting and enhancing the development of late-successional forest habitat for the species that depend on it. On non-LSR lands within the AMA, it is appropriate to apply a broader range of management activities and accept a higher level of risk, focusing on AMA goals and objectives.

A. BACKGROUND

The network of LSRs throughout the range of the Northern Spotted Owl (Map 1), was created to provide a distribution of late-successional forest habitat sufficient in quantity and quality to avoid foreclosure of future management options and ensure that late-successional species diversity will be conserved (ROD B-4 & 5).

Throughout this document, the term "late-successional" refers to habitat which has significant compositional and structural diversity, typically associated with the mature and old-growth conditions of late-seral forest (refer to Appendix A for the definitions of successional and seral

stages used in this assessment). However, because large scale, moderate to high intensity fires have burned throughout much of this assessment area in the past 150 years, existing late-seral habitat is relatively young, with much of the overstory vegetation in natural stands ranging from 80 to 150 years of age. In general, much of the structure found in old-growth stands (i.e., multi-layered canopy, trees with deeply furrowed bark, etc.) is lacking.

The following objective and goals have been established for LSRs by the Northwest Forest Plan:

Objective: To protect and enhance conditions of late-successional forest ecosystems, which serve as habitat for late-successional forest species.

Goals: 1. Encourage development of late-successional forest characteristics and maintain late-successional habitat and ecosystems.
2. Maintain biological diversity associated with native species and ecosystems.
3. Provide a network of fully functional, interacting LSRs throughout the Pacific Northwest.

In response to these goals and objectives, management on federal lands within LSRs must protect and/or enhance conditions of late-seral forests. The standards and guidelines contained in the ROD are intended to protect and/or enhance late-successional conditions.

Goals and objectives for the various AMAs are quite different from one another. All AMAs are intended to be learning centers which "encourage the development and testing of technical and social approaches to achieving desired ecological, economic, and other social objectives" (ROD D-1). Additionally, "Adaptive Management Areas are expected to produce timber as part of their program of activities" (ROD D-8), providing social and economic benefits to local communities which have been impacted by reductions in timber harvest levels on federally managed lands. Because the management emphasis for the Northern Coast Range AMA is the development of late-successional forest habitat, one of the primary technical objectives for this AMA is learning how to integrate the development and maintenance of late-successional forest habitat with production of timber products. As a result of this objective, a unique feature of LSRs in this assessment area is that the maximum age for timber harvest was increased from 80 years (established for all other LSRs within the range of the northern spotted owl) to 110 years (ROD C-12 & D-15). This waiver was granted to allow for treatment of stands which are currently 80 to 110 years old but lack many of the structural characteristics commonly found in old-growth stands, especially tree species diversity, down logs and snags, and multi-layered canopies. However, the Salem District Record of Decision and Resource Management Plan (USDI 1995) determined that timber harvest in LSR RO270 (Map 2) will not occur in stands which are older than 80 years. Additionally, the ROD allows for reconsideration of the LSR designation and/or standards and guidelines within this AMA as more is learned about the marbled murrelet (ROD D-15). Management has elected to postpone such considerations to a later date, as information regarding this species and its habitat is limited.

For more information regarding the Northern Coast Range AMA, see the recently prepared Northern Coast Range Adaptive Management Area Guide (USDI and USDA 1997).

All Late-Successional Reserve Assessments are subject to review by the Regional Ecosystem Office (REO). The REO serves in an advisory capacity to land managers, reviewing proposed actions and ensuring consistency with the Northwest Forest Plan (ROD page 35). They are charged with ensuring that all silvicultural treatments within LSRs "are beneficial to the creation of late-successional forest conditions" (ROD C-12) and that all non-silvicultural treatments within LSRs "are neutral or beneficial to the creation and maintenance of late-successional habitat" (ROD C-16). The REO is also authorized to develop or approve criteria which exempt some activities from REO review. Projects which are not within the scope of those analyzed or proposed in this assessment may be appropriate, but will need to be reviewed by the REO prior to implementation.

B. AREA INCLUDED IN THIS ASSESSMENT

This assessment area encompasses approximately 1,655,000 acres (based on the most current Geographic Systems Information data), including all types of ownership. It includes all lands within the boundaries of the Northern Coast Range AMA (as revised in 1997 due to changes in the boundaries of the fifth-field watersheds which make up this AMA), the Congressionally Reserved and Administratively Withdrawn lands at Cascade Head, and the small parcels of LSRs R0269 (38 acres) and RO807 (approximately 260 acres) outside of the assessment area, along the southern and eastern boundaries (Map 2). The Bureau of Land Management (BLM) manages approximately 133,000 acres within the AMA, while the Forest Service manages approximately 135,000 acres (Map 3 and Appendix B). Congressionally Reserved and Administratively Withdrawn lands at Cascade Head (Map 2) encompass 13,265 acres. Although these lands are not designated as LSR or AMA, they play an important role for late-successional species in this area and are considered in this assessment. Of the assessment area lands administered by the BLM and Forest Service, the Northwest Forest Plan designated five percent as Congressionally Reserved or Administratively Withdrawn, 66 percent as LSR within the AMA, 29 percent as non-LSR within the AMA, and less than one percent as LSR outside of the AMA boundary.

There are three designated LSRs in this AMA: RO269, RO270 and RO807. RO807 was identified as LSR LO269 during the development of the Northwest Forest Plan and in the Assessment Report: Federal Lands in and Adjacent to the Oregon Coast Province (USDA 1995), hereafter referred to as the Provincial Assessment Report. LSR RO270 is managed by the BLM, Salem District. LSRs RO269 and RO807 consist of both BLM and National Forest System lands. The boundaries of LSRs RO269 and RO270 were established primarily to protect northern spotted owl habitat and are not likely to change in the near future. The boundary of LSR RO807 was primarily established to protect marbled murrelet habitat and may change as more is learned about this species (ROD D-15).

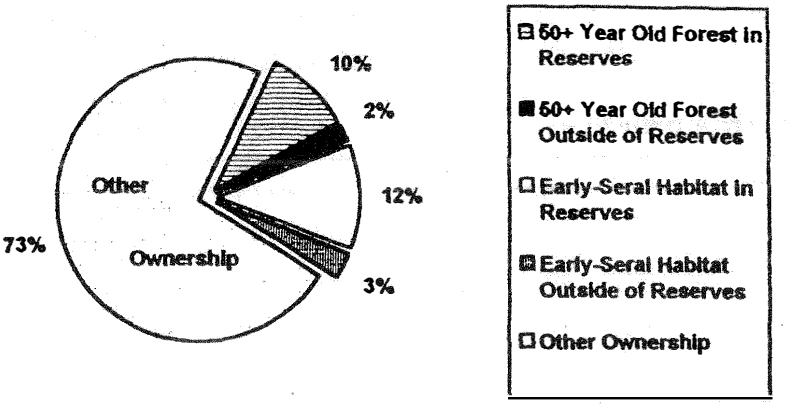
LSR	BLM acres	USFS acres	Total acres
RO269	4,484	16,050	20,534
RO270	5,953	- 0 -	5,953
RO807	79,197	80,310	159,507
AMA	43,410	38,376	81,786

C. CONTEXT OF THIS ASSESSMENT AREA WITHIN THE OREGON COAST PROVINCE

The assessment area lies between the Pacific Ocean and the Willamette Valley, and ranges from the watersheds which drain into Tillamook Bay in the north, and to the Siletz River basin in the south. The majority of the federally managed lands in this assessment area are within a physiographic province referred to as the Oregon Coast Province (USDA 1995). However, LSR RO807 extends into the west central portion of the Willamette Valley Province. These three LSRs were grouped into one assessment due to their proximity to and interdependence on each other, and because they are all located within the AMA. These LSRs are separated from the LSRs in the Cascade Range by the Willamette Valley (Map 1). LSR RO268, twelve miles to the south, is the only LSR which appears to be close enough and large enough to influence populations of species within this assessment area. It was analyzed as part of the Late-Successional Reserve Assessment: Oregon Coast Province - Southern Portion (RO268 and RO267), completed in 1997. A separate LSRA will be prepared for a small isolated LSR (RO271) located northeast of the assessment area. There is little or no late-successional habitat available to provide connectivity between RO271 and this assessment area.

Currently, 43 percent of all forests on federal land in the Oregon Coast Province are in the mid to late-seral stages of development. This includes stands 50 years old and older, and those which have a dominant size class of ten inches in diameter at breast height (dbh) and larger (USDA 1995). This represents about twelve percent (Figure 1) of the area in the entire Oregon Coast Province. Seventy-three percent of the lands in the Oregon Coast Province are not managed by federal agencies. Assessments of late-successional habitat in the Willamette Valley Province are not available at this time.

Figure 1. Mid- to Late-Seral Forest on Federal Lands in the Oregon Coast Province



Approximately 84 percent of all federal land in the Oregon Coast Province is in "Reserves" (including LSRs and Riparian Reserves), Congressionally Reserved and Administratively Withdrawn areas, or the Northern Coast Range AMA (USDA 1995). Thus, at least 22 percent (Figure 1, "Early-seral Habitat in Reserves" and "50+ Year old Forest in Reserves") of the Oregon Coast Province is being managed to provide late-successional habitat. Additionally, the State Department of Forestry and many of the industrial timber landowners are currently preparing Habitat Conservation Plans in compliance with Section 10 of the Threatened and Endangered (T&E) Species Act. Habitat Conservation Plans coordinate resource management with protection of T&E species and may identify areas which will provide late-successional habitat,

identify areas which will provide late-successional habitat, either by managing the area on rotations of 100 years or longer between timber harvest regeneration cuts, or by setting it aside as a reserve for a specified period of time. As these plans are completed, we will be able to develop a clearer picture of the amount, distribution, and linkages between existing and potential late-successional habitat in this assessment area. Refer to Appendix B for land ownership information displayed by fifth-field watershed.

D. HOW THIS ASSESSMENT WILL BE USED

LSRAs are not decision documents. They are prepared to provide managers with the information and recommendations necessary to make decisions consistent with the objectives, standards, and guidelines identified in the Northwest Forest Plan.

This LSRA provides information at the landscape scale for disturbance regimes, vegetative patterns and ecological function of different portions of the landscape. Finer scale assessments (i.e. watershed analysis and site specific project plans) can utilize this information to set local areas in the context of the larger landscape. This assessment also provides a landscape level strategy for maintaining or improving late-successional habitat by prioritizing treatment areas and identifying appropriate types of management activities. In doing so, the LSRA facilitates interagency working agreements for scheduling and accomplishing various treatments and studies.

Watershed analyses are finer scale assessments which enhance our ability to estimate direct, indirect and cumulative effects of management activities. They are better able to define the specific type, location and sequence of management activities within a watershed.

E. THE ASSESSMENT PROCESS

As specified in the ROD, LSRAs include the following eight components: 1) history and inventory of overall vegetative conditions; 2) identification of late-successional associated species known to exist within the LSR; 3) 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 insure that future activities are carried out as intended and to determine if the desired results were achieved.

In July 1995, the Provincial Assessment Report (USDA 1995) was completed. This LSRA expands from the concepts presented in the Provincial Assessment Report to describe the current vegetation patterns on the landscape and the climate, geology, landforms, and disturbance regimes which created them. Although focusing on federally managed lands, the vegetation characterization evaluates all lands within the assessment area, serving as a good reference for landscape level habitat conditions. Reference and current vegetative conditions on the landscape were used to determine how the LSRs are functioning in relation to objectives established in the Northwest Forest Plan. County surveys from the 1940s and 50s

provided a reference condition from which to evaluate current vegetation conditions and habitat for late-successional species within the assessment area.

Although a detailed assessment of the aquatic resource was not an objective of this LSRA, integration of the terrestrial and aquatic resource priorities at the landscape level helps in evaluating landscape function, identifying treatment priorities, and identifying appropriate management activities which meet the needs of both resources. The Provincial Assessment Report (USDA 1995) sets the aquatic resources discussed in this LSRA in the context of the Oregon Coast Range Province. This assessment identifies the various on-going efforts to prioritize watersheds for anadromous fish habitat restoration and how these efforts fit together to prioritize restoration activities across the entire assessment area.

Landscape analysis and design techniques were utilized to identify the functional role and condition of landscape sized blocks within the assessment area, and to prioritize them for treatment. Three broad **Landscape Zones** were delineated within the assessment area. These zones include: a **CORE** area which consists of contiguous federal ownership and is intended to provide the genetic source for populations of late-successional species; **CORRIDORS** which are intended to serve as travel routes for far ranging, late-successional species which are dispersing to and from late-successional habitat within and outside the assessment area; and **BUFFER** which is intended to serve as refugia for late-successional species in outlying portions of the assessment area and may facilitate dispersal of late-successional organisms within these portions of the landscape. In addition to these broad landscape zones, **Landscape Cells** were delineated based on the current amount and distribution of late-seral forest vegetation within the cell. The LSRA uses a combination of landscape zones and cells to prioritize areas for treatment. Securing the best late-successional habitat (defined in Chapter IV) and protecting the most critical fish habitat are identified as the highest priorities. Critical fish habitat located in low priority, early-seral landscape cells was identified and may need to be evaluated for protection or restoration during watershed analysis.

Due to the AMA emphasis in the assessment area, several landscape scale research questions are identified, along with the landscape cells which are good candidates for these research and learning opportunities.

Chapter V of this assessment identifies some conceptual successional pathways which vary based on sub-series environments and disturbance regimes, and the range and composition of some of the structural components which are currently found in forest stands in this assessment area. This assessment identifies management objectives which focus on restoring and maintaining the structural, compositional and functional elements of late-successional habitat. Appropriate management activities are then identified based on these management objectives and the existing site conditions which may "trigger" the activity.

The final component of the assessment, monitoring and evaluating management activities, helps identify those key features that need to be measured to determine if the proposed activities are meeting LSR objectives.

II. ASSESSMENT AREA HISTORY AND CHARACTERIZATION OF CURRENT CONDITIONS

A. HISTORIC AND CURRENT LAND USES

Additional information regarding historic and current land uses within the assessment area is available in the Social Assessment of the Northern Coast Range AMA (Wong-Leonard 1997).

1. Settlement Patterns

Before the first European explorations into the Pacific Northwest in the 1700s, American Indians occupied the coastal and interior valleys of western Oregon. The Kalapuya established a subsistence pattern extending westward from the Willamette Valley up to Mt. Hebo (Honey, et al. 1981). They were adept at using fire on a large scale for maintaining hunting and gathering areas in the Willamette Valley (Beckham, et al. 1982, Boyd 1986, and Zyback 1988). Along the coast, the Tillamooks used the coastal lowlands and river valleys of the Coast Range. They set small fires, usually one half to one acre in size (rarely over about three acres), to maintain hunting and gathering areas (personal conversation with C. Adams, Tribal Forester, and M. D. Mason, Tribal Attorney, 1994). The Kalapuya and Tillamooks traveled long, established trails through the Coast Range to trade with each other (Beckham 1975; Honey, et al. 1981). Some descendants of the Kalapuya and the Tillamooks are now members of the Confederated Tribes of Siletz Indians of Oregon and the Confederated Tribes of the Grand Ronde Community of Oregon.

In 1842, the first large group of immigrants (more than 100 people) arrived in Oregon. By 1843 over 1,000 settlers had arrived, and many of them settled in Yamhill County. The Donation Land Act of 1850 and the Homestead Act of 1862 provided enough incentives that the coastal lowlands and river valleys of the Coast Range were quickly settled by immigrants. More than 90 percent of the farms were established within the grasslands of the Willamette Valley and the Coast Range river valleys. Others settled in oak openings and other sparsely timbered areas which were easily cleared for cultivation. The remainder of the claims were associated with logging operations or water driven mills located on the river banks. As immigrants continued to pour into Northwestern Oregon between 1870 and 1900, the lower forested areas were claimed for farms and cleared to increase pasture and control brush. At that time, fire was one of the most effective means utilized by the settlers to clear the land (see fire disturbance discussion later in this chapter).

As the demand for lumber increased, many settlers in the more heavily forested areas of the Coast Range relinquished their homesteads to timber companies. Large tracts of land that were too remote for logging or homesteading and homesteads that never "proved-up" were incorporated into the National Forest System. Around the turn of the century, much of the land within twenty miles of the coast had been burned repeatedly and early surveyor's notes identified it as "brushfields." Tracts which were not being homesteaded became what we now know as the Hebo Ranger District of the Siuslaw National Forest.

In 1866, Congress granted all odd numbered sections of land thirty miles on each side of the railroad right-of-way to the Oregon and California Railroad Company. When the stipulations of the grant were violated, Congress litigated to have the lands revested to the United States government. Currently, these lands are predominately managed by the Bureau of Land Management, with some smaller tracts managed by the Forest Service.

2. Logging

As the homesteaders and settlers began clearing the land, the lower valleys were the first areas impacted by timber harvest and transportation routes. Splash dams were commonly used to transport logs down waterways to mills. In the late 1800s, railroads became an important means of transporting both people and logs. After damages inflicted by the 1933 Tillamook Burn to the railroad infrastructure, some of the major railroads operating on the fringes of the Coast Range went out of business. By the 1950s, previously inaccessible areas were accessible by an increased network of roads, and the use of steel spars for yarding enabled loggers to reach farther into the forest to harvest timber. In the 1970s, the timber industry and associated manufacturing industry reached its peak in the assessment area.

As existing stands of old-growth timber were depleted, large sawmills and plywood mills, which were major employers in the area, started to close. Today, logs are chipped or sawed in highly automated mills designed to process smaller diameter logs efficiently. More recently, the Northwest Forest Plan (USDA and USDI 1994b) established a new management direction for BLM and National Forest System lands, resulting in harvest at a much lower level than those during the 1970s and 1980s.

Today, in each of the four major counties (except Yamhill County) of this assessment area, employment in manufacturing has decreased. The phenomena is typified by the decline in forest industry employment, the major component of the region's manufacturing sector.

3. Agriculture

The narrow confines of the valleys and coastal plains naturally limited the degree of agricultural development in the assessment area. Agriculture, along with logging and fishing, provided the foundation for economic development. Today agriculture has not developed much beyond the original lands cleared by the first settlers. A significant dairy industry is located in and around the Tillamook area. Orchards, grass-seed fields, Christmas tree farms, and vineyards occupy the agricultural lands near the Willamette Valley. Small farms occupy the interior valleys. Residential areas are located in association with the agricultural lands.

4. Minerals

Rock quarries are scattered throughout the assessment area. They provide rock used in road surfacing and bank stabilization, and fill material for developing home and commercial lots. In the early 1980's, seismic oil and gas exploration was conducted throughout the area and large areas were leased through the oil and gas leasing program. Current records indicate that no further activity is planned. Based on geological formations it is believed that the assessment area has low potential for leasable minerals.

5. Recreation

Recreational uses include, but are not limited to, water play activities, canoeing, kayaking, drift boating, fishing, watching wildlife, hunting, horse-back and off-highway vehicle (OHV) riding, driving for pleasure, sightseeing, mountain biking, and hiking. As recreation demand increases groups are volunteering to develop and maintain additional trails. Current proposals include a horse-back riding trail on Mt. Hebo and OHV trails in the vicinity of the Upper Nestucca. The 1990 OHV proposal includes approximately 50 miles of trail, of which 23 miles have been approved and developed to date, and an additional 15 miles are currently being addressed in the Upper Nestucca Morotcycle Trails Environmental Assessment (BLM EA #OR-086-97-05, dated 6/25/97). This area's mild climate attracts tourist throughout most of the year, with heaviest visitation focused primarily on the coastal strip. Some recreational uses (i.e. hunting, berry picking) are strictly seasonal. Refer to the Salem District Resource Management Plan (USDI 1995) and the Siuslaw National Forest Land and Resource Management Plan (Siuslaw 1990) for additional details on proposed and existing recreation in the assessment area.

Scenery objectives tend to be compatible with LSR objectives. Large blocks of old growth, small patches of old growth, and even individual large, old trees are valuable for scenery. There are remnant old-growth trees in some developed recreation sites within the assessment area.

LSR and recreation objectives often conflict when road closures and obliterations restrict vehicle access.

6. Economic Values

Due to the highly productive forest which covers much of the assessment area, timber and a wide variety of other forest products are major contributors to the local economy. Other valuable forest products found in this assessment area include firewood, decorative ferns, grasses and boughs, Christmas trees, mushrooms, mosses, seedling transplants, bark, and burls. The economic stability of communities in the assessment area is also dependent on the agricultural industry, the commercial and sport fishing industry (supported by anadromous fish spawning and rearing habitat in the assessment area), and the recreation industry (supported by facilities such as campgrounds, visitor centers, and hiking trails).

B. PHYSICAL CHARACTERIZATION

1. Physiographic Province

The Oregon Coast Range is characterized by highly dissected low elevation mountains that were shaped by earthflows and debris slide processes. Incised valleys are distributed throughout the area. Dunes and wetlands occur along the coast, with numerous headlands made of more resistant rock.

2. Climate Description

The Coast Range has a maritime climate influenced by its proximity to the Pacific Ocean. Cool, wet winters and relatively warm, dry summers are characteristic of the area. The mean temperature of the coldest month (January) averages fifteen to twenty degrees Fahrenheit lower than that of July, the hottest month. Normal annual precipitation in the north Oregon Coast ranges from 50 inches to more than 175 inches. Most of the precipitation (generally 60 to 75 percent) falls as rain from November through March, with some intense winter storms. Occasionally, Arctic air meets an onshore flow, producing snowfall. In general, snow persists for only a few days except for the tops of the highest peaks. Strong winds (70 to 100 miles per hour), often associated with rainstorms, may occur during the fall and winter. The "Pineapple Connection (or Express)" pumps tropical heat and moisture from the central Pacific northward resulting in low pressure ystems that may drop several inches of rain over a period of a few days. El Nino and La Nina (ocean temperatures in the Pacific) conditions oscillate over a period of several years. We are currently experiencing a moderate La Nina, resulting in average to below normal temperatures and above average levels of precipitation in the assessment area. During El Nino, the assessment area is generally warmer and drier. There is also evidence of larger scale 20 to 30 year wet and dry climatic cycles, with indications that we are currently entering a wet cycle (George Taylor, Oregon State Climatologist).

The mountains of the Coast Range have a pronounced effect on local climate. Elevations range from sea level at the western edge of the assessment area and 50 to 200 feet in the Willamette Valley to over 3,000 feet in the highest peaks of the Coast Range. From north to south, the highest peaks in the assessment area are Mt. Hebo at 3,176 feet, Laurel Mountain at 3,589 feet, and Sugarloaf Mountain at 3,415 feet. Most other mountain tops are below 2,000 feet. Major ridges receive substantially more precipitation than do nearby lowlands. Coastal areas average 80 inches of precipitation annually and interior areas west of the crest receive an average of about 120 inches. Normal annual precipitation for some of the highest peaks range from 125 inches at Mt. Hebo to 175 inches at Laurel Mountain. In calendar year 1996, Laurel Mountain received 204 inches, the most precipitation for any station in the state of Oregon since rainfall records have been kept. The eastern slopes of the Coast Range average about 80 inches annually, decreasing to about 50 inches in the valley margin.

The prevalent annual streamflow cycle has flashy, high streamflows during the winter months followed by low baseflows during the dry summer months, when most of the flow in channels is derived from emerging groundwater. In coastal drainages notable flood years have been 1861,1890, 1909, 1927, 1953, 1955, 1964, 1974, 1982, 1983 and 1996.

High potential evapotranspiration 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 in the dissected volcanic uplands and Tillamook volcanic uplands geomorphic types (Table 1) because soils are generally thinner, higher in rock fragments and bedrock tends to be slightly permeable to impermeable. In other areas, stands on ridges and exposed south facing slopes with thin, rocky soils can develop plant moisture stress in late summer.

3. General Geology of the Northern Coast Range

The northern Coast Range is underlain by basalts that were originally part of the ocean floor. The Siletz and Tillamook Volcanics are the oldest rocks in the Coast Range, ranging in age from 53 to 56 million years old. The volcanic units include basalt flows, which are relatively resistant, and basaltic ashes, breccias and pillow basalts that are more erodable. Layers of sand, silt, clay and volcanic debris were deposited in shallow seas over the basalt forming the following sedimentary formations. A small percentage of the assessment area is the Tyee Formation, which is a thickly bedded sandstone. It grades northward into the finer grained, more thinly bedded Yamhill Formation. Along the coast, the Yamhill Formation is interlayered with basalt and is covered by the Nestucca and related sedimentary formations which are over 5,000 feet thick. The Nestucca Formation is a deep-water deposit mixed with ash from the Cascade volcanoes. Both the Yamhill and Nestucca Formations are very fine grained and highly erodable (Baldwin, 1964; Orr, et al. 1992). In general, the sedimentary rocks tend to be more erodable than the volcanics. Therefore, even though the volcanic units may cover less area in places, they resist rapid erosion of the higher elevations, exerting a controlling influence on landforms by maintaining the high topographic relief of the Coast Range.

Between 29 and 38 million years ago, igneous rocks were intruded into the sediments, and formed dikes and sills that are resistant to erosion. The highest peaks in the Coast Range are underlain by these resistant intrusions, such as Mt. Hebo near the Oregon Coast. Approximately 15 million years ago, the Columbia River basalts were erupted in eastern Washington and Oregon. They flowed westward and the heavier, fluid lavas were forced under the soft, water-saturated sediments. These lavas form "rootless" dikes and sills in the central and northern Coast Range. (Orr 1992).

The continuing tectonic uplift of the Coast Range began approximately 10 million years ago, when the Pacific ocean floor began to subduct beneath the North American continent. This uplift continues to build the Coast Range.

4. Landtype Association Units

Landtype associations were classified and mapped by delineating areas with similar geology and topography at a scale of 1:250,000. These areas were then categorized and described by comparing the attributes of stream gradient, stream density, and slope. Stream density was also used as a surrogate for landscape texture and dissection. Most of this information was produced using a digital elevation model (DEM) in a Geographic Information System (GIS). More information on Landtype Associations can be found in "A Hierarchical Approach to Classifying Landforms and Stream Systems in the Oregon Coast Range" (USDA 1997, in progress).

To delineate geomorphic zones for the entire assessment area (Map 4), landtype associations with similar geology were grouped into larger blocks or "geomorphic zones". It is assumed that the bedrock geology is the main determination for attributes such as stream gradient, confinement, and density; type of sediment that will be produced; and steepness of the slopes. The general characteristics of these large geomorphic zones have been summarized in Table 1.

TABLE 1. GEOMORPHIC ZONES

Geomorphic Zones	Geologic Features	Soil Characteristics	Stream Characteristics	Management Concerns
Interbedded volcanic and sedimentary rock. Includes the Nestucca Formation. Moderate to subdued relief. LTAs: 2S, 2C, 2T, 2K, 2N, 2Q	Siltstone, shale and sandstone of the Nestucca and Yamhill Formation interbedded with volcanic rock that was often intruded through the sediments at a later date. Sedimentary bedrock is generally very soft, and highly fractured and forms areas of low to moderate relief. Higher elevations are often dominated by volcanic rock on ridge systems. Large, ancient earthflows are common and often originated at the contact between sedimentary and volcanic rock.	Soft grained sedimentary rock is easily weathered and produces deep soils with high water holding capacities. Surface layers are rich in organic matter and amorphous clays which make them very productive. Soils developed on volcanic rock are not as easily weathered and may be steeper and more erosive. Soils are deep to very deep on hummocky, incised ancient earthflows. Water holding capacities are high and presence of alder is common.	Stream gradient: a moderate to high percentage (13-47%) of stream miles are in the 1-4% gradient class. Stream density: variable, but in the moderate range. Average of 7.1 miles/square mile. Substrate: because of the variable bedrock, sediment produced is a mixture of everything from silt to boulders. Springs are often found at the contact between sedimentary and volcanic rock and in landslide deposits.	Alder is very common on, ancient earthflow deposits and in floodplains. Earthflow deposits have deeper soils with higher water holding capacities and may explain the high occurrence of alder. Channel and bank stability is likely to be lower in landslide deposits because of their unconsolidated nature. Road slumping is common. Debris torrent risk is low to moderate.
Steep, dissected volcanic uplands. Includes the Tillamook and Siletz River Volcanics and interbedded sediments. LTAs: 2PSR1, 2PSR2, 2PSR3, 2P2, 3S	Pillow basalt, breccias and marine sediments of the Siletz River volcanics dominate geologic groups. The Siletz River volcanics are the oldest rocks found in the coast range and formed in a marine environment. Bedrock is hard and less permeable and forms steep valley sideslopes. This geomorphic unit is generally found on areas of high relief because it is more resistant to erosive forces.	Volcanic rocks are more resistant to erosive forces and weather into soils of variable depth depending on topographic position. Pillow basalts weather to clay. Soils are high in amorphous clays and organic matter. Incised valleys are more prone to erosive processes such as landslides because of oversteepened slopes. In general, soil depth on sideslopes is moderately deep and rock fragment content is higher. Soils on southerly slopes are more prone to moisture stress.	Stream gradient: over 75% of streams have greater than 4% gradient class. Stream density: variable, but in the mod rate range(average of 6.6 miles/square mile). Substrate: basaltic clay, silt, gravels, cobbles and boulders. These LTAs are likely to have a higher number of confined, high gradient streams.	Debris torrents originating from headwalls are very common. However, debris torrent risk is highly variable in these LTAs. Midslope road failures are more likely to occur because of high gradient streams. Intense burning on south facing slopes reduces productivity.
Tillamook volcanic uplands. Steep, highly dissected terrain. LTA: 2P	Geology consists of Tillamook Volcanics, interbedded fine grained sedimentary rocks and scattered volcanic dikes and sills. This area is a transition zone between the Tillamook Volcanic uplands and the coastal lowlands. As a result, this area is highly dissected, with steep V-shaped valleys.	Soils are similar to those developed in the Tillamook and Siletz River volcanics. Steep slopes with shallow gravely soils are more common. Rock outcrops are common. Erosion potential is high on oversteepened slopes. Soils on southerly slops are more prone to moisture stress.	Stream gradient a low number (less than 9%) of stream miles in the 0-4%-gradient class. Stream density: moderate to high. Substrate: a mixture of everything from silts and clays to durable gravels and boulders.	Debris torr nt potential is extremely high. Of all the LTAs in the Coast Range, this area has the highest percentage of slopes greater than 60%. Road failures are more likely to occur because of instability of bedrock and stream gradient. Road maintenance or stabilization is critical in reducing road failures. Removal of vegetation in head-walls also increases occurrence of landslide. Intense burning on steep, south facing slopes reduces productivity.

TABLE 1 (continued). GEOMORPHIC ZONES

Geomorphic Zones	Geologic Features	Soil Characteristics	Stream Characteristics	Management Concerns
Coastal volcanic headlands LTA: 2M	Geology is a mixture of erosion resistant volcanics and fine grained, erodable sediments. Moderate to steep relief.	Soils are highly productive compared to other zones. High year round soil moisture does not limit plant grow h or survival. Surface layers are rich in organic matter and amorphous clays.	Stream gradient: less than 9% have a 0-4% gradient. Stream density: moderate (6.4 miles/square mile) Substrate: basalt gravel, cobbles and boulders, s me clay	Numerous scenic areas and state parks. High potential for blowdown. Moderate risk of debris torrents.
High relief Tyee sandstone intruded by volcanic dikes LTA: 3R	Dikes form areas of higher relief and are more resistant to erosive forces. Coarse grained sedimentary rock intruded by volcanic dikes found in the southern portion of the assessment area.	Soils are moderately deep on spur ridges to very deep on broad backbone ridges. Soils are moderately productive to productive and have moderate water holding capacities. Soil moisture stress may limit plant growth or survival on steep slopes.	Stream gradient: over 85% of streams with high gradient. Stream density: 6.9 miles per square mile Substrate: basalt gravel with sandstone pebbles.	Transition zone from Coast Range to the valley, includes Kings Valley, may result in some unique habitats for plant and animal species. Moderate risk of debris torrents.
Low relief Tyee sandstone LTAs: 3D, 3W	Coarse grained sedimentary rock of the Tyee sandstone form areas of low relief. Occurs near the southern boundary of the assessment area and includes part of the Yaquina River drainage, areas south of the Siletz River and the lower portion of Drift Creek.	Soils are moderately deep on ridge systems to deep on lower side slopes. Soils range from gravely loams on steep slopes to clay loams where deep soils occur.	Stream gradient: low to moderate (19-32%) percentage of low gradient streams 0-4%. Stream density: 6-7 stream miles per square mile. Substrate: sandstone pebbles and cobbles, sand and silt.	Moderate risk of debris torrents.
Coastal lowlands LTAs: 2Z and 3Z	Areas of low relief that include the floodplains, estuaries, and coastal plains around Tillamook, Lincoln City, the Salmon River estuary and the dunes around Cape Kiwanda. High percentage of the area is underlain by alluvium and river terrace deposits (37%). Most of the remaining area is underlain by erodable, fine grained sediments.	Soils on low relief alluvial deposits are generally deep with moderate to poor drainage and have a higher frequency of flooding. Fine grained sediments are easily weathered and produce deep soils. Soils are typically andic intergrades rather than andisols.	Stream gradient: a high number (52-71%) of low gradient streams. Most of the low gradient streams are unconfined. Stream density: high with greater than eight stream miles/square mile. Substrate: mostly fine grained sediment, silts, clays and sand.	High occurrence of flooding and wet-lands. More human use and activity is increasing potential for water pollutants. Historically provided highest quality fish habitat. High potential for providing quality fish habitat due to large numbers of low gradient, unconfined streams. Low risk of debris torrents.
Willamette and Yamhill Valley lowlands LTAs: 2Y, 2H	Much of the area (51%) is underlain by Pleistocene lake deposits, primarily silt. A quarter of the area is underlain by alluvium and river terrace deposits. Gentle to flat lowlands, broad river valleys.	Soil/climate changes on the east side of the coast range. Dark surface layers become thinner and more red. Soils developed in deep lake deposits are used for agriculture and very productive.	Stream gradient: a high number (46%) of low gradient streams. Most low gradient s reams are unconfined. Stream density: no data. Substrate: mostly silts, clay and sand.	Population density is high and pressure on water resources is increasing. More water quality concerns and limitations. High probability of pollutants from agricultural run-off and non-point source pollution. Low risk of debris torrents.

5. General Soil and Soil/Climate Descriptions

Soils have generally developed from marine volcanics and sediments. A description of soils by geomorphic zone can be found in Table 1. Most soils are very productive for growing vegetation because of the climate, rapid decomposition rates and high biological activity. Typical forest soils are shallow (on ridges) to deep (on lower slopes) and have dark, humus-rich surface horizons high in amorphous clays. Dominate soil orders west of the Coast Range summit are andisols and inceptisols. They are wet for approximately three quarters of the year and mean annual soil temperatures range from zero to fifteen degrees Celsius. East of the Coast Range summit the climate becomes drier and soil order changes to ultisols and mollisols.

This assessment area has been categorized by climate and soil types into soil/climate zones. The Oregon Coast Province portion of the assessment area includes three soil/climate zones which are distinguished mainly by climate and landform (USDA, 1995):

Coastal Fog Zone

Climate within the coastal fog zone is typified by very high winter rainfall accompanied by high winds, with fog and low clouds common. This zone usually extends ten to fifteen miles inland from the coast. The eastern edge of this zone is generally determined by the extent to which fog hangs in the valley bottoms. Soil temperatures are relatively uniform from summer to winter (isomesic). Fog and low clouds increase effective soil moisture during the summer months and fog drip is common. Soil temperature rarely falls below freezing, ideal for growing Sitka spruce, western redcedar and western hemlock. The coniferous forest stands of this zone are typically dense, tall, and among the most productive in the world (Fujimori 1971).

Interior Zone

This zone has the highest mountain peaks, and therefore, the greatest variability in climate. In general, soil moisture remains high in the winter due to heavy rainfall or snowfall and moist in the summer months. Summer soil moisture levels on upper slopes south of the Salmon River are somewhat drier than those found north of the Salmon River. Soil temperature varies as elevation increases. Above 1,800 feet, soil temperature starts to decline and chance of snow increases. Snow rarely stays for more than a few days. Above 3,000 feet, temperature drops even more as soil temperatures change to frigid or cryic conditions. Throughout this zone, biological activity is high and accompanied by high decomposition rates and moderate accumulations of organic matter. Douglas-fir, red alder and western hemlock compose the majority of forest communities in the Interior Zone.

Valley Margin Zone

Frequent storms that move in from the Pacific Ocean, and cooling of the marine air as it is lifted over the Coast Range combine to produce considerable cloudiness from mid October to mid March. Most rainfall occurs during this period, with less than 10 percent of precipitation

occurring during the summer months. Soils are significantly drier and warmer during summer months, limiting plant growth. Oregon white oak, grand fir, and Douglas-fir compose the majority of forest communities in this zone.

C. VEGETATIVE CHARACTERIZATION

Vegetation can be characterized by plant series and plant associations, or plant communities. **Plant series** describe forest vegetation by the *dominant or climax tree species* that would be maintained over time without disturbance, e.g., western hemlock series (Franklin and Dyrness 1973). **Plant associations** (Hemstrom and Logan 1986) describe the *dominant tree and shrub and/or herb layers* that develop on a site over long periods of time, after coming into balance with the physical and biological environment of the site. **Plant community** (USDI 1995) describes the current *dominant tree, shrub and/or herb layers*.

Climate, geology and soils influence the occurrence of a plant series on a coarse scale. The Sitka spruce series dominates the maritime, Coastal Fog Zone and occurs in the wetter portions (especially north facing slopes on the west side of the Coast Range) of the Interior Zone in the western portion of the assessment area (Map 5). The western hemlock series occupies the majority of the landscape, dominating the Interior and Valley Margin Soil/Climate Zones. It is associated with the widest range of environments. The noble/Pacific silver fir series is limited to highest peaks of the Coast Range in the Interior Soil/Climate Zone. The grand fir series appears to be associated with the Valley Margin Zone and the floor of the Willamette Valley. The noble/Pacific silver fir and the grand fir series are found in small, isolated patches within the assessment area and the actual extent of these series is currently being studied.

Plant associations with similar species composition and productivity have been categorized into "*sub-series environments*". The sub-series environments within the Sitka spruce and western hemlock series are described as **wet**, **moist**, or **dry**. These are relative terms and are based on the moisture gradient in which they are found. In wet environments, soils are moist throughout much of the year. Plant growth in the dry environments is limited during the summer months by soil moisture stress. Soil moisture stress may be a limiting factor in the moist environments during the driest parts of the year.

Table 2 characterizes the relationship between plant series, sub-series environments, plant associations and plant communities found within the assessment area.

Table 2. Relationship Between Series, Sub-Series Environments, Plant Associations[1] & Plant Communities[2]

SERIES	SUB-SERIES ENVIRONMENTS	PLANT ASSOCIATIONS[1]
Sitka Spruce[1]	WET	[1]Sitka spruce/devil's club & salmonberry
Sitka Spruce[1]	MOIST	[1]Sitka spruce/Oregon oxalis, swordfern, & fool's huckleberry-red huckleberry
Sitka Spruce[1]	DRY	[1]Sitka spruce/salal, & salmonberry-salal
Western Hemlock[1] (Douglas-fir-red alder)[2]	WET	[1]western hemlock/devil's club, salmonberry, & salmonberry-vine maple
Western Hemlock[1] (Douglas-fir-red alder)[2] (Western hemlock-Douglas-fir-red alder) (Western hemlock-Douglas-fir)	MOIST	[1]western hemlock/Oregon oxalis, swordfern, vine maple/swordfern, & vine maple-salal
Western Hemlock[1] (Douglas-fir)[2] (Douglas-fir - Western hemlock) (Douglas-fir -Oregon white oak)	DRY	[1]western hemlock/dwarf Oregon grape, dwarf Oregon grape-salal, evergreen huckleberry, salal, salmonberry-salal, & all rhododendron plant associations
Noble/Pacific Silver Fir		[2](vine maple-rhododendron & big huckleberry)
Grand Fir		[2](snowberry/swordfern & salal-snowberry/swordfern)

1. Plant Association and Management Guide (Hemstrom and Logan 1986).
2. Current tree and understory species, Salem District Resource Management Plan (USDI 1995).

D. DISTURBANCE PROCESSES

1. Human Impacts

Human uses of the land have changed vegetation patterns through fire, land clearing, logging, planting with inappropriate species (or seedlings of the appropriate species from inappropriate seed zones) which are not adapted to local site conditions, mineral extraction, agriculture, fishing, manufacturing, road building and establishment of residential communities. Additionally, human settlement, road building, grazing, fire, farming and timber harvest have all dramatically affected fish habitat within the assessment area. Large woody debris has been removed from stream channels for harvest, flood control and navigation. Riparian areas have been cleared or converted from conifers to alder and brush. Stream channels have been constrained by road construction. These activities have increased landslides and erosion, increasing the amount of fine sediments carried and stored in streams, rivers and estuaries. Recreational activities can have major impacts on water quality, soils, vegetation and wildlife. The types of recreational impacts which could adversely affect attainment of LSR objectives are generally related to harassment of wildlife species and changes in vegetation, resulting in impacts to wildlife and plant habitats. For example, as hiking, horseback, and off-highway vehicle (OHV) use increases or expands into new, relatively undisturbed areas, disturbance could discourage use of the area by late-successional wildlife species such as the marbled murrelet. These activities could also negatively impact amphibians and "survey and manage" (ROD Table C-3) plant and invertebrate species.

Roads are an important issue for late-successional habitat because the human use associated with them can have negative impacts on attainment of LSR objectives. Impacts range from introduction of noxious and invasive plant species to illegal removal of live trees, snags, and large down wood, and dumping of garbage.

Administrative sites (i.e. campgrounds and picnic areas, radio towers and other facilities, parking lots, utility and road right-of-ways) reduce the amount of late-successional habitat locally. However, a number of these administrative sites are located either in developed areas or on mountain tops that are currently in an early-seral stage of development. Maintaining these early-seral conditions is thought to have little impact on the overall condition of LSRs (ROD, C-15, 17, and 18).

2. Physical Disturbance Processes

Understanding the geographic variability of soil, climate, and disturbance effects can help us interpret spatial landscape patterns and structural landscape components. Since plant and animal populations have adapted to the range of historic landscape patterns, an understanding of these patterns is important in managing late-successional habitat. Fire and wind are the two dominant natural disturbance processes affecting the large scale vegetation pattern in this assessment area. The frequency, severity and size of these disturbances have greatly influenced the composition and structure of habitats across the landscape.

Wind

Although wind is a common intermediate disturbance throughout the assessment area, it is especially significant in the Coastal Fog Zone, where yearly winter windstorms are responsible for creating small patches of blowdown scattered throughout this zone. Most patches are less than one half acre in size and few exceed ten acres in size. Infrequent severe windstorms cause blowdown of large tracts (100 to 1,000 acres) of forest. The most recent severe windstorms were the 1962 Columbus Day storm and the Friday the Thirteenth blowdown, November, 1981. Efforts to predict the location and size of these events have not been successful in the past. Effective guidelines have been developed and are being used to reduce the risk of blowdown associated with management activities such as timber harvesting and road building (USDA 1953, USDA 1964, Doubek 1982).

Fire

Both physical and biological elements of the landscape affect fire disturbance patterns. Physical features such as landform type (relief and drainage density patterns), soil and geologic substrates influence fire behavior patterns. Climatic features, such as precipitation, fog and wind patterns, control fire spread and effects on vegetation composition and pattern. The distribution of sub-series environments, seral stages, and the arrangement, composition, and structure of vegetation all influence the amount and arrangement of fuel, and thus, fire behavior patterns. The Tillamook Burn illustrates the effects of topography and fuels on fire behavior. The fire generally stopped at the ridgetop between the Nestucca and Tillamook River basins due to changes in the vegetation cover which resulted from previous fires in the Nestucca River basin and due to the effects of local topography on east wind conditions.

The long term history of fire in the entire area has not been systematically documented. Fire disturbances in Pacific Northwest coastal zones are described as low frequency (more than 200 years between disturbances), high severity regimes (Agee 1993). Ongoing and recently completed projects in the central Coast Range, approximately twenty miles south of this assessment area, have refined this general description. Analysis of charcoal distribution in a sediment core from Little Lake (located adjacent to Triangle Lake in LSR R0268) , revealed a mean fire return interval of 160 to 190 years from 2000 years ago to the present (Long 1995). Preliminary results from a large scale dendrological fire history project covering approximately 340,000 acres, spanning from the coast (Rock and Cummins Creek) to the valley margin (east of Triangle Lake) , indicate that there is spatial variability in historic fire patterns over the last 500 years. Coastal and Interior Zones in the study area appear to have been dominated by single or two age class stands, with fire return interval ranging from 200 to 300 years. Valley Margin Zone sites had a much higher proportion of two to four age classes, with fire return intervals ranging from 100 to 200 years (Impara, personal communication). This information suggests that there is large scale geographic variability in fire regimes across the landscape. The Fire Management Plan for the assessment area (Appendix C), proposes a control strategy for wildfire management and identifies that prescribed burning is appropriate on some sites.

American Indian and Euro-american settlement of the area since the latter half of the 1800s was responsible for many large and small scale fires. The Nestucca Fire of the 1840s and the 1933 Tillamook Fire each burned approximately 300,000 acres in, and adjacent to, this assessment area. Mt. Hebo and some of the surrounding areas (all of which, burned as part of the Nestucca Fire) reburned in 1902 and again in 1910 (Teensma, et al. 1991). Portions of the Tillamook Fire area reburned in 1939, 1945 and 1951 (Munger 1944, Kemp 1967). Since these fires occurred, many small scale fires have reburned portions of the larger fire's area. Small scale fires have also burned some mature forest stands.

Teensma, et al. (1991) mapped age class distributions (inferred from various sources) for four different years: 1850, 1890, 1920, and 1940. Several human caused fires between 1850 and 1940 have changed landscape patterns. The total number of patches in each age class almost doubled from 1850 to 1940 as a result of small human caused fires and suppression efforts on potentially large scale events. Approximately half of the entire assessment area (regardless of ownership) burned once since 1840. At least ten percent of the entire assessment area reburned once or twice between 1840 and 1950. These fires and reburns have had significant effects on landscape pattern, and on the composition and structure of vegetation.

Disturbance Regime Blocks Fire history information suggests there is spatial variability in fire effects across the assessment area. An attempt was made to map, at a landscape scale, the general geographic distribution of fire regimes in the Provincial Assessment Report (USDA 1995). The concept that fire regimes are stable temporally and spatially, and can be discreet geographic entities are working hypotheses that will be revisited and refined as more information becomes available.

Distribution of physical and biological environments were used to map disturbance regimes across the Northern Coast Province. Landform types (USDA 1981) and plant series distribution were used to group geographic areas into blocks predicted to have similar fire frequency, severity, and size patterns (Map 6). Relief patterns and climatic influences (fog, east wind events) were considered in the groupings.

These working boundaries were overlaid on the age class distribution maps (Teensma et. al, 1991) to validate assumptions about the effects of physical and biological elements on disturbance processes and resultant vegetation patterns. Geographic variability in patch sizes and types was closely approximated in overlaying the working boundaries on the age class distribution maps. This supported the hypothesis that landform/topography, climate and vegetation distribution influence fire disturbance processes and landscape pattern.

Five of the eight disturbance regime blocks described in the Provincial Assessment Report (USDA 1995) are located within this assessment area. Table 3 displays the disturbance regime characteristics and the resultant vegetation pattern for each of the disturbance regime blocks.

Table 3. Disturbance Regime Blocks

DISTURBANCE BLOCK	LAND-FORM	SUB-SERIES ENVIRONMENT	DISTURBANCE TYPE; REGIME DESCRIPTION[1]	LANDSCAPE PATTERN
COASTAL FOG	Low relief, scattered headlands and hummocks same area as soil/ climate zone	Wet and moist *Sitka* spruce environments dominate area.	Wind dominant process; operates at two scales - (1 high to mod. frequency storms, small to medium size, and high severity. (2 low frequency storms occur at large to giant size with high severity. Fire is uncommon; low frequency, large to giant size, and high severity. American Indians and European settlers have influenced fire pattern.	Heterogeneous mix of patch sizes and seral stages; earlier seral patches most frequently small to medium, resulting from small scale wind events; large and giant patches created infrequently and move from early to late-seral conditions.
NORTH INTERIOR-TILLAMOOK	Steep, h ghly dissected relief	Western hemlock moist and dry environments dominate the area, with wet and moist Sitka spruce environments represented in western part of the block and in local fog pockets and river bottoms.	Low frequency, high severity, large to giant size fire regime. European settlement may have affected fire patterns.	Large to g ant patches moving from early through to late condition.
NORTH INTERIOR-HEBO	Low, hummocky relief with scattered peaks	All western hemlock environments present, with the moist environment dominating.	Low frequency, mod. to high severity, medium to large fire regime. American Indian and European settlement activities have severely affected fire and vegetation patterns.	Medium to giant patches, with variable remnant tree retention. Alder plays a major role in successional development from early through late-seral conditions.
CENTRAL INTERIOR-LINCOLN COUNTY	Low relief, heavily influenced by wide coastal zone and adjacent valley margin	Moist env ronments of the western hemlock series dominate; with wet and dry environments represented as well.	Fire occurs at low frequency, variable severity and medium to giant sizes. American Indian and European settlement activities have greatly influenced fire activity in this block.	Medium to giant sized patches, with high variability of remnant trees within that move from early to late-seral conditions.
VALLEY MARGIN	Valley foothills of low relief, low to mod dissection	Dry western hemlock and grand fir environments	Fire occurs at shortest intervals - mod. to high frequency; variable sizes and severities.	Variable pattern

1. **Disturbance Frequency (years)**
   Low >300
   Moderate 100-300
   High <100

Severity (% mortality)
Low <30%
Moderate 30-70%
High >70%

Size (acres)
Small <100
Medium 100 - 1,000
Large 1,000 - 10,000
Giant >10,000

Landslides, Floods and Earthquakes

Landslides, earthquakes, and floods are integral to the development of landforms, soils, and streams in this assessment area. These earth forming processes have shaped mountains and valleys over a long period of time.

Large earthflows are common in the upland areas and most abundant in the fine grained rock types of the Nestucca and Yamhill formations. These large landslides may have covered thousands of acres. The resultant surrounding topography is lower relief and hummocky.

Springs are common and drainage patterns in the hummocky topography follow an irregular pattern. Recent studies have shown that the North Oregon Coast has experienced strong earthquakes in the past (Minor and Grant 1996) and is vulnerable to earthquakes, and tsunami flooding from off-shore earthquakes; an earthquake of magnitude eight to nine on the Richter scale has been predicted from studying historic earthquakes (Priest 1995). Such an earthquake could act as a trigger for these large earthflows, especially if the ground is saturated at the time.

Debris torrents commonly originate from headwalls in the incised drainage patterns on harder bedrock like the Siletz and Tillamook volcanics. They are confined to stream channels. Alder dominates those areas which are disturbed on a regular basis. Human activities such as logging and road construction, have destabilized steep slopes throughout the assessment area, increasing the occurrence of debris slides and torrents. Instead of a single sho t period of intense landsliding, which would have normally occurred following large scale fires, repeated sliding resulted from moderately severe storms. The number of large trees available to fall into stream channels has been greatly reduced (even eliminated in some areas) making the stream network less efficient at trapping and holding sediment. Although no systematic studies of this effect have been conducted across the landscape, these activities are thought to have changed channel shape and function. Streams lack the quality fish habitat in pools and complex side channels produced by logjams. As a result, during flood events, fish lack calm water holding areas and may get swept into the lower channels or out to sea where they may not be able to survive.

Floods are the result of various combinations of heavy rainfall, melting snow, high tides, steep topography, soil conditions, vegetation cover, and landslides. Flood occurrence is expected to increase over the next twenty-year period as the climate goes from a drier cycle to a wetter cycle (George Taylor, Oregon State Climatologist). Activities that increase runoff (e.g. road development and activities which remove the vegetation, duff, or litter layer from the forest floor) may increase landslides, which may change historic conditions and further increase flooding and the occurrence of landslides. Road closures or obliterations, road improvements or maintenance to correct drainage problems, and restoration of deteriorated sites can reduce runoff and reduce the risk of floods and landslides.

3. Biological Disturbance Processes

The insects and diseases discussed in this section commonly exist at endemic levels throughout the assessment area. Insect and/or disease caused tree mortality in small pockets cattered across the landscape can significantly improve habitat diversity for many vertebrate and invertebrate species which depend upon snags and down wood. Conversely, epidemic outbreaks over large areas can severely damage high value late-successional habitat, recreation sites, and plantations and young timber stands (a significant concern of local landowners adjacent to federally managed lands).

Insects

Because large blocks of old growth (10,000 to 100,00 acres in size) no longer exist in the Coast Range Province, knowledge regarding landscape scale disturbances resulting from insect outbreaks is limited. As the amount of late-seral forest increases, several species of insects have the potential for killing large numbers of trees over areas 100 acres or more in size. Increased numbers of dead or dying trees (either snags or down logs, resulting from disturbances) will favor several species of bark beetles (*Dendroctonus spp.*). Multi-layered western hemlock canopies increase the chance of western hemlock looper (*Lambdina fiscellaria lugubrosa*) outbreaks. However, old-growth stands are also better able to withstand insect attacks, having relatively larger and more diverse populations of insect predators and more diverse tree species mixes.

Several types of insects which defoliate or kill trees are common in the assessment area, but the insect which seems to be most commonly associated with individual tree mortality or small pockets of dead trees is the Douglas-fir beetle (*Dendroctonus pseudotsugae*). The spruce beetle (*Dendroctonus rufipennis*) is also common, especially in the Coastal Fog Zone, but tree mortality caused by this bark beetle has been rare over the past ten years. However, during outbreaks the spruce beetle usually outruns natural controls until most of the mature spruce is killed. From the mid 1960s through 1990, bark beetle caused tree mortality steadily declined throughout this assessment area as a result of land managers promptly removing pockets of blowdown.

The Sitka spruce weevil (*Pissodes strobi*) causes considerable damage to the terminal leaders of Sitka spruce trees in the assessment area. The weevil is generally thought to attack trees between about eight and 30 years old and up to 50 feet in height (Furniss and Carolin 1977). Growing Sitka spruce in small dense patches appears to minimize damage in plantations in this assessment area.

Douglas-fir beetle The Douglas-fir beetle is indigenous to the Coast Range of Oregon and is extremely common. This beetle maintains its normal low level populations by infesting Douglas-fir trees which have blown down or are weakened by root diseases or other stress-causing factors. At endemic levels, small populations of Douglas-fir beetles increase by breeding and reproducing in down, injured or diseased trees which have been dead for less than one year (Furniss and Carolin 1977). After a significant disturbance event, populations will increase in down and weakened Douglas-firs to levels at which beetles, in subsequent years,

will attack and kill healthy standing trees. If significant amounts of windthrow do not occur in following years, these outbreaks typically will last three more years, with the beetles attacking and killing successively fewer trees each year (Hostetler and Ross 1996).

The general pattern of Douglas-fir beetle outbreaks is predictable. When the number of infested trees and/or fresh down logs reaches or exceeds three trees larger than 12 inches in diameter per acre, it is likely that one standing, live Douglas-fir will be killed during the following spring for every two trees which were infested during the first year. For every four trees infested and killed during the second year, it is likely that one tree will be infested and killed in the third year; and for every 25 trees infested and killed in the third year, one tree will be successfully attacked and killed in the spring of the fourth year. The actual impacts will vary due to climate, general tree and stand vigor, etc. (Hostetler and Ross 1996).

This pattern of Douglas-fir beetle outbreaks has been identified based on relatively small pockets of blowdown or standing tree mortality, so caution is being exercised in applying this experience to larger areas and numbers of recently dead trees. Since much of the assessment area is deficient in snags and down wood, projects to create large numbers of snags and down wood have been proposed. Guidelines have been developed and are being implemented to limit risk of bark beetle outbreaks during these projects. They will be closely monitored to further refine these guidelines, if necessary.

Since 1990, the number of patches of dead/dying trees on federally managed lands in the assessment area has been increasing as windthrow and resulting tree mortality is being retained to increase snag and down woody debris levels. Concerned with the increases being reported by field crews, the BLM's Tillamook Resource Area used aerial photographs taken in 1993 to examine 318 randomly selected, quarter section sized samples in thirteen sub-watersheds in the upper portions of the Nestucca River Basin. This analysis identified an average of 2.6 patches of dead trees per square mile, with a median patch size of eight dead trees per patch and a range of two to 21 dead trees per patch. Field investigations of several patches revealed that bark beetles were generally attacking and killing trees in and adjacent to root disease centers. It is quite likely that bark beetles were attracted to these patches of stressed trees and could more easily overcome them. In addition, some apparently healthy trees along the edge of the root disease infection center were attacked and killed. Survey information regarding patches of dead trees in the Upper Nestucca prior to 1990 was not available. However, insect and disease detection flights for the Siuslaw National Forest from 1985 through 1989 identified 0.3 patches of dead trees per square mile in the Middle Nestucca sub-watershed, with an average of four dead trees per patch and a range of two to eleven dead trees per patch.

Disease

Laminated root rot Laminated root rot, caused by the fungus *Phellinus weirii*, is the most widespread and damaging disease in the assessment area. It is most abundant outside of the Coastal Fog Zone, and is especially prevalent in Douglas-fir stands on the eastern slopes of the Coast Range. *P. weirii* is a native root pathogen, and therefore, is a natural part of many forest ecosystems (Thies and Sturrock 1995). Tree species differ in their susceptibility to this disease. Douglas-fir and grand fir are highly susceptible (readily attacked and killed), western hemlock and noble fir are intermediately susceptible (often infected, but seldom killed), pines

and cedars are tolerant or resistant (rarely attacked or killed), and all hardwoods are immune (Hadfield, et al. 1986).

P. weirii survives in stumps and large roots of host trees up to 50 years after the trees have been cut or killed (Hadfield, et al. 1986). Infected stumps and roots are the inoculum sources for initiation of disease in the next stand of susceptible species established on the site (Tkacz and Hansen 1982; and Lawson, et al. 1983). Susceptible trees become infected as their roots contact inoculum in the soil (Thies 1984 and Hadfield, et al. 1986). This allows the disease to continue into the subsequent stand. On infested sites regenerated with susceptible species, substantial root contact with buried inoculum from the previous stand does not often occur for ten to fifteen years (Hadfield, et al. 1986). At this time, mortality in the new stand becomes apparent. When the stand is fifteen to twenty years old, the infection may begin to spread from the initial infection source. Disease centers are believed to expand radially at the rate of about one foot per year (Nelson and Hartman 1975). Field surveys conducted by Walt Kastner and Don Goheen (1994) in 25 to 45 year old stands in the Nestucca River Basin and the Scappoose block (in the vicinity of LSR RO271, northeast of the assessment area) indicate that approximately five to eleven percent of the area within Douglas-fir stands is infested with this disease, and Douglas-fir basal area in disease centers is less than half of that in healthy portions of the stand.

P. weirii has a major influence on the character of many Douglas-fir stands in the assessment area. Tree mortality creates snags and openings in the canopy. Shrubs, hardwoods, or shade tolerant, disease resistant conifer species quickly occupy these various sized gaps (Thies and Sturrock 1995). In addition, infection predisposes trees to windthrow. Live infected trees are susceptible to attack and killing by bark beetles. Therefore, this disease can be a major source of coarse woody debris. Disease centers range in size from less than one acre to several acres (Thies 1984).

Before human activities became the dominant disturbance agents on the landscape, the distribution and spread of the fungus was probably influenced strongly by fire history and pattern. Fire determined the location, spread, and longevity of the host trees, and thus the fungus. West of the summit of the Coast Range in the Nestucca River drainage, a significant association was found between *P. weirii* and slope position in 70 to 100 year old Douglas-fir stands (Kastner, et al. 1994). The percentage of plots containing *P. weirii* infected Douglas-fir trees was highest on ridges and decreased downslope. No relationships were found, however, between the incidence of disease and plant community type or aspect. The lower incidence of disease occurrence associated with lower slope positions seems most likely related to lower trees stocking levels (especially for Douglas-fir), resulting from competing vegetation and animal damage inhibiting successful regeneration.

In an unmanaged forest, trees infected with laminated root rot often blow down, pulling a substantial portion of infected material out of the soil. In managed stands, however, timber harvesting of infested sites generally leaves infected stumps and root systems in the soil (Thies and Sturrock 1995). Prompt reforestation of these sites with highly susceptible species, such as Douglas-fir, increases the occurrence and intensity of the disease. If highly susceptible species are favored in infection centers during thinning, the effects of the disease are likely to become more severe. In stands of highly susceptible species the traditionally recommended

commercial thinning prescriptions to maximize timber production have been found to increase the spread of laminated root rot and are generally not recommended when disease is present in 20 percent or more of the stand (Thies and Sturrock 1995). During planting and thinning, favoring less susceptible or non-host species in disease centers helps reduce the spread of this disease and increases stand diversity.

Swiss needle cast Swiss needle cast has been a source of increasing concern over the last ten years in stands of Douglas-fir in the Coastal Fog Zone. The following information on Swiss needle cast is provided by Oregon Department of Forestry (ODF 1996). The disease is caused by the native fungus, *Phaeocryptopus gaeumannii*, and only affects Douglas-fir trees. Wind-borne spores infect newly produced needles in spring. Symptoms include chlorosis, premature loss of needles, reduced height and diameter growth, and occasional mortality. Diseased trees commonly retain little more than current year needles. Affected stands typically have very dense shrub layers because of increased l ght coming through the rather sparse overstory canopy. There seems to be a considerable amount of variation in the severity of symptoms exhibited by individual Douglas-fir trees in a given stand, suggesting a genetic tolerance exists within the species. Symptoms are most obvious in late winter until bud break in spring. Also, the disease appears to be more severe on southerly exposures. Although the disease is most apparent in ten to twenty year old Douglas-fir plantations, mature stands are affected as well. An aerial survey of Oregon coastal forests conducted by the Oregon Department of Forestry in April 1996 revealed that most of the obviously symptomatic stands covered approximately 130,000 acres within fifteen miles of the coast. However, a few occurrences of the disease were noted further inland.

Until recently, the disease was mainly a problem where Douglas-fir was planted outside of its natural range. The disease was apparently first discovered in Switzerland in the early 1900's. Subsequently, the disease has been reported from other European countries (Boyce 1940, Peace 1961), New Zealand (Hood and Kershaw 1975), the eastern United States (Boyce 1940), and in Christmas tree plantations in the Lake states (Morton and Patton 1970). Swiss needle cast was found on Douglas-fir in the western United States and Canada in 1938 and 1939, but no significant disease related damage was reported (Meinicke 1939).

There is considerable speculation as to why the disease has recently become so damaging within the natural range of Douglas-fir. The following are some possible explanations offered by Oregon Department of Forestry (1996): Douglas-fir may be poorly adapted to many sites in the Coastal Fog Zone. Douglas-fir planted in this zone may lack the genetic tolerance to the disease because the seed source may have been from outside of the Coastal Fog Zone, even though it may have been from the appropriate seed zone. More Douglas-fir is now in this zone than historically, thus greatly increasing the inoculum load. Changes in climate and weather patterns may have favored the disease. The pathogen may have become more virulent. Finally, soil and plant nutrient relationships may have influenced susceptibility to the disease or severity of damage.

Based on current knowledge of this disease, Federal and State land managers are developing management strategies in the Coastal Fog Zone (ODF 1996 recommendations). In establishing new plantations on high risk sites in the Coastal Fog Zone, these guidelines recommend that species other than Douglas-fir should be planted. On other sites in the Coastal Fog Zone, the

proportion of Douglas-fir planted should be small and from a very local seed source. Disease tolerant seed sources are being investigated. In managing stands on high hazard sites, species other than Douglas-fir should be favored during thinning and sites which are predominately Douglas-fir should be interplanted with non-host species.

Annosus root disease Annosus root disease, caused by *Heterobasidion annosum*, is common at endemic levels in many Coast Range stands. It may become a concern when managing stands of western hemlock in the assessment area through repeated entries over long periods. The disease can cause substantial butt decay in western hemlock that is over 150 years old, as well as mortality resulting from stem breakage (Buckland, et al. 1949 and Foster, et al. 1954). Spores of the fungus colonize freshly exposed wood on stump surfaces and stem wounds; the disease spreads to adjacent healthy trees most commonly by root contacts (Hadfield, et al. 1986). Although the rate of disease infection was nearly twice as high in commercially thinned 40 to 120 year old western hemlock stands in western Oregon and Washington compared to unthinned stands, losses due to decay were very low (Goheen, et al. 1980). Minimizing wounding during thinning operations in western hemlock stands and retention of other species to produce a mixed species stand have been successful in reducing losses from this disease (Hadfield, et al. 1986).

Armillaria root disease Armillaria root disease occurs throughout the assessment area. It can be a primary killer of healthy trees, a secondary pathogen attacking stressed trees, and a saprophytic decay fungus of dead trees (Wargo and Shaw 1985). The causal fungus is *Armillaria obscura* (Hadfield, et al 1986). Mortality is the most serious form of damage (Morrison 1981). Armillaria root disease can also cause butt rot and reduced growth (Hadfield, et al. 1986 and Morrison 1981). All conifers in Oregon and Washington can be affected by this disease, but west of the Cascades, it is usually associated with conditions that stress trees (Hadfield, et al. 1986). Mortality in Douglas-fir plantations occurs most frequently when the trees are between 10 and 25 years old. Bark beetle attacks may hasten mortality of infected trees.

As trees increase in age, they appear to increase in resistance to the disease (Morrison 1981). In mature stands in the assessment area, most infection centers are rather small, usually involving a dozen trees or less. Trees generally die standing, producing snags. Often shade tolerant conifer reproduction will be released as a result of overstory mortality, adding to the structural diversity of the stand. The causal fungus infects nearby trees primarily by mycelial growth across root contacts, with some infection occurring by rhizomorphs growing several feet through soil and contacting susceptible roots (Hadfield, et al. 1986).

Establishing and maintaining trees in a vigorous condition will help to reduce damage from this disease (Shaw and Roth 1978). Specific management recommendations include, avoiding conditions that stress trees, such as poor quality planting, reforesting sites with low quality or off-site planting stock (Hadfield, et al. 1986), injury (Wargo and Shaw 1985), and establishing plantations on sites with a high hazard of disease (Shaw and Roth 1978).

Black-stain root disease Black-stain root disease, caused by *Leptographium wageneri*, appears to have the potential to cause higher levels of mortality in Douglas-fir than any other

native pathogen (Hansen, et al. 1988). It only attacks Douglas-fir and various species of pine, *Pinus sp.* The disease appears to be increasing in both frequency and severity in Oregon and Washington. The level of infection in the assessment area, however, is relatively low at the present time. West of the Cascades and into British Columbia, the disease occurs essentially over the entire range of Douglas-fir, with the most frequent and widespread infections occurring in southwest Oregon. Increasing disease occurrence may be related to increased levels of stand disturbance (Cobb 1988).

This root disease is unusual because it appears to cause the only true wilt disease of conifers (Cobb 1988). Hyphae of *L. wageneri* block the tracheids of host trees (Hadfield, et al. 1986). Mortality can occur within a few months after infection in seedlings and saplings (Cobb 1988). Large trees may die within 2 years after infection, but some may live for 10 years or longer.

Most infections in Douglas-fir stands occur when the trees are 15 to 25 years old, with trees over 30 years old apparently developing a degree of resistance (Hadfield, et al. 1986). Disease centers generally contain dead, symptomatic, and unaffected trees. Most disease centers are less than 0.1 acre, but can be as large as 10 acres.

Long distance disease spread occurs as a result of insect vectors (Hadfield, et al. 1986; and Hunt and Morrison 1980). Two root-feeding weevils (*Pissodes fasciatus* and *Steremnius carinatus*) and a root feeding bark beetle (*Hylastes nigrimus*) are known insect vectors of black-stain root disease in Douglas-fir (Hansen, et al. 1988 and Harrington 1988). Stress appears to be an important factor predisposing Douglas-fir trees to infection via insect vectors. These insects feed and breed in the roots of low vigor trees (Hadfield, et al. 1986). Once the disease has been introduced into a stand by the insect vectors, it spreads to susceptible host trees, regardless of vigor, via root grafts and contacts or by growing a short distance through the soil. The disease has been known to spread at the rate of nearly five feet per year.

To reduce losses from this disease Hadfield, et al. (1986) suggest favoring non-host trees in thinnings, interplanting with non-host trees, and avoiding site disturbance and tree injury. In stands of host trees, thinning between June 1 and September 1 has been successful in reducing the spread of black-stain root disease.

E. VEGETATIVE PATTERNS - REFERENCE AND CURRENT CONDITIONS

Disturbance processes, plant series and sub-series environments, and successional trends influence the range of vegetation patterns on the landscape. Comparisons of the amount and distribution of the various seral stages over time allow us to evaluate landscape changes. Plants and animals have adapted to the range of natural conditions across the landscape. Knowledge of the range of patterns allows us to evaluate and prioritize future management options.

Ideally, comparisons of vegetative patterns should be made at many points in time over a long period (several hundred years) to get a complete picture of the range of natural conditions. Comparisons can provide some insight into historic pattern, and can put current condition in context of the range of natural conditions. It is rarely possible to get specific landscape pattern information for such long time periods. However, we can make assumptions about historic

landscape pattern based on what we know about historical disturbance regimes and management history.

Seral-stage distr bution was only available for two points in time. A mid 1900's seral-stage map (Map 7) covering about 60 percent of the assessment area was derived from a series of county-wide vegetation coverages (described in Appendix A) completed between 1940 and 1956. Although some industrial forest practices were in effect prior to the 1940s, this seral-stage map provides the best information available on the composition of post fire, pre-intensive forest management vegetation patterns. Since logging had been occurring on private lands for more than fifty years and intensive logging on federal lands was just beginning, we are not setting the mid 1900's time period as our desired future condition. Instead, we are using it in conjunction with what we know about disturbance regimes to compare against current vegetation pattern. The scale of the maps developed by Teensma, et al. (1991), was too coarse to be useful for th s exercise.

The current vegetation seral-stage condition (Map 8) of federal lands, including adjacent non-federal lands, were developed by combining BLM and Forest Service vegetation layers. Oregon Department of Forestry provided seral-stage condition data for State lands within the assessment area. For lands not covered by these three datasets, 1988 data from the Coastal Landscape Analysis and Modeling Study (CLAMS) vegetation coverage was used. Appendix A defines each seral stage, as used in this assessment, and describes the process used to delineate seral stages on the maps.

By comparing the mid 1900's and current seral-stage conditions, we can identify some of the effects of past forest practices on vegetation pattern. Because mapping standards between the mid 1900's coverage and the current vegetation coverage are different, care must be taken in interpreting exact vegetation distribution changes. Additionally, since a mid 1900's coverage was not available for the entire assessment area, comparisons are only made across the areas common to both coverages. The following general trends emerged from this analysis of late-seral vegetation patterns across the landscape:

- **Patch Size:**
  Late-seral patch sizes are smaller in the current condition than they were in the mid 1900's reference condition. A shift in dominant patch size from giant (greater than 10,000 acres) to medium (100 to 1000 acres in size) and small (less than 100 acres) has occurred across the assessment area.

- **Number of Patches:**
  The number of patches across the landscape in late-seral condition have more than doubled.

- **Area in Late-seral Condition:**
  The amount of the assessment area in late-seral condition has been reduced. Late-seral stands occupy 50 percent less area in the landscape under current condition than in the mid 1900s.

These trends (decreases in patch sizes, increases in the number of patches, and a significant reduction in the amount of late-successional habitat) have contributed to late-successional

habitat loss and fragmentation across the assessment area. These three trends have also been observed and documented at a larger scale in the recent Provincial Assessment Report (USDA 1995) and at the watershed scale in the Nestucca Watershed Analysis (USDA and USDI 1994c).

In the mid 1900s, the LSR R0807 (Map 2) landscape pattern was largely that of a mid to late-seral-stage forest, with approximately 43 percent of the LSR acres in the late-seral stage, and 34 percent in mid-seral stage. The vegetation pattern was the direct result of the Nestucca fire and scattered numerous settlement burns that occurred throughout the area beginning in the mid 1800s (Teensma, et al. 1991). Late-seral-stage forest occupies about as much area under current conditions (39 percent), but the area occupied by mid-seral-stage forest has been reduced to about eleven percent. Pioneer through early-seral conditions (including the pure hardwood patches) have increased, accounting for 50 percent of the current area of this LSR (Table 4).

The mid 1900's vegetation pattern in LSR R0269 (Map 2) was dominated by late-seral-stage forest, occupying 66 percent of the landscape area. Very little of the LSR was in pioneer through early-seral stages. Current landscape patterns reflect a more variable condition, with significant representation of the pioneer through early-seral stages, and an 84 percent reduction in mid-seral-stage forest (Table 4). Additionally, most of the current late-seral-stage forest is between 110 and 120 years old, and lacking in some late-successional characteristics. Survey notes from the mid 1900s and photographs from that era indicate that the late-seral stands were much older and that down logs, snags, and big trees mixed with smaller trees (some of the characteristics that we associate with old growth) were abundant.

The change from a late-seral-stage dominated forest to a predominately early-seral-stage forest is most evident in LSR RO270 (Map 2). Ninety-two (92) percent of this LSR was dominated by late-seral-stage forest in the mid 1900s. Now 70 percent of it is in pioneer to early-seral-stage stands.

Fifty-eight (58) percent of the AMA which is not designated as LSR (see *AMA* column in Table 4) is mapped in the mid 1900's coverage. Compared to other federally managed lands in the assessment area, this area currently has the lowest proportion of late-seral habitat. Late-seral-stage forest currently covers 14 percent of the landscape, a 36 percent reduction from the mid 1900s conditions. However, it has the highest proportion of mid-seral-stage forest and pure hardwood, currently 21 and 15 percent respectively. Mid-seral-stage forest occupied 24 percent of the mid 1900's landscape. This reflects the recent fire history.

Table 4. Current Seral Stage Distribution

Seral stage[1]	R0807[2]	R0269	R0270	AMA[3]
	Percent of Area			
Pioneer (0 to 10 years)	11	11	0	8
Very Early (11 to 24 years)	14	14	15	13
Early (25 to 49 years)	17	12	53	29
Mid (50 to 79 years)	11	5	1	21
Late (80 + years)	39	55	29	14
Pure Hardwood	8	3	2	15

1. See Appendix A for seral stage definitions.
2. LSR RO807 was originally mapped as LO269 in the Northwest Forest Plan (USDA & USDI 1994b) and in the Provincial Assessment Report (USDA 1995)
3. This AMA is mapped as AO907 in most coverages associated with the Northwest Forest Plan (USDA & USDI 1994b). For the purposes of this table, this column excludes the LSR lands within the AMA.

III. CONDITION OF ASSESSMENT AREA FOR WILDLIFE, PLANTS AND ANADROMOUS FISH

A. WILDLIFE

1. Late-Seral and Interior Forest Conditions

As defined at the beginning of this assessment and in the Northwest Forest Plan (USDA and USDI 1994b), the term "late-seral" is applied to both mature and old-growth stands. The term "late-successional habitat characteristics" refers to the more complex structural elements which develop in older forests: trees with deformities, larger diameter trees, trees with larger limbs, older snags, larger sizes and quantities of down woody material, and secondary canopy layers. Old-growth stands usually exhibit the greatest degree of structural complexity. Many of the species that are closely associated with late-successional habitat have been found to rely heavily on these structural components for key life history requirements (e.g., breeding, foraging). Thus, late-seral stands which provide greater structural complexity should equate to better quality habitat for these species.

Due to past fire history, homesteading and extensive forest management activities, most of the assessment area has been fragmented into patches of pure conifer, mixed stands with varying proportions of conifers and hardwoods, pure ha dwood stands, young plantations and other early-seral types (Map 8). Most of the late-seral forest within the assessment area is composed of mature stands 80 to 120 years old, with few remaining old-growth patches. Habitat for late-successional species occurs primarily in areas where road access and past timber harvest activities were difficult or restricted. Map 7 shows the condition of late-seral forest habitat in the mid 1900s (prior to extensive logging), while Map 9 shows the current amount and distribution of larger patches (greater than 2000 acres) of late-seral stands. Mature forest patches currently occupy approximately 31 percent of federal lands within this assessment area; less than four percent of the federal land is old-growth forest.

Fragmentation of the forest has diminished the amount and quality of interior forest habitat. Interior forest habitat is defined as the portion of a stand which is beyond the influence of adjacent stand edges. Changes in understory vegetation, species composition, microclimate, and stand dynamics have been shown to occur for a distance of up to three tree lengths into the late-seral forest interior from the forest edge (Chen 1991, Concannon 1996). For this analysis, edge-effects on late-seral forest stands on federal lands were modeled with the following constraints: (1) high-contrast edges (pioneer to early-seral stands) were assumed to produce an edge-effect extending 500 feet into late-seral stands, and (2) low-contrast edges (mid-seral stands) were assumed to produce an edge-effect extending 100 feet into adjacent late-seral stands.

Table 5. Conditions of Known Spotted Owls Sites within the Northern Coast Range

Landowner	Total Number of Active Sites	Number of Viable Sites[1]	Sites Protected within RPAs
Forest Service	10	6	10
BLM	16	3	16
State lands	4	-	-
Other[2]	9	-	-
Totals	39	9	26

1. Sites with less than 40 percent suitable habitat (approximately 1,900 acres) within a 1.5 mile radius of the site are considered to be marginally viable. Habitats on all ownerships within 1.5 miles of site centers were analyzed.
2. Other landowners include: State, County, Tribal, and private.

An RPA incorporating all federal land allocations was delineated for a cluster of owl activity centers within the Cascade Head Experimental Forest (CHEF), the adjacent Cascade Head Scenic Research Area (CHSRA), and the Kellow/Butte block (a 500 acre block of federally managed land north of the CHEF). This proposed multi-site RPA was delineated according to guidelines established in the ROD to determine the number of suitable acres available to the Cascade Head and Kellow/Butte owls. Because there were not enough suitable acres within this proposed multi-site RPA to meet ROD guidelines, suitable acres on federally managed lands northeast of the CHEF boundary were incorporated into the RPA. **Within** CHEF and CHSRA, the RPA designation and the associated standards and guidelines do **NOT** apply because the Northwest Forest Plan designated these areas as Congressionally Reserved or Administratively Withdrawn. They are not a part of the Northern Coast Range AMA. **Outside** of CHEF and CHSRA, suitable habitat within the home ranges of the Cascade Head and Kellow/Butte owl pairs would be designated as RPA. Management of owl and murrelet habitat within CHEF and CHSRA must be consistent with the Endangered Species Act and is subject to consultation with the United States Fish and Wildlife Service.

2. Connectivity

Landscape connectivity provides for biological and ecological flows that sustain late-successional animal and plant species (FEMAT IV-52). The term "connectivity" may have different connotations depending on the species, ecological process or scale being considered. Connectivity for large home range species such as spotted owls will require a landscape perspective while a stand or group of stands may be sufficient for a small mammal.

Connectivity within Assessment Area

Patches of late-seral habitat are linked through riparian reserves on federal lands, critical habitat designated for marbled murrelets on federal lands, occupied marbled murrelet nest sites, activity centers for the northern spotted owl on federal lands, and forested State Parks. Because CHEF and CHSRA have a large amount of contiguous late-successional habitat, they are a critical link within the Core Landscape Zone. A Habitat Conservation Plan (HCP) is being developed for State forest lands, where late-seral linkages with federal lands will likely be maintained in the short or mid-term (twenty to 30 years), but may shift across the landscape over the long term. Forested headlands, such as Cascade Head and Cape Lookout, provide a north-south link of late-successional habitat and an east-west link with interior forests; these connections may be especially important for ocean foraging birds with large ranges, such as the bald eagle and marbled murrelet.

For species that travel long distances, connectivity exists across landscapes which meet the conditions for spotted owl dispersal habitat (50 percent of the forested landscape consisting of forest stands with a mean diameter at breast height of eleven inches or larger, and a canopy closure of 40 percent). Generally 35 to 40 year old stands with at least 60 trees per acre achieve this condition. For upland species, such as the red tree vole (the only "Survey and Manage" mammal within the assessment area), stands over 30 years old provide adequate connectivity (USDA and USDI 1996b). Less mobile species (i.e., salamanders, ground beetles, fungus) may persist only in mature forest patches which serve as refugia between larger blocks of late-seral stands.

As shown on Maps 2 and 3, the AMA includes blocks of public land (primarily federal and state), tribal land (in blocks or scattered parcels), private industrial forest land, and an area of checkerboard ownership of public land (BLM and State intermingled with private). Because most of the checkerboard public lands are in early-seral habitat conditions, any remaining mature forest is highly fragmented. Private lands can generally be classified as industrial forest lands, small private "in-holdings", agricultural lands (including rural residential) or town. Many of the industrial forest lands are currently less than 60 years old and assumed to be managed on short rotations (40 to 60 years between regeneration harvests) into the future. Agricultural and rural residential lands are likely to remain in early-seral conditions, as are small woodlots. Towns and cities support only a few native species and are not counted as a seral habitat condition.

Riparian areas on state and industrial forest lands will meet the requirements set forth in the Oregon Forest Practices Act, but are not likely to meet the standards of the Northwest Forest Plan for Riparian Reserves. Agricultural and rural residential riparian areas will be subject to county zoning ordinances, as recommended by the State of Oregon Department of Fish and Wildlife and by the Division of State Lands, but also are unlikely to meet the Riparian Reserve standards. In some areas, the extent of private lands between public lands limits connectivity between LSRs within the AMA.

Connectivity Between This Assessment Area and Adjacent LSRs

Outside of the assessment area, links to the north and northeast will rely on State Forest and occupied owl, murrelet, and bald eagle sites on BLM lands. The Tillamook State Forest extends north of the AMA and will likely provide at least twenty percent of the mature forest to support these species. Links to the north are sparse and end at the Columbia River. There is no late-seral habitat across the central Willamette Valley, providing linkage to the Cascades. Habitat patches in the south form the only connection for species migration into and out of the northern Coast Range. The large expanses of private lands surrounding these habitat patches are not managed to provide late-seral conditions (i.e., rotation ages are usually less than 60 years) and are therefore likely to inhibit late-seral connectivity south of the assessment area.

3. Wildlife Habitat Diversity within the Assessment Area

Since the predominant habitat type within the Oregon Coast Range historically was a forested ecosystem, most of the forest associated species in this assessment area adapted to environments with little or no forest fragmentation and relatively long disturbance return intervals (Teensma, et al. 1991 and Agee 1991). Since the early 1900's, habitat alteration and fragmentation by fire, settlement and timber harvest have resulted in an increase in species which prefer openings (Lehmkuhl and Ruggiero 1991). Within the Oregon Coast Range, McGarigal and McComb (1993) noted that most wildlife species are more strongly associated with early- or late-seral conditions than with mid-seral conditions. Appendix D lists wildlife species known to occur within the AMA boundary, including those associated with snags and down wood (Appendix D.2), coniferous forests (Appendix D.3), hardwood forests (Appendix D.3), grasslands (Appendix D.3), wetlands, and the ocean/ shoreline interface. Several threatened species and *federal species of concern*, taxa whose conservation status is of concern to the USFWS but for which further information is still needed, inhabit special habitats within the assessment area.

Wildlife Species Associated with Snags and Down Wood (CWD)

For many species, snags and down wood are key habitat features in one or all seral stages. Both snags and down wood, known collectively as coarse woody debris (CWD), provide a substrate for species foraging on invertebrates, fungi and lichens. Snags and down wood also provide dens and nest sites for birds, large and small mammals, amphibians and reptiles. Down wood retains moisture, providing the necessary microclimate for amphibians. Mammals use down wood as travel corridors, denning sites and cover.

Nesting cavities are excavated in dead or dying trees by species such as the pileated woodpecker. These cavities are later used by secondary cavity nesters. Requirements for nest hole size, snag diameter and snag height differ by species. Chickadees will nest in snags that are minimum of nine inches in diameter and ten feet tall, while minimums for Vaux's swifts and pileated woodpeckers are 25 inches in diameter and 40 feet tall (Brown 1985).

Due to past fire history and previous harvest or salvage practices, the large snag and down wood component is lacking throughout much of the assessment area. Carey and Johnson (1995) found that the abundance and diversity of small mammal populations related to the amount of cover provided by understory vegetation and, especially, down wood. Restoration of the CWD component is crucial to the development of foraging habitat for predators such as the spotted owl. Active recruitment of CWD should be considered as a major component of habitat development for stands at any age within this assessment area, especially within RPAs. In stands less than 50 years old, growing large trees for future CWD input should be one of the primary treatment objectives.

Wildlife Species Associated with Conifer Dominated Forests

Species associated with conifer dominated forests include the northern spotted owl and marbled murrelet (previously discussed), the Pacific fisher (a federal species of concern) and the red tree vole, a late-seral associate identified in the Northwest Forest Plan as a "Survey and Manage" species. Between patches of mature forest, connectivity and suitable habitat for the red tree vole should be provided in fifth-field watersheds with over ten percent federal lands which are 40 percent forested with stands at least 30 years old (USDA and USDI 1996b). Riparian reserves may not provide the necessary connectivity between habitats because red tree voles are associated with mid to upper slopes.

Several neotropical migrant birds with declining populations are associated with conifer dominated forests, notably the Vaux's swift, the western tanager, and the varied thrush (Andelman and Stock 1994). Other coniferous forest species include the brown creeper and the red-breasted nuthatch (bark foragers), the red crossbill and pine siskin (coniferous seed eaters), the northern goshawk, the American marten, the flying squirrel, and the Douglas squirrel (McGarigal and McComb 1993).

Bald eagles rely on coniferous patches for nest sites. Nest sites are usually close to foraging areas and depend on tree height and topography for views of the surrounding area. There are currently fifteen active nest sites within the AMA boundary: four on National Forest, three on BLM, one on State Forest, two on State Parks and the remaining on private lands. Three additional areas on National Forest land were designated as alternate sites through the Pacific Bald Eagle Recovery Plan (USDI-USFWS 1986).

Wildlife Species Associated with Hardwood Dominated Forests

Alder dominated communities are an important component of this assessment area. Appendix D.3 lists species within the assessment area which are associated with alder dominated forests, both upslope and riparian. If alder dominated habitats are not maintained, populations of alder associated species will decline. The white-footed vole is a species of concern that is strongly associated with riparian alder, especially in small stream habitats (Gomez 1992, Maser 1981). Other alder forest associates include two federal species of concern, Yuma and long-legged bats (McGarigal and McComb 1993), and two neotropical migratory birds with declining populations, the western wood-pewee and Wilson's warbler (Andelman and Stock 1994).

Oregon white oak dominated forests are scattered throughout the Willamette Valley and the eastern edge of the Coast Range, where they serve as the primary habitat for western gray squirrels, acorn woodpeckers and wintering Lewis' woodpeckers.

Wildlife Species Associated with Early-Seral Habitats

Species which prefer a combination of early-seral and forest edge habitats include black-tailed deer and Roosevelt elk. While portions of their life cycles (feeding, breeding, and resting) are associated with pioneer through early-seral conditions, these species depend on mid to late-seral habitat for thermal and hiding cover. Management of the federal lands towards late-seral forest conditions will likely result in lower population densities of these species over time.

The grassy coastal headlands of The Nature Conservancy's Cascade Head Preserve and the meadows within the Mt. Hebo Scenic-Biological Special Interest Area are critical habitat for the f derally threatened Oregon silverspot butterfly. Meadows and grasslands provide habitat for ground feeding and nesting birds, such as the American goldfinch, a neotropical bird with a declining population (Andelman and Stock 1994). Other neotropical migrants, such as Western bluebirds, are associated with open areas (e.g., meadows) which have snags suitable for nesting.

Ocean cliffs and off-shore rocks with nesting seabirds and foraging sites for the federally threatened northern bald eagle and the federally endangered peregrine falcon are protected as part of the Oregon Islands and Three Arch Rocks National Wildlife Refuges, Cape Meares, Cape Lookout and Cape Kiwanda State Parks, and the Cascade Head Scenic Research Area.

Estuaries and sandy beaches provide wintering, breeding and foraging habitat for many species of shorebirds. The snowy plover a federally threatened species, nests on unstabilized sand on ocean beaches. Bay Ocean Spit is the only area in the AMA with recent nesting activity and is likely to be designated as critical habitat for the recovery of the species.

Estuaries, lakes, wetlands, coastal pastures and Willamette Valley croplands support a wide diversity of animal species such as wintering waterfowl, hawks, falcons and short-eared owls. Some of these areas have been protected in State Game Refuges (E. E. Wilson and Carlton), National Wildlife Refuges (Basket-Slough, Ankeny, Siletz Bay and Nestucca Bay). The Nestucca Bay National Wildlife Refuge was set up to protect the Aleutian Canada Goose, a federally threatened species. The Cascade Head Scenic Research Area includes an estuary which the Forest Service is in the process of restoring. It will provide additional habitat for wintering waterfowl, anadromous fish, and invertebrates.

B. PLANTS

Appendix E lists special status plants known to occur within the assessment area and Appendix F lists several special management areas on federal and non-federal lands (Map 11). These areas support a wide variety of unique and declining habitats, important for maintaining the biological diversity of this landscape. These sites include The Nature Conservancy (TNC) Preserves at Cascade Head and Bradley Bog, the Mt. Hebo Special Interest Area (SIA, also referred to as the Mt. Hebo Scenic/Biological Area), the Cascade Head Scenic Research Area on National Forest System lands, several Research Natural Areas (RNAs) on National Forest and BLM lands, and BLM Areas of Critical Environmental Concern (ACECs). Several sensitive species and federal species of management concern occur within RNAs, ACECs and the Mt. Hebo SIA, where their protection has, in part, kept these plants from being listed as threatened or endangered.

As with wildlife species, management for many of the federal and state listed species needs to maintain pioneer and early-seral habitats and is not compatible with the development of late-successional characteristics. Many plant species native to wetlands and oak savannahs of the Willamette Valley have been extirpated from their native sites by land development and now exist only in small, isolated populations within the Valley Margin and Interior Zones. Species occurring in these isolated populations include Nelson's checkermallow (*Sidalcea nelsoniana*), a federally threatened species; burning bush (*Euonymous occidentalis*); California swordfern (*Polystichum californicum*); the lichen *Usnea longissima*; and tall bugbane (*Cimicifuga elata*), a federal species of concern. Another species associated with open canopies and high water tables is loose-flowered bluegrass (*Poa laxiflora*), a former federal Category 2 species. Due in part to the conservation management plan prepared in April 1992, this species has since been downlisted. Large populations of the plant are being maintained and monitored within the assessment area. Many of the sites to be maintained are within LSRs and will contribute to habitat diversity.

1. Survey and Manage Plant Species

Of the more than 200 plants, primarily non-vascular, that are listed as "survey and manage" species in Table C-3 of the ROD, 182 species are found in forested habitats. Of these, 177 are strongly associated with late-seral forests. Similarly, of the 39 species which are found in riparian or wetland habitats, 30 are strongly associated with late-seral forests (USDA and USDI 1994c). Several non-vascular "survey and manage" species have been found within the assessment area and others are likely to occur. Little is known concerning vascular and non-vascular plant and fungal species distribution. Standards and guidelines for survey protocols and plans for the implementation of these surveys are being developed by interagency work groups established by the Regional Ecosystem Office (REO) in November, 1994. "Survey and manage" species have been documented within Cascade Head Scenic Research Area, the Van Duzer Corridor, and several of the RNAs and ACECs. Other sites are being managed to protect populations of fungi and lichens. Because mosses are an important forest product, the effects of moss collection will continue to be monitored.

IV. IDENTIFICATION OF SPECIFIC AREAS FOR TREATMENT

A. LANDSCAPE ANALYSIS

The objective of forest management in LSRs is to create, protect, and enhance characteristics of late-successional forest ecosystems. Attainment of some late-successional characteristics can be accomplished, and even accelerated, by focusing treatments both spatially and temporally. Landscape level functions and processes should be considered when developing a strategy for future management activities. The following section defines a landscape analysis process and describes the resulting design, based on the current condition and the objectives for LSRs and the Northern Coast Range AMA, as identified in the ROD. This design should serve as a basis for planning management activities. The main objectives for landscape analysis and design in this assessment area are to:

- Set federal lands in context of the surrounding landscape.
- Identify blocks in federal ownership where various treatments may be applied.
- Develop landscape level goals that provide focus and direction for fine scale treatments, helping to set watershed analysis areas in context of their role in the larger landscape.
- Prioritize landscape areas for treatment.
- Maintain and restore late-successional ecosystem processes critical to ecosystem function in this assessment area.
- Identify landscape scale, adaptive management learning opportunities and monitoring methods consistent with the standards and guidelines for the Northern Coast Range AMA.

This landscape design was based on the concept of securing the best late-successional habitat first, developing corridors connecting the best habitats together, and then working with more degraded habitats. "Securing the best habitat first" refers to the process of:

1) Identifying the least fragmented areas which are currently functioning as late-successional habitat or have the highest potential for developing late-successional characteristics in a relatively short timeframe.
2) Protecting those portions of the area which are already functioning as late-successional habitat from activities which damage or detract from late-successional characteristics.
3) Treating those portions of the area which have been degraded or are not yet functioning as late-successional habitat. Treatments include road closures, road obliteration, silvicultural treatments to accelerate development of late-successional characteristics, creation of snags, creation or addition of down logs, and treatments to restore aquatic habitats.
4) Monitoring to ensure that the habitat is developing as planned and evaluating it to determine if it is functioning as late-successional habitat.

1. Landscape Zones

The first step in landscape design was to identify the current and potential function of various areas at a relatively coarse scale. Functional areas were derived from a synthesis of physical and biological attributes, as well as disturbance processes. A dominant consideration was the past and current ability of portions of the landscape to produce contiguous late-successional habitat. Other areas provided landscape scale connectivity to and from adjacent LSRs. Three zones were delineated based on landscape function. These **Landscape Zones** are described below.

The **Core Landscape Zone**, located in the western portion of the assessment area (Map 13), is primarily managed by the Siuslaw National Forest, and contains large blocks of contiguous land which is in federal ownership. Disturbance regimes in this area have historically resulted in large patches within the assessment area. Most of the spotted owl sites with sufficient habitat to be considered viable in the immediate future are located within the Core Landscape Zone. As a result, the intended function of this Core Landscape Zone is to provide the genetic source for populations of late-successional species (especially those with large home ranges).

Blending aquatic and terrestrial priorities for restoration prov des a focus for restoration activities over the entire landscape, from stream channels to ridgetops. The two largest Key Watersheds (Map 12) in the analysis area, Upper Nestucca and Drift Cr ek (Siletz), are located in the Core Landscape Zone (Map 13). Both are high priorities (priority 1 and 2, respectively) for fish habitat restoration projects. Objectives, goals, and restoration treatments developed under the Aquatic Conservation Strategy (ROD B-11 through B-34) are usually compatible with those developed for LSRs.

The **Corridor Landscape Zone** (Map 13) is located to the north and to the south of the Core Landscape Zone. These areas are intended to provide a key connectivity function to the surrounding LSR network, as well as adjacent state and private lands. Currently, the majority of spotted owl sites within these areas do not contain adequate levels of suitable habitat and are considered to be marginally viable as described in Chapter III. Habitat restoration on federal lands will improve this condition. Because of the checkered federal ownership patterns within the Corridor Landscape Zone, this zone is intended to provide refugia areas along travel routes for late-successional forest species which are dispersing to and from the populations in the Core Landscape Zone to adjacent late-successional habitat outside of the Core Landscape Zone.

The southern Corridor Landscape Zone provides the closest federal land links from this landscape to LSR R0268. The northwestern and northeastern corridors are important connections with state lands and they provide the closest federal land links from this landscape to LSR R0271. A Habitat Conservation Plan is being developed for the Tillamook State Forest, where patches of late-seral habitat will be located throughout the State forest, rotating through different areas over long periods of time. These Corridor Landscape Zones may provide for continual passage of species across the entire landscape.

Three key watersheds are located within the Corridor Landscape Zone. The Little North Fork of the Wilson River Key Watershed lies in the northwest portion of the northern corridor, while the Middle Fork of the Trask River Key Watershed lies in the northeastern portion of the northern corridor. The southern corridor contains the North Fork of the Siletz River Key Watershed.

The **Buffer Landscape Zone** is that portion of the assessment area which does not directly link to areas outside of this area and is not likely to develop large, contiguous blocks of late-successional habitat. It is likely to be important for connectivity and dispersal of some organisms to and from isolated portions of LSR RO807 (Maps 2 and 13) and is intended to provide refugia for late-seral species in portions of the assessment area which are likely to continue to be dominated by early and mid-seral stands.

Portions of the Corridor Landscape Zone and the entire Buffer Landscape Zone are in fire disturbance regimes which historically produced variable patch sizes with more seral-stage variability than would have been found in the Core Landscape Zone. Intermediate disturbances in the northeastern and southern Corridor Landscape Zones, and the Buffer Landscape Zones were common, and the multi-layered characteristic of late-successional forests may have been established at a younger age in portions of these zones. As a result, this area will support a different species mix of organisms than the Core Landscape Zone. These areas have the potential to support isolated populations of threatened, endangered or sensitive plants and late-successional animal species that have small home ranges.

Based on the potential ecological functions of these different areas, goals for each zone were established for managers to consider when prescribing activities within the assessment area.

CORE Landscape Zone goals:

- Minimize fragmentation. Provide large, contiguous patches of late-successional habitat and maximize interior forest habitat.
- Increase connectivity and dispersal habitat within the large interior blocks and develop late-successional habitat in the mixed-seral areas adjacent to the large interior blocks.

CORRIDOR Landscape Zone goals:

- Improve, create, and maintain late-successional habitat connectivity and dispersal habitat across the assessment area, especially between Reserved Pair Areas.
- Increase late-successional habitat connectivity and dispersal habitat within the larger network of LSRs and with late-seral blocks on state and private lands outside of the assessment area.

BUFFER Landscape Zone goals:

- Maintain and increase late-successional habitat connectivity and dispersal habitat.
- Develop and maintain refugia for late-successional-dependent species.

Goals common to all Landscape Zones:

- Maintain and restore habitat to support well distributed populations of late-successional forest species.
- Conserve biodiversity, including special habitats.
- Protect from wildfire, especially along high use travel corridors and on the mixed ownership areas in the Corridor and Buffer Landscape Zones.
- Consider land exchanges and changes in land use allocations wherever it assists in attainment of the above goals.

2. Landscape Cells And Treatment Priorities

The current condition of the landscape was used to further divide the assessment area into **Landscape Cells**. The current vegetation seral-stage condition used to describe vegetation patterns in Chapter II, was used to determine the distribution of late-seral-stage forest across the landscape (Map 8). Patches of late-seral forest were considered to be contiguous if they were connected through forested corridors as narrow as riparian buffers. The initial landscape analysis was done for the entire assessment area, including all ownerships and all land-use allocations (AMA, LSR, and Congressionally Reserved or Administratively Withdrawn) on federal lands. The landscape was divided into three types of landscape cells: **Late-Seral Landscape Cells**, having at least 50 percent of the cell in late-seral-stage forest; **Mixed-Seral Landscape Cells**, with 20 to 35 percent late-seral-stage forest; and **Early-Seral Landscape Cells**, consisting of less than 10 percent late-seral-stage forest. (The proportion of late-seral habitat would be much higher if only federal lands were considered.) Landscape cells were then placed in context of the Landscape Zones (Map 14). Treatment priorities for landscape cells and zones apply only to federally managed lands.

The Landscape Zones and Cells Map (Map 14) was developed to portray the <u>concepts</u> of the landscape analysis and design. These cells and zones are <u>not</u> intended to be additional land-use allocations. At the scale of this assessment, the boundaries are conceptual. It is inappropriate to calculate acreages of certain treatment opportunities within these cells and zones. Watershed and project level analyses may define where and to what extent these landscape analysis and design concepts apply.

Using these Landscape Zones and Cells, priorities for management activities were based on the objectives of securing the best late-seral habitat first, developing corridors connecting the best habitat together, and working to improve the more degraded habitats:

- **Priority 1** was assigned to the large, contiguous blocks with a high proportion of late-seral-stage forest. These areas have the best potential for developing large blocks of interior, late-seral habitat. Priority 1 areas emphasize protection of existing late-seral habitat and conservative levels of enhancement treatments which have a high degree of certainty that such treatments will be successful and will accelerate the development of late-successional forest habitat.
- **Priority 2** areas have the highest potential for providing key connectivity within and beyond the assessment area. These areas have at least moderate levels of late-seral-stage

forest and are good areas to focus on developing late-successional habitat which expands the existing late-seral-stage forest in these cells and builds out from the blocks which were designated as Priority 1.

- **Priority 3** areas currently have very little late-seral-stage forest, but are critical to the development of a fully-functioning network of LSRs. These areas emphasize creating late-successional habitat and providing connectivity between large blocks of late-successional habitat. A considerable amount of effort will be required to restore these landscapes.
- **Priority 4** areas contain small patches of late-seral-stage forest which are not located in Core or Corridor Zones. Priority 4 areas emphasize maintaining and developing local connectivity and refugia.
- **Priority 5** areas have very little to no late-seral-stage forest and are not located in Core or Corridor Zones. Some of these lands contain small patches of late-seral-stage forest which are important to maintain and expand to the extent possible. Priority 5 areas emphasize maintaining late-seral refugia and the habitat diversity which they provide, while recognizing the limita ions of small parcels of federally managed land in a mid to early-seral-stage landscape.

These priorities apply to the specific Landscape Cells as follows:

Late-Seral Landscape Cells are only located in the Core Landscape Zone (Map 14) - These cells encompass the largest contiguous blocks of late-seral-stage forest, having at least 50 percent of the cell in late-seral-stage forest. They contain many of the spotted owl and marbled murrelet occupied sites. The minimum late-seral patch size is 2,000 acres. Existing late-successional species populations in these cells provide the foundation for recovery of these species in the assessment area. Management activities which "trade off" long term gains in late-successional stand composition and structure for short term negative impacts (habitat loss and disturbance) are generally **NOT** appropriate. **Treatment Priority =1**.

Management goals within the Late-Seral Landscape Cells include:

- Manage existing late-successional habitat to avoid activities which may damage or degrade late-successional characteristics.
- Emphasize road closures consistent with the Access and Travel Management (ATM) Plans /Transportation Management Objectives (TMOs).
- Identify Key Watersheds and anadromous fish "core areas" which need restoration and apply silvicultural treatments which have a high degree of certainty that such treatments will be successful and will accelerate the development of late-successional forest habitat.
- Treat the complete range of seral stages. Accelerate stands which lack late-successional habitat characteristics through successional pathways by prescribing treatments which set stands on the appropriate trajectories **with a limited number of entries**.
- Leave some untreated stands in each of the seral stages to develop on a slow trajectory toward late-successional habitat for the following reasons:
  - ⇒ to provide a continuous supply of snags,
  - ⇒ to provide dense hiding cover,
  - ⇒ to provide untreated stands for comparison with treated stands,
  - ⇒ and to provide dense young stands, often a missing component on this landscape.

Mixed-Seral Landscape Cells located in the Core and Corridor Landscape Zones (Map 14) - These cells have a wide variety of seral classes. The late-seral-stage forest in these Landscape Cells ranges between twenty and 35 percent and occurs in patches 100 to 1000 acres in size. A number of spotted owl and marbled murrelet occupied sites have been identified in these cells. **Treatment Priority = 2**.

There are three overall management goals for this Landscape Cell:

- "Grow out" from the adjacent large blocks of late-seral-stage forest in the Late-Seral Landscape Cells. Specific management goals in these areas are exactly the same as for the Late-Seral Landscape Cells.
- Create new and enlarge existing patches of late-seral-stage forest within this zone. Prescribe treatments which attain late-successional characteristics by following the sub-series environment successional pathways described in Chapter V. Treatments may be scheduled in multiple entries.
- Identify Key Watersheds and anadromous fish "core areas" which need restoration and apply silvicultural treatments which have a high degree of certainty that such treatments will be successful and will accelerate the development of late-successional habitat.

Early-Seral Landscape Cells located in the Core and Corridor Landscape Zones (Map 14) - They are currently dominated by early-seral-stage forest. Less than 10 percent of the landscape is in late-seral-stage forest. Several Key Watersheds and anadromous fish "core areas" are located in these cells. These areas are the highest priorities for restoration treatments. **Treatment Priority = 3.**

Specific management goals within these areas are:

- Identify Key Watersheds and anadromous fish "core areas" which need restoration and apply silvicultural treatments which have a high degree of certainty that such treatments will be successful and will accelerate the development of late-successional forest habitat.
- Maintain and enhance dispersal habitat for late-seral associated species.
- Protect and buffer existing small patches of late-successional habitat.
- Apply silvicultural treatments around T&E species locations to enlarge existing small, scattered patches of late-seral-stage forest. Silvicultural treatments need to have a high degree of certainty that they will be successful and that they will accelerate the development of late-successional forest habitat.
- Concentrate on reducing or eradicating exotic species.

Mixed-Seral Landscape Cells located in the Buffer Landscape Zone (Map 14) - These cells contain scattered small patches (100 acres or less) of late-seral-stage forest. **Treatment Priority = 4**.

Specific management goals are the same as the Early-Seral Landscape Cells located in the Core and Corridor Landscape Zones. In addition:

- Maintain diversity by managing special habitats for non-late-successional species (e.g., prescribed burning).
- Maintain natural processes.

Early-Seral Landscape Cells in the Buffer Landscape Zone (Map 14) - contain less than 10% late-successional habitat. An anadromous fish "core area" is located in the Trask River Watershed and may be a high priority for restoration treatments. **Treatment Priority = 5**.

Specific management goals are the same as the goals identified in the Mixed-Seral Landscape Cells in the Buffer Landscape Zone.

The remote and isolated BLM parcels which are within the assessment and outside of the AMA boundary, fit well with the priorities and goals identified for Mixed-Seral Landscape Cells in the Buffer Landscape Zone (applies to the LSR RO269 parcels, approximately 40 acres) and for Mixed-Seral Landscape Cells in the Corridor Landscape Zone (applies to the LSR RO807 parcels, approximately 260 acres).

B. APPLYING TREATMENT PRIORITIES

Treatment priorities identified in this chapter are recommended ways to achieve landscape level goals and objectives and are intended to assist managers in developing schedules for planning and implementation of watershed analysis (see watershed analysis schedule for this assessment area, Appendix G), leading up to project level planning and implementation schedules. As watershed analyses are completed, they will identify issues and priorities which will further define the location and timing of management activities. The general priorities are: first, securing the best potential late-successional habitat; second, developing corridors connecting the best habitats; and third, restoring degraded habitats. Existing habitat quality and needs for connectivity may modify the priorities for treatments within landscape cells. On National Forest lands within the Core Landscape Zone, the Hebo Ranger District has developed landscape priorities which blend treatment priorities in the Late-Seral and Mixed-Seral Landscape Cells (Appendix H).

Treatment priorities are often refined at the project level. At the level of individual stands, treatment priorities can be implemented by first securing and protecting individual stands with the highest quality late-successional habitat, next focusing on linkages between stands, and finally developing or expanding refugia in areas where late-successional habitat is lacking.

Treatment priorities also apply to non-silvicultural treatments which stabilize degraded sites, improve soil productivity, and enhance late-successional characteristics (i.e., road closures and obliterations).

Landscape Design Links to the Adaptive Management Area

Management activities can accelerate the development of many features of late-successional forests and healthy aquatic habitat (e.g. big trees and high quality snags and logs). In addition, one of the AMA objectives is to provide economic benefits to local communities, for which timber is an important resource. Although it may be possible to sustain late-successional species on an entire landscape by providing the highest quality conditions (e.g. high amounts of high quality snags and logs) on a smaller portion of the landscape, management activities may damage some species and processes (e.g. fungi, competitive stress, continuous input of woody debris) that are critical components of late-successional ecosystems. Therefore, it is advisable to implement alternative strategies to meet late-successional goals on landscape units large enough to evaluate their effects on a range of species and ecosystem processes.

The landscape analysis and design process included all LSR and AMA lands within the assessment area (Map 2), allowing us to assess ecological processes and functions across the entire assessment area. Although small scale adaptive management research can occur in many places, opportunities to test and refine landscape level assumptions regarding the development and maintenance late-successional habitat are limited because non-LSR lands within the AMA are relatively small and scattered or are predominantly alder or young managed stands. Portions of LSR RO807 were identified as lacking much of the structure associated with late-successional habitat and not likely to develop this structure for quite some time, making them likely candidates for testing and refining silvicultural treatments which will accelerate the development of late-successional forest habitat and have a high degree of certainty that they will be successful. Carefully designed, developed, and monitored landscape level studies would allow analysis of these treatments at the landscape scale.

A process using the adaptive management concepts at the landscape level is described below. Landscape level questions and the landscape cells which appear to be most appropriate for studying these questions are recommended. Within LSRs, the landscape or fine scale adaptive management strategies selected must meet Late-Successional Reserve standards and guidelines (ROD D-11) and should meet the goals and objectives identified in the landscape design process, as well as fine scale specific needs or issues (i.e., special habitats, T&E species populations, etc.). Landscape level studies within LSRs should be carefully designed and developed in conjunction with the research community and the general public. Study design and implementation should be reviewed by the REO Research and Monitoring Committee for compliance with the ROD.

The **Hebo Late-Seral** and the **Upper Nestucca Mixed-Seral Cells in the Core Zone** (Map 14) are recommended as cells in which it would be appropriate to apply treatments which meet LSR standards and guidelines while providing sustainable commodities over time. One of the most basic questions that needs to be addressed in this AMA is if there is a particular level of timber harvest that is compatible with providing late-successional habitat. A recent study (Tappeiner, et. al. 1997) identified that old-growth stands in the Oregon Coast Range generally developed at relatively low stocking levels (40 to 50 trees per acre). In this assessment area, trees can be grown at stocking levels which exceed these natural levels. Alternative

management options could be selected to provide appropriate levels of late-successional habitat (focusing on the structural and compositional components described in Chapter V), while producing some viable level of timber harvest.

The **Hebo Late-Seral Cell** is also recommended as the appropriate place to study the various approaches for achieving Late-Seral Landscape Cell objectives and goals, especially the goal of accelerating attainment of late-successional habitat characteristics and reducing fragmentation as quickly as possible. Many strategies which will achieve these goals and objectives have been proposed, but some may be more effective or efficient than others.

The Upper Nestucca Mixed-Seral Cell has the highest level of managed stands 80 to 110 years old within the assessment area and, because of an extensive commercial thinning program generally lacks the structure associated with old-growth stands. The Hebo Late-Seral Cell was selected because the older natural stands are predominately 80 years old; due to commercial thinning and previous planting of off-site stock, the forest lacks much of the structure associated with old-growth tands. Proposed Reserved Pair Areas (RPAs) have been delineated within these cells and provide an opportunity to compare the effects of more passive management activities within RPAs with more aggressive treatments outside of RPAs.

The role of red alder in coastal forest ecosystems is a major concern in the Northern Coast Range AMA. The **Lower Nestucca Mixed-Seral Cells in the Core Landscape Zone** were identified to examine the function and significance of red alder, particularly in the development of late-successional habitat. Only a small portion of these cells are designated as LSR. Treatments in the LSR within these cells could take a more conservative approach; al owing a der to remain on the site for a longer period of time, treating Riparian Reserves to re tore fish habitat, underplanting of conifers in small natural or created openings to initiate conifer establishment, etc. Acceleration through successional pathways by various means could be tested in these cells outside of the LSR and contrasted with treatments in the LSR.

It was not necessary to identify research opportunities in the Corridor Landscape Zone, as research on treatments which accelerate corridor function can be examined at the landscape scale in the Mixed-Seral and Early-Seral Cells not designated as LSR. Management actions in RPAs could be compared with active management in adjacent areas to test treatment effectiveness.

Many of the processes and issues in the Buffer Landscape Zone occur at scales finer than the landscape level (i.e., special habitats, fire patterns, dispersal to and from isolated patches of late-successional habitat, individual species population trends). Because of this, landscape level questions for individual cells were not identified.

V. STRUCTURE AND COMPOSITION OF FOREST STANDS

It is important that management activities within Late-Successional Reserves maintain the compositional and structural elements necessary to the development of late-successional forest characteristics. Chapter IV characterized the landscape, set coarse scale goals, and prioritized areas for treatment. This section of the assessment describes some of the key late-successional habitat characteristics at various seral stages, focusing on the mature and old-growth condition.

A. SUCCESSIONAL PATHWAYS

Successional pathways describe the typical, dominant compositional and structural stages that can be expected under natural conditions as plant communities develop following a disturbance. The successional pathway that a plant community follows is a major determinant of how late-successional habitat characteristics develop in a given stand. They are described by the dominant tree species and relative density of the overstory (the upper reaches of the forest canopy, where most light is intercepted), regeneration of tree species in the understory, and the composition and density of the shrubs, herbs and grasses which make up the ground cover over time. The composition and density of stands at any seral stage are dependent on the type and intensity of disturbance, available seed sources and environmental conditions (Franklin, et al. 1988).

Sub-series environments (Table 4 and Map 5) were described within the western hemlock and Sitka spruce series. Although the concept of sub-series environments is likely to apply to the grand fir and the noble fir/Pacific silver fir series, information and experience with these plant series was not available, so sub-series successional pathways were not described. The plant communities of these sub-series environments vary in their successional pathways, both in the variety of species supported and the number of individual plants of a given species present. Conceptual models of succession were developed for each environment based on general successional sequences described by Franklin and Dyrness (1973), information derived from the Siuslaw Plant Association Guide (Hemstrom and Logan 1986) and resource inventories (Siuslaw Vegetation Resource Survey data, USDA 1987, and 1984 Siuslaw Ecoplot Intensive Survey data, Hemstrom and Logan 1986), and field observation. Although seral-stage development can follow a myriad of successional pathways, only the most commonly observed paths are described. The following is a working hypothesis of successional pathways that would occur for the four common climax vegetation series found in this assessment area and their sub-series environments.

1. Western Hemlock Series

Wet Environment

The western hemlock wet environments occur most often on lower slopes and in riparian areas. Soils have a high water table. Moving from the Coastal Fog Zone to the Coast Range Foothills along the edge of the Willamette Valley, the wet environment becomes more restricted to narrow bands in the valley bottoms. After disturbance, tree regeneration (especially regeneration of conifers) is sporadic, due to intense vegetation competition. Salmonberry is the predominant understory shrub species. Large down logs play an important role in this environment where they serve as "nurse logs", allowing seedling to become established above the surrounding shrubs. Red alder often has a larger presence than conifer in early-seral stages and remains a large component in young and mature stages.

The two dominant tree communities which occur in this environment (Table 7) are simply different mixes of red alder, Douglas-fir and western hemlock, depending on micro-site conditions. All three species re-establish quickly following a disturbance. Generally, either Douglas-fir or red alder dominate the site through the early and mid-seral stages. After the initial tree and shrub cover is established, competition for light is so intense that shade tolerant tree species dominate the regeneration layer; western hemlock is most common, but western redcedar is a significant component of this environment. If no major disturbance occurs, red alder will decline in both of these communities, losing its vigor and decaying beginning at about 80 years of age (Newton and Cole 1994). As the alder dies out, it is often replaced by shade tolerant conifers (western hemlock and western redcedar), which become a major component of late-seral overstory canopies (see Tables 38 and 39, illustrating the late-successional structure of stands in these environments). This sub-series environment has the lowest number of total trees per acre of the western hemlock environments and the highest percentage of red alder of all the sub-series environments.

Another common successional pathway in the wet environment begins with pure alder, 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 seedbed for alder. If undisturbed, the alder areas will begin to lose vigor and decay after 80 to 100 years of age. Shade tolerant species such as western hemlock and western redcedar will become established on a variable basis, depending on seed source. These conifers will begin to occupy the overstory as the alder deteriorates. In frequently disturbed areas such as floodplains and landslides, alder will constantly be regenerated, dominating the site.

On some sites, pure stands of western hemlock or salmonberry "brushfields" become established following the initial disturbance. However, these sites are considered to be less common and minor in distribution, so they are not identified in Table 7.

Table 7. Conceptual successional pathways[1] for dominant stand types in *all* disturbance regimes[2] in the western hemlock wet[3] environment.

Stand characteristic	Seral stage (age since major dis urbance in years) -- **western hemlock wet environment**					
	pioneer (0 to 10)	very early (11 to 24)	early (25 to 49)	mid (50 to 79)	late (80 to 149)	old-growth (≥150)
Dominant overstory stand type and ranking[4]	a (1) PSME/TSHE/ALRU	PSME/TSHE/ALRU	PSME/TSHE/ALRU	PSME/TSHE/ALRU	PSME/TSHE/ALRU[5]	PSME/TSHE
	b (1) ALRU/PSME/TSHE	ALRU/PSME/TSHE	ALRU/PSME/TSHE	ALRU/PSME/TSHE	ALRU/PSME/TSHE[5]	PSME/TSHE
	c (2) ALRU	ALRU	ALRU	ALRU	ALRU/TSHE[5]	TSHE/THPL
Total overstory (conifer and hardwood) canopy cover[6]	a Low to moderate	Moderate	High	High	Moderate to high[5]	Moderate
	b Moderate	High	High	High	Moderate[5]	Moderate
	c Moderate to high	High	High	High	Moderate to low[5]	Moderate to low
Dominant understory composition[7] and canopy cover	a RUSP, ACCI- high	RUSP, ACCI-mod	RUSP, ACCI-mod	RUSP, ACCI-mod	RUSP, ACCI-mod	RUSP, ACCI-mod
	b RUSP, ACCI- high	RUSP, ACCI-mod	RUSP, ACCI-mod	RUSP, ACCI-mod	RUSP, ACCI-high	RUSP, ACCI-mod
	c RUSP, ACCI- high	RUSP, ACCI-high	RUSP, ACCI-high	RUSP, ACCI-high	RUSP, ACCI-high	RUSP, ACCI-high

[1]Conceptual pathways developed from projections based on inventory data (USDA 1987 Vegetation Resource Survey and 1984 Ecoplot Intensive Survey, Hemstrom and Logan 1986 - Siuslaw National Forest) for stands in the late-seral stage, and field observations. For each stand characteristic, information within a row preceded by the same letter corresponds to the same successional sequence.

[2]Disturbance regimes are described in Chapter II (see *Disturbance Regime Blocks*).

[3]Includes the western hemlock/salmonberry, salmonberry-vine maple, and devil's club plant associations (Hemstrom and Logan 1986).

[4]Dominant overstory species codes: PSME = Douglas-fir, ALRU = red alder, TSHE = western hemlock, and THPL = western redcedar. Ranking codes indicate the relative probability of a particular successional sequence occurring: (1) = most commonly occurring sequence, and (2) = less commonly occurring sequence.

[5]The majority of the red alder (ALRU) would likely have fallen out of the stand by age 100.

[6]Canopy cover classes: high = more than 70%, moderate (mod) = 30 to 70%, and low = less than 30%.

[7]Dominant understory species codes: RUSP = salmonberry and ACCI = vine maple. Other common associated species include devil's club (western hemlock/devil's club plant association), red huckleberry, and swordfern (Hemstrom and Logan 1986).

Moist Environment (Western Hemlock Series)

The western hemlock 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 are most common in this sub-series environment (Table 8, conceptual pathways "a" and "b"). The first is a pure conifer stand type, usually found in areas following a disturbance which has created exposed mineral soil, a seed bed preferred by Douglas-fir. Varying amounts of shade tolerant species, especially western hemlock may be present, depending on how much litter and duff exist in the newly disturbed stands. 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 ten years after a stand replacing disturbance. From age 11 to 79, 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 relatively slim tree boles, and live 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 80 to 149 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 will be released. The number of trees in the regeneration layer varies greatly depending on seed source, overstory shade, and competing shrubs.

In areas which are relatively wet or are near a good alder seed source, alder can become a major component of this environment. Most commonly, these stands develop as Douglas-fir dominated stands with scattered pockets of red alder. They follow a successional pathway similar to that of the pure conifer stands. However, understory shrub and herb cover is generally higher under the red alder canopy. The increased competition can reduce the success of shade intolerant tree seedling establishment in the understory, shifting the composition of the regeneration layer in favor of shade tolerant western hemlock and western redcedar, which replace alder in the late-seral stage.

A less common tree community develops when conifer seed sources are not available following the disturbance. In this assessment area, these communities occur where large scale fires reburned two or more times (e.g., Mt. Hebo and the areas which reburned in the Tillamook Fire) in the same area between the mid 1800s and 1910. These stands are predominately red alder, with only widely scattered Douglas-fir or western hemlock. Without disturbance, the alder will begin to lose vigor and decay after about 80 years of age, leaving more of an open Douglas-fir stand or allowing establishment of shade tolerant conifer species, depending on seed source. Some areas with frequent small disturbances, such as landslides, will be maintained as pure alder.

In all stands, after age 150, wind, root rot, inter-tree competition and insects will continue to lower the overall density of Douglas-fir, creating more variation in stocking and species composition. Varying densities and ages of alder, shade tolerant conifer species and Douglas-fir will be found in the understory. Intermediate disturbances, especially prevalent in the Valley Margin Zone and the eastern fringes of the Interior Zone may serve to produce these characteristics sooner than those stands developing after a single disturbance. Table 14 illustrates the mature condition in the late-seral stage. It averages 109 total trees per acre, 53 percent of which are Douglas-fir, 34 percent are western hemlock, and red alder accounts for eight percent of the stand density.

Table 8. Conceptual successional pathways[1] for dominant stand types in *all* disturbance regimes[2] in the western hemlock moist[3] environment.

Stand characteristic	Seral stage (age since major disturbance in years) -- **western hemlock moist environment**					
	pioneer (0 to 10)	very early (11 to 24)	early (25 to 49)	mid (50 to 79)	late (80 to 149)	old-growth (≥150)
Dominant overstory stand type and ranking[4]	a (1) PSME	PSME	PSME	PSME	PSME	PSME/TSHE
	b (1) PSME/ALRU	PSME/ALRU	PSME/ALRU	PSME/ALRU	PSME/ALRU[5]	PSME/TSHE
	c (2) ALRU/PSME	ALRU/PSME	ALRU/PSME	ALRU/PSME	ALRU/PSME[5]	TSHE/TSHE
Total overstory (conifer and hardwood) canopy cover[6]	a Low to moderate	Moderate	High	High	High	Moderate to high
	b Low to moderate	Moderate	High	High	High[5]	Moderate to high
	c Moderate to high	High	High	High	Moderate[5]	Moderate
Dominant understory composition[7] and canopy cover	a POMU, ACCI-mod	POMU, ACCI-mod	POMU, ACCI-low	POMU, ACCI-low	POMU, ACCI-mod	POMU, ACCI-mod
	b POMU, ACCI-mod	POMU, ACCI-mod	POMU, ACCI-mod	POMU, ACCI-mod	POMU, ACCI-mod	POMU, ACCI-mod
	c POMU, ACCI-mod	POMU, ACCI-mod	POMU, ACCI-mod	POMU, ACCI-mod	POMU, ACCI-mod	POMU, ACCI-mod

[1]Conceptual pathways developed from projections based on inventory data (USDA 1987 Vegetation Resource Survey and 1984 Ecoplot Intensive Survey, Hemstrom and Logan 1986 - Siuslaw National Forest) for stands in the late-seral stage, and field observations. For each stand characteristic, information within a row preceded by the same letter corresponds to the same successional sequence.

[2]Disturbance regimes are described in Chapter II (see *D sturbance Regime Blocks*).

[3]Includes the western hemlock/swordfern, Oregon oxalis, vine maple/swordfern, and vine maple-salal plant associations (He strom and Logan 1986).

[4]Dominant overstory species codes: PSME = Douglas-fir, ALRU = red alder and TSHE = western hemlock. Ranking codes indicate the relative probability of a particular successional sequence occurring: (1) = most commonly occurring sequence, and (2) = less commonly occurring sequence.

[5]The majority of the red alder (ALRU) would likely have fallen out of the s and by age 100.

[6]Canopy cover classes: high = more than 70%, moderate (mod) = 30 to 70%, and low = less than 30%.

[7]Dominant understory species codes: POMU = swordfern and ACCI = vine maple. Other common associated species include Oregon oxalis, (western hemlock/Oregon oxalis plant association), salal (western hemlock/vine maple-salal plant association), and red huckleberry (Hemstrom and Logan 1986).

Dry Environment (Western Hemlock series)

The western hemlock dry environments occur on upper slope positions which are exposed to year round wind disturbance and 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, so it dominates the pioneer through late-seral stages in almost pure stands. In the mature condition, the species mix in this environment has the highest percentage of Douglas-fir and the lowest percentage of red alder, of any western hemlock or Sitka spruce environment (Table 14).

Shrubs such as salal, Oregon grape and Pacific rhododendron (common on Valley Margin Zone sites) will occupy most of the growing space the first ten years after a stand replacing disturbance. Like the moist environment, from age 11 to 79, Douglas-fir will dominate the growing space and in dense areas will be going through intense inter-tree competition. By age 80, as in the moist areas, portions of these areas could be occupied by dense stands. From age 80 to 149 mortality will continue, and overall tree density would be reduced. As the stand opens up, shade tolerant conifer species (primarily western hemlock) will become established on a random basis depending on seed source. After age 150, wind, root rot, inter-tree competition and insects will continue to lower the overall density of Douglas-fir, allowing western hemlock to become a significant component of the overstory canopy (Table 9).

The primary differences between the moist and dry environments are that the dry environment has more intense, initial shrub competition with establishing seedlings; more frequent small scale wind disturbance; and lower site productivity due to its relatively thin and droughty soil conditions, and lower available nutrients. These things combine, often resulting in smaller individual tree sizes and lower tree stocking levels than stands in the moist environment. This slows the development of some late-successional characteristics such as large trees, snags and logs. However, the high frequency of wind disturbance blowing down small patches on ridgetops and upper slopes may also accelerate late-successional structural characteristics, if it occurs in mid and late-seral stages, by removing overstory Douglas-fir and releasing shade tolerant western hemlock to create a multi-layered canopy, and increasing snags and large down wood. The infection levels of laminated root rot also tend to be higher on these upper slope positions (and throughout the dry environment in general), which contributes to the susceptibility of Douglas-fir trees to windthrow. Additionally, fire may do the same thing in the Valley Margin Zone and the eastern fringe of the Interior Zone. These frequent, low to moderate intensity fires can kill small pockets of trees and expose mineral soil which encourages seedling establishment, resulting in a two or more layered overstory canopy with numerous snags and large logs on the ground.

Table 9. Conceptual successional pathways[1] for dominant stand types in *all* disturbance regimes[2] in the western hemlock dry[3] environment.

Stand characteristic	Seral stage (age since major disturbance in years) -- **western hemlock dry environment**					
	pioneer (0 to 10)	very early (11 to 24)	early (25 to 49)	mid (50 to 79)	late (80 to 149)	old-growth (≥150)
Dominant overstory stand type[4]	PSME	PSME	PSME	PSME	PSME	PSME/TSHE
Total overstory canopy cover[5]	Low to moderate	Moderate	High	High	High	Moderate to high
Dominant understory composition[6] and canopy cover	POMU, GASH-mod	POMU, GASH-mod	POMU, GASH-low	POMU, GASH-low	POMU, GASH-mod	POMU, GASH-mod

[1]Conceptual pathways developed from projections based on inventory data (USDA 1987 Vegetation Resource Survey and 1984 Ecoplot Intensive Survey, Hemstrom and Logan 1986 - Siuslaw National Forest) for stands in the late-seral stage, and field observations.

[2]Disturbance regimes are described in Chapter II (see *Disturbance Regime Blocks*).

[3]Includes the western hemlock/evergreen huckleberry, salal, dwarf Oregon grape, dwarf Oregon grape-salal, salmonberry-salal, and all rhododendron plant associations (Hemstrom and Logan 1986).

[4]Dominant overstory species codes: PSME = Douglas-fir and TSHE = western hemlock.

[5]Canopy cover classes: high = more than 70%, moderate (mod) = 30 to 70%, and low = less than 30%.

[6]Dominant understory species codes: POMU = swordfern and GASH = salal. Other common associated species include dwarf Oregon grape, (western hemlock/dwarf Oregon grape and dwarf Oregon grape-salal plant associations), rhododendron (all western hemlock/rhododendron plant associations), evergreen huckleberry (western hemlock/evergreen huckleberry plant association), salmonberry (western hemlock/salmonberry-salal plant association), red huckleberry, and vine maple (Hemstrom and Logan 1986).

2. Sitka Spruce Series

Wet Environment

Found in the Coastal Fog Zone and the coolest, wettest sites of the Interior Zone, the Sitka spruce wet environment occurs on lower slopes, in riparian areas, and in poorly drained soils on steeper slopes. Soils have a high water table. Salmonberry and devil's club dominate the understory shrub species and respond rapidly to any disturbance of the overstory canopy. This vegetation competition results in sporadic regeneration of conifers following a disturbance. Large down logs play an important role, serving as "nurse logs" and allowing seedling to become established above the surrounding shrubs. Additionally, since these sites are close to the coast, they are commonly subjected to high winds during times when the normally wet soils are saturated; making windthrow a common intermediate disturbance. Windthrow and intense vegetation competition result in generally low stocking, averaging only 64 trees per acre which are nine inches or larger in diameter (Table 14), for stands in the late-seral stage.

The overstory canopies range from mixed western hemlock, Douglas-fir, and Sitka spruce to nearly pure stands of red alder. These sites are resilient to fire (Barnett 1984). The most common communities to develop over long periods of time are conifer dominated. Western hemlock and Douglas-fir are most commonly found in the overstory during the pioneer through late-seral stages, along with Sitka spruce and red alder (Table 10). Wind is a frequent intermediate disturbance, often creating large enough openings to allow establishment of shade intolerant Douglas-fir along with shade tolerant Sitka spruce, western hemlock and western redcedar. Thus, old-growth stands generally have a relatively even mix of Douglas-fir, Sitka spruce and western hemlock in the overstory.

The timing and amount of disturbance on a site, as well as available seed sources, can result in the establishment of a second, slightly less common, community dominated by alder. These stands typically include scattered western hemlock and Sitka spruce which survive in the shade of red alder and eventually make their way into the overstory. The pathway for alder dominated sites is similar to that of conifer dominated sites, but Douglas-fir generally plays far less of a role. As the alder begins to lose vigor and decay after 80 to 100 years of age, western hemlock, Sitka spruce and western redcedar often become established in the regeneration layer and eventually become the dominant species in the overstory. Salmonberry is usually well established under alder canopies, inhibiting seedling establishment. These sites are generally thought to have even lower stocking, 100 to 150 years after a major disturbance than the conifer dominated sites.

Pure alder stands are only maintained on sites which are continually disturbed by flooding or landslides. Outside of these areas, the alder will begin to lose vigor and decay after 80 to 100 years of age. In stands where Sitka spruce and western hemlock are not found in the overstory canopy or regeneration layer, successional development after the alder canopy falls apart is unclear (Hemstrom and Logan 1986). These stands may simply become brushfields, dominated by salmonberry for long periods of time. As these sites are only a minor component of the Sitka spruce wet environment and their successional pathway is relatively unpredictable, they are not projected in Table 10.

Table 10. Conceptual successional pathways[1] for dominant stand types in *all* disturbance regimes[2] in the Sitka spruce wet[3] environment.

Stand characteristic	Seral stage (age since major disturbance in years) -- **Sitka spruce wet environment**					
	pioneer (0 to 10)	very early (11 to 24)	early (25 to 49)	mid (50 to 79)	late (80 to 149)	old-growth (≥150)
Dominant overstory stand type and ranking[4]	a (1) PSME/TSHE/ PISI/ALRU	PSME/TSHE/ PISI/ALRU	PSME/TSHE/ PISI/ALRU	PSME/TSHE/ PISI/ALRU	PSME/TSHE/PISI/ ALRU[5]	PSME/PISI/TSHE/ THPL
	b (2) ALRU/TSHE/ PISI	ALRU/TSHE/PISI	ALRU/TSHE/PISI	ALRU/TSHE/PISI	ALRU[5]/TSHE/PISI	TSHE/PISI/THPL
Total overstory (conifer and hardwood) canopy cover[6]	a Low to moderate	Moderate	Moderate	High	Moderate to high[5]	Moderate to high
	b Moderate to high	High	High	High	Moderate to low[5]	Moderate
Dominant understory composition[7] and canopy cover	a RUSP, OPHO, POMU - high	RUSP, OPHO, POMU - high	RUSP, OPHO, POMU - moderate	RUSP, OPHO, POMU - moderate	RUSP, OPHO, POMU - moderate	RUSP, OPHO, POMU - moderate
	b RUSP, OPHO, POMU - high	RUSP, OPHO, POMU - high	RUSP, OPHO, POMU - high	RUSP, OPHO, POMU - high	RUSP, OPHO, POMU - high	RUSP, OPHO, POMU - high

[1]Conceptual pathways developed from projections based on inventory data (USDA 1987 Vegetation Resource Survey and 1984 Ecoplot Intensive Survey, Hemstrom and Logan 1986 - Siuslaw National Forest) for stands in the late-seral stage, and field observations. For each stand characteristic, information within a row preceded by the same letter corresponds to the same successional sequence.

[2]Disturbance regimes are described in Chapter II (see *Disturbance Regime Blocks*).

[3]Includes the Sitka spruce/salmonberry and devil's club plant associations (Hemstrom and Logan 1986).

[4]Dominant overstory species codes: PSME = Douglas-fir, PISI = Sitka spruce, ALRU = red alder, TSHE = western hemlock, and THPL = western redcedar. Ranking codes indicate the relative probability of a particular successional sequence occurring: (1) = most commonly occurring sequence, and (2) = less commonly occurring sequence.

[5]The majority of the red alder (ALRU) would likely have fallen out of the stand by age 100.

[6]Canopy cover classes: high = more than 70%, moderate = 30 to 70%, and low = less than 30%.

[7]Dominant understory species codes: RUSP = salmonberry, OPHO = devil's club, and POMU = swordfern. Other common associated species include vine maple, Oregon oxalis, and red huckleberry (Hemstrom and Logan 1986).

Moist Environment (Sitka Spruce Series)

The Sitka spruce moist environments occur on deep, wet and well drained soils; usually on benches, alluvial deposits, and mid to lower slopes in the Coastal Fog Zone and valleys of the Interior Zone. After disturbance, regeneration of conifers is predominant, with initial densities dependent on exposure of organic/mineral soil, availability of seed sources, and density of competing vegetation. Two tree communities predominate in this sub-series environment.

The most common community is a relatively dense, pure conifer stand of western hemlock and Sitka spruce, which appear to be in their optimum environment, dominating most natural stands from early through old-growth seral stages (Table 11). Douglas-fir and red alder rapidly establish anywhere that disturbance exposes a seedbed of mineral soil. Although vine maple, swordfern and red huckleberry grow extremely well, shrub and herb competition is not as intense as it is in the wet and dry environments. However, shrubs and herbs will still occupy most of the growing space the first ten years after a stand replacing disturbance. From ages 11 through 79, a mixture of conifers will dominate the growing space, going through intense inter-tree competition. By age 80, portions of these areas are likely to be occupied by dense stands with relatively slim tree boles and live crown ratios less than 25 percent. From age 80 to 149 mortality by inter-tree competition will continue, and tree density will be reduced. Portions of stands with initial stocking levels of less than 100 trees per acre have significantly larger bole diameters and crowns. As small opening are crea ed in the overstory canopy by blowdown, insects, disease or inter-tree competition; western hemlock, Sitka spruce, western redcedar and Pacific yew will establish, or are released, at varying densities depending on seed source and the degree to which the overstory has been opened. Intermediate disturbances which are especially prevalent in the Valley Margin Zone and the eastern fringe of the Interior Zone, may produce these characteristics sooner than those stands developing after a single large scale fire. Inventories of late-seral stands in the mature condition indicate an average stand density of 102 total trees per acre, comprised of 52 percent western hemlock and 29 percent Sitka spruce (Table 14). Douglas-fir accounts for only eleven percent of the stand density.

The second type of tree community occurs in areas wet enough and with adequate seed source to favor alder establishment. A substantial red alder canopy can develop and is the main competitor with conifers on many sites (Hemstrom and Logan 1986). This pathway is very similar to the pure conifer pathway, except that red alder can dominate the site for the first 80 to 100 years, when it begins to lose vigor and decay. Depending on seed source, the alder overstory is generally replaced quickly by shade tolerant species in the late-seral stage (see Table 11, conceptual pathway "b").

As with other wet and moist environments in the western hemlock and Sitka spruce series, wind, disease, inter-tree competition and insects will continue to lower the overall stand density after age 150, creating more variation in stocking. Varying densities and ages of alder, shade tolerant conifer species, and Douglas-fir will be found in the understory depending on the type and size of the disturbance. Additionally, areas with frequent disturbances, such as landslides, will be dominated by red alder. Since this is a minor portion of the landscape it is not shown as a pathway in Table 11.

Table 11. Conceptual successional pathways[1] for dominant stand types in *all* disturbance regimes[2] in the Sitka spruce moist[3] environment.

Stand characteristic	Seral stage (age since major disturbance in years) -- **Sitka spruce moist environment**					
	pioneer (0 to 10)	very early (11 to 24)	early (25 to 49)	mid (50 to 79)	late (80 to 149)	old-growth (≥150)
Dominant overstory stand type and ranking[4]	a (1) TSHE/PISI/ PSME	TSHE/PISI/ PSME	TSHE/PISI/ PSME	TSHE/PISI/ PSME	TSHE/PISI/ PSME	TSHE/PISI/ PSME/THPL
	b (2) ALRU/TSHE/ PISI	ALRU/TSHE/ PISI	ALRU/TSHE/ PISI	ALRU/TSHE/ PISI	ALRU[5]/TSHE/ PISI	TSHE/PISI/ THPL
Total overstory (conifer and hardwood) canopy cover[6]	a Low to moderate	Moderate	High	High	High	Moderate to high
	b Moderate to high	High	High	High	Moderate[5] to low	Moderate
Dominant understory composition[7] and canopy cover	a ACCI, POMU, VAPA - moderate	ACCI, POMU, VAPA - moderate	ACCI, VAPA, POMU - low	ACCI, VAPA, POMU - low	ACCI, POMU, VAPA - moderate	ACCI, POMU, VAPA - moderate
	b ACCI, POMU, VAPA - moderate	ACCI, POMU, VAPA - moderate	ACCI, POMU, VAPA - moderate	ACCI, POMU, VAPA - moderate	ACCI, POMU, VAPA - moderate	ACCI, POMU, VAPA - moderate

[1]Conceptual pathways developed from projections based on inventory data (USDA 1987 Vegetation Resource Survey and 1984 Ecoplot Intensive Survey, Hemstrom and Logan 1986 - Siuslaw National Forest) for stands in the late-seral stage, and field observations. For each stand characteristic, information within a row preceded by the same letter corresponds to the same successional sequence.

[2]Disturbance regimes are described in Chapter II (see *Disturbance Regime Blocks*).

[3]Includes the Sitka spruce/swordfern, Oregon oxalis, and fool's huckleberry-red huckleberry plant associations (Hemstrom and Logan 1986).

[4]Dominant overstory species codes: PSME = Douglas-fir, ALRU = red alder, TSHE = western hemlock, PISI = Sitka spruce, and THPL = western redcedar. Ranking codes indicate the relative probability of a particular successional sequence occurring: (1) = most commonly occurring sequence, and (2) = less commonly occurring sequence.

[5]The majority of the red alder (ALRU) would likely have fallen out of the stand by age 100.

[6]Canopy cover classes: high = more than 70%, moderate = 30 to 70%, and low = less than 30%.

[7]Dominant understory species codes: ACCI = vine maple, POMU = swordfern, and VAPA = red huckleberry. Other common associated species include Oregon oxalis and fool's huckleberry (Hemstrom and Logan 1986).

Dry Environment (Sitka Spruce Series)

The Sitka spruce dry environments occur on ridgetops and upper slope positions on relatively shallow and well drained soils in the Coastal Fog Zone. This environment also occurs on recently stabilized sand dunes in the salt-spray zone, where shore pine is often the pioneer species. Moisture is a limiting factor in the dry environments, especially for Sitka spruce which experiences droughty conditions during the late summer. Except for shallow soils on steeper slopes, soils in this environment are relatively resilient to the effects of fire.

Salal and salmonberry will occupy most of the growing space the first ten years after a stand replacing disturbance (Table 12) and can be tough competitors if conifer seedlings do not become rapidly established on the site. However, Douglas-fir, western hemlock and Sitka spruce all tend to become rapidly established on these sites following any disturbance (depending on seed source availability). By eleven years after the disturbance, these three conifer species generally begin to dominate the growing space. Red alder is also common on these sites, frequently occurring in small amounts, but rarely becoming a major component of the stand. Between 25 and 49 years after the disturbance, denser conifer pockets will be experiencing intense inter-tree competition. Although stocking densities in this environment are lower than stocking densities in the moist environment, by age 80 portions of these sites could be occupied by dense stands. Inter-tree competition, insects and disease will begin to cause mortality. Such mortality will continue throughout the late and old-growth seral stages.

Intense shrub competition is likely to be the primary factor for low stocking in the Sitka spruce dry environment during the pioneer seral stage. However, wind may be the primary factor for maintaining those low stocking levels during the later seral stages. Wind is a frequent intermediate disturbance factor in this environment, creating patches of blowdown throughout dry environment stands. Blowdown patches vary greatly in size. Smaller patches allow shade tolerant western hemlock, Sitka spruce and, to a lesser extent, western redcedar and Pacific yew regeneration to be released or become established. Larger patches allow the establishment of Douglas-fir and red alder in the regeneration layer. Thus, it appears to accelerate the development of multi-layered overstory canopies when it occurs in mid and late-seral stands. Table 14 illustrates that late-seral stands in the mature condition average 89 trees per acre, with Douglas-fir as the dominant overstory species.

Table 12. Conceptual successional pathways[1] for dominant stand types in *all* disturbance regimes[2] in the Sitka spruce dry[3] environment.

Stand characteristic	Seral stage (age since major disturbance in years) -- **Sitka spruce dry environment**					
	pioneer (0 to 10)	very early (11 to 24)	early (25 to 49)	mid (50 to 79)	late (80 to 149)	old-growth (≥150)
Dominant overstory stand type[4]	PSME/PISI/ TSHE/ALRU	PSME/PISI/ TSHE/ALRU	PSME/PISI/ TSHE/ALRU	PSME/PIS / TSHE/ALRU	PSME/PISI/ TSHE/ALRU[5]	PSME/PISI/ TSHE/THPL
Total overstory canopy cover[6]	Low to moderate	Moderate	High	High	High[5]	Moderate to high
Dominant understory composition[7] and canopy cover	GASH, POMU, VAPA - moderate	GASH, POMU, VAPA - moderate	GASH, POMU, VAPA - moderate	GASH, POMU, VAPA - moderate	GASH, POMU, VAPA - high	GASH, POMU, VAPA - moderate to high

[1]Conceptual pathways developed from projections based on inventory data (USDA 1987 Vegetation Resource Survey and 1984 Ecoplot Intensive Survey, Hemstrom and Logan 1986 - Siuslaw National Forest) for stands in the late-seral stage, and field observations.
[2]Disturbance regimes are described in Chapter II (see *Disturbance Regime Blocks*).
[3]Includes the Sitka spruce/salal and salmonberry-salal plant associations (Hemstrom and Logan 1986).
[4]Dominant overstory species codes: PSME = Douglas-fir, PISI = Sitka spruce, TSHE = western hemlock, ALRU = red alder, and THPL = western redcedar.
[5]The majority of the red alder (ALRU) would likely have fallen out of the stand by age 100.
[6]Canopy cover classes: high = more than 70%, moderate = 30 to 70%, and low = less than 30%.
[7]Dominant understory species codes: GASH = salal, POMU = swordfern, and VAPA = red huckleberry. Other common associated species include vine maple and salmonberry (Sitka spruce/salmonberry-salal plant association), and fool's huckleberry (Hemstrom and Logan 1986).

3. Grand Fir Series

The grand fir series within this assessment area has not been extensively studied. A joint BLM (Steve Garza and Nancy Wogen) and Forest Service (Cindy McCain and Barb Raible) study will provide us with additional information regarding the occurrence of this series and its successional pathways. Grand fir can occur from sea level to 6,000 feet on a variety of landforms and soils. It can grow in many plant communities, on fair to very good forest sites, and in association with nearly all tree species found in the Pacific Northwest. Within the assessment area, the grand fir environment typically occurs at elevations at or below 1,000 feet along the eastern slopes of the Coast Range in or near the Valley Margin Zone (Map 5), and at higher elevations on drier sites. Annual precipitation is approximately 50 inches, decreasing eastward as one nears the Willamette Valley floor. Grand fir can act as both a climax and early-seral species, ranging from a late colonizer of dry forest sites to a pioneer on recently burned sites. In places where low intensity ground fires have been excluded, grand fir was found to invade rapidly, indicating it is the destined climax species (Antos and Shearer 1980).

Fire is a common disturbance in the grand fir zone. Fires have a variable severity ranging from low intensity ground fires to high intensity crown fires. After a disturbance such as a ground fire, the successional pathway would start with the establishment of grasses, small herbs, swordfern, salal, common snowberry, and vine maple as the ground cover in the pioneer through early-seral stages. Douglas-fir and co-dominant hardwoods such as big leaf maple, Oregon ash, hazelnut, and Oregon white oak will reproduce and comprise most of the understory tree component. As the canopy begins to close, scattered amounts of shade tolerant grand fir regeneration 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. In a major disturbance such as a crown fire, the successional pathway would be similar. Initially, conifer and hardwood regeneration will be scattered due to a higher competition from ground cover and fewer live residual trees as a seed source. As the same conifer and hardwood species regenerate and become established over time, and the canopy begins to close, the shade tolerant grand fir would become established in the understory. In both scenarios, as the forest matures, the canopy would be co-dominated by Douglas fir, Oregon white oak, and bigleaf maple. As the forest reaches its climax stage, grand fir or possibly grand fir in combination with Douglas-fir would become the dominant overstory. Eventually, deteriorating Douglas-fir and hardwoods will occupy various strata within the stand and coarse woody debris would become scattered throughout the forest in the late-seral stage.

4. Noble Fir/Pacific Silver Fir Series

The noble fir/Pacific silver fir environment occurs at elevations greater than 2,500 feet in the Northern Coast Range AMA. Communities in which noble fir/Pacific silver fir are major climax components occur sporadically in high rainfall areas (greater than 80 inches), typically on mountain tops and north to northeast slopes in the northern Oregon Coast Range. Noble fir is classified as shade intolerant and is incapable of establishing itself under a closed forest canopy. In natural stands, noble fir is subject to replacement by its very shade tolerant

associates, Pacific silver fir and western hemlock. An anomaly in this area is a frequent occurrence of stands of noble fir at the highest elevations of the Oregon Coast Range from which Pacific silver fir is absent (Packee, et al. 1981). Primary locations in which these species are found include Saddleback Mountain, Fanno Ridge, Bald Mountain, Trask Mountain, and Mt. Hebo.

The typical successional pathway after a major disturbance, would start with the immediate establishment of a variety of herbaceous vegetation. Vine maple and Pacific rhododendron would soon follow. Shortly after establishment of ground cover, Douglas-fir and noble fir seedlings would become established. Western hemlock may be established simultaneously or develop later under a forest canopy. Pacific silver fir usually is last to invade the site, coming in under the mixed canopy of Douglas-fir, noble fir and western hemlock. Once the Pacific silver fir reaches the upper canopy, it often outgrows the western hemlock and becomes taller after 100 years. Noble fir usually maintains a height advantage over Pacific silver fir wherever they occur together (Packee, et al. 1981). The understory can be characterized as mostly open, with the dominant shrub species consisting of vine maple and Pacific rhododendron. Conifer seedlings generally experience little competition from hardwoods and shrubs in these plant communities. Due to the locations in which these stands occur, they are often subject to small scale disturbances such as wind, and snow and ice storms. At each occurrence of these small scale disturbances course woody debris would become common and scattered throughout the stand. As the stand matures, so will its complexity. Deteriorating conifers will occupy various strata within the stand, with shade tolerant Pacific silver fir and western hemlock seedlings continually establishing themselves in the disturbed areas.

5. Management Implications Of Successional Pathways

Use of successional pathways in evaluating proposed management activities requires knowledge of the physical environment (soil/climate zone, landform and slope position), the biological environment (series and sub-series environments), and where the stand is in its successional development. This information should be used in conjunction with other information and concerns (Aquatic Conservation Strategy concerns, LSR management objectives, wildlife habitat distribution, etc.) to determine the appropriateness of a proposed management activity or the outcome of a recently implemented management activity. There may be instances when the dominant vegetation development pathways are by-passed to create conditions desired for specific purposes. For example, a wet environment in the western hemlock series densely stocked with conifer would be an uncommon site condition for mature stands in that environment. However, many planted stands in that environment are densely stocked with conifers and, due to a severe deficit of large woody structure in the streams in this assessment area, it is often desirable to grow large trees which can be placed in the stream, enhancing fish habitat.

Specific prescriptions for management activities should consider which structure and compositional elements are possible and appropriate for a given site, as specific management objectives may be more easily accomplished in one environment than in another. Table 13 highlights some of the key components of late-successional forest habitat and evaluates the

potential for a given environment to be able to support that component (or management objective). Comparison of these potentials will assist managers in determining which activities will best meet their objectives. These conditions are not absolutes, but occur over a continuum throughout the various environments because of microsite conditions.

Table 13. Potential for Sub-Series Environments to Meet Key Structural Components When Considering Dominant Natural Successional Pathways.

Management Objectives	Western Hemlock Sub-Series Environments		
	Wet	Moist	Dry
Grow large trees	H	H	M
Establish multi-layered canopy of conifer	M	H	M-L
Establish multi-layered canopy of conifer & hardwoods	H	M	L
Recruit large diameter snags & large woody debris	H	H	M-L
Maintain high stocking (high stand density)	L	H	M
Provide coarse woody debris for aquatic structures	H	H	L
Provide variable spacing (gaps, clumpiness)	H	H	M
Develop/maintain wind firmness	M	H	M

Management Objectives	Sitka Spruce Sub-Series Environments		
	Wet	Moist	Dry
Grow large trees	H	H	M
Establish multi-layered canopy of conifer	M	H	M
Establish multi-layered canopy of conifer & hardwoods	H	H	L
Recruit large diameter snags & large woody debris	H	H	M
Maintain high stocking (high stand density)	L	H	M
Provide coarse woody debris for aquatic structures	H	H	M-L
Provide variable spacing (gaps, clumpiness)	H	H	M
Develop/maintain wind firmness	M-L	M	M-L

H=High probability M=Moderate probability L=Low probability

In the **Western Hemlock Zone:**
The "wet" environment has the highest potential for:

- supporting a low to moderate density of conifers with high spacing variability (due to competitive nature of shrubs).
- developing a canopy composed of a variety of species in each layer, with a large component of hardwood species and shade tolerant conifers (western hemlock and western redcedar).
- being a place to grow the largest trees (but not many of them), with some trees having large, heavy limbs on the lower bole of the tree ("wolfy" trees).
- being a good place to recruit those few large trees for future aquatic structure.

The "moist" environment has the potential for:

- developing an overstory which will have a high density of conifers and variable spacing.
- developing a multiple species, conifer canopy, with some hardwood component mixed in.
- being a place to grow and recruit a quantity of large diameter snags and coarse woody debris both on site and for aquatic structure.

The "dry" environment would support different structural characteristics. It has the potential for:

- developing an overstory with moderate densities. Spacing could be less variable, however, harsh sites with shallow soils and fine scale disturbances may result in variably spaced trees with gaps.
- developing wolfy limbed trees, due to either fine scale disturbances (wind or disease) or harsh site conditions.
- supporting a mix of shade tolerant (western hemlock and western redcedar) and shade intolerant (Douglas-fir) species in lower canopy layers. There would be few hardwoods in the canopy.

In the **Sitka Spruce Zone**:

The "wet" environment has the highest potential for:

- supporting the lowest density of conifers with highly variable spacing (due to competitive nature of shrubs).
- developing a canopy composed of a variety of species in each layer, with a large component of hardwood species and a relatively even mix of shade tolerant (western hemlock and Sitka spruce) and intolerant (Douglas-fir) species in the lower canopy layers, becoming established in openings and on nurse logs.
- being a place to grow the largest trees (but not many of them). Many would be wolfy.
- being a good place to recruit those few large trees for future aquatic structure.

The "moist" environment has the potential for:

- developing an overstory with a relatively high density of conifers at variable spacings.
- developing a multiple species overstory canopy composed mainly of conifers (western hemlock and Sitka spruce) with some hardwood component.
- being a place to grow and recruit a quantity of large diameter snags and coarse woody debris both on site and for aquatic structure.

The "dry" environment has the potential for:

- developing an overstory with moderate densities. Spacing could be less variable, however, harsh sites with shallow soils and fine scale disturbances may result in variably spaced trees with gaps.
- developing trees with wolfy limbs, due to either fine scale disturbances (wind or disease) or harsh site conditions.
- supporting a mix of shade tolerant (western hemlock and western redcedar) and shade intolerant (Douglas-fir) species in lower canopy layers. There would likely be a hardwood component in the overstory canopy.

In ALL environments in ALL vegetation zones management activities should strive to:

- maintain health and vigor of the plant communities.
- encourage natural diversity of plant species in all layers.
- maintain existing late-successional structural components (e.g., large trees, wolfy limbs, large logs on the ground, snags).
- recruit snags and large, down logs.
- encourage development of in-stand vertical and horizontal diversity.

The noble fir and Pacific silver fir series is a unique environment not discussed in depth here. Management objectives in this environment should encourage increasing biodiversity by re-establishing those species at higher elevations.

B. LATE-SUCCESSIONAL STRUCTURAL AND COMPOSITIONAL CHARACTERISTICS

The structure of natural coastal 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 (Franklin and Spies 1991). No one condition is appropriate across the landscape. Knowledge of late-successional structural and compositional characteristics is key in identifying the desired future conditions to strive for in management activities. The mature and old-growth conditions descr bed in this section of the document are provided as the best available information for th s assessment are and are recommended as the desired future condition.

1. Differences in Forest Structure Between Stands of Different Ages

Late-successional forest function may be influenced by the changes which occur in vegetation structure and composition at different ages of development (Franklin and Spies 1991). The condition of existing late-seral forests within this assessment area provides a reference point to compare younger stands against when assessing their capability of achieving desired future conditions. Additionally, it is important to recognize that managed stands develop quite differently from natural stands. Since the majority of the late-seral stands currently present in the assessment area are 80 to 120 years old (USDA 1995 and Teensma, et al. 1991), there is sufficient local information available to characterize the mature condition only. There is limited information available for the old-growth condition of late-successional forests in the Coast Range. Recent (1996) photo interpretation of vegetation for the Drift-Siletz watershed analysis shows that approximately four percent of that landscape is in the old-growth condition.

Tree density (trees per acre), mean stand diameter at breast height, and basal area are most important in discriminating among age classes. Tree density is about twice as high in young, natural stands as it is in stands in the mature and old-growth conditions. Basal area increases

with age class, and mean tree diameter is highest in mature stands which lack the smaller diameter shade tolerant trees common in old growth (Franklin and Spies 1991).
Stand condition is influenced by the age of the stand. Percentages of snags with natural cavities, percentage of Douglas-fir boles with resinosis, and percent of tree crowns with broken tops are higher in old growth than in the younger age classes (Franklin and Spies 1991). The understory cover of herbaceous vegetation and deciduous shrubs increases with stand age class. Density of shade tolerant saplings is highest in old growth, lowest in mature stands, and intermediate in young stands (Franklin and Spies 1991).

General character stics of old-growth forests that differ from mature include: co-dominance of shade tolerant species such as western hemlock in the overstory, diverse vertical distribution of vegetation, multi-layered tree canopies, numerous gaps in the overstory canopy, large amounts of CWD, and many large trees, some with broken or deformed tops.

2. Mature Forest Structural Characteristics

The description of stand conditions in Table 14 is expressed in terms of trees, logs or snags per acre by species and size class for live trees, and by size class for snags and down logs. Data is based on plot information from the Siuslaw National Forest Vegetation Resource Survey (USDA 1987) and the 1984 Siuslaw Ecology Intensive Survey (Hemstrom and Logan 1986). These surveys focused on sampling late-seral stands on the Siuslaw National Forest. The information in Table 14 was based solely on plots from the Hebo Ranger District and, given the limited occurrence of old growth on this district, the data this table best represents the mature condition on the western half of the assessment area.

Since the structural and compositional data in Table 14 represents the averages of stands in the mature condition, management activities should not target it as an average stand condition. It does, however, provide a reasonable representation of the differences in species and trees per acre by sub-series environments. This information is appropriate within the Siuslaw National Forest boundaries in the assessment area. On lands in the eastern portion of the assessment area stand structural and compositional components are anticipated to be significantly different. Identification and mapping of sub-series environments on these lands are currently in progress, and data from these inventories should be utilized when it becomes available.

The following statistically significant trends (analysis of variance at the 10% level) have been interpreted from the information in Table 14:

In the Western Hemlock series:

- total live trees per acre increase significantly from wet to moist environments, and from dry to moist environments.
- the number of Douglas-fir trees per acre increases significantly from wet to moist and dry environments.
- the amount of red alder increases significantly going from dry to wet environments.

Western hemlock and western redcedar were found in all western hemlock environments.

In the Sitka Spruce series:

- the total number of live trees per acre decreases significantly from moist to dry environments, and from dry to wet environments.
- the amount of Douglas-fir in the moist environments was significantly lower than the amount of Douglas-fir in the dry and wet environments.

Western hemlock is a common co-dominant component in all Sitka spruce environments, much more common than western redcedar.

The variability in snag and down log components across all environments was not statistically significant at the ten percent level. It is important to note that snags, down logs and many of the trends identified above may be influenced by fine scale differences in disturbances and environments. For example, dry environments may experience more within-stand wind and disease related events than the other environments.

Table 14. Structure and Composition of the Mature Condition of Late-Successional Stands by Sub-Series Environments (information is expressed in numbers of trees, logs or snags per acre; all data was rounded to the nearest whole number)

	Western Hemlock - Dry (18 plots)					Western Hemlock - Moist (21 plots)					Western Hemlock - Wet (36 plots)				
Species	Small	Medium	Large	Giant	Total	Small	Medium	Large	Giant	Total	Small	Medium	Large	Giant	Total
Bigleaf maple											1	<1			1
Douglas-fir	20	25	6	<1	51	28	23	6	<1	58	9	10	6	<1	25
Red alder	2	<1			2	7	1			9	13	2			15
Sitka spruce		<1	<1		<1	1	<1	0	<1	1	2	1	<1	<1	2
Western hemlock	19	10	2.2	<1	31	25	11	2	<1	37	23	11	3	<1	36
Western redcedar	4		<1	<1	4	4	<1	<1	<1	4	5	1	<1	<1	6
Total Live Trees	45	36	8	1	89	64	36	9	1	109	53	24	9	1	86
Hard conifer snags	15	2	1	<1	17	14	2	<1	<1	16	4	1	<1	<1	6
Soft conifer snags	2	2	3	1	8	3	3	2	1	8	1	1	1	1	3
Hard log	23	6	1		30	14	2	1	<1	18	10	2	1	<1	13
Soft log	5	2	2	1	10	7	5	5	1	18	3	6	2	1	11
	Sitka Spruce - Dry (13 plots)					Sitka Spruce - Moist (39 plots)					Sitka Spruce - Wet (33 plots)				
Douglas-fir	8	13	10	<1	31	3	6	3	<1	11	9	5	5	<1	20
Red alder	11	1	<1		13	8	1	<1		8	8	2	<1		10
Sitka spruce	6	7	3	<1	16	8	11	9	2	29	3	3	4	2	11
Western hemlock	19	6	2		27	33	17	4	<1	53	12	7	3	<1	22
Western redcedar	1	1	<1		2	<1				<1	2	<1	<1	<1	3
Total Live Trees	46	28	16	<1	89	51	34	15	2	102	34	16	12	2	64
Hard conifer snags	4	1	<1	<1	5	9	2	1	<1	12	5	1	1	<1	7
Soft conifer snags	1	2	3	1	6	1	1	2	1	5	1	1	2	1	4
Hard log	6	2	<1		9	12	4	2	<1	18	8	3	3	1	16
Soft log	4	2	3	1	9	8	4	5	1	18	3	5	2	1	11

Size classes: Small = 9.0 to 20.9 inches diameter at breast height (dbh)
Medium = 21.0 to 31.9 inches dbh
Large = 32.0 to 47.9 inches dbh
Giant = 48.0+ inches dbh

Data Sources: 1987 Vegetation Resource Survey - 109 plots
1984 Siuslaw Ecoplot Intensive Survey - 51 plots

Snags= dead standing conifers 10 feet tall or taller, with dbh in the above size classes.
Hard snags = snags in decay classes I, II and III (Cline 1977) Soft snags = snags in decay classes IV and V (Cline 1977)

Logs= pieces greater than 20 feet long, having the large end of the log in the above size classes.
Hard logs = logs in decay classes I, II and III (Fogel, Ogawa and Trappe 1973) Soft logs = logs in decay classes IV and V (Fogel 1973)

3. Old-Growth Forest Structural Characteristics

The following information is based on a study by Franklin and Spies (1991) conducted in the Oregon Coast Range south of Newport. 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. Density of large diameter Douglas-fir decreases with increasing moisture in the Coast Range, while density of sub-canopy trees generally decreases with increasing site moisture, probably as a result of increasing basal area of shade tolerant trees in the upper canopy which create low light conditions unfavorable to understory trees. Franklin and Spies data (Table 15) outlines significant structural and compositional characteristics by moisture classes. These moisture classes are similar to the sub-series environments identified earlier in this document.

Table 15. Some Structural Components of Stands in the Old-Growth Condition in the Oregon Coast Range by Moisture Classes (Spies and Franklin 1991), shown by mean and range[1] (in parenthesis).

STRUCTURAL COMPONENT	DRY[2]	MODERATE[2]	MOIST[2]
TOTAL basal area of all trees (square feet/acre)	283.1 (200.4 - 405.1)	304.9 (222.2 - 418.2)	313.6 (196.0 - 500.9)
Basal area of shade tolerant species, e.g., hemlock and redcedar (ft^2/acre)	9.6 (0 - 47.5)	69.7 (26.1 - 139.4)	135.0 (43.6 - 274.4)
Number of Douglas-fir trees larger than 40 inches dbh (trees/acre)	12 (4 - 23)	10 (4 - 19)	7 (1 - 10)
Total number of trees larger than 40 inches dbh (trees/acre)	12 (4 - 23)	11 (4 - 21)	10 (2 - 25)
Total number of sub-canopy trees (trees/acre)	17 (0 - 59)	21 (2 - 61)	0

1. The range portrayed here represents the mean, plus or minus one standard deviation (95% confidence limit).
2. 45 plots were sampled in each moisture class.

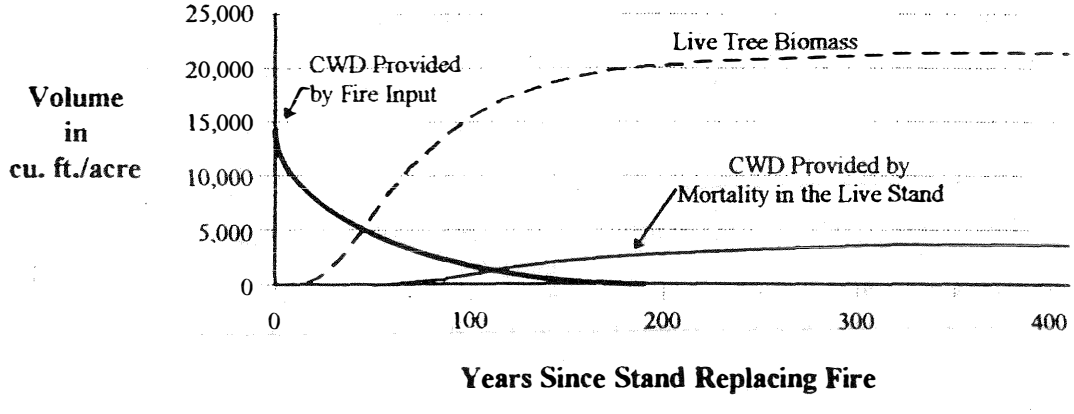
Franklin and Spies (1991) also found that some stand conditions (such as quantity and quality of snags, cavities, and live trees with broken tops) in the Coast Range did not seem to vary by moisture class.

4. Coarse Woody Debris (CWD)

Distribution of CWD through Space and Time

Many late-successional structural and compositional elements develop by the time a stand is 100 to 150 years old. However, large accumulations of Coarse Woody Debris (CWD), including both snags and down logs, take a long time to develop naturally after a stand replacing disturbance. Due to rapid decomposition rates in the Coast Range most of the CWD from the previous stand is not detectable 100 to 150 years after it reaches the forest floor (Wright 1997). Additionally, at 100 to 150 years CWD accumulations are just beginning to increase as large trees begin to die (Spies and Cline 1988). This results in CWD levels operating on a different cycle than live tree biomass. CWD levels are actually highest early in succession and lowest in mid-seral stands. Figure 2 displays the general cycle of CWD over time for a single disturbance event.

Figure 2. Coarse Woody Debris Cycle Following a Stand Replacing Disturbance



Levels of CWD in this assessment area are even lower than the levels depicted in Figure 2 for several reasons:

1) Much of the assessment area has burned in multiple fires within a relatively short period of time (less than 50 years between fires). Subsequent fires generally burned up the logs and snags created by the initial fire and the newly burned, young trees are not large enough to contribute substantial amounts of CWD.
2) In the early 1900s, most of the large logs and snags created by wildfires were salvaged (removed and sold as commercial timber).
3) Many of the natural 80 to 120 year old stands which would have started to contribute large CWD were harvested in the past 50 years. In commercially thinned stands, most of the suppressed trees (which would have provided CWD as they died) have been removed,

snags have been felled for safety concerns, and some of the down wood has been harvested. In clearcuts most of the live trees have been salvaged or removed as firewood. Some of the CWD was removed from the site during harvest and post harvest treatments (i.e., slash burning). Spies and Cline (1988) observed that at least six times more CWD carries over after wildfire in old-growth systems than after logging in old-growth; in addition, the CWD left after logging is smaller and decays faster. Young managed stands will not provide high levels of CWD for at least 150 years after harvest (Wright 1997).

Tables 16 and 17 display the results of two recent surveys of CWD in plantations on the Siuslaw National Forest. Table 16 represents the levels of down wood at the time of final harvest. This information was collected for a fuels inventory by Peterson and Barnes (1987) and compared to previous fuels data inventories. It shows that the majority of material is in the nine inch to over twenty inch size classes. The smaller material is consumed by slash burning at a higher rate than the larger size classes. On the average 2,901 cubic feet per acre remain after harvest and 1,487 cubic feet per acre remain after slash burning.

Table 16. Down Wood Conditions Following Clearcut Harvest 1980 to 1990[1]

Site Condition	CWD Levels by Size Class (in cubic feet/acre)			
	3" to 9"	9" to 20"	Over 20"	Total Over 3"
Before Slash Burning	801	1,082	1,018	2,901
After Slash Burning[2]	81	541	865	1,487

1. Peterson, J.L. and D.A. Barnes (1986-1987). Comparison of biomass characteristics on clearcut units on the Siuslaw National Forest with other western Washington and Oregon sites.
2. Post burn consumption based on professional judgment of worst case scenario. Assumed 3" to 9" material 90 percent consumed, 9" to 20" material 50 percent consumed, and over 20" material 15 percent consumed.

Table 17 displays down log information collected during stand exams for plantations on the Siuslaw National Forest. This information is within the ranges reported by BLM, Salem and Coos Bay Districts, where stand exam information for 40 year old plantations which show down log quantities mostly in the larger diameter classes with an average of 3,085 cubic feet per acre, ranging from 1,831 to 4,083 cubic feet per acre. Values shown in Table 17 indicate the average and one standard deviation in parentheses, which represents the range of the population. The variability is readily apparent. In the early successional plantations, most of the down wood volume is in the soft log class, decay classes III through V. This is consistent with information presented by other researchers (Spies and Cline 1988). Depending on the plantation age, the average down wood volume ranges from 3,010 to 3,409 cubic feet per acre Log lengths were also surveyed. On the average, 51 percent of the down logs inventoried were greater than twenty feet in length, ranging from 29 to 61 percent of the logs being greater than twenty feet in length.

Table 17. Existing Down Log Volumes (Range in Parenthesis) in Plantations on the Hebo Ranger District

Plantation Age	Average Hard Log Volume (in cubic feet/acre)	Average Soft Log Volume (in cubic feet/acre)	TOTAL Log Volume (in cubic feet/acre)
11 to 24 years old	630 (0 to 2,094)	2,423 (0 to 5,049)	3,010 (0 to 6,084)
25 to 49 years old	413 (0 to 1,346)	2,956 (0 to 7,216)	3,409 (0 to 7,787)

1. The range portrayed here represents the mean, plus or minus one standard deviation (95% confidence limit).

The CWD created by a single stand replacing event and then "lost" because of subsequent fire or timber harvest, is referred to as the "**lost legacy**". With most late-seral stands being in the mature condition, CWD in this assessment area is already at the low end of its natural range. Additionally, much of the assessment area has been impacted by repeated burning (Tillamook Burn and Nestucca/Mt. Hebo Fires). Because the levels of CWD are generally low over much of the assessment area, this lost legacy cannot be readily replaced. Since CWD is critical to the development of late-successional habitat, it is recommended that watershed analysis and site specific project plans identify the areas impacted by this lost legacy. Silvicultural treatments in these areas should focus on the development of large trees and the creation of CWD, balancing the need for CWD with the need to accelerate the attainment of other late-successional habitat characteristics and the risks from insects and fire.

The July, 1996, Regional Ecosystem Office Review Exemption Criteria (Appendix I) states: "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." The optimum levels of snags and down logs needed to sustain late-seral species have not been determined. Most studies have focused on natural stands, identifying the levels of CWD which exist and currently sustain populations of late-seral species. The best available information on late-seral levels of CWD in this assessment area comes from three studies - Spies and Cline (1988), Spies and Franklin (1991), and a Master's thesis in progress by Wright (1997). The Spies and Cline (1988) data and the Spies and Franklin (1991) data were collected from the same plots on sites south of Newport in the Oregon Coast Range. For CWD levels in stands less than 80 years old, the data is extremely variable. This may be because the 1988 and 1991 studies sampled stands which included areas burned two to four times since the mid 1800s, while the Wright data presented in this chapter focuses on natural stands which are likely to have experienced a single disturbance event. However, in all three studies, the CWD levels for late-seral stands are comparable and have been developed into recommendations for this assessment area.

Current CWD Levels

The level of CWD may correlate more closely with disturbance events than with sub-series environments. Because natural disturbances typically do not destroy much of the debris biomass in large pieces of wood, large snags and logs are present in most natural stands of all ages. In addition, CWD is unevenly distributed in the forest; the amount of CWD may vary tenfold between closely adjacent areas and more than half of the CWD may occur on less than one fifth of the total area (Spies and Cline 1988). As shown in Table 18, stand age affects the size and amount of CWD.

Table 18. Current Mean (Range in Parenthesis) Numbers of Snags and Down Logs in the Oregon Coast Range by Stand Age (Spies and Cline 1988)

AGE OF STAND	[1] SNAGS PER ACRE (mean # of snags per acre)			[2] DOWN LOGS PER ACRE (mean # of *logs per acre*)			
	All sizes	>20"	>20" and >16 feet tall	<12" diameter	12" to 24" diameter	>24" diameter	Total #, all sizes
Young (<80 years)	48 (26 to 70)	7 (3 to 11)	2 (0 to 4)	70 (39 to 101)	39 (23 to 55)	7 (3 to 11)	117 (84 to 150)
Mature (80-199 yrs.)	53 (1 to 105)	7 (0 to 14)	3 (0 to 7)	130 (39 to 221)	41 (6 to 76)	10 (0 to 24)	182 (70 to 294)
Old-growth (>199 years)	17 (14 to 20)	7 (4 to 10)	4 (2 to 6)	69 (29 to 109)	45 (39 to 81)	15 (7 to 23)	128 (64 to 192)

1. Includes all decay classes and snags over four inches in diameter and four inches tall
2. Includes all decay classes and no minimum length.

Current Snag Levels Table 19 displays the mean and range (plus or minus one standard deviation) of snag levels found in natural stands in the Oregon Coast Range. At this time, it is the best available information on existing snag levels. The values for "all heights" represent all snags greater than four inches in diameter and greater than four inches tall. The cubic feet/acre values from the Wright Model recently prepared for the Siuslaw National Forest (Wright 1997) are also displayed. Within natural stands at any age, between 40 and 60 percent of the coarse woody debris component is snags (Spies and Cline 1988). Based on this information, the values in Table 19 from the Wright Model represent half of the CWD component. The other half of the CWD component volume is displayed as down logs in Table 20.

Wright's model suggests that the mean range for snags (half of the CWD component from her model) in young natural stands 30 to 50 years old would be 3794 cubic feet/acre. Evaluation of recent Managed Stand Survey data from 50 managed stands on the Siuslaw National Forest showed that plantations seventeen to 50 years of age had an average of six snags per acre, with a range from zero to 40 snags per acre. No snags were found on half of the plots and only three plots recorded a snag greater than twenty inches at dbh. Most snags are less than the average stand diameter, indicating suppression mortality.

Table 19. Current of Number and Volume of Snags in Natural Stands in the Oregon Coast Range, shown by mean and range[1] (in parenthesis).

Stand Age	Spies and Franklin (1991)				[2] Wright (1997)
	Total # of Snags/Acre > or = 20" dbh (all heights)	Total # of Snags/Acre > or = 20" dbh **AND** > 16 feet tall	Total # of Snags/Acre <20" dbh (all heights)	Cubic Feet/Acre of All Snags[3]	Cubic Feet/Acre of All Snags[3]
[4] Young (<80 years)	7 (3 to 11)	2 (0 to 4)	48 (26 to 70)	1230 (615 to 1845)	3794 (2844 to 4839)
Mature (80-199 yrs)	7 (0 to 14)	3 (0 to 7)	53 (1 to 105)	1488 (200 to 2775)	1644 (1603 to 1686)
Old Growth (>199 yrs.)	7 (4 to 10)	4 (2 to 6)	17 (14 to 20)	2117 (229 to 4006)	1906 (1867 to 1946)

1. The range portrayed here represents the mean, plus or nin s one standard deviation (95% confidence limit).
2. Wright's (1997) recently developed model suggests that the mean range for CWD in 30 to 50 year old natural stands would be 265 cubic meters/hectar or 3794 cubic feet/acre. These values represent what would be expected following a single fire event in the Central Interior Soil/Climate Zone. Values for the North Interior Zone were not significantly different. Values for the Coastal Fog Zone were higher in the old-growth condition and need further study before applying them. Note: values displayed are half of the act al values modeled, since modeled values included both snags and down logs which are found in approximately equal proportions in Oregon Coast Range stands (Spies and Cline 1988).
3. Snags include all dead standing trees four inches in diameter and larger and four inches tall and taller.
4. Knowledge of the types of stands where Spies' and Franklin's data (1991) was collected suggests that these values and ranges may be on the low end of the range of conditions for the levels of snags found in the Oregon Coast Range. The young, natural stands (less than 80 years of age) which they sampled are likely to have included stands which experienced multiple fires (two to four) since the mid 1800s. Under this type of disturbance, the levels of snags would be much lower than snag levels in stands which experienced only a single stand replacement disturbance.

Current Levels of Down Wood Table 20 displays the mean and range (plus or minus one standard deviation) of down wood that could be expected in the Oregon Coast Range under natural conditions. The amount of down wood found in young natural stands less than 80 years old ranges from 525 to 4839 cubic feet/acre. Mature forests have lower volumes of down wood than are found in old growth. A high proportion of the down wood in stands less than 80 years old is concentrated in decay classes III, IV and V. Mature stands tend to have down wood distributed in decay classes II through V. Down wood in old-growth stands tends to be concentrated in decay classes II and III (Franklin, Spies and Thomas 1988).

Table 20. Current Down Wood Volumes and Percent of Ground Covered in Natural Stands of the Oregon Coast Range (Spies and Cline 1988), shown by mean and range[1] (in parenthesis).

Stand Age	[2]Spies and Cline, 1988		Wright Model, 1997
	[3]Cubic Feet/Acre	[4]Percent of Ground Covered	[5]Cubic Feet/Acre
[6]Young (<80 years)	1102 (525 to 1979)[5]	3.8% (2.5% to 5.1%)	3794 (2844 to 4839)
Mature (80 to 199 years)	1731 (300 to 3162)	5.2% (1.6% to 8.8%)	1644 (1603 to 1686
Old Growth (>199 years)	3262 (1382 to 5141)	6.2% (3.5% to 8.9%)	1906 (1867 to 1946)

1. The range portrayed here represents the mean, plus or minus one standard deviation (95% confidence limit).
2. Spies' and Cline's data (1988) includes all decay classes, to a four inch minimum log diameter.
3. Spies' and Cline's data was reported in cubic meters/hectar; the following conversion formula was used for this table: cubic meters/hectar X 14.306 = cubic feet/acre
4. The Oregon Coast Range had the lowest percent cover of any Pacific Northwest ecosystem assessed. Percent cover is an expression of projected horizontal area covered by down wood. It is calculated from log length and diameter.
5. Wright's (1997) recently completed modeling suggests that the mean range for CWD in 30 to 50 year old natural stands would be 265 cubic meters/hectar or 3794 cubic feet/acre. These values represent what would be expected following a single fire event in the Central Interior Soil/climate Zone. Values for the North Interior and the Coastal Fog Zones were not significantly different. Note: values displayed are half of the actual values modeled, since modeled values included both snags and down logs which are found in approximately equal proportions in Oregon Coast Range stands (Spies and Cline 1988).
6. Knowledge of the types of stands where Spies' and Cline's data (1988) was collected suggests that these values and ranges may be on the low end of the range of conditions for the levels of down wood found in the Oregon Coast Range. The young, natural stands (less than 80 years of age) which they sampled are likely to have included stands which experienced multiple fires (two to four) since the mid 1800s. Under this type of disturbance, the levels of down wood would be much lower than down wood levels in stands which experienced only a single stand replacement disturbance.

VI. MANAGEMENT CONSIDERATIONS AND APPROPRIATE ACTIVITIES

Chapter IV characterized landscape level blocks, which have similar characteristics and play similar roles in the late-successional network, and recommended coarse scale goals and treatment priorities. This section of the assessment uses the structural and compositional elements described in Chapter V to develop a process and criteria for recommending management activities which will hasten the development of late-successional habitat within the assessment area.

A. EXISTING OR POTENTIAL SITE CONDITIONS

There are a variety of existing or potential conditions on the landscape, largely a result of past land-use patterns and/or practices, which could "trigger" a management activity. The purpose of silvicultural treatments within LSRs is to benefit the creation and maintenance of late-successional forest conditions over the long term (ROD C-12). Nonsilvicultural activities which are neutral or beneficial to the creation and maintenance of late-successional habitat are allowed; activities that pose adverse impacts may need to be modified or eliminated (ROD C-16).

1. Silvicultural Treatments to Accelerate Development of Late-Successional Characteristics

Studies have shown that accelerated development of many of the structural components of late-successional stands can be achieved through active management (Oliver 1992, Marshall 1991). Wide spacing provides the site condition for open-grown trees and the development of large, lateral branches which result in a "wolfy limb" character to individual trees. Through time, the large trees will die, decay and fall to the ground or into the stream channel. As a result, it can be suggested that growing big trees also accelerates development of the down wood and snag components in size classes typical in late-successional habitats. As identified in Chapter V, development of the CWD component should be the primary focus of silvicultural activities in those areas where the "lost legacy" occurs. Development of multiple canopy layers, overstory canopy gaps, and a patchy understory can be encouraged through silvicultural activities. However, understanding the spatial distribution of these features at the stand and landscape scales is a topic which needs further research..

The effects of accelerated development of structural characteristics on ecosystem processes (i.e. tree growth and maturation, death and decay, disturbances), and functions (i.e. nutrient and hydrologic cycling, buffering of microclimates, storing carbon) are not fully known and understood. Some processes and functions cannot be accelerated and will simply take time to develop. Thus, adaptive management studies should be designed with enough variability in treatments and enough untreated controls to provide for any unknown elements, functions and processes.

The following site conditions could trigger silvicultural treatments:

Stands Currently on a Suitable Trajectory for Attainment of Most Late-Successional Characteristics - These stands are developing late-successional habitat characteristics appropriate to their current seral stage. These stands may benefit from less intensive treatments such as the creation of snags and large down wood, planting shade tolerant species which do not have existing seed sources in the immediate area, and road closures or obliteration.

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

The uniformity of trees within a stand determines the rate of differentiation and self-thinning. Although plantations are generally more uniform, portions of the stands are as non-uniform as many natural stands, and some portions of natural stands developed as uniformly as the plantations. Stand conditions are a continuum, with a wide range of development which has taken place in natural stands. The plantations are skewed towards the more uniform end of the spectrum. Thinning dense, uniform stands such as these to a wider spacing would provide the remaining trees more of an opportunity to grow rapidly before coming into intense competition again.

Active management such as thinning and underplanting could accelerate tree growth and establishment of a secondary tree canopy, encouraging development of large overstory trees and multiple canopy layers, and creating large trees which could provide CWD. Many of these conditions would develop within 30 to 75 years. Without thinning and underplanting, the managed stands would eventually obtain late-successional characteristics, but attainment of many of these characteristics could take more than a century. Such management activities are compatible with the Aquatic Conservation Strategy and will be used within Riparian Reserves to "maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands," and "habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species" (ROD B-11).

On federal lands, most of the pioneer, very-early, and early-seral-stage stands identified on Map 8 are managed plantations. The early-seral-stage stands are predominately 25 to 40 years old and may benefit from silvicultural treatments focused on developing late-successional characteristics over the next fifteen years. Younger stands less than 25 years old may require some sort of density management within the next 40 years. Scientific research supports the concept that changing the current trajectory of these stands by manipulating tree densities and species composition will accelerate the development of some late-successional characteristics (Oliver and Larson, 1990; Marshall, 1991).

Inappropriate Species Mix - In some areas existing species mixes may be inappropriate for the site and detrimental to the attainment of late-successional characteristics. This is often the case when past disturbances, especially if human caused, resulted in a species shift from what was there naturally, or introduced noxious or non-native species which inhibit the regeneration of native plant communities. Silvicultural treatment of Riparian Reserves in this site condition is compatible with the Aquatic Conservation Strategy.

Catastrophic Events (Disturbance) - Every effort should be made to employ management practices which are not likely to result in catastrophic disturbances. However, it is likely that catastrophic disturbances (insects, disease, wind or fire) will occur. These disturbances may be detrimental to the goals and objectives of the LSR/AMA. Consider silvicultural treatments which reduce or mitigate the impacts to late-successional habitat if a disturbance exceeds ten acres and reduces canopy closure to below forty percent. In the case of insect outbreaks, chemicals should be used as a control treatment only as a last resort. All management responses to disturbance events will follow the guidelines in the ROD.

Risk of Catastrophic Events - Some treatments are appropriate if they are essential to reduce the risk of future damage to late-successional forest conditions (ROD C-15). Since small scale disturbances are natural events which are likely to enhance development of late-successional habitat, it is important to understand that treatments under this site condition focus only on those areas where there is high risk of large-scale disturbance which will hinder the attainment of LSR objectives. The proposed Fire Management Plan (Appendix C) identifies some fuel treatments which are appropriate. Treatments to reduce the risk of a widespread disease that may hinder the attainment of LSR objectives would focus on promoting disease resistant or non-host species, based on the appropriate successional pathway for the site and the stand structure and composition as identified in Chapter V of this assessment.

Forest Genetics Plantations - These existing sites consist of small stands, usually less than fifteen acres, developed to study the genetics of a single tree species. The stocking of these stands has been carefully designed and developed through careful control of seed and seedlings, and grafting. Specific plans have been implemented and are followed for each site. Current plans propose thinning most of these sites. Where appropriate, sites will be managed to enhance late-successional characteristics.

2. Non-Silvicultural Treatments and Activities

The following site conditions could trigger non-silvicultural treatment and activities:

Degraded Sites/Poor Soil Productivity (including Landslides and Debris Torrents) - Another condition on the landscape where management activities can assist in attainment of late-successional characteristics is when soil productivity is so severely degraded that the site can no longer support or maintain plant communities which would occur at healthy sites. Soil restoration activities could be employed to restore the soil quality on these sites.

Need to meet Aquatic Conservation Strategy Objectives - Existing conditions in riparian areas, wetlands, and aquatic habitats may hinder attainment of Aquatic Conservation Strategy (ACS) objectives. In order to meet ACS objectives over time, these areas should be a high priority for restoration.

Special/Unique Habitats - There are some sites in the assessment area which are not expected to be on the trajectory of attaining late-successional structural characteristics (Map 12). These sites occupy a small component of the landscape (less than one percent) and are considered important for the contribution they add to diversity across the landscape, such as rock outcrops, wetlands and meadows and the unique species which inhabit them. Management considerations should include protection and maintenance of these special habitats.

Recreational Uses - Developed and undeveloped recreational uses have the potential to adversely impact late-successional habitat and associated species by damaging critical elements of the habitat, increasing noise or physical disturbance, and introducing competitive non-native species. When opportunities arise, existing uses are being evaluated for consistency with the Northwest Forest Plan, which allows neutral impacts for non-silvicultural activities within the LSR. Some existing developed sites have been modified to better achieve with Aquatic Conservation Strategy (ACS) objectives, improving riparian habitat and increasing the potential for development of late-successional characteristics. Expansion of existing facilities and uses, and proposed new facilities and uses should not preclude LSR and ACS objectives.

Research and Harvest of Special Forest Products - Some research projects and the removal of special forest products (moss, ferns, mushrooms, firewood, etc.) also have the potential to adversely impact late-successional habitat and associated by damaging critical elements of the habitat, increasing noise or physical disturbance, and introducing competitive non-native species. These activities are being evaluated for consistency with the Northwest Forest Plan, which allows neutral impacts for non-silvicultural activities within the LSR. They are managed by identifying appropriate areas for these activities, implementing the associated mitigating measures where appropriate, and monitoring to evaluate long term effects.

B. PLANNING AND DESIGNING APPROPRIATE ACTIVITIES

Table 21 identifies potential and existing site conditions which could trigger an appropriate management action. In some cases, such site conditions would have different objectives and thus a different response from management depending on the seral stage of development. For example, in the very early-seral stage (less than 10 years old) a silvicultural prescription might not space trees so widely that the risk of damage by animals or competition from herbs and shrubs would be so high that the desired tree species would be lost. Instead, a management goal in the very early-seral stage might be to plant and maintain enough trees on site that one could be assured that adequate stocking to meet long term objectives would be attained. It might not be until the later seral stages that confidence in survival would be high enough that a management activity would risk thinning trees widely.

The appropriate management activities identified in Table 21 are the result of an integrated prescription which considers management objectives, successional pathways appropriate for a given site, and desired future conditions. Information presented in this table will help to guide the development of prescriptions for the appropriate management activities. The management objectives apply to most management activities which occur within the assessment area and are important to maintaining and achieving late-successional characteristics or special habitats for "at risk" plant, wildlife and fish populations. Not all management activities identified as appropriate in Table 21 will be applicable to every project. If the identified objectives cannot be met or the proposed management activity is not within the scope of activities included in Table 21, the project is subject to review by the Regional Ecosystem Office (REO) for consistency determination with the ROD. Additionally, to be exempt from REO review, silvicultural activities must meet the Guidelines for Habitat Manipulation following Table 21.

Although we have listed many management activities that would be appropriate in late-successional reserves, they have been kept very general. This was done purposefully to allow specialists to make recommendations based on site specific evaluation.

Those who are planning/designing and implementing projects in this assessment area should use the following process for determining appropriate management activities:

1) Identify the site/stand condition on the landscape which would trigger a management action (Table 21).
2) Relate the site to objectives and goals which have been established for that portion of the landscape (e.g. Landscape Cell/Zone, Northwest Forest Plan land allocation, watershed analysis, and site specific plans.
3) Determine the seral stage of development, and the appropriate sub-series environment and successional pathway for the site.
4) Determine the site specific issues of the area.
5) Establish the appropriate management objectives (Table 21) and sideboards (Tables 6, 13, 14, 15, 18, 19, and 20). For complex projects it will be beneficial to work through these steps with an Interdisciplinary Team.
6) Prepare a prescription which integrates site specific issues and needs with the appropriate objectives and goals.

Table 21. Appropriate Management Activities in Late-Successional Reserves Based on Existing Stand/Site Condition, Seral Stage, and Management Objectives.

The following **common management objectives** are applicable to *all* stand/site conditions listed in this table:

- Maintain site occupancy (conifers and hardwoods) appropriate for plant association and sub-series.
- Maintain tree vigor and health.
- Encourage natural regeneration.
- Encourage variation in tree spacing.
- Retain and encourage diversity of native species.
- Maintain and restore site productivity.
- Manage the risk of insect and disease outbreaks.
- Manage in compliance with Aquatic Conservation Strategy standards and guidelines.
- Manage road and trail systems consistent with Access and Travel Management/Transportation Management objectives.
- Manage in compliance with Research Natural Area, Area of Critical Environmental Concern, Special Interest Area, botanical area, and T&E species objectives.

Note: Management activities appropriate in LSRs may also be appropriate in the rest of the assessment area. **NOT** all management activities listed for each existing site/stand condition apply in every case.

Silvicultural-related stand conditions

Existing stand condition	Seral stage	Supplement to common management objectives	List of potentially appropriate management activities
Stand or area on a suitable trajectory for attainment of most late-successional structural characteristics (includes conifer and mixed hardwood-conifer stands of varying density)	All seral stages.	Supplemental management objectives by seral stage for "dense uniform conifer stands." (following section) also apply to seral stages in this section	No treatment. Create snags and large down wood. Close or obliterate roads. Plant shade tolerant species Refer to Tables 9, 10, and 11 for more specific information regarding specific stand structural elements.
Dense and/or uniform conifer stands (typically plantations or other stands where the management focus has been on single resource uses, such as commercial thinning for timber production)	Pioneer and very early (0 to 24 years)	Grow large trees.	No treatment. Interplant with appropriate native species. Implement density management (including adjustment of species composition). Fertilize following density management. Prune

Table 21, continued.

Existing stand condition	Seral stage	Supplement to common management objectives	List of potentially appropriate management activities
Dense and/or uniform conifer stands, continued	Early (25 to 49 years)	Grow large trees. Encourage development of large limbs on some trees. Encourage windfirmness - avoid excessive windthrow.	No treatment. Implement density management (including adjustment of species composition) by thinning to variable spacing within stands and/or across the landscape. Fertilize following density management. Place large wood in streams and in stands. Create snags. Use prescribed fire for creation of structure and management of species composition.
	Mid (50 to 79 years) and late (80 to 110 years).	Grow large trees. Develop large limbs on some trees. Develop multiple canopy layers. Create large diameter snags and down logs. Develop windfirmness - avoid excessive windthrow.	Create gaps and clumps. Underplant with appropriate native species. Apply any of the appropriate management activities listed for the "early" seral stage. *Note: stands designated as suitable habitat in RPAs are reserved from timber harvest.*
Existing species mix inappropriate for the site (conifers dominating hardwood sites, hardwoods dominating conifer sites, "off-site" plantations, Douglas-fir dominating Sitka spruce environments in the Coastal Fog Zone, noxious weeds/exotic species, etc.)	All		No treatment. Remove and re-establish appropriate species (site conversion). Refer to Successional Pathways. Control noxious weeds/exotic plants. Manage stand density. Release appropriate species from competition. Use prescribed fire.

Table 21, continued.

Existing stand condition	Seral stage	Supplement to common management objectives	List of potentially appropriate management activities
An existing condition of disturbance larger than ten acres and having less than 40% canopy closure - including fire, insect, disease, windthrow, etc.	All	Salvage guidelines in ROD C-13 through C-16 and salvage guidelines at the end of this chapter	No treatment. Reallocate CWD to provide off-site CWD for fish and/or wildlife habitat needs. If reallocation of CWD for fish and/or wildlife habitat improvement is not feasible, it is appropriate to remove excess CWD for economic benefit in accordance with salvage guidelines at the end of this chapter and Table 24. Replant with appropriate native species, including disease resistant/non-host species. Apply pheromones.
A condition (see Appendix C) where treatment is necessary to reduce the risk of a large-scale stand replacement fire that may hinder the attainment of LSR objectives	All	"Risk" guideline in ROD C-15, salvage guidelines at the end of this chapter, and Fire Mgmt. Plan (Appendix. C)	No treatment; provide on-site and off-site CWD for fish and wildlife habitat needs. Treat fuels as identified in the attached Fire Management Plan (Appendix C).
A condition where treatment is necessary to reduce the risk of a widespread disease (examples: laminated root rot, Swiss needle cast) **that may hinder the attainment of LSR objectives**	All, except stands over 110 years old	"Risk" guideline in ROD C-15	No treatment. Thin to promote disease resistant or non-host species (tree removal consistent with CWD guidelines). Plant with disease resistant/non-host species.
Forest genetics plantations and facilities (progeny evaluation sites and seed orchards)	All	ROD C-17, Developments	Manage existing sites - thin progeny sites and treat seed orchards as per existing forest genetics plans. Enhance late-successional characteristics as opportunity allows.

Table 21, continued.

Non-silvicultural-related site conditions (all seral stages)		
Existing site condition	**Supplemental considerations and objectives**	**List of potentially appropriate management activities**
Degraded site/soil productivity		Add large down wood. Close or stabilize roads. Increase infiltration by fracturing compacted surfaces. Fertilize and/or plant native nitrogen-fixing species. Monitor changes in productivity.
Landslides/debris torrents		Restore roads. Stabilize slopes. Reduce risk of additional road failure and landslides by pulling back sidecast on steep slopes and removing low maintenance culverts at stream crossings. Plant native nitrogen-fixing species.
Poor riparian health hinders attainment of ACS objectives (poor quality fish and wildlife habitat, excessive sedimentation, changes in hillslope hydrology, elevated stream temperatures, low levels of CWD in streams)		Close or stabilize roads. Stabilize slopes. Maintain/replace culverts. Create stream channel complexity. Place CWD in stream channels and riparian areas (includes importing CWD from off-site sources). Create snags. Increase infiltration by fracturing compacted surfaces. Restore potential of the site for natural recruitment of conifers.
Harvest of special forest products	ROD C-16 and C-18.	Monitor to evaluate long term effects. Harvest in accordance with Suislaw National Forest Special Forest Products Environmental Assessment and BLM Special Forest Products Handbook. Balance firewood removal with CWD needs.

Table 21, continued.

Existing site condition	Supplemental considerations and objectives	List of potentially appropriate management activities
Research	ROD C-18 and C-19.	Allow as appropriate.
Poor condition of or declining trends in Special Habitat Areas (alpine meadows, wetlands, rock outcrops, talus slopes)		Close or stabilize roads. Stabilize slopes. Maintain/replace culverts. Create stream channel complexity. Place CWD in stream channels and riparian areas No treatment. Use prescribed fire. Clear vegetation manually or mechanically. Restore soils. Control exotic plants and noxious weeds. Re-establish native plant communities.
Recreational use (improvement of existing facilities and trails, expansion of existing facilities and trails, development of new facilities and trails, recreation events)	ROD C-16, C-17, and C-18. Neutral or beneficial effect to creation and maintenance of late-successional habitat and associated species (including Survey and Manage species). Avoidance of "adverse effects" to T&E species and critical habitats. Does not retard or prevent attainment of LSR objectives.	Monitor impacts to T&E and Survey and Manage species. Evaluate existing uses, modify or revise existing plans. Close, relocate or construct campsites, trails, dispersed recreation sites. Stabilize, close, or obliterate roads. Maintain or replace culverts. Restore riparian condition. Control exotic plants and noxious weeds. Designate appropriate areas. Provide resource protection information.
Other (rock quarries, mines, mineral extraction, realty actions, habitat improvement projects, electronic sites, etc.)	ROD C-16 through C-19.	Identify appropriate areas and mitigation measures.

C. GUIDELINES FOR HABITAT MANIPULATION

Potentially appropriate projects which do not meet the existing guidelines or guidelines proposed later in the chapter, will be submitted to the Regional Ecosystem Office (REO) for review prior to implementation.

1. Existing Guidance

The Salem District Record of Decision and Resource Management Plan (USDI 1995) and the Land and Resource Management Plan for the Siuslaw National Forest (USDA 1990) provide specific guidance for habitat manipulation in special or unique habitats. They also supplement the Northwest Forest Plan (ROD) by providing more specific direction in critical areas, such as LSR RO270.

The Northwest Forest Plan addresses maintaining dispersal habitat for terrestrial species through Riparian Reserves. The Riparian Reserve network was designed to facilitate dispersal of both terrestrial and aquatic species. The reserve system and other mitigating measures found in the Northwest Forest Plan replaces the 50-11-40 rule. Dispersal habitat for the owl is defined as stands with an average tree diameter over eleven inches dbh and a minimum crown closure of 40 percent. Stand treatments which reduce the crown closure to below 40 percent (or approximately 60 trees per acre in a 35 year old stand in the Coast Range) may affect dispersal for owls. The effects of silvicultural prescriptions on dispersal habitat will be identified and evaluated at the fifth-field watershed level in consultation with the U.S. Fish and Wildlife Service and the level one consultation team for the Oregon Coast Province. In the LSRs in this assessment area, the Riparian Reserve network covers approximately 80 percent of the landscape. In general, activities proposed in this assessment are planned both inside and outside of Riparian Reserve boundaries within LSRs. Many of the objectives for LSRs are similar to Riparian Reserve objectives and thus, similar treatments are appropriate. All activities within Riparian Reserves must be consistent with Aquatic Conservation Strategy objectives (ROD B-12 through B-17).

The Northwest Forest Plan provides specific direction for the establishment and protection of Owl Reserved Pair Areas (RPAs) within this assessment area. Initial boundaries have been identified for all of the RPAs in the assessment area, including those delineated in the Nestucca and Drift (Siletz) Watershed Analyses (USDA and USDI 1994c, and USDA and USDI 1996a, respectively). Boundaries of all RPAs will be site specifically analyzed and finalized by the end of calendar year 1998. The Northwest Forest Plan restricts timber harvest within RPAs: "Reserve all suitable habitat in that area [the RPA] from timber harvest." (ROD D-16), and "allow[s] for management of currently unsuitable areas consistent with Late-Successional Reserve management standards and guidelines for silviculture and salvage" (ROD D-17).

Appendices I.1 and I.2 contain two letters of direction from the REO which outline specific types of treatment that are already exempt from review. It has been sufficiently demonstrated that these treatments have a high rate of success and will accelerate the development of certain characteristics of late-successional forest habitat.

2. Guidelines Developed in This LSR Assessment

In order to be exempt from further REO review, silvicultural activities in the LSRs will include the following coarse woody debris, salvage, and density management guidelines. These guidelines can also assist managers in identifying appropriate treatments in the non-LSR portions of the AMA.

Coarse Woody Debris (CWD) Management

Management prescriptions for meeting CWD objectives can be developed using the following steps:

1. Determine the overall objectives of the area under consideration based on the objectives identified in Table 21 and the goals and objectives outlined for Landscape Cells and LSR Zones in Chapter IV.
2. Evaluate (using a standardized method, if possible) existing amounts and decay classes of CWD in context of both the individual stand and the surrounding landscape. Consider the effects of previous entries and the potential for future entries.
3. Incorporate specific project area objectives for resources such as soil, fish, wildlife and plants. Resource specialists and IDT need to be familiar with CWD strategies.
4. Identify desired CWD level and a strategy for attaining that level (see the four strategies identified in this section of the assessment). Residual wood counts toward target levels. The seral stage and existing CWD levels will determine the feasibility of attaining sufficient CWD cover for wildlife.
5. Determine that the levels of CWD left on the site will not initiate unacceptable levels of bark beetle outbreaks or unacceptable risk of fire.
6. Evaluate economics - the ability to pay for the operation versus the value. Current funding mechanisms often do not allow for some of the prescriptions that would be appropriate to employ. The choice is often between doing nothing or removing more trees from the site than is desirable in order to pay for the operation. Interdisciplinary teams often struggle with weighing the benefit of thinning stands to encourage growth of larger trees and more diverse structure with attainment of CWD levels.
7. Select a different strategy to accomplish desired CWD levels, if necessary. Projects may be appropriate which do not employ this method of assessment and determination of CWD levels. These projects will be submitted to the REO for review prior to implementation.

Additional considerations:

* Retain the largest trees available for future structural components (i.e. wolf trees for marbled murrelet nesting habitat).
* Where safety considerations are met, protect existing snags larger than or equal to 20 inches in diameter at breast height (dbh) and ten percent of snags between nine and 20 inches in dbh (snag use will be greater in the size classes closer to 20 than to nine). Retain any snags knocked over during management activities as down wood.

* Mimic the natural variability in quantity and spatial arrangement of snags and down wood across the landscape. Do not focus on CWD levels in the uplands at the expense of CWD levels in riparian areas, and visa-versa.
* Where economically feasible, CWD can be incorporated into prescriptions by creating snags and down wood in adjacent mature stands and/or importing down wood from nearby locations with excess (e.g., windthrown trees) CWD.
* Within or adjacent to an RPA or Late-Seral Landscape Cell, the CWD level prescribed should be as close to suggested levels (Table 24) as is feasible for the existing seral stage.

The variability in distribution of CWD is dependent on the size of the landscape being considered. For example, a concentration of down wood resulting from windthrow may exceed natural levels in a small area, but compensate for a deficit in down wood over the surrounding larger area. Meeting even the minimum CWD level in the early-seral stages may be difficult and could involve felling down wood and creating snags within a thinning unit and/or at the edges of adjacent late-seral stands. If existing levels of CWD are low on a portion of the landscape, it is unlikely that CWD levels found in natural stands can be achieved quickly. In young stands less than 50 years old, there is little opportunity to create snags or down wood larger than twenty inches, as 50 year old trees in these plantations are generally less than sixteen inches in diameter at breast height. However, silvicultural prescriptions which accelerate tree growth can be implemented, setting stands on a trajectory to meet mature and old growth CWD levels. Subsequent entries, after stands are at least 60 years old, may be designed to promote CWD creation (by killing live standing trees once they become large enough) and maintain accelerated tree growth, developing CWD in the larger size classes. Insect and fire risk limit the amount of CWD that can be created in a single entry. The creation of CWD could be scheduled over time to reduce the potential for Douglas-fir bark beetle outbreaks.

Table 24 summarizes considerations and strategies that could be applied in single or multiple entries into a stand or landscape area. Target levels are recommended for minimum, moderate and high ranges of CWD to provide at each seral stage. The target levels selected depend on landscape and resource conditions at each seral stage and correlate with the strategies which follow the table. The ranges for each CWD level are a combination of Tables 19 and 20, as shown in Table 22. For each row, the median for Spies and Franklin's volume data is added to the median for Spies and Cline's volume data and appears in the Totals column; likewise, the low end of Spies and Franklin's data is added to the low end of Spies and Cline's data and the high ends are added to the high end, appearing in the totals column as a range. Wright's data is also summed: median snag volume plus median log volume, low end plus low end of range, high end plus high end of range. Minimum target levels were selected from low ends of the range to the medians; moderate target levels were selected using medians from Spies and Wright's data; high target levels were selected from the median to high ends of the ranges. Because most of the Spies and Franklin snag data came from stands between 60 and 80 years old, snag volumes were not included in target CWD ranges for seral stages below 60 years old. Snag and down wood inputs were added together for the higher target levels in seral stages above 60 years old (later mid-seral and late-seral stages). For stands under 80 years old, Wright's model predicted higher levels of CWD than were found by Spies, Franklin and Cline.

For this reason, the minimum and moderate levels of CWD were selected from Spies' data for the early and mid-seral stages and from Wright's for the high levels. The shaded portions of Table 22 highlight the numbers used in Table 24.

Table 22. Volume (cubic feet per acre) of Snags and Down Wood in Natural Stands in the Oregon Coast Range, shown by mean and range[1] (in parenthesis).

	SNAGS (Table 19)		DOWN WOOD (Table 20)		TOTALS	
Stand Age	Spies and Franklin	Wright	Spies and Cline	Wright	Spies, Cline & Franklin	Wright
25-79	1230 (615-1845)	3794 (2844-4839)	**1102 (525-1979)**	**3794 (2844-4839)**	2332 (1140-3824)	7558 (5688-9678)
80-199	1488 (200-2775)	1644 (1603-1686)	1731 (300-3162)	1644 (1603-1686)	**3219 (500-5937)**	**3288 (3206-3372)**
>199	2117 (229-4006)	1906 (1867-1946)	3262 (1382-5141)	1906 (1867-1946)	**5379 (1611-9147)**	3812 (3734-3892)

In order to meet more than minimum target levels in stands less than 50 years old, a high percentage of the standing volume would have to be left as CWD unless there is existing large CWD left from previous entries or there is a way to introduce large CWD from the surrounding area. Economics, risk and scheduling would need to be balanced with the target levels for CWD.

The amount of residual CWD depends on disturbance history and soil/climate zone. Wright's model predicted that the Coastal Fog Zone would generate more CWD than the Interior Zones. The figures in Table 22 were collected from or modeled for the Central Interior Soil/Climate Zone and may underestimate natural levels in the Coastal Fog Zone. Target levels should be adjusted as more site specific data is collected and more is learned about the requirements of plant and wildlife species associated with CWD.

As stand age and tree volumes increase, it will take fewer trees to meet target levels. The figures in Table 23 are included for comparison purposes only and cannot be used in place of collecting stand specific data for project level planning. Tree sizes are likely to vary by site class, stocking level and species.

Table 23. Conversion Table: Stand Age, Average Tree Diameter, and Average Volume/Tree in Fully Stocked Stands (based on Site Class II Yield Tables; McArdle et. al. 1961)

Average Stand:			Gross Volume:	
Age (years)	Number of Trees per Acre 7"+ dbh	Diameter at Breast Height (dbh in inches)	Cubic Feet/Tree	Board Feet/Tree
30	254	9"	11	62
50	231	13"	28	144
70	158	17"	68	398
80	136	19"	84	503
110	95	24"	150	977
140	75	28"	222	1,509

Strategies for Achieving Desired CWD Levels At the landscape scale, recommended CWD levels (Table 24) are not likely to be achieved during a single entry in early or mid-seral stands. Long-term, site specific strategies are necessary to guide current and future entries toward the goal of achieving the desired levels of snags and down wood. The following general strategies were developed to achieve specific objectives for the most common site conditions found in this assessment area. Strategies may need further refinement to accomplish site specific goals and objectives.

Strategy #1

Objective: Immediately improve nutrient cycling, fungal and soil invertebrate health, and habitat for CWD-dependent species. (Emphasize short-term needs.)

Implement this strategy when one or more of the following conditions apply(ies):

- The entry is the last opportunity to finance CWD input through timber harvest.
- The surrounding landscape is deficit in snags and/or down wood, and it would benefit wildlife by providing nesting, denning or foraging habitat.
- Soil productivity has been degraded by depletion of organic matter (e.g. by fire or severe erosion).

Prescription: Maximize input of CWD at all seral stages. In older stands, leave at least half of the CWD volume in snags to spread the down wood input over time. In younger stands, leave up to half of the CWD volume in snags, depending upon soil productivity needs.

Benefit: Improves degraded sites in the shortest period of time by maximizing fungal and microorganism habitat. Provides immediate increase in down log and snag habitat for wildlife.

Disadvantages: In young stands, this strategy provides only a short-term "fix", as small-diameter trees decay rapidly and potential for providing larger CWD later is reduced; size class insufficient for species that need large snags and down logs; limited number of trees left on site reduces future options for CWD; minimizes economic return for projects in the short term.

Table 24. Considerations & Treatment Options for Prescribing CWD Levels by Seral Stage

Seral Stage	Considerations, Treatment Strategies and Target Levels[1]
Pioneer and Very Early 0 - 24 years	Considerations: Stands deficit in CWD are probably relics of past management or multiple disturbance events. Maximize options for future CWD development through treatments such as precommercial thinning (PCT) at variable spacing. PCT and seedling maintenance create large amounts of fine CWD. Options: - No treatment to provide down wood at this time. (Strategy #4) - PCT and manual maintenance (removal of alder and brush). - Import down wood or create CWD in adjacent stands.
Early Seral 25 - 49 years	Considerations: First commercial thinning entry opportunity. Small tree size favors moderate or minimum levels at this stage. High levels may be appropriate in areas with soil productivity or wildlife habitat concerns or if only a single entry is expected for stands deficit in landscape level CWD or in a CORE Landscape Zone. Up to 1/2 of CWD volume should be left as snags. Options: - Minimum level 525-1100 cubic feet per acre (Strategy #3) - Moderate level 1100-1980 cubic feet per acre (Strategy #2) - High level 1980-3800 cubic feet per acre (Strategy #1) - No treatment (Strategy #4) - Import down wood or create CWD in adjacent stands.
Mid Seral 50 - 79 years	Considerations: Opportunities for first or second commercial thinning entry. Trees are larger and can provide larger CWD. Up to half of CWD volume should be left as snags. Options: - Moderate level 1100-1980 cubic feet per acre (Strategy #2)-depending on tree sizes and anticipated future entry. - High level 1980-4840 cubic feet per acre (Strategy #1)-depending on tree sizes and unlikely future entry. - Minimum level 525-1100 cubic feet per acre (Strategy #3) - No treatment (Strategy #4) - Import down wood or create CWD in adjacent stands.
Late Seral - mature 80 - 110 years	Considerations: May be last entry opportunity. Deficit levels of snags and down wood in stand and in surrounding landscape might warrant high to moderate levels of snag and down wood creation. To provide habitat for snag dependent species and future down wood, over half of the CWD volume should be left as snags. Options: - High level - 3200-5940 cubic feet per acre (Strategy #1) - Moderate level - 1730-3200 cubic feet per acre (Strategy #2) - No treatment (Strategy #4)
Late Seral over 110 years	Considerations: Deficit levels of snags and down wood in stands and in the surrounding landscape, or need for future CWD might warrant snag and down wood creation. Over half of CWD volume should be left as snags. Options: - No treatment - Mod. level to High level - 1610-5940 cubic feet per acre (Strategy #1 or #2)

1. Options provide specific CWD levels associated with the strategies described in the text. The order in which the specific CWD levels are presented as options suggests their greater likelihood of applicability to stands in each seral stage. The CWD ranges provided for each option are based on data in Table 22 (rounded to the nearest multiple of five cubic feet/acre).

Strategy #2

Objective: Balance long-term and short-term needs by supplying a steady input of CWD over time. Provide for short term needs of CWD while maintaining future options for recruitment of large size CWD.

Implement this strategy when one or more of the following conditions apply(ies):

- The stand has moderate to high levels of CWD in all decay classes.
- The surrounding landscape has moderate to high levels of CWD and effects on wildlife would be neutral or beneficial.

Prescription: Aim for moderate levels of CWD appropriate for the seral stage. Provide some CWD in early and mid-seral stages by dropping trees and/or creating snags to meet at least minimum CWD levels, as shown in Table 24. At early and mid-seral stages, focus on maintaining live tree stocking levels which will result in growing big trees rapidly (20 inches dbh or larger, at stand age 80). In late-seral stages, create large snags and down logs to achieve moderate levels of CWD in Decay Classes I and II and III, while retaining future options for CWD creation when Decay Classes IV and V are more abundant and Decay Classes I-III are deficit. In all seral stages, leave half of the CWD volume as snags.

Benefits: Provides incremental input of CWD over time. Strives to maintain habitat for down wood and snag dependent species while maintaining future options. *In younger forests*, provides for immediate needs for a minimal level to moderate level of CWD while increasing the probability of being able to provide larger size and higher quality CWD habitat in mature stands.

Disadvantages: May not meet immediate needs for CWD if surrounding landscape is deficit. Will take longer to get desired sizes (especially in the larger size classes) and quantities of CWD, as higher numbers of trees per acre would be left on-site at each entry to provide CWD which can be incorporated during successive entries.

Strategy #3

Objective: Develop large trees for future CWD. (Emphasize long-term needs.)

Implement this strategy when one or more of the following conditions apply(ies):

- Existing CWD on the site is at, or higher than, the minimum CWD level in Table 24.
- Existing CWD in the surrounding landscape is at, or higher than, moderate levels.
- The stand cannot provide sufficient volume to meet CWD levels higher than the minimum range.

Prescription: Drop trees and/or create snags to meet minimum CWD levels shown in Table 24 for each seral stage. Leave greater than half the volume as snags.

Benefits: Provides some input of CWD over time. Grows larger CWD for future.

Disadvantages: May not meet short-term needs for CWD.

Strategy #4

Objective: Allow natural succession processes to dominate by maintaining some untreated areas.

Implement this strategy when one or more of the following conditions apply(ies):

- Vegetation manipulation is not scheduled to occur in the area.
- Stands are already on the trajectory for attainment of late-successional conditions.
- Surrounding older forests provide adequate snag or down wood habitat in the short-term.
- Nutrient cycling and fungal and soil invertebrate health are not a concern.

Prescription: No Action - natural suppression, no thinning.

Benefit: Diversity of habitat, constant input of wood over time. Can be used as an experimental control to monitor differences between treatments.

Disadvantages: Will take longer to attain other LSR objectives and to accumulate quantities of large CWD and snags.

Example

An IDT is assessing an area within these LSRs to accelerate attainment of late-successional characteristics. The planning area is within the CORE Landscape Zone and specifically within Landscape Cell #3, which means that approximately 90 percent of the surrounding landscape is in early seral condition. The goal of this area is to provide contiguous late-successional habitat and to increase connectivity and dispersal habitat. Estimates, based on field observations, identified that the majority of the area has low levels of down logs, around 700 cubic feet per acre. The units have been densely planted to 350 trees per acre (tpa). Both short and long-term wildlife habitat is important.

Strategy #2 would be appropriate in this case, balancing long-term and short-term needs by supplying a steady input of CWD over time. The level of CWD appropriate for strategy #2 in an early seral plantation (see Table 24) is within the range of 1100 to 1980 cubic feet per acre. Using an average size tree of 12 inches dbh x 90 feet tall to a 4 inch top, the volume of the average tree would be 31 cubic feet (Siuslaw data). From the range of CWD volume, subtract the existing level of down wood (700 cu.ft./ac) and divide by the number of cubic feet in a tree of average size (31 cu. ft.) to determine that it would be appropriate to add 13 to 41 trees per acre (tpa) of CWD to this site. Up to half of the trees (7 to 20 tpa) would be left as snags. Depending on the site specific resource objectives, the CWD could be distributed in different parts of the same unit and/or within the immediately adjacent area.

The number of trees in the stand (350 tpa) and the need to leave a fairly dense stand (100 to 120 tpa) for future recruitment of CWD leaves a sufficient number of trees to sell to pay for the operation (at least 200 tpa). The contract value is such that up to 40 tpa could be left and the project still pay for itself. No hazard from a fire or insect/disease standpoint is involved, so the team chooses to leave 40 tpa or about 1200 cu.ft./ac. in addition to the existing 700 cu.ft./ac. for total of 1900 cu.ft./acre averaged out across the unit and immediately adjacent landscape. Another way to increase the variability across the unit would be to create snags and down wood in mature or late-seral stands along unit edges; this would add larger CWD to the site and allow more of the thinning volume in the younger stand to be removed.

Salvage

Guidelines for "salvage" as defined in the Northwest Forest Plan on pages C-13 through C-16 of the ROD are appropriate for this assessment area. Retain high levels of CWD - 1,610 to 5,940 cubic feet per acre, based upon CWD levels in the surrounding area.

Significant fuel accumulations constitute an increased risk of wildfire in areas of high use or other areas of high fire hazard. "Risk reduction" guidelines (ROD C-15) for removal of down wood as recommended in the Fire Management Plan (Appendix C) are appropriate.

Removal of Hazard Trees and Windthrow Along Maintained Roads and Around Facilities Removal of standing hazard trees and down wood along maintained roads and around facilities is authorized for this assessment area in any of the following situations:

a) Within road clearing limits, if it constitutes a barrier to use and/or maintenance of a facility or road which is to be kept open (ROD C-16, C-17 and C-19).
b) It poses a public safety hazard (ROD C-15 and C-17).
c) It can be relocated from areas which already have adequate quantities of CWD for placement in areas deficient in CWD or for use in stream habitat improvement projects (ROD C-17). For purposes of this guideline only, adequate quantities of CWD will be defined as levels of CWD which are excess to the high level in late-seral stands and excess to moderate levels in stands at all other seral stages (Table 24).
d) It can be removed to discourage CWD theft in areas where two or more separate cases of theft have been documented within one mile of each other within the preceding six month period. Removal of CWD within one mile of the theft sites along "through roads" and along the drivable portions of "spur" (dead-end) roads beyond the theft sites in this assessment area is exempted from further REO review if it meets the following standard: the CWD is easily visible and accessible, considering terrain, level of road use, time of year (before or after shrubs leaf-out), and type and amount of vegetation (grasses and low shrubs, allowing easy visibility and access, versus salmonberry or salal). In steep terrain with a heavy shrub component CWD can be removed up to thirty feet from the cut and fill-slope lines of major access roads. In flat terrain with little to no shrub cover down wood can be removed if it is in an area where wood theft occurs within 100 feet of a facility or road cut and fill-slope lines. (Not currently authorized in ROD; would require additional analysis through NEPA and/or Forest Planning process)

In Riparian Reserves, removal of hazard trees or windthrow under any of the above guidelines must also comply with the Aquatic Conservation Strategy (ROD C-30 through C-38).

Adjacent to Private Lands In certain situations the ROD standards and guidelines for salvage may apply to disturbances which occur adjacent to private property boundaries and threaten the survival of trees on the adjacent landowner's property, result in a hazard to the surrounding landowner or their property, or impact the management of surrounding lands. These situations will be submitted to REO for review until exemption criteria are developed.

Density Management

Density management refers to any manipulation of the density of vegetation on a given site, including manipulation of species composition, where appropriate. Only treatments which differ from the existing REO exemption criteria, Appendix I, are discussed in this section.

Precommercial thinning (TSI) and commercial thinning in early-seral stands

In areas where the stand proposed for treatment is at or below moderate CWD levels (generally reflecting the impacts of a "lost legacy"), emphasize maintaining relatively high levels of stocking (considering the long term outlook for the sub-series environment successional pathways, Chapter V, and structural and compositional components, Tables 21 and 24) to maximize CWD creation during the mature condition, rather than providing heavily thinned patches and openings at this time. CWD Strategies #2 or #3 are most appropriate. Treatment will encourage development of a species composition which is appropriate to the sub-series environment. As stands move into the mid-seral stage, treatments will begin to focus on providing the heavily thinned patches and openings as described in Appendix I.2, Treatment Standard #4, and on increasing the CWD component in the stand.

Commercial Thinning Activities

- The variability described in Appendix I.2, Treatment Standard #4 should focus on providing unthinned and heavily thinned areas based on the sub-series environments described in Chapter V, Successional Pathways.

- A long-term CWD strategy and prescriptions based on Table 24 are key elements of all commercial thinning projects. Consider current guidelines for preventing bark beetle outbreaks and reducing risk of wildfire when preparing prescriptions.

- For stands in areas where CWD is at acceptable levels (see CWD section earlier in this chapter), selective thinning can provide variable spacing by creating clumps and gaps which are generally less than one acre in size. Gaps over one half acre in size should not occupy more than five percent of the area in the stand.

- In Riparian Reserves if there is less than 50 percent suitable dispersal habitat, densities should not be reduced below 40 percent crown closure (or about 60 tpa at age 30 to 35).

- Unthinned stands in all age classes will be left on the landscape within the Late-Seral Landscape Cells in the Core Zone.

- Appendix I.2, Stand Attribute #2 is based on 20 inch dbh trees and stands up to 80 years old. The objective of this part of the exemption criteria is to maintain the largest trees on site. This objective is appropriate for treatments in the Northern Coast Range AMA. However, because this AMA is allowed to treat stands up to 110 years old, the stand average is likely to be larger than 20 inches in dbh. For the Northern Coast Range AMA, Stand Attribute #2 is revised to read: "In stands with a basal-area-weighted average age of 80 to 110 years, individual trees exceeding the average stand diameter plus twenty percent, rounded down to the next whole inch 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." For example, harvest in a 100 year old stand (as authorized in this AMA) which has an average stand diameter of 24 inches dbh, would not remove trees over 28 inches (24" x 1.2 = 28.8", rounded down to the next whole inch = 28" dbh) from the site, except as otherwise provided in the exemption criteria.

VII. MONITORING

Monitoring is critical to evaluating success in achieving late-successional structural and compositional characteristics across the landscape The long term goal is to provide future managers, scientists, and citizens with better information and the opportunity to evaluate the effectiveness of different management approaches to achieving LSR objectives.

Many of the important issues about how to manage for older forest conditions will take at least 20 years to ***BEGIN*** to address. Although the response time is relatively short in terms of forest ecosystem development, it is much too long for human careers. We must set-up and implement our management activities so future natural resource managers can evaluate the effectiveness of the treatments we prescribe. The Monitoring and Evaluation Plan in the Northwest Forest Plan (ROD E:3-12) contains a general framework for the kinds of information to collect and the Research and Monitoring subgroup of the REO is developing more specific guidance. The *Monitoring* Chapter in the Northern Coast Range Adaptive Management Area Guide (USDI USDA 1997) suggests variables that could be monitored in order to address issues and questions specific to this assessment area. These issues include: late-successional forest, species of concern, riparian species and habitat, human communities and adaptive management. The Northern Coast Range AMA web site* lists ongoing and potential research and monitoring opportunities, some of which are described in the *Research and Learning* Chapter of the AMA Guide (*http://www.fsl.orst.edu/coop/ama/ncama).

Monitoring Questions and Evaluation Methods

The following questions should be considered for monitoring in this assessment area. The proposed evaluation methods further define some of the critical components which should be monitored to evaluate the questions over time.

Forest Composition and Structure

Questions: Is the amount of forest in late-successional habitat increasing in the LSRs? Are thinning prescriptions obtaining the desired results? How much CWD can we leave without incurring unacceptable levels of damage from disease, insects and fire?

Evaluation Methods: Monitor structure at the stand level such as number and quality of snags, coarse woody debris, etc. Determine if vegetation characteristics are being created/maintained at a landscape level by sampling at the stand level. Use data from the existing PRIME (Pacific Resource Inventory Monitoring and Evaluation) and CVS (Current Vegetation Survey) plots established within the AMA. Monitor insect populations and disease levels which have the potential to hinder the attainment of LSR objectives (i.e. - Douglas-fir and Sitka spruce bark beetles, and Swiss needle cast). The Hebo Restoration Study will provide data pertinent to several of these questions.

Interior Forest

Question: Is the amount of interior forest increasing? Are microclimates within the interior forest stabilizing? Interior forest habitat conditions and area may be increased by altering the structure of plantations next to or within existing older forest patches. Accelerating the development of these plantations to more nearly approximate the characteristics of the surrounding forest should stabilize microclimate changes at the perimeter and interior of older stands. These changes in humidity, temperature, light and wind have important implications to growth rates, species composition and organic matter decomposition rates (Concannon 1996, Chen 1991).

Evaluation Methods: Amounts of interior forest can be determined from aerial photographs. Evaluation of changes in microclimate would require field research. At this time, monitoring populations of wildlife and plant species which are most sensitive to these mircoclimates may be the most effective tool for answering microclimate questions.

Connectivity

Corridors connecting late-seral landscapes were identified in this assessment.

Questions: Are corridors functioning as intended? Are Riparian Reserves functioning as corridors between blocks of late-successional habitat?

Evaluation Methods: Tag, or use other methods for tracking, species with varying degrees of mobility. Continue of practice of banding owls and following up with annual surveys; where feasible, use radio-telemetry to track tagged owls.

Fish, Wildlife and Plant Species Composition and Trends:

Questions: Are the abundance and health of late-successional species populations increasing? Are some species missing that should be in the assessment area? Are key habitat components available for all late-successional species? Are habitat conditions for owls improving and are owl reproduction and survival rates increasing? Are "at risk" non-late-successional species being precluded? Are key habitat components missing that would help maintain the population viability of these species? Is microhabitat appropriate for animal species with small home ranges and plants?

Evaluation Methods: Survey to determine cu rent species composition and population trends, and monitor repopulation of the assessment area by late-successional species. Particular focus should be given to listed and proposed species, federal species of concern, and survey and manage species. Evaluate habitat components by determining soil temperature and moisture, relative humidity, wind speed, micro-organisms, and specific CWD types and characteristics. Much of this habitat data could entail extensive research. Protocols are being developed for "survey and manage species". Lichens are being studied as an air quality monitoring tool. Stream surveys are conducted annually for fish and a study of amphibians in the South Fork of Schooner Creek is ongoing. Most of the existing spotted owl sites are monitored by federal and state research biologists or industrial forest owners. These efforts, along with marbled murrelet surveys, should be better coordinated to encompass more sites with a uniform survey effort. The impacts of disturbance on marbled murrelets are being monitored by Oregon Department of Forestry at occupied sites on state lands.

Special Forest Products:
Questions: Is the harvest of special forest products negatively impacting late-successional species and their habitats? Are the existing guidelines for harvest being followed?
Evaluation Methods: Study harvest levels and recovery rates to identify the effects of special forest product harvest on late-successional forest habitat. Continue the Hebo moss harvest study and use it to learn how to design other special forest product studies in the future, as opportunities arise. Evaluate firewood policy effects on LSR, considering the value of leaving CWD on the site to meet wildlife habitat needs and maintain soil productivity, and the potential that it could be used for structure in fish habitat improvement projects, ver us removing it as fuelwood. Study the effectiveness of treatments performed under "Salvage Guideline d" (Chapter VI) to determine if such treatments reduce fuelwood theft in LSRs; if not, eliminate or modify them.

Special Habitats:
Question: Are special habitats being adequately maintained?
Evaluation methods: Conduct field surveys and monitor population abundance and trends. The Nature Conservancy monitors Oregon silverspot butterfly populations on their preserve and on National Forest System lands. The Forest Service maintains habitat for the butterfly on a yearly basis. Special habitat management often involves the reduction/elimination of noxious/invasive weed populations and the control of off-road vehicle use in maintained meadows or native dune-grass areas.

Noxious and Invasive Species:
Question: Is the abundance of noxious and invasive species decreasing?
Evaluation methods: Conduct field surveys using agency and county weed control experts. Monitor areas where biological controls have been released or where manual control occurs on a regular basis. Monitor forest understory for spread of holly and English ivy.

Roads:
Questions: What are the trends in density and condition of roads? Are LSR and Aquatic Conservation Strategy requirements being met (especially in Key Watersheds)?
Evaluation Methods: Continue to evaluate the Siuslaw Access and Travel Management guide (ATM) and the Salem District, BLM, Transportation Management Objectives (TMOs, currently being developed) to insure that they will meet long term LSR objectives. Use maps and aerial photos to determine and document locations of roads. Conduct field surveys to evaluate needs for road closure and monitor effectiveness of closure methods.

Aquatic Conservation Strategy:
Questions: Are the abundance and health of aquatic and riparian dependent species populations increasing? Are instream and riparian habitat restoration projects achieving their intended results?
Evaluation methods: Use field methods and surveys to monitor water quality, species populations and habitat quality. Use aerial photographs and satellite imagery to monitor changes in riparian vegetation.

Recreation:

Recreation can impact water quality, soil productivity, and sensitive, federally threatened and/or "survey and manage" species through disturbance or habitat modification.

Question: Are recreational opportunities and existing uses in the assessment area compatible with or preventing attainment of LSR objectives?

Evaluation Methods: Monitor campgrounds and well known dispersed campsites for potential impacts to water quality and sensitive species. Monitor hiking, livestock, mountain bike and OHV trails for soil compaction, impacts on water quality, introduction or spread of noxious or invasive plant species, and habitat modification (including impacts on plants, invertebrates, amphibians and small mammals).

Monitor noise disturbance and habitat impacts from OHV use, which may preclude or inhibit use of the LSR by late-seral forest associated species. Surveys could include the number and condition of trails, estimates of number of users, and daily and seasonal patterns of use. Monitor existing wildlife and plant populations and changes over time in population levels and/or demographics. Study should be made on the OHV trail classification system (open, limited, and closed) to determine if these classifications are compatible with the LSR allocation or if adjustments need to be made on a local or large scale basis.

VIII. SUMMARY AND CONCLUSIONS

Use of Ecologically Based Silvicultural Prescriptions

Site specific prescriptions need to acknowledge the differences in the composition and structure of young, mature and old-growth forests In general, older forests have:

a) An overstory with a mix of shade tolerant and intolerant tree species
b) Diverse vertical distribution of vegetation
c) Large snags and down logs.

Prescription objectives should be attainable given the seral stage of the vegetation in the stand and adjacent landscape.

In general, silvicultural prescriptions should be based on natural successional pathways for the appropriate disturbance regime and sub-series environment. Other treatments may be selected to meet site specific objectives.

Use of Landscape Analysis

Based on ownership patterns, current conditions, and the amount and distribution of remaining late-successional habitat within the LSR, three primary zones were identified.

a) The Core Landscape Zone is designed to serve as the genetic pool or seed source for late-successional forest dependent species.

b) The Corridor Landscape Zone connects clusters of late-successional habitat north and east of the Core Landscape Zone and provides a limited connection (due to ownership patterns) with the adjacent LSR to the South (R0268).

c) The Buffer Landscape Zone consists primarily of BLM lands in a checkerboard ownership pattern in the central eastern portion of the assessment area. This area is vital for maintaining small patches of late-successional forest habitat and plant species diversity in the Valley Margin Zone.

Landscape Cells were identified within these Zones by grouping late-seral patches according to degree of fragmentation (greater than 50 percent in late-seral condition, between twenty and 35 percent in late-seral condition, and less than ten percent in late-seral condition). Prioritization was based on securing the largest patches first, filling-in and growing out from large patches, and connecting isolated patches.

The LSR assessment process identified the need to retain, improve and restore the best habitat areas before devoting limited funding and resources to areas which would take longer to achieve desired conditions. Priority areas for fish habitat restoration are listed in Table 6. The terrestrial and aquatic priorities and restoration emphasis areas will be integrated with other resource concerns at the level of watershed analysis.

Management Opportunities and Considerations

1. Consider land-use allocation changes where they would assist in the ability of the LSR to function. Although this assessment does not identify any site specific areas for changes in land-use allocation, it suggests where future changes might be appropriate.

2. Consider land ownership exchanges or acquisitions of lands when it would facilitate the ability of the LSR to function. The ROD (C-17) lists legitimate reasons for land exchanges providing the benefits are equal to or improve upon current conditions of the LSR, either in area distribution or habitat quality.

3. Where possible, block up federal lands to improve connectivity and increase the expansion of interior forest.

4. Where possible, connect late-successional habitat on federal lands to late-successional habitat on other public lands. For example, treat NF plantations to link late-successional habitat in the Sand Lake RNA to late-successional habitat at Cape Lookout State Park.

5. Where appropriate, use knowledge gained from the ongoing management of the Tillamook State Forest to help answer questions about managing federal lands, minimizing duplication of effort. For example, use monitoring information acquired by ODF harvest in and around murrelet nesting stands.

6. Provide small scale research opportunities throughout the AMA. For landscape level questions, provide large scale research opportunities in mature conifer stands within the Hebo Late-Seral and Upper Nestucca Mid-Seral Cells (primarily LSR); provide large scale research opportunities in deciduous mix stands within the Lower Nestucca block (primarily AMA with some LSR).

7. As a general guideline within the Core Landscape Zone, give first priority to treating young stands in the Little Nestucca Watershed and south to the Siletz River. These stands are crucial to blocking up or connecting existing high quality habitat. Give second priority to treatments which decrease fragmentation within and increase connectivity between late-seral cores in the Nestucca, Sand Lake and Agency Creek Watersheds.

8. Assessing levels of CWD on the landscape is proposed as an essential component of silvicultural treatments and salvage. Current field techniques to accurately measure CWD levels are so expensive and time consuming that they cannot be effectively applied. Reliable techniques for estimating CWD levels should be developed for use by interdisciplinary team members. Opportunities to develop a photo series similar to that developed for determining fuel loading in clearcuts should be investigated. Measurement should focus on CWD which is at least twenty inches in diameter and twenty feet long or longer, measured in cubic feet per acre.

9. Maintain and restore special habitats. This may involve extra efforts in noxious/invasive plant management.

10. Minimize the recreational impacts to T & E and "Survey and Manage" species and their habitats.

11. Establish an unified interagency strategy for management of RPAs by (1) finalizing all of the RPA designations proposed in this assessment by the end of calendar year 1998; (2) by the same date, clearly defining acceptable management opportunities within the RPAs; and (3) developing a strategy for monitoring occupancy and reproductive success.

12. Further develop project implementation scheduling.

Transportation System Planning

It was beyond the scope of this assessment to do a site specific road and trail plan for federal lands in the assessment area, because many other resource and management objectives need to be considered in that planning effort. However, this assessment provides Landscape Zone and Cell goals and objectives which can help guide the development of transportation system plans. The Siuslaw Access and Travel Management (ATM) guide has been completed and a cursory review by the team did not identify major conflicts with meeting LSR objectives. Transportation Management Objectives (TMOs) are being developed for the Salem District of the BLM. Integrated transportation system planning needs to be a cooperative effort between the two agencies. BLM is greatly constrained by mixed ownerships and reciprocal agreements for road construction and maintenance, requiring shared construction costs. and user fees fund many of the roads on BLM lands. The ROD (B-19 and C-16, 19, and 32) provides additional direction for roads within LSRs.

When conducting transportation system planning, the type of landscape cell should be considered. For instance, Late-Seral Cells in the Core Landscape Zones should be a high priority for road closures and road obliteration because of the potential to create large blocks of harassment-free landscapes which would benefit species sensitive to disturbance and edge-effects.

Limitations of the LSR Analysis

This Late-Successional Reserve Assessment is a landscape level look at terrestrial ecosystems, how they are currently functioning, how they could be functioning, and how to identify and prioritize habitat restoration needs for late-successional forest species. Limitations of the LSR analysis are described below.

1. We were not able to determine how much remnant old-growth was in the late-seral-stage stands (i.e. what portion of the LSR currently met the desired future condition). Accurate historical data is not available to provide a clear picture of the amount of late-successional habitat existing prior to the mid 1900s.

2. Many special habitats could not be mapped at the LSR scale. Wetlands, meadows and other unique features on the landscape will need to be addressed at the watershed scale.

3. Integration of the terrestrial system with the aquatic elements of an area is more appropriate at a smaller scale (i.e. watershed) and was not included in this LSR assessment. Appendix G provides a tentative schedule for watershed analyses by fifth field watershed.

4 The late-seral vegetation class data could not be broken into distinct classes, e.g. for 80-110 year old stands. Stands with late-successional characteristics could not be separated from young mature stands or stands with simple structure.

5. Many of the specific life history requirements for species dependent on late-successional habitat in the Oregon Coast Range are unknown, e.g. how sensitive they are to disturbance, how many acres of habitat they require, how many snags or down logs they require, what determines nest site selection.

6. Existing landscape levels in natural stands may not be reflective of historic CWD levels. Accurate data for determining specific amounts and distribution of CWD needed in this assessment area is not available. The ability to sustain and increase CWD levels will depend on funding restrictions.

7. Site specific implementation scheduling is more appropriate at the watershed analysis level. A tentative schedule for watershed analysis can be found in Appendix G.

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LATE-SUCCESSIONAL RESERVE ASSESSMENT

for Oregon's

Northern Coast Range

Adaptive Management Area

MAPS

Late Successional Reserve Network

Pacific Ocean

Forest Grove
Portland
Hebo
Pacific City
Willamina
Grand Ronde
Lincoln City
Depoe Bay
Newport
Corvallis
Toledo
Waldport
Alsea
Yachats
Eugene
Reedsport
Elkton
Drain

LEGEND

- RO807
- RO271
- RO269
- RO270
- RO268
- All other LSRs
- Administratively Withdrawn
- Congressionally Withdrawn
- Water Bodies
- Rivers
- Major Roads

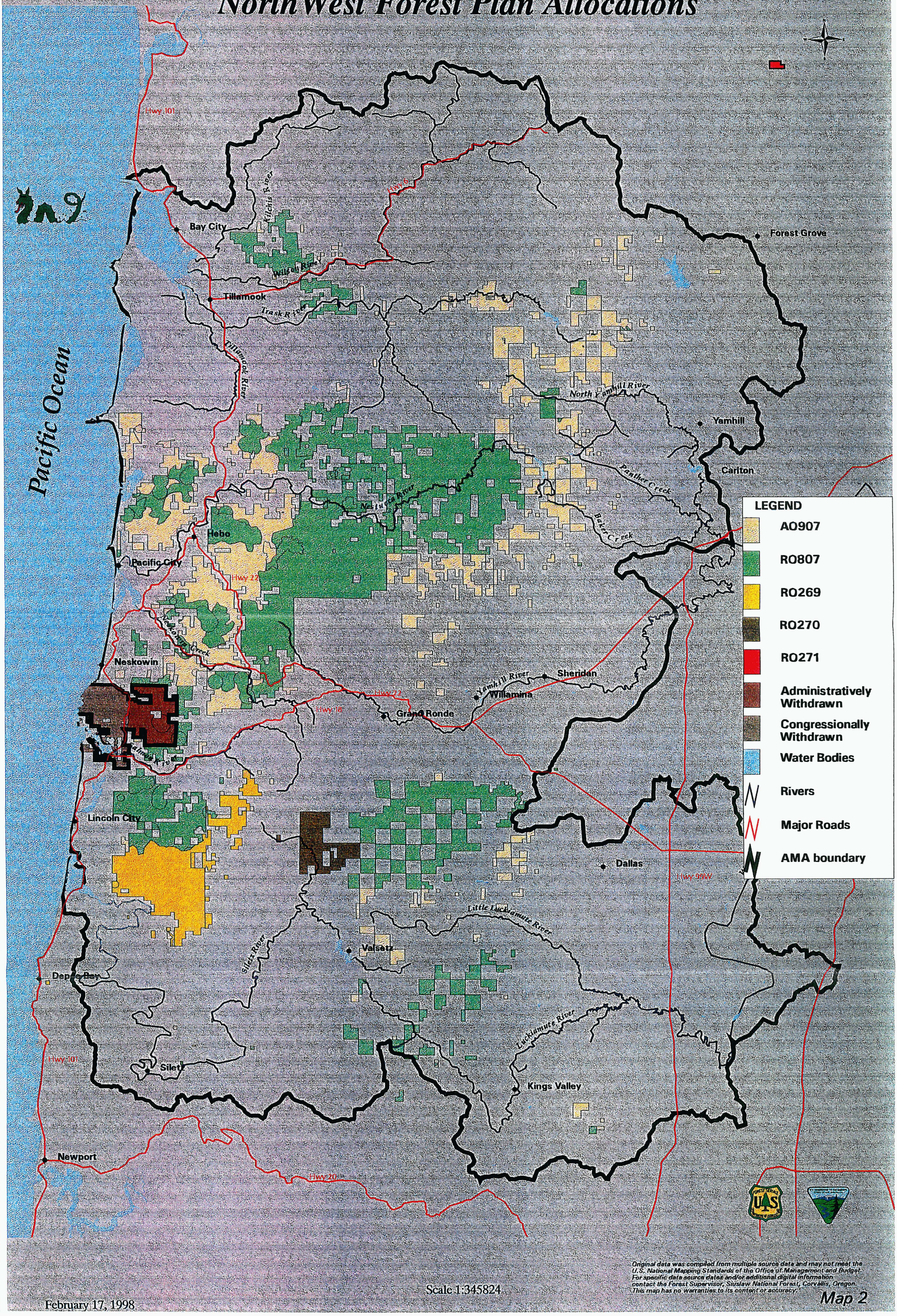
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Map 1

Northern Coast Range Adaptive Management Area
NorthWest Forest Plan Allocations



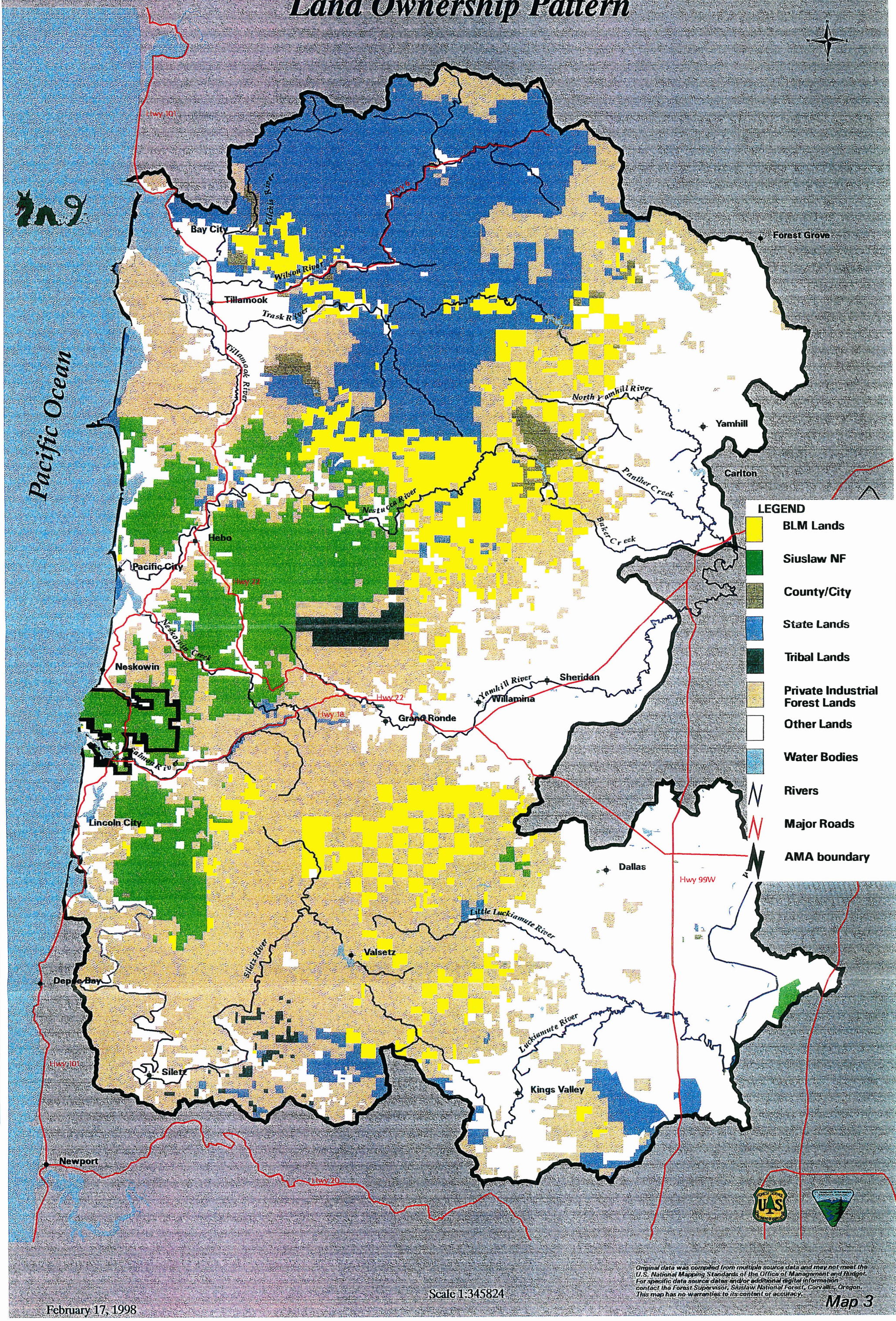
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Map 2

Northern Coast Range Adaptive Management Area
Land Ownership Pattern



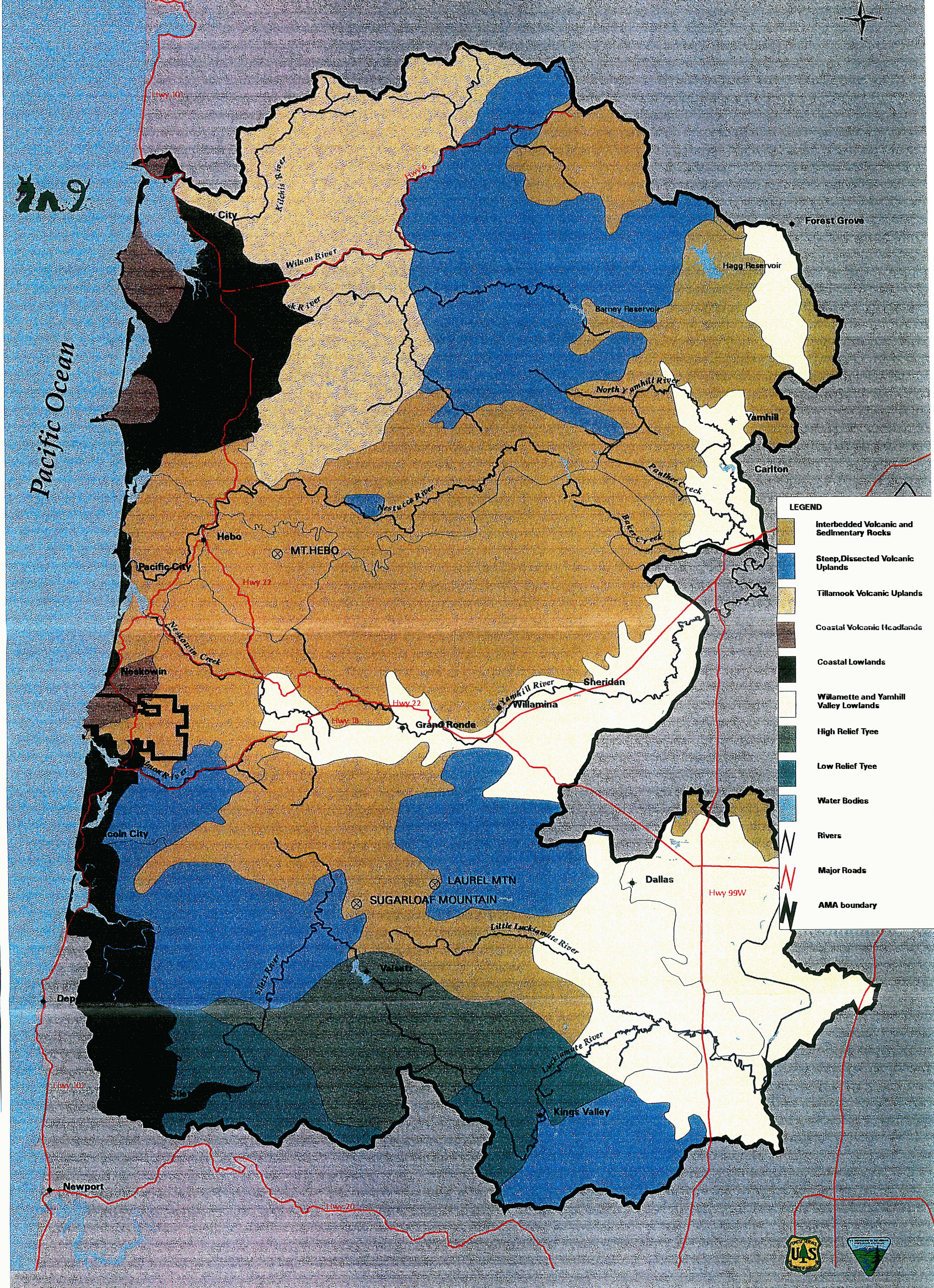
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Map 3

Northern Coast Range Adaptive Management Area
Geomorphic Zones



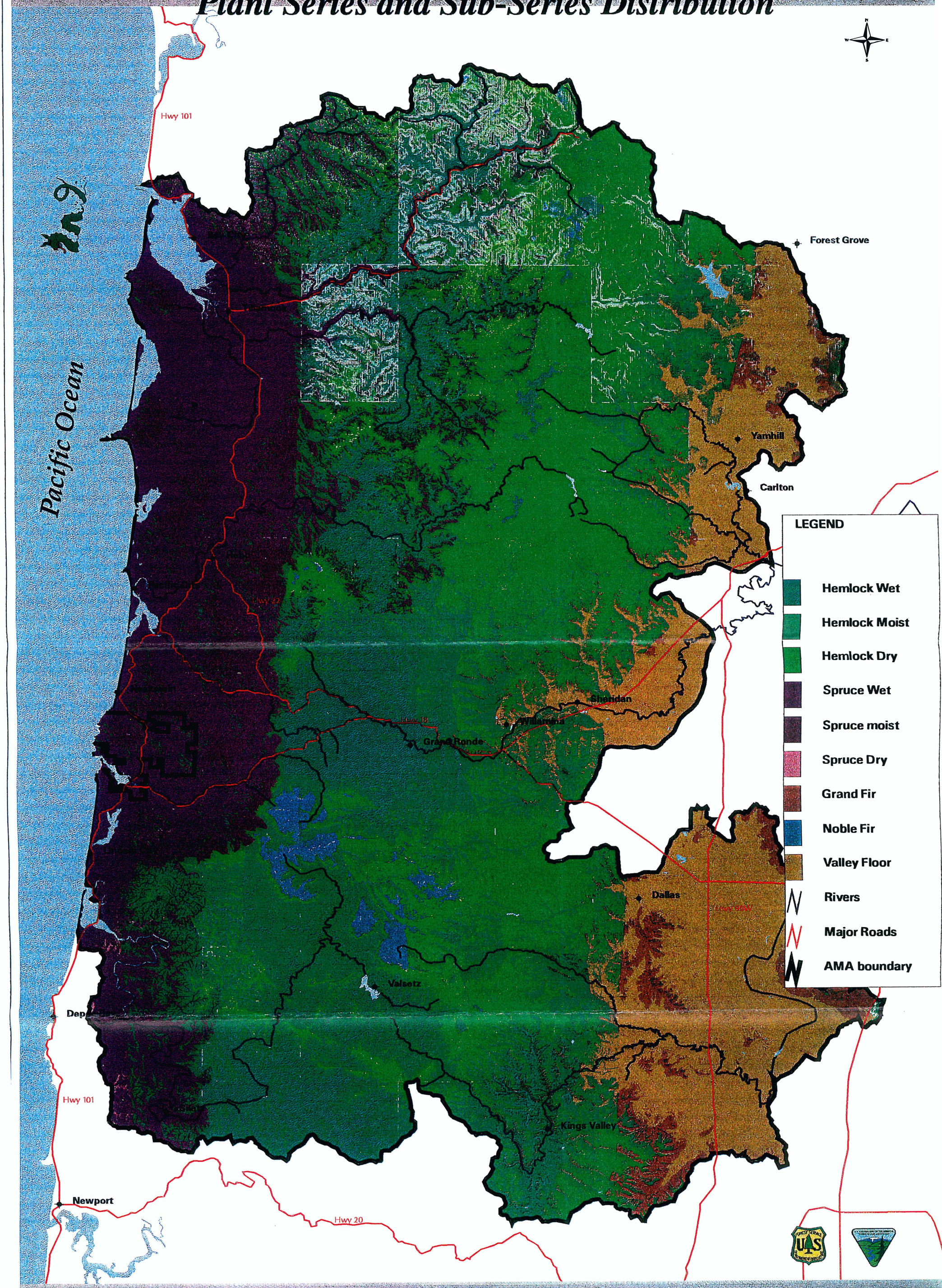
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Map 4

Northern Coast Range Adaptive Management Area
Plant Series and Sub-Series Distribution



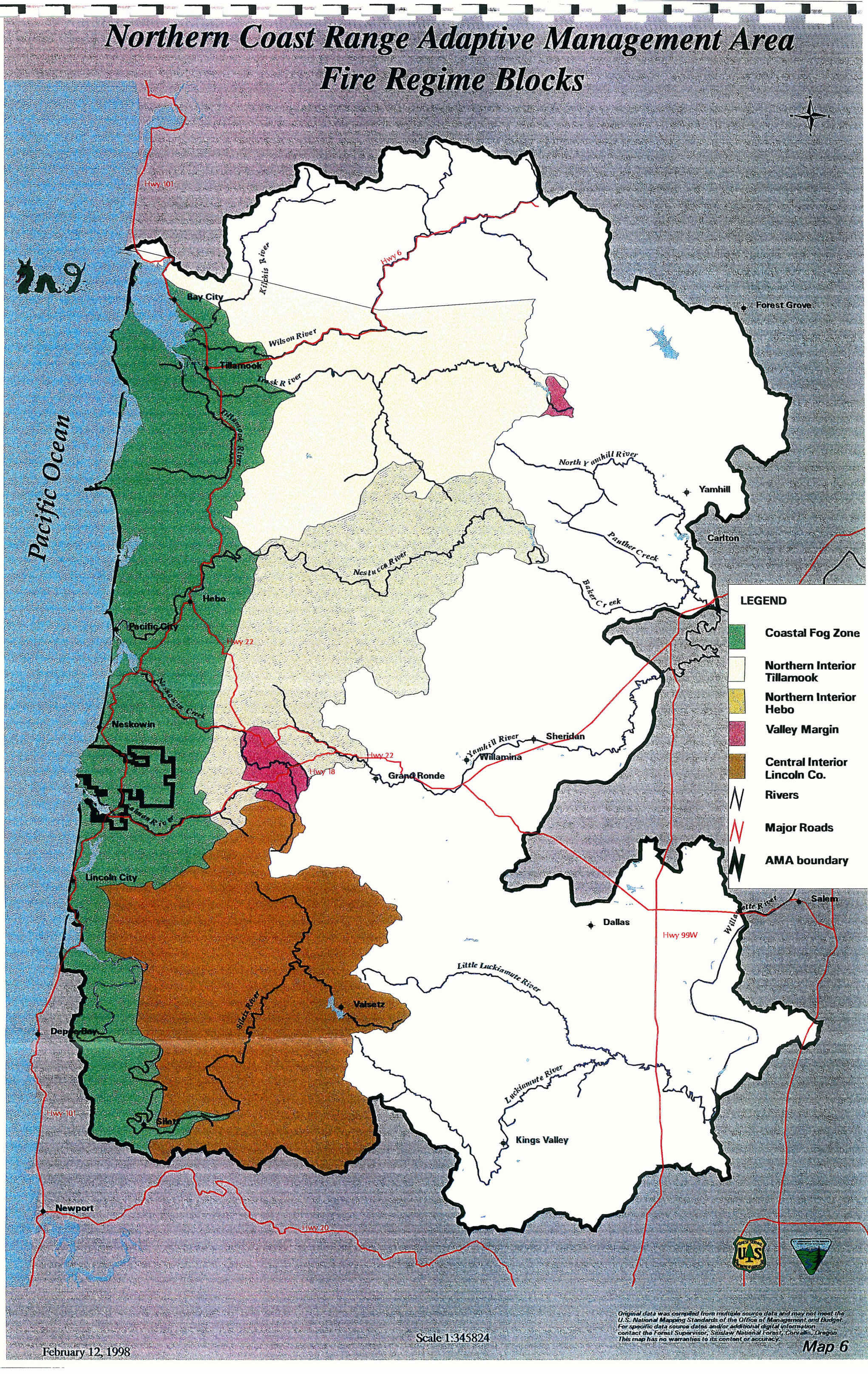
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Map 5

Northern Coast Range Adaptive Management Area
Fire Regime Blocks



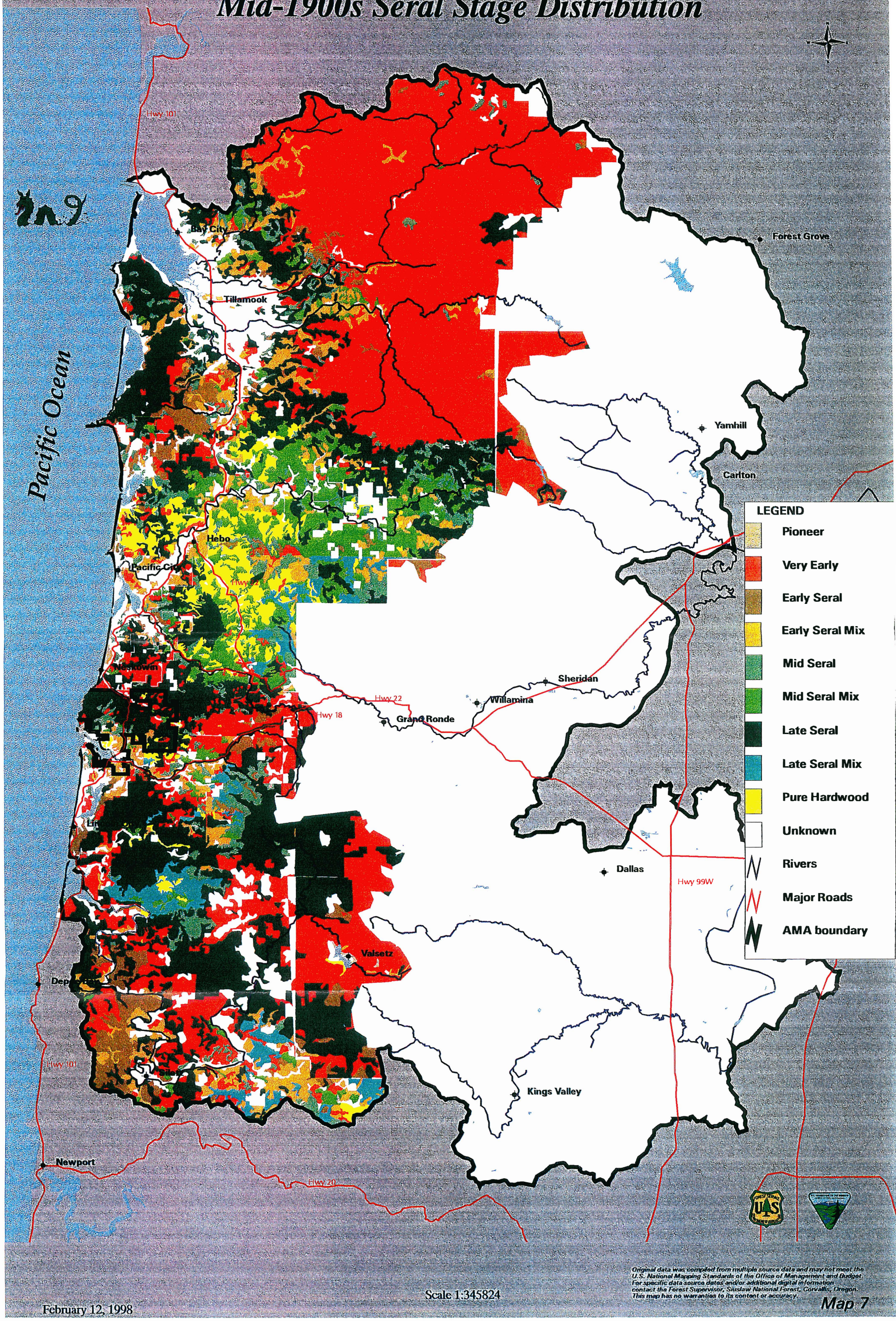
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Map 6

Northern Coast Range Adaptive Management Area
Mid-1900s Seral Stage Distribution



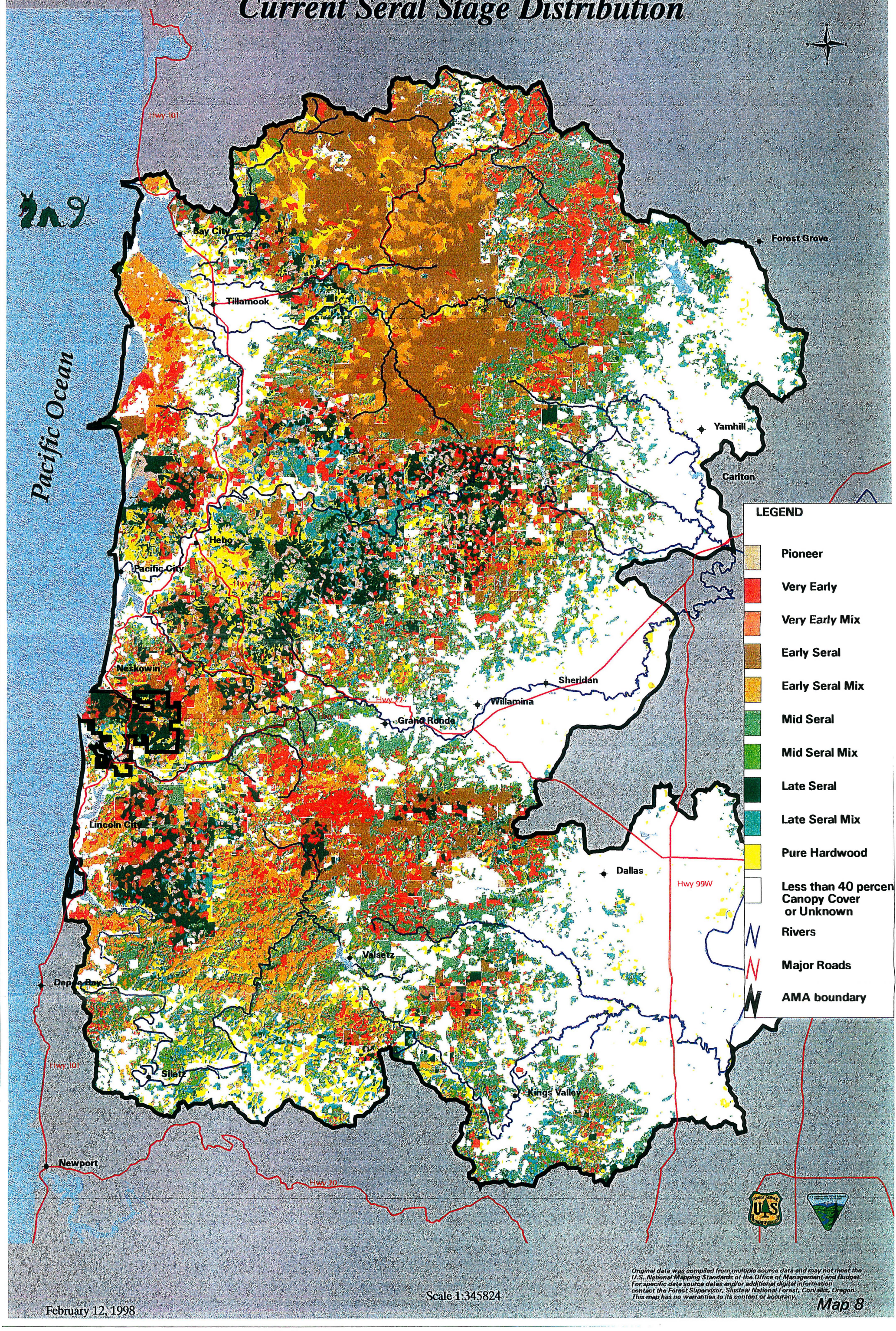
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Map 7

Northern Coast Range Adaptive Management Area
Current Seral Stage Distribution



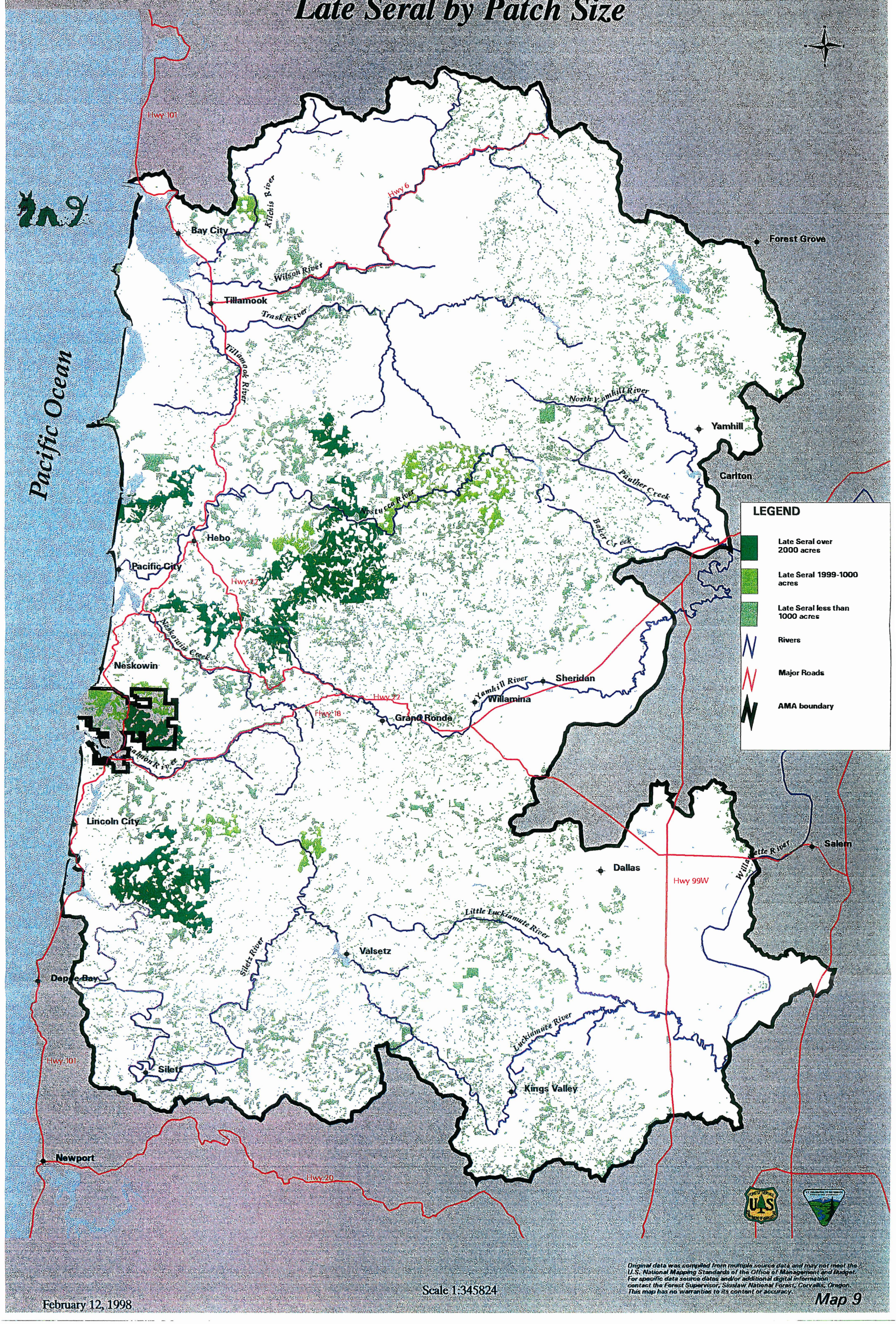
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Map 8

Northern Coast Range Adaptive Management Area
Late Seral by Patch Size



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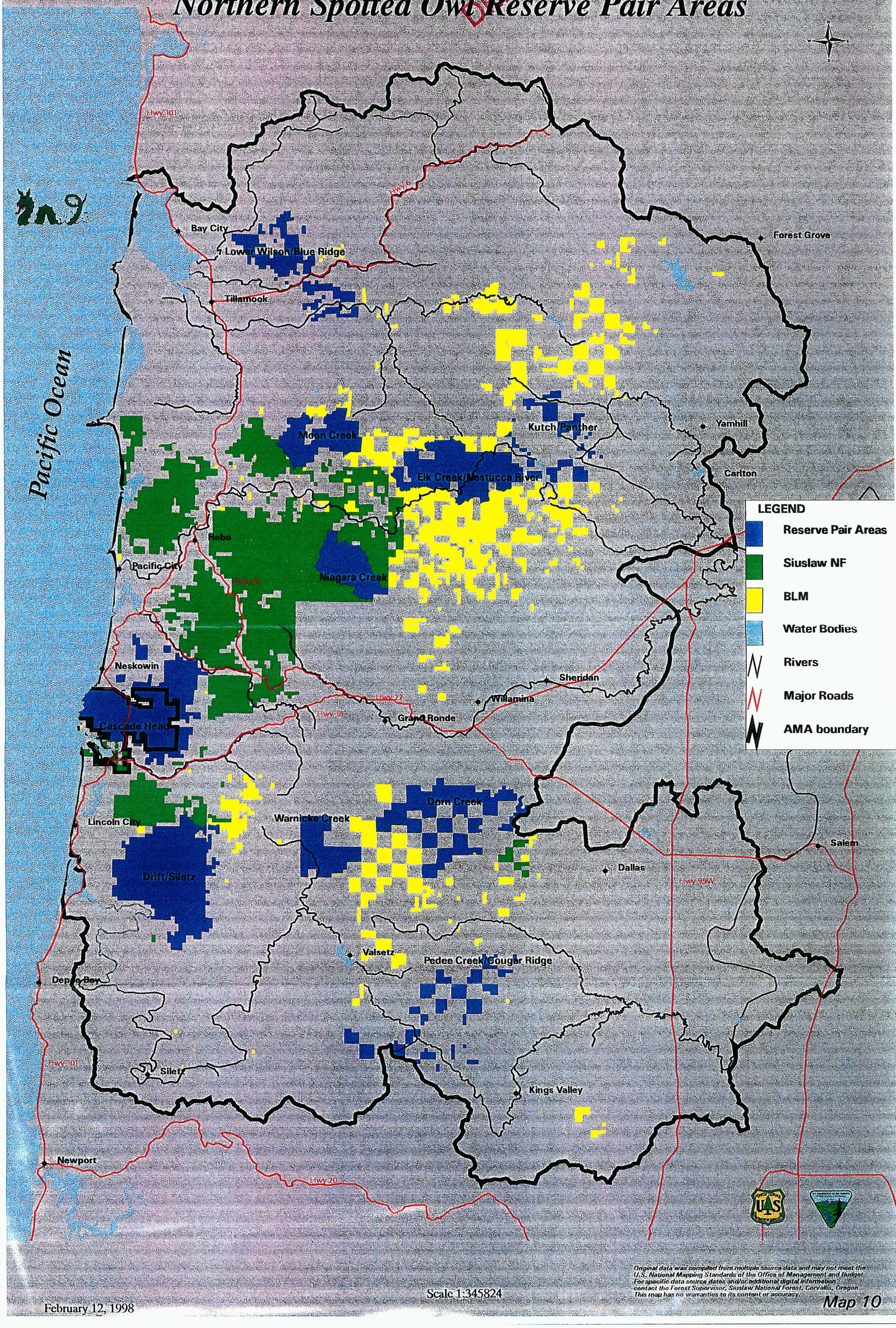
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Map 9

Northern Coast Range Adaptive Management Area
Northern Spotted Owl Reserve Pair Areas

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Map 10

Northern Coast Range Adaptive Management Area
Special Management Areas

Pacific Ocean

Hwy 101

KILCHIS RIVER COUNTY PARK

Hwy 6

CAPE MEARS STATE PARK

Henry Hagg Reservoir

CAPE LOOKOUT STATE PARK

HIGH PK MOON OR ACEC/RNA

SAND LAKE RNA

ELK CREEK ACEC

BRADLEY BOG PRESERVE

WALKER FLAT ACEC

SHERIDAN PK ACEC

RENEKE CREEK RNA

NESTUCCA RIVER ACEC

CAPE KIWANDA STATE PARK

MT HEBO SCENIC INTEREST AREA

THE BUTTE ACEC/RNA

Hwy 22

NESTUCCA SPIT STATE PARK

NESTUCCA BAY NWR

NESKOWIN CREST RNA

CASCADE HEAD EXP. FOREST

CASCADE HEAD PRESERVE

Hwy 22

Hwy 18

VAN DOZER CORRIDOR

LOST PRAIRIE ACEC

SADDLEBACK MTN. ACEC/RNA

DEVILS LAKE STATE PARK

VALLEY OF THE GIANTS ACEC/ONA

RICKREALL RIDGE ACEC

BASKETT SLOUGH NWR

Hwy 99W

SILETZ BAY NWR

LITTLE SINK ACEC/RNA

SARAH HELMICK STATE PARK

ANKENY NWR

LITTLE GRASS MTN. ACEC/ONA

E.E. WILSON GMA

FOREST PEAK ACEC/ONA

Hwy 101

Hwy 20

LEGEND

- USFS Special Mgmt. Areas
- BLM ACEC/RNA/ONA
- State Lands
- Nature Conservancy Lands
- Fish and Wildlife Service Lands
- County
- Water Bodies
- Siuslaw NF
- BLM Lands
- Rivers
- Major Roads
- AMA boundary

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Map 11

Northern Coast Range Adaptive Management Area
Aquatic Areas of Special Concern

Pacific Ocean

Hwy 101
KILCHIS RIVER
Hwy 6
Bay City
TILLAMOOK BAY
WILSON RIVER
Tillamook
Forest Grove
SCOGGINS CREEK
TRASK RIVER
TILLAMOOK RIVER
NORTH YAMHILL RIVER
Yamhill
NESTUCCA RIVER
Carlton
NETARTS/SAND LAKE
Hebo
Pacific City
Hwy 22
WILLAMINA CREEK
LOWER SOUTH YAMHILL
Neskowin
Sheridan
NESKOWIN
LITTLE NESTUCCA
Hwy 22
Willamina
Hwy 18
Grand Ronde
SALMON RIVER
SOUTH YAMHILL RIVER
DEVILS LAKE
MILL CREEK
Lincoln City
SCHOONER CREEK
Salem
Dallas
UPPER SILETZ RIVER
Hwy 99W
RICKREALL CREEK
Valsetz
Depoe Bay
MIDDLE SILETZ RIVER
LUCKIAMUTE R
LOWER SILETZ RIVER
Hwy 101
Siletz
ROCK CREEK
Kings Valley
Newport
Hwy 20

LEGEND

- Key Watersheds
- Water Bodies
- Watersheds of Special Concern
- Anadromous Fish Core Areas
- Watersheds
- Rivers
- Major Roads

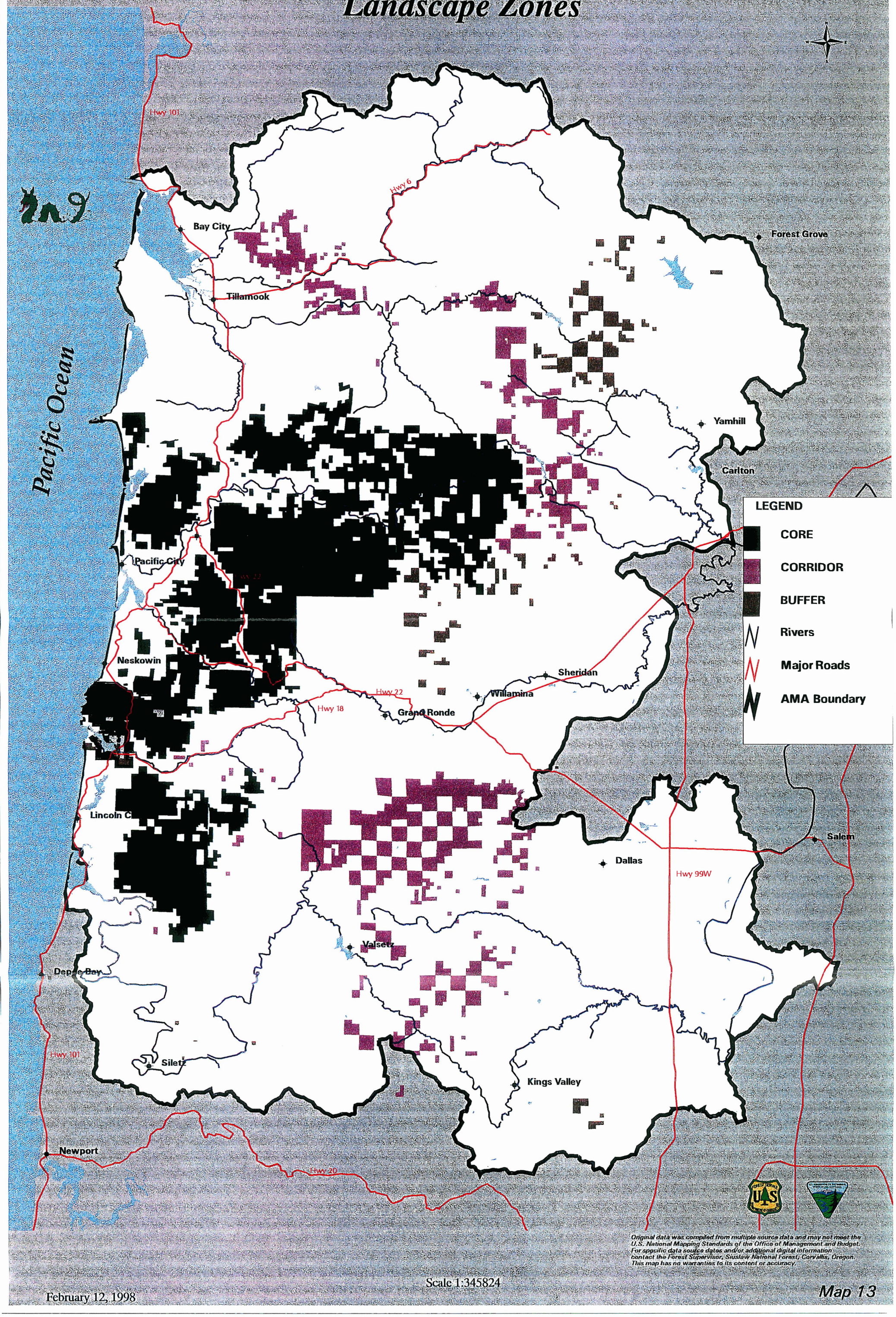
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Map 12

Northern Coast Range Adaptive Management Area
Landscape Zones



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

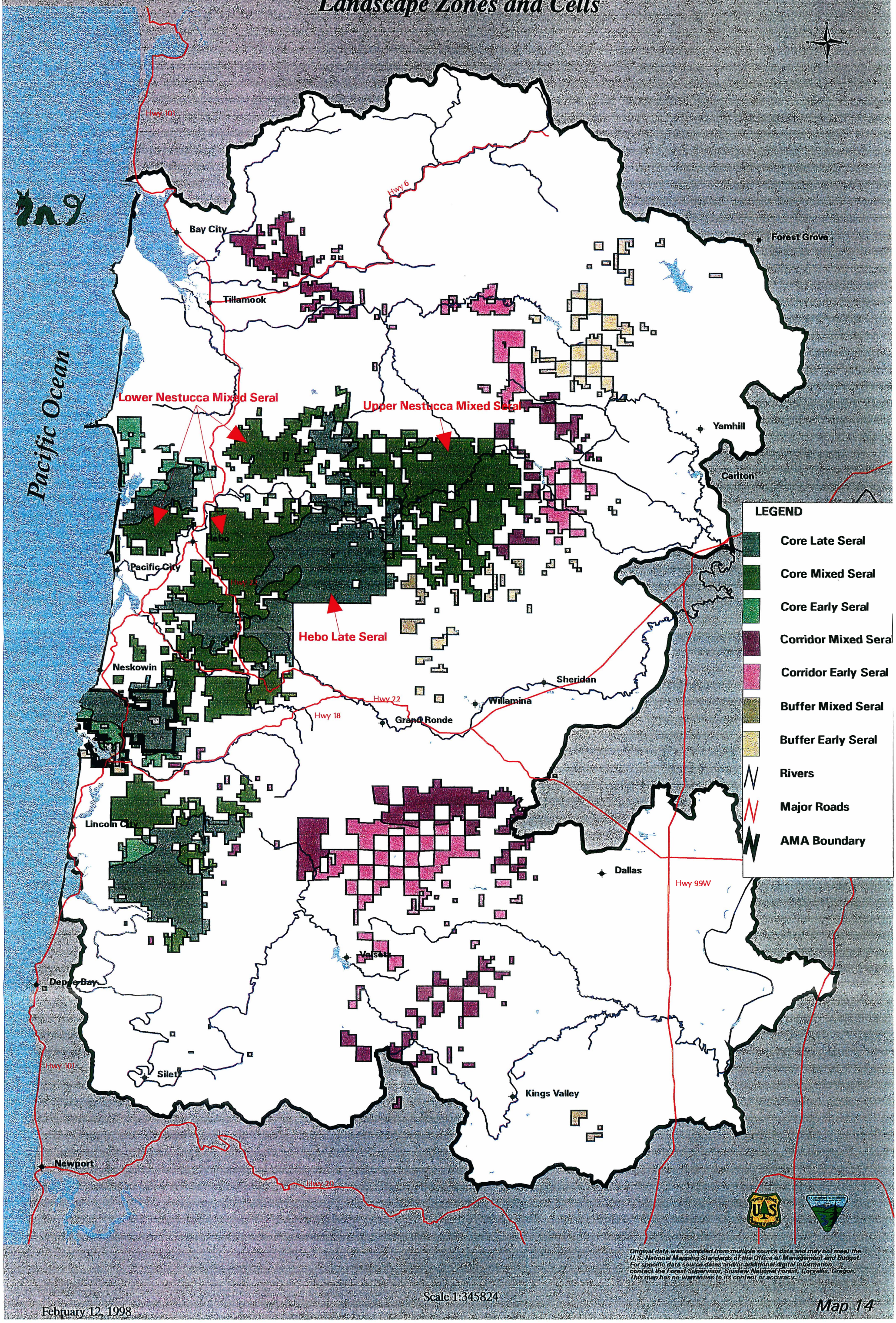
Scale 1:345824

February 12, 1998

Map 13

Northern Coast Range Adaptive Management Area

Landscape Zones and Cells



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

Scale 1:345824

February 12, 1998

Map 14

LATE-SUCCESSIONAL RESERVE ASSESSMENT

for Oregon's

Northern Coast Range

Adaptive Management Area

APPENDICES

APPENDIX A

Seral-Stage Classification

and

Mapping Standards

Seral Stage Classification
and
Mapping Standards

Seral Stage Definitions Used in This Assessment

Definitions used in this assessment were roughly similar to those identified in Forest Ecosystem Management: An Ecological, Economic, and Social Assessment (FEMAT 1993). However, the FEMAT definitions were adapted to fit this assessment area and specific seral-stage characteristics that this LSRA Team emphasized. All timelines are artificial, in that they may represent the "typical" timelines for conifer stands in this assessment area in each environment. However, the type of disturbance, availability of seed sources, and a wide variety of environmental factors can substantially change these timelines. The definitions also identify the dominant size class of typical stands in each seral stage as an aid in evaluating stand structure.

Seral Stages - The series of relatively transitory plant communities which develop during ecological succession from bare ground following a disturbance such as fire, through climax, when plant succession culminates and the plant community becomes relatively stable:

- **Pioneer** - This seral stage generally covers the period from **0 to 10 years** following a disturbance, depending on site conditions and stand history. This is the period from disturbance to establishment of a conifer or hardwood stand. Herbs, shrubs, and grasses generally dominate the site. Conifer or hardwood trees are generally less than five inches in diameter at breast height (dbh, measured at four and one half above ground level).

- **Very Early-Seral Stage** - This seral stage generally covers the period from **11 to 24 years** following a disturbance, depending on site conditions and stand history. It covers the period from stand establishment to crown closure. At the end of this period, conifers or conifer/hardwood mixes typically dominate the site. Dominant size class of stands is typically **five to ten inches dbh**. Trees have long crowns with live limbs all the way to the ground. These stands serve as good hiding cover for many mammals, reptiles, and amphibians. In managed plantations, tree limbs begin to overlap, shading out the understory shrubs, herbs, and grasses.

- **Early-Seral Stage** - This seral stage generally covers the period from **25 to 49 years** following a disturbance, depending on site conditions and stand history. This is the period in a stand's life from crown closure to self-pruning. Stands maintain full crown closure, however, the live canopy begins to move up. Dominant size class of these stands typically ranges from **five to eighteen inches dbh**. Tree boles have many dead limbs which have been shaded out, making it easier for larger mammals to move along the ground and birds to fly through the understory. In managed plantations, trees often grow so close together that thinning of the stand may be necessary to maintain wind firmness. The understory is often very sparse, with few or no tree seedlings or saplings, shrubs, herbs, and grasses.

- **Mid-Seral Stage** - This seral stage generally covers the period from **50 to 79 years** following a disturbance, depending on site conditions and stand history. This is the period in a stand's life from self-pruning to maturation. Stands still maintain full crown closure, usually resulting in a high, single-canopy layer throughout the stand. Dominant size class of these stands typically ranges from **ten to eighteen inches dbh**. There is little stand diversity (little to no understory yet). In natural and unthinned stands, tree mortality begins to increase. These stands provide some hiding and thermal cover.

- **Late-Seral Stage** - This condition generally begins at approximately **80 years**, depending on site conditions and stand history. This seral stage includes two stand conditions:

  ⇒ **Mature** - This condition generally covers the period from **80 to 149 years**, depending on site conditions and stand history. This is the stage in a stand's life when height growth and crown expansion of the dominant trees begins to slow. Trees begin to form large, heavy limbs. Insects, disease, and windthrow begin to kill or damage individual trees, creating openings in the overstory canopy. Shade tolerant seedlings may become established in the understory. Snags and large down logs begin to accumulate. Much of the compositional and structural features of late-successional forests are just beginning to develop - large accumulations of coarse woody debris, trees with large limbs and thick bark, numerous trees with deformities such as broken or forked tops, multiple canopy layers with an abundance of shade tolerant species in the understory, large diameter trees, etc. The dominant size class of these stands typically ranges from **nineteen to 32 inches dbh**.

  ⇒ **Old Growth** - Stands in this condition are generally **150 years old and older**, depending on site conditions and stand history. At this stage in a stand's life it begins the transition into a more stable plant community with moderate to high canopy closure; a mullet-layered, mullet-species canopy dominated by large overstory trees; a high incidence of large trees with thick bark, some with broken tops and other indications of old and decaying wood (decadence) and deformities; numerous large snags; and heavy accumulations of wood, including large logs on the ground (FEMAT 1993). Size class is extremely variable in these stands, but trees **larger than 32 inches** dbh are common, with a component of trees larger than 48 inches dbh.

- **(Any Seral Stage) Mix** - The word "mix" following any seral stage implies that the designated stand's overstory canopy is comprised of 50 to 80 percent hardwoods, usually red alder in this assessment area. **Pure Hardwood** - Designates stand's in which 80 percent or more of the overstory canopy is comprised of hardwoods.

Late-Successional Habitat - This term generally refers to stands which have the structural and compositional characteristics believed to be important habitat elements for species dependent on older forest stands. Such features include large trees with deformities or broken tops, large logs on the forest floor and in stream channels, multi-layered canopies, gaps, shade tolerant tree species in the understory, etc. These features may be found in stands in the old-growth condition of the late-seral stage. However, the term "late-successional" refers to the structure of the habitat **without regard for age**.

Development of Seral-Stage Map Coverages

The mid 1900s seral-stage coverage for this assessment area was developed from a series of county-wide vegetation coverages that were originally digitized by Pacific Meridian Resources (PMR). The original county maps which PMR worked from, were developed in the mid 1900s and published at that time. These maps were assembled from existing maps provided by the individual landowners. Unmapped areas were filled by field observation before World War II and from aerial photographs after World War II (starting in 1946). Data included primary and secondary tree species, mean size class and or dbh, and percent density. These items were used to designate seral stages as shown on the following page (Table B.1.). Each county used different size classes, so seral stages were assigned to each county coverage, then the maps were jointed together. In some cases data was vague or missing.

The current seral-stage coverage for this assessment area was developed by combining polygon vegetation datasets from the BLM's Salem District, the Siuslaw National Forest, the Tillamook State Forest and, for areas not covered by these three datasets, from the Coastal Landscape Analysis and Monitoring Study (CLAMS). All vegetation datasets were developed from aerial photograph interpreted data, except the CLAMS dataset which was based on remotely sensed satellite imagery. State, BLM, and Forest Service datasets have been supplemented with stand examination and other field survey data where such surveys have been completed. Items which were used in this classification included: primary and secondary species, mean size class, stand age, and type of stand (managed or natural). These items were used to designate seral stages as shown in Table B.2.

Note: The datasets for both the mid 1900s and the current seral-stage mapping do not provide enough information to distinguish between stands which are in a mature condition and those which are old growth. Therefore, all late-successional habitat is lumped together as "late-seral-stage" forest in Maps 7, 8, and 9, and in Table 4 which was derived from these datasets. Local BLM and Forest Service biologists estimate that old-growth stands occupy less than one percent of all lands (four percent of the federal lands) in this assessment area.

Table A.1. Cross-walk to mid-1900s seral stages (Map 7).

Seral Stages	Lincoln County	Polk County	Tillamook County	Yamhill County
Untyped	Primary and secondary species left blank			
Very Early (11 - 24 years)	Conifer/conifer stands less than 5" dbh	Conifer/conifer stands less than 6" dbh	Conifer/conifer stands less than 5" dbh	Conifer/conifer stands less than 6" dbh
Very Early Mix (11 - 24 years)	Conifer/hardwood stands less than 5" dbh	Conifer/hardwood stands less than 6" dbh	Conifer/hardwood stands less than 5" dbh	Conifer/hardwood stands less than 6" dbh
Early (25 - 49 years)	Conifer/conifer stands 5" to 11" dbh	None	Conifer/conifer stands 5" to 11" dbh	Conifer/conifer stands which did not have a size class, but had an individual dbh between 5" & 10"
Early Mix (25 - 49 years)	Conifer/hardwood stands 5" to 11" dbh	None	Conifer/hardwood stands 5" to 11" dbh	Conifer/hardwood stands which did not have a size class, but had an individual dbh between 5" & 10"
Mid (50 - 79 years)	Conifer/conifer stands 11" to 21" dbh	None	Conifer/conifer stands 11" to 21" dbh	Conifer/conifer stands 11" to 21" dbh
Mid Mix (50 - 79 years)	Conifer/hardwood stands 11" to 21" dbh	None	Conifer/hardwood stands 11" to 21" dbh	Conifer/hardwood stands 11" to 21" dbh
Late (80 + years)	Conifer/conifer stands larger than 21" dbh	Conifer/conifer stands larger than 16" dbh	Conifer/conifer stands larger than 21" dbh	Conifer/conifer stands larger than 20" dbh
Late Mix (80 + years)	Conifer/hardwood mixed stands larger than 21" dbh	Conifer/hardwood mixed stands larger than 16" dbh	Conifer/hardwood stands larger than 21" dbh	Conifer/hardwood stands larger than 20" dbh
Pure Hardwood (any age)	Hardwood/conifer and hardwood/ hardwood stands larger than 5" dbh	Hardwood/conifer and hardwood/ hardwood stands larger than 6" dbh	Hardwood/conifer and hardwood/ hardwood stands larger than 5" dbh	Hardwood/conifer and hardwood/ hardwood stands larger than 6" dbh

Table A.2. Cross-walk to current seral stages (Maps 8 and 9, and Table 4).

Seral Stages	Siuslaw National Forest	Salem District, BLM	Tillamook State Forest	CLAMS
Pioneer (0 - 10 years)	Plantations 10 years old or less			
Very Early (11 - 24 years)	Conifer plantations 11 to 24 years old **OR** natural conifer stands 5" to 10" dbh	Conifer plantations 11 to 24 years old	Conifer plantations 11 to 24 years old	Conifer stands less than 10" dbh (small size class)
Very Early Mix (11 - 24 years)	Conifer/hardwood mixed stands 11 to 24 years old **OR** natural conifer/ hardwood stands 5" to 10" dbh	Conifer/hardwood mixed stands 11 to 24 years old	Conifer/hardwood mixed stands 11 to 24 years old	Conifer/hardwood mixed stands less than 10" dbh (small size class)
Early (25 - 49 years)	Conifer plantations 25 to 49 years old			
Early Mix (25 - 49 years)	Conifer/hardwood mixed stands 25 to 49 years old			
Mid (50 - 79 years)	Conifer plantations 50 + years old **OR** natural conifer stands 10" to 18" dbh **OR** natural conifer stands 51 to 80 years old	Conifer stands 50 to 79 years old	Conifer stands 50 to 79 years old	Conifer stands 11" to 20" dbh (medium size class)
Mid Mix (50 - 79 years)	Conifer/hardwood mixed plantations 50 + years old **OR** natural conifer/ hardwood mixed stands 10" to 18" dbh **OR** natural conifer/hardwood mixed stands 51 to 80 years old	Conifer/hardwood mixed stands 50 to 79 years old	Conifer/hardwood mixed stands 50 to 79 years old	Conifer/hardwood mixed stands 11" to 20" dbh (medium size class)
Late (80 + years)	Natural conifer stands greater than 18" dbh	Conifer stands greater than 80 years old	Conifer stands greater than 80 years old	Conifer mixed stands larger than 21" dbh (large & very large size classes)
Late Mix (80 + years)	Natural conifer/ hardwood mixed stands greater than 18" dbh	Conifer/hardwood mixed stands greater than 80 years old	Conifer/hardwood mixed stands greater than 80 years old	Conifer/hardwood mixed stands larger than 21" dbh (large & very large size classes)
Pure Hardwood (any age)	Hardwood stands at any age			Broadleaf Categories

APPENDIX B

Land Ownership by Fifth-Field Watersheds

Table B.1. Land Ownership by Fifth-Field Watershed (in acres)

Fifth-Field Watershed Number	Watershed Name	BLM, Salem District	Siuslaw National Forest	Oregon Department of Forestry	State and County Parks	Private Industrial Forest	Tribal Lands	Other
1710020301	Little Nestucca River	201	18,892	800	324	10,508	- 0 -	8,703
1710020302	Nestucca River	36,131	69,331	8,121	356	24,571	5	25,992
1710020303	Tillamook River	109	355	3,435	- 0 -	21,632	- 0 -	13,361
1710020304	Trask River	8,868	- 0 -	64,981	- 0 -	23,646	- 0 -	14,465
1710020305	Wilson River	4,009	- 0 -	96,241	380	15,614	- 0 -	6,586
1710020306	Kilchis River	2,907	- 0 -	33,699	537	2,390	- 0 -	2,013
1710020308	Tillamook Bay	- 0 -	- 0 -	1,885	88	3,284	- 0 -	15,398
1710020309	Netarts/Sand Lake/ Neskowin Creek Frontal	76	15,566	- 0 -	2,183	15,835	- 0 -	14,999
1710020404	Upper Siletz River	12,174	- 0 -	- 0 -	- 0 -	32,252	- 0 -	183
1710020405	Middle Siletz River	11	- 0 -	168	40	37,736	1,654	1,811
1710020406	Rock Creek/Siletz River	1,411	- 0 -	6,720	- 0 -	14,953	610	3,928
1710020407	Lower Siletz River	553	4,344	1,105	17	59,977	980	13,122
1710020408	Schooner Creek/ Drift Creek	2,186	18,214	- 0 -	- 0 -	15,784	- 0 -	4,747
1710020409	Salmon River	2,959	11,636	26	903	24,728	- 0 -	7,489
1710020410	Devils Lake/Depoe Bay/Newport Frontal	- 0 -	2,016	- 0 -	106	2,361	- 0 -	6,396
1709000306	Luckiamute River	8,728	- 0 -	13,802	234	69,844	- 0 -	108,669
1709000702	Rickreal Creek	3,275	798	64	211	18,032	- 0 -	94,761
1709000801	South Yamhill River	3,503	5,325	46	289	51,474	7,918	20,838
1709000802	Willamina Creek	15,208	1,022	443	- 0 -	22,145	1,795	13,066
1709000803	Mill Creek	12,380	91	3	46	11,492	- 0 -	10,156
1709000804	Lower So. Yamhill River	1,523	- 0 -	- 0 -	- 0 -	7,587	- 0 -	67,113
1709000806	North Yamhill River	12,899	- 0 -	- 0 -	- 0 -	22,355	- 0 -	78,184
1709001003	Scoggins Creek	3,928	- 0 -	10,072	- 0 -	27,185	- 0 -	45,819

APPENDIX C

Fire Management Plan

for the

Northern Coast Range Adaptive Management Area

FIRE MANAGEMENT PLAN

This plan is being proposed for adoption by management and will be subject to approval in compliance with the National Environmental Policy Act, following determination that it conforms with the appropriate land and resource management plans.

Risk from Ignition Sources

Fire occurrence in this assessment area between 1960 and 1996 was very low with 0.03 fires occurring per 1000 acres per year. These fires were predominantly human caused, with abandoned campfires and escaped slash burning from clearcuts and landings accounting for the majority of the fires. Twenty-one fires were caused by lightning over the 26 year period. A total of 700 acres burned, including 134 acres which resulted from escaped prescribed fires ignited by the federal agencies.

The most recent large fire in the area was the Rockhouse Fire which occurred in 1987. This human caused fire started on private land under abnormally dry conditions and strong east winds. A total of 5000 acres burned in this fire, including 376 acres of the eastern portion of LSR RO270, administered by the Bureau of Land Management.

Outside of the Rockhouse Fire the largest and highest intensity fires since 1970 were caused by escaped slash burns. These fires occurred on the outside edge of broadcast burned, clearcut harvested, sale areas. Generally the cause of these escapes can be attributed to burning under very dry conditions with east winds. This type of weather condition was necessary to meet objectives of the Oregon Smoke Management Plan, which was to avoid impacting the Willamette Valley with smoke. The objective for these prescribed fires was to prepare the site for reforestation and to a lesser extent to reduce the fire hazard created after the harvest.

Since broadcast burning of clearcut harvest units will not be a common activity within the federally managed portion of these LSRs, this cause of fire will be reduced. Management ignited prescribed fire will still be considered where appropriate for meeting LSR objectives (e.g. to maintain T&E species, to decrease excessive ladder fuels).

Prescribed fires that escape from private landowners onto federal land are still a possibility. This type of fire occurs regularly. In 1996 two of these fires burned National Forest System lands in LSR RO807, each burning less than two acres. Additionally in 1996, a third fire burned one acre of LSR RO270.

The Oregon Department of Forestry (ODF) regulates burning on private land. Considering fire danger and risk of the fire escaping, ODF issues a burning permit that requires specific fire fighting resources to be on the site of the burn. This greatly reduces the risk of a large scale fire event.

The remainder of human caused and lightning fires all burned at a very low intensity with little resource damage. The size of these fires ranged between 0.01 to 41 acres. The largest fire burned untreated clearcut slash before it could be treated.

Wildfire Strategies

To achieve the objective of protecting and enhancing conditions of late-successional forest ecosystems in the assessment area all wildfires will be suppressed by employing the control strategy, minimizing fire size and loss of habitat. Resource protection and maintenance of existing late-succession habitat will be the primary goals of the suppression action. Direction on fire suppression is found in Forest Service Manual (FSM) 5100 - Chapter 5130, Siuslaw National Forest Fire Management Action Plan, BLM Manual 9214 and Salem District Record of Decision and Resource Management Plan. During fire suppression activities, fire managers will consult with resource specialists familiar with the area (ROD C-17 and C-18) and ensure that habitat damage is minimized. The responsible Line Officer(s) will designate a resource advisor to the fire incident. The designated resource advisor will have responsibility equal to other members of the fire suppression organization and will be part of the team assembled by the Line Officer for development of the Escaped Fire Situation Analysis (EFSA) as described in FSM Manual 5132 and BLM Manual 9210.

The greatest threat appears to be in areas where patches of windthrow exceeding one acre in size are adjacent to private lands. Where economically feasible within these areas, removal of down wood within 50 feet of private ownership landlines is recommended. This would provide an anchor point from which fire managers could initiate the control strategy.

Suppression Techniques to Minimize Habitat Damage

1) Avoid the draw-down of pools of water in creeks and rivers during periods of low water flows.

2) Do not allow the use of heavy equipment in stream channels.

3) Avoid the use of retardant and heavy equipment in riparian areas.

4) Locate base and spike camps outside of known locations of threatened and endangered species.

5) Minimize the building of any new roads or widening of existing roads.

6) Include construction of waterbars as standard procedures on all firelines. All roads opened to provide access for fire equipment will be drained and seeded or obliterated.

7) Develop a fire rehabilitation plan through an interdisciplinary process. Select treatments on the basis of on site values, probability of successful implementation, social and environmental considerations (including protection of native plant community), and cost as compared to benefits.

Prescribed Fire

As described in Chapter II, most of the assessment area had long fire return intervals and fires were often large. Implementation of Prescribed Natural Fire (PNF) would be risky due to the large private land holdings within and adjacent to the federal lands within this assessment area. Further development or use of PNF is not recommended at this time.

Management ignited prescribed fire will still be considered where appropriate for meeting LSR or special habitat objectives with less risk. Many of sites appropriate for management ignited prescribed fire are located in the eastern fringe of the Interior Soil/Climate Zone and in the Valley Margin, or in meadows scattered throughout the assessment area.

Short term Risks

Thinning and creation of coarse woody material (CWD) in managed stands will increase the risk of large scale fire events due to the increase in fuels created by these activities. Factors affecting the level of increased fire hazard include size and quantity of fuel input, time since input, stand age and density, spacing between treated areas, and yarding method in areas which are thinned. The expected fine dead fuel loading after thinning should range between seven and 25 tons per acre, depending on the number of trees that will be thinned from the stand. Fine dead fuels are defined as dead vegetative materials three inches in diameter or less. Fine fuels are an important consideration in the risk of a fire event since they are the component of the fuel profile that most influences the rate at which a fire will spread. The fine fuels should decompose to background levels, within three to ten years after thinning. This portion of the fuel profile by itself represents a temporary risk that is acceptable as long as contiguous slash is not present over large areas and adjacent to main travel routes.

All of the human caused fires in these LSRs over the last 36 years have occurred in close proximity to roads. Over the next five to ten years, up to 50 percent fewer roads will be maintained for public travel on Forest Service administered lands within this assessment area (Siuslaw National Forest Access and Travel Management Plan). The decrease in available roads will concentrate traffic on the roads that are maintained and left open. When roads that are left open are adjacent to thinning areas an increased potential for a fire start will exist. Due to the mixed ownership surrounding the lands managed by the BLM, there will continue to be a higher risk for human caused fires adjacent to road corridors.

South aspects are another area of concern where risk of a fire is high. A review of 269 fire reports from 1970 through 1995 on the Siuslaw National Forest showed that 64 percent of the fires were on a south aspect, nineteen percent on a west aspect, twelve percent on an east aspect and five percent on a north aspect.

Short term Risk Reduction Treatments

Acceptable methods to accomplish short term risk reduction include: hand piling; grapple piling; swamper burning; yarding; lop and scatter; and chipping. The following treatments may be prescribed when a thinning occurs adjacent to a private property lines or an open primary or secondary road:

1) Piling and burning of material more than two feet long and up to three inches in diameter at the large end, within 50 to 100 feet of the road prism and the private property line will be allowed.
2) Burning will only occur outside of the summer months during moist soil and fuel conditions.
3) Treated areas on south aspects will be wider than 100 feet, depending on slope and fuel loading below the treated area.

Long term Risks

The greatest risk of a large scale fire event occurring in these LSRs is the propagation of a sustained independent crown fire. Current research indicates that when tree spacing is less than twenty feet by twenty feet (tree density is greater than 110 trees per acre), then sustaining a crown fire is possible. Thinning prescriptions that reduce tree density to less than 100 trees per acre will reduce the threat of a running crown fire. The creation of coarse woody debris (CWD) will add a longer term duration of risk than the fine fuel load created by the thinning. The first additional risk associated with CWD is that of resistance to control. Resistance to control is defined as the relative difficulty of constructing and holding a control line as affected by resistance to line construction and by fire behavior. CWD would hinder the use of direct handline fireline construction. Heavy equipment may be necessary in some areas to construct fireline due to contiguous concentrations of CWD. The greatest risk with CWD would be in areas that have an excess of 40 pieces per acre, a minimum diameter at the small end of the log of fourteen inches and a minimum length of 40 feet.

The second additional risk would come from the increased risk of crowning potential. The amount and condition of fuels at or near the forest floor and the intensity at which they burn greatly influences the propagation of a crown fire. Increasing the amount of CWD would increase the intensity and duration of surface fires, raising the likelihood of crown fires.

APPENDIX D

Wildlife Species Known to Occur

in the

Assessment Area

Appendix D.1. Wildlife Species Known to Occur within the Assessment Area (derived from Southern Coast Range LSRA and Nestucca Watershed Analysis species lists.)

CLASS: Amphibian, Bird, Mammal, Fish, Invertebrate -

Within each class are alphabetical sorting codes which are groupings by family, primary habitat, and/or genus:

family - "AMPHIBIAN-F" is a frog, "AMPHIBIAN-S" is a salamander; "BIRD-BL" refers to the blackbird family; "BIRD-FIN" is a finch; "BIRD-GAL" is a gallinaceous bird; "BIRD-WTR-SH " is a shorebird; MAMMAL-RO" is a rodent; "MAMMAL-RO-SQ" is a squirrel; etc.

primary habitat - "wtr" for water; "wtro" for ocean

genus - "AMPHIBIAN-SA" is a salamander in the genus *Ambystoma*; "BIRD-DOC" is a dove in the genus *Columba;* "BIRD-wtroAL" is associated with water/ocean and is an alcid; "BIRD-wtroCO" is associated with water/ocean and is a cormorant). In some cases, letters were selected merely as grouping tools in an alphabetical-sorting system. This sorting system was used to make it easier to locate specific species or genera by scientific or common name.

COMMON NAME: (WV) = primarily found in the Willamette Valley portion of the AMA

STATUS: Federal & USFS listing/State Listing/Oregon Natural Heritage Program Status/BLM Listing

SC = Federal Species of Concern S&M = Survey and Manage Species, identified in NW Forest Plan

T=Threatened, E=Endangered, and S = Sensitive PT = Proposed for Federal Listing as Threatened

C=Critical, V=Vulnerable, P=Peripheral or Naturally Rare, and U=Undetermined

1 = Threatened with extinction or presumed to be extinct throughout entire range

2 = Threatened with extirpation or presumed to be extirpated from Oregon

3 = More information needed before status can be determined; may be Threatened or Endangered in Oregon or throughout their range

4 = Taxa which are of concern, but are not currently Threatened or Endangered

BT = Bureau Tracking BA = Bureau Assessment BS = Bureau Sensitive

EXOTIC = Non-native, introduced species. EXTIRP? = may no longer be in area

ABUND = Abundance Category: C=Common; R=Rare; O=Occasional; U=Uncommon

CLASS	SCIENTIFIC NAME	COMMON NAME	STATUS	ABUND
AMPHIBIAN-F	*Rana aurora*	Red-legged Frog	SC/U/3/-	C
AMPHIBIAN-F	*Rana catesbeiana*	Bullfrog	EXOTIC	C
AMPHIBIAN-F	*Pseudacris regilla*	Pacific Treefrog		C
AMPHIBIAN-F	*Rana pretiosa*	Spotted Frog	EXTIRP?	R
AMPHIBIAN-F	*Ascaphus truei*	Tailed Frog	SC/V/3/BS	C
AMPHIBIAN-FT	*Bufo boreas*	Western Toad	-/V/3/-	C
AMPHIBIAN-S	*Aneides ferreus*	Clouded Salamander	-/U/3/BS	C
AMPHIBIAN-S	*Ensatina eschscholtzii*	Ensatina		C
AMPHIBIAN-SA	*Ambystoma gracile*	Northwestern Salamander		C
AMPHIBIAN-SA	*Ambystoma macrodactylum*	Long-toed Salamander		C
AMPHIBIAN-SD	*Dicamptodon copei*	Cope's Giant Salamander		C
AMPHIBIAN-SD	*Dicamptodon tenebrosus*	Pacific Giant Salamander		C
AMPHIBIAN-SP	*Plethodon dunni*	Dunn's Salamander		C
AMPHIBIAN-SP	*Plethodon vehiculum*	Western Redback		C
AMPHIBIAN-SR	*Rhyacotriton kezeri*	Columbia Torrent	-/V/3/BS	C
AMPHIBIAN-SR	*Rhyacotriton variegatus*	Southern Torrent	SC	C
AMPHIBIAN-SU	*Taricha granulosa*	Rough-skinned Newt		C
BIRD-BL	*Dolichonyx oryzivorus*	Bobolink	-/V/4/-	O
BIRD-BL	*Corvus corax*	Common Raven		C
BIRD-BL	*Xanthocephalus xanthocephalus*	Yellow-headed Blackbird		O
BIRD-BL	*Pica pica*	Black-billed Magpie		C
BIRD-BL	*Eremophila alpestris*	Horned Lark		U

Appendix D.1. Wildlife Species Known to Occur within the Assessment Area (continued)

CLASS	SCIENTIFIC NAME	COMMON NAME	STATUS	ABUND
BIRD-BL	*Sturnella neglecta*	Western Meadowlark		U
BIRD-BL	*Molothrus ater*	Brown-headed Cowbird		C
BIRD-BL	*Euphagus cyanocephalus*	Brewer's Blackbird		C
BIRD-BL	*Agelaius phoeniceus*	Red-winged Blackbird		C
BIRD-BL	*Corvus brachyrhynchos*	American Crow		C
BIRD-BL	*Sturnus vulgaris*	European Starling	EXOTIC	C
BIRD-BL	*Icteus galbula*	Northern Oriole		U
BIRD-BL-J	*Aphelocoma coerulescens*	Scrub Jay		C
BIRD-BL-J	*Cyanocitta stelleri*	Steller's Jay		C
BIRD-BL-J	*Perisoreus canadensis*	Gray Jay		U
BIRD-CAP	*Chordeiles minor*	Common Nighthawk		U
BIRD-DO	*Zenaida macroura*	Mourning Dove		U
BIRD-DOC	*Columba fasciata*	Band-tailed Pigeon		C
BIRD-DOC	*Columba livia*	Rock Dove		U
BIRD-F	*Tyrannus verticalis*	Western Kingbird		U
BIRD-FCC	*Contopus sordidulus*	Western Wood-pewee		C
BIRD-FCC	*Contopus borealis*	Olive-sided Flycatcher		C
BIRD-FCE	*Empidonax difficilis*	Pacific-slope Flycatcher		C
BIRD-FCE	*Empidonax traillii (brewsteri)*	Willow Flycatcher (Little)	SC	C
BIRD-FCE	*Empidonax hammondii*	Hammond's Flycatcher		U
BIRD-FIN	*Carduelis pinus*	Pine Siskin		C
BIRD-FIN	*Carduelis tristis*	American Goldfinch		C
BIRD-FIN	*Carduelis psaltria*	Lesser Goldfinch		C
BIRD-FINP	*Carpodacus mexicanus*	House Finch		C
BIRD-FINP	*Carpodacus purpureus*	Purple Finch		C
BIRD-GAL	*Meleagris gallopavo*	Wild Turkey		U
BIRD-GAL	*Bonasa umbellus*	Ruffed Grouse		C
BIRD-GAL	*Phasianus colchicus*	Ring-necked Pheasant	EXOTIC	U
BIRD-GALG	*Dendragapus obscurus*	Blue Grouse		U
BIRD-GALQ	*Oreortyx pictus*	Mountain Quail	-/-/4/S	U
BIRD-GALQ	*Callipepla californica*	California Quail		C
BIRD-GRO	*Loxia curvirostra*	Red Crossbill		C
BIRD-GRO	*Coccothraustes vespertina*	Evening Grosbeak		C
BIRD-GRO	*Pheucticus melanocephalus*	Black-headed Grosbeak		C
BIRD-HA-EA	*Aquila chrysaetos*	Golden Eagle		U
BIRD-HA-EA	*Haliaeetus leucocephalus*	Northern Bald Eagle	T/T/1/T	U
BIRD-HA-EA-O	*Pandion haliaetus*	Osprey		U
BIRD-HA-FAL	*Falco sparverius*	American Kestrel		U
BIRD-HA-FAL	*Falco peregrinus anatum*	American Peregrine Falcon	E/E/1/E	U
BIRD-HA-FAL	*Falco columbarius*	Merlin	-/-/-/BA	U
BIRD-HAW	*Elanus caeruleus*	Black-shouldered Kite	-/-/3/BT	U
BIRD-HAWH	*Circus cyaneus*	Northern Harrier		U
BIRD-HAWKA	*Accipiter striatus*	Sharp-shinned Hawk		U
BIRD-HAWKA	*Accipiter cooperii*	Cooper's Hawk		U
BIRD-HAWKA	*Accipiter gentilis*	Northern Goshawk	SC/C/3/S	R
BIRD-HAWKB	*Buteo lagopus*	Rough-legged Hawk (WV)		U
BIRD-HAWKB	*Buteo jamaicensis*	Red-tailed Hawk		C
BIRD-HAWKB	*Buteo lineatus*	Red-shouldered Hawk (WV)		O
BIRD-HTV	*Cathartes aura*	Turkey Vulture		C
BIRD-HU	*Stllula calliope*	Calliope Hummingbird		R
BIRD-HU	*Calypte anna*	Anna's Hummingbird		U
BIRD-HUS	*Selasphorus rufus*	Rufous Hummingbird		C

Appendix D.1. Wildlife Species Known to Occur within the Assessment Area (continued)

CLASS	SCIENTIFIC NAME	COMMON NAME	STATUS	ABUND
BIRD-HUS	*Selasphorus sasin*	Allen's Hummingbird	-/-/4/-	C
BIRD-NU	*Certhia americana*	Brown Creeper		C
BIRD-NU	*Sitta canadensis*	Red-breasted Nuthatch		C
BIRD NU	*Sitta carolinensis*	White-breasted Nuthatch		C
BIRD-OWL	*Bubo virginianus*	Great Horned Owl		C
BIRD-OWL	*Otis kennicottii*	Western Screech-owl		U
BIRD-OWL	*Glaucidium gnoma*	Northern Pygmy Owl	-/U/3/BT	U
BIRD-OWL	*Tyto alba*	Barn Owl		U
BIRD-OWL	*Aegolius acadicus*	Northern Saw-whet Owl	-/-/-/BT	U
BIRD-OWLA	*Asio otus*	Long-eared Owl		U
BIRD-OWLA	*Asio flammeus*	Short-eared Owl		U
BIRD-OWLS	*Strix occidentalis caurina*	Northern Spotted Owl	T/T/1/T	U
BIRD-OWLS	*Strix varia*	Barred Owl		O
BIRD-PIP	*Anthus spinoletta (rubescens)*	American Pipit		C
BIRD-SK	*Lanius ludovicianus*	Loggerhead Shrike		U
BIRD-SK	*Lanius excubitor*	Northern Shrike		U
BIRD-SL	*Calcarius lapponicus*	Lapland Longspur		U
BIRD-SP	*Passer domesticus*	House Sparrow		C
BIRD-SP	*Passerella iliaca*	Fox Sparrow		C
BIRD-SP	*Spizella passerina*	Chipping Sparrow		U
BIRD-SP	*Pooecetes gramineus*	Vesper Sparrow	-/U/3/-	U
BIRD-SP	*Chondestes grammacus*	Lark Sparrow		U
BIRD-SP	*Passerculus sandwichensis*	Savannah Sparrow		C
BIRD-SPME	*Melospiza georgiana*	Swamp Sparrow		U
BIRD-SPME	*Melospiza lincolnii*	Lincoln's Sparrow		U
BIRD-SPME	*Melospiza melodia*	Song Sparrow		C
BIRD-SPT	*Pipilo erythrophtalmus*	Rufous-sided Towhee		C
BIRD-SPZ	*Zonotrichia atricapilla*	Golden-crowned Sparrow		C
BIRD-SPZ	*Zonotrichia albicollis*	White-throated Sparrow		U
BIRD-SPZ	*Zonotrichia leucophrys*	White-crowned Sparrow		C
BIRD-SW	*Chaetura vauxi*	Vaux's Swift		C
BIRD-SW	*Cypeseloides niger*	Black Swift	-/P/3/BA	R
BIRD-SWG	*Progne subis*	Purple Martin	-/C/3/BS	U
BIRD-SWH	*Hirundo rustica*	Barn Swallow		C
BIRD-SWH	*Hirundo pyrrhonota*	Cliff Swallow		C
BIRD-SWR	*Riparia riparia*	Bank Swallow	-/U/3/	U
BIRD-SWS	*Stelgidopteryx serripennis*	No. Rough-winged Swallow		U
BIRD-SWT	*Tachycineta bicolor*	Tree Swallow		C
BIRD-SWT	*Tachycineta thalassina*	Violet-green Swallow		C
BIRD-TAN	*Passerina amoena*	Lazuli Bunting		U
BIRD-TAN	*Piranga ludoviciana*	Western Tanager		C
BIRD-TAO	*Sialia currucoides*	Mountain Bluebird	-/-/-/BT	O
BIRD-TAP	*Sialia mexicana*	Western Bluebird	-/V/4/BS	U
BIRD-TH	*Turdus migratorius*	American Robin		C
BIRD-TH	*Ixoreus naevius*	Varied Thrush		C
BIRD-THC	*Catharus ustulatus*	Swainson's Thrush		C
BIRD-THC	*Catharus guttatus*	Hermit Thrush		U
BIRD-THMK	*Mimus polyglottos*	Northern Mockingbird		U
BIRD-TI	*Psaltriparus minimus*	Bushtit		C
BIRD-TI	*Chamaea fasciata*	Wrentit		C
BIRD-TJ	*Junco hyemalis*	Dark-eyed Junco		C
BIRD-TIKLT	*Regulus satrapa*	Golden-crowned Kinglet		C

Appendix D.1. Wildlife Species Known to Occur within the Assessment Area (continued)

CLASS	SCIENTIFIC NAME	COMMON NAME	STATUS	ABUND
BIRD-TIKLT	*Regulus calendula*	Ruby-crowned Kinglet		C
BIRD- IP	*Parus rufescens*	Chestnut-backed Chickadee		U
BIRD-TIP	*Parus gambeli*	Mountain Chickadee		O
BIRD-TIP	*Parus atricapillus*	Black-capped Chickadee		C
BIRD-V	*Vireo huttoni*	Hutton's Vireo		C
BIRD-V	*Vireo solitarius*	Solitary Vireo		U
BIRD-V	*Vireo gilvus*	Warbling Vireo		C
BIRD-V	*Vireo olivaceus*	Red-eyed Vireo		U
BIRD-VS	*Myadestes townsendi*	Townsend's Solitaire		U
BIRD-W	*Icteria virens*	Yellow-breasted Chat		C
BIRD-WA	*Wilsonia pusilla*	Wilson's Warbler		C
BIRD-WA	*Geothlypis trichas*	Common Yellowthroat		C
BIRD-WA	*Oporornis tolmiei*	MacGillivray's Warbler		C
BIRD-WAD	*Dendroica nigrescens*	Black-throated Gray		C
BIRD-WAD	*Dendroica townsendi*	Townsend's Warbler		U
BIRD-WAD	*Dendroica coronata*	Yellow-rumped Warbler		C
BIRD-WAD	*Dendroica occidentalis*	Hermit Warbler		U
BIRD-WAD	*Dendroica palmarum*	Palm Warbler		U
BIRD-WAD	*Dendroica petechia*	Yellow Warbler		C
BIRD-WAV	*Vermivora ruficapilla*	Nashville Warbler		U
BIRD-WAV	*Vermivora celata*	Orange-crowned Warbler		C
BIRD-WAX	*Bombycilla garrulus*	Bohemian Waxwing		U
BIRD-WAX	*Bombycilla cedrorum*	Cedar Waxwing		C
BIRD-WDPK	*Sphyrapicus ruber*	Red-breasted Sapsucker		U
BIRD-WDPK	*Colaptes auratus*	Northern Flicker		C
BIRD-WDPK	*Dryocopus pileatus*	Pileated Woodpecker	-/V/4/BS	U
BIRD-WDPKP	*Picoides villosus*	Hairy Woodpecker		U
BIRD-WDPKP	*Picoides pubescens*	Downy Woodpecker		U
BIRD-WDPKW	*Melanerpes lewis*	Lewis' Woodpecker (WV)		U
BIRD-WDPKW	*Melanerpes formicivorus*	Acorn Woodpecker (WV)		U
BIRD-WR	*Thryomanes bewickii*	Bewick's Wren		C
BIRD-WR	*Cistothorus palustris*	Marsh Wren		C
BIRD-WR	*Salpinctes obsoletus*	Rock Wren		U
BIRD-WRT	*Troglodytes aedon*	House Wren		U
BIRD-WRT	*Troglodytes troglodytes*	Winter Wren		C
BIRD-wtr	*Cinclus mexicanus*	American Dipper		C
BIRD-wtr	*Ceryle alcyon*	Belted Kingfisher		C
BIRD-wtr-DUCK	*Aix sponsa*	Wood Duck		U
BIRD-wtr-DUCK	*Histrionicus histrionicus*	Harlequin Duck	-/P/2/-	U
BIRD-wtr-DUCK	*Oxyura jamaicensis*	Ruddy Duck		C
BIRD-wtr-DUCK	*Clangula hyemalis*	Oldsquaw		U
BIRD-wtr-DUCKA	*Anas strepera*	Gadwall		U
BIRD-wtr-DUCKA	*Anas clypeata*	Northern Shoveler		U
BIRD-wtr-DUCKA	*Anas platyrhynchos*	Mallard		C
BIRD-wtr-DUCKA	*Anas acuta*	Northern Pintail		C
BIRD-wtr-DUCKAT	*Anas discors*	Blue-winged Teal		U
BIRD-wtr-DUCKAT	*Anas crecca*	Green-winged Teal		C
BIRD-wtr-DUCKAT	*Anas cyanoptera*	Cinnamon Teal		U
BIRD-wtr-DUCKAW	*Anas americana*	American Wigeon		C
BIRD-wtr-DUCKAW	*Anas penelope*	Eurasian Wigeon		U
BIRD-wtr-DUCKAY	*Aythya valisineria*	Canvasback		C
BIRD-wtr-DUCKAY	*Aythya americana*	Redhead		U

Appendix D.1. Wildlife Species Known to Occur within the Assessment Area (continued)

CLASS	SCIENTIFIC NAME	COMMON NAME	STATUS	ABUND
BIRD-wtr-DUCKAY	*Aythya affinis*	Lesser Scaup	-/-/4/-	C
BIRD-wtr-DUCKAY	*Aythya collaris*	Ring-necked Duck	-/-/4/BT	U
BIRD-wtr-DUCKAY	*Aythya marila*	Greater Scaup		C
BIRD-wtr-DUCKB	*Bucephala albeola*	Bufflehead	-/P/2/BA	C
BIRD-wtr-DUCKB	*Bucephala clangula*	Common Goldeneye		C
BIRD-wtr-DUCKB	*Bucephala islandica*	Barrow's Goldeneye	-/P/4/BA	C
BIRD-wtr-DUCKM	*Lophodytes cucullatus*	Hooded Merganser		U
BIRD-wtr-DUCKME	*Mergus serrator*	Red-breasted Merganser		C
BIRD-wtr-DUCKME	*Mergus merganser*	Common Merganser		C
BIRD-wtr-GA	*Anser albifrons*	Great White-fronted Goose		U
BIRD-wtr-GB	*Branta canadensis*	Canada Goose		C
BIRD-wtr-GB	*Branta canadensis leucopareia*	Aleutian Canada Goose	T/E/1/T	R
BIRD-wtr-GB	*Branta canadensis occidentalis*	Dusky Canada Goose	-/-/4/BS	U
BIRD-wtr-GBB	*Branta bernicla*	Brant		C
BIRD-wtr-GC	*Chen rossii*	Ross' Goose		C
BIRD-wtr-GC	*Chen caerulescens*	Snow Goose		C
BIRD-wtr-GL	*Gavia immer*	Common Loon	SC/-/2/BA	C
BIRD-wtr-GL	*Gavia adamsil*	Yellow-billed Loon		R
BIRD-wtr-GL	*Gavia pacifica*	Arctic (Pacific) Loon		C
BIRD-wtr-GL	*Gavia stellata*	Red-throated Loon		C
BIRD-wtr-GRA	*Aechmophorus occidentalis*	Western Grebe		C
BIRD-wtr-GRA	*Aechmophorus clarkii*	Clark's Grebe		U
BIRD-wtr-GRPC	*Podiceps nigricollis*	Eared Grebe		U
BIRD-wtr-GRPC	*Podiceps grisegena*	Red-necked Grebe	-/C/2/BS	U
BIRD-wtr-GRPC	*Podiceps auritus*	Horned Grebe	-/P/4/BA	C
BIRD-wtr-GRPL	*Podilymbus podiceps*	Pied-billed Grebe		C
BIRD-wtr-GS	*Cygnus buccinator*	Trumpeter Swan		U
BIRD-wtr-GS	*Cygnus columbianus*	Tundra Swan		C
BIRD-wtr-GU	*Oceanodroma leucorhoa*	Leach's Storm Petrel		U
BIRD-wtr-GULL	*Rissa tridactyla*	Black-legged Kittiwake		C
BIRD-wtr-GULLK	*Xema sabini*	Sabine's Gull		U
BIRD-wtr-GULLL	*Larus philadelphia*	Bonaparte's Gull		C
BIRD-wtr-GULLL	*Larus occidentalis*	Western Gull		C
BIRD-wtr-GULLL	*Larus heermanni*	Heermann's Gull		C
BIRD-wtr-GULLL	*Larus glaucescens*	Glaucous-winged Gull		C
BIRD-wtr-GULLL	*Larus thayeri*	Thayer's Gull		U
BIRD-wtr-GULLL	*Larus californicus*	California Gull		C
BIRD-wtr-GULLL	*Larus canus*	Mew Gull		C
BIRD-wtr-GULLL	*Larus delawarensis*	Ring-billed Gull		C
BIRD-wtr-GULLL	*Larus argentatus*	Herring Gull		U
BIRD-wtr-GULLT	*Sterna caspia*	Caspian Tern	-/-/4/BT	C
BIRD-wtr-GULLT	*Sterna paradisaea*	Arctic Tern		U
BIRD-wtr-GULLT	*Sterna hirundo*	Common Tern		U
BIRD-wtr-HE	*Egretta thula*	Snowy Egret	-/U/2/-	C
BIRD-wtr-HE	*Bubulcus ibis*	Cattle Egret		U
BIRD-wtr-HE	*Casmerodius albus*	Great Egret	-/U/4/-	U
BIRD-wtr-HE	*Nycticorax nycticorax*	Black-crowned Night-heron		U
BIRD-wtr-HE	*Botaurus lentiginosus*	American Bittern		U
BIRD-wtr-HE	*Butorides striatus*	Green-backed Heron		U
BIRD-wtr-HE	*Ardea herodias*	Great Blue Heron		C
BIRD-wtr-PEL	*Pelecanus occidentalis*	California Brown Pelican	E/E/2/E	C
BIRD-wtr-RA	*Coturnicops noveboracensis*	Yellow Rail		U

Appendix D.1. Wildlife Species Known to Occur within the Assessment Area (continued)

CLASS	SCIENTIFIC NAME	COMMON NAME	STATUS	ABUND
BIRD-wtr-RA	*Fulica americana*	American Coot		C
BIRD-wtr-RA	*Porzana carolina*	Sora		U
BIRD-wtr-RA	*Rallus limicola*	Virginia Rail		U
BIRD-wtr-S	*Gallinago gallinago*	Common Snipe		C
BIRD-wtr-SH	*Actitis macularia*	Spotted Sandpiper		U
BIRD-wtr-SH	*Aphriza virgata*	Surfbird		C
BIRD-wtr-SH	*Heteroscelus incanus*	Wandering Tattler		U
BIRD-wtr-SH	*Catoptrophorus semipalmatus*	Willet		U
BIRD-wtr-SH	*Haematopus bachmani*	American Black		U
BIRD-wtr-SH	*Himantopus mexicanus*	Black-necked Stilt		O
BIRD-wtr-SHA	*Arenaria interpres*	Ruddy Turnstone		C
BIRD-wtr-SHA	*Arenaria melanocephala*	Black Turnstone		C
BIRD-wtr-SHCA	*Calidris ptilocnemis*	Rock Sandpiper		U
BIRD-wtr-SHCA	*Calidris canutus*	Red Knot		U
BIRD-wtr-SHCA	*Calidris acuminata*	Sharp-tailed Sandpiper		U
BIRD-wtr-SHCA	*Calidris pusilla*	Semipalmated Sandpiper		U
BIRD-wtr-SHCA	*Calidris bairdii*	Baird's Sandpiper		U
BIRD-wtr-SHCA	*Calidris alpina*	Dunlin		C
BIRD-wtr-SHCA	*Calidris minutilla*	Least Sandpiper		C
BIRD-wtr-SHCA	*Calidris mauri*	Western Sandpiper		C
BIRD-wtr-SHCA	*Calidris melanotos*	Pectoral Sandpiper		U
BIRD-wtr-SHCA	*Calidris alba*	Sanderling		C
BIRD-wtr-SHCH	*Charadrius alexandrinus nivosus*	Western snowy plover	T/T/2/T	U
BIRD-wtr-SHCH	*Charadrius semipalmatus*	Semipalmated Plover		C
BIRD-wtr-SHCH	*Charadrius vociferus*	Killdeer		C
BIRD-wtr-SHLI	*Limnodromus griseus*	Short-billed Dowitcher		C
BIRD-wtr-SHLI	*Limnodromus scolopaceus*	Long-billed Dowitcher		C
BIRD-wtr-SHLIN	*Limosa fedoa*	Marbled Godwit		C
BIRD-wtr-SHNU	*Numenius americanus*	Long-billed Curlew	SC/-/4/BS	U
BIRD-wtr-SHNU	*Numenius phaeopus*	Whimbrel		C
BIRD-wtr-SHPH	*Phalaropus lobatus*	Red-necked Phalarope		C
BIRD-wtr-SHPH	*Phalaropus fulicaria*	Red Phalarope		C
BIRD-wtr-SHPL	*Pluvialis dominica*	Lesser Golden-plover		U
BIRD-wtr-SHPL	*Pluvialis squatarola*	Black-bellied Plover		C
BIRD-wtr-SHTR	*Tringa flavipes*	Lesser Yellowlegs		C
BIRD-wtr-SHTR	*Tringa melanoleuca*	Greater Yellowlegs	-/-/2/BA	C
BIRD-wtr-SHTR	*Tringa solitaria*	Solitary Sandpiper	-/-/3/BT	R
BIRD-wtroAL	*Brachyramphus marmoratus*	Marbled Murrelet	T/C/2/T	U
BIRD-wtroAL	*Synthliboramphus antiquus*	Ancient Murrelet		U
BIRD-wtroAL	*Ptychoramphus aleuticus*	Cassin's Auklet		C
BIRD-wtroAL	*Cepphus columba*	Pigeon Guillemot		C
BIRD-wtroAL	*Uria aalge*	Common Murre		C
BIRD-wtroAL	*Fratercula cirrhata*	Tufted Puffin		C
BIRD-wtroAL	*Cerorhinca monocerata*	Rhinoceros Auklet		C
BIRD-wtroCO	*Phalacrocorax pelagicus*	Pelagic Cormorant		C
BIRD-wtroCO	*Phalacrocorax auritus*	Double-crested Cormorant		C
BIRD-wtroCO	*Phalacrocorax penicillatus*	Brandt's Cormorant		C
BIRD-wtroDUCKSS	*Melanitta fusca*	White-winged Scoter		C
BIRD-wtroDUCKSS	*Melanitta nigra*	Black Scoter		U
BIRD-wtroDUCKSS	*Melanitta perspicillata*	Surf Scoter		C

Appendix D.1. Wildlife Species Known to Occur within the Assessment Area (continued)

CLASS	SCIENTIFIC NAME	COMMON NAME	STATUS	ABUND
MAMMAL	*Aplodontia rufa*	Mountain Beaver		C
MAMMAL	*Didelphis virginianus*	Opossum	EXOTIC	C
MAMMAL-BAT	*Eptesicus fuscus*	Big Brown Bat		C
MAMMAL-BAT	*Plecotus townsendii townsendii*	Townsend's Big-eared Bat	SC/C/2/S	R
MAMMAL-BATLA	*Lasionycteris noctivagans*	Silver-haired Bat		C
MAMMAL-BATLA	*Lasiurus cinereus*	Hoary Bat		U
MAMMAL-BATMY	*Myotis thysanodes*	Fringed Myotis	SC/V/1/B	R
MAMMAL-BATMY	*Myotis volans*	Long-legged Bat	SC	C
MAMMAL-BATMY	*Myotis californicus*	California Myotis		C
MAMMAL-BATMY	*Myotis yumanensis*	Yuma Bat	SC	U
MAMMAL-BATMY	*Myotis evotis*	Long-eared Bat	SC	C
MAMMAL-BATMY	*Myotis lucifugus*	Little Brown Myotis		C
MAMMAL-CARN	*Ursus americanus*	Black Bear		C
MAMMAL-CARNC	*Vulpes vulpes*	Red Fox		U
MAMMAL-CARNC	*Urocyon cinereoargenteus*	Gray Fox		U
MAMMAL-CARNC	*Canis latrans*	Coyote		C
MAMMAL-CARNF	*Felis concolor*	Mountain Lion		U
MAMMAL-CARNF	*Felis rufus*	Bobcat		C
MAMMAL-CARNM	*Procyon lotor*	Raccoon		C
MAMMAL-CARNMA	*Martes americana*	Pine (American) Marten	-/C/3/BS	R
MAMMAL-CARNMA	*Martes pennanti pacifica*	Pacific Fisher	SC/C/2/S	R
MAMMAL-CARNME	*Mephitis mephitis*	Striped Skunk		C
MAMMAL-CARNME	*Spilogale gracilis*	Western Spotted Skunk		C
MAMMAL-CARNMU	*Mustela vison*	Mink		C
MAMMAL-CARNMU	*Mustela erminea*	Short-tailed Weasel (Ermine)		C
MAMMAL-CARNMU	*Mustela frenata*	Long-tailed Weasel		C
MAMMAL-CARNMV	*Lutra canadensis*	River Otter		C
MAMMAL-CERV	*Odocoileus hemionus*	Black-tailed Deer		C
MAMMAL-CERV	*Cervus elaphus*	Elk		C
MAMMAL-H	*Lepus americanus*	Snowshoe Hare		U
MAMMAL-H	*Sylvilagus bachmani*	Brush Rabbit		C
MAMMAL-I	*Sorex bendirei*	Marsh Shrew		C
MAMMAL-I	*Sorex trowbridgei*	Trowbridge's Shrew		C
MAMMAL-I	*Sorex vagrans*	Vagrant Shrew		C
MAMMAL-I	*Sorex yaquinae*	Yaquina Shrew		U
MAMMAL-I	*Sorex obscurus*	Dusky Shrew		U
MAMMAL-IN	*Neurotrichus gibbsi*	Shrew-Mole		C
MAMMAL-ISC	*Scapanus townsendi*	Townsend Mole		C
MAMMAL-ISC	*Scapanus orarius*	Coast Mole		C
MAMMAL-RO	*Thomomys mazama*	Mazama Pocket Gopher		C
MAMMAL-RO	*Myocastor coypus*	Nutria	EXOTIC	C
MAMMAL-RO	*Ondatra zibethicus*	Muskrat		U
MAMMAL-RO	*Erethizon dorsatum*	Porcupine		C
MAMMAL-RO	*Castor canadensis*	Beaver		C
MAMMAL-RO-M	*Zapus trinotatus*	Pacific Jumping Mouse		C
MAMMAL-RO-M	*Mus musculus*	House Mouse	EXOTIC	C
MAMMAL-RO-M	*Peromyscus maniculatus*	Deer Mouse		C
MAMMAL-RO-M	*Clethrionomys californicus*	Western Red-backed Vole		C
MAMMAL-RO-MI	*Microtis longicaudus abditus*	Long-tailed Vole		C
MAMMAL-RO-MI	*Microtis oregoni*	Creeping Vole		C
MAMMAL-RO-MI	*Microtus townsendii*	Townsend's Vole		C

Appendix D.1. Wildlife Species Known to Occur within the Assessment Area (continued)

CLASS	SCIENTIFIC NAME	COMMON NAME	STATUS	ABUND
MAMMAL-RO-SQ	*Spermophilus beecheyi*	California Ground Squirrel		C
MAMMAL-RO-NE	*Neotoma cinerea*	Bushy-tailed Woodrat		C
MAMMAL-RO-NE	*Neotoma fuscipes*	Dusky-footed Woodrat		C
MAMMAL-RO-PH	*Phenacomys longicaudus*	Red Tree Vole	S&M	U
MAMMAL-RO-PH	*Phenacomys (Arborimus) albipes*	White-footed Vole	SC/U/3/S	R
MAMMAL-RO-RA	*Rattus rattus*	Black Rat	EXOTIC	C
MAMMAL-RO-RA	*Rattus norvegicus*	Norway Rat	EXOTIC	C
MAMMAL-RO-SQ	*Tamias townsendii*	Townsend's Chipmunk		C
MAMMAL-RO-SQ	*Spermophilus beecheyi*	California Ground Squirrel		C
MAMMAL-RO-SQT	*Glaucomys sabrinus*	Northern Flying Squirrel		C
MAMMAL-RO-SQT	*Tamiasciurus douglasii*	Douglas' Squirrel		C
MAMMAL-RO-SQT	*Sciurus griseus*	Western Gray Squirrel (WV)		U
MAMMAL-SEA	*Zalophus californianus*	California Sea Lion		U
MAMMAL-SEA	*Phoca vitulina*	Harbor Seal		C
MAMMAL-SEA	*Eumetopias jubatus*	Northern Sea Lion	T/V/3/T	U
MAMMAL-SEA	*Mirounga angustirostris*	Northern Elephant Seal		O
REPTILE-LIZ	*Elgaria coerulea*	Northern Alligator Lizard		C
REPTILE-LIZ	*Eumeces skiltonianus*	Western Skink		C
REPTILE-LIZ	*Sceloporus occidentalis*	Western Fence Lizard		C
REPTILE-S	*Charina bottae*	Rubber Boa		U
REPTILE-S	*Coluber constrictor*	Racer		U
REPTILE-S	*Diadophis punctatus*	Ringneck Snake		U
REPTILE-S	*Pituophis melanoleucus*	Gopher snake		U
REPTILE-STH	*Thamnophis elegans*	Western Terrestrial Garter		U
REPTILE-STH	*Thamnophis sirtalis*	Common Garter Snake		C
REPTILE-STH	*Thamnophis ordinoides*	Northwestern Garter Snake		C
REPTILE-TUR	*Clemmys marmota marmota*	No.western Pond Turtle	SC/C/2/S	R
REPTILE-TUR	*Chrysemys picta*	Painted Turtle (WV)		U
Selected FISH	**********	**********	*********	*******
SF-F	*Oregonichthys crameri*	Oregon Chub (WV)	E/S/-/-	
SF-FS	*Oncorhynchus mykiss*	Steelhead	PT/-/-/PT	
SF-FS	*Oncorhynchus keta*	Chum Salmon		
SF-FS	*Oncorhynchus nerka*	Humpback Salmon		
SF-FS	*Oncorhynchus tshawytscha*	Chinook Salmon		
SF-FS	*Oncorhynchus kisutch*	Coho Salmon	PT/-/-/PT	
SF-FSA	*Oncorhynchus clarki clarki*	Coastal Cutthroat Trout		
SF-FSL	*Lampetra tridentata*	Pacific lamprey	SC	
SF-FSL	*Lampetra avresi*	River lamprey	SC	
SF-FST	*Acipenser transmontanus*	White Sturgeon		
SF-FST	*Acipenser medirostris*	Green Sturgeon	SC	
Selected Inverts.	**********	**********	*********	*******
SI-INSECT	*Speyeria zerene hippolyta*	Oregon Silverspot Butterfly	T/-/1/T	
SI-INSECT	*Ptersotichus rothi*	Roth's Blind Ground Beetle	SC	
SI-INSECTC	*Ceraclea vertreesi*	Vertrees's Ceraclean Caddisfly	SC	
SI-INSECTC	*Rhyacophila haddocki*	Haddock's Caddisfly	SC/-/3/-	
SI-INSECTC	*Ochrotrichia alsea*	Alsea Micro Caddisfly	-/-/3/-	
SI-SN	*Algamorda newcombiana*	Newcomb's Littorine Snail	SC	

Appendix D.2. Wildlife Species Associated with Logs and Snags (derived from Southern Coast Range LSRA species list and Brown, tech.ed., USDA 1985)

Only species using logs or snags as primary feeding, breeding or resting habitat are included.
CLASS: Codes are used to group by family and genus.

CLASS	SCIENTIFIC NAME	COMMON NAME	LOGS	SNAGS
Amphibian	*Abystoma gracile*	Northwestern Salamander	*	
Amphibian	*Ambystoma macrodactylum*	Long-toed Salamander	*	
Amphibian	*Aneides ferreus*	Clouded Salamander	*	
Amphibian	*Dicamptodon ensatus*	Pacific Giant Salamander	*	
Amphibian	*Ensatina eschscholtzi*	Ensatina	*	
Amphibian	*Plethodon dunni*	Dunn's Salamander	*	
Amphibian	*Plethodon vehiculum*	Western Redback Salamander	*	
Bird-Gal	*Bonasa umbellus*	Ruffed Grouse	*	
Bird-wr	*Troglodytes troglodytes*	Winter Wren	*	
Bird-wr	*Thryomanes bewickii*	Bewick's Wren	*	
Birdsp	*Pipilo erythrophtalmus*	Rufous-sided Towhee	*	
Mammal	*Aplodontia rufa*	Mountain Beaver	*	
Mammal-Cm	*Mustela vison*	Mink	*	
Mammal-Co	*Canis latrans*	Coyote	*	
Mammal-in	*Neurotrichus gibbsi*	Shrew-Mole	*	
Mammal-in	*Sorex pacificus*	Pacific Shrew	*	
Mammal-in	*Sorex vaquinae*	Yaquina Shrew	*	
Mammal-in	*Sorex trowbridgei*	Trowbridge's Shrew	*	
Mammal-in	*Sorex bendirei*	Marsh Shrew	*	
Mammal-r	*Clethrionomys californicus*	Western Red-backed Vole	*	
Mammal-r	*Phenacomys albipes*	White-footed Vole	*	
Mammal-ro	*Microtis longicaudus abditus*	Long-tailed Vole	*	
Mammal-ro	*Microtis oregoni*	Creeping Vole	*	
Mammal-rt	*Eutamias townsendi*	Townsend Chipmunk	*	
Reptile	*Contia tenuos*	Sharptail Snake	*	
Reptile	*Charina bottae*	Rubber Boa	*	
Reptile	*Elgaria coerulea*	Northern Alligator Lizard	*	
Reptile	*Thamnophis sirtalis*	Common Garter Snake	*	
Bird-Bl	*Sturnus vulgaris*	European Starling		*
Bird-Owl	*Glaucidium gnoma*	Northern Pygmy Owl		*
Bird-Owl	*Otis kennicottii*	Western Screech-owl		*
Bird-Owl	*Bubo virginianus*	Great Horned Owl		*
Bird-Owl	*Aegolius acadicus*	Northern Saw-whet Owl		*
Bird-Owl	*Tyto alba*	Barn Owl		*
Bird-Owls	*Strix varia*	Barred Owl		*
Bird-Owls	*Strix occidentalis caurina*	Northern Spotted Owl		*
Bird-oha	*Pandion haliaetus*	Osprey		*
Bird-ohaf	*Falco sparverius*	American Kestrel		*
Bird-sw	*Chaetura vauxi*	Vaux's Swift		*
Bird-swg	*Progne subis*	Purple Martin		*
Bird-swt	*Tachycineta thalassina*	Violet-green Swallow		*
Bird-swt	*Tachycineta bicolor*	Tree Swallow		*
Bird-ta	*Carpodacus mexicanus*	House Finch		*

Appendix D.2. Wildlife Species Associated with Logs and Snags (continued)

CLASS	SCIENTIFIC NAME	COMMON NAME	STATUS	ABUND
Bird-tap	*Sialia mexicana*	Western Bluebird		*
Bird-tflv	*Contopus borealis*	Olive-sided Flycatcher		*
Bird-tip	*Parus atricapillus*	Black-capped Chickadee		*
Bird-tip	*Parus rufescens*	Chestnut-backed Chickadee		*
Bird-twd	*Sitta carolinensis*	White-breasted Nuthatch		*
Bird-twd	*Sitta canadensis*	Red-breasted Nuthatch	*	*
Bird-twd	*Certhia americana*	Brown Creeper		*
Bird-wdp	*Picoides villosus*	Hairy Woodpecker	*	*
Bird-wdp	*Picoides pubescens*	Downy Woodpecker		*
Bird-wdpk	*Dryocopus pileatus*	Pileated Woodpecker	*	*
Bird-wdpk	*Sphyrapicus ruber*	Red-breasted Sapsucker		*
Bird-wdpk	*Colaptes auratus*	Northern Flicker	*	*
Bird-wr	*Troglodytes aedon*	House Wren	*	*
Bird-wtrdu	*Aix sponsa*	Wood Duck		*
Bird-wtrdu	*Bucephala albeola*	Bufflehead		*
Bird-wtrdu	*Lophodytes cucullatus*	Hooded Merganser		*
Bird-wtrdu	*Mergus merganser*	Common Merganser		*
Mammal	*Didelphis virginianus*	Opossum	*	*
Mammal-Bat	*Lasionycteris noctivagans*	Silver-haired Bat		*
Mammal-Bat	*Eptesicus fuscus*	Big Brown Bat		*
Mammal-Batm	*Myotis lucifugus*	Little Brown Bat		*
Mammal-Batm	*Myotis evotis*	Long-eared Bat		*
Mammal-Batm	*Myotis yumanensis*	Yuma Bat		*
Mammal-Batm	*Myotis californicus*	California Bat		*
Mammal-Batm	*Myotis thysanodes*	Fringed Myotis		*
Mammal-Ca	*Lynx rufus*	Bobcat	*	*
Mammal-Cb	*Ursus americanus*	Black Bear	*	*
Mammal-Cm	*Spilogale gracilis*	Western Spotted Skunk	*	*
Mammal-Cme	*Martes pennanti pacifica*	Pacific Fisher	*	*
Mammal-Cme	*Martes americana*	Pine Marten	*	*
Mammal-Cmu	*Mustela frenata*	Long-tailed Weasel	*	*
Mammal-Cmu	*Mustela erminea*	Short-tailed Weasel	*	*
Mammal-Cof	*Urocyon cinereoargenteus*	Gray Fox	*	*
Mammal-Cr	*Procyon lotor*	Raccoon		*
Mammal-ro	*Erethizon dorsatum*	Porcupine	*	*
ammal-ro	*Neotoma cinerea*	Bushy-tailed Woodrat	*	*
Mammal-rom	*Peromyscus maniculatus*	Deer Mouse	*	*
Mammal-rosq	*Tamiascirius douglasi*	Douglas Squirrel	*	*
Mammal-rosq	*Glaucomys sabrinus*	Northern Flying Squirrel		*

Appendix D.3. Wildlife Habitat Associations within the Assessment Area

Species Associated with Conifer Dominated Forests

Amphibians: Northwestern salamander
Clouded salamander

Mammals: Red tree vole
Red-backed vole
Douglas squirrel
American marten
Pacific fisher

Birds:
*Gray jay
Hammond's flycatcher
Olive-sided flycatcher
*Pine siskin
*Purple finch
*Red crossbill
Brown creeper
*Red-breasted nuthatch
Vaux's swift
*Golden-crowned kinglet
Chestnut-backed chickadee
Yellow-rumped warbler
Varied thrush
Western tanager
*Hermit warbler
Townsend's warbler
Hairy woodpecker
Pileated woodpecker
*Northern goshawk
Sharp-shinned hawk
*Spotted owl
Marbled murrelet

* = most strongly associated with conifer-dominated forest (Source: McGarigal and McComb 1993)

Species Associated with Alder Dominated Forests

Amphibians: Ensatina *(upslope species)*
Dunn's salamanderi *(riparian species)*

Mammals:
Little brown myotis
Long-legged myotis
Yuma myotis
Gray fox
Raccoon
Western spotted skunk
Beaver
Pacific jumping mouse
White-footed vole
Long-tailed vole
Creeping vole
Townsend's vole
Dusky-footed woodrat
Vagrant shrew

Birds:
*Northern oriole
Western wood pewee
Pacific-slope flycatcher
Black-headed grosbeak
*White-breasted nuthatch
American robin
Bushtit
Ruby-crowned kinglet
Black-capped chickadee
*Warbling vireo
Black-throated gray warbler
MacGillvray's warbler
*Yellow warbler
Wilson's warbler
Red-breasted sapsucker
Downy woodpecker
Lincoln sparrow
Ruffed grouse
Western screech owl
Cooper's hawk

* = most strongly associated with alder-dominated forests (Sources: McGarigal and McComb 1993; Vesely 1996.

Species Associated with Pioneer and Very Early-Seral Habitats

Birds: Rufous hummingbird
House finch
American goldfinch
Lesser goldfinch
White-crowned sparrow
Rufous-sided towhee
American pipit
Mountain bluebird
Western bluebird
Western kingbird
Barn swallow
Violet-green swallow
Purple martin
Mountain quail
Turkey vulture
Short-eared owl
Black-shouldered kite
Northern harrier
Red-tailed hawk
American kestrel
Merlin

Mammals: Beechey ground squirrel

Reptiles: Northern alligator lizard

Insects: Oregon silverspot butterfly

APPENDIX E

Plant Species of Concern Known to Occur

in the

Assessment Area

Appendix E. Plant Species of Concern Known to Occur within the Assessment Area

FE or FED = Federal Status: T= Threatened, FSC= Federal Species of Concern;
Btr = BLM Tracking Species, BA = BLM Assessment Species
ST = State Status: T=Threatened, C= Candidate
O = Oregon Natural Heritage Program Category
R6 = on Regional Forester's Sensitive Species List in the Pacific Northwest Region (Region 6), U.S. Forest Service
SU = Survey and Management Strategy: 1 = manage known sites; 2 = survey prior to activities and manage sites;
3 = conduct extensive surveys and manage sites; 4 = conduct general regional surveys.

R6 Code	Scientific Name	Common Name	Form	FE	ST	O	R6	SU	Habitat Description
ANTCUR	*Antitrichia curtipendula*		Moss					4	On branches in canopy of fog-penetrated forests; stream
ASTLYC	*Asterophora lycoperdoides*		Fungus					3	Fruit bodies of other fungi
BONMON	*Bondarzewia montana*		Fungus					1,2	
BRYSUB	*Bryoria subcana*	horsehair lichen	Lichen			2		1,3	Coastal bays & streams
CALABI	*Calicium abietinum*		Lichen					4	
CALGLA	*Calicium glaucellum*		Lichen					4	
CALVIR	*Calicium viride*		Lichen					4	High humidity forest conditions; substrate & texture specific
CANCIB	*Cantharellus cibarius*		Fungus					3,4	
CANFOR	*Cantharellus formosus*		Fungus					1,3	
CANTUB	*Cantharellus tubaeformis*		Fungus					3,4	
CETCET	*Cetrelia cetrarioides*	giant shield lichen	Lichen					4	Foggy, riparian forest on older hardwood trees
CHABRU	*Chaenotheca brunneola*		Lichen					4	
CHAFER	*Chaenotheca ferruginea*		Lichen					4	
CHAPAC	*Chamonixia pacifica sp. nov.*		Fungus					1,3	#Trappe 12768
CLACRI	*Clavulina cristata*		Fungus					3,4	Well-developed litter layer
CLANOR	*Cladonia norvegica*	Norway cup lichen	Lichen					3	Unknown
CYPINQ	*Cyphelium inquinans*	soot lichen	Lichen					4	
DIPALB	*Diplophyllum albicans*		Liverwort					1,3	Tree-trunks, rotten wood & humic soil in coastal forest
ENDORE	*Endogone oregonensis*		Fungus					1,3	Coast & coast ranges
HYDREP	*Hydnum repandum*		Fungus					3	
HYPDUP	*Hypogymnia duplicata*		Lichen					1,2	
LOBORE	*Lobaria oregana*		Lichen					4	Open coastal forests
LOBPUL	*Lobaria pulmonaria*		Lichen					4	Moist, hardwood forest & swamps

Appendix E. Plant Species of Concern Known to Occur within the Assessment Area (continued)

R6 Code	Scientific Name	Common Name	Form	FE	ST	O	R6	SU	Habitat Description
LOBSCR	*Lobaria scrobiculata*		Lichen					4	Trees & mossy outcrops
LOXCOR	*Loxosporopsis corallifera*		Lichen					1,3	Immediate coast
MARMAC	*Martellia maculata*		Fungus					1,3	
NEOKAU	*Neolentinus kauffmanii*		Fungus					1,3	Occurs only on logs or stumps of PISI
NEPBEL	*Nephroma bellum*		Lichen					4	Open forest
NEPLAE	*Nephroma laevigatum*		Lichen					4	Coastal forest
NEPRES	*Nephroma resupinatum*		Lichen					4	Coast & montane shady forests
OTILEP	*Otidea leporina*		Fungus					3	
PANLEU	*Pannaria leucostictoides*		Lichen					4	
PANSAU	*Pannaria saubinetii*		Lichen					4	
PELCOL	*Peltigera collina*		Lichen					4	Coastal forests; moist habitats at low elev. to subalpine
PELPAC	*Peltigera pacifica*		Lichen					4	
PHACAL	*Phaeocollybia californica*		Fungus					1,3	
PHAEOC	*Phaeocollybia ssp.*		Fungus					1,3	
PHAKAU	*Phaeocollybia kauffmannii*		Fungus					1,3	
PLALAC	*Platismatia lacunosa*	ragged lichen	Lichen					4	Moist forest on decidious & hardwood trees
POHSPH	*Pohlia sphagnicola*	Pohlia moss	Moss			2	S		Sphagnum bogs; sea level to montane; moist sandy soil
PSEANO	*Pseudocyphellaria*		Lichen					4	Coastal forests, riparian areas, Willamette Valley hardwoods
PSEANT	*Pseudocyphellaria*		Lichen					4	Open forest, esp. in riparian areas
PSECRO	*Pseudocyphellaria crocata*		Lichen					4	Coastal forests, valley bottoms, foothills and riparian areas
PYRQUE	*Pyrrhospora quernea*	pyrrhospora lichen	Lichen					1,3	Immediate coast
RHIBRU	*Rhizopogon brunneiniger*		Fungus					1,3	Dry to moderate
SPACRI	*Sparassis crispa*		Fungus					3	Large trees
STIFUL	*Sticta fuliginosa*		Lichen					4	Low elev. forests; valleys, riparian hardwoods
STILIM	*Sticta limbata*		Lichen					4	Low elev. forests; valleys, riparian hardwoods
TELFLA	*Teloschiste flavicans*	teloshistes lichen	Lichen			3		1,3	Dry uplands & prairies, on coastal shrubs
THA4867	*Thaxterogaster sp. nov.*		Fungus					1,3	Coarse woody debris in fog belt
THA6242	*Thaxterogaster sp. nov.*		Fungus					1,3	Coarse woody debris in fog belt
THA7427	*Thaxterogaster sp. nov.*		Fungus					1,3	Coarse woody debris in fog belt
THA7962	*Thaxterogaster sp. nov.*		Fungus					1,3	Coarse woody debris in fog belt

Appendix E. Plant Species of Concern Known to Occur within the Assessment Area (continued)

V in front of R6 Code means vascular plant.

R6 Code	Scientific Name	Common Name	Form	FE	ST	O	R6	SU	Habitat Description
THA8520	*Thaxterogaster sp. nov. #Tr*		Fungus					1,3	Coarse woody debris in fog belt
TUB2302	*Tuber sp. nov. #Trappe*		Fungus					1,3	Coarse woody debris in fog belt
TUB12493	*Tuber sp. nov. #Trappe*		Fungus					1,3	Coarse woody debris in fog belt
TYLPSE	*Tylopilus pseudoscaber*		Fungus					1,3	Moist forest with coarse woody debris
USNLON	*Usnea longissima*		Lichen					4	
VANEORE	*Anemone oregana vr. felix*	Oregon bog anemone	Vascular			2	S		Spagnum bogs or marshes
VARCTSU	*Arceuthobium tsugense*	Dwarf mistletoe	Vascular					WA	TSHE stands
VCARMA	*Carex macrocephala*	Large-headed sedge	Vascular			4			
VCARPAT	*Cardamine pattersonii*	Saddle Mtn. bittercress	Vascular	FSC	C	1	S		
VCIMELA	*Cimicifuga elata*	Tall Bugbane	Vascular	FSC	C	1	S		Moist hdwd-mix forest; along edge; N slopes; rocky/loose soil
VDARCAL	*Darlingtonia californica*	California pitcher-plant	Vascular	BTr		4			Bogs, fens
VDODAUS	*Dodecatheon austrofrigidum*	Frigid Shooting Star	Vascular	FSC		1	S		Along rivers below high water line; on rocks; also high elev.
VDRYFIL	*Dryopteris filix-mas*	Male fern	Vascular			2	S		Dense shade along streams
VERYELE	*Erythronium elegans*	Elegant Fawn-lily	Vascular	FSC	T	1	S		Meadows, rocky cliffs, brush, open forest, & edges of bogs
VERYREV	*Erythronium revolutum*	Coast fawn-lily	Vascular	BTr		4			Streambanks/wet places in light to fairly thick wooded areas
VEUOOCC	*Euonymus occidentalis*	Burning bush	Vascular			4			
VFILOCC	*Filipendula occidentalis*	Queen-of-the-forest	Vascular	FSC	C	1	S		Shady, damp sites
VFRICAM	*Fritillaria camschatcensis*	Black Lily	Vascular			2	S		Bogs
VPOALAX	*Poa laxiflora*	Loose-flowered	Vascular			4	S		Moist areas; edges of streams, seeps, benches
VPOAMAR	*Poa marcida*	Weak bluegrass	Vascular	BTr		4			Moist areas in coastal mountains
VPOLCAL	*Polystichum californicum*	California swordfern	Vascular	BA		2			
VRHICRI	*Rhinanthus crista-galli*	Yellow rattle	Vascular	BTr		3			
VSIDHIR	*Sidalcea hirtipes*	Hairy-stemmed mallow	Vascular		C	1	S		Grassy meadows near the coast; coastal headlands & bluffs
VSIDNEL	*Sidalcea nelsoniana*	Nelson's checker mallow	Vascular	T	T	1			Grass meadows not wet throughout the growing season
VSILDOU	*Silene douglasii var. oraria*	Cascade Head Catchfly	Vascular	FSC	T	1	S		Grassy coastal bluffs
VSTEHUM	*Stellaria humifusa*	Spreading starwort	Vascular	BTr		3			

APPENDIX F

Special Management Areas

Appendix F. Special Management Areas

ACEC = Area of Critical Environmental Concern
RNA = Research Natural Area
TNC = The Nature Conservancy
SNF = Siuslaw National Forest (Hebo Ranger District)
BLM = Bureau of Land Management

Management Area	Agency	Acres	Description
Bradley Bog	TNC	40	Unique coastal wetland with *Darlingtonia californica*
Cascade Head Experimental Forest (CHEF)	SNF	7,210	Research forest related to spruce/hemlock, provides late-seral habitat for wildlife
Cascade Head Scenic Research Area (CHSRA)	SNF	6,400	Partially overlaps the experimental forest; encompasses a diversity of coastal habitats available for recreation and research
Cascade Head Preserve	TNC	280	Coastal headland grassland, dominant red fescue herbaceous community, critical habitat for silverspot butterfly
Elk Creek ACEC	BLM	1,577	Remnant old-growth parcel and bald eagle management site.
Forest Peak ACEC/RNA	BLM	134	Remnant older forest parcel adjacent to valley lowlands. Also contains small meadow.
High Peak-Moon Creek ACEC/RNA	BLM	1,538	Old-growth and mature conifers with interior forest conditions. Includes high elevation noble fir, lower elevation Douglas fir, and riparian conifer forest.
Little Grass Mtn. ACEC/RNA	BLM	45	High elevation grassland surrounded by mature Douglas-fir forest.
Little Sink ACEC/RNA	BLM	81	Remnant old-growth patch with two small slump ponds
Lost Prairie ACEC	BLM	58	Unique wetland with special botanical concerns

Appendix F. Special Management Areas (continued)

Management Area	Agency	Acres	Description
Mt Hebo Scenic-Biologic Special Interest Area	SNF	1,684	High elevation grasslands provides critical habitat for silverspot butterfly in a unique botanical community which includes Mt Hebo fawn lily.
Neskowin Crest RNA	SNF	686	Overlaps CHEF and CHSRA. Late-seral Sitka spruce/western hemlock forest.
Nestucca River ACEC	BLM	1,062	Special botanical concerns along riparian zone.
Reneke Creek RNA	SNF	480	Red alder riparian community with late-seral Sitka spruce forest.
Rickreall Ridge ACEC	BLM	177	Unique plant community.
Saddleback Mtn. ACEC/RNA	BLM	151	High-elevation relic silver fir forest community.
Sand Lake RNA	SNF	241	Native unstabilized dune grassland with adjacent Sitka spruce forest.
Sheridan Peak ACEC	BLM	299	Special botanical concerns, *Poa marcida* management area.
The Butte ACEC/RNA	BLM	40	Douglas-fir/grand fir and Oregon white oak plant communities.
Valley of the Giants ACEC/ONA	BLM	51	Classic old-growth forest 300-700 years old with interior forest conditions.
Walker Flat ACEC	BLM	10	Wet meadow with special botanical concerns; *Sidalcea nelsoniana* population.

APPENDIX G

Watershed Analysis Schedule by Fifth-Field Watersheds

Appendix G. Watershed Analysis Schedule by Fifth-Field Watersheds

The following tentative schedule has been established for conducting watershed analysis on federal lands within the assessment area, pending availability of funding. Project plans are developed from watershed analyses.

	Currently Planned for Watershed Analysis in Calendar Year:				
Watershed Name	**Done**	**1997**	**1998**	**1999 +**	**Lead Office***
Little Nestucca River		X			Hebo R. D.
Nestucca River**	X				
Tillamook River				X	TBNEP/Hebo R. D.
Trask River**				X	TBNEP/Tillamook R.A.
Wilson River**				X	TBNEP/Tillamook R.A.
Kilchis River**		X			TBNEP
Neskowin Creek Frontal			X		Hebo R. D.
Sandlake Frontal		X			Hebo R. D.
Upper Siletz River**	X				
Middle Siletz River				X	Marys Peak R. A.
Rock Creek/Siletz River				X	Marys Peak R. A.
Lower Siletz River				X	Hebo R. D.
Schooner/Drift Creeks**	X				
Salmon River			X		Hebo R. D.
Devils Lake Frontal	X				
Luckiamute River		X			Marys Peak R. A.
Rickreal Creek		X			Marys Peak R. A.
South Yamhill River		X			Tillamook R. A.
Willamina Creek		X			Tillamook R. A.
Mill Creek		X			Marys Peak R. A.
Lower So. Yamhill River		X			Marys Peak R. A.
North Yamhill River				X	Tillamook R. A.
Scoggins Creek				X	Tillamook R. A.

*- Lead offices are: Hebo Ranger District (R. D.), Siuslaw National Forest; Marys Peak and Tillamook Resource Areas (R. A.s), Salem District, BLM; and Tillamook Bay National Estuary Project (TBNEP).

**- Portions of these watersheds are designated as Key Watersheds in the Northwest Forest Plan.

APPENDIX H

Treatment Priorities for Landscape Cells

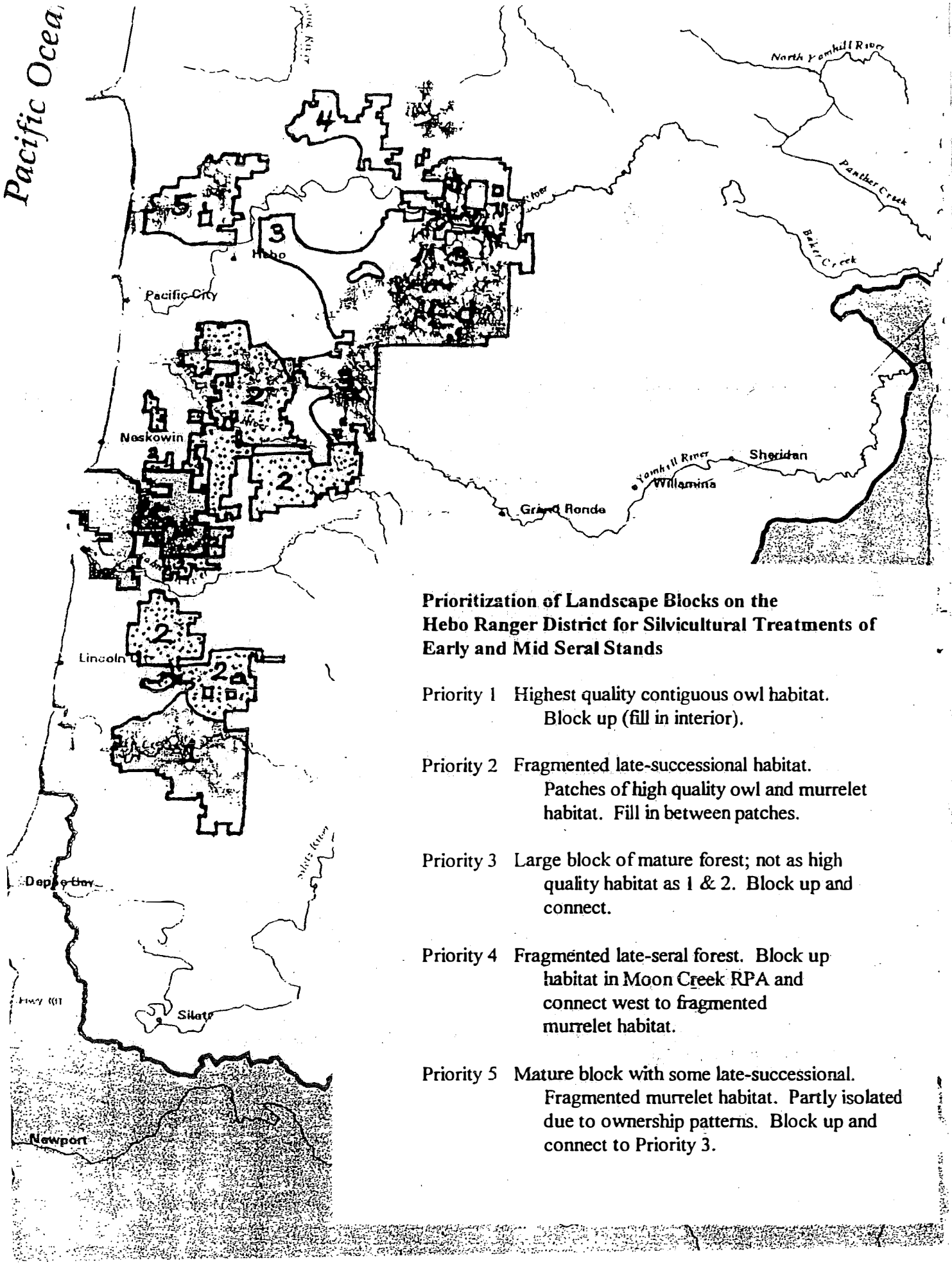
on the

Hebo Ranger District

Appendix H. Treatment Priorities for Landscape Cells on the Hebo Ranger District

The majority of the Hebo Ranger District is within the Core Landscape Zone, as are the Congressionally Reserved and Administratively Withdrawn Areas in the Cascade Head Experimental Forest and Scenic Research Area. Due in large part to the fire history of the area, the oldest stands of trees and the highest quality late-successional habitat on the District are located between Euchre Mountain in the south and Mt. Gauldy in the north. The majority of the northern spotted owls on Hebo have been found within the Euchre Mountain to Mt. Gauldy area. New owls entering this area are likely passing through BLM lands to the east and south, making the south to north habitat link in the Core important for connectivity to existing late-successional habitat and habitat developing in the Nestucca Watershed and on the slopes of Mt. Hebo. Refer to Appendix H Map 1 for a more clear picture of the areas discussed. Most of the late-seral (mature and old-growth) forest from the Clear Creek drainage and Little Nestucca Watershed south to the Euchre Mountain area is at least 110 years old. These stands may benefit by the addition of large snags and logs to increase habitat quality for late-successional species. These treatments could be done in conjunction with thinning stands less than 80 years old. Because of the existing owl pairs, importance to connectivity and the age of the late-seral stands, this "southern block" of the Hebo Ranger District is **first priority** to block up and connect late-successional habitat, primarily by thinning (density managment treatments). The majority of stands currently available for thinning are less than 50 years old. Depending on the condition, accessibility and isolation of stands between five and 50 years old, stands could be treated in multiple entries or receive no treatments at all. For example, if a stand is surrounded by late-successional habitat and is at the end of a road planned for closure, it could be treated only once, regardless of age. Treatment of stands along ATM roads could be done in several entries. The ***highest priority*** within the southern RPA would be to block up the existing late-successional habitat as quickly as possible. Within the rest of the "southern block". the priority would be to connect the patches of late-successional habitat to provide interior habitat for new owl pairs and connectivity to the north. (For example, the late-seral stands in the Little Nestucca watershed and in the Erickson and Rock Creek Subwatershed are fragmented, but could provide suitable spotted owl nesting habitat as soon as the surrounding stands are tall enough to decrease "edge effects" and thereby increase the amount of interor forest.)

The **second priority** for thinnings would be connecting the late-seral blocks in the "northern block" of the Hebo Ranger District. Small patches of late-successional habitat are located on Buzzard Butte, in the Sand Lake area, in the East Beaver Creek and Moon Creek/Bay's Creek Subwatersheds, and in the Square Top/East Creek area. Some of the areas between these patches are dominated by alder and will be considered for conversion to conifer. Small blocks on the outer edges of federal ownership and not crucial to connectivity would be **third priority**. However, the beneficial of linking late-successional habitat on State Park lands with late-successional habitat on federal lands to make a larger block of habitat (e.g., Cape Lookout and Sand Lake RNA) should be considered.



Prioritization of Landscape Blocks on the Hebo Ranger District for Silvicultural Treatments of Early and Mid Seral Stands

Priority 1 Highest quality contiguous owl habitat. Block up (fill in interior).

Priority 2 Fragmented late-successional habitat. Patches of high quality owl and murrelet habitat. Fill in between patches.

Priority 3 Large block of mature forest; not as high quality habitat as 1 & 2. Block up and connect.

Priority 4 Fragmented late-seral forest. Block up habitat in Moon Creek RPA and connect west to fragmented murrelet habitat.

Priority 5 Mature block with some late-successional. Fragmented murrelet habitat. Partly isolated due to ownership patterns. Block up and connect to Priority 3.

APPENDIX I

Regional Ecosystem Office Exemption Criteria

for

Certain Silvicultural Treatments

United States Department of Agriculture | Forest Service | R-6/R-5

Reply to: 2470/1920 Date: May 9, 1995

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

To: Forest Supervisors, Owl Forests

Enclosed is a memorandum from the Regional Ecosystem Office (REO) exempting certain precommercial thinning, release, and reforestation activities within LSRs from REO review. I am pleased about this exemption and consider it a key step toward accomplishing ecosystem management objectives in a timely manner. However, since some readers will view the criteria as unnecessarily restrictive, I ask you to keep the following points in mind.

This is the first REO review exemption. It is based on proposals submitted to REO for review or upon proposals REO has discussed in the field. It is, of necessity, conservative. REO continues to express a desire to expand this exemption to other types of activities at the earliest possible time.

Before this memorandum was signed, all silvicultural activities were subject to REO review. Now most young stand thinning (including related sale), release, and reforestation proposals are not subject to review. This is a positive step, and there is little to be gained by discussing whether the criteria should have gone further at this time. Since no commercial thinning proposals have ever been submitted to REO for review, for example, REO had little basis to expand these criteria at this time.

The criteria to not infer a right or wrong, or consistency or non-consistency with standards and guidelines. The criteria simply draws the line between those proposals no longer subject to REO review, and those that remain subject to review. Proposals not meeting the criteria should be submitted for review as in the past, and REO expects to continue to meet its commitment to complete such reviews within 3 weeks, or less, of date received.

Note that the exemption for reforestation is in addition to the somewhat broader exemption already included in the standards and guidelines for reforestation activities required because of existing timber sales.

This exemption also applies to the Issue Resolution Team (IRT) since IRT review was only required in preparation for sending to REO. Specific questions about this exemption should be addressed to the President's Forest Plan coordinator on your unit.

/s/ John E. Lowe
JOHN LOWE
Region Forester, R-6

/s/ Steve Clauson (for)
LYNN SPRAGUE
Regional Forester, R-5

Enclosure

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

Memorandum

Date: April 20, 1995

To: Regional Interagency Executive Committee
(See Distribution List)

From: Donald R. Knowles, Executive Director /s/ Don Knowles

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

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

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 technic l specialists, and our understanding of LSR objectives, REO is hereby exempting the following types of activities from the REO review requirement stated on pages C-12 and C-26 of the ROD. Silvicultural projects meeting the following criteria are exempted from REO review because such projects have a high likelihood of benefiting 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 objectives.

   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.

   e. 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.

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

REGIONAL ECOSYSTEM OFFICE

333 SW *1st*
P.O. Box 3623
Portland, Oregon 97208-3623
Phone: 503-326-6265 FAX 503-326-6282

MEMORANDUM

DATE: July 9, 1996

TO: Regional Interagency Executive Committee (RIEC)
Ken Feigner, Director, Forest & Salmon Group, Environmental Protection Agency
Robert W. Williams, Regional Forester, R-6, Forest Service
Stan M. Speaks, Area Director, Bureau of Indian Affairs
Michael J. Spear, Regional Director, U.S. Fish & Wildlife Service
William Steele, 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: LAC, RMC, LSR Workgroup

Enclosure

Criteria Exempting Certain Commercial Thinning Activities From RE0 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-Succession 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 (Chase) and designated conservation areas (Daces) 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 unity 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 Oly pic 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 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, pag 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 th se 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 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. (revised per REO memorandum of September 30, 1996)

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. Prescr ptions 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.

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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. Aubly, 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.