ASSESSMENT REPORT

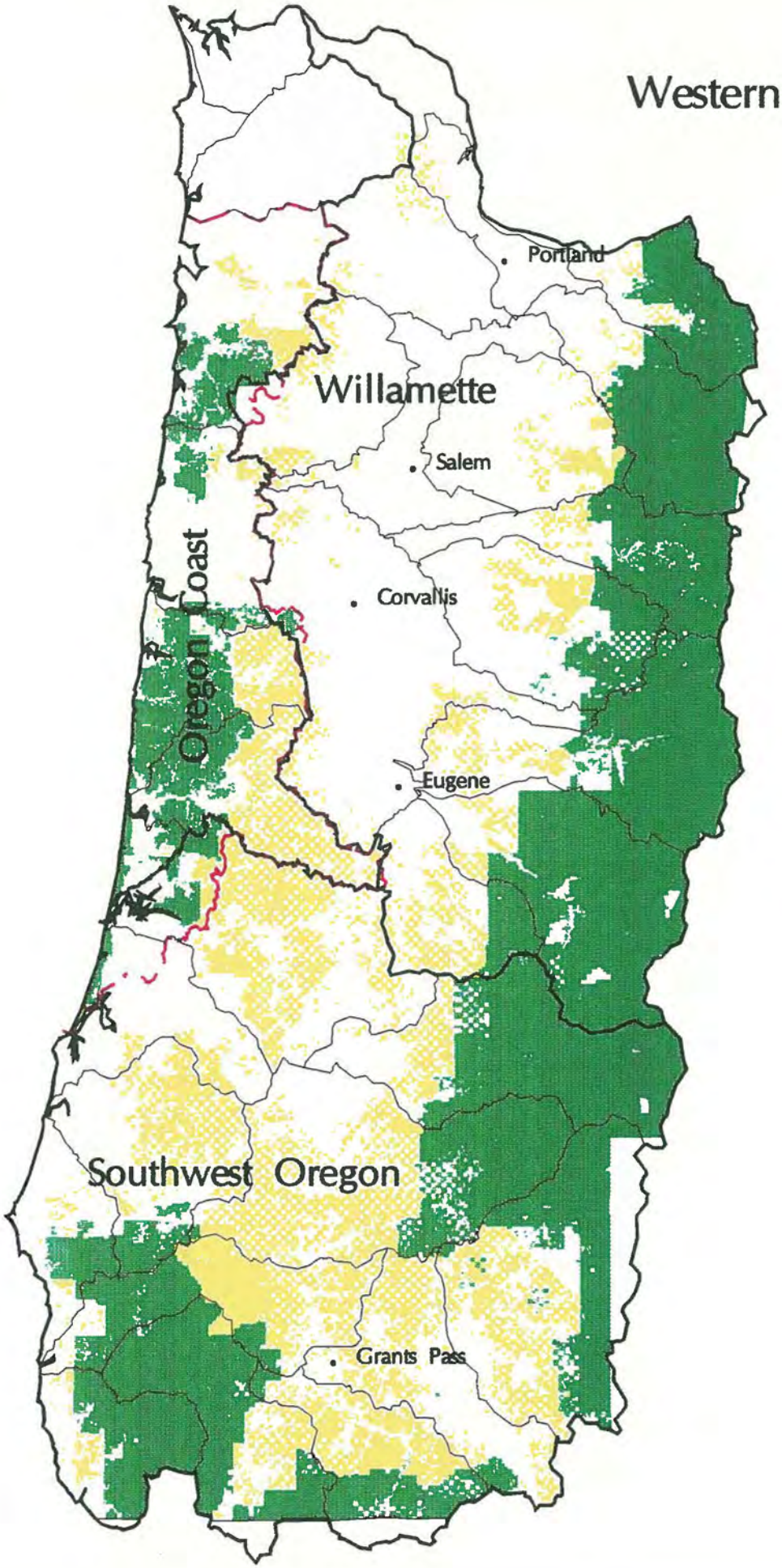
FEDERAL LANDS IN AND ADJACENT TO OREGON COAST PROVINCE

July 1995

We abuse land because we regard it as a commodity belonging to us.
When we see land as a community to which we belong, we may begin to use it with love and respect...That land is a community is the basic concept of ecology, but that land is to be loved and respected is an extension of ethics.

- Aldo Leopold

Western Oregon Provinces



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Scale 1:1905720

March 21, 1995

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A. INTRODUCTION

New direction, released in April 1994, for managing federal forests within the range of the northern spotted owl established a novel approach to assessing and managing resources on public lands. Federal agencies are now fully expected to assess the natural resources in physiographic provinces and watersheds, regardless of landownership, and to consider ways to meet resource goals through cooperating and coordinating with other public land management agencies and private landowners. Resources are also expected to be assessed at various landscape scales, from watersheds of 20-200 square miles to river basins, provinces, and regions, to increase understanding of ecological relations.

The Siuslaw National Forest, with assistance from the Salem and Eugene Districts of the Bureau of Land Management (BLM), conducted an assessment of the physical, biological, and social conditions in a 2.4 million-acre area within and adjacent to the Oregon Coast Province. The purpose is to provide a province and Forestwide view of major resource issues and potential management implications in the Study Area. This assessment provides, for the first time, one consistent source of information about resources across agency and administrative boundaries, and highlights priorities for management.

Specific objectives of this assessment are:

1. Document current knowledge about large-scale natural processes occurring in the Oregon Coast Range.
2. Determine how well current vegetation conditions on federal lands meet the Northwest Forest Plan objectives, by:
   - Identifying areas especially deficient in mature-conifer habitat for associated species; and
   - Estimating the probable sale quantity (PSQ) available from Matrix and Adaptive Management Area (AMA) lands.

   Two interim Late-Successional Reserve assessments were prepared as a by-product of this assessment. Objectives are to identify appropriate vegetation management activities for specific areas in the Late-Successional Reserves.

3. Determine how well current watershed conditions meet Northwest Forest Plan objectives at the Forestwide scale.
4. Provide a large-scale perspective of social and economic conditions in the area.
5. Identify opportunities for interagency coordination activities.

We tried to make the information useful to watershed analysis teams by showing how a particular watershed fits into the larger scale landscape. For example, large-scale assessment could show how streams in a watershed contribute to aquatic condition of a river basin, or how forest stands within a watershed fit into a larger late-successional reserve. The assessment information should also minimize duplication of large-scale analyses by watershed analysis teams.

A merged GIS database for the entire area, though a formidable task, was accomplished. The GIS data were assembled from the Siuslaw National Forest, Salem District BLM, Eugene District BLM, and the state of Oregon. Watershed analysis teams can now quickly access data for all federal lands and some private lands within a watershed, and reduce start-up time to begin analysis. Appendix A.1 lists the GIS data layers developed for the Study Area and provides a summary of the GIS Forest Library currently available.

OVERVIEW OF AREA

In general, the coastal region is characterized by high rainfall, moderate summer and winter temperatures, and rapidly growing coniferous forests. The mountains are composed of moderately folded but much-faulted formations that are mostly Tertiary in age (10-60 million years old) and easily eroded. Tertiary formations are sedimentary and mostly of marine origin along the coast, but with some volcanic formations.

The Coast Range varies from north to south and west to east in relation to the topography, climate, disturbance processes and subsequent characteristics and successional patterns of forest vegetation, both upland and riparian. The southern portion is characterized by short, very steep slopes and V-shaped ridge crests and stream channel bottoms. Average precipitation is slightly less than in the northern section, resulting in drier south-facing slopes. The northern portion has gentler slopes and wider, more U-shaped stream channels.

The major natural factors affecting Coast Range ecosystems are fire, wind and landslides. The Coast Range appears to have experienced infrequent, large-scale fires about every 300-350 years and more frequent, small-scale events every 50-100 years. The large-scale fires were typically stand-replacement, severe fires, though they did not always burn over an entire area. Some appeared to burn only the drier slopes and ridges, skipping the riparian areas. Some moved rapidly through the overstory canopy and only lightly burned understory and duff. The fires, followed by intense rainstorms and wind, brought many benefits to the ecosystem. Steep, erodible slopes, made more unstable by fire-killed vegetation, would fail after intense precipitation. Large wood and sediments would slide into stream channels and cause short-term decimation of fish habitat. However, within a few years, fish populations would increase dramatically due to the increased pools and spawning grounds and slowed streamflows. Forage for deer and elk would be stimulated and vegetation diversity would increase.

Benefits from the small-scale disturbances, such as fire or windstorms, were creation of small gaps. These allowed shade-tolerant understory species to receive more light for growth; grass, forbs and shrubs invaded; and additional snags and downed logs were available for wildlife species, all of which contributed to a more complex stand structure and species diversity.

Most of the Study Area is steep, forested terrain that made overland travel difficult. Human populations are know to have inhabited the coastal region for at least 3,000 years. Native tribes had a subsistence living where food resources were plentiful, primarily along the coast in summer and around the estuaries and banks of coastal rivers during fall and winter.

White settlement began after the coastal zone was discovered by European maritime explorers and later by fur trappers beginning regular expeditions to the Oregon coast (in the 1820s). The Willamette Valley attracted most of the settlers to this region, due to the fertile soils, moderate climate and abundant resources. Fewer settled along the Coast and within the interior valleys of the Coast Range mountains. At the time of Oregon statehood in 1859, population of Oregon was only about 52,000. The whole Northwest was still a "back eddy". By the standards of either the Indians or the whites, not many people were involved in settlement (Wilkinson 1992). The years following statehood, however, brought major changes to the northwest and to the Coast Range.

Pacific salmon and steelhead were found on virtually every river on the Oregon coast. The coastal streams of Oregon supported vast ranges of Pacific salmon. Historical accounts of salmon numbers are mind-boggling. Some of the most abundant populations were found in the tributaries of coastal lakes like Tenmile, Siltcoos and Tahkenitch.

The first salmon cannery was established in 1886 at Waldport along the Alsea River, and within about 10 years canneries appeared on the rest of the coastal rivers--at Siletz Bay, Yaquina Bay, Siuslaw, Umpqua, Nestucca and Salmon--and on coastal lakes. Fish were caught by the most efficient means possible, using, for example, gill-netting, V-shaped traps of piles and netting, and fish wheels. Stories of daily commercial catches make the 1980s catch numbers appear paltry.

The annual pressures on fish populations were proving too great, however. Attempts were made to regulate the commercial fishing through gear restrictions and catch limits, but enforcement was unattainable. By the 1920s most of the canneries had closed down.

In 1930, the population of Oregon had grown to 1 million. The coastal highway was constructed in the 1930s and soon to follow were roads built through the narrow mountain valleys linking the major population centers in the Willamette Valley with the coast.

In addition to unchecked predation on the salmon, other human activities were having a devastating effect on fish habitat. Logging operations clearcut across creeks and streams, leaving spawning habitat inundated by logs, slash and mounds of silt. Logging, farming and road building all deposited silt and perhaps chemicals into the water. These activities also affected the presence and characteristics of large wood that had lodged in streams and acted to slow the flow of water and create fish-rearing pools.

Historically, many of the coastal rivers had wide flood plains, were braided into numerous channels, and contained large amounts of wood. Since human settlement, large wood was removed from rivers and estuaries to allow log drives and boat traffic. Wood was also removed from smaller coastal streams through splash damming. During the early boom years of timber harvesting, loggers were required to remove wood that fell in the streams during harvest operations on federal land.

Roads were built along river valleys where low gradients offered the easiest and least expensive area for construction. To prevent roads from flooding, streams were channelized to force water to flow down one predictable waterway. The natural meandering and flooding of the rivers along the low gradient mainstems

was halted, and with it much of the opportunity for salmonid spawning and rearing habitat.

By 1970, the population of Oregon reached 2 million. Homesteading and road building broke up large tracts of isolated areas--habitat to many mammals, such as gray wolves, fisher, and lynx. Additionally, increased rates of harvest of mature and older trees removed habitat for species dependant on late-successional forests. Roads offered the least expensive way to reach dispersed stands of mature timber for harvest operations. Fragmentation results from a harvest pattern called "staggered setting", in which small clearcuts increasingly remove evenly distributed portions of old growth. Initially, intact forest is permeated by an extensive road network that is required to implement this harvest pattern. After about 30% of a given landscape has been cut, however, isolated forest islands are all that remain (Perry 1994).

At the time, this "staggered setting" cutting pattern was considered to benefit wildlife by increasing "edge-effect", and to benefit watersheds by limiting the amount of area that would be impacted at any one time within a subbasin. The resulting dense road network was responsible for the loss of several wildlife animals, including the wolverine and fisher, not seen since the 1970s.

Today, the population of Oregon is about 2.75 million. The federal lands contain only about 43% mature or older forest stands, compared to 60% around 1940, and the average patch size of functional mature conifer habitat is about 137 acres. Fish habitat is in marginal to poor condition. Streams lack large wood and channels are narrowly confined, which limits pool creation and hastens stream flow. Most of the large, low-gradient streams and river mainstems--areas with the most potential for fish production--are adjoined by private lands being used for purposes that do not maintain fish habitat.

In the past five years, three new species have been added to the federal list of threatened species--northern spotted owl, marbled murrelet, and snowy plover. And recently, the cutthroat trout in the Umpqua River Basin and the coho salmon along the Oregon and northern California coast have been proposed for listing.

The new Northwest Forest Plan offers a glimmer of hope for recovering some of the healthy ecological conditions that sustained vast numbers of native species prior to human settlement. This assessment provides one small step in that direction.

B. DESCRIPTION OF STUDY AREA

The Study Area is located in western Oregon and is primarily within the Oregon Coast Province, delineated by the Northwest Forest Plan (see Vicinity map). All national forest and BLM lands, except East Fork Nehalem, that fall within the Province and all Siuslaw National Forest lands that fall outside the Province are included. The area outside the Province is limited by fifth-field watersheds in which Siuslaw NF lands are located. These include four in each of the Willamette and Southwest Oregon Provinces (see Map B.1, Assessment Area).

The Oregon Coast Province is about 2.95 million acres and extends from the Columbia River to the Umpqua River basin. The Study Area occupies about 71% of the Province and very small portions of two others. Within the 2.4 million-acre Study Area are five entire river basins--Wilson-Trask-Nestucca, Siletz-Yaquina, Alsea, Siuslaw, and Siltcoos-- and small portions of four others--Yamhill, Upper Willamette, Umpqua and Coos; 66 fifth-field watersheds have been delineated around federal lands (see Map B.2, River Basins & Watersheds.) Three river basins in the northernmost end of the Oregon Coast Province are not included because they contain no national forest land and only small fragmented areas of BLM and National Park Service lands.

LANDOWNERSHIP

Landownership in the Study Area is a patchwork primarily of federal and private lands. Most of the area is under either federal management (38%) or private industrial forestry (31%) (see Map B.3, Private Lands). The State owns 13% and the remaining land (18%) is in private ownership, with only small portions owned by cities, counties, or Indian tribes (Table B.1). A complete list of landownership by river basin and fifth-field watershed is provided in Appendix B.1. Names of the sixth-field watersheds associated with each fifth-field watershed is provided in Appendix B.2.

The largest human settlement, Tillamook, is in a wide valley in the northern part of the Study Area. Other settlements include coastal ports, small coastal communities, mountain communities, and small valley communities. Today, all the very large valley communities are located east of the Study Area along the I-5 corridor running the length of the Willamette Valley.

Table B.1 Landownership in Study Area

River basin	Acres	5th-field Watersheds	Landownership (%) Federal	State	Pvt.-Ind.For.	Other
Wilson-Trask-Nestucca	602,400	13+	26	37	21	16
Yamhill	488,700					
In Study Area	34,600	2	19	0	51	30
Siletz-Yaquina	478,400	10+	16	5	58	21
Upper Willamette	1,198,300					
In Study Area	20,400	2	48	3	30	19
Alsea	436,300	16	64	0.2	19	17
Siuslaw	493,300	12	52	4	30	14
Umpqua	977,100					
In Study Area	178,500	4	46	10	28	16
Siltcoos	81,300	4	38	7	36	19
Coos	459,100					
In Study Area	79,900	3	18	30	22	30
TOTAL	2,405,100	66	38	13	31	18

Note: Of the total acres, 2,091,700 are in the Oregon Coast Province; 313,400 acres are in the other provinces.

NORTHWEST FOREST PLAN

In April 1994, the Northwest Forest Plan (the Plan) was signed by the Secretaries of Agriculture and Interior as the culmination of years of federal agency efforts to address heated controversies about managing federal forests in the Pacific Northwest. The Plan was a landmark product of interagency cooperation and scientific analysis resulting from the President's Forest Conference of April 1993.

The Plan provides a network of late-successional forests and an interim and long-term scheme for protectiing aquatic and associated riparian habitats adequate to provide for threatened and "at-risk" species associated with such habitats. The federal lands were allocated to various management emphases with

specific standards and guidelines. A summary of land allocations in the Study Area follows:

Designated Areas

Congressionally Reserved Areas
Three Wildernesses (Cummins Creek, Drift Creek, and Rock Creek), Cascade Head Scenic Research Area, and Oregon Dunes National Recreation Area on the Siuslaw National Forest; and Yaquina Head Outstanding Natural Area on the Salem District BLM.

Late-Successional Reserves (LSR)
Areas identified to protect and enhance conditions of late-successional and old-growth forest ecosystems, which serve as habitat for late-successional and old-growth-forest related species, including the northern spotted owl.

The Study Area contains six uniquely identified LSRs, totaling about 637,000 acres (70% of the area), including one that is an aggregation of Late-Successional Old-Growth (LSOG) blocks and marbled murrelet sites in the Hebo Ranger District. Table B.2 lists the LSRs and size of each (see Map B.4 for locations of LSRs).

Table B.2. Late-Successional Reserves in the Study Area

	NF LANDS				
LSR	LSR	Admin. W.	Total	BLM Lands	TOTAL
LSR LO269 (Hebo LSOGS)	66,571	7,418	73,989	0	73,989
LSR RO269	15,940	110	16,050	3,205	19,255
LSR RO270	0	0	0	5,968	5,968
LSR RO268	243,167	6,524	249,691	80,268	329,959 1/
LSR RO267	63,933	1,914	65,847	61,780	127,627
LSR RO265	21,470	4,060	25,530	?	25,530
TOTAL	411,081	20,026	431,107	151,221	582,328

1/ Acreage excluding the 3 Wildernesses, which also contribute to late-successional conditions.

Note: Comparison of LSR acres with other data tables in this assessment should not be made. Data for the GIS layers come from more than one source, with more than one scale. Consistencies between data layers have not been resolved yet.

Adaptive Management Area (AMA)

An area identified with the objective of developing and testing new management approaches to integrate and achieve ecological and economic health, and social objectives.

The Study Area contains the Northern Coast Range Adaptive Management Area in the northern portion of the Province. The entire AMA is about 1.3 million acres, of which about 250,000 acres are on federal land. Only a portion of the AMA (about 896,000 acres) falls within the Study Area. Of the federal portion in the Study Area, about 51,000 acres are AMA lands and 111,600 acres are Late-Successional Reserves, including LSOGs and murrelet habitat sites.

Objectives for the Northern Coast Range AMA are: 1) to restore and maintain late-successional forest habitat, consistent with marbled murrelet guidelines, 2)to provide significant opportunity for the state to participate in a major cooperative adaptive management effort, and 3) to provide opportunity for interspersed privately owned forest lands to be incorporated into a plan for the area, if landowners so desired.

Land in the AMA outside of reserves is available for scheduled timber harvests, and timber volume is counted as part of the Probable Sale Quantity (PSQ).

Administratively Withdrawn Areas

Areas identified in current Forest Plans or BLM Resource Management Plans (RMPs) that were withdrawn from timber management to meet recreation, scenic, wildlife, or other management objectives that are incompatible with scheduled timber harvests.

Within the Siuslaw National Forest, these designated areas include the following:

- Special Interest Areas (Mt. Hebo, Cape Perpetua, Marys Peak and Kentucky Falls),
- Cascade Head Experimental Forest,
- Research Natural Areas,
- coastal recreation areas (Sand Lake and Sutton Area),
- bald eagle management areas, and
- undeveloped/unroaded recreation areas (Boulder Creek and Wassen Creek).

All of these areas are included within LSRs and must additionally contribute to LSR objectives. One exception currently is the Mt. Hebo Special Interest Area (SIA) meadows, which are managed as habitat for the threatened Oregon silverspot butterfly.

Such BLM lands are designated as Areas of Critical Environmental Concern (ACECs), including Research Natural Areas and Outstanding Natural Areas (see list in Appendix B.3).

Riparian Reserves

These are areas along all streams, wetlands, ponds, lakes, and unstable and potentially unstable areas where riparian-dependent resources receive primary emphasis. Riparian Reserves are also intended to serve

terrestrial species' needs, such as dispersal habitat. (A detailed description of the purpose of Riparian Reserves is provided in the Aquatic and Wildlife Section of this report.)

On the Siuslaw National Forest, interim Riparian Reserve widths are as follows:

1. Fish-bearing streams--520 feet slope distance (a distance equal to the height of 2 site-potential trees) along each side.
2. Permanently flowing nonfish-bearing streams--260 feet slope distance (a distance equal to the height of 1 site-potential tree) along each side.
3. Intermittent streams--260 feet slope distance (height of 1 site-potential tree) along each side.
4. Wetlands >1 acre--the body of water or wetland, and the distance equal to the height of one site-potential tree, or 150 feet slope distance from the edge of the wetland, whichever is greater.
5. Wetlands <1 acre and unstable and potentially unstable areas--from the edge of wetland to the outer edges of riparian vegetation, or 100 feet slope distance, whichever is greater.

Analysis of Riparian Reserve allocations in the Study Area indicate they include 80-90% of the total Forest land. Watershed analysis, site-specific analysis, or both are required to finalize Riparian Reserve widths along particular streams and wetlands.

The Bureau of Land Management applies other criteria to their lands to determine riparian reserve widths. Where site potential tree heights are used, a different measurement may be used.

Matrix

These are federal lands outside of the designated areas listed above, where management is based on provisions of the Siuslaw Forest Plan or BLM District RMPs. Matrix is available for scheduled timber harvests, and timber volume is counted as part of the Probable Sale Quantity.

Table B.3 displays percentage of federal lands in each land allocation. Riparian Reserve acres have not been removed from the land allocation summary. Map B.5 displays the Northwest Forest Plan land allocations, and Map D.3 shows interim Riparian Reserves for the Siuslaw National Forest portion of the Study Area.

Key Watersheds

Twenty key watersheds (Tier 1) are within the Study Area and occupy about 17% of the area. Key Watersheds are intended to help conserve at-risk anadromous salmonids and resident fish species. Table B.4 lists Key Watersheds by river basin and indicates the size of each. For those Key Watersheds that are only a portion of a fifth-field watershed, the name of the fifth-field watershed is shown. Map B.6 provides an overlay of Key Watershed locations in the Study Area.

Table B.3 Northwest Forest Plan Allocations (Acres)

River basin (RB)	Federal land	Federal land in RB, %	Plan Allocations: Cong. desig	LSR	AMA	Admin. Withdr.	Matrix
			(Acres and percentage of river basin)				
Wilson-Trask-N	155,800	26	3076 2%	98,549 63%	45,466 29%	7473 5%	0
Yamhill[1/]	6,700	1	-	6347	189	-	-
Siletz-Yaquina	76,900	16	3786 5%	60,368 78%	3,466 5%	2890 4%	5259 7%
Upper Willamette[1/]	9900	1	-	8649	-	461	733
Alsea	281,000	64	22,214 8%	204,169 73%	-	8965 3%	45,407 16%
Siuslaw	256,200	52	1460 <1%	197,623 77%	-	400 <1	58,456 23%
Umpqua[1/]	83,000	8	1282	48,012	-	5995	26,187
Siltcoos	31,000	38	13,206 43%	13,664 44%	-	-	4655 15%
Coos[1/]	14,500	6	13700	-	-	-	-
TOTAL	915,000	38%	58,724 6%	637,381 70%	49,121 5%	26,185 3%	140,707 15%

C = Congressionally Designated, LSR=Late-Successional Reserve, AMA=Adaptive Management Area, Admin. With.= Administratively withdrawn, RB=river basin

[1/] Only a small portion of the river basin is in the Study Area.

Table B.4 Key Watersheds by River Basin

River Basin	Key Watershed	Acres
Wilson-Trask-Nestucca	Kilchis River	6,931
	Little N.Fork Wilson River (in Wilson River)	11,881
	Elkhorn Creek (in Upper MF Trask)	10,468
	Upper Nestucca River incl. Boulder/Tony/Limestone, Powder/Niagara Creeks	90,072
Siletz-Yaquina	Drift Creek-Siletz (in Schooner)	26,464
	N.Fork Siletz River/Warnicke Creek (in Upper Siletz)	11,547
	Mill Creek (in Toledo)	2,899
Alsea	N.Fork Beaver Creek (in Beaver)	7,546
	Drift Creek-Alsea	43,160
	Upper Lobster Creek (in Lobster Creek)	26,391
	Tobe Creek (in S.Fork Alsea)	1,856
	Yachats River	27,754
	Cummins/Tenmile/Rock/Big Creeks	40,979
	Bailey Creek (in Mercer)	2,973
Siuslaw	N.Fork Siuslaw River (in N.Fk.Siuslaw River)	14,140
	W.Fork Indian Creek (in Indian)	8,837
Siltcoos	Upper Fiddle Creek (in Siltcoos)	6,373
Umpqua	N.Fork Smith River	43,887
	Wassen Creek (in Smith)	17,788
	Franklin Creek (in Lower Umpqua)	4,588
TOTAL		406,534

Summary

When landownership patterns in the Oregon Coast Range Province are considered as a whole, allocating a large portion of federal lands to Late-Successional Reserves and Riparian Reserves seems most appropriate. Federal lands occupy only about 27% of the entire Province, and 38% of the Study Area. Industrial

forest lands occupy 31% of the Study Area. If large, unfragmented blocks of mature conifer forests are to be created for species associated with such habitats, federal lands are the most likely places. Likewise, if anadromous stream habitats are to be restored in the short run, or until more comprehensive land stewardship programs for watersheds can be initiated, federal lands must play a leading role. Large, interim Riparian Reserves encourage greater understanding of how to manage watersheds before remaining potential fish habitat is degraded.

C. LARGE-SCALE NATURAL PROCESSES

Bailey's ecoregion classification of the United States places the Study Area in the Oregon and Washington Coast Ranges section of the Cascade Mixed Forest-Coniferous Forest-Alpine Meadow Province (McNab and Bailey 1994). The Coast Ranges section is primarily highly dissected low mountains that were shaped by debris slide processes on slopes of 40 to 120%. Incised valleys are distributed throughout the section. Dunes and bogs occur along the coast, with numerous headlands formed of more resistant rock. An elevation range from sea level to 1,800 feet is dominant. Most mountain tops are below 2,000 feet, though several are 3,000-4,000 feet elevation and a few have meadows on top, which offer spectacular views on clear days.

Soils are developed from Cenozoic sandstones, siltstones, shales, and marine volcanics. Typical soils are moderately deep or deeper, and have dark, humus-rich topsoil. Predominant soil orders are andisols and inceptisols that are not dry for more than a quarter of year, with mean annual soil temperatures of 0-15°C. In the coastal lowlands and hills, seasonal soil temperatures are moderated by fog and sea breezes.

Where high waterholding capacities exist, plant communities are dominated by deciduous or deciduous/conifer mixed stands on all slope positions, with understory vegetation communities typically composed of salmonberry, devils club, and other moisture-requisite plants. Where low waterholding capacities exist, plant communities are dominated by conifer stands on flat to convex slopes and alder occurs only in concave draws. Understory plants are primarily those that tolerate dry summer months, such as salal.

Potential natural vegetation types are Sitka spruce forests in the coastal fog belt. Western redcedar is present in drainages and lower elevations where soil moisture is abundant. In the interior of the Coast Range, sites adjacent to riparian areas are often dominated by western hemlock. The dominant type on mid-to-upper slopes is a climax western hemlock forest, generally composed of Douglas-fir with minor western hemlock and western redcedar.

The major natural factors affecting ecosystem dynamics are fire, wind, and landslides.

CLIMATE

The Oregon Coast Province has a maritime climate resulting from its nearness to the Pacific Ocean and influence of the Japanese Current. Cool, wet winters and relatively warm, dry summers are characteristic. Low-pressure systems feed a stream of cool, moist air from the North Pacific Ocean onto the Oregon Coast from November through March. The moist air rises over the Coast Range and drops large amounts of precipitation. Occasionally, Arctic air meets an onshore flow, producing snowfall. In general, snow persisting for more than a few days is limited to the tops of the highest peaks.

Temperatures are relatively mild. The average annual temperature on the Forest is 50°F. The average high in August is 73°F, but summers are hot and dry in

the interior of the Forest. Along the coast is a cool, damp "fog belt" which can extend inland up to 1 mile. The average low in January is 36°F. In the winter, when high pressure obstructs the onshore flow of relatively warm air, skies clear and nightime frost may appear. High pressure usually develops off the coast in the summer, deflecting most storms north into Canada. The high-pressure system occasionally breaks down during late summer, resulting in rain during August and September. Although precipitation amounts are typically small, the tendency for summer rains is greatest on the North Coast. Fog occurs often along the coast and inland river valleys during the summer. Fog drip may contribute significantly to available mositure during the summer in the immediate coastal strip.

Orographic effects are pronounced in the Oregon Coast Range. Major ridges receive substantially more precipitation than do nearby lowlands. Coastal areas average 75 to 95 inches of precipitation annually, and interior areas west of the crest receive an average of about 120 inches annually. Higher precipitation occurs in the northern Coast crest area, with up to 190 inches annually around Cedar Butte in the Tillamook State Forest, and about 175 inches annually in the mountainous terrain east of Siletz Bay. East of the Coast Range crest, in the Willamette Valley border area, precipitation averages about 50 inches each year.

High potential evapotranspiration and low precipitation during warm, sunny summers may produce moisture deficits where soil and bedrock have low waterholding capacities. Moisture available to plants varies greatly between different areas of the province. The primary cause is the inherent differences between areas in moisture-holding capacity of soils and bedrock. Moisture deficits are more pronounced in the south half of the Forest than in the north half because soils are generally thinner and bedrock tends to be only slightly permeable to impermeable in the south. Soils in the north half are generally deeper and the bedrock is more highly fractured and permeable. However, in all zones, stands on ridges and exposed south-facing slopes with thin, rocky soils can develop substantial plant moisture stress in late summer. These conditions are especially common on the south end of the Forest.

Prevailing winds are moderate northwesterly in summer and strong southwesterly in winter. Dry easterly winds can occur for 2-3 days at any time of the year. Also, generally during the winter, several windstorms each year reach velocities up to 100 miles per hour. Relative humidity is generally above 40%, except during easterly winds.

Within the Sitka spruce area, wind is the dominant force shaping the landscape (Agee 1993). Fires occur in this area, but the moister climate makes them less frequent. Windstorms, often associated with rainstorms, may occur during the fall and winter. One severe windstorm in this area was the Columbus Day storm of 1962, when windspeeds of 120 miles per hour were measured at Newport. This storm blew down many timber stands throughout the Coast Range.

A more recent storm in November 1981 had wind speeds of 140 miles per hour measured in Yachats. Such storms, especially during periods when the soil is saturated with moisture from recent rainfall, often trigger extensive blowdown. Each year, because of strong winds, small gaps are created in the forest canopy as storms pass through.

SOIL/CLIMATE ZONES

Derivation of Zones

For the purposes of forest-wide assessment, the Study Area has been divided into five soil/climate zones (hereafter referred to as "zones"). Each zone represents a unique combination of the key building blocks that form a foundation for the ecosystem: landforms, soils, geology, and climate. These groupings of physical factors, in combination with natural disturbance processes such as fire and wind, influence the vegetation characteristics of each area.

In order to delineate the unique soil/climate zones, the Study Area is first divided into several components called Landtype Associations (LTAs) that have distinct physical and climatic characteristics. Each Landtype Association is composed of various Soil Resource Inventory Mapping Units, or landtypes, that were described in the Siuslaw National Forest Soil Resource Inventory. The landtypes that make up each association are generally similar in geology, landform, soils, and hydrologic response. A detailed description of each Landtype Association can be found in Appendix C.1 (Landtype Associations).

The geology, landform, and soils characteristics of each LTA is combined with climatic factors to develop the soil/climate zones. Five zones are described for the Study Area (Map C.1):

1) Coastal Fog Zone
2) Northern Interior Zone
3) Central Interior Zone
4) Southern Interior Zone
5) Valley Margin Zone

The five zones will be described, then the role of natural disturbances and subdivision of the zones into eight smaller disturbance-regime blocks.

Description of Zones

1) Coastal Fog Zone

- High winds commonly in winter
- Very high winter rainfall;
- Fog and low clouds that result in slight differences from summer to winter air and soil temperatures (isomesic), and increase effective soil moisture in summer;
- High soil moisture in summer (except on few very shallow soils on south slopes);
- Very high accumulations of soil organic matter;
- Soils high in amorphous clays - often thixotropic; and

- Vegetation dominated by spruce, cedar, and hemlock with salmonberry and alder as important components;

2) Northern Interior Zone

- Occasional very high winds in winter;
- Very wet winters and moist summers;
- Significant differences in soil temperatures from summer to winter (mesic) below 3000 feet;
- Winter soil temperatures that range to very cold (mesic to cryic) above 3000 feet;
- Generally high soil moisture with moderate soil moisture fluctuations from winter to summer;
- High biologic activity accompanied by high decomposition rates and moderate to high accumulations of soil organic matter;
- Very deep fine-textured soils overlying highly permeable bedrock; and

- Plant communities on most slopes that include alder, salmonberry, and devils club with Douglas-fir and western hemlock as the dominant conifers; mixed deciduous/conifer stands occupy most forested sites

3) Central Interior Zone

- Occasional high winds in winter;
- Wet winters and moist summers;
- Significant differences in soil temperatures from summer to winter (mesic) below 3000 feet;
- Winter soil temperatures range to very cold (mesic to cryic) above 3000 feet;
- Moderate soil moisture fluctuations from winter to summer with summer soil moisture levels varying from very high on lower slopes to moderately dry on upper sideslopes;
- High biologic activity accompanied by high decomposition rates and moderate accumulations of soil organic matter;
- Deep to very deep moderately fine-textured soils overlying slowly to moderately permeable bedrock;

- Plant communities are mixed conifer and alder/salmonberry with <u>either</u> alder or conifer dominating on higher slope positions depending upon summer soil moisture levels;
- Douglas-fir and western hemlock compose the majority of forest communities

4) Southern Interior Zone

- Occasional very high winds in winter;
- Very wet winters and moist summers;
- Significant differences in soil temperatures from summer to winter (mesic) below 3000 feet;
- Winter soil temperatures range to very cold (mesic to cryic) above 3000 feet;
- Moderate to very great fluctuations in soil moisture from winter to summer;
- High biologic activity accompanied by high decomposition rates and moderate accumulations of soil organic matter;

- Shallow to deep, fine to medium textured soils overlying impermeable bedrock;

- Conifers dominate plant communities on most slopes with alder/salmonberry and mixed conifer communities generally only in draws and along perennial streams;
- Douglas-fir and hemlock dominate the majority of forest communities

5) Valley Margin Zone

- High winds are uncommon;
- Moist winters and dry summers;
- Significant differences in soil temperatures from summer to winter (mesic);
- High soil moisture fluctuations from winter to summer with low soil moisture common during summers;
- Moderately high biologic activity and moderate decomposition rates and low to moderate accumulations of soil organic matter; and

- Vegetation ranges from madrone and oak in the easternmost areas of these areas to mixed-conifer forests in the western-most areas;
- Douglas-fir is the dominant conifer species in forest communities.

Watershed boundaries do not neatly coincide with soil/climate zones, but about half of the watersheds are within a single zone. The other watersheds contain 2-3 zones. Appendix C.2 provides a list of the soil/climate zones located in each of the watersheds.

NATURAL DISTURBANCE PROCESSES

Fire and wind are the two dominant disturbance processes affecting vegetation pattern at the large scale in the Oregon Coast Province. The frequency, severity, and size of these disturbances have greatly influenced composition and structure of both plant and animal habitats across the landscape. Geographic variability of disturbance effects will provide baseline information and guide the type and arrangement of future ecosystem management activities.

Both physical and biological elements of the landscape affect disturbance process patterns and effects. The physical environment includes geologic and climatic processes. Physical features such as landform type (relief and drainage density patterns) and soil and geological substrates influence fire behavior patterns and vegetation response. Climatic features, such as precipitation, fog, and east wind patterns may control fire spread and effects on vegetation composition and pattern. Biological distribution of the major forested vegetation series (Sitka spruce, western hemlock) identify macro habitats and potential fuel loading. The Sitka spruce series, for example, is located in areas with high coastal influence (high humidity, frequent fog).

Knowledge of ecosystem processes and effects provides baseline information for ecosystem management. Plant and animal species have adapted to the edaphic, temporal, and spatial patterns on the landscape. An understanding of the range of vegetation patterns can provide us with a template for providing habitat for the myriad of species we manage.

Fire History

The long-term history of fire activity and effects in the Study Area have not been systematically documented. Fire disturbances in Northwest coastal zones are described as low frequency (more than 200 years between disturbances), high severity regimes (Agee 1993). Projects are currently underway to provide much-needed information to determine temporal elements of fire activity in the Coast Range. Although studies are ongoing, preliminary results indicate distinct differences in disturbance frequency, intensity, or both from coastal to interior to valley margin zones. Variability within zones also appears to be important (Impara, personal communication).

Large scale fire activity in the Study Area from 1850-1940 has been reported. Teensma et al. (1991) mapped age class distributions (inferred from various sources) for four time years: 1850, 1890, 1920, and 1940. The distribution of age classes across the Study Area is listed below in Table C.1.

Table C.1. Percentage of landscape burned between 1850 and 1940

Age Class (years)	1850	1890	1920	1940
	-------Percentage of Landscape----			
Recently burned	42	8	10	3
0-49	--	17	2	19
50-99	--	24	14	3
100-199	21	2	24	37
200+	20	32	33	21
untyped	16	16	16	16

Age-class distribution has changed within these periods, from a bimodal young/old landscape in 1850 to a multi-aged landscape in 1940. The percentage of area occupied by the 200+ age-class remains fairly constant throughout time. The total number of age-class patches has increased 57% from 1850 to 1940 (Table C.2). Patch sizes are decreasing, especially in the 100-199 age class. Geographic variability is apparent in both the number and type of age-class patches within the Study Area (see Maps C.2 and C.3).

Table C.2. Number of patches in 1850 and 1940

Age-class (years)	1850	1940
	--Number of patches--	
Recently burned	68	2
0-49	3	56
50-99	7	26
100-199	22	80
200+	21	26
TOTAL	121	190

Post-settlement fire activity has been high in the Study Area since the mid 1800s. Sites across the Study Area were burned, then reburned from one to three times. Frequency of burning activity in the Study Area is as follows:

-- 3% unknown
-- 42% burned before 1850
-- 48% burned once since 1850
-- 5% burned twice since 1850
-- 1% burned three times since 1850

Map C.4 details numbers and areas of reburn from 1850-1940. This estimate is probably conservative because only large fires were reported, many of which were actually several fires that burned and reburned within the mapped period (Munger 1944, Juday 1976, Teensma et al. 1991). Many smaller scale settlement-related reburns may have also occurred between mapping periods (Teensma et al. 1991). In addition, the number of reburns has risen dramatically from pre-settlement to post-settlement periods (Teensma et al. 1991).

The frequency of reburns can significantly influence stand characteristics. Snag density and coarse woody debris loadings may decline. Reburns may also reduce seed source and favor early seral or fire-adapted species (Agee 1993). Stand development may be delayed, lengthening early seral conditions on the landscape.

Development of Disturbance Regime Blocks

Landtype Associations and Vegetation Series maps were used to stratify the landscape into disturbance regime blocks. The Associations were grouped into areas predicted to have similar disturbance behavior patterns. Relief patterns and climatic influences (fog, east wind) were considered in the grouping. The Plant Association Groups (PAGs) (Map C.5) were then used to refine the boundaries of the disturbance regime blocks. Appendix C.3 provides a description of the PAGs associated with the Study Area.

These working boundaries were overlayed on the age-class distribution maps (Maps C.2, C.3, and C.4) to validate assumptions about the effects of physical and biological elements on disturbance processes and resultant vegetation patterns. The overlay provided an accurately description of the geographic variability of patch distribution across the landscape. It also validated the inferred strong influence of landform/topography, climate, and vegetation distribution on disturbance processes and landscape pattern.

Eight disturbance regime blocks were identified (Map C.1), each with a unique combination of disturbance elements, vegetation composition, and patterns. Block locations reflect a distinct east/west gradient, concurring with Coastal, Interior and Valley Margin zones observed by Impara (personal communication) and Juday (1976), described earlier. Within-zone distinctions were based on variability in vegetation composition and development or patterns on the landscape.

The following groupings are used to describe each disturbance block:

Disturbance size and behavior:

- **Small:** <100 acres. Creeping and smoldering ground fires with occasional torching of individual or clumps of trees in pockets of heavier fuels.
- **Medium:** 100-1000 acres. Torching of individual or clumps of trees is more frequent with runs of crown fire. Wind dictates the spread and direction of the fire.
- **Large:** 1001-10,000 acres. Crown fires independent, fire runs through the crowns without support from an intense surface fire. The crown fire may race far ahead of the front of the surface fire. Spotting and major fire runs occur. Wind dictates the spread and the direction of the fire.

  Jumbo: >10,000 acres. Fire behavior is the same as large size.

Disturbance frequency:	Low	> 300 years
	Moderate	100-300 years
	High	< 100 years
Disturbance severity:	Low	< 30% stand mortality
	Moderate	30-70% stand mortality
	High	> 70% stand mortality

The eight disturbance regime blocks are described below, grouped by soil/climate zones. Analysis of the vegetation in each block has not been completed. Comparisons of pre-logging and current seral stage distributions can help determine management related impacts on vegetation pattern. This information can be used in conjunction with knowledge of historic pattern to guide management priorities and activities within each disturbance block. Completed analysis is scheduled to be completed this year.

Coastal Fog Zone

Coast (Block 1): Landforms in this zone are characterized by low relief, with scattered headlands and hummocks. Wet and mesic Sitka spruce plant association groups dominate the area.

Wind is the dominant process affecting landscape pattern in this zone, varying from small to medium disturbances at high to moderate frequencies, and large to jumbo size disturbances at low frequency. Fire is very uncommon (low frequency) and severe, creating jumbo patches on the landscape. Potential for lightning ignition is virtually absent, with high humidity/low evapotranspiration discouraging severe fire activity under all but extreme drought and high east wind conditions.

A unique landform in this fire block is the Rock and Cummins Creek complex. These drainages are oriented east to west, funneling east winds at high speeds, which could lead to rapid fire spread through this area. Aboriginal and settlement activity has played a major role in shaping pattern as well. Portions of this block have burned at least three times since the 1850s.

Repeated burning could be responsible for increases in the number of small and medium patches. High reburn frequency may also affect snag density and coarse woody debris loading in some areas.

Landscape pattern is a heterogeneous mix of patch sizes and seral stages. Early seral patches are most frequently small and medium, resulting from small-scale wind events. Large and jumbo patches move from early to mid, often to late seral based on the low frequencies of fire and large scale wind events.

Successional pathways vary depending on disturbance type. Wind thins from above, which may accelerate succession by favoring a shade-tolerant understory of Sitka spruce, with western hemlock and western redcedar as cohorts in places. Downed wood serve as nurse logs that favor later seral species such as Sitka spruce and western hemlock. Fire thins from below, which may arrest succession by favoring earlier seral species like red alder and Douglas-fir. Early seral brush species such as salal and salmonberry are also favored.

Seral distribution patterns--Seral distribution patterns reflect the heterogenous nature of this block, with all seral stages represented on the landscape in variable amounts (Fig. C.1). Appendix D.1 provides a description of seral designations used in this report. In 1948-56, mature conifer was the dominant seral stage, covering 40% of the area, distributed chiefly in large patches across the landscape (Fig. C.2 and Fig. C.3). Mature conifer areas are much reduced under current conditions (25% of area), with over a 100% increase in the number of patches. Distribution patterns have shifted more to medium patches (Fig. C.3). Jumbo patches have disappeared under current condition, fragmenting into smaller patches. The number of acres of all seral stages in the small patch class has increased (Fig. C.4).

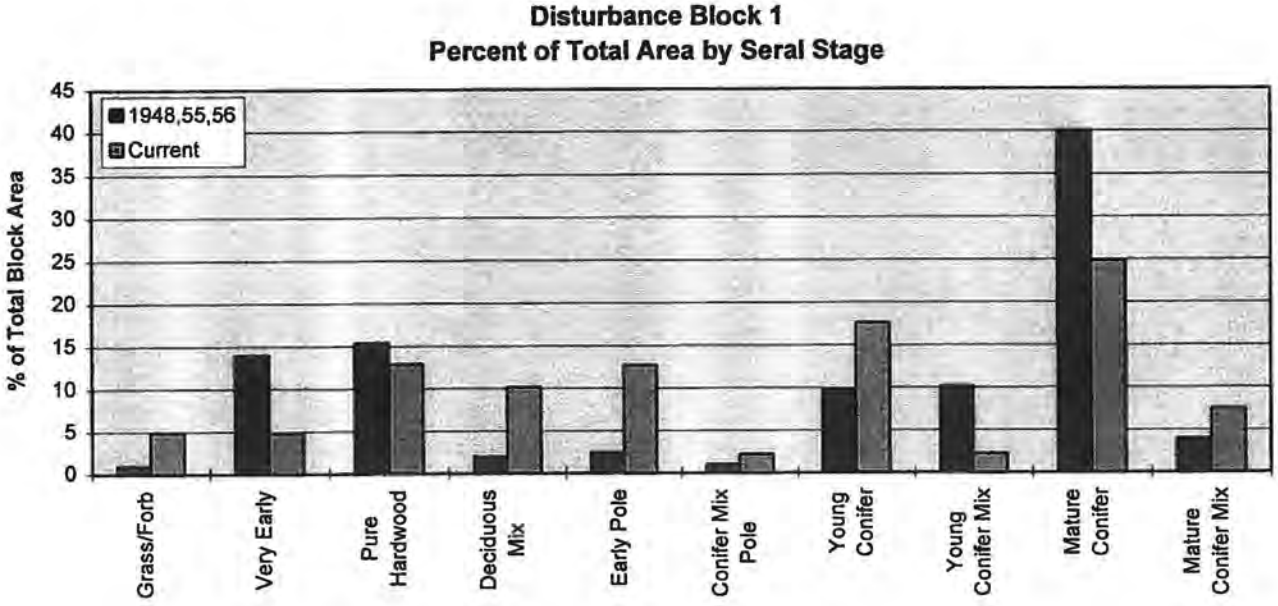


Figure C.1 Disturbance Block 1, Percent of total area by seral stage

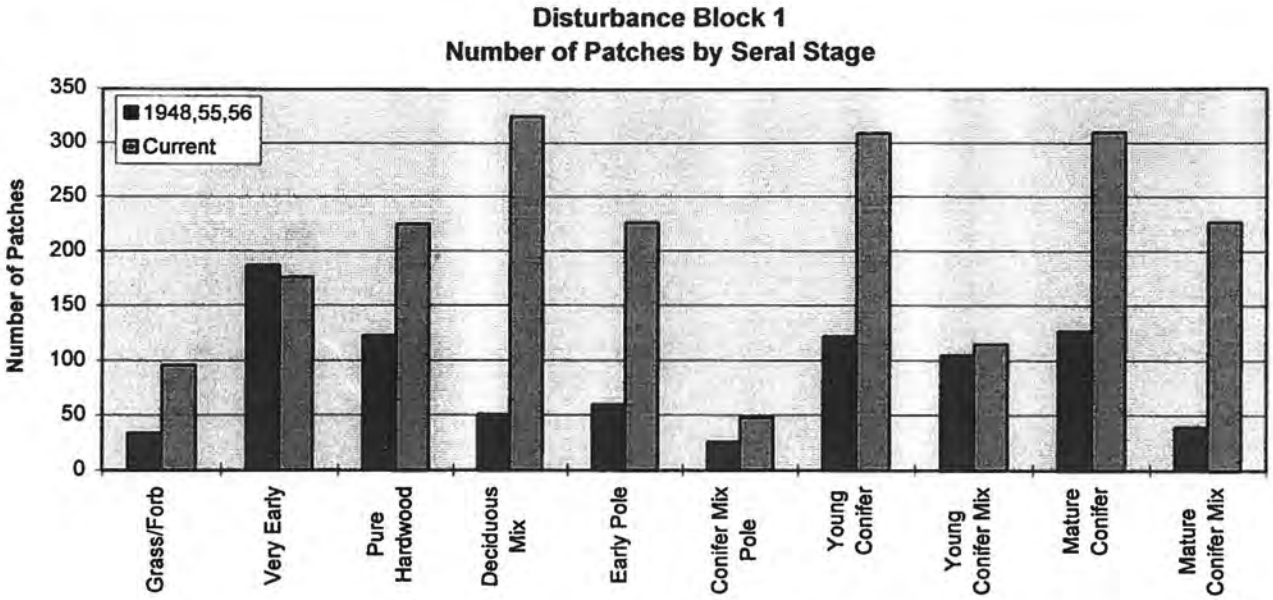


Figure C.2 Disturbance Block 1, Number of patches by seral stage

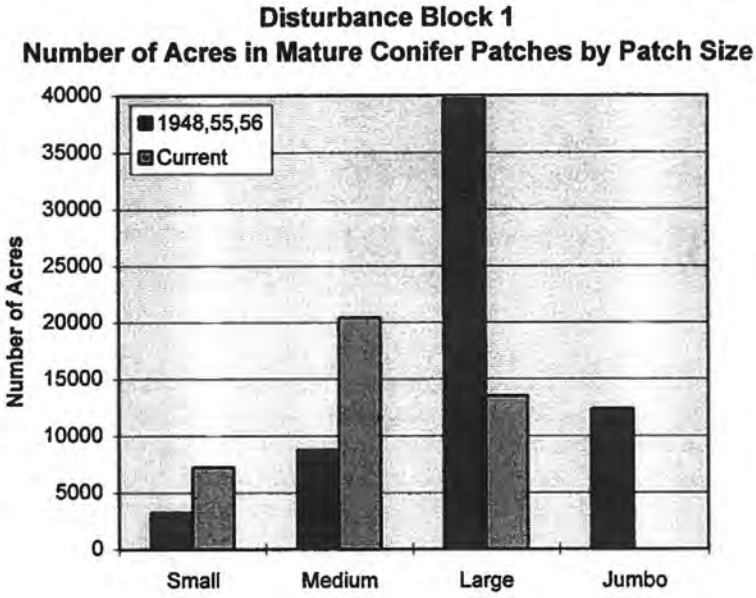


Figure C.3 Disturbance Block 1, Number of acres in mature conifer patches

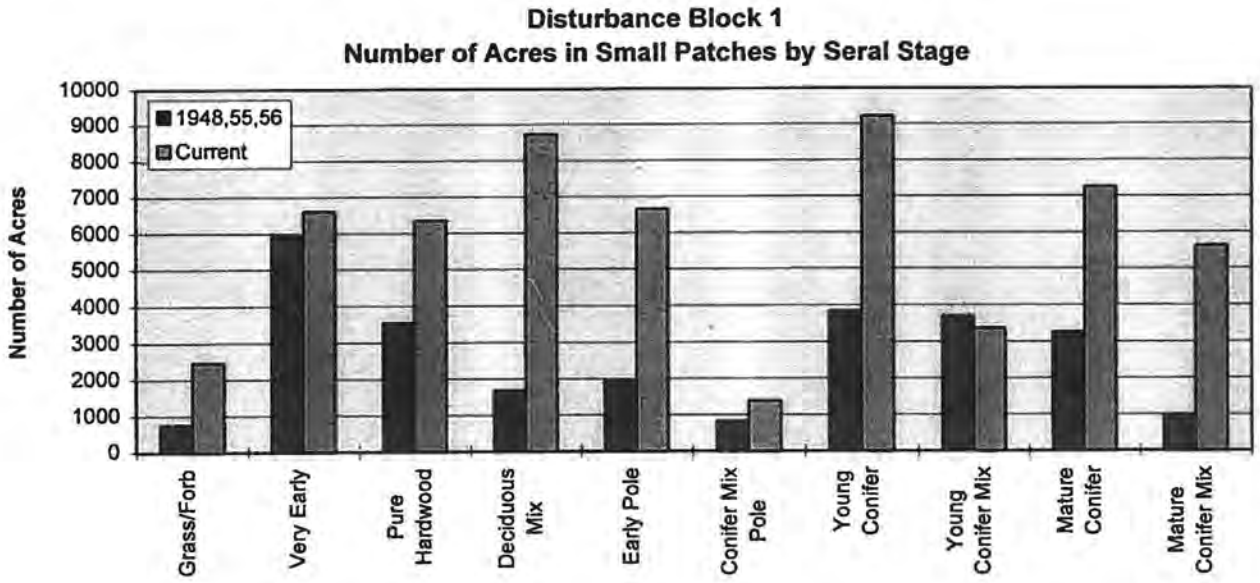


Figure C.4 Disturbance Block 1, Number of acres in small patches

Management implications--Loss and fragmentation of mature conifer habitat, and fragmentation of many seral stages (especially pure hardwood, deciduous mix and young conifer) are evident in this block. Management activities that accelerate succession and aggregate patches are recommended to encourage mature conifer restoration. Aggregation of early seral patches is desirable to reduce fragmentation, and produce large to jumbo patches. Scattered small to medium patches of the early seral component may continue to be distributed across the landscape.

Northern Interior Zone

Northern Interior-Tillamook (Block 2). Steep,highly dissected bedrock-dominated ridge systems characterize the landforms in the Tillamook block. Both western hemlock and Sitka spruce zones are present. Mesic and well-drained western hemlock plant association groups occupy about half the Siuslaw National Forest land, with wet and mesic Sitka spruce groups in 35% of the Siuslaw land base.

Fires in this block are infrequent and severe. A strong east/west ridge system, coastal influence, and high precipitation decrease chances of fire spread. The Columbia River corridor funnels east winds of powerful force; consequently fires burn hot and spread rapidly in periods of drought. When fires occur they are wind driven. Lightning potiential exists in the interior of the block on higher ridges. Historically, fires may have been ignited by aborigines and settlers from both the Tillamook basin and the Willamette Valley

margin. The fires of 1850 produced one patch in this block that occupies 21,000 acres.

Large and, more commonly, jumbo patches dominate the landscape. A single seral stage will dominate this zone, proceeding from early through mid, often to late seral, given the low fire frequency of this block.

Alder is a dominant component in early seral conditions, and remains an important cohort throughout later seral stages. Douglas-fir may be common in mid-seral stages, with Sitka spruce, western hemlock and western redcedar dominating in late-seral stages.

Northern Interior-Hebo (Block 3). Landforms in the Hebo block consist of low, hummocky relief, with scattered peaks. Dominant plant association groups consist of mesic (44%), well-drained (28%), and wet (22%) western hemlock types.

Landscape pattern in this zone has been heavily affected by settlement and post-settlement burning practices, so that the pre-settlement pattern is difficult to determine. At least a quarter of this block has burned at least twice since the 1850s. This estimate of reburns may be conservative because many settlement fires were not recorded. Fire potential and behavior under drought and strong east wind conditions are similar to those of Northern Interior-Tillamook (2), although Block 2 may serve to protect this zone from milder east wind effects. On the east edge of the block, conditions are somewhat drier and fires that would burn without drought and strong east winds could smolder and creep in logs and duff, with occasional individual and clumps of trees torching. This fire behavior leads to a potential regime of low frequency, moderate to high severity, medium to large fires in this zone.

Landscape vegetation pattern in this zone can consist of medium to jumbo patches, with variable residual tree densities within patches. Either a single seral stage dominates this zone, moving through succession from early to mid to late conditions, or a more complex post-fire pattern of early, mid-late can be found, depending on fire behavior elements. Because this regime is episodic, early seral conditions would succeed to mid-seral, and potentially late seral over time.

Alder plays a major role in all seral stages, dominating many early seral conditions, and persisting in mid and late seral stages. Douglas-fir is a major component of mid-seral conditions, with western hemlock and western redcedar dominating late seral stages.

Central Interior Zone

Central Interior-Lincoln County (Block 5). Landforms of the Lincoln County block are characterized by low relief, gentle bedrock-dominated ridges and valleys. About half of the Siuslaw National Forest in this block are covered by mesic western hemlock plant association groups, with wet (25%) and well-drained (17%) also well represented.

Low relief combined with a wide coastal zone adjacent to this block (the coastal zone is widest at this point) create variable fire conditions. Fire

behavior in this block would be influenced by the strong north east winds in drought years. Fire effects in the western portion of the block would be dampened by the strong coastal influence. Lightning activity would be most likely in the higher topography in the north-central section of the block. The fires of the 1830s to 1840s, for instance, consisted of 15 patches: one small, six medium, six large, and two jumbo. These factors create a regime of low frequency, variable severity (moderate to high), and medium to jumbo size disturbances.

Landscape pattern has been heavily influenced by settlement and post-settlement activities. The southern half of this block has burned at least twice since the 1850s. This area was probably used and homesteaded by both Native American and European settlers, with easy access from the Willamette Valley.

Alder is a component of earlier seral stages, but it is beginning to decrease in importance, especially towards the south end of the block. Douglas-fir, dominates mid-seral stages, with western hemlock and western redcedar major components of late seral conditions.

Central Interior-Alsea (Block 6). Landforms of moderate relief and high dissection occupy the Alsea block. Most vegetation lies within the mesic and wet plant association groups of the western hemlock series. Wet and mesic Sitka spruce associations are found along stream corridors and in local fog zones.

Fire is an infrequent, severe process in this block. Coastal headlands serve as a moderate barrier to marine influence. Lightning activity is very low. This block lies in a remote area with little to no aboriginal or settlement activity. Fire behavior in this block dependa on strong east winds in drought years. During the summer, this area can receive additional east wind events from the thermal low that moves along the coast from the Sacramento Valley and then moves inland over the northern portion of the block. These conditions serve to create a fire regime of low frequency, high severity and large to jumbo fires (a single burn patch from the fire of 1849 occupied 265,000 acres).

Large to, more commonly, jumbo patches compose the landscape. One to few patches cover most of the area in this zone, creating a strong matrix consisting of a single seral stage. This dominant seral stage will change over time, from early to mid, probably to late seral conditions, given the low frequency of disturbance.

Post-disturbance succession can follow several pathways, depending on disturbance type, frequency, and post-fire conditions. Alder becomes an infrequent component in early seral conditions, being relegated to stream channels or frequently disturbed sites in the southern end of this zone. Douglas-fir, western hemlock, and western redcedar are components of mid and late seral conditions. Stand density and species composition are a function of topographic conditions, reburn frequency, seed source availability, and brush competition.

Seral distribution patterns--Seral distribution patterns in 1940-56 reflect this block's disturbance regime (Figs. C.5 and C.6), with about 60% of the landscape occupied by mature conifer, distributed among 100 patches. Mature

conifer patch area was dominated by two jumbo patches (Fig. C.7). Mature conifer mixed stands were distributed over 18% of the landscape in a few more than 100 patches. Patch area was covered by mostly large and medium patches. Total mid-late seral conditions were distributed over 78% of the landscape.

Current conditions display a much different vegetation pattern (Fig. C.5). Mid to late seral conditions occupy 41% of the block area--a decrease of 90%. Mature conifer stands are distributed across 30% of the landscape in over 650 patches. No jumbo patches exist (Fig. C.7). Medium patches now dominate the landscape area, with many small patches also represented. Mature conifer mixed stands occupy about 11% of the landscape, in close to 500 patches. No large patches exist, with medium and small patches representing the size-class distribution (Fig. C.8).

Numbers of patches and acres in the small patch class (Fig. C.9) for all other seral stages has also increased dramatically from 1940-56 to present.

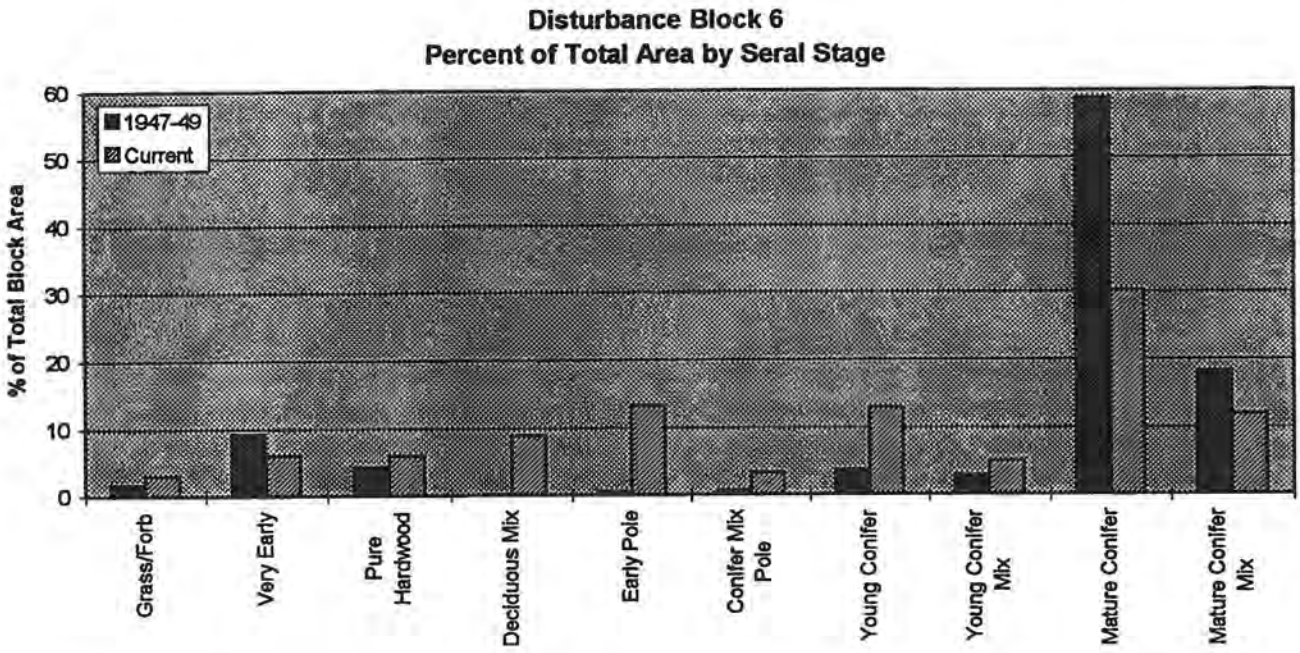


Figure C.5 Disturbance Block 6, Percentage of area by seral stage

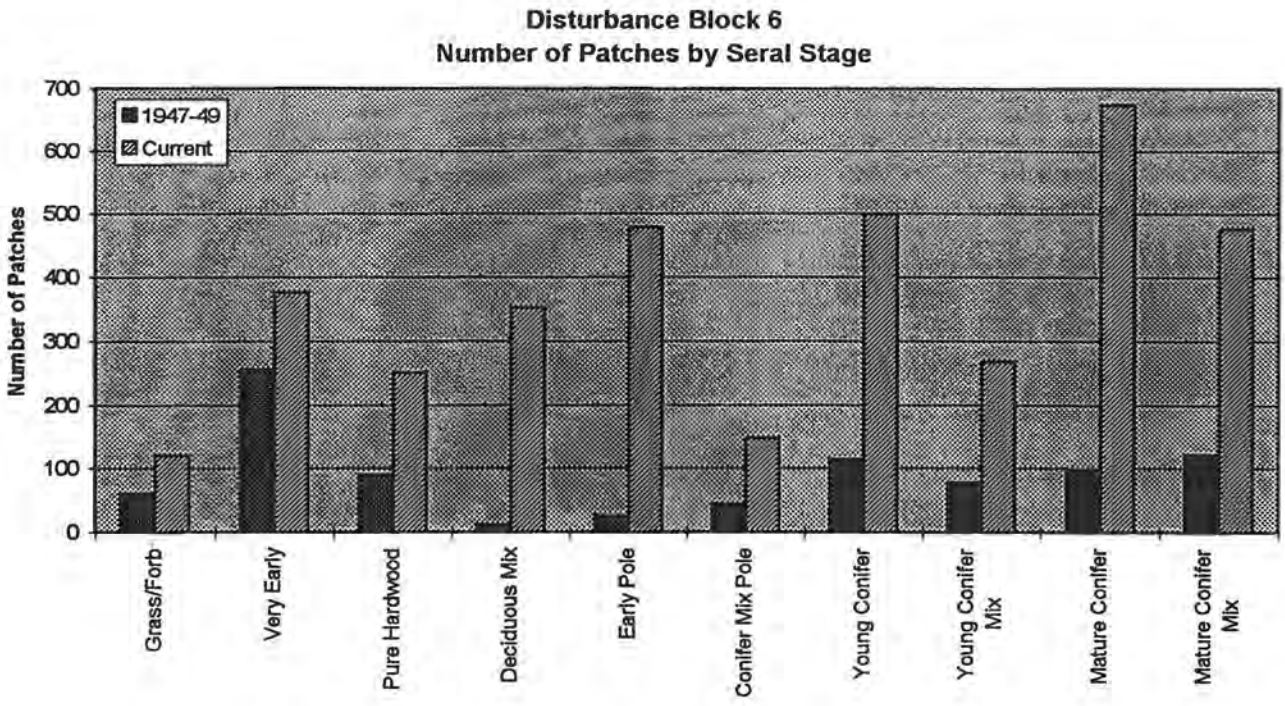


Figure C.6 Disturbance Block 6, Number of patches by seral stage

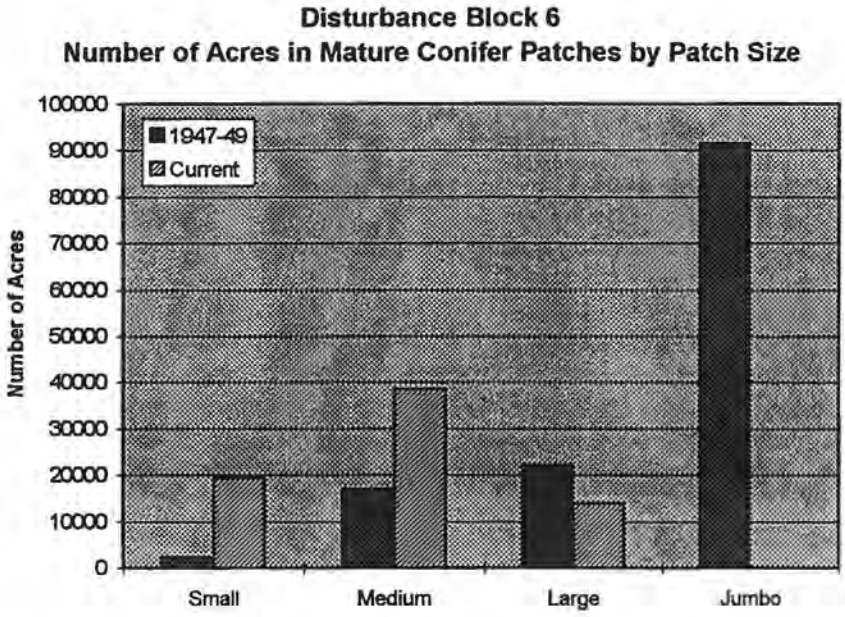


Figure C.7 Disturbance Block 6, Number of acres in mature conifer patches

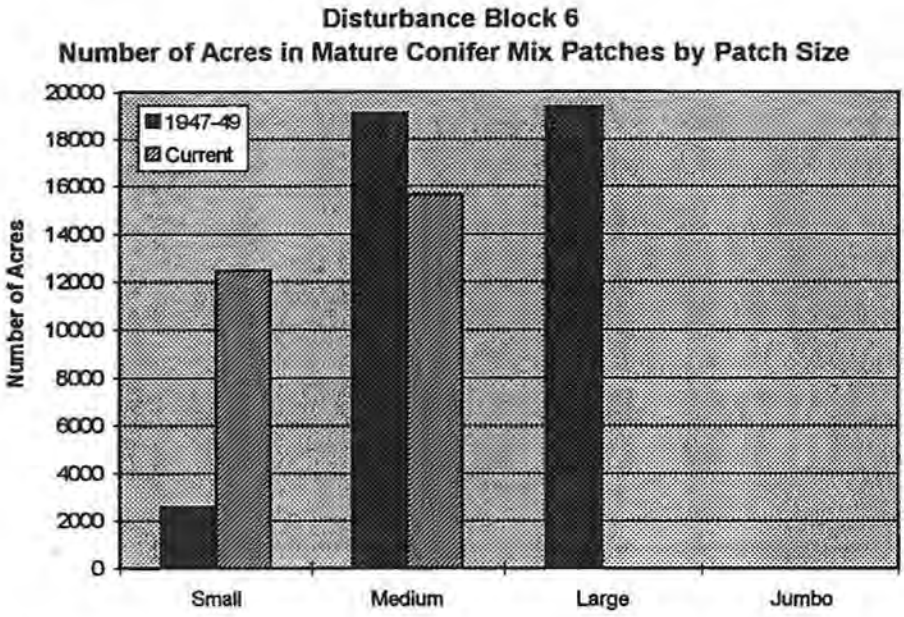


Figure C.8 Disturbance Block 6, Number of acres of mature conifer-mix patches

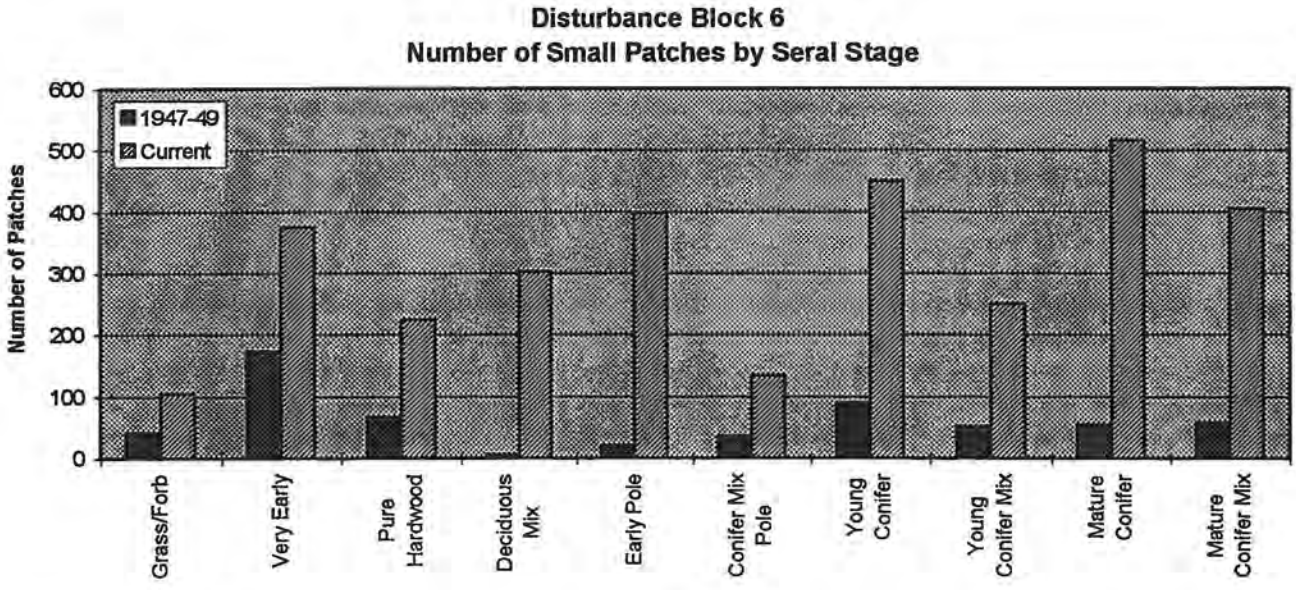


Figure C.9 Disturbance Block 6, Number of small patches by seral stage

Management Implications--Loss of mid-late seral conditions and fragmentation of existing habitat are two driving issues in this block. Management activities to aggregate patches and accelerate succession should be considered.

Central Interior-Marys Peak/Alsea Valley (Block 7). The Marys Peak/Alsea Valley block includes variable landforms, with valley fringe (Alsea Valley), moderate relief features and peaks (Marys Peak). Vegetation types are variable as well, with well drained, mesic and wet western hemlock associations occupying about equal area throughout the block.

Alsea Valley and Marys Peak have been heavily used by both Native Americans and European settlers. Fire patterns may have been affected by this use. A portion of the block has had at least three reburns since 1850. Marys Peak is a potential lightning source. Fire behavior and effects should be more severe to the east of Mary's Peak because of the rain shadow. The steep slopes that surround Marys Peak and the gentler relief around Alsea Valley also produce variable fire behavior within this block.

The variable vegetation pattern reflects the physical and biological variability on the landscape. Separating human from process effects is difficult. Landscape pattern potentially consists of medium to jumbo patches, with high potential for variability of remnant trees within and between patches.

Southern Interior Zone

Southern Interior-Siuslaw River (Block 8). Landforms in the block have moderate relief and high dissection. Mesic to dry plant associations in the western hemlock series occupy the site, with over 90% of the dry Plant Association Groups distributed within this block.

Fire pattern in this block has variable size, low to moderate frequency and moderate to high severity. The Siuslaw River acts as a funnel for east winds, creating conditions that could lead to large or jumbo fire events, similar to block six. Deeply dissected ridges create barriers to wind movement and potentially fire spread, and could be responsible for variable fire effects, especially across the central and southern portions of the block. The Goodwin Peak/Baldy Mountain ridge system has the highest lightning probablity. Some aboriginal and settlement influences have affected landscape pattern, with small portions of the block burning at least twice since 1850.

Vegetation patterns in this block are variable in size, ranging from small to jumbo patches in early or mid-seral stages, with some patches developing into a late seral stage.

Conifer species, such as Douglas-fir, dominate most upland seral stages, with western redcedar and western hemlock often found first as cohorts, then as dominants in late seral conditions. Alder is found only in frequently disturbed upland zones and drainage bottoms.

Valley Margin Zone

Valley Margin North (Block 4N). The North block forms the western tip of the valley margin that extends to the Willamette Valley. This section, the Van Duzer corridor, serves to funnel strong east winds to the Interior and Coastal Zones. Because so little of this block lies within the Study Area it will not be discussed further.

Valley Margin South (Block 4S). The landforms of the South block consist of valley foothills of low relief, and low to moderate dissection. Plant association group information is unavailable for this block.

This block has the highest potential for lightning-caused fires because of the storm track out of the south that allows for drier storms. Numerous settlements in the Willamette Valley create high potential for human-ignited fires.

The smaller fire sizes in this block may be due to lower fuel loadings that result from frequent burning. Variability in vegetation between north and south aspects is pronounced, resulting in higher fuel loadings on north aspects. The fire return interval in this block is the shortest of any of the blocks.

Appendix C.2 provides a list of fifth-field watersheds and the predominant fire blocks contained within each of them.

Disturbance Block Summary

Geographic variability is apparent in disturbance sizes and frequencies, severities, or both throughout the Study Area from Coastal to Interior to Valley Margin zones. Age class patterns (composition and distribution) have changed from 1850-1940, and they have been influenced by reburn activity. Patch sizes have decreased since 1850, especially in the 100-199 age class. Seral stage distribution has continued to change over time. Mid to late seral acreage has decreased by 40% since the 1940's. Mid to late seral jumbo patches have become fragmented into smaller stands.

Loss of mid to late seral conditions, and fragmentation of mid to late seral stands are two major issues affecting our current landscape pattern in federal lands. Management activities that may accelerate successional status, aggregate patches into larger blocks on the landscape, or both should be explored. Larger scale assessments of the relation of physical processes, soil conditions, and vegetation pattern will help guide the range of sites and treatments necessary to reach these goals.

Management Implications

Table C.3 displays a summary of disturbance block characteristics and management implications.

Table C.3 Summary of disturbance blocks

Block	Dominant Process	Freq.	Size	Landscape Pattern	Management Recomms.
COASTAL FOG					
Coast (1)	Wind	Moderate	medium small	Mixed sizes. Alder - large component.	Create large and jumbo mature/old stands, with scattered earlier seral stages. Alder is an important component in earlier seral stands.
	Wind	Low	large/ jumbo	PAG- S.spruce. wet and mesic	Sitka spruce (some western hemlock and Douglas-fir) are important components of later seral stages.
	Fire	Low	jumbo	High historic use has affected pattern.	
NORTHERN INTERIOR					
Tillamook (2)	Fire	Low	jumbo/ large	Single seral stage. Alder prevalent on most slopes in most stages. PAG: W.hemlock - mesic, well-drained sites. Sitka spruce - well-drained, mesic sites.	Create jumbo patches of single seral stage. Alder is important cohort in most seral stages.
Hebo (3)	Fire	Low	medium-jumbo	Single or 2-3 seral stages present. Alder prevalent on most slopes in most stages. PAG: W.hemlock mesic to well-drained. High historic use has affected pattern.	Create med-jumbo stands. Alder is important cohort in most seral stages.

Table C.3 continued.

Block	Dominant Process	Freq.	Size	Landscape Pattern	Management Recomms.
CENTRAL INTERIOR					
Lincoln Co. (5)	Fire	Low	medium-jumbo	Variable. Alder component of early stages only. PAG: W.hemlock - mesic, common. High historic use has affected pattern.	Medium to jumbo stands of one to a few seral stages. Alder component of some early seral stands.
Alsea (6)	Fire	Low	jumbo	Large patches of a single seral stage. Alder component of early stages only.	Create jumbo patches of a single seral stage. Alder is scattered component of early seral stages only.
Marys Peak (7)	Fire	Var.	Variable	Medium-jumbo patch. Alder infrequent, only in early stages. Heavy human use has affected pattern.	Create medium to jumbo patches of single or a few seral stages. Alder occurs infrequently in early seral patches.
SOUTHERN INTERIOR					
Siuslaw River (8)	Fire	mod-low	Variable	Variable sizes. Alder only in drainage bottoms. PAG: W.hemlock dry to mesic sites.	Create variable sized patches of one to several seral stages. Alder is component of riparian early seral stages only.
VALLEY MARGIN					
North (4N)	Not studied.				
South (4S)	Fire	mod-high	Variable	Variable. No alder.	Create variable patch sizes and seral stages.

LANDSLIDE RISK

Landslides are integral to the production of Coast Range landforms, soils, streams, and fish habitat. They introduce sediment (including gravels necessary for spawning), and large trees that act as energy dissipators and sediment storage sites into the stream systems. Eventually, over geologic time periods, landslides reduce stream gradients and flatten slopes. However, the timing of landslides is critical to whether they produce mostly benefits, or also cause disruption and degradation of natural processes.

Periodic large scale fires and wind storms killed trees on critically unstable steep slopes. The soils on many of those slopes failed, and introduced massive amounts of sediment and trees into the stream systems. For a decade or two these streams were in disequilibrium and produced difficult times for fish and other aquatic life. But then the good times came. Once log jams had settled the sediment flows, the complexity of the stream channels was greatly increased. This resulted in very much increased aquatic habitat - especially for anadromous fish. Excepting a few smaller fire and wind events, and large storms that caused scattered landslides across the landscape, this enhanced stream/habitat condition lasted until the next catastrophic event, usually one to several hundred years later.

Logging and attendant road construction altered landslide rates by destabilizing steep slopes in a chronic, persistent way within most drainage basins in the Coast Range. Instead of a single short period of intense landsliding, the channels were hit with a steady input of landslide debris whenever a moderately severe storm occurred. Also, landslides from logged sites only introduce sediment without also introducing the large logs that controlled stream channel gradients and sediment distribution. This resulted in two problems for streams and their aquatic life. First, the sediment inputs were more constant and unrelenting. Many channels have experienced elevated sediment loads for several decades. Second, and most important, supplies of large trees to the stream channels was greatly reduced or eliminated. This drastically changed stream channel shapes and function. Instead of complex step/pool profiles with multiple side channels produced by ever forming log jams, many channels in heavily logged basins have become simple bedrock shoots connecting the ridges with the rivers or ocean with few pools or side channels so necessary for anadromous fish habitat.

Based on landslide inventories in the 1970s and 1980s and on original interpretations of slope stability, landtype mapping units of the Siuslaw National Forest Soil Resource Inventory (SRI) have been ranked according to landslide frequency following major storms. Two distinct types of landslides are considered--debris slides and slumps.

Debris Slides

Sliding of low cohesion soils as on steep slopes after periods of high intensity rains that produce very high soil pore water pressures are called debris slides. Landtypes with high frequency of debris slides are typically steep, highly dissected, even-faceted slopes with shallow to moderately deep soils over impermeable bedrock or substrate. By determining the amount of the component landtypes within each Landtype Association (LTA), each has been

ranked as generally high risk or low risk for debris slides and slumps. See Map C.6 for Landtype Associations having high risks for landslides.

Landtype Associations with high risk for debris slides are:

2P, 2PSR1, 2PSR2, 3B, 3C, 3C1, 3E1, 3F, 3F1, 3M, 4F, 4G

Table C.4 lists the fifth-field watersheds in the Study Area that are made up predominantly of LTAs with high risk for landslides.

Table C.4. Watersheds with predominant high risk for debris slides

Watersheds (5th field)	Area in high risk LTA (%)
Wilson-Trask-Nestucca River Basin	
Kilchis	56%
Lower NF Trask	100
Lower Trask	100
Upper MF NF Trask	85
Wilson	64
Siletz-Yaquina River Basin	
Schooner/Drift (Siletz)	54
Siletz	57
Alsea River Basin	
Alsea	68
Big/Rock/Cape	54
Five Rivers	100
Lobster/Lobster Cr.	65
Tenmile/Cummins	77
Yachats	88
Siuslaw River Basin	
Deadwood	100
Esmo Whitt	82
Knowles	100
Indian	78
Lower Lake	100
Lower Siuslaw	76
N Fk Siuslaw	56
Upper Lake	100
Wildcat	54
Umpqua River Basin	
Lower Umpqua	60
N Fk Smith	70
Smith	95
West Fk Smith	86

Deep Seated Slumps and Earthflows

Deep, high cohesion soils and perennially high groundwater on moderately steep to steep slopes often fail, or move as large blocks called slumps or earthflows. Landtypes with high frequency of slumps are typically hummocky, uneven, broken and deeply incised by stream channels. Slopes are often convex, and soils are usually very deep to shattered, weak, highly permeable bedrock.

LTAs most prone to slumping or earthflow are:

2B, 2C, 2PSR3, 2T, 3Q, 3S, 3T

Table C.5 lists the fifth-field watersheds that are made up predominantly of LTAs with high risk for slumps and earthflows.

Table C.5. Watersheds with high risk for slumping

Watersheds (5th fields)	% area in high risk LTA
Wilson-Trask-Nestucca River Basin	
Nestucca	100
Three Rivers	92
Lower Nestucca	65
Yamhill River Basin	
Willamina	100
Yamhill	99
Alsea River Basin	
Berry	59
Big/Rock/Cape	47
N Fork Alsea	47
Upper Willamette River Basin	
Marys Peak	79
Tumtum	56

A list of all the fifth field watersheds and the number of acres and percentage area located within Landtype Associations with high risk for landslides (debris flow and slumping) is provided in Appendix C.4.

Management Implications

Areas prone to debris slides, e.g., primarily in the southern portion of the Siuslaw NF and in Drift Ck-Siletz, should be avoided for any extensive and intensive management activity from road-building and harvesting. Light distribution of silviculture management would be more appropriate for these areas.

Areas prone to slumping, e.g., Marys Peak and much of Hebo District, are expected to have higher road maintenance costs. Consider reducing or removing many of the roads built on landtypes with high risk for slumping.

SOIL PRODUCTIVITY

Productivity is defined as a site's ability to produce biomass. It is a function of climate, relief, parent material, and especially soils. Generally, soils developed in climates that provide optimum moisture and warm temperatures throughout the year that have high water-holding capacities, and high nutrient capital in organic and mineral forms, are the most productive.

Although Coast Range forests are generally considered very productive, significant variations in productive potential result from local differences in soil, climate, and past wildfire, and management activities.

Effects of Wildfire and Timber Harvest Activity

All areas that have had repeated, intense, frequent fires, clearcut harvests with subsequent slash burns, or both have suffered some decline in the potential amount of biomass that can be produced in the future. This decline is due to the volatilization of nutrients sequestered in the burned materials, and, in areas of clearcut logging, the long term reduction or elimination of large logs on the soil surface that act as reservoirs for moisture, fungal, and macro and micro-invertebrates.

Though volatilization of nitrogen and other nutrients during intense fires and slash burns may measurably reduce site productivity in some areas, the most profound changes in soil/site characteristics have occurred where logging activities have interrupted the steady, though sporadic inputs of large logs to the forest floor.

The majority of biologic activity in any forest takes place below the ground surface. Micro and macro organisms such as fungus, insects, arthropods, and bacteria are the integral components of the below ground food web. They are the factories that process all organic matter to make the nutrients available for recycling through subsequent generations of plants. Ideal temperate marine climatic conditions across the Study Area encourages growth of huge quantities of organic matter, and very large populations of soil organisms. The result is the uniquely prodigious nutrient capital and biologic potential of the Oregon Coast Range soils.

Continuity of the intense processing of organic matter by soil organisms in the temperate rainforest ecosystem depend to a very large extent on long term supplies of organic materials contained within all forest residue, but especially logs. Rapid turnover of organic materials by the soil organisms incorporates even large logs into the soil in a few dozen decades. Periodic new supplies ar critical to the continuity of the ecosystem.

Past fires have (with few exceptions) provided replenishment of large logs on a 100 to 400 year cycle. (Conveniently, almost as if nature knew what it was doing, the longer the cycles, the larger are the logs; which, by virtue of their size, are able to last through the next long cycle). Sites where harvest has removed the large logs now must contend with a significant gap in the normal cycle of replenishment. That gap will significantly reduce the total below, and above ground biologic activity.

Higher life forms such as birds, and small mammals depend upon the availability of insects and fungus associated with the decomposition and nutrient mineralization associated with the forest's large wood. Therefore, all life associated with coastal forests is affected by log removal. The continued presence of large wood and associated biologic activity may well be the most universally requisite component of mature and ancient conifer forest ecosystems.

Management Implications

The actual amount of decline varies greatly between sites and will have to be assessed at the Watershed Analysis scale. Those areas with the lowest inherent productivity have suffered the greatest relative potential productivity losses from fires and logging. LTAs with the lowest inherent productivity (compared to other LTAs in the Coast Range) include:

Coastal Fog zone: 4X
Northern Coast Crest zone: 2P, 2PSR1
Central Coast Crest zone: 2PSR2, 2PSR3, 2T1, 3Q
Southern Coast Crest zone: 3F, 3F1, 4F, 4G
Valley Border zone: 2H, 2S, 2Y, 3H, 3W, 4J

D. TERRESTRIAL ENVIRONMENT

CURRENT VEGETATION

Federal lands in the Study Area contain a wide distribution of seral stage vegetation types, from grass/forbs to mature conifer and mature hardwood/conifer mixes. Mature conifer currently makes up the largest proportion (33%) of the seral types (Figure D.1), though this proportion is less than the 48% that existed in the late 1940s. A comparison of seral stage distributions between the 1940s-1950s and current conditions is shown in Table D.1 and on Map D.1 (Seral stages--prelogging) and Map D.2. (Seral stages--current). Changes in vegetation patterns since that time include a reduction in percentage of mid- to late-seral stages, classified as mature conifer and mature mixed conifer/hardwood, and fragmentation of mature seral stages. In addition, there is a reduction of young conifer/hardwood mixed stands, probably due to the alder conversion management objective of the past two decades, which was in response to the growing demand for building material.

Table D.1 Seral stage distribution on federal lands in Study Area

Seral Stage	Prelogging (acres)	%	Current (acres)	%
Grass/forb	9,720	1%	24,260	3%
Very early (<10 yrs)	118,800	13	48,470	5
Early pole (11-25 yrs)	24,410	3	126,890	13
Conifer/hardwood pole (11-25 yrs) (5-11 inches dbh)	15,940	2	17,470	2
Pure hardwood	51,260	6	69,280	7
Deciduous Mix (hardwood dominated mixed stands (all sizes)	9,490	1	71,160	8
Young conifer (25-50 yrs)	58,790	7	152,140	16
Young conifer mix (25-50 yrs) (10-18 inches dbh)	61,460	7	25,250	3
Mid-late stage				
Mature conifer mix (>50 yrs)	101,890	12	93,830	10
Mature conifer (>50 yrs) (> 18" dbh)	426,310	48	313,220	33
TOTAL	878,082		941,975	

Seral-stage distribution was determined from air-photo interpreted digital coverages of 1940-56 (prelogging) federal lands within the Study Area and current vegetation of combined Siuslaw NF and BLM--Salem and Eugene Districts. (Appendix D.1 provides details on the combined vegetation coverages.)

Representation of each seral stage is found in both periods. Amounts and distribution of seral stages, however, have changed (Figure D.1). The most significant change has occurred in the mid to late-seral landscape area. These seral stages have decreased 40% since the 1940s, with mature conifer and mature conifer-mixed stands occupying 60% of the landscape in 1940-56 versus 43% now.

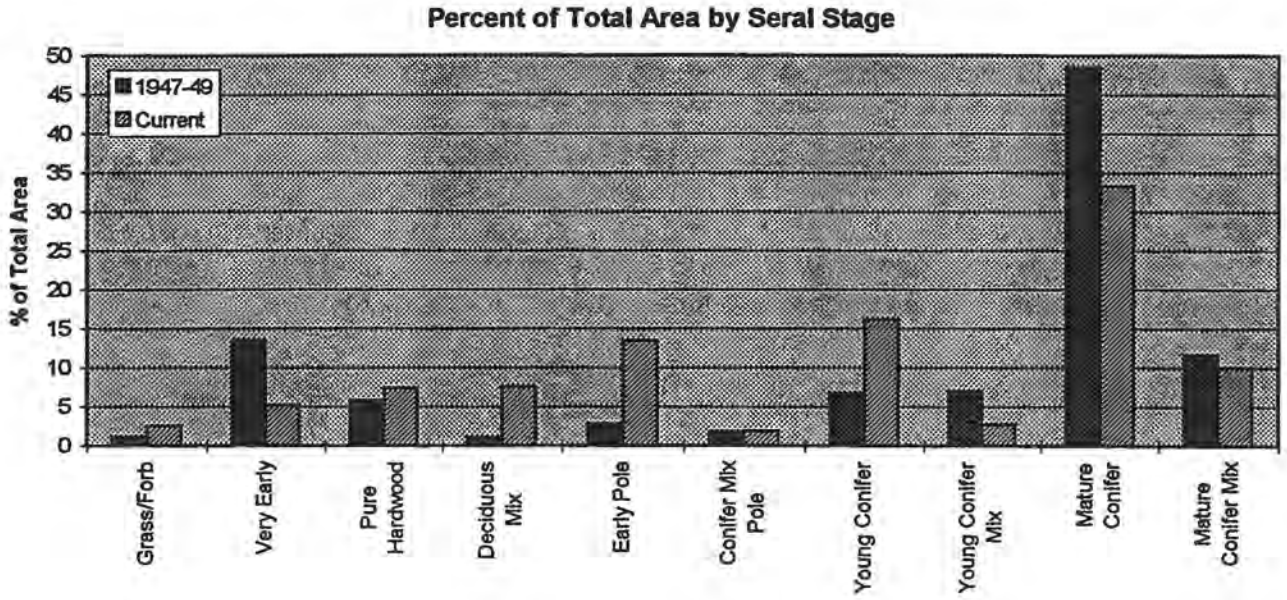


Figure D.1 Percentage of total area by seral stage

The largest remaining areas of mature conifer and mature-conifer mix remain in the southern portion of the Oregon Coast Province, because of the difficulty of logging the extremely steep, erodible slopes and the limits placed on logging by the Mapleton lawsuit of 1984.

Intensive timber management by clearcut harvesting over the last 40 years has fragmented mature forest stands more than historic fires. Patch size distribution of mature conifer stands has been significantly altered between periods (Fig. D.2). Since 1949, jumbo patches (>10,000 acres) have been reduced to medium patches of 100 to 1,000 acres, and small patches of 10 to 100 acres.

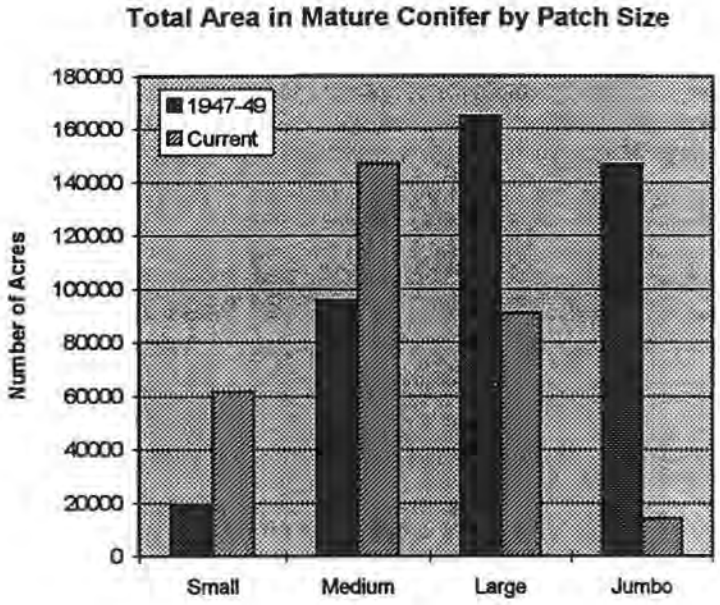


Figure D.2 Total area in mature conifer by patch size

On the Siuslaw National Forest, 37% of forested land has been under even-aged management, with clearcut regeneration harvests. Many of the remaining, "natural" stands, especially those adjacent to roads or clearcuts, have had some canopy structure changes through individual tree removal. Also, in the 1960s an effort was made to thin a significant number of mature stands, however, the exact extent of this activity is not well documented. A discussion of the management practices used on Siuslaw plantations since about 1950 is provided in Appendix D.2.

The Northwest Forest Plan establishes new direction for managing vegetation on federal lands in the Oregon Coast Range. Late-successional Reserves (LSRs) are established to promote growth of mature conifer stands and reduce fragmentation of remaining mature stands. Riparian Reserves are identified to provide vegetation most needed for restoring healthy aquatic environments and habitat for a host of wildlife species, and Matrix lands were identified as lands that could be managed for commercial production to meet some of the demand for wood fiber. Current condition of vegetation in Late-Successional and Riparian Reserves is addressed separately in subsequent sections of this report. Timber stands available for harvest in Matrix is discussed in the next section.

Matrix Vegetation

Vegetation management opportunities only for the Siuslaw National Forest portion of the Study Area are discussed. Timber management in Matrix on BLM lands is guided by the BLM Resource Management Plans and is not discussed here.

Lands allocated to Matrix and the Adaptive Management Area outside of reserves can be managed for wood production following standards and guidelines in the Siuslaw Forest Plan. One exception exists, due to the Northwest Forest Plan amendment-- where federal lands within a fifth-field watershed are comprised of 15% or less late-successional forest, all remaining late-successional stands should be protected (NW Forest Plan 1994, pg. C-44). A few fifth-field watersheds in the study area are currently below the recommended standard:

Lower N FK Trask (BLM)
Tillamook (FS and BLM)
Upper MF NF Trask (BLM)
Rock (BLM)
Upper Siletz (BLM)
Blodgett (FS)
Upper Lake (BLM)
Upper Siuslaw (BLM)
West Fk Smith (FS and BLM) Note- BLM data is incomplete for this watershed.

The highlighted watersheds include Siuslaw NF lands; they would not be available for harvest of late-successional stands in the near future. A complete list of watersheds and percentage in mature conifer condition is provided in Appendix D.3.

The estimated acres of Matrix, including those in the adaptive management area, on the Siuslaw National Forest are displayed by river basin (Table D.2). Acres shown include Riparian Reserves. When Riparian Reserves are removed from the land base, about 16,400 acres remain in the Matrix and adaptive management area (Table D.2). See Map D.3 (Riparian Reserves) and Map D.4 (Matrix lands) for a spatial display of these allocations. About 48% (7,867 acres) of those lands are managed stands. The remaining 52% (8,490 acres) is in natural stands and are of mature size, although only about 6,000 acres are conifer stands.

The Northwest Forest Plan specified an annual probable sale quantity of 23.7 MMBF for the Forest. This figure, calculated for Option 9 of the Draft Plan, was based only on acres in the Matrix and Adaptive Management Area. The Matrix was defined as all forested land outside of Riparian and Late-Successional Reserves, and on land specified as suitable for commercial timber management in the Siuslaw Forest Plan. The Riparian Reserves for Option 9 in the Draft Plan were defined as a distance equal to 1/2 of a site-potential tree height for either side of intermittent streams and two site-potential tree heights for either side of perennial streams; which on the Siuslaw NF is about 130 and 520 feet, respectively. In the Final Plan, the reserve width for intermittent streams was increased to one full site-potential tree height. This significantly reduced the Matrix acres, but probable sale quantity was not recalculated.

Because of the high density of streams in the Coast Range, a large portion of land allocated to Matrix is within Riparian Reserves. The remaining Matrix lands form narrow bands along ridges and are highly fragmented, with a median patch size of less than 10 acres. Even if the Matrix is managed under Siuslaw Forest Plan standards and guidelines, probable sale quantity would be much less than the 23.7 MMBF predicted in the Northwest Forest Plan. Given the Chief's

Table D.2 Summary of Matrix and LSR Acres

Northwest Forest Plan Allocation Summary for Forested Land on the Siuslaw National Forest

River Basin:	PFP Allocation	Managed Stands (ages)					Natural Stands		Total
		0-10	11-20	21-30	31-40	41+	Conifer	Hardwood	
Wilson-Trask-Nestucca	LSR	6,569	2,845	2,552	1,826	316	30,045	12,884	57,037
	Matrix	1,466	874	1,077	737	46	2,685	1,833	8,717
	RR assoc. w/ matrix	3,212	3,180	2,972	1,889	606	4,692	9,820	26,371
Yamhill	LSR	932	700	43	0	-	3,879	749	6,303
	Matrix	3	9	-	-	-	1	-	13
	RR assoc. w/ matrix	12	35	-	-	-	55	17	119
Siletz-Yaquina	LSR	5,547	4,663	4,194	3,980	260	20,716	4,487	43,847
	Matrix	149	64	100	40	22	463	130	968
	RR assoc. w/ matrix	708	224	799	381	-	1,414	915	4,441
Upper Willamette	LSR	383	479	643	716	138	5,595	318	8,273
	Matrix	31	-	-	-	-	24	-	55
	RR assoc. w/ matrix	9	-	-	-	-	5	-	15
Alsea	LSR	12,297	13,274	12,881	9,694	8,998	72,831	14,719	144,694
	Matrix	534	382	452	171	48	1,245	0	2,832
	RR assoc. w/ matrix	3,009	4,752	3,951	4,755	795	10,216	3,962	31,439
Siuslaw	LSR	5,613	10,562	12,248	8,959	726	61,297	9,543	108,948
	Matrix	151	185	316	209	39	882	87	1,869
	RR assoc. w/ matrix	1,441	1,891	2,825	2,624	96	5,692	1,184	15,753
Umpqua	LSR	985	2,565	5,740	844	10	33,420	3,681	47,246
	Matrix	4	39	2	19	-	87	77	228
	RR assoc. w/ matrix	3	66	8	25	-	133	118	352
Siltcoos	LSR	245	1,609	1,840	565	101	6,920	2,247	13,527
	Matrix	14	224	213	150	100	612	365	1,676
	RR assoc. w/ matrix	42	383	617	127	99	852	517	2,637
Total	LSR	32,571	36,697	40,139	26,585	10,550	234,705	48,628	429,875
	Matrix	2,352	1,776	2,160	1,324	255	5,999	2,492	16,357
	RR assoc. w/ matrix	8,436	10,532	11,171	9,802	1,595	23,058	16,534	81,127
	TOTAL	43,359	49,005	53,470	37,711	12,400	263,761	67,653	527,359

policy on clearcutting, and spatial problems caused by the highly fragmented Matrix, actual probable sale quantity will be about 4.5 MMBF.

Also, given how fragmented the Matrix is by reserves, few feasible commercial-thinning timber sales will be possible without including managed stands in the Riparian Reserves. Commercial thinning is consistent with the Forest Plan, as long as the activities are the means of implementing the aquatic conservation strategy in the Riparian Reserves. In Late-Successional Reserves commercial thinnings will be the main tool for promoting and accelerating development of late-successional habitat. Appendix D.4 describes the process used to determine the PSQ estimate.

Managed Stands

Managed stands, in reserves as well as in Matrix, were established under a high-intensity timber management program, and the areas currently in this condition are too densely stocked to represent the full range of natural conditions for the Coast Range. Density management, usually in the form of commercial or precommercial thinning, will be needed to reduce stocking and accelerate development of late-successional forest stand characteristics. The Forest has about 200,000 acres of managed stands, and 75,000 are at an age when inter-stand competition is reducing tree canopy ratios. Canopy ratio becomes important when it is lowered to a point where stands become stagnant, and development of late-successional characteristics is severely delayed or, possibly, never achieved. Stands with poor growth characteristics are also more vulnerable to blowdown if density management is delayed beyond the optimum age. In addition, densely stocked stands are more vulnerable to insect infestation. Acres of stands within reserves are shown in Table D.2.

Generally, stands more than 25 years old benefit from density management, and the trees are usually large enough to make commercial thinning an option. Experience to date indicates that 50-60% of the area within these stands would actually be thinned. Acres available by land allocation are as follows:

	Total acres	Thinnable acres
Late-Successional Reserves	57,204	28,000
Matrix	2,659	1,300
Riparian Reserves associated with Matrix	16,982	8,500
Total	76,845	37,800

Mature stands in the Matrix are also highly fragmented by Riparian Reserves, and any harvest activity will consist of small partial or group selection cuts. The exception may be some hardwood stands, especially in riparian areas, where conversion to conifer-dominated forest may be appropriate ecologically.

WILDLIFE HABITATS AND SPECIES ASSOCIATED WITH LATE-SUCCESSIONAL FORESTS

There is a wide variety of species that inhabit the many seral stages and vegetative types in the Coast Range of Oregon. The species that have been given the highest priority for analysis are those primarily associated with late seral forest communities. The Northwest Forest Plan strives to recover habitats for late-seral species within the range of the northern spotted owl. While the two species most commonly mentioned as late-seral associates are the northern spotted owl and marbled murrelet, many other late-seral species reside in or are suspected to reside in the Coast Range Province. Watershed analysis teams will list all species that inhabit each watershed; however, emphasis will be placed on analysis and restoration of habitats upon which late-seral species depend.

Appendix D.5 lists species of concern that have been identified in FEMAT (those having 40 points or less in FEMAT Table IV), and Survey and Manage species found in Table C-3 of the ROD for the Northwest Forest Plan. The Regional Forester's Sensitive Species may warrant specific analysis as well. Appendix D.6 lists R-6 Sensitive Species for the Siuslaw National Forest.

Amount and Pattern of Late-Successional Forests

In order to identify highest priority areas for recovery and restoration, stand data were analyzed to identify deficiencies in location and amounts of late seral habitats. Analysis consisted of determining location and amount of late seral stage conifer-dominated natural stands, called "mature conifer" and "mature-conifer mix" in the previous section. These are defined as: 1) conifer and mixed conifer/hardwood stands with average diameter at breast height (dbh) greater than 18" on Forest Service lands, and 2) stands greater than 50 years old on BLM lands. Current seral stage distributions of two Late-Successional Reserves--L0269 in Hebo and R0268 in the Alsea and Siuslaw river basins--are shown in Tables D.3 and D.4. Comparing the two LSRs, proportions of seral stages appear to be similar, although the two areas are in different parts of the Study Area. On average, mid-late seral stages occupy about 46 percent of the LSRs.

LSR's vary by amount and pattern of late-successional habitats. The highest proportion of late seral conifer habitat conditions are found in the southern portions of the Forest and in some coastal stream basins that have seen a minimal amount of timber harvest activities. The best LSR's (those with the most late seral habitats) are R0268 (approximately 182,000 acres), and L0269 (approximately 48,000 acres). The rest are smaller in size and contain less late-seral conifer habitat (R0267, R0265, and R0269 with approximately 39,000, 31,000, and 12,800 acres, respectively). Appendix D.3 presents the acreage and proportion of mature conifer stands on federal lands in each fifth-field watershed. This includes all federal lands in the Study Area, regardless of land allocation. Figure D.3a summarizes these data. Figure D.3b displays the same information by fourth field river basin. The pattern of mature conifer is most dependent on past timber harvest and other activities such as homestead clearing.

Table D.3 Seral Stages of LSR RO268

Seral Stage	LSR	Withdrawn	Total	%
		(acres)		
Grass/forb	2,530	397	2,927	<1
Very early (<10 yrs)	18,925	37	18,962	5
Early pole (11-25 yrs)	45,145	422	45,567	13
Conifer/hardwood pole (11-25 yrs) (5-11" dbh)	6,326	85	6,411	2
Pure hardwood	13,668	603	14,271	4
Deciduous Mix (hardwood dominated mixed stands) (all sizes)	18,298	4,383	22,681	6
Young conifer (25-50 yrs)	51,721	4,238	55,959	15
Young conifer mix (25-50 yrs) (10-18" dbh)	10,555	455	11,011	3
Mature conifer mix (>50 yrs)	39,488	6,626	46,114	12
Mature conifer (>50 yrs) (> 18" dbh)	121,966	10,239	132,205	34
Untyped	14,447	568	15,015	
TOTAL	343,069	28,054	371,123	

Seral stage distribution was determined from combining current vegetation coverages of the Siuslaw NF and BLM--Salem and Eugene Districts. (Appendix D.1 provides details on the combined vegetation coverages.)

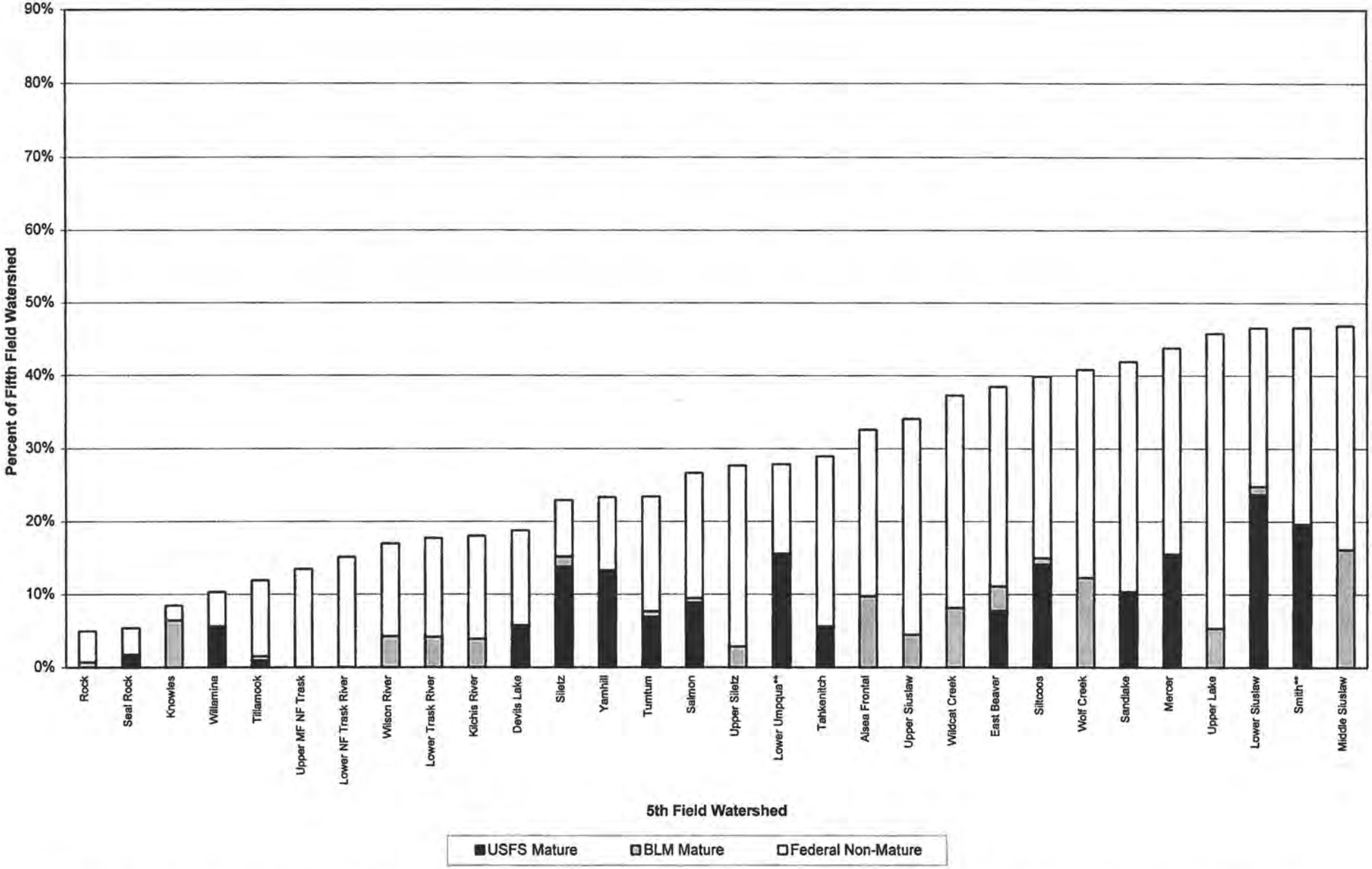
Table D.4 Seral Stages of LSR LO269

Seral Stage	LSR	Withdrawn (acres)	Total	%
Grass/forb	259	1,165	1,424	2
Very early (<10 yrs)	7,047	32	7,080	8
Early pole (11-25 yrs)	9,061	740	9,801	11
Conifer/hardwood pole (11-25 yrs) (5-11" dbh)	1,122	46	1,168	1
Pure hardwood	7,021	2,192	9,213	10
Deciduous Mix (hardwood dominated mixed stands) (all sizes)	7,166	1,155	8,322	9
Young conifer (25-50 yrs)	6,129	1,663	7,792	8
Young conifer mix (25-50 yrs) (10-18" dbh)	1,105	192	1,296	1
Mature conifer mix (>50 yrs)	8,969	509	9,478	10
Mature conifer (>50 yrs) (> 18" dbh)	26,728	6,951	33,678	36
Untyped	2,399	706	3,104	
TOTAL	77,005	15,351	92,356	

Seral stage distribution was determined from combining current vegetation coverages of the Siuslaw NF and BLM--Salem District. (Appendix D.1 provides details on the combined vegetation coverages.)

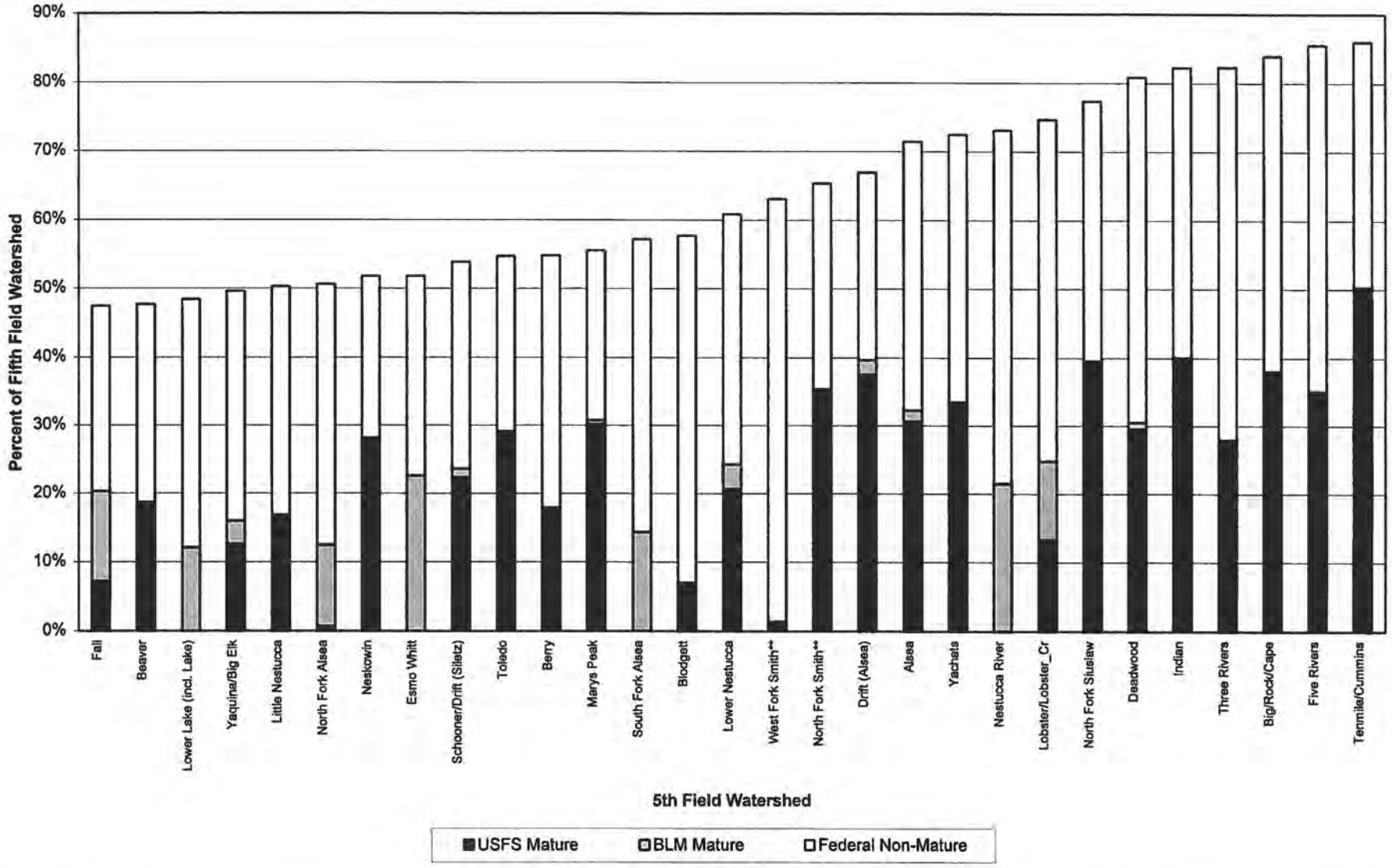
Appendix D.7 presents the amount of interior forest mature conifer habitat (habitat greater than 500 feet from edge) on federal land by fifth field watershed. Figure D.4 summarizes these data. The pattern and amount of interior conifer habitat follows closely that described above for mature conifer. Watershed in the southern portion of the Forest are higher in interior conifer forest conditions than other watersheds. This is largely due to difficulty of access and harvest concerns due to other resource impacts. Areas that would best benefit from stand aggregation projects are areas most highly fragmented by past harvest, many of these are in the eastern portions of the Waldport Ranger District and the central portion of the Alsea District.
Map D.5 displays locations of mature conifer and interior forest habitat on federal lands.

Figure D.3a: Mature Conifer Forest Condition (Mature and Non-mature) by Fifth Field Watershed (Page 1)



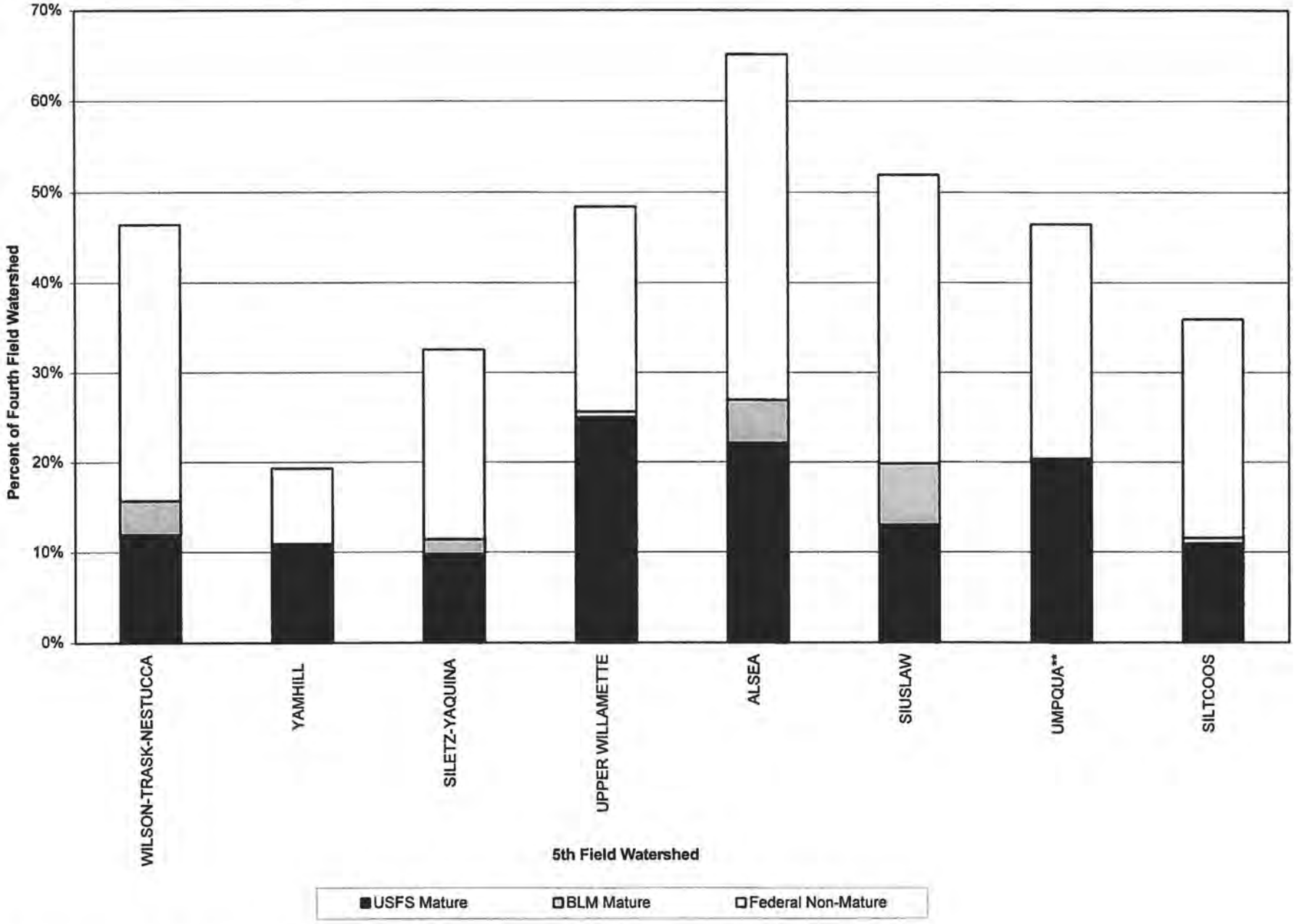
**BLM acreage data were incomplete for Lower Umpqua, North Fork Smith, Smith, and West Fork Smith watersheds as of 8/95 (all in Umpqua fourth field watershed).

Figure D.3a: Mature Conifer Forest Condition (Mature and Non-mature) by Fifth Field Watershed (Page 2)



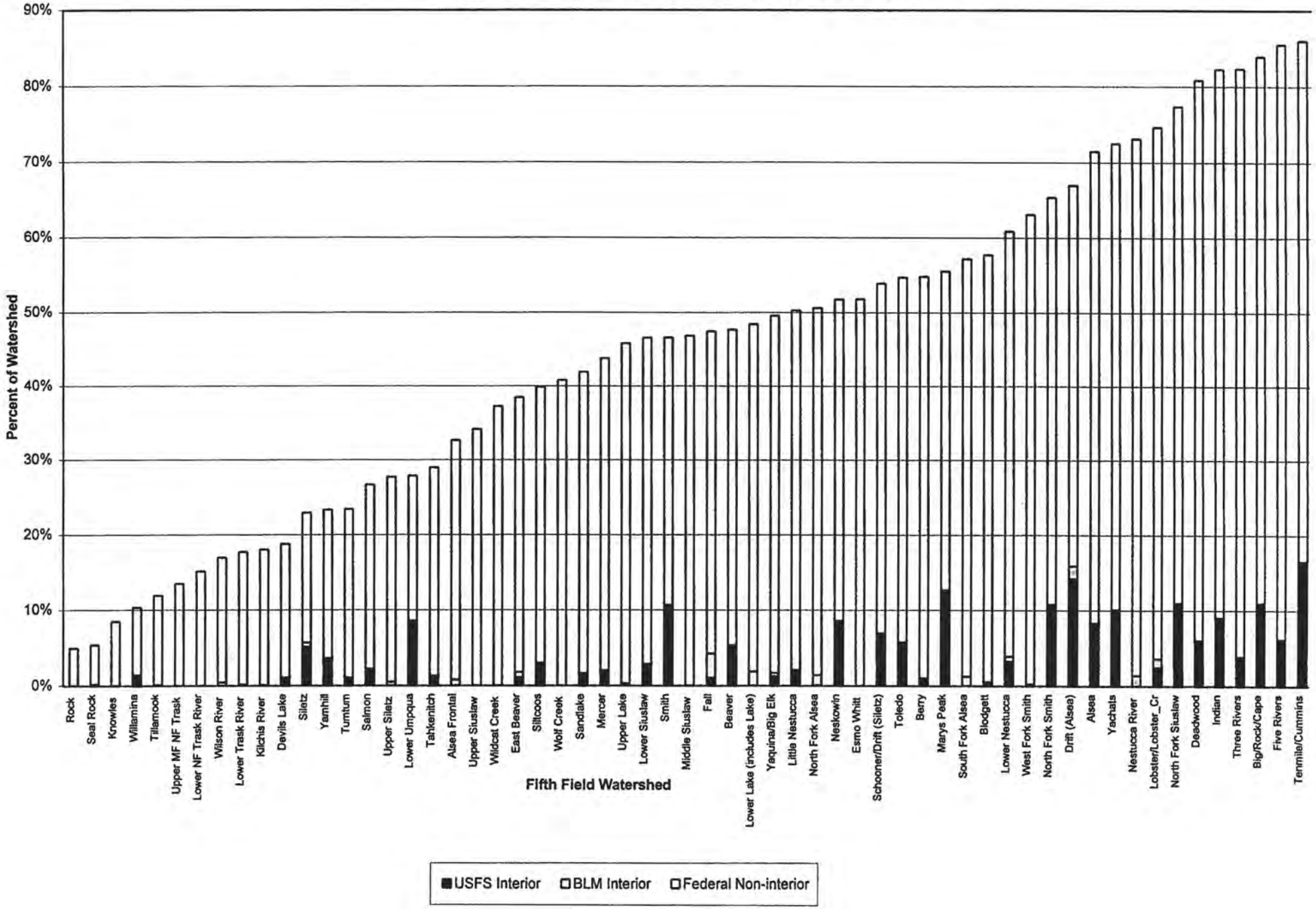
**BLM acreage data were incomplete for Lower Umpqua, North Fork Smith, Smith, and West Fork Smith watersheds as of 8/95 (all in Umpqua fourth field watershed).

Figure D.3b: Mature Conifer Forest Condition (Mature and Non-mature) by Fourth Field Watershed



**BLM acreage data for the Umpqua fourth field watershed were incomplete as of 8/95.

Figure D.4: Interior Forest Condition by Fifth Field Watershed



Dispersal Habitat Analysis

Dispersal habitat for northern spotted owls is one of the four constituent elements (nesting, roosting, foraging, dispersal) of federally designated critical habitat. It is important to determine the existing condition of dispersal habitat across the landscape before assessing potential impacts of management activities on critical habitat. Dispersal habitat on all federal ownerships should be analyzed when a proposed project may reduce ability of habitat to provide dispersal needs. One purpose of the Riparian Reserve system in the Northwest Forest Plan is to provide for dispersal habitat such that the 50-11-40 analysis would no longer be necessary. The Riparian Reserve system, however, is not currently fully functional, primarily due to the large number of acres in plantations. Appendix D.8 presents the 50-11-40 analysis for each 1/4 Township and is provided to help determine effects of changes on dispersal habitat. Of the 136 1/4 townships analyzed, 9 of 12 deficit on the Forest are on the Hebo Ranger District. The best opportunity to improve dispersal habitat is through stocking control of overstocked plantations and to allow others to grow into dispersal class stands (11 inch diameter trees having a crown closer of at least 40%). Although Appendix D.8 contains information on national forest lands only, it remains useful to watershed analysis teams as a first reference because many of the 1/4 townships within the Siuslaw National Forest have National Forest System land as the only federal ownership.

Northern Spotted Owls

Analysis of northern spotted owl habitat around pairs and territorial singles includes data from both BLM and Forest Service lands. Immediate owl habitat needs are most critical within the median home range radius (1.5 miles) around nest groves or territorial owl areas, however long-term habitat recovery on a large scale should still receive precedent over short-term single pair needs. Restoration of owl habitat needed for nesting and survival of young should focus on those areas that are most deficient in mature conifer cover within the median home range. Appendix D.9 presents amounts of mature conifer that exist within median home ranges (1.5 mile radius) around owl pair and territorial single locations expressed as a percentage of all habitat within the same radius by 5th-field watershed, Figures D.5 and D.6 summarize these data. The data vary from 16.5% habitat within the median home range (Blogett watershed on Waldport) to 99.3 % (Knowles watershed on Mapleton).

Figure D.5: Proportion of Federal Lands in Owl Home Ranges

Note: No owls occur in Berry, Devils Lake, Kilchis, Lower NF Trask, Rock, Sand Lake, Seal Rock, Three Rivers, Tillamook, Upper MF NF Trask, Willamina, and Yamhill. Knowles and Wildcat are not included since the data is confirmed incorrect.

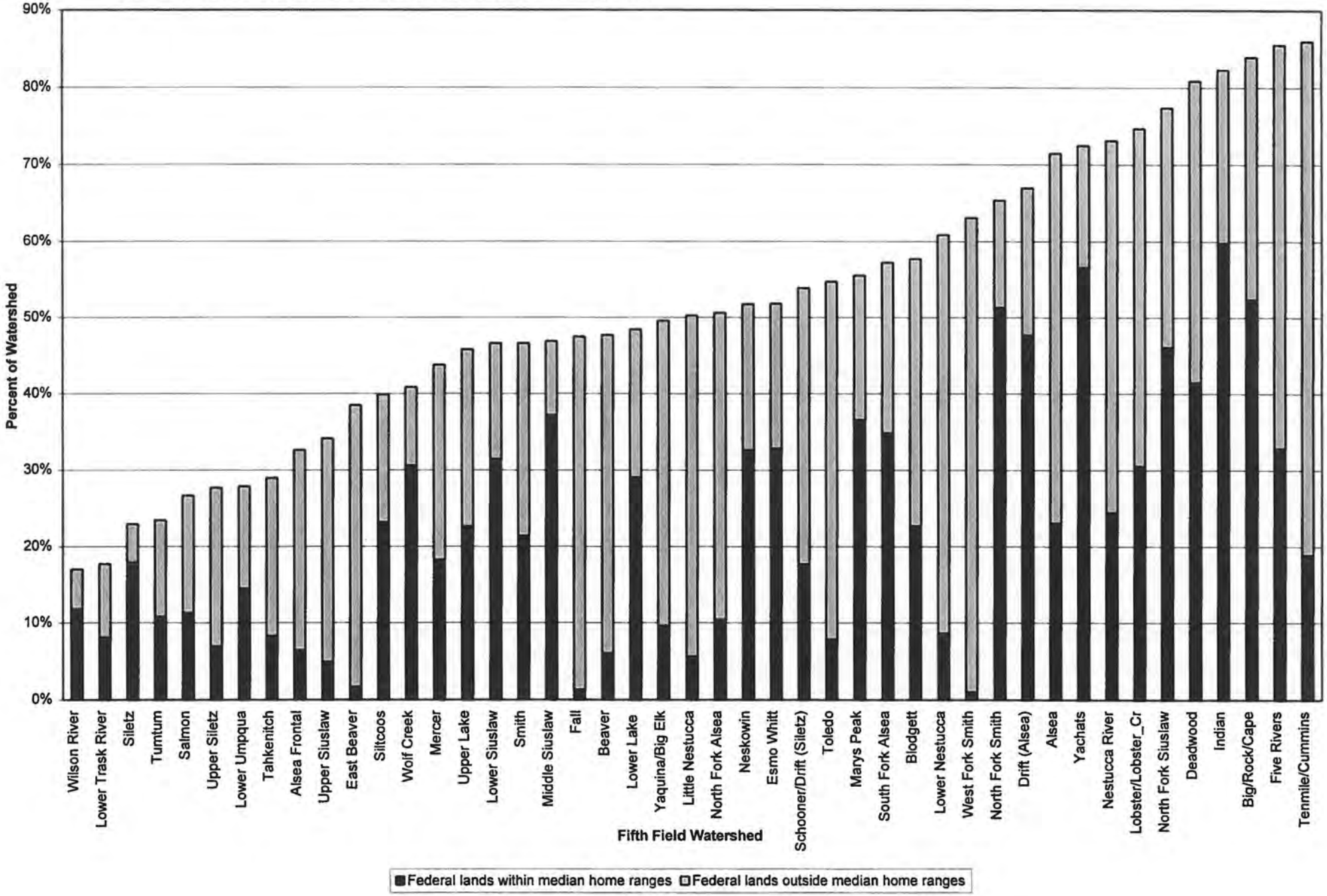
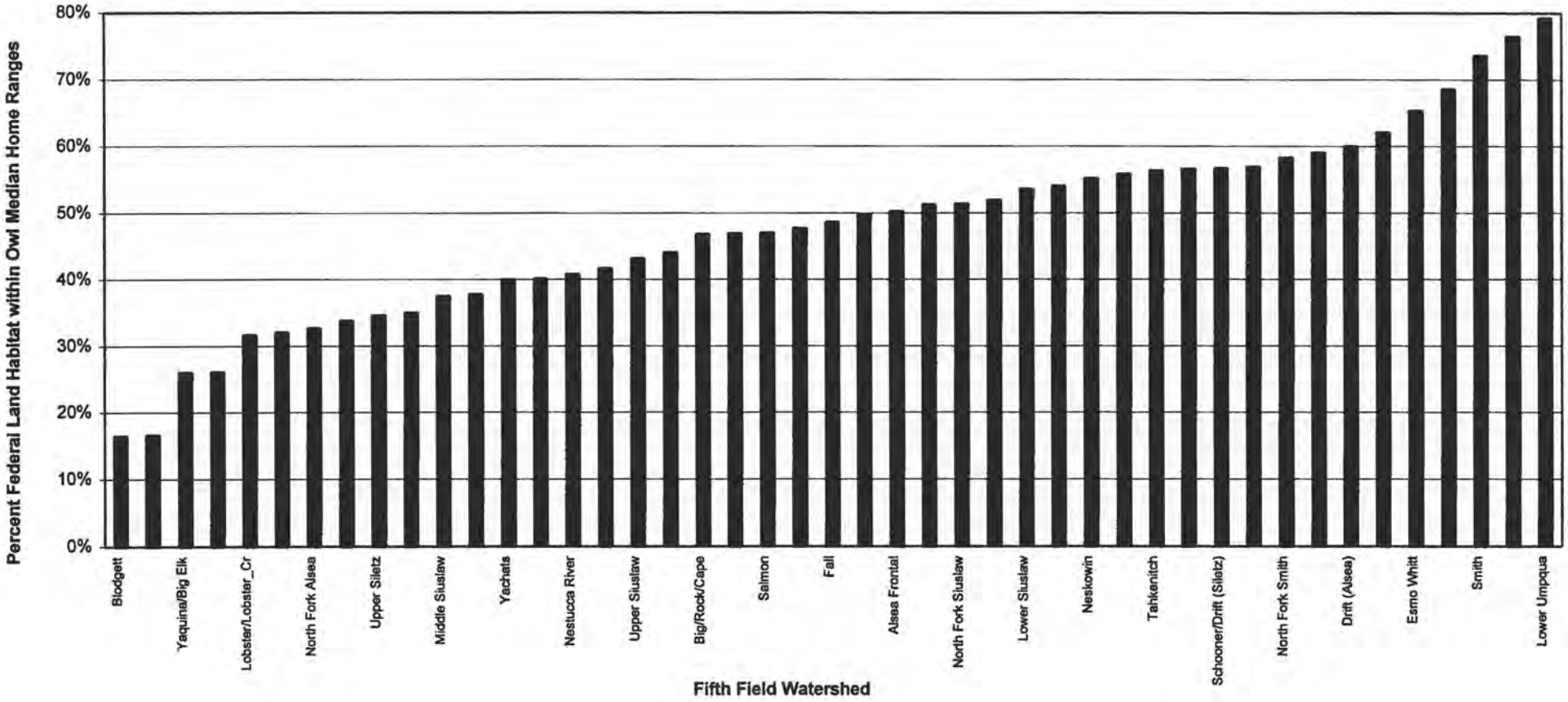


Figure D.6: Percent Federal Land Habitat within Owl Median Home Ranges

Note: No owls occur in Berry, Devils Lake, Kilchis, Lower NF Trask, Rock, Sand Lake, Seal Rock, Three Rivers, Tillamook, Upper MF NF Trask, Willamina, and Yamhill. Knowles and Wildcat are not included since the data is confirmed incorrect.



Marbled Murrelets

Data for sites occupied by marbled murrelets are for Forest Service lands only. Murrelet habitat needs are most critical within 0.5 miles of where behavior suggesting nesting has been observed. Short-term restoration of murrelet habitat for nesting and protection from predation should focus on areas most deficient in mature conifer cover within 0.5 miles of occupied behavior. However, the same focus on long-term habitat recovery at the landscape scale as mentioned above for owls, pertains to murrelet habitat as well. Appendix D.10 shows amounts of mature conifer that exist within 0.5 miles of such sites on the Siuslaw National Forest expressed as a percentage of all habitat within the same radius by 5th field watershed. Figure D.7 summarizes these data. Data range from only 6.0% (Tillamook watershed on the Hebo Ranger District) to 87.3% (Beaver watershed on the Waldport Ranger District). Generally the murrelet areas have less habitat on the Hebo Ranger District than elsewhere on the Forest, with Siuslaw and Umpqua River drainages having the most.

Riparian Reserves

Riparian Reserves are intended in part to provide habitat for a variety of vertebrate, invertebrate, vascular, and non-vascular species. Riparian reserves influence quantity and quality of late-successional forests, based on the following three attributes:

1) Abundance and ecological diversity--acreage and variety of species, communities, and environments.

2) Process and function--ecological processes that develop and maintain the ecosystem and meet the requirements of species and populations.

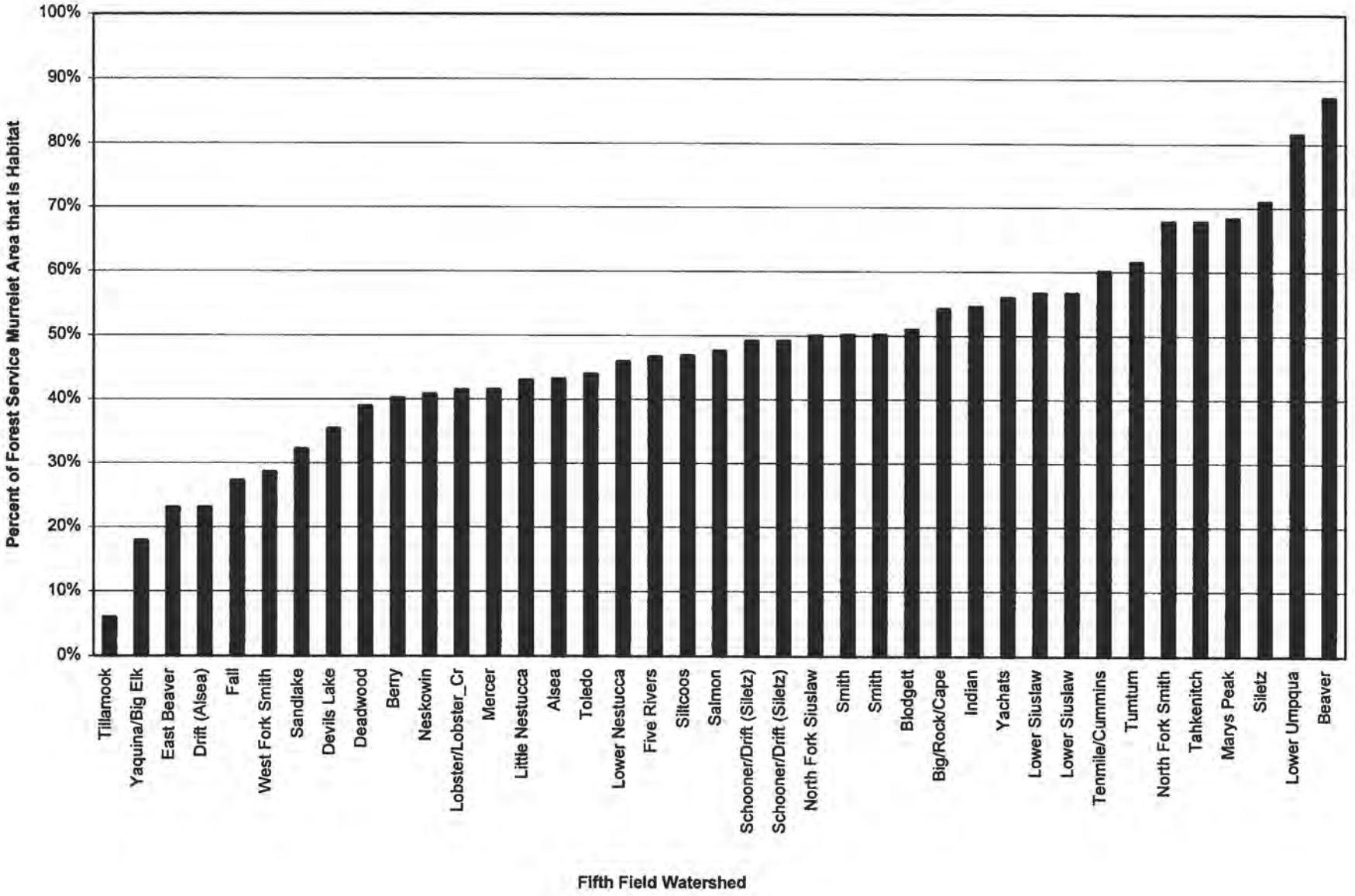
3) Connectivity--extent to which landscape patterns of the ecosystem provide for biological flows that sustain animal and plant populations.

Condition of Riparian Reserves played an important part in FEMAT's ratings of habitats' ability to support populations of various species groups. Specifically, 5 components of Riparian Reserves were considered in the evaluation and rating process: 1) distances protected for different stream classes; 2) overall acreage of reserves; 3) distribution of reserves across the landscape; 4) management proposed for reserves; and 5) existing and future quality of the habitat in the reserves. These ratings are presented in FEMAT Table IV-17 through Table IV-39, pages IV 80-177. The ratings were developed through a series of 12 panels comprised of 67 experts covering all major plant and animal taxa associated with late-successional and old-growth forests in the Pacific Northwest.

Some fish, wildlife, and plant species were analyzed between draft and final SEIS for the NWFP to clarify FEMAT's ratings, to examine possible standards and guidelines and land allocation changes that would benefit those species through improved habitat conditions on federal land, and to assess impacts of other revisions to Alternative 9. As a result, Alternative 9 was revised to incorporate Riparian Reserve Scenario 1 instead of Riparian Scenario 2. That is, to provide riparian protection of riparian areas along intermittent streams, the Riparian Reserve width was doubled from 1/2 to 1 tree length.

Figure D.7: Proportion of Habitat within Murrelet Areas on Forest Service Land

- No USFS lands in: Alsea Frontal, Esmo Witt, Kilchis River, Knowles, Lower NF Trask River, Middle Siuslaw, Nestucca River, South Fork Alsea, Upper Lake, Upper Siletz, Upper Siuslaw, Upper MF NF Trask, Wildcat Creek, Wilson River, Wolf Creek
- No murrelets in: lower Lake, North Fork Alsea, Seal Rock, Three Rivers, Willamina, Yamhill



Watershed analysis is a process to consider and recommend alternative Riparian Reserve widths, if appropriate. The draft revised Watershed Analysis Guide, "Ecosystem Analysis at a Watershed Scale", includes a Terrestrial Ecology Addendum which provides a framework of detailed questions to assess proposed modifications of standards and guidelines, which would include changes in riparian widths. The process focuses on species thought to occur in the watershed, including those associated with Riparian Reserves. Appendix D.11 includes a list of species that are strong associates of Riparian Reserves within the range of the northern spotted owl and are suspected or known to occur in the Coast Range of Oregon. Examples of questions that should be answered prior to altering riparian widths include:

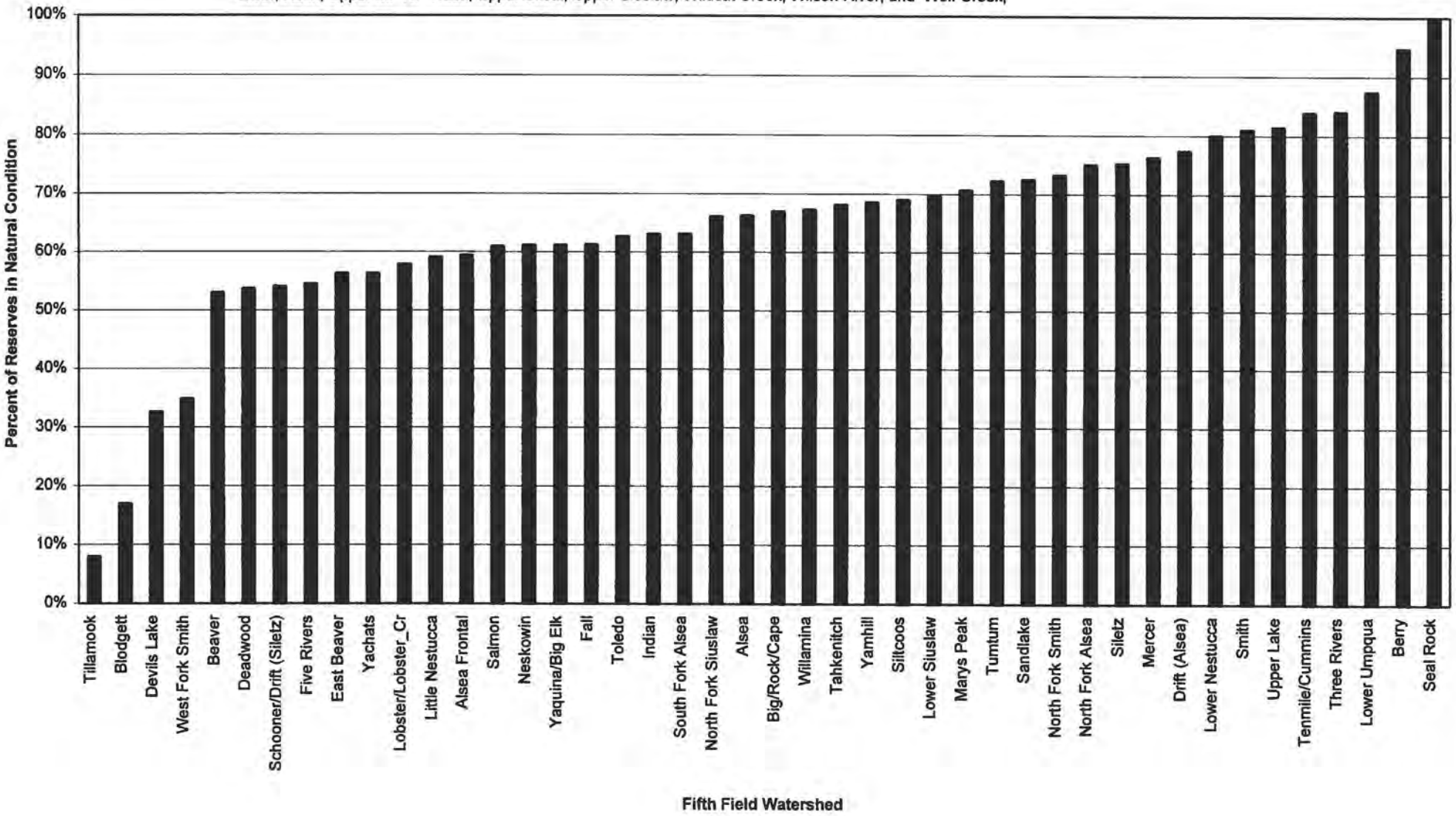
1) What is the historic and current distribution of the species and its habitat in the watershed?
2) How does the watershed relate to habitat and population viability of the species over the entire range?
3) How would potential adjustments in land allocations or Standards and Guidelines (S&G's) affect the species' population and habitat?
4) What locally rare and endemic species from Table C-3 of Attachment A of the ROD are located in the watershed; where are they; and what are appropriate steps for management of their sites?
5) What is the condition of Riparian Reserve habitat, and how would altering interim riparian reserves affect terrestrial and riparian processess and functions?
6) What are the condition and location of special habitats in the watershed?

Function and effectiveness of Riparian Reserves at any given time is directly related to overall condition of habitats within Riparian Reserves. Appendix D.12 shows existing condition (i.e. natural vs managed) of Riparian Reserves on lands allocated to LSRs. Figure D.8 summarizes these data. Data for Riparian Reserve health vary from 17% in Blogett watershed to highs of 94.7%, 87.4%, and 84.0% on Berry, Lower Umpqua, and Tenmile/Cummins, respectively. Restoration of Riparian Reserves should be specific to the Aquatic Conservation Strategy Objectives (ROD, B-11) that address the role and function of these habitats.

Figure D.8: Proportion of Riparian Reserves in Natural Condition on Federal Lands in LSRs

(Data is only for portions of fifth fields falling within LSRs)

No data for Esmo Whitt, Kilchis River, Knowles, Lower Lake, Lower NF Trask, Lower Trask, Middle Siuslaw, Nestucca River, Rock, Upper MF NF Trask, Upper Siletz, Upper Siuslaw, Wildcat Creek, Wilson River, and Wolf Creek,



Isolated Secure Habitat Blocks

The Coast Range has undergone massive changes from both natural and human factors. One primarily human-caused change has been a reduction in relatively large contiguous areas of late-successional habitats due mainly to roading for timber harvest activities (Maps D.6 - D.8). The following table illustrates how availability of large contiguous forested areas has changed in just the last 100 years.

Year	Isolated Acres in Coast Range[1/]	Median Patch Size
~1900	Virtually the entire Range (1,000,000+)	100,000+
~1945	576,000	3,000
1990	121,000	137

1/ Acres of land greater than 0.25 miles from roads.

Wildlife communities have responded to the above, some positively and some negatively. Species that evolved in and are adapted to large relatively unbroken blocks of habitat are listed below with their last known occurrence in the Coast Range of Oregon.

Species	Last Known Coast Range Occurrence
Grizzly bear	About 1820
Gray wolf	1934
Wolverine	1972
Fisher	1973
Lynx	1984

Restoration and recovery of large areas of unbroken late-seral forest communities will not happen by chance, and will require seizing opportunities identified through watershed analysis. Five areas of the Siuslaw National Forest with relatively high proportions of mature conifer forest and relatively low road density have the best potential for recovery of unbroken late-seral forest communities:

1) Key WS that contains Hebo-Nestucca Roadless Area, Three Rivers WS, and the Key WS portion of the Little Nestucca WS.
2) Key WS portion of Schooner Drift (Siletz) WS.
3) Key WS portions of Beaver, Drift (Alsea), and Toledo WS.
4) Yachats, Tenmile/Cummins, and the Key WS portions of Big/Rock/Cape, North Fork Siuslaw, and Indian Creek WS's.

5) North Fork Smith and Key WS portions of Siltcoos, Smith, Lower Umpqua, and FS lands west of roadless area, some of which are in the Smith and Lower Umpqua WS's.

In the above watersheds, vegetation management with a "get in and get out" fashion (carrying out chosen projects over a short period of time, followed by a long period of inactivity) would best assist recovery of relatively secure-undisturbed areas of the Coast Range.

Botanical Resources

Species lists referenced above in the Riparian Reserves section include late-seral associated vascular and non-vascular plants for the Coast Range of Oregon. However, Poa laxiflora also needs to be considered during watershed analysis. The draft Poa laxiflora Species Management Guide and database of Poa locations are available from the Forest Botanist. The database contains site locations, size, and current management strategy for each site. This information is also available in GIS.

Elk Habitat Capability

This section describes the process and criteria used to delineate elk capability areas (ECAs) on the Forest. ECAs are shown on Map D.9.

The Forest contains a wide variety of habitats; many forested and some non-forested types that are important to Roosevelt elk. Long-term capability of lands to grow and support elk within a particular drainage is largely correlated with landforms. ECAs were delineated by landforms (as measured by landtypes), land ownership, and knowledge regarding how elk populations have responded to past habitat manipulation.

During the process of identifying ECAs, a variety of considerations were addressed, the most important being topography of the sub-basins. Throughout the delineation process, consideration was given to "rolling gentle slopes", or "smooth ridgelines", or "steep incised drainages" that are more definitively described in the Soil Resource Inventory-Siuslaw National Forest (Badura et al., 1974). Other considerations, although given less emphasis, included: a) areas with successful elk management (forage seeding, fertilizing, meadow maintenance, etc); and b) percentage of Forest Service ownership within a sub-basin. It is assumed that ownership patterns influence the actual ability of management actions on Forest System Lands to make a difference in any particular sub-basin. Those sub-basins with less than 25% of their area in the Siuslaw National Forest were given less than moderate ratings, even if the landtype indicated high or moderate potential.

The following sample of 9 landtype descriptions are for lands delineated as ECAs. These 9 represent 90-95% of all landtypes found in ECAs.

The following are the 9 most common landtypes found in the sample:

LANDTYPE CAPABILITY	DESCRIPTION OF LANDTYPE
Highly Productive	
Landtype #43	-- Site Class II and III -- Smooth hummocky sideslopes, toeslopes, terraces, and ridgetops -- Ancient landslide deposits -- Slopes between 0 and 30%
Landtype #53	-- Site Class II and III -- Smooth gentle benches and toeslopes -- Created by ancient landslides -- Slopes between 0 and 30%
Moderately Productive	
Landtype # 42	-- Site Class II and III -- Smooth slopes and ridges -- Often old landslide acitvity -- Slopes between 30 and 50%
Landtype # 52	-- Site Class II and III -- Smooth to moderately dissected sideslopes -- Ancient landslide activity -- Slopes between 30 and 50%
Landtype # 16	-- Site Class III -- Smooth, moderate to steep slopes beneath ridges. -- Well drained soils -- Slopes between 30 and 80%
Least Productive	
Landtype # 51	-- Site Class III -- Smooth to moderately dissected steep slopes -- Shallow soils < 3' to bedrock -- Slopes between 50 and 90%
Landtype # 41	-- Site Class III and IV -- Well drained surface and subsoils -- Steep, smooth to moderately dissected slopes -- Slopes between 50 and 90%
Landtype # 44	-- Site Class III and IV -- Well drained throughout soil profile -- Steep with moderately to highly dissected slopes -- Slopes between 50 and 90%

Landtype # 54 -- Site Class III
-- Rapid permeability
-- Steep, moderately to highly dissected slopes
-- Slopes between 50 and 90% plus

Appendix D.13 presents a description of the ECA's and the 5 most common landtypes in the High, Moderate, and Low Productivity ECA's.

Summary of the above elk information points to a few important areas. One is that the best elk habitat is gently rolling ground with associated meadows, and two is that the best elk habitat is generally found on the Hebo Ranger District and the central part of the area made up of Alsea, Waldport and Mapleton Ranger Districts. It should be made clear that the capability of any area to grow and hold elk has no direct bearing on how management chooses to emphasize elk. Emphasis brings into consideration road management, hunting season location and length, and habitat manipulation. Oregon Department of Fish and Wildlife strongly supports efforts to improve elk range and provide a diversity of hunting experiences to the public. Forest Service's role in elk management focuses on habitat maintenance/improvement, agency cooperation and public involvement. The ECA's above range from low to high. Watershed analysis should use the overall pattern of high, moderate and low to identify the best opportunities for elk across the forest. Road closures to improve elk habitat effectiveness and diversity of hunter recreation are elements of elk management as is converting roads to stringer meadows and maintaining natural openings. All of these should be considered when seeking to blend late successional forest needs with the needs of a species that does best in an environment with a variety of successional stages.

Management Implications for Late-Successional Forest Restoration

Existing habitat conditions were used to identify fifth-field watersheds that had reduced levels of desired late-succesional forest communities and present the best opportunity to restore the fabric of late successional forest communities across the landscape. Only watersheds that contain more than 20% federal ownership were considered in the following procedure. The criteria used to identify the fifth-field watersheds were the number of federal acres, as a percentage of the total federal acres available, of: 1) interior forest habitat; 2) mature conifer habitat; 3) natural stands in riparian reserves; 4) suitable habitat within the median home range radius (1.5 miles) of owl pairs and territorial singles; and 5) suitable marbled murrelet habitat within the reserve distance (0.5 miles) of occupied sites. Using the above criteria, the sequence is described below:

1) Select the 20 watersheds that have the fewest acres of interior forest habitat and check to make sure all these make sense and should be carried to the next step.

2) Select from the 20 watersheds above the 10 that have the fewest acres of mature forest habitat and check to make sure all these make sense and should be carried to the next step.

3) For the 10 watersheds from above, display riparian condition data, owl median home range data and data for murrelet 0.5 mile circles so that consideration came be given to site-specific needs of these resources and species.

Steps above recognize a sliding scale of importance between resources listed. This scale starts with the overarching need to recover the fabric of late-successional forests by using information on interior forest habitat first, then mature forest, then Riparian Reserve natural stands (function and effectiveness) and so forth. The least critical in the long term is the restoration of individual owl pair or marbled murrelet nesting habitat because these sites may pass through periods of activity and inactivity as the Coast Range is restored. After the highest priority watersheds are identified, a priority setting that mirrors the above should be used to select stands for treatment (i.e. restore connectivity, enlarge future interior forest patches, and enhance riparian reserves). If "all else is equal", then at the watershed scale, select for stands within 1.5 miles of owl pair areas and stands within 0.5 miles of occupied murrelet sites. This process will not only address the most urgent work first but will require fewer seasonal restrictions and the need to consult on a program of restoration activities. Appendix D.14 displays the results of the sequenced selection process described above.

E. AQUATIC ENVIRONMENT

Weathering of sedimentary bedrock has created dense dendritic (branched) drainage patterns in most of the Coast Range. Sandstone and siltstone layers generally dip to the west and form a pattern of gentle west-facing slopes and short, steep east-facing slopes. Where volcanic or intrusive bedrock dominates, slopes range from gentle to steep, and are rolling, broken, and uneven with lattice-dendritic patterns. These features are largely a result of ancient massive landslides that rearranged whole mountain slopes. Hard volcanic rocks resistant to erosive forces of sea and intense rainfall are responsible for the ruggedly beautiful headlands along the coast, such as Cape Perpetua and Cascade Head, and most of the higher peaks across the Forest.

Precipitation is abundant. About 5 million acre-feet of precipitation, including minor amounts of snow and fog, falls onto the Coast Range each year. Because most of this precipitation falls in the winter, and because little of it is snow, winter streamflows are high and late summer streamflow ranges from moderate in areas of deep soils and fractured bedrock to very low where soils are shallow over impermeable bedrock.

All watersheds in the Study Area originate in the Coast Range, except for the southernmost watersheds of the Umpqua River basin. Within the boundaries of the Siuslaw National Forest, there are 3,200 miles of perennial streams and about 5,000 miles of intermittent streams. Headwater streams rise and fall quickly as a result of the frequent coastal rainstorms and flow rapidly through V-shaped canyons. The short and steep headwater streams merge into larger streams with gentler gradients and U-shaped or flat flood plains. Most large streams flow into major estuaries that empty into the Pacific Ocean.

The steepness of the upland stream channels and the frequent high flows result in tremendous amount of energy that effectively transports sediment and nutrients into and through stream channels, and creates fish habitat by depositing gravel and carving pools where fallen logs or other features impede streamflow. Conversely, high stream energy can scour away fish spawning gravel and fill pools with sediments where structure is lacking and flow is unimpeded. Sediments can smother eggs and recently-hatched fish in spawning beds.

WATER QUALITY

Water quality becomes an issue when beneficial uses of streams are affected. Primary beneficial uses of forest streams are domestic water supply and production of native anadromous fish. A secondary benefit is the aesthetic value of complex stream channel systems and generally crystal clear water. All of these uses are affected by increases in sediment and water temperature, and contamination by toxic materials, and disease organisms.

Water quality may be degraded by a wide range of human activities. In the non-urban portions of the Study Area, logging, road construction, and farming activities are by far the most likely to reduce water quality.

Effects of Logging

Detrimental effects of timber management on water quality result from road construction and removal of vegetation. These activities exacerbate the inherently erosive slopes and cause accelerated landslides and increased solar radiation on water surfaces:

- Clearcutting - Increases landslides/sediment, channel erosion, and water temperature

- Partial cutting - Increases channel erosion, soil compaction, and water temperature

- Road Construction - Increases landslides/sediment, surface erosion/sediment, and peak flows

Accelerated erosion, stream sedimentation, and elevated water temperatures are pervasive across mountainous portions of the Study Area. Hot spots of sedimentation and high water temperatures are especially prevalent in logged areas in the Northern Interior and Southern Interior Zones.

Four factors work in concert to increase both stream water temperature and landslide erosion rates:

1) Soil and bedrock water-holding capacity.

a) Water Temperature - Areas with low water retention have larger portions of total water at or near the surface during hotter times of the year. This increases the effectiveness of solar radiation on water and decreases the amount of cooling by dilution of cold ground water.

b) Landslides - Shallow soils and impermeable bedrock that must transmit large quanties of water during high intensity storms are more likely to fail and slide downslope. Where soils are deep and bedrock is highly fractured, debris slides are unlikely.

The Southern and Central Interior Zones, and the Valley Margin Zone have the largest areas of shallow to moderately deep soils over impermeable bedrock.

2) Streamside vegetation

a) Water Temperature - Streams in the Interior and Valley Margin Zones are very much dependent upon the shading effects of streamside vegetation to keep water cool. These areas are typically drained by very high densities of shallow, low-volume streams which pick up large amounts of solar radiation if not shaded.

All areas but the Fog Zone are affected equally by presence or absence of streamside vegetation.

b) Landslides - Vegetation at upper or headwater ends of stream systems greatly increase the strength of soils near those streams. These areas (known as headwalls) are the most active erosion surfaces in the Coast Range. During high intensity storms first order and ephemeral streams are more likely to experience debris slides where deep-rooted vegetation is lacking.

3) Fog Zone

a) Water Temperature - The Coastal Fog Zone along the Pacific Coast acts as a temperature buffer for small streams that flow primarily within it. The amount of vegetation near those streams makes little difference in water temperature extremes. However, larger streams flowing through the Fog Zone which originate in interior basins are not measurably cooled by the lower air temperatures of the Coastal Fog Zone because very little of the total volume of stream water is exposed to the cooler air temperatures.

b) Landslides - The conditions present in the Fog Zone have no known effect on landslide rates.

4) Roads

a) Water Temperature - Roads have no measurable effect on water temperatures.

b) Landslides - Roads change surface and groundwater transmittance rates and routes. They also weaken slopes by undercutting soils and bedrock, and overloading slopes with sidecast and fill materials. The combination of these effects results in greatly increased rates of landslides where roads exist.

Current Conditions

Preliminary stream temperature monitoring over the past several years indicates some widespread stream temperature problems in the Study Area. Most streams within basins that had clearcut-harvest levels typical of the 1980s are today showing 7-day average summer temperatures that are above the state minimum water quality standard of 62°F. Streams within Wildernesses and streams entirely or mostly within the Coastal Fog Zone have not exceeded the state standard.

The areas most likely to suffer increased stream temperatures as a result of additional harvest are the Central and Southern Interior Zones and the Valley Margin Zone. High soil and bedrock water-holding capacities in the Northern Interior Zone, and cool summer air temperatures in the Coastal Fog Zone make these areas least likely to experience elevated water temperatures following harvest activities.

Landslide activity associated with harvest and road construction has been most prevalent in the Central and Southern Interior Zones, and within the steeper areas of the volcanic headlands in the Coastal Fog Zone. Future harvest in these zones will be most likely to result in accelerated landslides on steep headwalls.

Effects of Farming

Detrimental effects of farming activities result from heavy equipment traffic, spreading of petroleum-based fertilizers, and concentrated numbers of farm animal, especially on stream banks.

- Dairy, Pasture, Grazing - Increases channel bank erosion/sediment, nitrate pollution, water temperature, and soil compaction

- Row Crop - Increases soil compaction, surface erosion/sediment, pollution from fertilizers (nitrate/sulfate/phosphate pollution)

Detrimental resource effects are most likely in areas of extensive dairy farming north of the Yaquina River in the Northern Interior and northern half of the Coastal Fog zones and in areas of pasture/crop farming in the Valley Margin zone.

Interagency Coordination Opportunities

The Environmental Protection Agency (EPA) Office in Seattle has proposed some rivers and lakes in the Oregon Coast Range Province be identified (listed) for regulation under the Clean Water Act, Section 303(D). This section of the Act allows States to identify waters for which effluent limitations, including thermal discharges and pollutants, required by Section 301 are not stringent enough to assure protection and propagation of a balanced indigenous population

of shellfish, fish and wildlife. The proposed rivers are primarily lower mainstems running through private lands. See Map E.2 (Waters Proposed for CWA, Sec. 303(d) Listing).

Rivers	Lakes
Miami (lower portion)	Devils
Kilchis (lower half)	Siltcoos
Wilson (lower portion)	Tahkenitch
Trask (lower half)	Mercer
Tillamook	Woahink
Nestucca (lower half)	Munsel
Salmon (lower 1/3)	Clear
Yaquina (lower half)	
Alsea (middle portion)	
Siuslaw (lower 1/3)	
Smith (entire)	

The Forest may have an opportunity to work with the EPA to identify appropriate maximum loading and recommend management practices to reduce effluents, high temperatures or both affecting those water bodies. The EPA, in turn, is in a position to give Forest personnel technical assistance on water quality matters.

WATER QUANTITY

Demands for municipal, agricultural, and industrial water from the Forest will come primarily from communities in the Coastal Fog zone (LTAs 2B, 2M, 2M1, 2N, 2Q, 2P2, 2T, 2Z, 3A, 3M, 3T, 3Z, 4A, 4X) and the Valley Margin zone (LTAs 2H, 2S 2Y, 3H, 3S, 3W, 4J). These areas contain most population centers and agricultural lands. They also contain virtually all of the present and future economically-feasible groundwater supplies in the Central Coast Range. All of the larger water users are under state of Oregon water user permit. A few of the smaller water users are neither under state permit nor inventoried by any federal agencies.

The Interior zones have many single and small domestic-use water withdrawals. Municipal water users are few, though significant. They include the Cities of Toledo, Alsea, and Mapleton. As in the Fog and Valley Margin Zones, many smaller water users are neither permitted by the state nor inventoried by any federal agencies. See Map E.3 (Water user inventory).

Currently, commercial and domestic uses of surface water in the central Coast Range has not reduced instream flows below those needed by anadromous fish, nor have any detrimental effects on other aquatic life been attributed to surface water withdrawals.

Extensive deep-well withdrawal of ground water from sand dunes in the southern portion of the Oregon Dunes National Recreation Area (in LTA 4X) for industrial and municipal uses continues to be the primary area where use of water from federal lands is controversial. Drawdown of several small lakes in the dunal sheet near the sites of deep municipal/industrial wells may be linked. Studies of the groundwater response to deep well drawdown are being made by both local municipalities and the US Geological Survey.

Interagency Management Opportunities

The Oregon State Department of Water Resources (DWR) maintains county maps and data on surface and ground water supplies, instream and out-of-stream water rights, minimum flows, scenic waterways, and Department of Environmental Quality designations (Ron Campbell, DWR, personal communications). These data may be useful in assessing current and future water demand and availability through watershed analyses.

Counties beginning their "Periodic Review" process (i.e., a periodic updating of their comprehensive land-use plans) are being supplied by DWR with water availability maps. Counties have been encouraged to update and improve their inventories of current and projected water needs and identify possible problems. There should be good opportunities at that time to work with the state and counties on a joint assessment of future water needs and potential conflicts with the Aquatic Conservation Strategy.

FISH DISTRIBUTION

Distribution and status of fish populations in streams on federal lands in the Oregon Coast Province have been documented and discussed in great detail in a plethora of recent reports (House 1992, Nickelson et al. 1992, Beidler and Westfall 1993, Stewart et al. 1993; USFS 1993a, 1993b, 1994a, 1994b; USFS et al. 1994; many others). The primary reasons for this flurry of interest has been the well-known recent crisis of anadromous salmonid runs (Nehlsen et al. 1991; Nickelson et al. 1992; Pacific Rivers Council 1992) and subsequent development of the Northwest Forest Plan (USFS and BLM 1994a), itself in large part a response to that crisis in the Pacific Northwest. See the above reports for more details.

Nehlsen et al. (1991) listed 28 anadromous salmonid stocks at risk of extinction or of concern on the Siuslaw NF alone. In 1994, all cutthroat trout life-history phases in the Umpqua River were recommended for listing as endangered by the National Marine Fisheries Service. Recently, in July 1995, the coho salmon was proposed for listing as a threatened species throughout the Oregon and northern California coasts. Petitions have also been filed to list steelhead as endangered coastwide. Because of these actions and a host of similar concerns, the National Marine Fisheries Service has initiated a status review of all anadromous salmonid runs throughout the Pacific Northwest. Fall chinook runs appear to be the only salmonid stocks in generally healthy condition in the Coast Range (USFS et al. 1994).

Salmonid fishes are found in virtually all perennial streams in every river basin in the Study Area (map E.4). On the Siuslaw NF, anadromous fish run into 1,200 miles of large, mostly low-gradient streams low in each basin, with only resident cutthroat trout found in 2,000 miles of small, high-gradient perennial tributaries. Some of the Forest's 5,000 miles of intermittent streams are undoubtedly used for spawning during high water, but the extent is unknown.

Steelhead tend to ascend the systems farther than do coho and chinook salmon. Sea-run cutthroat trout undoubtedly are found throughout much of the range of steelhead and salmon, although exactly how far they go is not clear because of difficulty in distinguishing sea-run and resident forms of the species. Chum salmon only inhabit reaches just upstream from tidewater in coastal estuaries.

The following is mostly summarized from USFS (1994b). Steelhead spawn in upper portions of river mainstems and throughout all tributaries accessible to anadromous fish. They generally prefer smaller and steeper streams than do either coho or chinook salmon. Chinook tend to spawn in mainstems and low portions of large tributaries, and they are often absent from small, coastal streams. Coho generally spawn in small, shallow streams that are widely distributed throughout upper mainstems and most relatively low-gradient tributaries. Cutthroat trout are generally distributed throughout all accessible areas. Although sea-run cutthroat are smaller tham other anadromous salmonids and thus could spawn in headwater streams and tributaries that are even smaller or steeper than those used by steelhead, their distribution may be more similar to that of coho (USFS et al. 1994). Chum salmon spawn very low in scattered basins with large estuaries.

Although habitat requirements of salmonid species differ markedly, fish distibution maps (for salmon, steelhead, and trout) only indicate presence or absence of each species (Maps E.5 and E.6). For example, short coastal streams in the basaltic area between Cape Perpetua and Heceta Head tend to have higher gradients and more riffles than streams in surrounding sedimentary areas. As such, they are more favorable to steelhead than to coho salmon. Yet the distribution maps show only that steelhead and coho are present in these streams, and do not reflect greater abundance of steelhead compared to coho there.

Most downstream reaches of watersheds are typically privately owned and would contain any anadromous species known to run farther upstream (Map E.4). Relative distribution of anadromous salmonids in streams on BLM, state, and private land upstream and inland from the Siuslaw NF is similar to that on the Forest, except that chum salmon are absent.

In general, fall chinook and coho salmon, winter steelhead, and resident and sea-run cutthroat trout have the widespread, homogeneous distribution patterns described above in both large river basins and small watersheds. Notable differences among basins are mostly limited to the spotty occurrence of chum salmon around the Study Area; increased abundance of chum salmon in the Nestucca basin; presence of spring chinook salmon and hatchery summer steelhead in the Nestucca basin; presence of wild spring chinook and summer steelhead in the Siletz basin; and a small spring chinook run in Drift Creek of the Alsea River. Adult spring chinook and summer steelhead enter freshwater much earlier in the year, so they are found only in streams with deep, cool pools in which to hold during the summer.

FISH HABITAT

That the most critical components of fish habitat in the short, steep streams in the Coast Range are large woody debris and the deep pools that result has been well documented (USFS 1990). This debris creates a stair-step effect that provides places for hiding and rearing, retains spawning gravels, and holds and slowly releases sediment and nutrients.

In general, instream fish habitat throughout the Study Area generally appears to be in marginal to poor condition (Baker et al. 1986; House 1992; USFS 1993a, 1993b, 1994a, 1994b; USFS et al. 1994). A fundamental problem seems to be that stream channels have lost most large woody debris and have become narrowly confined and disconnected from their valley floors (Dewberry 1994). Mean and median numbers of all types of pools per mile in the Umpqua, Siuslaw, Alsea, and Nestucca basins (21-39) all fall below the lower limit of historical conditions for this important habitat component (40 pools/mile for reaches 10- to 30-feet mean width; data used for USFS 1993a).

Also, less than 4% of stream segments surveyed in the North Fork Siuslaw River have enough complexity (both depth and cover) to meet a combination of objectives from PACFISH (USFS and BLM 1994b), the State of Washington, and Oregon Department of Fish and Wildlife (objectives vary by mean width and gradient of the stream segment; USFS 1994b). Fully 90% of the stream miles surveyed in the Nestucca River basin do not come within 75% of PACFISH (USFS and BLM 1994b) standards for large wood (USFS et al. 1994). The stream

inventories from which Table E.1 is derived were also used for several of the above reports, so Table E.1 tends to corroborate what is already known.

Lumping data from large and small streams is generally inappropriate, and doing so for 5th-field watersheds in this analysis could give an inaccurate picture of habitat conditions. Also, not segregating data by location within a given watershed, and combining data from streams above and below private land is problematical.

Nevertheless, little real relative difference has been found among 5th-field watersheds in terms of large woody debris, even though the average number of pieces per mile varies over 10-fold (Table E.1). This absence of differences is because, with the exception of Three Rivers, large woody debris is in short supply in all basins compared to PACFISH objectives (USFS and BLM 1994b). This finding is not surprising because these are averages for extensive, heavily impacted areas that mask any better conditions in limited local areas that were not logged or stream-cleaned.

Relative condition of deep-pool habitat is highly variable because of the way criteria were set up, and it is strongly related to size of the stream (Table E.1). Mean widths of streams on the Siuslaw NF cluster around 10 feet, which is the dividing line for small and moderate-size streams. Thus, relative condition of streams less than 10 feet wide is based on percentage of pools that are more than 1.5 feet deep, while for streams more than 10 feet wide it is based on percentage of pools more than 3 feet deep. Reeves et al. (1989) found that pools deeper than 3 feet were excellent winter rearing habitat for coho salmon, and even pools 1.5 to 3 feet deep were more suitable habitat than shallower areas.

In streams less than 10 feet average width, the percentage of pools greater than 1.5 feet deep is consistently greater then the 20% minimum for good conditions, but in streams more than 10 feet average width, the percentage of pools greater than 3 feet deep is consistently less than 20%. Many of the smaller streams that appear to provide good deep-pool habitat (Marys Peak, Fall Creek, and Berry Creek) may in reality be just the opposite. The percentage of surface area in these streams that is comprised of pools is so low (11-21%) that it just means the few pools found happened to be deep ones.

Only 4 of 27 watersheds (15%) - the Little Nestucca River, Yaquina/Big Elk system, Big/Rock/Cape creeks, and North Fork Siuslaw River - do not have a poor rating in one of the three categories (percentage surface in pools, percentage of deep pools, and large woody debris/mile). As noted above, the North Fork Siuslaw rates poorly on a more site-specific basis. This site information suggests Table E.1 may even overestimate condition of the habitat. Indeed, if the width of the North Fork Siuslaw streams had averaged 10 feet instead of 9.9 (certainly possible given sampling error), relative abundance of deep pools would rate poor because only 6% of the pools were 3 feet or deeper.

Table E.1 Fish habitat conditions of inventoried streams

Watershed	Miles surv.	Avg. wid. ft.	Pool %	Rel. cond	Pools >1.5' %	Rel. cond	Pools >3 ft %	Rel. cond	LWD/ mile	Rel. cond	Riparian %Hard dom.	%Con dom
Wilson-Trask RB												
Little Nestucca	14.2	8.4'	40	fair	27	good	-	-	55	fair	47	43
Lower Nestucca	41.6	11.1'	22	poor	-	-	8	poor	58	fair	66	26
Neskowin	6.7	7.9'	22	poor	16	fair	-	-	17	poor	35	48
Three Riv.	2.5	11.4'	16	poor	-	-	1	poor	86	good	69	16
Siletz-Yaquina RB												
Schooner /Drift	24.1	16.2'	44	good	-	-	17	fair	31	poor	33	64
Siletz R.	0.1	5.8'	4	poor	0	poor	-	-	16	poor	57	41
Yaquina/ Big Elk	9.3	8.7'	52	good	45	good	-	-	44	fair	42	36
Upper Willam. RB												
Marys Peak	4.1	7.4'	21	poor	32	good	-	-	40	fair	22	76
Alsea RB												
Berry Cr.	1.3	8.6'	20	poor	40	good	-	-	50	fair	32	47
Big/Rock/ Cape	40.2	15.9'	32	fair	-	-	11	fair	48	fair	39	60
Five Riv.	61.0	10.2'	67	good	-	-	13	fair	19	poor	55	32
Lobster Cr	1.7	7.3'	51	good	31	good	-	-	13	poor	56	40
Fall Creek	11.8	9.3'	11	poor	100	good	-	-	58	fair	45	51
Alsea (03)	17.4	10.5'	41	good	-	-	7	poor	28	poor	18	65
Alsea (05)	16.6	12.7'	52	good	-	-	12	fair	16	poor	18	65
Drift (03)	20.2	8.0'	81	good	36	good	-	-	9	poor	31	63
Drift (05)	9.3	11.2'	53	good	-	-	8	poor	51	fair	31	63
Mercer Cr.	5.0	11.0'	60	good	-	-	18	fair	4	poor	39	28
Tenmile/ Cummins	22.3	19.2'	27	poor	-	-	19	fair	31	poor	39	52
Yachats R.	33.9	10.7'	61	good	-	-	6	poor	16	poor	46	35

Table E.1 (cont.)

Watershed	Miles Surv.	Ave. Wid	% Pool	Rel. Cond	%Pool >1.5'	Rel. Cond	%Pool >3'	Rel. Cond	LWD/ Mile	Rel. Cond	Riparian %Hard Dom.	Riparian %Con Dom
Siuslaw RB												
Deadwood (02)	4.3	12.1'	78	good	-	-	13	fair	13	poor	36	60
Deadwood (03)	2.7	11.6'	86	good	-	-	23	good	34	poor	36	60
N Fk Siu	56.1	9.9'	47	good	46	good	-	-	39	fair	38	51
Indian Cr	27.5	10.6'	57	good	-	-	14	fair	22	poor	37	55
Umpqua RB												
Low.Umpqua	4.2	10.6'	77	good	-	-	11	fair	14	poor	38	50
N.Fk.Smith	3.3	23.8'	80	good	-	-	7	poor	42	fair	30	45
Siltcoos RB												
Siltcoos R	4.4	8.8'	54	good	40	good	-	-	26	poor	42	38

Note: Data based on streams surveyed between 1991 and 1994. See Map E.7 (Fish-bearing Streams by Year Surveyed).
Standards used to assess relative condition of habitat in Table E.1 are:
Percent of stream made up of pools: <30% - poor; 30-40% - fair; >40% - good.
Percent of pools that are deep: <10% - poor; 10-20% - fair; >20% - good.
Pieces of LWD per mile: <40% - poor; 40-80% - fair; >80% - good.

Despite the generally marginal condition of the habitat, the most intact watersheds can serve as refugia on which to base recovery of depleted fish runs, and have been given special recognition and protection as key watersheds (USFS 1993b) (Table B.4, map E.4). This concept is supported by more site-specific watershed analyses which indicate that the best remaining fish habitat is mostly in pristine streams in the Cummins Creek and Rock Creek Wildernesses (USFS 1994a) and in the partially roadless Niagara Creek complex key watershed of the Nestucca River basin (USFS et al. 1994). Also, virtually all the habitat in the North Fork Siuslaw River system that is in fair or better condition is in the five subwatersheds that constitute the key watershed there (USFS 1994b).

Most potential for production of fish historically was in large, low-gradient streams. Most of the volume of water (habitat quantity) is found there, and the low gradients (habitat quality) provide more capacity for fish to feed, rear, and survive high water velocities, particularly during winter storms. At the scale of the present analysis, areas with such streams generally equate to lower reaches of river mainstems, which were ideal for early homesteads and are still almost exclusively privately owned. Therefore, the private lands strung up river valleys (see maps) generally contain those stream reaches in the Coast Range with the most intrinsic capacity for fish. Most of this habitat is now

severely degraded by farming, logging, and other development, however, and much potential has been lost because of entrenchment of the channels (USFS et al. 1994).

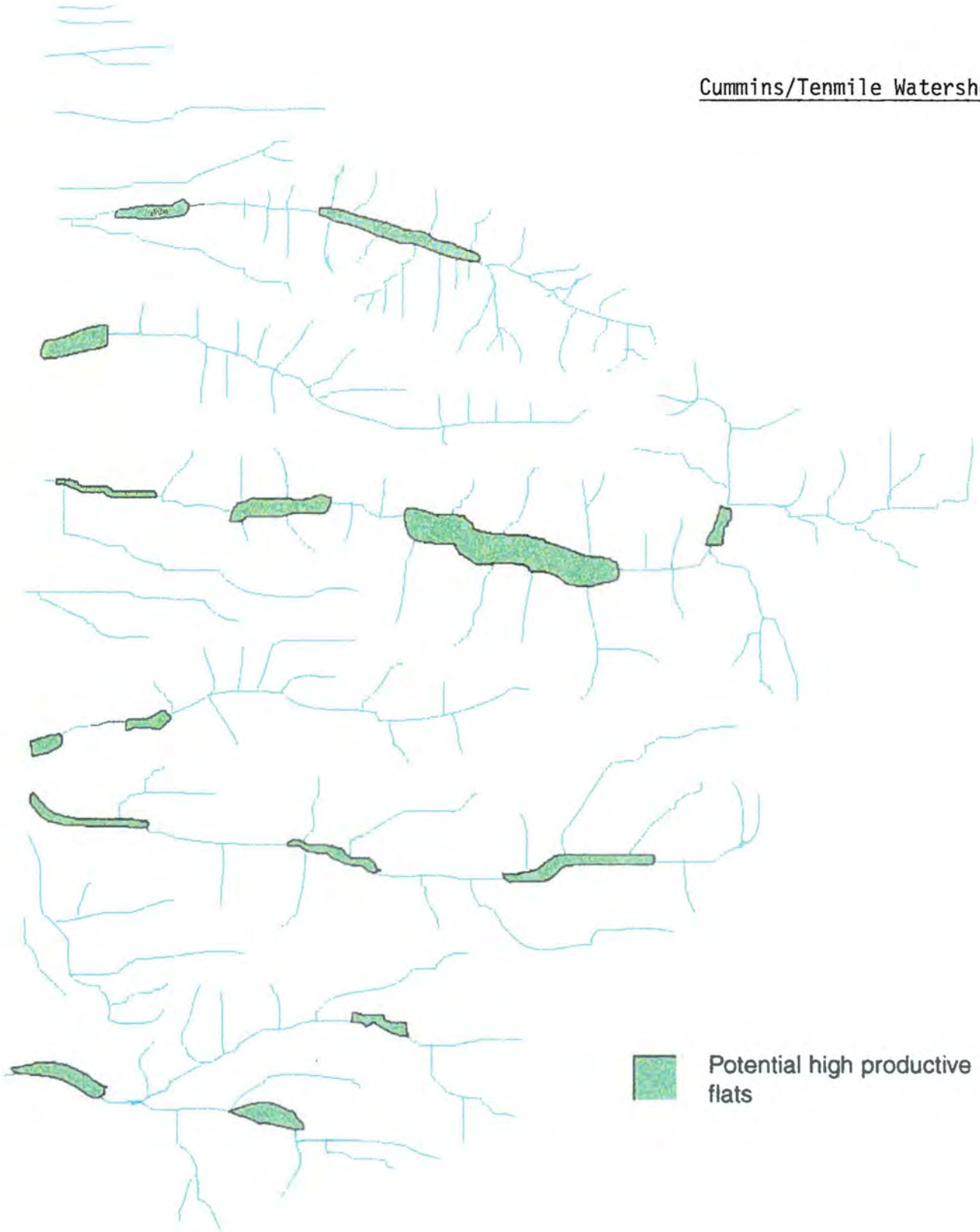
Some discontinuous low-gradient areas with increased potential for fish habitat exist upstream on steeper federal lands, however. These areas, commonly called "productive flats", consist of localized, wide flood plains across which main and side channels of streams are free to meander, recruit large logs and form debris jams, and otherwise create deep pools and other prime habitat (Reeves 1988). Because productive flats cannot be shown on maps with scales appropriate to a provincial analysis, more site-specific maps of flats and historical fish habitat potential in individual 5th-field watersheds from Dewberry (1994), USFS (1994a and 1994b), and USFS et al. (1994) are included (Figs. E.1 and E.2).

The Siuslaw NF has a written strategy for restoring whole watersheds, with a primary objective of improving stream habitats (USFS 1993b). Efforts are focused on identifying and securing the best remaining habitat within key watersheds (see maps for their location), and special emphasis is given to projects that directly benefit anadromous salmonids. Additional emphasis is on habitats either contiguous with the best remaining habitats, or in key "nodal" positions downstream (PRC 1993). These concepts apply at various scales from 5th-field watersheds down to stream reaches.

Riparian Conditions

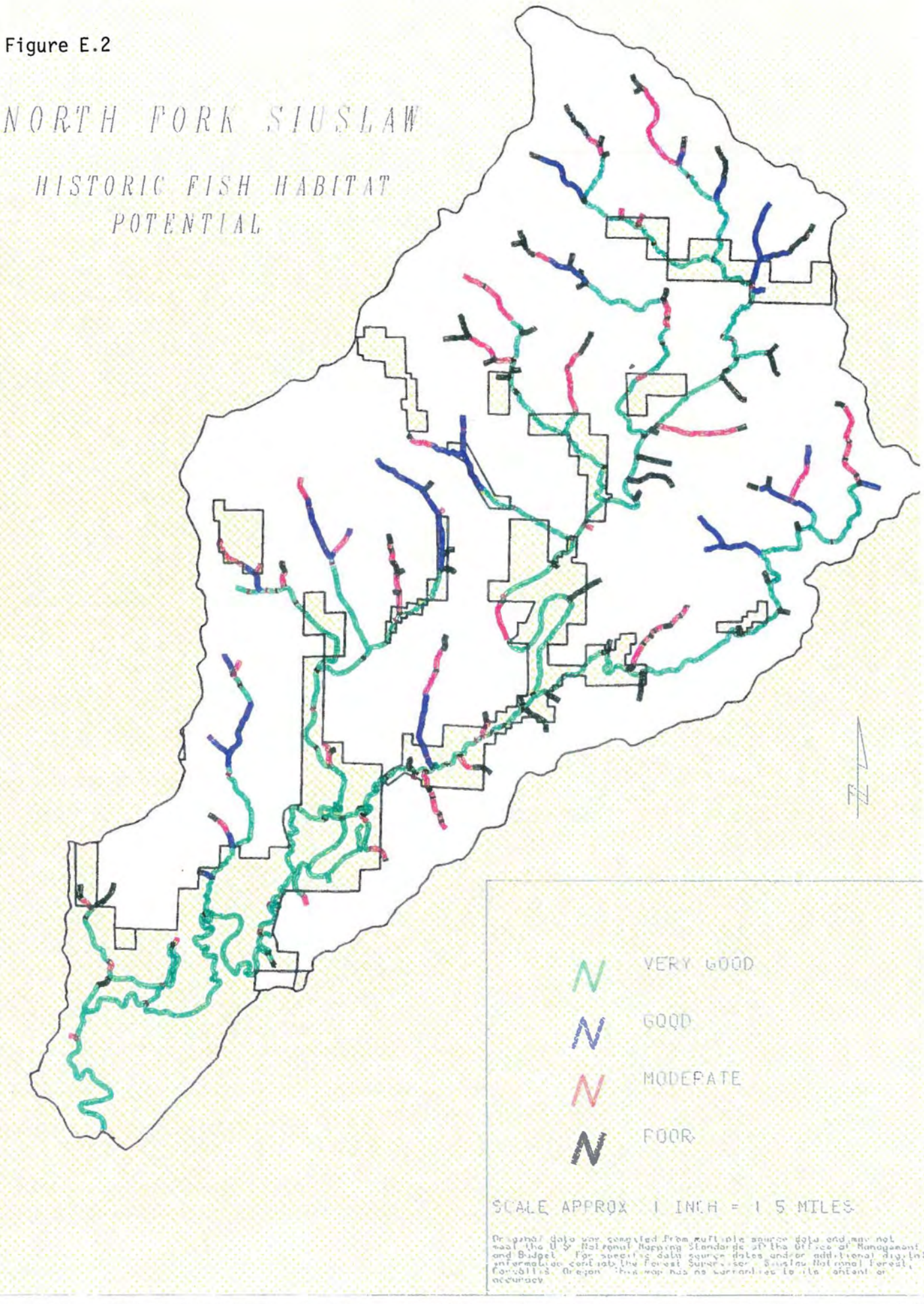
Hardwood trees are far less resistent to decay than are conifers and serve as critical habitat-forming instream structure for a relatively short time. Therefore, much of the current shortage of large woody debris in streams and adjacent areas has been attributed to conversion of riparian stands dominated by large conifers to shrubs and red alder (USFS 1990, 1994a, 1994b; USFS et al. 1994; many others). The percentage of federal land within 100 feet of streams (riparian area) dominated by hardwoods and conifers is shown in Table E.1.

Comparison of general instream habitat conditions in 5th-field watersheds (percentage of reach in pools, percentage of deep pools, and abundance of large wood) with riparian vegetation in those watersheds does not indicate any significant relations (Spearman Rank Correlations of 0.08-0.27 for various comparisons). This lack of cause-and-effect suggests that valid comparisons on the large scales appropriate to this assessment are difficult because strong correlations between deep pools/LWD and relative abundance of structure-forming riparian conifers in more localized areas are to be expected. Any broad relations for a watershed could easily be destroyed by removal of large woody debris from channels during logging and stream cleanout activities in a portion of the basin. Also, current vegetation typing for riparian areas is often based on more extensive adjacent upland conditions, which may or may not be representative.



FigureE:1Location of potential hot spots (high productive flats) in the study area. Data partially from field work by T.C. Dewberry and J. Sleeper. Rest of data from work by J. Sleeper. Redrawn from original map by J. Sleeper.

Figure E.2


NORTH FORK SIUSLAW
HISTORIC FISH HABITAT POTENTIAL
VERY GOOD
GOOD
MODERATE
POOR
SCALE APPROX 1 INCH = 1.5 MILES
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.

Fish Habitat Needs Within Late-Successional Reserves

Shortages of conifers in riparian areas and resultant large woody debris in streams have been clearly identified as major factors limiting production of anadromous salmonids in the Coast Range. One short-term solution to this situation is construction of instream structures by using boulders and logs. Studies have shown that large, complex log structures provide deep pools and good cover. Thus, large, standing conifer trees within 100 feet or so of streams have great innate value as habitat to assist in recovery of depleted anadromous salmonid runs. Dewberry (1994) points out that, in a productive flat area, just a couple of large conifers are needed to reconnect the stream channel with its floodplain, and create complex pools and side channels.

If conifers are abundant in the riparian area, and the trees are not needed as habitat for Threatened and Endangered wildlife species, consideration should be given to making these surplus trees available for falling for instream structure projects. Outside streamside areas, hazard trees, blowdown, and other conifers that are not needed as downed large woody debris should be considered for transport and use for instream structures. On the Siuslaw NF, the total number of large conifers needed for this purpose would not exceed 50 per year (12 per district).

ODFW Objectives

The Oregon Department of Fish and Wildlife advises federal land management agencies on habitat issues, and coordinates fish management activities such as stocking fish on federal land. The Department is preparing plans to manage fish resources in most basins within the boundary of the Siuslaw NF: i.e., the Salmon, Siletz, Yaquina, Alsea, Yachats, Siuslaw, and Umpqua rivers and mid-Coast small ocean tributary streams. These basin plans contain specific goals for various habitat components (stream conditions, instream flows, water temperature, channel complexity, sedimentation, nutrient recycling, water quality, and fish passage), but they are currently in draft form and available for internal review only, so details are not included here.

In general, though, the intent of The Department's basin plans is highly complementary to the Forest's intent to manage fish habitat in watersheds under the direction in the Forest strategy (USFS 1993b) and the Northwest Forest Plan (USFS and BLM 1994a). Oregon's objective to manage for self-sustaining fish assemblages native to the basin, rather than individual fish populations, mirrors the Forest Service's emphasis on ecosystem management and wild populations. Other complementary policies and objectives are emphasizing habitat protection over habitat restoration and enhancement; restoring and maintaining viable populations of all species of native salmonids; focusing restoration attempts on coho salmon, if single-species management is appropriate; reversing the declining condition of habitat so that measurable improvements or stabilization can be achieved in key aspects of watershed conditions reflective of a basin's capacity to produce fish; and preserving the best fish habitat that still exists so that these key watersheds will serve as refuges for fish to repopulate more degraded habitats as they recover.

Management Implications

For many years, the Siuslaw NF spent $200,000-$300,000 annually on fish habitat enhancement and restoration projects such as instream structures and planting conifers in riparian areas. In the last 2 years, this work has taken the form of a broader, $1-2 million program of watershed restoration activities. Most work in the near future is expected to focus on watershed restoration.

In recent years, the Forest has also been developing a strategy to guide protection and restoration of fish habitats and populations (USFS 1993b). Basic components of the comprehensive, integrated strategy are protecting existing conditions, identifying key watersheds, developing watershed plans and partnerships with others, and increasing public understanding and participation, all leading untimately to restoring whole watersheds. All these components have analogous counterparts in the Aquatic Conservation Strategy, i.e., riparian reserves, key watersheds, watershed analysis, and watershed restoration (USFS and BLM 1994), so Forest efforts to benefit fish are continuing uninterrupted under the Northwest Forest Plan.

Because the Forest's long-term strategy for fish and watersheds is so similar to the intent of the Aquatic Conservation Strategy, no major conflicts in philosophy or direction currently exist. Problems are more logistical and suggest the following major recommendations:

> Make more of the Threatened and Endangered species budget available for projects benefiting listed fish species and to support efforts to keep other fish from being listed;
>
> Provide more time for adequate up-front planning and scoping of habitat and restoration projects by prioritizing work loads more rigorously;
>
> Provide adequate support funds with the jobs-in-the-woods restoration program;
>
> Look for ways to improve the process of contracting stream surveys; and,
>
> Support more monitoring of site-specific effects of fish habitat structures.

Although tenets of the watershed and fish habitat restoration strategy are sound and widely supported by outside groups and the academic community, long-term effectiveness of many restoration activities like road stabilization, precommercial thinning, and riparian planting are relatively untested. Thus, monitoring of whole watershed restoration efforts is a high priority, and the Forest is one of four in the Region that is developing a program to do so in cooperation with the PNW Research Station. The Umpqua River basin, which includes three key watersheds and one roadless area where fish habitat is extensively protected and enhanced, is of special concern because the cutthroat trout in this basin have been proposed for listing as endangered.

As a result of fragmented and intermingled land ownership patterns in the Coast Range, those stream reaches with the lowest gradient and greatest potential to produce fish are mostly on private land (Fish Habitat section). Thus, federal

agencies have limited ability to unilaterally restore fish habitat and runs on a large scale, and ultimate recovery of anadromous fish stocks in coastal streams depends on heavy participation by other landowners and groups. Such cooperative efforts would appear to be a major challenge in basins with a large number of individual owners. Basins that offer the most promise could be those where non-federal lands are largely owned by major timber corporations, such as Drift Creek of the Alsea, Wassen and Knowles creeks, and streams draining into Tahkenitch, Siltcoos, and Tenmile Lakes.

F. SOCIAL SETTING

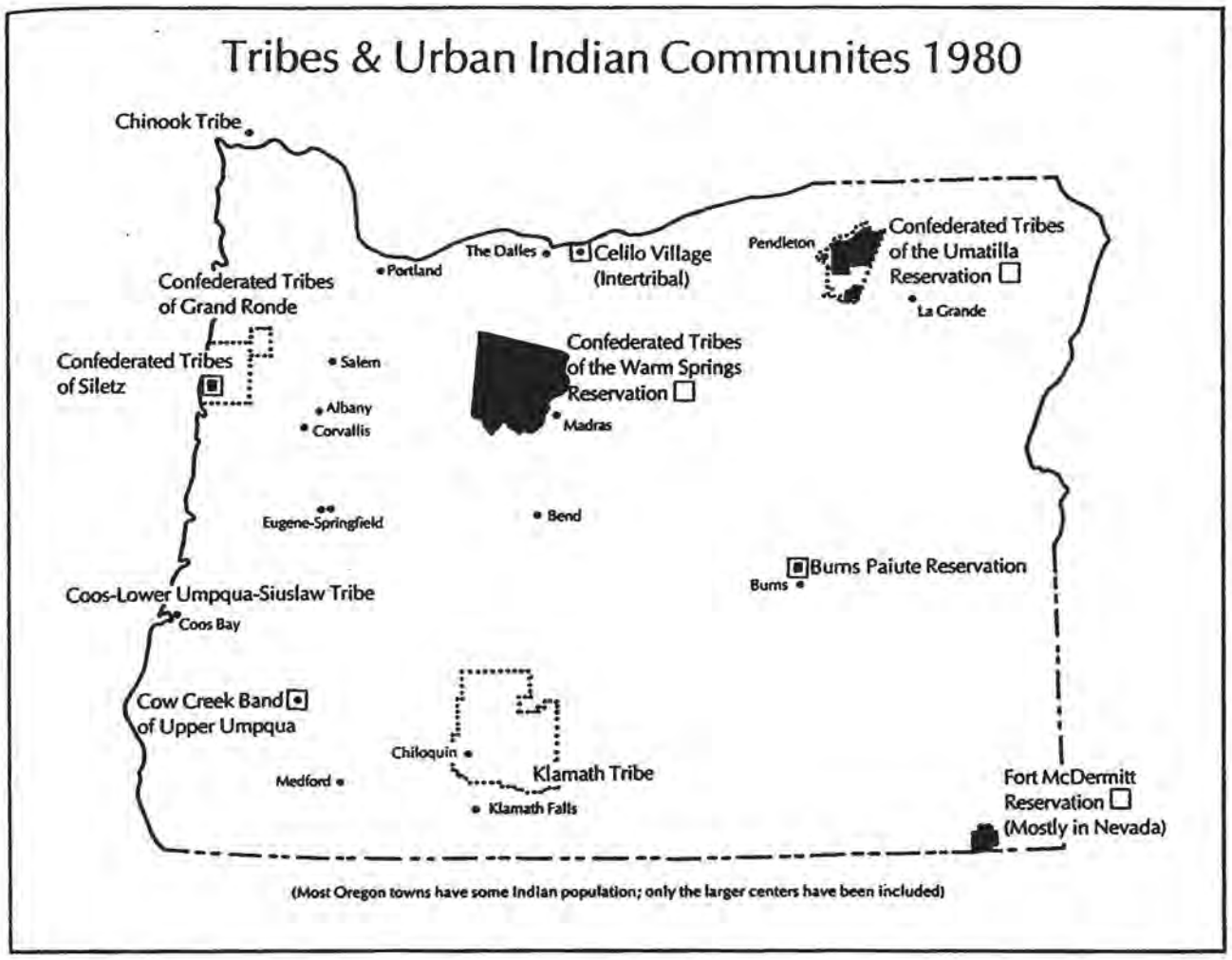
HISTORY OF HUMAN SETTLEMENT

American Indian Societies and Current Issues

The coastal and interior valleys of western Oregon have been the homeland of culturally and economically diverse American Indian societies for millenia (Beckham et al. 1982). The Euroamerican settlement of western Oregon resulted in catastrophic population decline and displacement among the region's Indian peoples. During the mid-1850s, surviving Indians from throughout western Oregon were placed on a large, multi-tribal Indian reserve encompassing parts of the Oregon coast and Coast Range. Throughout the late-1800s, in an effort to bring tribal peoples into the "American mainstream", and to open the area to white settlers, the size of the reserve was drastically reduced. Tribes living there were finally "terminated" from federal supervision and control in the early 1950s; that is, western Oregon's reservations were closed. A reversal of American Indian policy in the mid-1970s has led to federal re-recognition of western Oregon's tribal peoples. Today, western Oregon's Indians are grouped into tribal confederations (Figure F.1) whose centers of government and small reservations are located in Coos Bay, Grand Ronde and Siletz (Zucker et al. 1983).

Given the complex history of these tribal peoples, present reservation boundaries do not accurately reflect the far-reaching cultural, economic and political interests of past or contemporary tribal governments. Today, delineating geographic areas with exclusive interest to a single confederated tribe is not easy. For purposes of describing tribal interests in the Study Area, the Confederated Tribes of the Grand Ronde Community express greatest concern for lands from Lincoln City northward. Members of the Confederated Tribes of the Siletz, many of whom occupy its 3,666 acre reservation, are concerned with lands west of Corvallis to the Oregon Coast, and south to Tenmile Creek near Cape Perpetua Scenic Area. The Confederated Tribes of the Coos, Lower Umpqua, and Siuslaw are concerned with lands from Cape Perpetua to Coos Bay, including the Oregon Dunes National Recreation Area. In addition, the Coquille Tribe has interests in lands around Coos Bay. None of the Tribes has reserved treaty rights on federal lands, but much of this land is composed of former Indian allotments and was once included in the Coast Reservation.

The Study Area includes places once used by American Indian peoples as villages, fishing and shellfish gathering stations, religious sites, and cemeteries, and thus is rich in archaeological evidence and artifacts (Beckham et al. 1982; Minor et al. 1985; Minor and Toepel 1986; Minor 1992). Land ownership maps and archival data document the boundaries of the Coast Range Reserve and the later location of Indian Allotments. Current natural resource management issues of interest to the tribes involve fisheries, wildlife, water quality, and timber. Thus, the confederations have a vested and far-reaching interest in the lands encompassed by the Study Area. Western Oregon tribal governments should be included in NEPA scoping analysis, and public review of Forest Service projects affecting natural and heritage resources within the



KEY
- Reservations
- Former Reservations (Boundaries at termination)
- Federally Recognized

Source: Zucker, Jeff, K. Hummel and Bob Hogfoss. 1983. Oregon Indians: Culture, History and Current Affairs.

Figure F.1 Locations of Indian Tribes (1980)

Study Area. Key sources of information about tribal contacts, protocol, and consultation are the Siuslaw National Forest archaeologist, the Oregon State Historic Preservation Office Commission on Indian Services (located in Salem). Two important Forest Service sources about working effectively with the tribes are available from the Forest Service: "Desk Guide to Tribal Government Relations" (R-6 Regional Office 1991); and "Forest Service National Resource Book on American Indian and Alaska Native Relations" (Washington Office 1995). Archaeological remains, sacred sites, and human burials are protected under both state and federal historical preservation statutes and therefore require special consideration and consultation among the tribes, the State Historic Preservation Office, and the agency during project analyses, planning, and implementation.

White Settlement and Influence on Current Landscape Patterns

The first European maritime explorers arrived on the Oregon coast in the late 1700s. Soon thereafter, land-based explorations and the fur trade brought mountain men, fur traders, and missionaries into the Willamette Valley and Coast Range. Trading outposts in the wilderness, such as Fort Vancouver on the Columbia River, eventually attracted settlers to the fertile soils of the Willamette Valley. By 1845, some 6,000 people had traveled the 1,900 miles across the "Oregon Trail". The Donation Land Act of 1850 and the Homestead Act of 1862 provided incentives for settlement in the Willamette Valley and the Coast Range. Large tracts of timberland, and homesteads that never "proved up", became incorporated in the National Forest system. Eventually, agriculture, logging, and commercial fishing provided the economic foundation for developing communities and the current way of life in the Willamette Valley, Coast Range, and coast.

Pioneer cemeteries, historical trails and wagon roads, homestead remains, and fruit orchards are remnants of Willamette Valley and Coast Range pioneer history throughout the Study Area. Federal acts such as the Forest Homestead Act of 1906 and the Western Scattered Settlers Project of 1906 required close government scrutiny of "homesteads", fortunately resulting in inspection records, inventories, and detailed maps denoting building locations, land features, and vegetation types (Juntunen and Roberts 1994). These records add insight into local pioneer and settlement history, and they are an invaluable source of baseline data about the area's natural environment at the turn of the century.

The Study Area contains an abundance of historical sites dating from the mid-1850s to the 1930s. Some sites have likely been recorded during previous cultural resource inventories for timber sales and other projects. These records are housed in the Forest Supervisor's and Ranger District Offices and should be consulted before any project is begun in the Study Area. Additional compliance-level cultural resource inventories may also be required. The Siuslaw NF has a detailed data base of settlement records, which should be used to guide effective field inventories (Juntunen and Roberts 1994). These records would also provide baseline information useful in reconstructing the historical Coast Range environment. For example, Coast Range settlers logged the forest; created innumerable meadows and forest openings for buildings, gardens, and pasture; planted fruit orchards and other "exotic" trees and shrubs; and were responsible for many of the fires that swept through the Coast Range. Although the specific effects of these homesteads may be

difficult to see today, cumulatively they are responsible, in part, for the current condition of the Study Area, and the human land-use patterns within it.

CURRENT SOCIAL SETTING AND EMPLOYMENT

Population characteristics of the Study Area may help identify and explain current and future forest-related human uses. For example, analysts and managers ought to know about population center location, growth rates, and shifts in demographic and economic characteristics, all of which may influence recreation choices and visitation rates on public lands in the future.

Most census and employment data are aggregated at the county or city scale. Although some of the nine counties we describe--Tillamook, Washington, Yamhill, Polk, Lincoln, Benton, Lane, Douglas, and Coos--are not entirely contained within the Study Area, their social characteristics are relevant to the assessment because the people who live in them recreate in, travel through, and contribute to or derive resources from the Study Area.

Demographics

Detailed population data for the nine-county area for 1980, 1990, and 1993 are given in Appendix F.1 (Oregon Housing and Community Services Department, 1993; Center for Population Research and Census, 1994). The data reveal some of the demographic characteristics discussed below. Many of the area-wide figures will mask variation among individual counties; individual county data are also found in Appendix F.1.

Racial/Ethnic Distribution

Although minority populations grew rapidly (by about one third) between 1980 and 1990, the total number of minority residents in the area is still small. The 1990 U.S. census figures show that the population of the area is predominantly (94%) white, with county figures ranging from 92% to 98%. Nationwide, about four out of five persons is white. People of Hispanic origin are included in the White racial group, and comprise 3.5% of the area population. Racial group populations for the entire area are 2.6% Asian, 1.1% Native American, 0.6% Black, and 1.1% "Other".

Population Distribution

In 1993, the nine-county area contained an estimated 1,068,600 people, or 35% of Oregon's population. Fifty-eight percent of the population was classified as living in incorporated and 42% in unincorporated areas. Most of the population living in or close to the Study Area is concentrated in urban, relatively densely populated areas in the Willamette Valley: Portland, Salem, Albany, Corvallis, Eugene, and Springfield. The Coast Range portion of the area is relatively sparsely populated, and the coastal portion contains several small cities and towns.

The northern portion (Tillamook, Washington, and Yamhill counties) and southern portion (Lane, Douglas, and Coos counties) of the area both contain about 42% of the area's total population; just 16% live in the middle three

counties (Polk, Lincoln, and Benton). These population concentrations are largely due to the densely populated Portland metro area in Washington County, and the Eugene-Springfield metro area in Lane County. Washington and Lane Counties are the two most populous counties, with 33% and 28% of the total. Tillamook and Lincoln Counties are the least populous of the nine counties, with 2% and 4% of the area total. Each county's 1993 population and its percentage increase since 1990 are shown in Figure F.2.

Population Growth

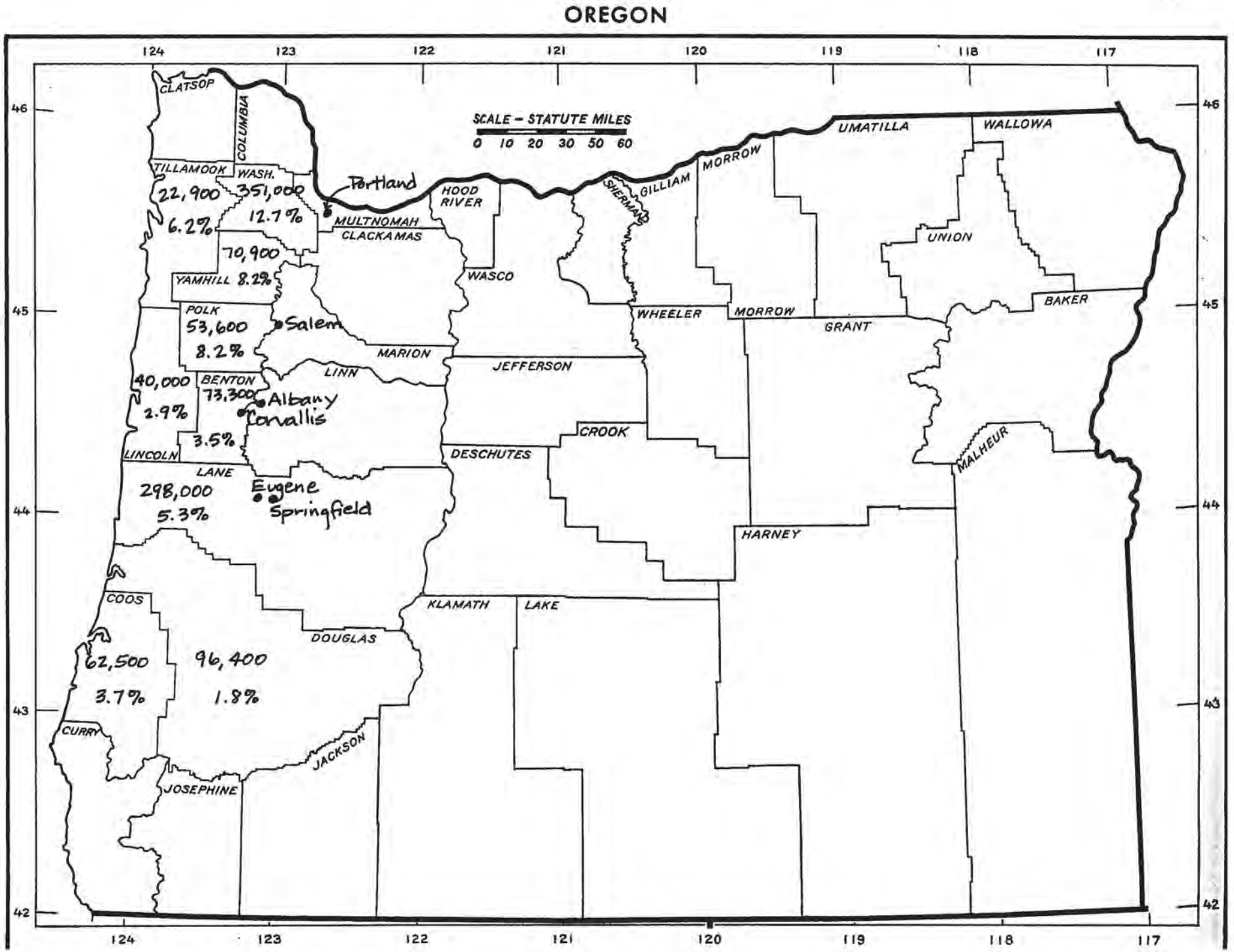
Population change is the result of two factors: natural increase (births minus deaths) and net migration (persons moving into an area minus those moving out). Population growth figures for 1980-1990 and 1990-1993 are shown in Table F.1. The nine-county area population increased 10.1% during 1980-1990 and 7.3% (a significantly higher annual rate of increase) in the three years from 1990-1993. This recent increase is striking because most of the Study Area counties grew far more slowly from 1980-1990 than the 10.1% average indicates. Above-average growth in Washington and Yamhill counties during that decade mask very slow growth--and sometimes decline--in the rest of the area.

Table F.1 Coastal city population changes (1980, 1990, 1993)

Coastal counties and cities	1980 pop.	1990 pop.	1993 pop.	80 - 90 Increase	90 - 93 Increase	80-93 Increase	80-90 % change	90-93 % change	80-93 % change
TILLAMOOK COUNTY	21,164	21,570	22,900	406	1,330	1,736	2%	6%	8%
Bay City	986	1,027	1,055	41	28	69	4%	3%	7%
Garibaldi	999	886	930	(113)	44	(69)	-11%	5%	-7%
Rockaway Beach	906	970	1,105	64	135	199	7%	14%	22%
Tillamook	3,981	4,006	4,190	25	184	209	1%	5%	5%
LINCOLN COUNTY	35,264	38,889	40,000	3,625	1,111	4,736	10%	3%	13%
Depoe Bay	723	870	940	147	70	217	20%	8%	30%
Lincoln City	5,469	5,892	6,195	423	303	726	8%	5%	13%
Newport	7,519	8,437	8,885	918	448	1,366	12%	5%	18%
Waldport	1,274	1,595	1,700	321	105	426	25%	7%	33%
Yachats	482	533	600	51	67	118	11%	13%	24%
LANE COUNTY	275,226	282,912	298,000	7,686	15,088	22,774	3%	5%	8%
Dunes City	1,124	1,081	1,185	(43)	104	61	-4%	10%	5%
Florence	4,411	5,171	5,705	760	534	1,294	17%	10%	29%
DOUGLAS COUNTY	93,748	94,649	96,400	901	1,751	2,652	1%	2%	3%
Reedsport	4,984	4,796	4,875	(188)	79	(109)	-4%	2%	-2%
COOS COUNTY	64,047	60,273	62,500	(3,774)	2,227	(1,547)	-6%	4%	-2%
Bandon	2,311	2,224	2,425	(87)	201	114	-4%	9%	5%
Coos Bay	14,424	15,076	15,170	652	94	746	5%	1%	5%

During the early and middle 1980s, a nationwide recession accompanied by a shortage of local job opportunities resulted in increased out-migration. Incorporated areas actually grew by 17.8%, while unincorporated areas increased by just 1.1%. These percentages illustrate that though total population grew, out-migration was taking place from small towns and rural areas, largely related to reduced timber-based employment.

Figure F.2 Estimated 1993 county populations and % increase from 1990-1993



In the late 1980s a recovering economy increased the availability of jobs, resulting in reduced out-migration and increased in-migration, a trend that has continued into the 1990s. Economic and population growth have been due in part to industrial diversification during the 1980s, and to inflows of new residents from California and other places with relatively less healthy economies. Traditionally timber-dependent communities and counties have continued to lose residents or have grown much more slowly in the 1990s than the rest of the area.

Two important features of recent (1990-1993) population growth are significantly increased net migration (as compared to natural increase), and a growing number of older citizens. From 1990 to 1993, population growth in the nine-county area from net migration was 52,139, or 72% of total growth. County figures for this statistic ranged from 48% (Douglas) to 96% (Tillamook) of total growth (Figure F.3).

Between 1990 and 1993, 14% of net migration was by residents age 65 and over, compared to 9% for Oregon. The 1993 proportion of area residents in this age class is 13%, up from 10% in 1980. County residents age 65 and older range from 10% (Washington and Benton) to 21% (Tillamook and Lincoln) of the total population (Figure F.4). Along with a general aging of the population has been an apparent influx of retirees to western Oregon, particularly to some of its coastal communities. Population changes in coastal cities within the Study Area are shown in Table F.1.

Future population growth in the Study Area will be governed by a host of factors operating at national, regional, and local scales. The Northwest Policy Center (1995) projects that growth in technology, communications, trade and services, and construction are expected to create job opportunities in these sectors. In-migration to western Oregon will continue, though more slowly than in the 1990-1993 period, as economic conditions and job prospects elsewhere improve. Continued influx of retirees from out of state is expected to continue (Oregon Employment Department 1993). Retirees tend to contribute to the stability of local economies, because many have sources of income not readily affected by fluctuations in the business cycle.

Employment and Economy

Statistics describing employment levels in different sectors distinguish between agricultural and nonfarm jobs; nonfarm jobs are further separated into manufacturing and nonmanufacturing sectors. In the nine-county area, nonmanufacturing employs far more workers (77%) than do the manufacturing (20%) or agricultural--farm, fishing, forestry--(3%) sectors (Oregon Employment Department 1993). The various nonmanufacturing sectors and their share of jobs in the area are services (22.8%); retail trade (20.1%); government (16.1%); wholesale trade (5.9%); finance, insurance and real estate (4.2%); construction (4.1%); transportation, communication, and utilities (3.5%); and mining (0.2%). Employment for individual counties, which varies widely, is shown in Appendix F.2.

Figure F.3 Percent of 1990-1993 growth due to net migration, by county

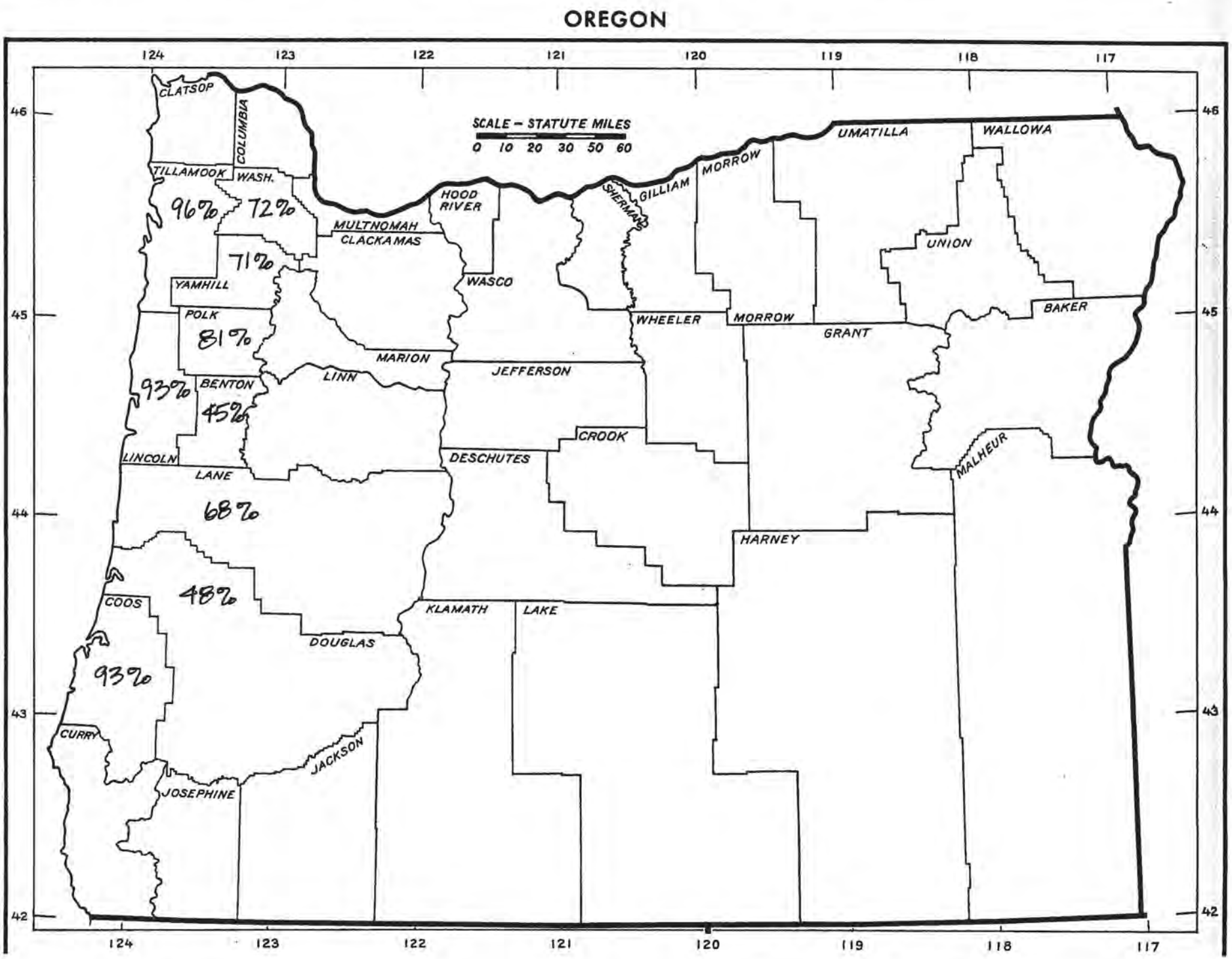
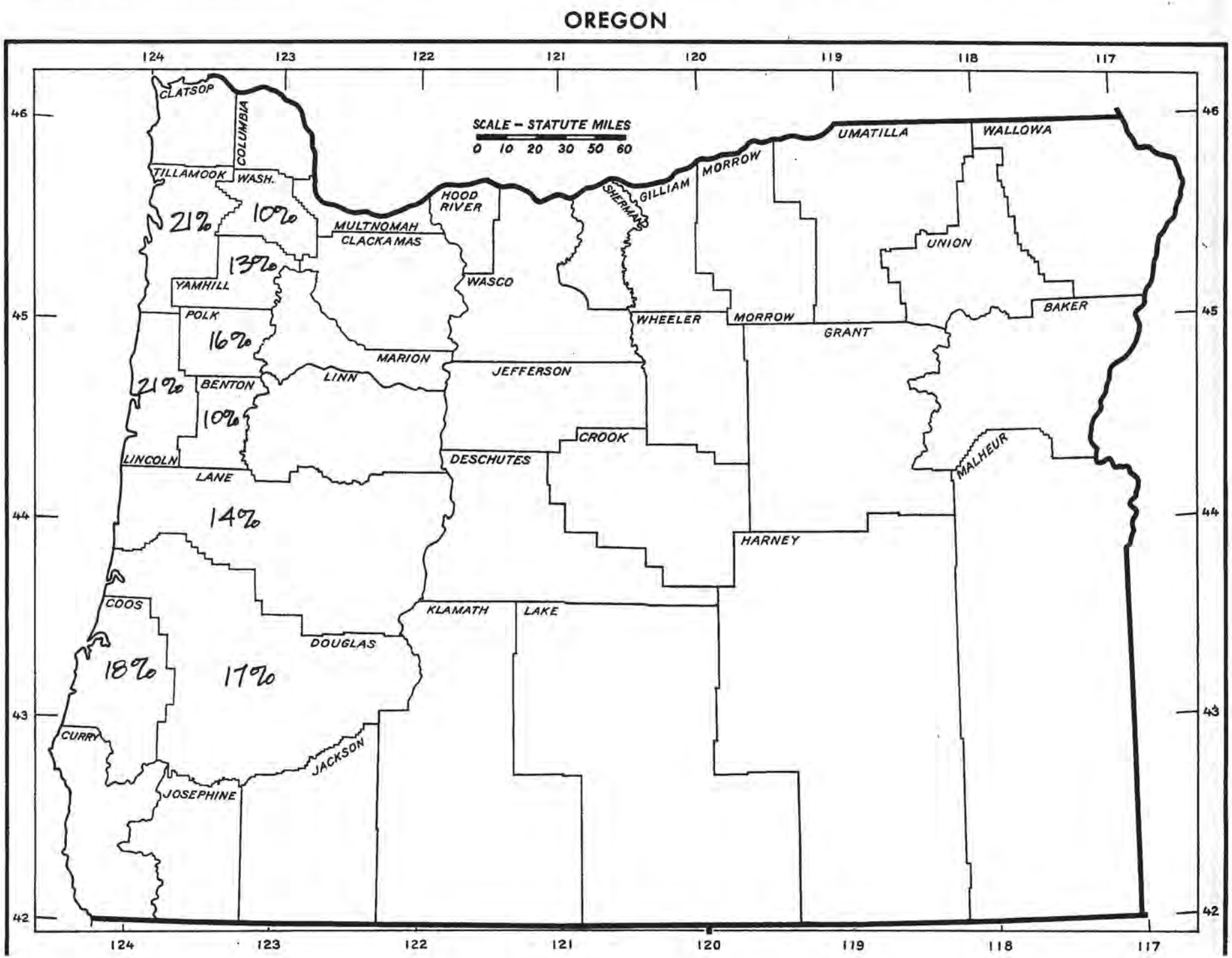


Figure F.4 Percent of population that is greater than 65 years of age, by county (1993)

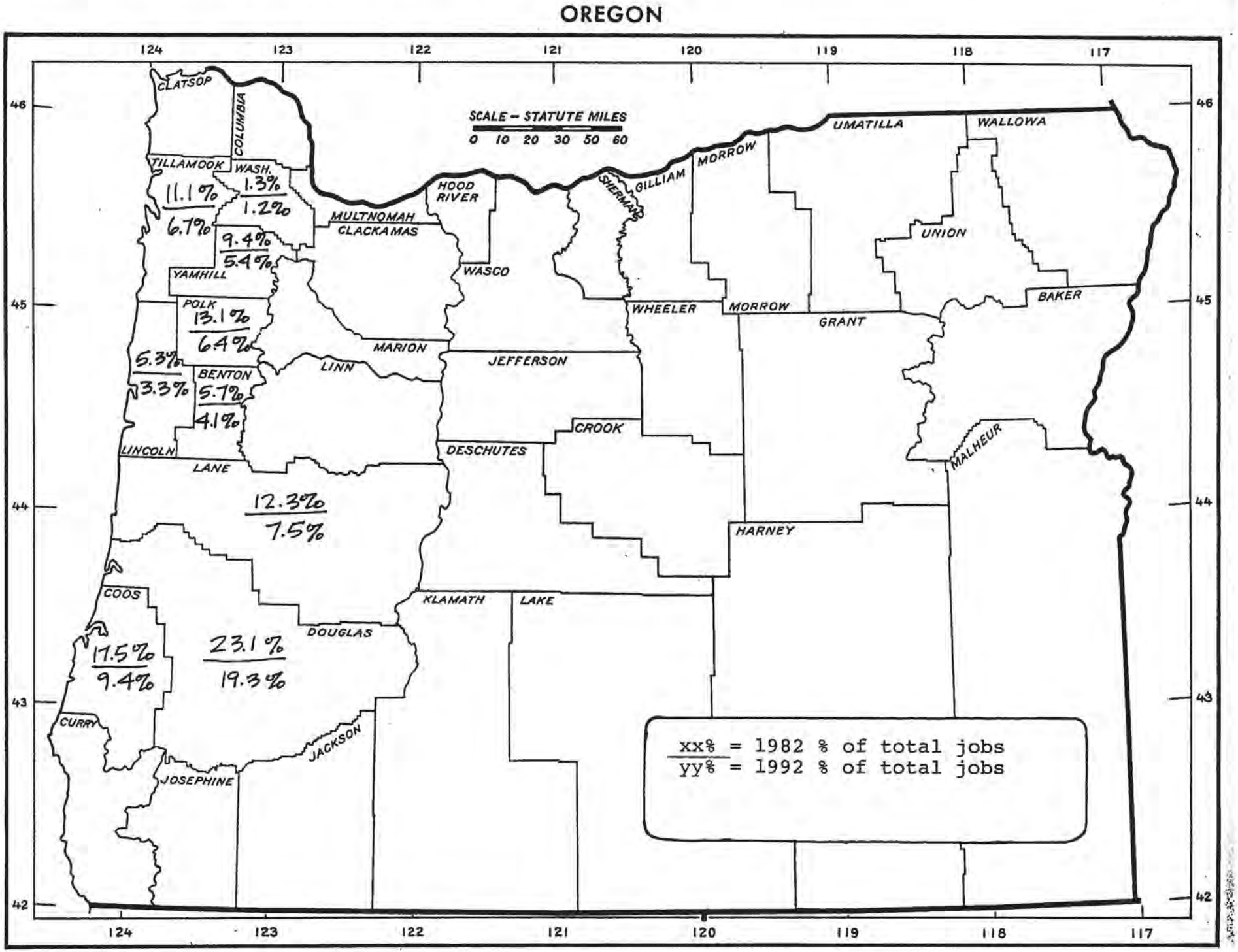


Between 1982 and 1992, farm jobs in the area increased by about 72% (from 6,364 to 10,959) but remained a small proportion of the total workforce, increasing from 2.2 to 2.8% of the total. Total jobs in the nine-county area grew by 38%, but jobs in manufacturing grew far more slowly (8%), dropping from 26 to 20.3% of all employment. Although manufacturing employment grew slowly in the past decade, its composition shifted markedly. Employment in the lumber and wood products sector shrunk by almost 4,000 jobs between 1982 and 1992, dropping from 9.1 to 5.6% of all employment. These losses were balanced by a gain in nontimber manufacturing jobs scattered across a wide range of industries.

The declining relative importance of the manufacturing sector in Oregon reflects a nationwide trend, caused in part by: growth of manufacturing in other countries; introduction by U.S. manufacturers of labor-displacing technologies; and declining supplies of inexpensive and easily accessible raw materials. The substitution of technology for labor and the declining supply of cheap natural resources have had especially important effects on local resource-based industries: lumber and wood products, paper, and fishing. In Oregon, the recession of the early 1980s brought about the introduction of more automated production processes and a phasing out of older mills, resulting in a need for fewer workers. Reduced timber supply from public lands in the 1990s has contributed to lower lumber and wood products employment. The 1982 and 1992 proportion of jobs in the lumber and wood products sector for each county is shown in Figure F.5. 1992 county figures range widely, from a high of 23.1% in Coos County, to a low of 1.3% in urban Washington County.

As the proportion of resource-based jobs has declined, services, trade, construction, and manufacture of electronic equipment, machinery, and manufactured housing have shown above-average growth. The increased role in the economy of activities related to information transfer and technology is expected to continue, as is growth in secondary processing of forest products (Northwest Policy Center 1995).

Figure F.5 Lumber and wood products employment as a percentage of total jobs, by county, for the years 1982 and 1992.



ROAD NETWORK

Roads through the Study Area form a grid. Highway 101 along the coast is parallel to major roads in the Willamette Valley. East-west oriented roads, roughly parallel to each other, cross the Coast Range and link the coast and the valley, and their major population centers. Many smaller, winding roads cover the intermediate area, where the topography is hilly.

Road access to federal lands in the Study Area will decrease. Many federal and county roads were built to transport harvested timber. Within the Siuslaw National Forest, miles of road peaked at about 2,400. Because of recent declines in federal timber sales and accompanying reductions in road maintenance funding, the Forest will be reducing open roads to one-fourth of its historical maximum over the next several years. County and state roads through the Study Area are expected to remain static; the county is not building new roads. Any new roads built in the immediate future in the Study Area are likely to be private.

Emphasis on trails has increased throughout the Study Area, primarily for recreation, but also with some interest in providing alternatives to roads as transportation routes.

CURRENT USES

Scenery

The Study Area falls within the Coast Range characteristic landscape. A characteristic landscape or landscape character type is a geographical area that has "similar visual characteristics of land form, rock form, vegetation, and water form. No single landscape feature alone determines a character type; all features combine to create a certain visual image, but land form is usually more influential than other characteristics" (Pollock et al 1981). The Coast Range landscape:

> "contains steep mountain slopes with ridges that are often extremely sharp. The ridge system is usually parallel to the coast, but is dissected so much that it may not be readily apparent. Steep mountain slopes often drop directly to the ocean edge especially at headlands, but most river mouths and bays have flat coastal plains. The extensive dunes area is nearly level at the ocean edge. Gentle valley lands are also found on the eastern fringes of the mountains as they join with the Willamette basin.
>
> "In both the mountains and the coastal margin, the vegetation is generally a dense stand of coniferous forest with dense understory. The pattern is broken in the mountains by hardwoods in hillside masses and along drainages. Natural openings also occur on barren peaks and small meadows. Along the coastal margin, the sand dunes, salt marshes and rocky barren areas frequently break the dense vegetation. Vegetation is characterized by Sitka spruce, western hemlock, western red cedar, Douglas-fir, grand fir and red alder.

The coastal margin has a wide variety of water features including bays, river mouths, streams and some fresh water lakes. The inland mountains have no lakes, some rivers and numerous streams and creeks.

Rock features are numerous along the coastal margin in the form of headlands and sea stacks. Inland, only occasional rock features appear along rivers or as rock outcrops and cliffs on mountain slopes or peaks." (Pollock et al 1981)

Experience of the Landscape

People perceive broad distinctions in scenery in the Study Area. The large landscape image is of three landforms--valley edge, Coast Range, and ocean side--and the corridors that cross the Range. These landscape divisions parallel the coast line and divide the land west to east.

Tidal river flats with associated pasture and farmland are a finer distinction in land type and associated use. People are interested in these areas seen when nearing the coast traveling east to west, and that also break up the coastline south to north. Such valuable and beautiful tidal-influenced lands are seen east of Coos Bay along the Umpqua, east of Florence along the Siuslaw, and near Cascade Head and Tillamook. In the Study Area, these tidal-influenced lands are wider in the north, and broadest around Tillamook where five rivers meet the ocean.

More subtle divisions in landscape character can be seen north to south. Three major scenery divisions can be distinguished along the coast. Farthest south, are sandy, rolling dunes. Here, the ocean is at a distance and generally not seen from the major highway (US 101), except at bays, when travelers are passing through towns. The dunes, associated marshes, beaches, and tree islands are viewed mostly away from the Highway. Here color, light, motion--the forces or effects of change--in the natural landscape are beautiful, what people come to see, and what is watched. The mid-coast has rocky headlands, sandy beaches, and dramatic, picturesque ocean views. Rock walls along the Highway accent the rocky headlands.

North of Lincoln City, the flat, tidal-influenced land widens, and scenery is more dominantly a cultural landscape that includes pastures, barns, and calm, contained pastoral views. The Statewide Comprehensive Outdoor Recreation Plan (1988) states, "The agricultural landscape is ...a strong component of the scenic beauty of the state." Salmon River and Highway 18 mark a distinction that divides the scenery as well as Landtype Association north and south in the Study Area. To the north, ridges are not as predominately oriented north and south. Breaks in the ridges create valleys which tend to run north and south; as a result, the scenery is more open and accessible.

Actually and experientially, the Coast Range has been a barrier between the Willamette Valley and the coast. Crossing through it to the coast, the mountains serve to accent a feeling of arrival at the ocean after the journey from the Valley. They create a transition or sense of passage that highlights the experience of arrival from the relatively dark, winding narrow river corridors traveling through the Coast Range to the light, open, expansive ocean side.

People generally view the scenery in the Study Area in two ways: along corridors and from open high points. Study-Area wide, roads, rivers, and the oceanside form the corridors. The primary viewing corridor is along the coast. The scenic value of the coast corridor is characterized year-round by these experiences:

- Looking for the view to the west;
- Traveling perpendicular to the view;
- A changing angle of view;
- Traveling winding narrow cliffside roads;
- Viewing and crossing natural landforms;
- Crossing over rivers and bays on bridges;
- Seeing middens and travelways showing long evidence of people on the landscape;
- Visiting small picturesque towns by bays and rivers;
- Seeing masses of native plants,
- Viewing animals in water, air, meadow, pasture; and
- Observing the dramatic atmospheric effects of weather on land and water, light and air and often open view.

Generally, routes through the Coast Range are winding and narrow. Travel is usually at a slower pace than north-south Willamette Valley or coastline travel. Views enroute are short and are generally focused within 1/4 to 1/2 mile of the road. Trees often arch over the road, creating a tunnel effect. Route 6 crosses the Coast Range to the north, and differs in character from other corridors. Land here is higher and the road changes elevation so that travel is more dramatic, with longer views where the viewer is above the view, and more dramatic landscape. The narrow, winding roads to the coast heighten the experience of the ridged landform, as well as highlighting the importance of small towns that break up the route along the way. Road corridors are associated with river corridors and traveling across rivers and along rivers is part of the scenic experience of viewing the coast landscape. The contrast of experience inland to oceanside and the slow pace and country highway scale of travel are components of the scenic value of the Study Area.

The second major way of viewing scenery in the Study Area is from the high points, that offer wide views of valleys, distant mountains, and the ocean. Viewpoints and landmarks are important to people as a means to locate themselves and to escape from the confining topography of the Coast Range where "ridges seem to run in every direction" (Dicken and Dicken 1979). The meadows associated with some peaks, such as Kings Mountain, Russell Point, Larch Mountain, Mount Hebo, and Marys Peak, are also of scenic interest.

Inland, away from major corridors, are a number of destination sites in forested areas of interest for their scenic value. Waterfalls and old-growth groves are the primary points of scenic interest. Examples are Niagara Falls, old growth stands on Marys Peak, Kentucky Falls, and old growth groves on the Mapleton Ranger District.

Concentrations of people and communities are mainly in the Willamette Valley and along the coast. "Hamlets", small clusters of settlement at road intersections where there are valleys or spots of flat land, are

characteristic of the Study Area. Scenery can also be viewed from towns, hamlets, houses, and recreation sites, though again primarily in association with corridors.

Scenic Features

Highlights of the Study Area scenery are the natural landmarks, scenic areas, scenic viewpoints, and scenic corridors. Appendix F.3 provides a list and description of the most important sites.

Scenery Management and Status

Scenery in the Study Area is managed by the Bureau of Land Management, the Siuslaw National Forest (managed by sites, corridors, and viewsheds), the state Department of Transportation (managed by sites and corridors), Oregon State Parks and Recreation (managed by sites), the Oregon Department of Forestry (managed by objectives), and to various extents by different counties and cities. An example of viewshed management objectives is displayed on Map F.1 (Viewsheds for the Siuslaw National Forest).

Scenery management is guided by the Oregon State Department of Land Conservation and Development's statewide planning goals (latest revision in 1994), the Coastal Zone Management Act (1972); by the National Scenic Byways Program (Forest Service), the Backcountry Byway Program (B.L.M.), by Senate Bill 643 (1983,1985) which concerns preservation of major historical and scenic features of the state highway system, Oregon Scenic Waterways Act of 1969 (1985,1987,1988); the National Wild and Scenic Rivers Act (1968); the National Forest Management Act (1976); the Act establishing Cascade Head Scenic-Research Area (1974); the Act establishing the Oregon Dunes National Recreation Area (1972), and county and city zoning.

Number of Viewers

Viewing scenery on the coast is the primary tourist attraction in the state, as noted by the 1988 State Board of Tourism survey. Most major US and state highways in the Study Area are classified as "sensitivity level I roads" by the Forest Service. These are roads heavily travelled, in addition to which, the major purpose of about one-fourth of the users is to view scenery while traveling along these roads. In the Study Area these roads include US Highway 101, State Routes 126, 38, 36, 34, and 18, and county road 871 to Sand Lake. State highways 6, 8, and 20, and county road 229 have not been classified under this system. The amount of use on Highways 6, 8, 20, and a portion of 229 would make these roads and road segments sensitivity level I roads. Highway 8 has the highest use of any road in the assessment area, up to 44,000 average daily traffic count (number of vehicles per day).

Oregon Department of Transportation traffic volumes for 1993 shows that at a minimum, 2,500 to 5,000 people a day view scenery along the Oregon Coast. Average daily traffic numbers for 1993 show from 3,000 to 19,999 vehicles a day traveling the Coast Highway (Hwy 101) through the Study Area, depending on which segment is measured. Use is heavier near towns and associated stretches of coastlines: Coos Bay, Reedsport, Florence, Waldport, Newport, Lincoln City, and Tillamook. The longest stretches of heaviest use are from south of Coos

Bay to midway along the southern portion of the Oregon Dunes and from Depoe Bay to Otis.

Highway 18 from Valley Junction to Otis is the most heavily used inland-to-coast corridor. Figuring people viewing scenery here based on the Scenery Management system of a quarter of the total viewers for roads of this scenic significance--and figuring only one person per car--at least 1,250 to 2,500 people a day view scenery along Highway 18.

Current Scenic Condition

Much of the federal and private industrial land in the Study Area is in a condition that looks managed. Appendix F.4 summarizes the inventories of scenic quality objectives for the federal lands.

For all corridors and to some extent viewsheds, coherence and consistency of the landscape is a key scenery management issue, which relates obviously to adjacent land management. As noted in the FEIS for the Siuslaw National Forest Plan, pg. III-92,--and also true for the whole Study Area--over half of the land seen in many viewsheds is privately owned. Thus, no one agency or individual can control the appearance of a viewshed. Examples of mixed land ownership and related scenery concerns occur along Highway 34 and on Highway 126 east of Eugene. Highway 126 is an example of a sensitivity level I viewshed that is heavily altered (FEIS, pg. III-93). The Salem District-BLM is highly fragmented with 53% in other ownership. In the Coos District-BLM, as with the Eugene and Salem Districts, "most of the planning area has fragmented land ownership patterns with non-BLM lands dominating the landscape. The majority of the private lands are intensively managed for timber production, limiting the BLM's ability to effectively manage visual qualities on viewsheds." (Coos Bay District Proposed Resource Management Plan, Environmental Impact Statement, North Bend, Oregon: U.S. Dept. of Interior, September, 1994, 3-86).

Attention to elements that characterize the coast landscape experience has resulted in some facilities that strengthen that experience. The Proposed Oregon Coast Highway Corridor Master Plan (January 1995) addresses a number of concerns related to consistency such as vegetation planning. The Alsea Bridge in Waldport is a wonderful example of appropriate cultural reference in a new facility.

Increasingly, however, visual elements in the Study Area landscape are **inconsistent with the characteristic coastal landscape** experience. Inconsistencies include the following:

> **Conversion of natural landscape to obviously managed landscape through use of non-native plants and excessive grading and paving.** Example: subdivision in coastal communities along 101, conversion to non-native plants as the result of clearing at corridor recreation sites.
>
> **Small scale planting and clearing.** Example: Spots of development scattered over otherwise natural-appearing stretches of coast land along Highway 101. The coast character would be reinforced by large scale with masses of native plants and areas unbroken by development.

Excessive widening and straightening of roads and highways. Example: Highway 101 north of Florence and south of Reedsport.

Building that does not reference its natural and cultural setting. Example: subdivision development north of Florence and in Yachats.

Mixture of building types, increased number of buildings, and paved area. Example: At scattered locations throughout the Study Area including on Federal lands, the increased number of buildings and paved area and mixture of non-vernacular, non-sympathetic building types and forms, incompatible with local structures and settings.

Disruption of viewing of rivers from bridges. Example: the highway to Tillamook where bridges have been constructed so that people have difficulty seeing the river.

Managing sites with high scenic value for mixed use. Example: Marys Peak, where mixed use makes managing for scenic values difficult in some locations.

Coastal communities are no longer perceived as visually subordinate to their natural setting. As a result of cumulative inconsistencies and fragmentation of the characteristic Coast Range landscape, its scenic and cultural value is diminished, and, in some places, lost.

Management Implications

Federal lands make up much of the natural, beautiful coastal zone scenery. Among its other values, natural-appearing coastal land is the primary value in the state for tourism. Study of federal and adjacent lands in the Oregon coastal landscape shows the great importance of federal lands--and Tillamook State Forest in the northern portion of the Study Area--as providing stretches of natural-appearing landscapes. Areas of natural-appearing land have diminished over time and recently are rapidly disappearing along the Coast overall. Along the Coast, federal land and state-owned beaches are large-scale land forms; in between, the scenery is increasingly broken-up and small-scale.

High quality Coast scenery managed for the overall public interest is an important resource for local communities. Federal management should strengthen relationships with local communities that support the role scenic Federal land has for them, and with all land managers to participate in and encourage consideration of the larger coast setting. Federal land purchases can build on the role federal land currently serves, and help to establish more coherent blocks of natural appearing land as the framework for Oregon scenery. Federal land management should preserve natural scenery, and minimize and restrict development on federal lands along travel corridors and at recreation sites.

The Siuslaw National Forest should review and update, as necessary, the Forest Plan standards and guidelines for viewsheds to reflect the change in timber management direction. Also, a new scenery management system is being adopted by the agency.

The Forest Service and Bureau of Land Management have different scenery management systems. Cooperative efforts to plan scenic resource management across administrative boundaries would better serve the public.

Recreation

Recreation opportunities in the Study Area can be differentiated along north, central, and south coastal areas and the inland area. The sandy dunes outdoor experiences are south of Florence. The central coast is rocky with sandy beaches and offers scenic vistas, forested campgrounds, and long stretches of beaches to walk along. Most of the resort town recreation opportunities are found north of Depoe Bay. Inland in the mountains are forested campgrounds, trails, and occassional viewpoints. Along rivers are waysides, boat launches, fishing spots, and a few campgrounds. Towards the Valley, parks provide more organized sport facilities. At bays, boating and fishing sites and other recreation opportunities are concentrated.

Public recreation opportunities are provided by numerous government agencies, including Forest Service, Bureau of Land Management, Oregon State Department of Forestry, State Parks, nine counties, and several cities and towns. Also, some boating facilities are provided by Port Commissions and Oregon Department of Fish and Wildlife.

Overall recreation guidelines for the Study Area are provided by the Oregon Outdoor Recreation Plan (1988-93 and 1994-99), the Oregon State Comprehensive Outdoor Recreation Plan (1991), and Statewide Planning Goal 5, which is "to conserve open space and protect natural and scenic resources". The Oregon Coastal Zone Management Act also applies particularly to the Study Area, and helps to guide planning and minimize impacts on recreation quality and other resources of recreation elements, such as individual boat ramps and docks.

Recreation Visitors

Data from county and federal agencies show an overall increase in recreation use and in the variety of activities on lands they manage. Use of State Parks has increased at day use and decreased at overnight sites during 1994. Chambers of Commerce report more users and a wider variety of activities in recent years (Chamber of Commerce 1995). Recreation use in the Study Area is highest in July, August, and September.

The highest recreation-use sites in the Study Area are day-use sites at state parks. More than half the state park day-use sites in the Study Area had more than 200,000 visits each in 1994, some over a million. Other sites in the Study Area with high use include Sea Lion Caves--a privately operated facility--and Windy Cove Campground in Douglas County. Appendix F.5 provides a list of developed recreation sites by county and includes visitor use information where available. Appendix F.6 provides a list of highest use sites.

Very high use occurs at many of the Forest Service sites in the Oregon Dunes National Recreation Area (Dunes Overlook, Horsfall and South Jetty Staging Area) and at Cape Perpetua Scenic Area. The high use levels may indicate that these sites are destination recreation sites for people who reside outside the

Study Area boundary. Uses of these sites may be tied to other uses of surrounding recreation attractions.

The Study Area generally has three types of visitors to its recreation sites: local, rural users; urban visitors from all over the country and from other countries; and visitors who travel west, often over the Coast Range from the Willamette Valley and, less often, from eastern Oregon. The state Department of Tourism's visitor profile shows that the Oregon Coast tourist is more interested in scenery than in recreation, and interested in a Sunday drive as a form of recreation (from a visitor profile done in 1988).

An upcoming profile is expected to show some increased interest in recreation. In the United States, in general, recreation "customers" are "increasingly older, urban, and more racially and ethnically diverse" (Dwyer 1994). Travel industry trends report that the number of single parent households continues to increase, the stress factor in travel is increasing, the "mature" market is greater, public concern about the environment is expanding, and the industry needs to learn many different cultures' customs in order to provide better service (from Travel Industry - Talking Points, June 1993).

Recreation Activities

Many different recreation activities are pursued in the Study Area. Most of the undeveloped recreation opportunities, such as hiking, wildlife viewing, mountain biking and other dispersed recreation activities occur on federal or state lands. Organized sports activities are generally pursued on county and city park lands.

Appendices F.7 and F.8 provide lists of recreation activities that occur on public lands in the Study Area. The types of activities available at sites managed by different agencies is generally not distinct, except that organized sports are only listed for County sites. See References for sources of recreation activity data.

Travel Through the Area. Coastal recreation opportunities attract people from out-of-state and central Oregon, as well as local communities. There are, therefore, large numberd of visitors traveling through the Study Area across the Coast Range to oceanside sites, and up and down the coast corridor. Use of Tillamook County Parks by Portlanders is described as "fluctuating with the weather," where people leave the city on good weekends and use county recreation sites on their way to the coast (Bradley 3-9-95). A large portion of recreationist's time is spent in the activity of "driving for pleasure" or driving to a destination site.

Developed Recreation. Most of the developed recreation sites are located adjacent to water. The recreation attraction and amenity value of the coast is shown by the density of parks, campgrounds, and waysides found there, compared to sites farther inland and elsewhere in Oregon. Recreation sites along the coast are adjacent to water, sand, or both. All, but a few developed recreation sites inland, are located adjacent to water. The few exceptions are on mountains which serve as observation points--Mary's Peak, Mount Hebo, Roman Nose--or in or near expanses of sand and sand dunes as along South Jetty (wetlands and water are also attractions to the area).

The recreation sites tend to be in clusters along a corridor of recreation opportunities associated with a natural feature -- creek, river, coast, peak, dune. Along these corridors, there are a series of recreation sites managed by various agencies. Even on land operated by one agency, there are corridors of sites as at Sand Lake, Sutton Lake, Siltcoos River, South Oregon Dunes, and the Wilson River.

Many, if not all, recreation sites have been used historically and pre-historically. A number are old homesteads of settlers and earlier were sites used by Native Americans. Forest examples are Cape Perpetua, Mt. Hebo's Pioneer Indian Trail, and Canal Creek which was a homesite and had been used by Native American prior to white settlement.

Trails. Most trails in the Study Area link recreation features within ten or fewer miles on land managed by one agency. A few trails are planned that cross agency boundaries on a more local scale, such as the trail planned by the BLM and the Forest Service in the area of Wassen Creek.

The Oregon Coast Trail and the Corvallis-to-the-Sea Trail are planned as long distance routes through the Study Area. Portions of these trails exist today and serve to link areas north to south, and east to west. Planning has been done cooperatively by several agencies.

Dispersed Recreation. The majority of federal lands is available for dispersed recreation. Large areas of semi-primitive to primitive land (described in the following section on recreation settings) offer dispersed recreation opportunities. Much of the Oregon Dunes NRA is used for dispersed recreation, and special designated areas, such as Drift Creek and Cummins Creek Wildernesses, and Cascade Head Scenic Research Area are used for dispersed recreation. All recreation use in Elliot State Forest is dispersed.

While types of recreation activities do not vary much between land management agencies, recreation settings do vary. The Siuslaw National Forest provides the only Wilderness settings in the Study Area and the only large primitive recreation settings for dispersed recreation. Federal land provides the only semi-primitive settings greater than 3,000 acres, and consequently may be called the most ideal semi-primitive recreation settings for dispersed recreation. The Forest contains most of the semi-primitive settings, as well as the largest areas of semi-primitive setting.

Wildlife Viewing. The Study Area has a variety of opportunities to view wildlife. On the coast, people watch birds, whales, and sea lions. Elk are watched along the Umpqua River corridor and at other flat lands along the coastal creeks. Prime whale-watching sites are found at Yaquina Head, Cape Perpetua, and from boats outside of Depoe Bay. At and near the Sea Lion Caves and on the docks of Newport, people can observe sea lions. People watch fish at fish hatcheries, particularly in the fall to see the salmon runs. Two fish hatcheries are on the Alsea River, one on the Siletz, one on Tillamook, one on Three Rivers/Cedar Creek of the Nestucca, and one at Lake Creek Falls (BLM).

Off-Highway Vehicles. The primary off-highway vehicle areas on public land in the Study Area are south of Marys Peak on BLM land (6000 visitors reported for

1994), Sand Lake, Tillamook State Forest, and the Oregon Dunes NRA. All face similar issues concerning the desire to separate OHV use from other uses and the need to minimize impacts of disturbance on adjacent lands.

Recreation Setting Condition

Much of the BLM land is in a roaded-natural or roaded-modified condition (BLM, 1995). (See Appendix F.9 for definitions of recreation opportunity spectrum classifications.) On the Siuslaw Forest, most land is inventoried as roaded modified. Most National Forest land in the Study Area has been given a recreation opportunity spectrum objective of rural, based on modified appearance -- modified vegetation patterns and roaded condition -- but is semi-primitive or roaded natural in social characteristics and setting. Classification of these land areas would more closely follow National Recreation Opportunity Spectrum definitions if classified as roaded natural or semi-primitive. With recent road closures, this land may become more roaded natural or primitive in appearance over time.

Five large blocks of forested land in the Study Area are in a semi-primitive to primitive condition:

Drift Creek Wilderness Area with Drift Creek Adjacent land, 11,707 acres. An adjacent owl habitat area has about 2000 acres.

Wassen Creek Area, 11,204 acres, includes Siuslaw NF and Coos BLM lands. On BLM land in the Wassen Creek Area, there are some well maintained roads and other roads that have completely revegetated. The area has been previously logged. Wassen Creek is designated by BLM as an "Area of Critical Environmental Concern." Wassen Creek can be linked with developed recreation opportunities offered by Sweet Creek Trailheads, Kentucky Falls.

Hebo - Nestucca, 13,172 acres ca. 1990, not included as undeveloped area in the Siuslaw NF Plan. Use of Hebo - Nestucca area is linked with developed recreation on Mount Hebo.

Cummins Creek Wilderness, 9,173. Cummins Creek Wilderness is associated with Cape Perpetua Scenic Area.

Rock Creek Wilderness, 7,486 acres.

For further discussion of management implications of these large areas of undeveloped land and adjacent land, see section G.

Four tracts of land in the Oregon Dunes National Recreation Area are semi-primitive and total 19,993 acres. They are separated by road corridors which have intensive recreation use. The least roaded area on Eugene BLM is the Upper Lake Creek Special Resource Management Area (Williams 3-24-95).

A number of smaller areas of undeveloped or "primitive" condition were noted during the Study:

The South Fork of the Kilchis River and the ridge top north of the Kilchis River (gross estimate 3,200 acres) - two tracts of undeveloped ground in the Tillamook State Forest.

Little North Fork of the Willis and Salmonberry River Canyon, important for "primitive" recreation value, particularly as related to fisheries - undeveloped land in the Tillamook State Forest.

Many unroaded tracts of 5 acres on Eugene BLM land.

Baker Beach/Lily Lake on the Oregon Coast, of interest for its primitive setting.

Threemile Lake and the Horsfall to Beale Lake area in the Oregon Dunes National Recreation Area are important for "primitive" recreation value related to fisheries (M.Clady 1995).

Primitive areas within State Parks, designated as natural areas or heritage areas (Johansen 3-27-95).

The number and size of recreation facilities is increasing. The number and size of buildings and paved surfaces continues to increase in existing recreation areas, and new areas are being developed for recreation. In developed recreation sites with a natural to rural setting, the tendency is to become more urban in materials and density. Some sites in the Study Area have become more urban in character than is appropriate to their recreation setting and may no longer provide the expected recreation experience.

Management Implications

Many of the the recreation opportunities along the coast are on federal land. The Department of Tourism finds that the public would like more recreation programs combined with education , more guided recreation opportunities,and some business opportunities such as outfitter guiding federal land (Roberts 1995). Other sources find that bicycle touring and mountain biking are not adequate to meet future demands (Chambers of Commerce and others 1995). The types of opportunities provided in the future may need to be changed to meet needs of older recreationists and the more varied population (Dwyer 1994).

The State Comprehensive Outdoor Recreation Plan (1994) continues to identify a shortage of primitive and semi-primitive recreation opportunity. The supply is consistently below the demand. The Plan recommends providing primitive recreation on smaller acreages as a way of increasing availability to more people.

The State Committee on Outdoor Recreation Plan and Goal 5 of the Statewide Planning Goals guide recreation planning in the Study Area. For federal land in the Study Area, the Northwest Forest Plan now also influences recreation planning and operations. Of the social conditions evaluated as part of this Study, some recreation activities appear to be contrary to the Aquatic Conservation Strategy objectives. Data on current condition included here shows that the same river, creek, and lakeside sites that the Aquatic Conservation Strategy aims to protect from human impact are the places most heavily used and enjoyed for recreation. Currently, no clear sense exists

among federal managers on how to resolve these opposing interests. We are seeking to protect creeks and riparian systems from human impacts and also to recognize and allow people to enjoy and benefit in health and spirit from these waterside sites. They are natural attractions for people who have instinctively felt them to be necessary to their existence since people have existed in the Study Area. Ample evidence shows that such places have always been seen as eminently habitable. The Northwest Forest Plan emphasizes the critical social values of the Forest, as well as serving to direct implementation of the Aquatic Conservation Strategy. We need to determine where the impact is unacceptable for other resources, and adjust recreation uses to balance the resource use. It would be difficult, and probably not desirable for human well-being, to eliminate recreation use at locations where social values have long been demonstrated by use.

The BLM reviews proposed recreation construction using criteria of the Aquatic Conservation Strategy (Foti 2-22-95). For National Forest management, this review has become a more clear step in planning. To help reduce impacts of new sites on riparian areas and implement the Aquatic Conservation Strategy, standards and guidelines concerning protection of riparian areas (FW-087 to 093) could be developed to apply to recreation and other human impacts, covering placement of built features relative to creeks, including placement of developed camping sites. An exception could be made where the built feature serves to reduce human impact. Some National Forests currently have a 100-foot setback from riparian areas for recreation development to meet soil and water concerns.

Watershed restoration projects have worked to reduce some human impacts to riparian areas at dispersed camping sites and from trail use. On Federal lands, Recreation Opportunity Setting (Appendix F.9) gives insight into site environmental quality. Sites which have developed beyond their appropriate Recreation Opportunity Setting may also have recreation use that exceeds the capacity of the site in its present condition. In the Study Area, as elsewhere, sites where recreation use has exceeded site capacity also contain evidence of environmental impacts. Currently, on Forest Service land, some obvious human environmental impacts at existing developed recreation sites are monitored and corrected (repaired, mitigated, restored) through annual surveys of site condition. A further systematic means of reducing human impacts is through the "Meaningful Measures" monitoring process which requires that standards of site ecological quality be met.

Within the Study Area, cities, counties, and the state--especially in the coastal zone--have for almost 20 years been evaluating and limiting potential impacts to water quality under the Land Conservation and Development Commission and the Coastal Zone Management Act. Both the Coastal Zone Management Act and the Statewide Planning Goals have the same emphasis as the Northwest Forest Plan on social values, interagency cooperation, and water quality and the way land planning must consider natural systems. Through implementing these laws and guidelines, the public and these agencies have evolved a local experience and knowledge of the natural systems, cultural resources, local people, and communities. This framework, which includes extensive cooperation, can aide current federal management efforts. The agencies have a systematic process for public involvement, where public involvement is incorporated, even institutionalized as part of planning, and where social concerns tend to be central to management.

Other Uses

Small Forest Products

In the Study Area, small or special forest products can be gathered on Tillamook State Forest, Elliot State Forest, BLM land, and on the Siuslaw National Forest. Appendix F.10 provides a list of special forest products available under permit in the Study Area. People also gather special forest products on private forest land.

The state Department of Forestry sells permits for collection of special forest products. On state Forest land products available vary according to the District where a permit is purchased. Special forest product information is kept by District, according to where permits are sold. The portion of Tillamook State Forest in the Study Area is in Tillamook and Forest Grove State Forestry Districts. Elliot State Forest is in western Lane and Coos Districts, immediately south of the Study Area. Salal, fern, moss, beargrass, and boughs are known to be gathered on Tillamook State Forest. Moss collection has increased substantially from 1993 to 1994. Bear grass permits have increased from 1990 to 1994, but few salal and bough permits have been issued. Elliot State Forest has had small brush leases for salal (Mortonsen 3-10-95). On State Forest land, most special forest product collection was done in the north part of the Study Area. Beargrass, cascara bark, ferns, firewood, moss, and poles were collected mostly in the northern State Forest land, on Tillamook District in 1993 (most recent data available). Salal, cedar products, boughs, cones, vine maples, small alder trees, and mushrooms were collected, mostly from the northeast on Forest Grove District.

On BLM land, sales of special forest products are down in 1994 from previous years because of policy changes (Hegg 1995). Similarly, policy changes have recently been made by the Forest Service. All special forest products are generally available everywhere across the forest (Hegg 1995). Beargrass (when collected) may be more available towards the coast. The Salem District, which is adjacent to the northeast portion of the Siuslaw Forest, issues the most permits for poles and rails, moss, and boughs. The Eugene District, adjacent to the central part of the Study Area, issues the most permits for greens. The Coos District which is adjacent to the Forest in the southern portion of the Study Area has the most permits for sawtimber/pulp wood, fuel wood, Christmas trees and ferns. The Coos District has the most revenue from ferns and fuelwood, and the most revenue from special forest product sales/permits. Salem has the greatest revenue from boughs, firewood and moss. Boughs on Salem District brought the most revenue of any one product on BLM managed land.

Special Forest Product collection also varies north to south on the Siuslaw National Forest. Poles (cedar and other), moss, mushrooms, alder stakes, transplants (vine maple, salal, shore pine, evergreen huckleberry, waxmyrtle), boughs, cascara bark, firewood (commercial, personal, and free, and further categorized into weekend and find your own), and Christmas trees are gathered on the Forest. Pole collection is greatest on Hebo. Moss collection and Christmas tree cutting are greatest to the north, on Hebo District. Alder stake collection is greatest on Hebo and Mapleton. More boughs are collected

on Waldport District than elsewhere on the Forest. Commercial firewood collection is greatest at Waldport. Firewood collection is greatest on the Waldport, Hebo, and Mapleton Districts. Mushroom collection is greatest at the Oregon Dunes. Transplant collection is highest on the NRA, but it is also high on the Waldport, Mapleton, and Hebo Districts. Data is given for 1993, and was not available for 1994.

The Siuslaw Forest Plan was amended in 1994 to include standards and guidelines for Special Forest Products. The new standards were devloped with consideration for the Northwest Forest Plan, including the Aquatic Conservation Strategy. Special consideration was given to protection of riparian areas from the impacts of special forest products collection.

Hunting

The Study Area provides hunting opportunities for small and large game animals and birds, including bear, cougar, deer, elk, blue and ruffed grouse, cock pheasant, valley quail, mountain quail, turkey, mourning dove, band-tailed pigeon, duck and merganzer, coot, geese (only in specific permit hunt areas), black brant, common snipe, and crow.

There were 2,531 archery hunters in the general vicinity of the Study Area in 1993 (see note below describing area). 33,686 people hunted deer with rifles. The Tillamook Area (Trask Game Unit) was hunted most within the Study Area for black tail deer (when hunters were asked which units they hunted most). For all deer, numbers of licenses show most deer hunters within the Study Area on the land between Highway 229 up by Lincoln Beach to Highway 36 down by Florence (the Alsea Game Unit).

The most archery elk hunters within the Study Area are north of Tillamook area (Wilson Game Unit). In the general Study Area in 1993, there were 2591 general archery hunters, or 5238 total elk archery hunters when restricted hunting is included. There were 17,054 rifle elk hunters in the general Study Area in 1993.

Bear were hunted in the northern most part of the Study Area (Wilson Unit) and in the Alsea/ Stott Mountain area in 1993. There were a total of 431 bear hunters with most in the Alsea/Stott Mountain area. Ninety-five bears were killed.

In 1993, there were 36 cougar hunters and 8 cougar killed in the South Coast hunting area. (Less than a sixth of the "South Coast area" is within the Study Area.)

Since 1952, statewide, the number of deer killed has decreased. In 1993, the number was about 29% lower, but the number goes up and down. The number of deer hunters in 1993 is 1.2 times what it was in 1952. The number also varies. The number of elk hunters has increased to more than 50 times what it was from 1933 to 1993. The number of deer killed is 37 times the number in 1933. The increase has been happening over the years. The number of cougar hunters has increased more than 20 times from 1976 to 1993. The number of cougar killed in 1993 is 39 times the number in 1976. The number has increased over the years.

Fishing

Fishing is a prime activity noted for developed recreation sites throughout the Study Area. The Area has fishing opportunities in creeks, rivers, estuaries, ocean, and lakes. See also "Recreation."

Estuaries within the Study Area are: Tillamook, Netarts, Sand Lake, Nestucca , Siletz, Yaquina, Alsea, Lower Siuslaw, Winchester, Depoe and immediately south of the Study Area, Coos. There are fifty some rivers and major creeks within the Study Area. Lakes include Sand, South, North, Hebo, Devil's , Mercer, Munsel, Clear, Sutton, Lily, Alder, Buck, Dune, Woahink, Siltcoos, Tahkenitch, Threemile, Beale, Horsfall, Butterfield, and Saunders. Lakes are concentrated east and west of Highway 101, where the creeks hit the sand dunes, with a few lakes in the hills inland. Fisheries are one of the primary resources of these water bodies and there are fisheries issues related to their management.

The Study Area includes the Northwest Oregon Department of Fish and Wildlife Fishery Zone with a small portion of the Southwest Zone (a portion of the Dunes and the part of the Umpqua River drainage). Fish caught include chinook, coho, other salmon, steelhead, warmwater game fish, other fish (Fish Division). In general, all wild (non fin-clipped) steelhead are required to be released.

In 1993, a total of 79,989 salmon and 16,400 steelhead were caught for sport and personal use within the Study Area according to the Oregon State Department of Fish and Wildlife Fish Division. Umpqua River and Bay (11,518) and Tillamook River and Bay (7819) have the highest number of sport fish caught among river bays within the Study Area. Among "regions" and "basins" in the Study Area, Tillamook Bay Region has the highest number of salmon and steelhead sport fish caught in the assessment area in 1993 (21,472), Nestucca Basin second highest (8090). (This is higher than the Coos Bay Basin total, 4095.)

Comparing 1981 to 1993, the sport fish catch of Chinook is down in all ports, but Garibaldi Bay. Coho sport catch numbers have gone down in all ports within Study Area (Fish Division, 1994). Numbers for these and other port species are the most accurate of fish historical statistics (Corrarino 1995) so were only used rather than also using individual river numbers which also generally show numbers down. Sport fish catch is down in Coos Bay, also. Chartered fishing boats numbers are observed to be lower in Coos Bay (Chamber of Commerce, 1995). For the ports within the Study Area, however the numbers have fluctuated over these years.

Note: The Study Area covers a small portion of Wilson Game Management Unit (#12), most of Trask G.M.U. (#14), Stott Mountain G.M.U. (#17), Alsea G.M.U. (#18), Siuslaw G.M.U. (#20), and a very small portion of Tioga G.M.U. (#24). The numbers of hunters and animals given here are based on counting all of Wilson, Trask, Stott Mountain, Alsea, and Siuslaw. Coos numbers are not included because the area within the Study Area is so small.

G. MANAGEMENT OPPORTUNITIES

This federal lands assessment provides additional data and perspective on the current condition of the forest and streams of the Coast Range. The natural processes acting on the coastal mountains and valleys were explained in Section C. Fire and wind were dominant influences on the vegetation patterns prior to human settlement, and landslides periodically, but infrequently, replenished large wood and debris to the streams. Since human settlement, logging has been the dominant influence on vegetation. The loss and fragmentation of mature conifer forest stands over most of the Coast Range was described in Section D. Section E summarized the conditions on all inventoried streams as marginal to poor for anadromous or resident fish habitat.

Today, the landownership pattern is fragmented, primarily between federal and industrial forest owners. Federal lands occupy only 38% of the Study Area, while industrial forests occupy 31%. Cooperative efforts with adjacent landowners will be crucial to restore the conditions necessary for healthy riparian ecosystems and habitat for species associated with large blocks of mature forests.

1. Opportunities to reflect natural processes

The Coast Range is prone to large-scale natural disturbance from fire and wind on a very low frequency of about 300 years. For the past 40 years, human activities in the area have created more frequent and scattered disturbances. Timber harvesting has completely changed the natural patterns of vegetation, almost mimicing a large stand-replacing fire. If we were to to work in syncrony with natural cycles, very few disturbances should be created by human activity during the next 100-200 years.

The northern and central interior disturbance blocks, 2 and 6 respectively, appear to deviate farthest from their historic condition. These areas originally supported the largest, unfragmented patches of late seral vegetation. In the central interior block (block 6), extensive clearcutting of mature conifer stands resulted in few remaining patches of functional old growth. In the northern interior block (block 2), past intensive harvesting and interest in converting alder stands to conifer has resulted in highly fragmented areas of mature forest and species composition changes. Management activities that can accelerate successional development and/or aggregate patches into larger blocks on the landscape should be explored for all areas of the Coast Range, but efforts to block up the largest areas should focus on these two disturbance blocks.

Most of the land in disturbance block 6 is allocated to Late-Successional Reserve under the Northwest Forest Plan. This allocation is consistent with the natural vegetation pattern; however, some matrix lands have also been allocated to this block. The lands in disturbance block 2 are within the North Coast AMA and include numerous, small late-successional/old growth (LSOG) allocations. Managing the intermingled matrix and AMA lands for commercial timber production, through clearcutting, does not appear to be consistent with the natural range of vegetation patterns that would be found here. Matrix lands in these blocks

might be best managed on a long rotation (about 300 years). The trees could be grown for large, high-quality, straight-grained lumber. Currently, few, if any, federal lands are being managed for such timber, and the market for this material is expected to continue over the next 200 years. Harvests of these old trees could mimic the large, stand-replacing fires that occurred every 300-400 years. Soil and debris would periodically slide into the streams, carrying with it large debris that could replenish the material needed to create pools and spawning beds.

2. Fish Runs - Limited Opportunities for Success

Currently, instream fish habitat on federal lands throughout the Study Area is in marginal to poor condition. Recently, the coho salmon has been proposed by US Fish & Wildlife Service to be listed as threatened throughout the coastal region, and National Marine Fisheries Service has recommended the cutthroat trout in the Umpqua River be listed as endangered.

Restoration of aquatic ecosystems will require changing the way we manage land over a large area, not simply managing for a few species on designated federal reserves. Fortunately, the objectives in the Northwest Forest Plan for restoring late-successional stands on federal lands benefit fish resources. Specific actions to improve fish habitat on federal land include: maintaining existing conditions (e.g., stormproofing watersheds by stabilizing and obliterating roads); restoring immediate habitat conditions (adding large woody debris, recreating stream complexity); and restoring long-term habitat conditions by reestablishment of natural riparian areas (via designation of riparian reserves, and riparian planting). The Siuslaw NF's written strategy for restoring whole watersheds focuses efforts on identifying and securing the best remaining habitat within key watersheds, and on habitats either contiguous with those best habitats, or in key nodal positions downstream.

However, restoring anadromous fish runs in the coastal region will require cooperation of numerous landowners, especially along the lower reaches of streams and river bottoms--which are primarily in non-federal ownership-- where the gentlest slopes and greatest potential for fish production lie. Fish habitat may be restored on upstream reaches in federally managed lands, but unless the lands adjacent the large river bottoms and estuaries are also restored to a functioning riparian condition, fish runs will always be of low to marginal quality. Cooperative management opportunities are most promising within:

Drift Creek of Alsea
Knowles Creek
Wassen Creek
Streams draining Tahkenitch, Siltcoos, and Tenmile Lakes

On the Forest, developed recreation sites adjacent to rivers present obstacles to stream restoration. All theses sites should be evaluated to determine how to remove stream-adjacent structures or fills that impede natural stream flow or retard riparian vegetation growth.

Many upper reaches of the major anadromous rivers are on BLM lands to the east of the Forest. The Siuslaw NF should seek collaborative efforts with BLM,

through watershed analyses and/or project designs, to determine priorities for fish habitat restoration work.

3. Management Recommendations for Large Woody Debris

One result of the intensive timber management program of the last 30 years has been the removal of large downed logs and intense burning of organic matter from the forest floor, as described in Sect. C. The loss of this material reduces the opportunity to sustain the unique Coast Range plant species biomass. Some areas of the Forest have experienced more organic matter loss and subsequent soil productivity losses than others--where logging occurred on areas that had frequently burned during the past several centuries. In these areas, efforts to retain more large wood than called for in the Forest Plan should be considered during watershed analysis and project planning.

4. Undeveloped recreation opportunities

The role of federal lands as a provider of primitive and semi-primitive recreation opportunities is expected to grow in importance as population grows rapidly in the Willamette Valley. The increasing development of private land increases the value of undeveloped land for open space and natural scenic resources. Areas most prone to scenic degradation from development are along the Coast, river valleys and skylines. It will become more important for public lands to preserve or protect natural scenery and restrict development along these areas.

Scenery and recreation opportunities offered by federal lands are valuable to local communities, particularly along the Coast where these lands make up the dominant portion of natural-appearing land. We should pursue opportunities to develop interagency plans to manage the scenic corridors and recreation sites, essential to the quality of the Oregon coast.

5. Opportunities for Large Secure Blocks

Road density today is significantly higher than it was during pre-logging days. In 1945, the Siuslaw National Forest contained about 576,000 acres of isolated lands (land >1/4 mile from roads) with an average patch size of 3,000 acres. Today, there are only 121,000 acres of isolated land and the average patch size is 137 acres.

Lands within the Siuslaw National Forest have been analyzed to identify opportunities to recover large blocks of unroaded areas to provide secure habitat, with reduced human contact, for species needing such habitat, such as fisher and bobcat. The areas were also chosen to serve as wildlife habitat; meet objectives for fish habitat restoration; and provide remote, unroaded recreation areas.

Key watersheds are the core of the Forest Plan's fish habitat restoration and population recovery strategy. These areas already contain the majority of remaining large blocks of intact timber stands, thus potentially providing adequate habitat for some smaller mammals that require large isolated areas.

Fourteen of the 15 key watersheds on the Siuslaw NF (Lobster Creek is the exception) are nestled in five somewhat larger land areas that have outstanding values for many other resources and are located on lands least suitable for development. The selected areas:

- contain most of the Forest's remaining late-successional forest habitat;
- have lower road densities than surrounding areas;
- have many landtypes with high risk for landslides;
- contain watersheds with several municipal and domestic water sources;
- do not contain developed recreation sites; and
- have potential to provide primitive and semi-primitive, non-motorized recreation opportunities.

The five selected areas are shown on Map F.3.

1) Key WS that contains Hebo-Nestucca Roadless Area, Three Rivers WS, and the Key WS portion of the Little Nestucca WS.
2) Key WS portion of Schooner Drift (Siletz) WS.
3) Key WS portions of Beaver, Drift (Alsea), and Toledo WS.
4) Yachats, Tenmile/Cummins, and the Key WS portions of Big/Rock/Cape, North Fork Siuslaw, and Indian Creek WS's.
5) North Fork Smith and Key WS portions of Siltcoos, Smith, Lower Umpqua, and FS lands west of roadless area, some of which are in the Smith and Lower Umpqua WS's.

Most of the demand for developed recreation is expected to be along the Coast, not in the interior of the Coast Range. Large, unroaded blocks in the 5 areas listed above are expected to be compatible with current and future recreation demands. The Forest currently lacks any primitive recreation areas, although three Wildernesses already exist in two of these areas. The selected areas could also provide better semi-primitive opportunities.

The Umpqua River basin, which includes three key watersheds and one roadless area where fish habitat is especially protected and enhanced, is of special concern because the cutthroat trout in this basin has been proposed for listing as endangered. This is in addition to the coho salmon which is proposed for listing as threatened on all the Oregon coastal streams.

We recommend pursuing restoration of these areas by scheduling any vegetation and stream management activities early (in the next few years) followed by reducing or removing all but the primary routes through them. Watershed analyses should identify the best roads for further closure. Interagency cooperative opportunities should be sought to enlarge the unroaded, secure blocks.

The five areas identified above have also been selected as some of the high priority Class I Reserves proposed by Reed Noss in his delineation of biodiversity reserves for the Oregon Coast Range (Noss 1992). Cummins Creek/Rock Creek complex, Drift Creek (Alsea) and Mt. Hebo/Nestucca River are ranked as the top three areas among the 31 proposed reserves. The other proposed reserves include:

Sweet Creek/Mt. Grayback (#10) - includes N. Fk. Smith
Smith R./Umpqua River (#13) - includes Umpqua and W.Fk. Smith R.

Deadwood Mt./Schooner Ck/Lost Prairie (#18) - includes Drift Ck (Siletz)
Yachats Mt. (#17) - included in #4 above.

6. Priorities for Vegetation Management by Watershed

Fifth-field watersheds that have reduced levels of desired late-successional forest communities present the best opportunity to restore the fabric of late-successional forest communities across the landscape. Of primary concern is condition (amount) of federal interior forest and federal mature conifer in each fifth-field watershed.

The 10 watersheds that surfaced as the best opportunities to restore the fabric of late-seral conifer communities on federal lands in the Coast Range are:

Fourth-field Watershed	Fifth-field Watershed	% Mature	% Interior
SILETZ-YAQUINA	Upper Siletz	10	2
SIUSLAW	Upper Lake	12	1
	Upper Siuslaw	13	2
ALSEA	Blogett	12	1
	North Fork Alsea	25	3
	South Fork Alsea	25	2
WILSON-TRASK-NESTUCCA	Sandlake	25	4
	East Beaver	29	5
	Nestucca River	29	2
SILTCOOS	Tahkenitch	19	5

Restoration of individual owl pair or marbled murrelet nesting area habitat is lower priority for stand treatment activities than interior and mature conifer habitat. Owl and murrelet sites may pass through periods of activity and inactivity as the Coast Range is restored. The next step in getting down to a stand for treatment is a priority setting that mirrors the above at the watershed scale, i.e., restore connectivity, enlarge future interior forest patches, and enhance riparian reserves. If "all else is equal", then at the watershed scale, stands within 1.5 miles of owl pair areas and stands within 0.5 miles of occupied murrelet sites should receive priority. This process will not only address the most urgent work first but will require fewer seasonal restrictions and less consultation for a program of restoration activities.

7. Interagency cooperative opportunities

In addition to those opportunities mentioned above, a few others are important:

The BLM and FS are under the same Northwest Forest Plan direction, but have different methods of determining interim Riparian Reserve areas. The two agencies should coordinate methods, especially where FS and BLM lands are within the same watershed and river basin.

Cooperative efforts in recreation planning and scenery management across administrative boundaries within the Coast Range Province would better serve the public.

Cooperative efforts to develop a joint visitor information center with common brochures and maps describing recreation opportunities in the Province could provide a 'one-stop shopping' center for both the public and agencies, improve communication and reduce associated costs to government.

Opportunities exist to share technical skills, data collection, monitoring and restoration planning.

Opportunities to develop a central GIS database for the Province could start with FS, BLM and EPA data. Watershed analysis teams would benefit from this single source of data and associated costs of data collection would be reduced.

Opportunities to work with the state in assessing future water needs for coastal towns could identify potential conflicts with the Aquatic Conservation Strategy and perhaps lead to early solutions.

REFERENCES

Agee, James K. Fire Ecology of Pacific Northwest Forests. Island Press, Covela, CA. 1993. 475 pp.

Badura, G.J., H. Legard, and L. Meyer. 1974. Siuslaw National Forest Soil Resource Inventory. USDA-Pacific Northwest Region. 139 pp.

Baker, C., V. Crispin, B. House and C. Kunkel. 1986. Nestucca River Basin anadromous salmonid habitat overview. Interagency report.

Beckham, Stephen D., K.A. Topel and R. Minor. 1982. Cultural Resource Overview of the Siuslaw National Forest, Western Oregon. Heritage Research Associates Report No. 7.

Beidler, W. and G. Westfall. 1993. Fish management review Siuslaw District. Northwest Region, Oregon Department of Fish and Wildlife.

Center for Population Research and Census, 1994. Population Estimates for Oregon: July 1, 1993. School of Urban and Public Affairs, Portland State University.

Corliss, F.F. 1973. Soil Survey of Alsea Area, Oregon. U.S. Government Printing Office, Washington, D.C., 109 pp.

Dewberry, T.C. 1994. Historical reconstruction of the basalt block basins from Cape Perpetua to Heceta Head and recommendations for restoration. Pacific Rivers Council, Eugene, OR. 35pp.

Dicken, Samuel N., and Emily F. Dicken, The Making of Oregon: A Study in Historical Geography, Portland: Oregon Historical Society, 1979.

House, R.A. 1992. Management of anadromous salmon and trout habitat and their status in the Salem District. Bureau of Land Management, 42pp.

Impara, Peter. unpublished preliminary results OSU Forest Science Dept.

Juday, Glenn P. 1976 The Location, Composition, and Structure of Old-growth Forests of the Oregon Coast Range. PhD dissertation, OSU

Juntunen, Judy R. and C. Roberts. 1994. Historic Records Project, Siuslaw National Forest. Benton County Historical Society and Museum, Philomath, Oregon.

McNab, W.Henry and Robert G.Bailey. 1994. Map Unit Descriptions of Subregions (Sections) of the United States. USDA Forest Service ECOMAP project.

Minor, Rick, K.A. Toepel, R.L. Greenspan, and D.C. Barner. 1985. Archaeological Investigations in the Cape Perpetua Scenic Area, Central Oregon Coast. Heritage Research Associates Report No. 40.

Minor, Rick, and K.A. Toepel. 1986. The Archaeology of the Tahkenitch Landing Site: Early Prehistoric Occupation on the Oregon Coast. Heritage Research Associates Report No. 46.

Minor, Rick. 1992. Archaeology of the Cape Creek Shell Midden, Cape Perpetua Scenic Area, Central Oregon Coast: Interim Report of the 1991 Investigations. Coastal Prehistory Program, Oregon State Museum of Anthropology, Eugene.

Munger, T.T. 1944. Out of the ashes of the Nestucca. Amer. For. 50:342-47.

Nehlsen, W., J.A. Lichatowich, and J.E. Williams. 1991. Pacific salmon at the crossroads: Stocks at risk from California, Oregon, Idaho, and Washington. Fisheries 16(2): 4-21.

Nickelson, T.E., J.W. Nicholas, A.M. McGie, R.B. Lindsay, D.L. Bottom, R.J. Kaiser, and S.E. Jacobs. 1992. Status of anadromous salmonids in Oregon coastal basins. Oregon Department of Fish and Wildlife, 83pp.

Northwest Policy Center, 1995. The 1995 Portrait; Regional Econmic Review and Outlook. Graduate School of Public Affairs, University of Washington.

Noss, Reed F. 1992. A Preliminary Biodiversity Conservation Plan for the Oregon Coast Range. A Report to the Coast Range Association, Newport, OR. 40 pp.

Oregon Department of Transportation, Oregon Coast Highway Corridor Master Plan, Salem: Oregon Dept. of Transportation, January, 1995.

Oregon Department of Transportation, 1993 Traffic Volume Tables, Salem: Transportation Research Section, October, 1994.

Oregon Employment Department, 1993. 1992 Oregon Covered Employment and Payrolls by Industry and County.

Oregon Employment Department, 1993. Regional Economic Profiles.

Oregon Employment Department, 1983. 1982 Oregon Covered Employment and Payrolls by Industry and County.

Oregon Housing and Community Services Department, 1993. Oregon Census Abstract.

Pacific Rivers Council. 1992. A new strategy for watershed restoration and recovery of Pacific salmon in the Pacific Northwest. Eugene, Or. 31pp.

Parks and Recreation Department, Statewide Comprehensive Outdoor Recreation Plan, 1988-1993, Salem: Oregon State Parks and Recreation Division, December, 1988.

Perry, David A. 1994. Forest Ecosystems. The Johns Hopkins University, Baltimore.

Pollock, James, et al, Landscape Character Types of the National Forests in Oregon and Washington, Portland: U.S. Forest Service, 1981.

Reeves, G.H. 1988. Distribution and abundance of fish and fish habitat in Upper Elk River 1985-1986. Pacific Northwest Research Station, Corvallis, OR.

Reeves, G.H., F.H. Everest, and T.E. Nickelson. 1989. Identification of physical habitats limiting the production of coho salmon in Western Oregon and Washington. USDA Forest Service Gen. Tech. Rept. PNW-GTR-245.

Stewart, G., R. Reeve, T. Stein, and M.J. Hedrick. 1993. Fish management review Lincoln District. Northwest Region, Oregon Department of Fish and Wildlife. 34pp.

Teensma, Peter D., John T. Rienstra and Mark A. Yeiter. 1991. Preliminary reconstruction and analysis of change in forest stand age classes of the ORegon Coast Range from 1850 to 1940. USDI Tech. Note T/N OR-9.

USDA Forest Service. 1990. Final environmental impact statement for the land and resource management plan. Siuslaw National Forest, Corvallis, OR.

USDA Forest Service. 1993a. A first approximation of ecosystem health National Forest System lands. Pacific Northwest Region, 109pp.

USDA Forest Service. 1993b. Watershed protection and restoration in the Mid-Oregon Coast Range. Siuslaw National Forest, 19pp.

USDA Forest Service. 1994a. Cummins/Tenmile watershed analysis. Siuslaw National Forest, 113pp.

USDA Forest Service. 1994b. North Fork of the Siuslaw River watershed analysis. Siuslaw National Forest, 100pp.

USDA Forest Service and USDI Bureau of Land Management. 1994a. Final supplemental environmental impact statement on management of habitat for late-successional and old-growth forest related species within the range of the northern spotted owl. Volumes I and II.

USDA Forest Service and USDI Bureau of Land Management. 1994b. Environmental assessment for the implementation of interim strategies for managing anadromous fish-producing watersheds in eastern Oregon and Washington, Idaho, and portions of California. Washington, D.C.

USDA Forest Service, USDI Bureau of Land Management, Environmental Protection Agency, National Marine Fisheries Service, Soil Conservation Service, and U.S. Fish and Wildlife Service. 1994b. Nestucca watershed analysis. 74pp.

Wilkinson, Charles F. 1992. Crossing the Next Meridian: Land, Water, and the Future of the West. Island Press, Washington DC.

References for the Social Section of the Assessment Report

Anderson, Charles, Tillamook County Parks Department, Tillamook, telephone call to by Jessica Dole, March 9, 1995.

Balfour, Rick, Oregon Department of Forestry, Tillamook State Forest, telephone call with Jessica Dole, March 9, 1995. Recreation use information.

Ballon, Brian, Oregon Department of Forestry, Salem, Oregon, telephone conversation with Jessica Dole, 1995.

Barry, Rose Mary, Douglas County Park Department, telephone call to by Jessica Dole, March 9, 1995.

Benton County Parks, Benton County Parks System Comprehensive Plan, Corvallis, Oregon: Bennett and Bennet Associates, January, 1995.

Bureau of Land Management, Coos Bay District Proposed Resource Management Plan Environmental Impact Statement, Volume I, II, III, and Map Package, North Bend, Oregon: U.S. Department of the Interior, September 1994.

Bureau of Land Management, Coos Bay District, Umpqua Resource Area Transportation Map, Coos Bay District, North Bend, Oregon: July 1988. Received Spring 1995. Shows extent of roads.

Bureau of Land Management, Eugene District, "Cumulative Small Sales Summary Report for Fiscal Year 1993," Eugene, Oregon: Bureau of Land Management, undated, received March 22, 1995.

Bureau of Land Management, Eugene District, Cumulative Small Sales Summary Report for Fiscal Year 1994," Eugene, Oregon: Bureau of Land Management, undated, received March 22, 1995.

Bureau of Land Management, Eugene District, Fiscal Year 1994 Small Sale Report, Eugene, Oregon: Bureau of Land Management, printed February 23, 1995. Gives information for all B.L.M. Districts with note from John Hegg, February 23, 1995.

Bureau of Land Management, Eugene District Proposed Resource Management Plan/Environmental Impact Statement, Volume II, Eugene, Oregon: Bureau of Land Management, November, 1994.

Bureau of Land Management, Oregon Recreation Guide, Portland, Oregon: Bureau of Land Management, 1993. Map.

Bureau of Land Management, Salem District, Alsea Resource Area, Salem, Oregon: May 1994. Map showing extent of roads. Mailed to Forest Service on March 24, 1995.

Bureau of Land Management, Salem District, Columbia Planning Unit, Salem, Oregon: October, 1993. Map showing extent of roads. Mailed to Forest Service on March 24, 1995.

Bureau of Land Management, Salem District, Nestucca Planning Unit, Salem, Oregon: undated. Map showing extent of roads. Mailed to Forest Service on March 24, 1995.

Bureau of Land Management, Salem District Proposed Resource Management Plan/Environmental Impact Statement, Salem, Oregon: 1994.

Bureau of Land Management, Salem District, Willamina Planning Unit, Salem, Oregon: undated. Map showing extent of roads. Mailed to Forest Service on March 24, 1995.

Cililllin, Joe, Bureau of Land Management, Eugene District, Lake Creek Watershed, Eugene, Oregon: undated, received March 24, 1995. Hand drawn map showing Lake Creek Watershed Boundary unroaded areas with "primitive" recreation experience opportunity.

Corrarino, Charles, Fish Biologist, Fish Division, Oregon Department of Fish and Wildlife, Portland, Oregon, telephone interview by Jessica Dole, 1994.

Coos Bay Chamber of Commerce, Coos Bay, Oregon, telephone conversation with Jessica Dole, February 23, 1995.

Coos County Parks Department, Coos Bay, Oregon, telephone call to by Jessica Dole, March 9, 1995.

Department of Land Conservation and Development, Oregon's Statewide Planning Goals, 1994 Edition, Salem, undated, ca. 1994.

Dicken, Samuel N. and Emily F. Dicken, The Making of Oregon: A Study in Historical Geography, Portland, Oreogn: Oregon Historical Society, 1979.

Douglas County Park Department, "Campground Usage", Winchester, Oregon: Douglas County Park Department, sent by, with note from Rose Mary Barry, Douglas County, dated March 9, 1995.

Douglas County Park Department, "Douglas County Parks," Winchester, Oregon: Douglas County Park Department, undated, received Spring 1995.

Duran, Frank, Siuslaw National Forest, "Special Forest Products Fiscal Year 1993", Corvallis, Oregon: U.S. Forest Service, undated.

Dwyer, John F., Customer Diversity and the Future Demand for Outdoor Recreation, General Technical Report RM-252, Fort Collins, Colorado: Rocky Mountain Forest and Range Experiment Station, August, 1994.

Fish Division, Oregon Salmon and Steelhead Catch Data, 1981-93, Portland: Oregon Department of Fish and Wildlife, December, 1994.

Fish Division, Oregon, All Tags Sport Catch, 1993, Portland: Oregon Department of Fish and Wildlife, December 1, 1994.

Forest Landscape Architect, Siuslaw National Forest showing Sensitivity Levels of Roads, Alsea- Waldport, Corvallis, Oregon: undated, done before 1994, probably ca. 1980's for use in Forest Plan. Map.

Forest Landscape Architect, Siuslaw National Forest showing Sensitivity Levels of Roads, Hebo, Corvallis, Oregon: undated, done before 1994, probably ca. 1980's for use in Forest Plan. Map.

Forest Landscape Architect, Siuslaw National Forest showing Sensitivity Levels of Roads, Mapleton, Corvallis, Oregon: undated, done before 1994, probably ca. 1980's for use in Forest Plan. Map.

Forest Landscape Architect, Siuslaw National Forest showing Sensitivity Levels of Roads, Waldport, Corvallis, Oregon: undated, done before 1994, probably ca. 1980's for use in Forest Plan. Map.

Foti, Belle, Monitoring, Bureau of Land Management, Salem District, telephone call to by Jessica Dole, February 22, 1995.

Grapel, Al, Landscape Architect, telephone conversation with Jessica Dole, concerning intent of Recreation Opportunity Spectrum settings in Forest Plan, February 22, 1995.

Haney, David, Bureau of Land Management, Salem District, telephone call to by Rebecca Ries, March, 1995, concerning scenery management.

Hegg, John, Bureau of Land Management, Eugene District, telephone conversation with Jessica Dole concerning special forest products, February, 1995.

Helphinstine, W.M., "MA - 2 Area Designations," letter to the Forest Supervisor, Siuslaw National Forest, dated December 6, 1993. Nominates Pawn and Gibson as MA -2 Old growth recreation areas.

Johansen, Steve, Oregon State Parks Department, telelphone call to by Jessica Dole concerning "primitive" and unroaded areas, March 27, 1995.

Johnson, Hod, Sea Lion Caves Inc., "The percentage of business done each month at Sea Lion Caves," memo to Jessica Dole, April 20, 1995. Telephone call to on April 19, 1995.

Kranz, Al, Oregon Department of Forestry, Elliot State Forest, telephone call to by Jessica Dole concerning "primitive' and unroaded areas, March 28, 1995.

Lane County Parks, "Harbor Vista Camping Statistics, 1994", Eugene, Oregon: Lane County Parks, received Spring 1995.

Lane County Parks, Eugene, Oregon, telephone call to by Jessica Dole, March 8, 1995.

Lane County Parks Division, Lane County Oregon Road and Recreation Map, Eugene, Oregon: Lane County Government, 1993.

Lincoln County Parks Department, Newport, Oregon, telephone call to by Jessica Dole, March 9, 1995.

McSwain, Rich , Oregon Department of Transportation, Salem, telephone call to by Rebecca Ries, concerning Highway 101 scenery, March, 1995.

Menten, Jon, Bureau of Land Management, Coos District, telephone call to by Jessica Dole, March 24, 1995. Telephone call to and note from, March 28, 1995. Concerning unroaded Bureau of Land Management land.

Morian, Pat, Oregon Department of Transportation, Salem, telephone call to by Rebecca Ries, concerning scenery management, March, 1995.

Oregon Department of Fish and Wildlife, Oregon Sport Fishing Regulations, 1995, Lebanon, Oregon: WJF Marketing Services, Inc., 1995.

Mortonsen, Tona, Special Forest Products, Oregon Department of Forestry, Tillamook District, telephone call with Jessica Dole, March 13, 1995.

Mummey, Dan, Engineer, Siuslaw National Forest, interview by Jessica Dole, concerning trends for roads, February 16, 1995.

Natural Heritage Advisory Council to the State Land Board, 1993 Oregon Natural Heritage Plan, Salem, Oregon: State Land Board, 1993.

Oregon Coast Aquarium, Newport, Oregon, telephone call to by Jessica Dole, March 31, 1995.

Oregon Department of Fish and Wildlife, 1994, Big Game Statistics, Portland, Oregon: May 12, 1994.

Oregon Department of Fish and Wildlife, Synopsis of 1994-95 Oregon Upland Game Bird, Waterfowl and 1995 Spring Turkey Season Regulations, Portland, Oregon Department of Fish and Wildlife, undated, ca. 1995.

Oregon Department of Fish and Wildlife, 1995 Oregon Big Game Regulations, Portland, Oregon: Oregon Department of Fish and Wildlife, undated, ca. 1995.

Oregon Department of Forestry (received from, no author given), Elliot State Forest, Coos Bay, Oregon: 1990. Map which shows extent of roading. Received April 6, 1995.

Oregon Department of Forestry, Forest Grove District, "Commercial Price Ranges for Miscellaneous Forest Products," Forest Grove: November, 1990. Received from Oregon Dept. of Forestry, March 14, 1995.

Oregon Department of Forestry, "Forest Grove District Special Forest Products Revenue Summary," Tillamook, Oregon: Oregon Department of Forestry, August 30, 1994.

Oregon Department of Forestry, "Recreation Resources; Non-Motorized Trails and Campgrounds in the Tillamook State Forest, Wilson River Highway Area," Forest Grove, Oregon: Tillamook State Forest, undated, received Spring 1995.

Oregon Department of Forestry, "Special Forest Products," shows products dollar amounts by District, Tillamook, Oregon: Oregon Department of Forestry, undated, sent March 14, 1995.

Oregon Department of Forestry, The Work of the Oregon Department of Forestry, Salem, Oregon: August, 1993. Received from Peg Foster, Public Affairs Office Oregon Department of Forestry, Salem, Oregon, Spring, 1995.

Oregon Department of Forestry, Tillamook District, price list for small forest products, Tillamook, January 17, 1995, received from Dept. of Forestry, March 14, 1995.

Oregon Department of Forestry, "Tillamook District Special Forest Products Revenue Summary," Tillamook, Oregon: Oregon Department of Forestry, August 30, 1994.

Oregon Department of Forestry, Western Oregon District, "Minor Forest Products, Minimum Price List," July 19, 1989, Received from Oregon Dept. of Forestry on March 14, 1995.

Oregon Department of Forestry, "Western Oregon District Special Forest Products Revenue Summary," Tillamook, Oregon: Oregon Department of Forestry, September 28, 94.

Oregon Department of Transportation, Oregon Coast Highway Corridor Master Plan, Salem: Oregon Department of Transportation, January, 1995.

Oregon Department of Transportation, Oregon Scenic Byways Program, Salem, Oregon: Oregon Department of Transportation, undated, rec. 1995.

Oregon Department of Transportation, 1993 Traffic Volume Tables, Salem: Transportation Research Section, October, 1994. Includes 1993 Traffic Flow Map.

Oregon State Marine Board with the Oregon Department of Fish and Wildlife, Oregon Boating Facilities Guide, Salem, September, 1992.

Oregon State Parks and Recreation Department, Oregon Coast Lighthouses, Salem, Oregon: undated, received Spring 1995.

Oregon State Parks and Recreation Department, Oregon Outdoor Recreation Plan, 1988-1993, Salem, Oregon: December, 1988.

Oregon State Parks and Recreation Department, Oregon Outdoor Recreation Plan, 1994-1999, Public Review Draft, Salem, Oregon: Oregon Parks and Recreation Department, October 1, 1994.

Oregon State Parks and Recreation Department, "Overnight Campground Occupancy, Fiscal Year 1993-94," Salem, Oregon: Oregon Parks and Recreation Department, undated, rec. Spring 1995.

Oregon State Parks and Recreation Department, Park Guide, Salem, Oregon: Oregon State Parks and Recreation Dept., undated, rec. Spring 1995.

Oregon State Parks and Recreation Department, Recreational Needs Bulletin: Oregon State Comprehensive Outdoor Recreation Plan, Salem, Oregon, 1991.

Oregon State Parks and Recreation Department, 1993-1994 State Park Statistics, Reports on Fiscal Year '93-94 Attendance, Revenue and Expenditures, Salem, Oregon: Oregon Parks and Recreation Department, undated, received 1995.

Oregon State Parks and Recreation Department, Year-round Campgrounds, Salem, Oregon: undated, received Spring 1995.

Oregon State Parks and Recreation Department, Statewide Comprehensive Outdoor Recreation Plan, 1988-1993, Salem: Oregon State Parks and Recreation Division, December, 1988.

Oswald, Don, Coastal Specialist, Land Conservation and Development Commission, Salem, telephone call to by Jessica Dole, March 10, 1995.

Polk County General Services, Polk County Roads, Dallas, Oregon: March 14, 1995. Map showing recreation sites.

Polk County Parks Department, Dallas, Oregon. Telephone call to by Jessica Dole by March 9, 1995.

Pollock, James W., Landscape Character Types of the National Forests in Oregon and Washington, Portland, Oregon: U.S. Department of Agriculture, 1981.

Putnam, Tod, Traffic Monitoring Department, Oregon Department of Transportation, Salem, Oregon, telephone conversation with Jessica Dole, February 16, 1995.

Remington, Jack D., Mountain Bike Guide to Oregon, Oregon State Parks and Recreation Division, 1987.

Roberts, Robin, Oregon State Department of Tourism, telephone call to by Jessica Dole, 1995.

Rukke, David, Recreation, Bureau of Land Management, Salem District, telephone call to by Jessica Dole, February 22, 1995. Concerning recreation sites and use.

Schay, Pete, Bureau of Land Management, Salem District, telephone call to by Jessica Dole concerning unroaded areas, March 24, 1995.

Schutt, Kathy, Oregon Department of Parks and Recreation Department, Salem, Oregon, letter to Rebecca Ries, landscape architect coop student, March 8, 1995 and telephone call to, March, 1995.

Simpson, Mary, Benton County Parks Department, Corvallis, Oregon, telephone call to by Jessica Dole, 1995.

Siuslaw National Forest, Access and Travel Management Guide, Corvallis, Oregon: Siuslaw National Forest, September, 1994

Siuslaw National Forest, "Current Product Group Status or Management Condition on the Siuslaw National Forest," Special Forest Product Management Environmental Assessment, Corvallis, Oregon: 1995.

Siuslaw National Forest, Forest Wide Assessment Study Area with ROS, Corvallis, Oregon: February 9, 1995. Map showing Recreation Opportunity inventory information on the Forest with hand drawn unroaded areas from 1990 maps ca. Forest Plan, and showing combination unroaded area key watershed areas important for primitive and semi-primitive recreation.

Siuslaw National Forest, Final Environmental Impact Statement, Land and Resource Management Plan, Siuslaw National Forest, and Appendices Volume I, II, Corvallis, Oregon: Forest Service, 1990.

Siuslaw National Forest, Final Environmental Impact Statement, Oregon Dunes N.R.A., Siuslaw National Forest, Corvallis, Oregon: Forest Service, 1994.

Siuslaw National Forest, Land and Resource Management Plan, Siuslaw National Forest, Corvallis, Oregon: Forest Service, 1990.

Siuslaw National Forest, Management Plan; Oregon Dunes National Recreation Area, Siuslaw National Forest, Corvallis, Oregon: Forest Service, July, 1994.

Siuslaw National Forest, Forest Wide Assessment Study Area with Visuals, Corvallis, Oregon: February 14, 1995. Map showing scenic quality inventory information for Forest.

Siuslaw National Forest, Siuslaw National Forest; Alternative 9, Recreation Sties, Trails, Corvallis, Oregon: October 7, 1994. Map showing Forest Recreation sites and Northwest Forest Plan designations.

Straton, Kathryn A., Project Coordinator, Policy and Planning Division, Oregon Parks and Recreation Department, Salem, Oregon, telephone conversation with Jessica Dole, March, 1995.

Tillamook Chamber of Commerce, Tillamook, Oregon, telephone conversation with Jessica Dole, February 23, 1995.

Tillamook County, Oregon, Home of Tillamook Cheese, State of Oregon, 1993. No author given. Received Spring, 1995. Brochure/map.

Tillamook County Parks Department, "Tillamook County Parks, Boat Ramps and Recreation Areas," Garibaldi, Oregon: Tillamook County Parks, rec. Spring 1995.

Tillamook County Planning Department, telephone call by Jessica Dole, concerning land use, February 24, 1995.

Transportation Research Section, Oregon Department of Transportation, 1993 Traffic Volume Tables, Salem: Oregon Department of Transportation, October, 1994.

"**Travel Industry** - Talking Points; Quarterly Updates on Industry Trends and Information," June, 1993. Sent by Robert Bodine, Region 9, Forest 6. Author not given.

Tualitin Hills Park and Recreation District, Tualitin Hills Park and Recreation District; District Park and Recreation Facilities, Beaverton, Oregon: September, 1993. Received Spring 1995. Map.

Turowski, Dennis, Recreation Planner, Bureau of Land Management, Coos District, telephone call to from Jessica Dole, April 6, 1995.

U.S. Forest Service, Pacific Northwest Regional Office, message concerning report to Oregonian, saying that decline in budget will mean increased emphasis on dispersed recreation, February, 1995.

Washington County Department of Support Services, Facilities Management Division, Henry Hagg Lake, Scoggins Valley Park, Washington County, Hillsboro, Oregon: Washington County and U.S. Department of the Interior Bureau of Reclamation, undated, received April 6, 1995. Map/brochure.

Wayland, Chris, Washington County Parks Department, telephone call to by Jessica Dole, March 31, 1995.

Welch, Esther L., Lincoln County Road Department, Newport, Oregon, letter to Jessica Dole, dated April 5, 1995. Information on Lincoln County Parks .

Wells, Al, Park Maintenance Coordinator, Tualitin Hills Park and Recreation District, Washington County, Oregon, telephone call to by Jessica Dole, March 9, 1995.

Williams, Joe, Recreation Planner, Bureau of Land Management, Eugene District, telephone call to by Rebecca Ries, March, 1995. Telephone call to by Jessica Dole and note from, March 24, 1995.

Yamhill County Planning Department, McMinnville, Oregon, telephone call to by Jessica Dole, March 8, 1995.

Yamhill County Department of Public Works and Oregon Department of Transportation, Yamhill County, Oregon, McMinnville, Oregon: September, 1992. Map.

Zeller, Clyde, Oregon Department of Forestry, Tillamook State Forest, telephone call to by Jessica Dole concerning "primitive' and unroaded areas, March 24, 1995.

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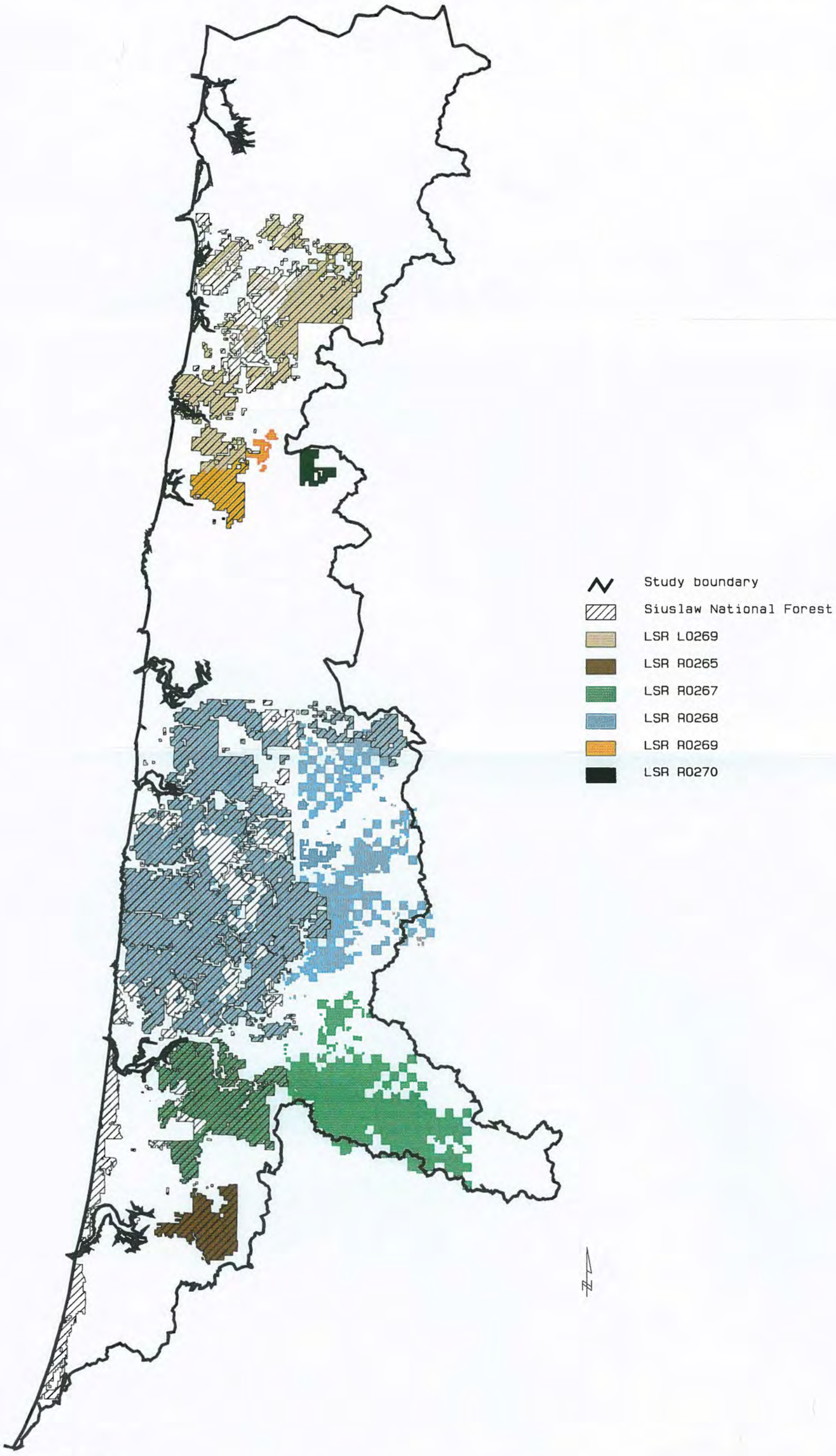
Forest Wide Assessment Study Area

MAP B.1

Late Sucessional Reserves In Assessment Area

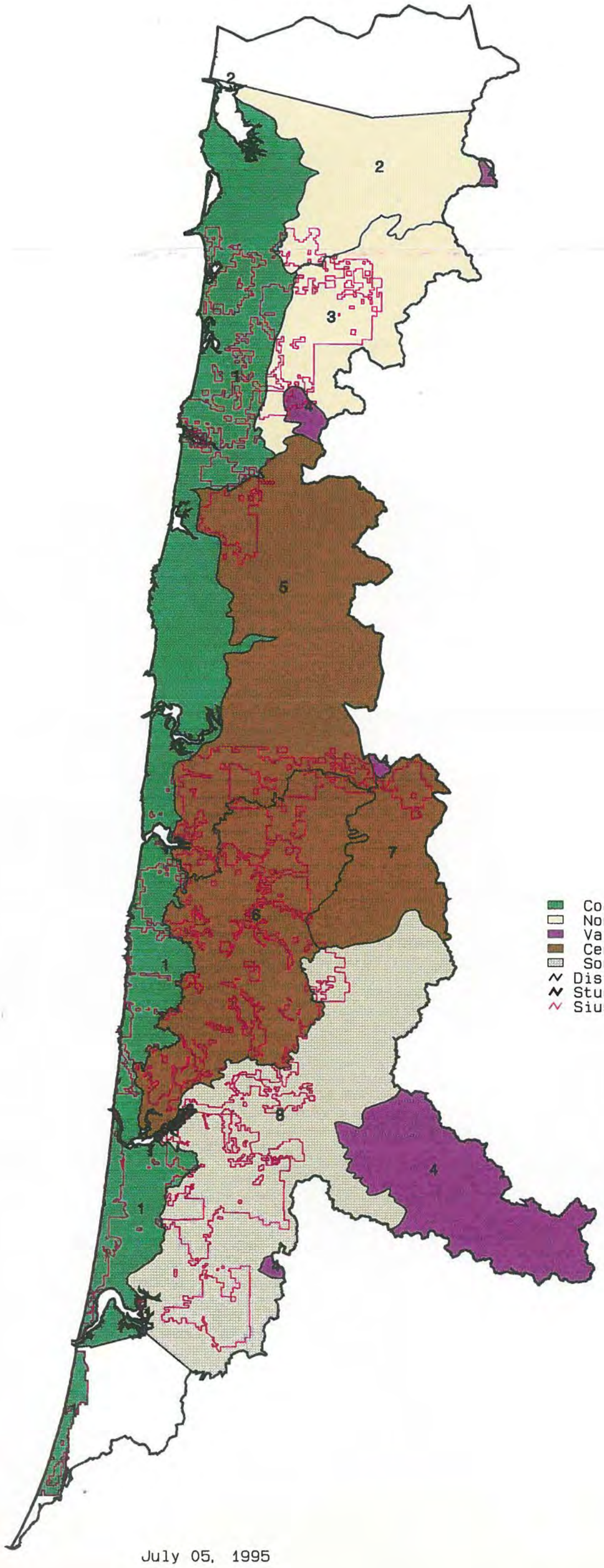


Scale 1:660530

MAP B.4

Federal Land Assessment Study Area

Soil Climate Zones



July 05, 1995

MAP C.1