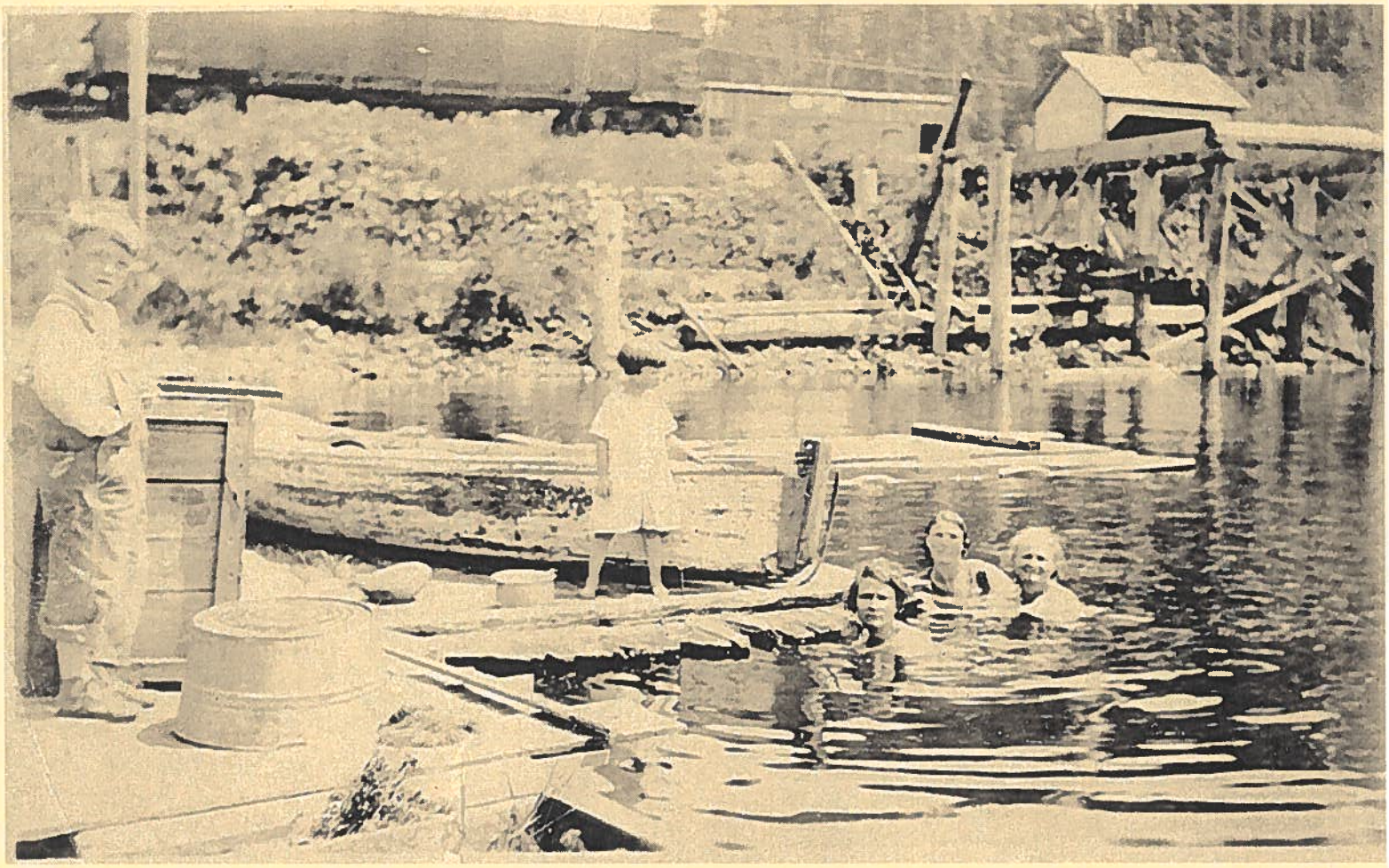
COASTAL LAKES WATERSHED ANALYSIS



SEPTEMBER 1998

Coastal Lakes Watershed Analysis

Siuslaw National Forest, Corvallis, Oregon

Finalized January 1999

This Analysis was Prepared By:

Cindy Burns, Wildlife Biologist
Paul Burns, Fisheries Biologist
Barb Ellis, Geographic Information Systems
Johan Hogervorst, Hydrologist
Kerrie Palermo, Dunes Wildlife Biologist
Lori Robertson, Silviculturist and Human History
Pamela Wright, Ecologist and Team Leader

Special Thanks To:

Dave Beck, Recreation
Stu Johnston, Silviculture
Dan Segotta, Botanist
Tom Taylor, Timber

Cover Photo: About 1934 at old Kroll boat ramp on Tahkenitch Lake. Thomas Merlin Richardson "Mert" on the dock with his cousin, aunt, mother, and grandmother.

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CHAPTER 1: CHARACTERIZATION

WATERSHED ANALYSIS

The purpose of watershed analysis is to develop and document a scientifically based understanding of the processes and interactions occurring within a watershed. It is intended to provide guidance on how best to implement the direction in the Northwest Forest Plan (USDA/USDI, 1994). The Coastal Lakes Watershed Analysis (WA) was conducted by an interdisciplinary team from the Mapleton Ranger District and Dunes National Recreation Area. Interested residents, landowners, and specialists from other agencies also provided information throughout the processes.

This document contains information on the processes, both human and natural, that are active within the watershed, how those processes are distributed in time and space, what the current upland, riparian and aquatic conditions in the watershed are, and how those factors influence wildlife and aquatic habitat and human uses. The watershed analysis will then be used at the site level to plan land use activities and identify what and where restoration activities will be most effective, and activities to be monitored.

No decisions are made with this document. The findings represent a foundation on which to develop site specific project proposals and base specific decisions. This document will continue to be updated and revised as land management and natural events change the conditions of the watershed.

LOCATION

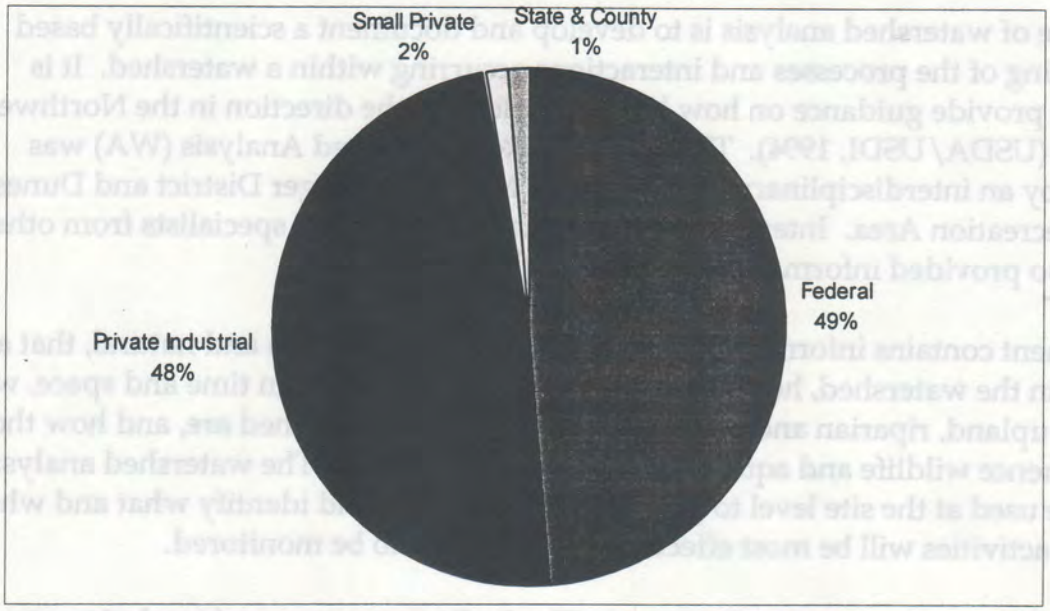
The Analysis Area includes 68,000 acres of sand dunes, large and small coastal lakes, and forested and agricultural land on the Oregon Coast. Four major streams and their tributaries flow through mature and managed forests into Tahkenitch, Siltcoos, and Woahink Lakes, through the Dunes National Recreation Area, then pour out into the Pacific Ocean. The watershed is south of the city of Florence and contains a bedroom community, Dunes City. (Map 1). It lies between the Umpqua and Siuslaw Rivers adjacent to the Pacific Ocean (Township 19, 20 and 21 South, and Range 10 and 11 west).

LAND OWNERSHIP

Ownership of the watershed is dominated by federal (49%)and private industrial forest (48%), with a small fraction of the acres owned by small private land owners (2%) and local governments (1%) (Figure 1). Federal land is administered by the Siuslaw National Forest of which about half is the congressionally designated Oregon Dunes National Recreation Area (ODNRA). Most of the private industrial land surrounds the

lakes, while most of the small private land lies in the river valley bottoms or the Florence bedroom community. The county and state is all recreational parks (Map 2).

Figure 1. Percent Coastal Lakes Watershed acres by type of land owner.



FEDERAL LAND MANAGEMENT DIRECTION

Management Direction for the watershed is provided by the *Siuslaw National Forest Land and Resource Management Plan* (SNF-LRMP) as amended by the *Northwest Forest Plan* in 1994 (USDA, USDI, 1994), and the *Management Plan Oregon Dunes National Recreation Area* (1994). The Northwest Forest Plan added several land allocations, including the Late-Successional Reserves and Riparian Reserves which are the major land allocations guiding this watershed on public land. Fiddle Creek is a Tier 1 Key Watershed.

Table 1. Northwest Forest Plan land management allocations. Acres within the Coastal Lakes Watershed.

Amended Forest Plan Land Allocations	Acres
Late-Successional Reserves	13,714
Riparian Reserves	5,603
Matrix	655
Non-Federal Acres	16,317

The overall objective for the Late-Successional Reserve is to manage for late-successional species such as spotted owls and marbled murrelets. The overall objective of the Riparian Reserves is to implement the Aquatic Conservation Strategy to protect and improve aquatic habitats. The remaining area is to be managed as Matrix which emphasizes timber

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production. These portions of the watershed occur primarily as small slivers on ridgetops (Map 3).

PHYSICAL SETTING

Climate

The weather of the central Oregon Coast is dominated by the East Pacific High during the summer months (Frye, Pond and Elliot, 1972). This high pressure cell sits about 200 miles off the Oregon or Washington coast and causes north to northwest winds from 10-30 miles per hour, especially in July and August. Wind-induced coastal upwelling is frequent and long lasting associated with these longshore winds in summer (Smith, 1972). In the fall, the high is displaced to the south and the North Pacific storm track moves across the Oregon coast (Cramer, 1973). Storms and their associated winds come out of the southwest and wind gusts can exceed 100 miles per hour at the headlands during intense winter storms.

The watershed area has a temperate marine climate with varying average annual precipitation totals due to on distance from the Pacific Ocean and topographic features. The dunal sheet, very close to sea level, averages 65 inches of rain per year while totals just 5 ½ miles east at Canary Station, about 100 feet above sea level, average 80 inches per year. Still farther east in the headwaters of the watershed, average annual rainfall often exceeds 90 inches at elevations just above 1200 feet. Most of this precipitation falls as rain and three-fourths of it falls during the autumn and winter months.

Weather Bureau records from Reedsport, Oregon, just south of the watershed indicate a mean annual temperature of 52° F. These same records give average maximum temperatures of 61° F for the two warmest months of July and August, and an average minimum temperature of 44.5° F for January, the coolest month.

Geology

There are four geologic units mapped for this watershed: Tyee Formation, Basalt Intrusions, Quaternary (recent) Alluvium and Quaternary Beach and Dune Sands (Map 4). These geologic units parallel the unique and functionally different aspects of the watershed. The Tyee Formation, which underlies most of the watershed, is most prominently displayed in the steep, techtonically uplifted hillslopes and ridges in the uplands of the watershed as well as around the larger lakes. Although only a small part of the watershed, the Basalt Intrusives represent the highest peaks in the watershed. Quaternary alluvium can be found in the creek valleys that finger high up into the watershed as well as the bottoms of the largest coastal lakes. Quaternary Beach and Dune Sands make up the dunal sheet that helped to form the unique lakes and creek valleys of the watershed.

The Tyee Formation that dominates the WA area is part of the southern Tyee Basin of Oregon. This 130-mile sandstone basin was formed in the Eocene epoch as sediments were deposited in shallow seas over a basalt basement known as the Siletz River Volcanics. The southern tip extends just below Agness, Oregon and the northern edge of this basin reaches Lincoln City, Oregon (Dott and Chan, 1983). Recent gas and oil exploration has revealed a separate subbasin in the Coastal Lakes watershed area, the Smith River subbasin, most likely formed in the early Eocene epoch. For a more comprehensive and technical description of the geology in the Smith River subbasin, refer to Appendix A of the Smith River Watershed Analysis (1997).

Sandstone in this formation is well-indurated (cemented) with low porosity and correspondingly low permeability, allowing downward water movement only through joints or fractures in the bedrock. With the presence of a thin, highly permeable soil mantle coupled with the relatively impermeable bedrock in this location, storm water moves to stream channels very efficiently in this system, causing streams to rise and fall quickly, especially during intense winter storms.

Sandstone layers of the Tyee formation are inter-bedded with thinner, more erodible siltstone layers. Because these siltstone layers are both more easily weathered and contain smectite clays that shrink and swell during winter rains, slope instability can be a factor, especially in steeper areas where sandstone bedding is parallel to the slope. This inherent instability plays a big part in the building and maintenance of roads in the headwaters of this watershed.

The Tyee formation also has a number of Basalt Intrusions that came up through its softer marine sediments during the Oligocene epoch. After uplift of the Coast Range in the Miocene epoch, erosion exposed many of these more durable dikes and sills which became the prominent peaks of the Coast Range. There are a number of these basalt peaks to the east of the watershed (Smith River WA area), and three of these touch the northeastern tip of the watershed area in the vicinity of Sunset Mountain and Mt. Peter. No other basalt intrusions have been mapped in the watershed.

Formation of both the lake and creek valley bottom sediment deposits in recent geologic time are categorized as Quaternary Alluvium. During the melting of the last cycle of glaciation in the Pliestocene Epoch, sea level rose creating the general features of the coastline, including the dunes. The mouths of large rivers like the Siuslaw and the Umpqua were drowned (submergence), causing deposition of river-transported sediments that filled the edges of these river valleys. At the same time, coastal lakes were formed as sand moved ahead of the advancing sea and cut off the mouths and estuaries of smaller rivers that lacked the erosive power to keep their mouths from being inundated. Sediment, once transported to the ocean in creeks like Maple, Fiddle and Fivemile in this watershed, was now being deposited in and above the coastal lakes, forming long alluvial

valleys. The length and width of these valleys above the coastal lakes is a distinguishing feature in the state of Oregon.

The fourth geologic unit mapped in the watershed is Quaternary Beach and Dune Sands which comprises the dunal sheet along the coast between the Pacific Ocean and the coastal lakes. It has been theorized that the indentation in the coastline between Heceta Head and Cape Arago created potential for accumulation of sediment in the form of a bar or spit as a result of sediment being carried in longshore currents along the shoreline. As the sea level rose, this accumulation of sand was pushed onto dry land by wave action. It has been further theorized that this inland advance of sediment reached its maximum advance at the end of the period of submergence about 6000 years ago. The eastern extent of sand in the watershed is indefinite south of the Siuslaw River, especially along the west edge of Woahink Lake. The boundary shown (on Map 4) was approximated by field geologists who examined road cutbanks in the area (personal communication, Courtney Cloyed).

Soils

Soils weathered from sandstone in the area tend to range from gravely loams on steep slopes in the uplands of the watershed to gravely clay loams where deeper soils occur in the coastal lakes and hills lower in the watershed. In the uplands soils range from very shallow to moderately deep while lower In the watershed, soils are moderately deep to deep on ridge systems and very deep where scattered earthflows are present. Upland soils are moderately productive with low water holding capacities and plant limiting soil moisture in summer except on north slopes. Coastal lake and hills areas, which include hummocky terrain in the Henderson Creek area, have moderately productive to very productive soils. In contrast to the upland soils, water holding capacities are moderate to high and soil moisture is rarely limiting to plants (Ellis-Sugai et al, 1998).

Although it is not formally mapped, there is an area of the watershed between the north side of Woahink Lake and the old town of Canary that contains a predominance of highly weathered siltstone bedding that can be seen in cutbanks in the area. Soil weathered from bedrock in this area is a heavy, impermeable clay, highly susceptible to shrink and swell (Schlicker, et al, 1974).

The sand included in the dunes is mostly siliceous subangular to rounded grains ranging from very fine to medium grain sizes. Clay lenses, peat strata and limited zones of weak cementation can also be found buried in places throughout the dunal sheet where the dunes have shifted due to wind action. Porosity of the sand in four samples taken near Florence ranged from 36.5 to 39.2% and average permeability has been measured at 535 gallons per day per square foot (Schlicker, et al, 1974).

More detailed soils information can be found in the two county soil surveys that cover this watershed. Lane County Soil Survey has been completed for the north half of the

watershed but the Douglas County Soil Survey covering the south end is not yet in print at this writing. However, soil series present in the Douglas County portion of the watershed and their descriptions can be obtained upon request from the Natural Resources Conservation Service in Roseburg, Oregon.

Dunes

The eastern extent of sand in the watershed is indefinite south of the Siuslaw River, especially along the west edge of Woahink Lake. The boundary (Map 4) was approximated by field geologists who examined road cutbanks in the area (personal communication, Courtney Cloyd). Porosity of the sand in four samples taken near Florence ranged from 36.5 to 39.2% and average permeability has been measured at 535 gallons per day per square foot. The sand included in the dunes is mostly siliceous subangular to rounded grains ranging from very fine to medium grain sizes. Clay lenses, peat strata and limited zones of weak cementation can also be found buried in places throughout the dunal sheet where the dunes have shifted due to wind action (Schlicker, et al, 1974).

The average thickness of the sand deposit at the coastline is about 125 feet to bedrock. The saturated zone of this sand mantle creates a homogeneous, simple dunal aquifer that ranges anywhere from three to thirty feet from the surface throughout the dunes area of the watershed. Groundwater testing by Hampton (1963) showed a drop in the watertable of 2.5 feet from July 1 to October 1 and an increase of 5.15 feet from October 1 to March 1 during a period of 63.6 inches of rainfall in the area. In addition, it has been estimated that over 75% of average annual precipitation reaches the dunal aquifer (Brown and Newcomb, 1963; Hampton, 1963). Although lake levels of Siltcoos and Woahink are higher than the dunal watertable during summer, recharge of the aquifer from the lakes has not been found to be significant (Schlicker, et al, 1974).

Schlicker (1974) estimated that groundwater percolation to the ocean was about 50.3 million gallons per day or 56,400 acre-feet per year. He estimated that total annual discharge to surface water west and east would be 62,750 acre feet per year. Water quality is generally good from the dunal aquifer except for high iron content that requires some treatment. It has been theorized that with the vegetating of the dunes for stabilization, litter buildup and decomposition has caused increased iron levels in percolating water. Present withdrawls are mostly north and south of the watershed at this time, but future development in the area may cause expansion of aquifer withdrawal to this area. At present, water systems for communities in the Dune City and Glenada areas are poorly developed and are composed of systems that withdraw and treat water from the lakes for local housing developments.

Lake and Stream Hydrology

This hydrology is very unique. Nestled between the mouths of the Siuslaw and Umpqua Rivers, it is a complete system, supporting strong anadromous fish runs and providing numerous wetland and deep water habitats. There are nineteen named lakes in the watershed, and the formation of all of them are either directly or indirectly related to the formation of the dunes (Map 5). The Maple, Fiddle and Bear Creek systems flow into Siltcoos Lake while Fivemile and Leitel Creek systems flow into Tahkenitch Lake.

Tahkenitch and Siltcoos are large, shallow lakes that both have outlets draining to the ocean currently controlled by dams. Both the Siltcoos River and Tahkenitch Creek flow through the dunes to arrive at the ocean. Woahink Lake, a much deeper lake than its two larger counterparts, flows into Siltcoos Lake via Woahink Creek. Cleawox and Threemile Lakes have few tributaries and are fed primarily by the dunal aquifer. Within the dunes there are a number of perennial and ephemeral lakes that fluctuate with dunal aquifer levels throughout the year.

Water Quality

Water quality issues in the uplands, lakes and dunes of the watershed relate to various landuses. In the uplands, that include the broad creek valleys above the lake, intensively managed agricultural and forest lands have the greatest effect on water quality. Around the lakes, urbanization, recreation and intensive forest management are the greatest threats. In the dunes, recreation, water release from dams and changes brought about to stabilize dunes have the greatest impact on water quality. Practices such as rechannelizing streams to create pastureland, removal of riparian vegetation during logging and grazing, and development of homesites on the shorelines of sensitive coastal lakes have all contributed to decreases in water quality in the watershed, in some cases to a substantial degree.

SOCIAL SETTING

Human Uses

Native American Use of the Coastal Lakes Watershed

Ancestors of the current Confederated Tribes of Coos, Lower Umpqua, and Siuslaw inhabited this watershed. The Lower Umpqua (Kalawatset) used the Tahkenitch Lake area and the Siuslaw spread south from the Siuslaw river drainage to perhaps the Siltcoos River. The exact historical land boundary between these two tribes is vague. They spoke two closely related dialects of a language generally identified as Siuslaw and probably intermingled (personal communication Phyllis Steeves, Beckham, 1982, 1986).

Early records indicate the existence of Indian villages at the mouths of the coastal streams, living off the rich resources of the ocean, estuaries, and lakes, making some trips inland to hunt or to gather berries. Salmon was of foremost importance along the Siuslaw and lower Umpqua rivers and was also probably important along the outlets of Siltcoos and Tahkenitch lakes. Only one to three months of accumulated work time was required for subsistence, leaving a lot of time for leisure pursuits, including gambling and art work. (personal communication, Phyllis Steeves)

One of the two oldest sites of prehistoric occupation on the Oregon coast is at Tahkenitch landing. Such old sites are rare because the rising sea levels during the Holocene have submerged much of the evidence older than 3000 years. The location of Tahkenitch Landing some distance inland from the present coastline protected it from erosion. Occupation of this village is documented at 8,000 years before present. Whale bone remains at the site indicate ocean influence of a historic bay that has since been cut off by the moving sand dunes. The inhabitants regularly consumed clams and large quantities of small fish. A variety of sea mammals and birds constituted a smaller portion of the remains. About 3,000 years ago the site was abandoned (Minor and Toepel, 1986).

Homesteading, Grazing and Logging

Many of the pioneers came by land from the Willamette Valley to Mapleton, then by boat to Glenada, overland to Woahink, then by boat to destinations off Siltcoos. Others came up the beach from the Umpqua. The land the settlers found consisted of "an endless expanse of dead, charred, big trees remaining from terrible forest fires" that raged in the mid 1800's. They cleared the land by drilling holes in the snags, inserting burning coals inside so that in a few days snags burned through and fell over. For years they kept burning to clear the land of brush, logs, and stumps. These settlers mainly established orchards and farmed small berries and grains. Some of them were able to bring a few head of livestock (Siuslaw Pioneer, 1947 & 51& 54). Pioneer Dan Miles wrote that gardening was easy--just "plant a seed and it grew, no insects. There were no worms in apples west of the Coast Range mountains" (Siuslaw Pioneer, 1979).

In the 1890's pigeon, grouse and ducks were plentiful, and "by 1898 deer were beginning to show up around the burned over country". Raccoon, bear and cougar were hunted. Salmon ran up all the creeks that flow into Fiddle Creek. Dan Miles recalled "Every gravel bar would just be alive with 'Silverside' salmon trying to lay their eggs. Not just during the first freshets in the fall, but there would be a big run each freshet for about four more freshets." Trout fishing was also good, with catches of 200 under 10" and about 30 of the big ones after an afternoon's effort (The Siuslaw Pioneer, 1979). Martin Christensen recalled fishing on Siltcoos Outlet. "We set nets down there near the outlet." He had seen 40 nets across the outlet, some staked well above the water. "You'd have more fish in the upper net than the lower one. There was thousands of fish." Martin also talked about trapping 50 beaver, which made up a pickup load (The Siuslaw Pioneer, 1984).

Recreation

Recreational uses of the watershed motorized and non-motorized watercraft, camping, hiking, mountain biking, off-highway-vehicles, diving, birdwatching, autotouring, aircraft (floatplanes), clamming, hunting, and fishing in lakes, streams, and the ocean. Honeyman State Park is the second largest state park in Oregon (522 acres) with 235 tent sites, 143 trailor sites, and 6 group sites. Camp Cleawox Girl Scout Camp includes about 45 acres leased from the Forest Service since the 1930s. Camp Baker Boy Scout Camp, a 149 acre peninsula on Siltcoos Lake, was mostly logged in the 1940s but still has some old spruce.

History of Forest Service Management

The analysis area became part of the Forest Reserves in 1907, but little logging occurred on federal land in the watershed until the late 1950's. After World War II demand for lumber increased, political pressure was exerted for the national forests to provide wood, and logging increased rapidly (Table 2).

Table 1.2. Number of acres logged on federal land in the Coastal Lakes Watershed, 1916 - 1995.

Time Period	USFS	BLM*	BLM & USFS
1916 - 1955	458	1,533	1,991
1956 - 1975	6,254	7,740	15,021
1976 - 1995	3,112	9,807	10,498
TOTAL	9,824	19,080	29,472

Intensive road building and logging operations occurred, especially between 1960 and 1972. Clearcutting was the predominant logging method to optimize regeneration of Douglas-fir, the fastest growing, timber producing tree in this area. Following the 1962 "Columbus Day Storm" large scale salvaging of damaged trees occurred. *Need something more specific to this watershed....number of. acres or timber sales.*

Early in the century, the Forest Service land contained small, scattered parcels of land that had been abandoned for overdue taxes. Difficulties arose with these parcels including logging trespass and lack of surveys. In 1970 only about 19% of the boundaries had been surveyed. Officials relied on "cutting agreements" in which consent was based on boundaries that "looked about right". In the 1980's much of the land was surveyed, and efforts were made to consolidate Forest Service managed property through land exchanges (personal communication, Mark Buehrig).

The first skyline logging occurred in late 1960's on the former Smith River District. In the 1970's the U.S. Forest Service increased log suspension requirements, thus allowing removal of trees from very steep slopes. The road network expanded and logging on federal land increased (Map 6). The Fivemile Fork Sale *(Year?)* included large riparian buffers *(How large?)*, and units laid out ridge to ridge, which provided better soil protection than highlead systems or the rough days of the "drag 'em to the lake" approach (Personal communication, Tom Taylor).

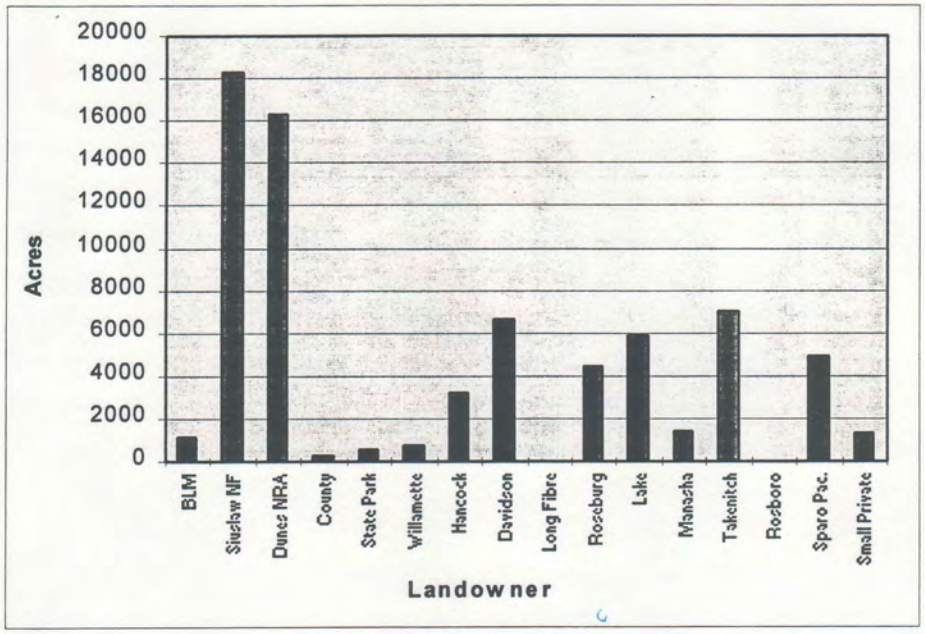
Concern that this area of the Forest had a high rate of soil instability was raised periodically and resulted in interruptions of timber harvest. This section of the Mapleton Ranger District and farther contains some very steep, heavily dissected terrain, which combined with the early sidecast road building and timber harvest resulted in landslides. Construction of the Bell Divide Road was a landmark issue when, after a rain-on-snow event in 1968-69, many headwalls failed. The Gilmore Report of 1970 reported that road building was the main contributor to the problems and planned a study to compare different types of logging systems and road building. Experimental helicopter logging was used and then cable logging resumed with the added improvements of endhaul road building, full and partial suspension, and headwall leave areas (Personal communication Tom Taylor).

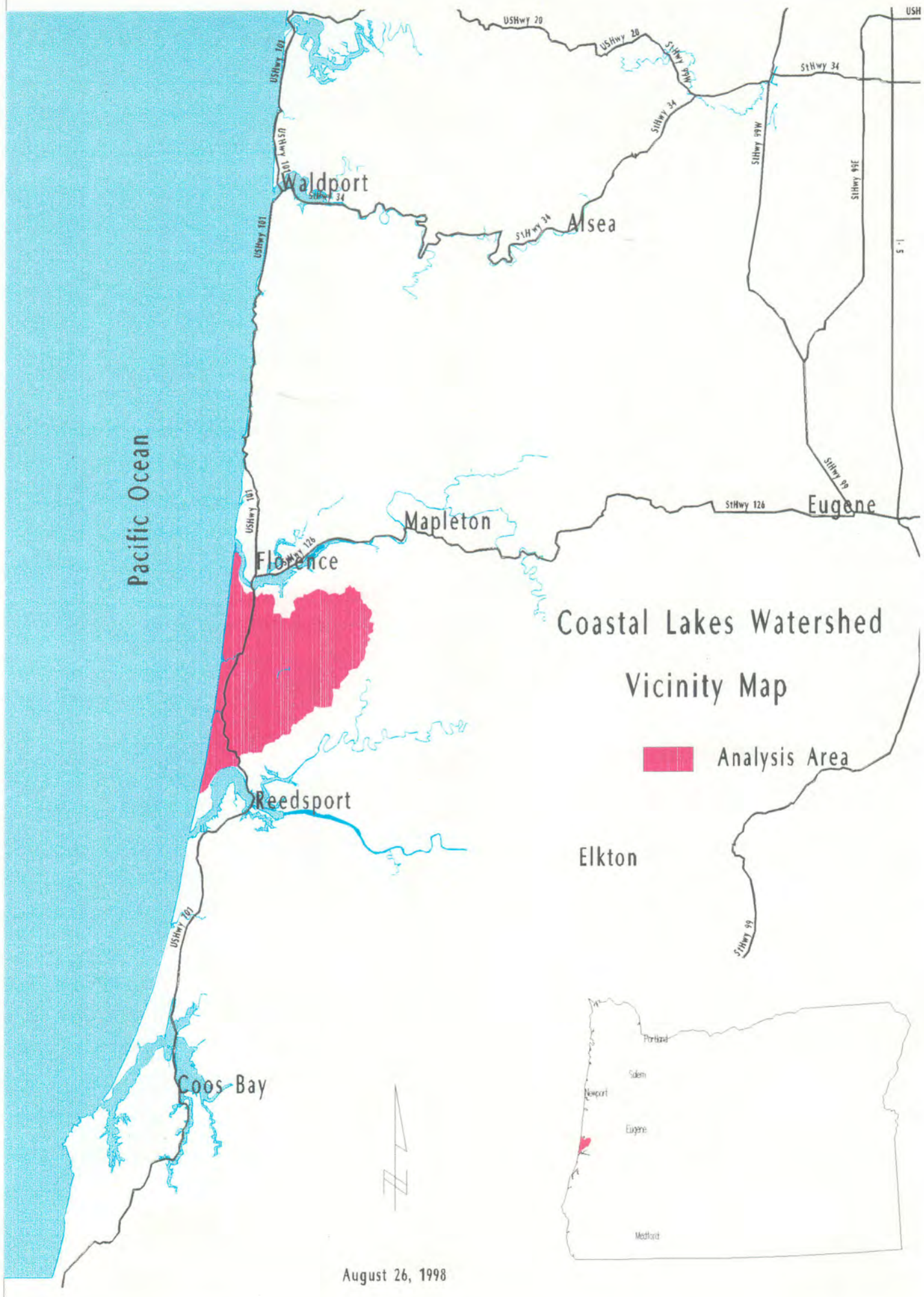
A 1983 lawsuit stopped timber sales on the Mapleton District. sixty-six percent of the District was classified as high risk for landslides, with the south end of the district having the majority of unstable ground. The U.S. District Court for Oregon ordered the USFS to study the effectiveness of headwall leave areas. The resulting report, by Swanson and Roach, on file at the Forest office, predicts that headwall leave areas are 90% effective as a mitigation.

Fragmented Land Management

The Coastal Lakes Watershed is managed by a diverse group of landowners and public agencies with a wide range of objectives (Figure 1.2). This fragmented management strongly influences resource conditions and landscape patterns today. Additionally, many other agencies and private groups also exert influence on how water related resources in the watershed are managed. After meeting with large numbers of the people in the watershed including agricultural, civic, and environmental leaders, we have tried to provide integrated information for the area as a whole. One of the greatest challenges for those who live and work here is to learn how to cooperatively manage the resources of this extraordinary watershed.

Figure 1.2. Number of acres by landowner in the Coastal Lakes Watershed.





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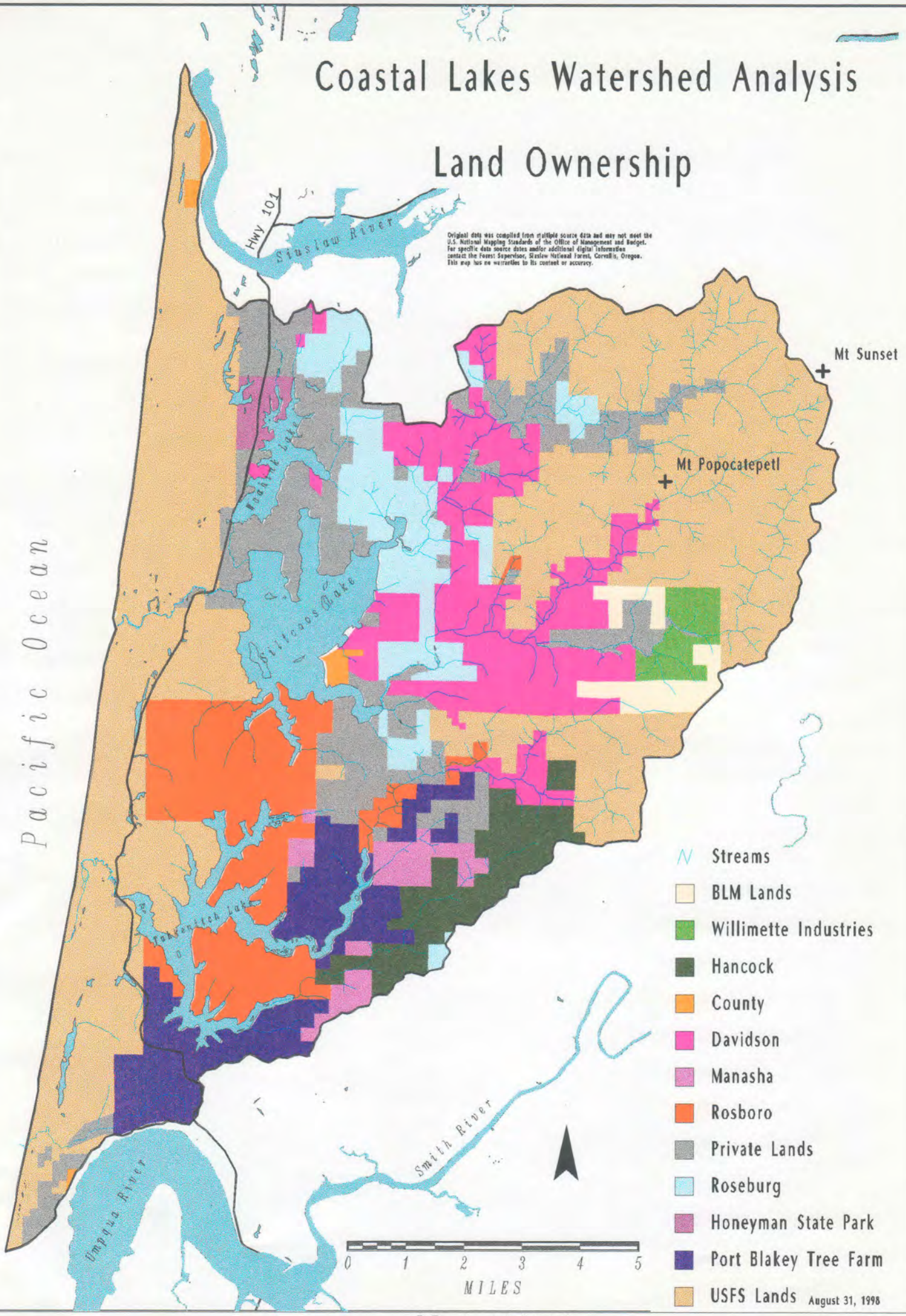
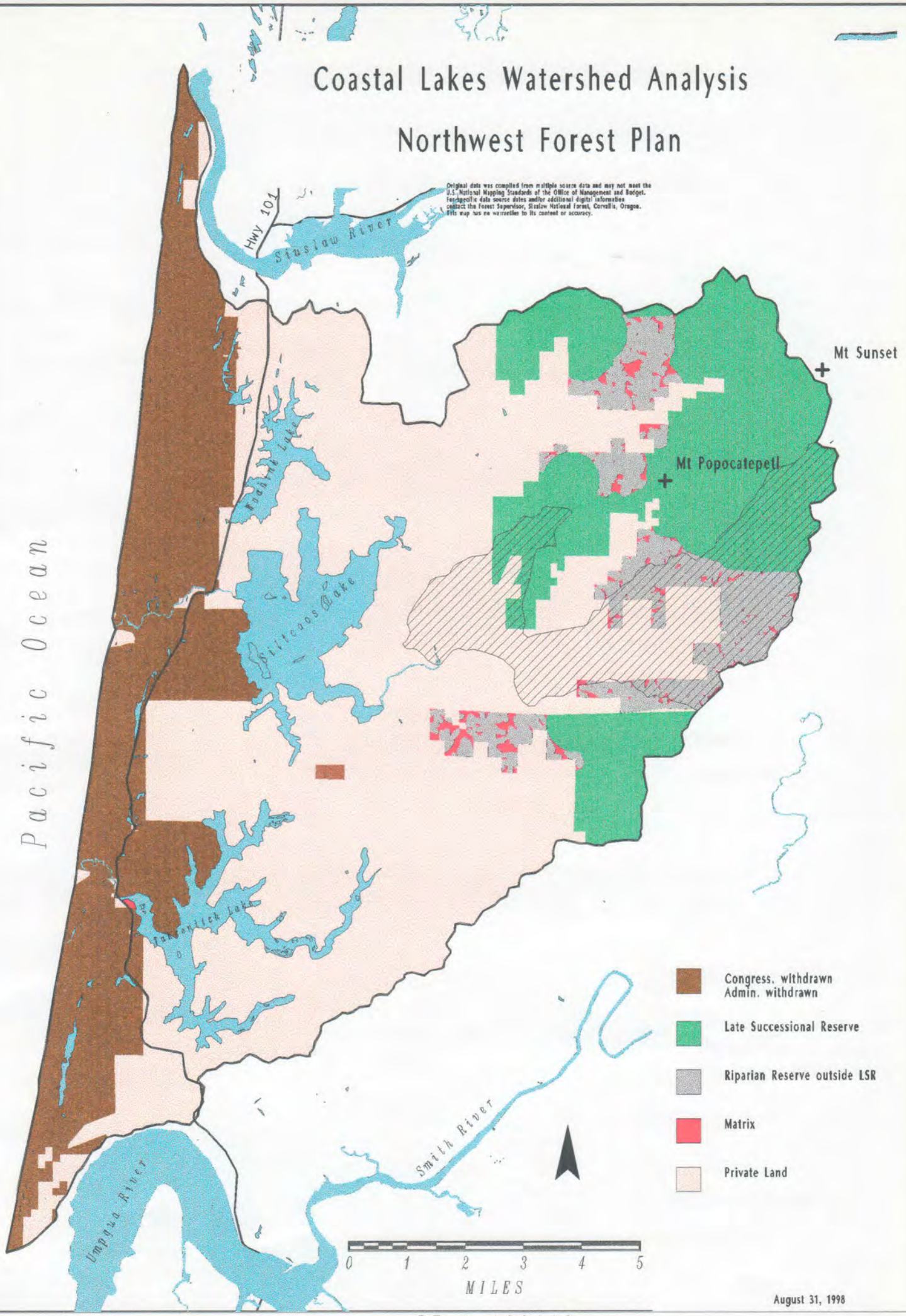
Coastal Lakes Watershed Analysis

Land Ownership



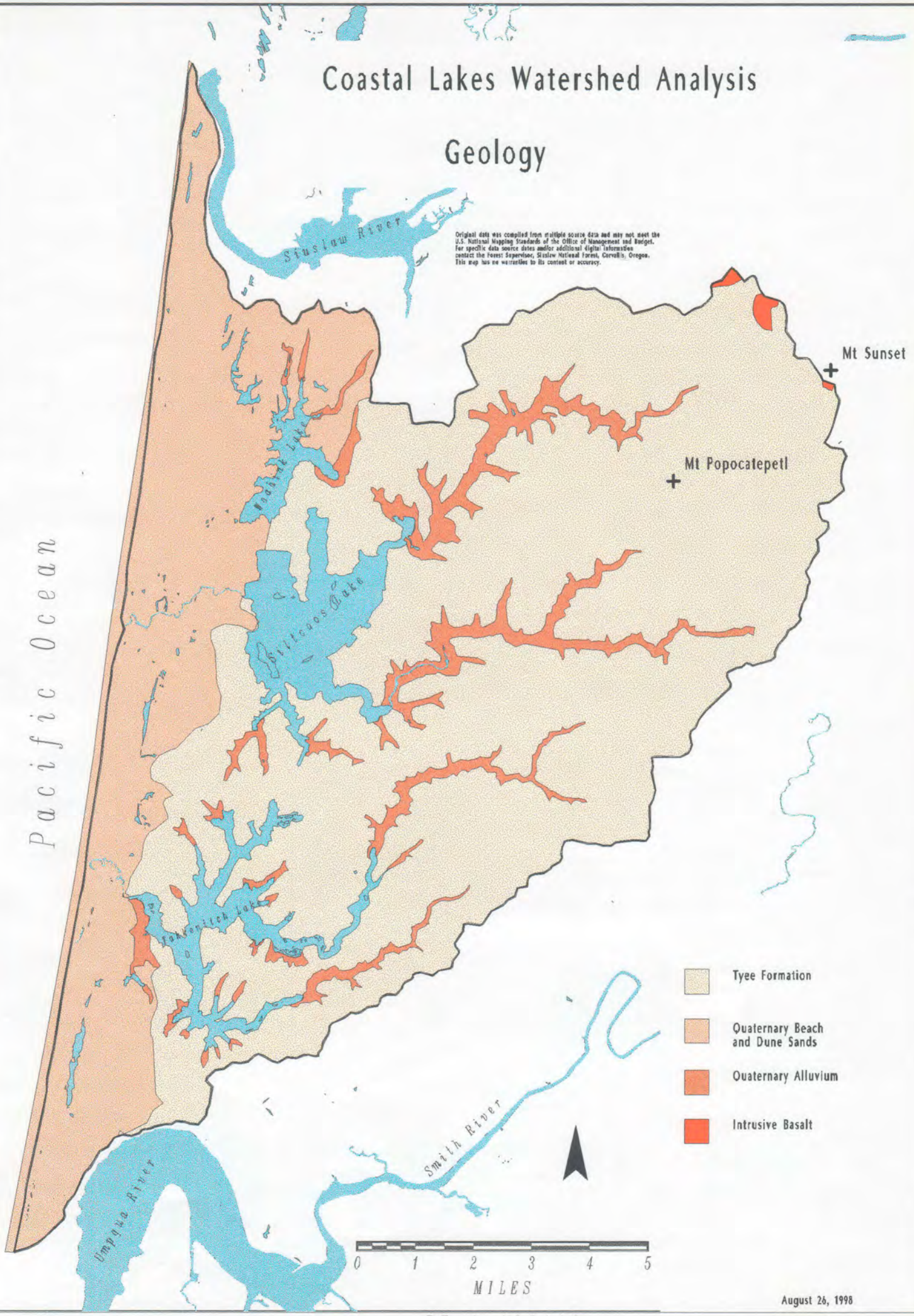
Coastal Lakes Watershed Analysis

Northwest Forest Plan



Coastal Lakes Watershed Analysis

Geology



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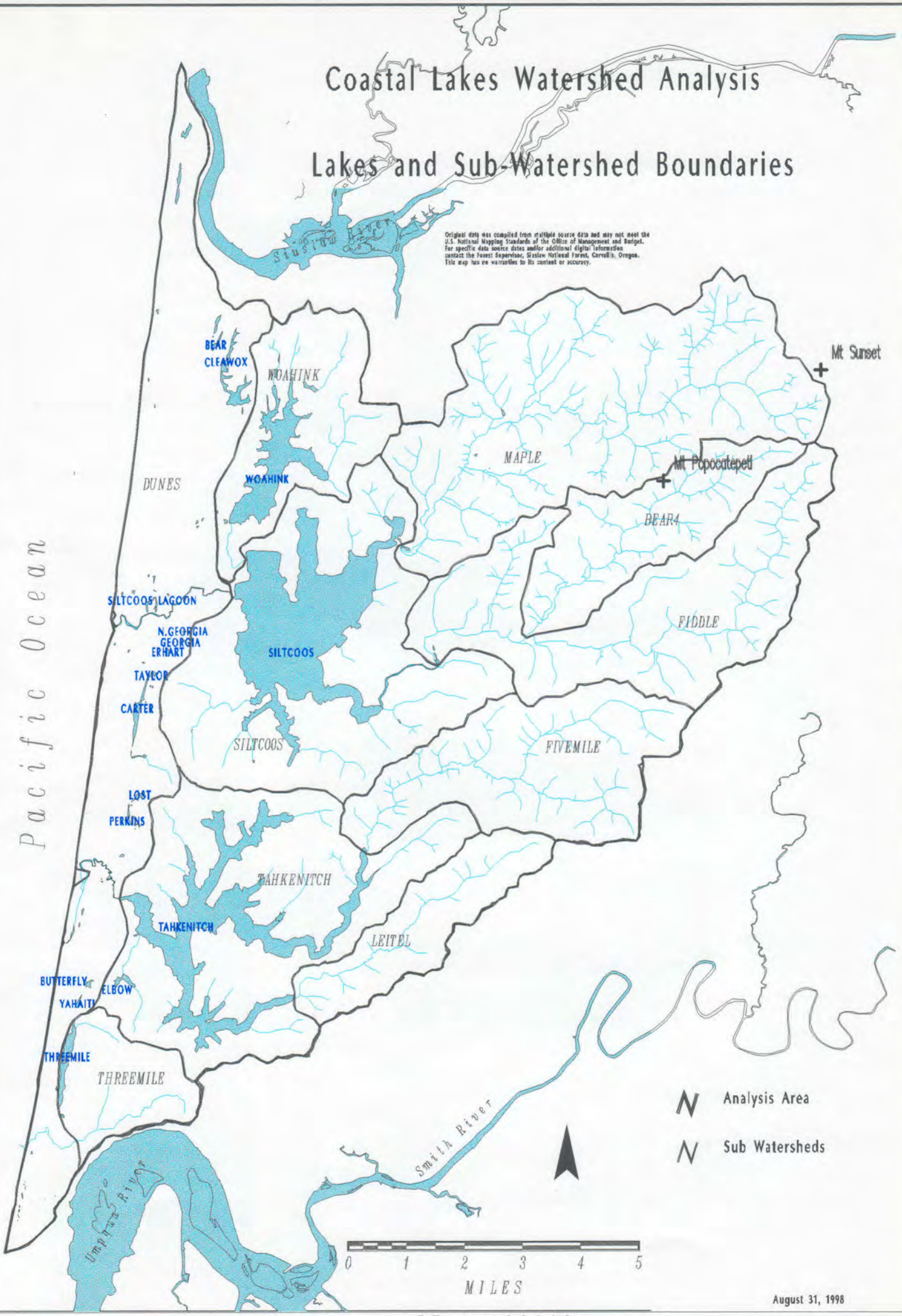
Coastal Lakes Watershed Analysis

Lakes and Sub-Watershed Boundaries



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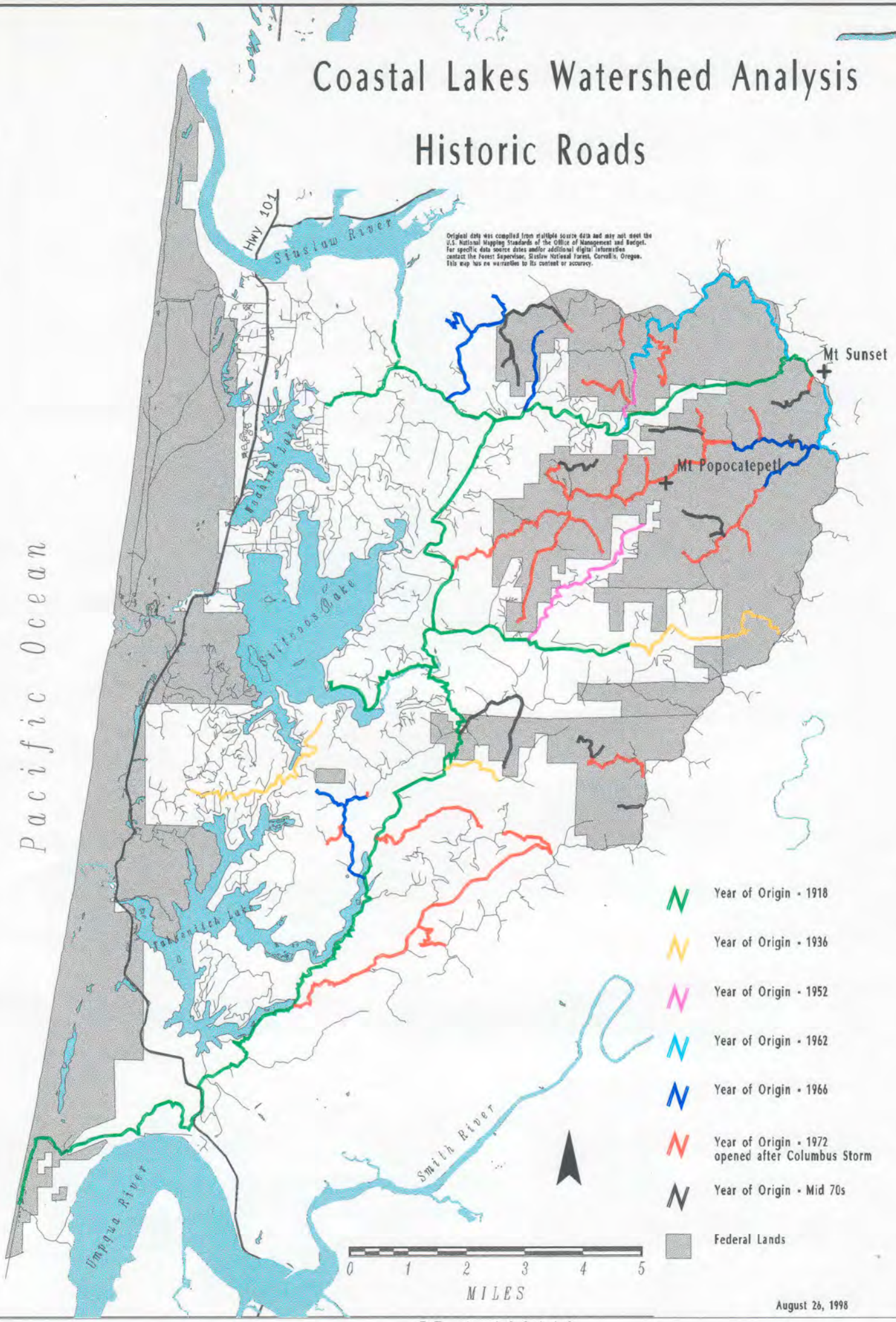
Coastal Lakes Watershed Analysis

Historic Roads



CHAPTER 2: ISSUES AND KEY QUESTIONS

Issues are developed to address uses, values and concerns raised in the Northwest Forest Plan and other higher level plans, interactions with watershed residents, landowners, and interested individuals, and discussions with state and federal agency personnel. The key questions focus the rest of the analysis on the most important ecological processes and how processes interact in the watershed.

Issue #1 - How can upland forests be managed to reduce forest fragmentation and support late successional species of concern?

Key Question: What seral classes and patch sizes existed historically on this landscape? What natural disturbances led to those conditions?

Key Question: Do the changes in vegetation patterns, stand structure, and composition that have occurred on the landscape over the past century affect the long-term health and sustainability of forest conditions and its ability to function as suitable wildlife habitat?

Key Question: How much of the current forest is mature conifer and how is it spatially distributed? How does late-successional forest habitat in the watershed function in the larger landscape? How much suitable habitat is available for spotted owls and marbled murrelets in their provincial home range? How doe current road densities affect these species?

Key Question: How much of the current mature conifer is considered "interior mature habitat" (habitat >500 feet from edges)? What is the spatial distribution of the interior habitat?

Key Question: Are there specific areas outside federal lands in the watershed which serve an important function for connectivity? Where are the key areas to target for land exchange potential?

Key Question: Where is the high quality bald eagle habitat?

Key Question: What vegetation management prescriptions are recommended for this Watershed?

Issue #2 - How has wetland and riparian habitat been altered by past and current land use, and how can the wetland habitat and ecological functions be protected and enhanced?

Key Question: What would we expect for the natural vegetation structure and composition along rivers, lakes, streams and in wetlands in the watershed? How has it been affected by Euroamerican human land use?

Key Question: What are the major natural disturbances prior to Euroamerican human settlement; what are the major disturbances today? What are the relationships between upland and riparian disturbances?

Key Question: How will restoration activities affect human uses of the watershed, *i.e.* grazing, access, recreation, navigation?

Key Question: What is the extent of marsh areas in the watershed? What role do they play in the function of aquatic and terrestrial habitats?

Issue #3 - How can lakes and stream channel conditions be improved to protect existing habitat and provide better habitat for fish and other aquatic species?

Key Question: How has function of lakes for coho changed in the last 100

Key Question: How are lake levels being managed at this time? Who is responsible for monitoring? How does current management of lake levels compare to historic levels and what is the biological effect on aquatic species? What effect do dams have on fish movement and productivity?

Key Question: What is the current and historic relative abundance and distribution of species of concern in the watershed?

Key Question: Where are our best opportunities for riparian restoration (riparian tree planting, commercial thinning)?

Key Question: Where are our best opportunities for instream restoration?

Key Question: Do any fish passage problems exist on federal land in the watershed?

Key Question: Where are the highest priorities for land acquisition in the watershed?.

Key Question: Where are our best opportunities for private partners for restoration? What are the benefits and deterrents for partnering (from the perspective of landowners and Forest Service).

Key Question: What role do estuaries play for fisheries, especially coho?

Key Question: What is the best treatment of non-native plants and animals in the lakes?

Issue #4 - What is the current condition of water quality in the watershed? What are the impacts to water quality? What opportunities exist to improve water quality?

Key Question: What are the riparian conditions for shade, bank stability and long-term large woody debris supply for the watershed? What are critical areas to restore to aid aquatic habitat?

Key Question: What is the condition of the dunal aquifer? What needs to be done to protect this water resource?

Key Question: Are there any unique geologic or geomorphic conditions in this watershed that affect function of the terrestrial and aquatic systems (sediment and wood routing)? How were the dunes formed and what is unique about them in the region? How were the coastal lakes formed and what is unique about this formation in the region?

Key Question: What type of soils exist in the watershed and how do these soils affect the hydrologic character of the watershed? (i.e. flow regimes and water tables).

Key Question: What is the extent of grazing in the watershed? What are the direct effects on water quality from grazing practices in the watershed? Where diking and channelization have occurred in depositional areas, how are aquatic resources affected? Where does diking restrict floodplain connection within the watershed?

Key Question: What is the current status of water temperature in the watershed? Where should monitoring focus in the future?

Key Question: Where are the areas of high, moderate and low instability within the watershed? How do unstable areas affect both sediment and large wood routing in the watershed? Given these dynamics, where would structure placement be most effective in the watershed to enhance fish habitat?

Key Question: Where are there road problems that could be chronic fine sediment producers for the long term? Which roads are priorities to fix? maintain? Obliterate? Any opportunities to work with private industry to fix roads?

Key Question: How is water quality in the Coastal Lakes being affected by: development? logging? grazing? recreation? What, if anything, can be done by the Forest Service to improve water quality? What monitoring has occurred in these lakes and what is needed

for the future? What are the most important water quality parameters that need to be tracked for these lakes? What advice/public involvement can be given to the Dune City and Lane County planners to assist in protection of these lakes?

Key Question: Are there any relatively untouched areas that could serve as reference conditions in the watershed for terrestrial or aquatic ecosystems?

Issue #5 -- What is the expected impact of continued population growth, urban development, and recreation use on the watershed? How can development and human use be managed to minimize impacts on the sensitive dunal, wetland, and riparian ecosystems?

Key Question: What increased uses on Federal forested lands in the upper portions of the watershed are expected over the next 20 years (*e.g.* road use, special uses)? What added demands will those have on resources and wildlife?

Key Question: What increased development will occur on the lakes in the watershed over the next 20 years? How will that affect water quality, wildlife, fish and other natural resources?

Key Question: What increased recreation demands will occur in the Dunes National Recreation Area over the next 20 years? How will that affect wetlands, water quality, wildlife, fish and other natural resources?

Key Question: What will be the combined and cumulative effects on natural resources from the interaction and increased uses of resources by people on National Forest land, dunes, and lakes?

Other Issues Considered But Not Analyzed in this Watershed Analysis:

Spreading of European Beach Grass on the sand dunes. This issue was considered extensively in the Dunes National Recreation Area Plan. Measures are being taken to control the spread of beach grass to the extent possible.

All terrain vehicles (ATV). This issue was also considered in depth in the Dunes National Recreation Area Plan.

HISTORIC CONDITIONS

Upland Sediment and Wood Routing

The processes that affect stream function are related to channel gradient and confinement by the surrounding hill slopes. Streams have been separated into geomorphic segments (Appendix G) to explain how water, wood and substrates move through the watershed (Map 7). In general, source reaches provide material, transport reaches move material through, and deposition reaches represent areas where material is deposited. Identifying the location of geomorphic segments are in the watershed allows resource managers to predict where potential fish habitat is and where restoration efforts will be most successful.

This Coastal Lakes Analysis Area contains an unusually high amount *(you mean acres? percent?)* of unconfined deposition area. These particular areas are unique because they contain long, very broad valley bottoms above coastal lakes with a high percentage of wetlands just above the arms of these lakes. These conditions create exceptionally good coho rearing habitat.

The long deposition reaches in the upland valleys include Maple, Fiddle, Fivemile and Leitel Creeks and some of their larger tributaries. They compose a series of valleys above the coastal lakes that have historically contained a wide diversity of habitats. Before human settlement, these long, low gradient valleys contained streams that meandered back and forth between steep adjacent hillslopes. Just above the lake arms and well up into these valleys, there was probably an abundance of side channels and wetlands associated with these streams. Riparian vegetation consisted of alternating patches of sedges, shrubs and trees, producing shady conditions along a majority of these stream lengths.

Up higher in these valleys there were probably stream sections dominated by alder and conifer, and also meandering streams with side channels. During large storms, debris torrents entered the valley from steep side tributaries, introducing large wood to these valley creeks. Streams changed course to accommodate these inputs and because of the low gradient, slow water conditions, large wood stayed in the valley rather than being transported through the system. As streams cut into new locations, it was not uncommon for old, buried large wood to be re-exposed in the banks of streams as is still seen today. High flow events caused water to spill out over stream banks, and stream energy was dissipated quickly in broad floodplains of these valleys.

Wetlands and Deepwater Habitats

Wetlands and deepwater (lake) habitats are distributed throughout the watershed (Map 8--Source National Wetlands Inventory). This wetlands classification (Cowardin, et al 1979), uses five main systems to categorize wetlands and deepwater habitats: marine, estuarine, riverine, lacustrine and palustrine (Appendix H). All five of these systems are represented in the watershed and give some indication of the historic diversity and extent of swamps, bogs and marshes that were so prevalent in the upland valleys, near the lakes and in the dunes after vegetative stabilization.

Within each of these systems are a plethora of subsystems, classes and subclasses (Appendix H) based on vegetation, amount of water present during the year, disturbance factors and bottom characteristics at each location. For this analysis, these divisions have been lumped into the groupings (Map 8).

Table 3.1. Acres of wetland and deepwater habitats in the watershed based on the National Wetlands Inventory.

Wetlands/Deepwater Habitat Category*	Acres	Predominate Locations	Acres and Percentages by System
Estuarine, subtidal and intertidal	66	Near mouths of Siltcoos River and Tahk. Creek	Estuarine = 66 ac. (0.7%)
Lacustrine, limnetic (water > 2m)	5,647	Coastal lakes	
Lacustrine, littoral (water < 2m)	381	Shoal areas of coastal lakes	Lacstr. = 6,028 ac (64%)
Marine, intertidal	147	Beach west of dunal sheet	Marine = 147 ac. (1.6%)
Palustrine, aquatic bed	21	Siltcoos Lagoon and Bear Lake	
Palustrine, emergent vegetation, permanently and semipermanently flooded	516	Larger lake arms; Threemile Creek	
Palustrine, emergent vegetation, flooded part year	947	Maple, Fiddle, Fivemile Creeks; Dunes	
Palustrine, forest, scrub, shrub, flooded part year	1,953	Dunes; Leitel and Threemile Creeks	
Palustrine, unconsolidated bottom, permanently and semipermanently flooded	69	Dunes	
Palustrine, unconsolidated bottom, flooded part year	128	Dunes	Palstr. = 3,097ac. (33%)
Riverine, tidal	50	Siltcoos River	

		and Tahk. Creek	
Riverine, low gradient	28	Siltcoos River and Tahk. Creek	Riverine = 78 ac. (0.8%)
Totals	9,416		

* Subclasses under the five main systems have been lumped for clearer mapping. See Appendix X for detail on subsystems, classes and subclasses.

Coastal Lakes

Sixty-four percent of the wetland and deepwater habitats in the watershed are lacustrine (lake), and the nineteen 19 named lakes range in size from under one acre to over 3,000 acres (Map 5). All these lakes owe their existence to the inland advance of the dunes, making them extremely unique.

While so many lakes exist in one area, they are very different in terms of form and productivity. The largest lakes farthest inland are fed predominately by surface streams while others receive inputs from both surface drainage and an extensive dunal aquifer. Several additional unnamed interdunal and ephemeral lakes exist in the dunal sheet and are fed exclusively by the dunal aquifer.

The five largest lakes: Siltcoos, Tahkenitch, Woahink, Cleawox and Threemile.

Table 3.2. Lake characteristics for the five largest lakes in the Coastal Lakes Watershed Analysis area (from North to South within watershed)1/.

Lake Name	Acres	Ave. Depth (feet)	Max Depth (feet)	Shoreline Length (miles)	Shoal Area	Marsh/ Swamp Assoc.	Water Retention Time
Cleawox	87	17	48	5.2	36%	minor	4 mos.
Woahink	820	33	68	14.2	17%	moderate	1.2 yrs
Siltcoos	3,164	11	22	27.8	32%	significant	2 mos.
Tahkenitch	1,674	11	23	25.5	36%	significant	2 mos.
Threemile	63	13	33	2.8	45%	minor	2 mos.

1/ Information taken primarily from Atlas of Oregon Lakes, Johnson et al, 1985.

Siltcoos Lake is the largest coastal lake in Oregon and represents bar formation across the mouth of an old estuary after the last period of glaciation. Its broadness and nondendritic nature make it quite different than any of the other sand dune formed lakes and these qualities are thought to be reasons that migratory waterfowl are so prevalent on this lake. Being very shallow (82% < 15 feet), it is a highly productive (eutrophic), and probably was long before human settlement because of its dimensions. Sunlight penetrates to the

bottom in much of Siltcoos Lake, allowing aquatic vegetation and fauna to thrive. This shallowness also allows complete mixing of waters at nearly all times of year, with subsequent uniform oxygen levels throughout the profile, and higher nutrient and turbidity levels than other lakes. Algae growth is pronounced, giving the lake a characteristic green, murky appearance.

Siltcoos Lake has a 68 square mile drainage basin which includes Maple, Fiddle, Woahink and Lane Creeks. Its outlet is through the 1.5 mile Siltcoos River which empties into the Pacific Ocean. Before human alterations to the lake outlet, periodic salt water intrusions commonly occurred in winter at high tides due to its elevation only 8 feet above sea level.

Siltcoos Lake has a number of islands which support rich stands of riparian vegetation and are used by wildlife and migratory birds. Three of the most prominent islands, Butterfly, Reed and Jernigan Islands, have been proposed for designation as Significant Natural Areas in the past (Johnson et al, 1985). Also important to waterfowl are freshwater marshes (Palustrine, Emergent Vegetation, Permanently and Semipermanently flooded) in Maple and Fiddle Creeks just above Siltcoos Lake (Map 8).

Similar to Siltcoos Lake, Tahkenitch was also submerged at its mouth by the rising ocean after the last period of glaciation and was eventually cut off from the ocean by the advancing dunes. However, Tahkenitch has a more dendritic pattern, common to most cut off river systems, with longer arms and a narrower main body than Siltcoos Lake. At an elevation of approximately 15 feet above sea level, it was not prone to salt water intrusions like Siltcoos Lake.

The drainage basin for Tahkenitch is 34 square miles and includes the Fivemile and Leitel Creek drainages. Due to the morphology of this lake and the valleys above it, there are large, freshwater marshes in two miles of lower Leitel Creek and four miles of lower Fivemile Creek (Map 8). Tahkenitch Creek is the outlet of this lake and flows through dunes for less than one mile before it meets the Pacific Ocean. This creek is somewhat less susceptible to becoming bar bound than Siltcoos because of the larger elevation drop from Tahkenitch Lake to the ocean.

Although some weak stratification has been observed in Tahkenitch Lake, it is usually well mixed by strong sea breezes and shows little tendency to stratify. Subsequently, similar to Siltcoos Lake, it shows similar levels of oxygen throughout its profile. Water in this lake is low in mineral content and soft, and like most of the coastal lakes it is enriched with sodium and chloride because of its proximity to the ocean.

Woahink Lake was once an arm of Siltcoos Lake. Historic records testify that Woahink Creek (the outlet to this lake) once drained into the Siltcoos River, but its outlet became Siltcoos lake in the 1890s when wind action shifted dunes in the area. This creek was again re-routed when Highway 101 was constructed. Woahink Lake is currently adjoined by

dune complexes on its western edge. Unlike Siltcoos and Tahkenitch, this lake is much deeper with steep walls and significantly less shoal area than its larger counterparts in the watershed (Table 4). Its deepest point is 74 feet, or 36 feet below sea level (termed a crytodepression), the lowest of any sand-dune dammed lake on the Oregon Coast (Johnson et al, 1985).

Historically, Woahink has been characterized as one of the most oligotrophic (unproductive) lakes in Oregon. Studies in the late 1960s and early 1970s found that Woahink's water chemistry was very similar to that of Crater Lake in Southern Oregon (personal communication, Larson). Studies in the past have also revealed high clarity due to low organic productivity, high settling velocity of incoming soil materials and sediment deposition in deep, relatively undisturbed waters. Secchi disk readings taken to test clarity (depth of visibility) have been as high as 24 feet (2 stations on Woahink, August, 1972).

In deeper lakes like Woahink, thermal stratification occurs in early spring when winter winds decline. A warmer layer develops at the surface of this lake which does not mix with colder, more dense water below. Summer thermoclines can be found between 20 and 30 feet in Woahink Lake and it is not uncommon for surface water temperature to be from 20-25°F greater than those near the bottom (Larson, 1974). Respiration and decomposition cause some depletion of oxygen and even anaerobic conditions in the lower, isolated layer of the profile during this stratification, especially at the mud/water interface. In fall, surface heating decreases and surface waters cool to temperatures similar to lower depths. Total mixing then continues throughout the winter, and at this time water temperatures at any depth are not lower than 39° F.

A lack of large tributaries that feed this lake is another unique feature about Woahink Lake. The largest of its tributaries is Gibbs Creek which is about three miles in length and half of this length is a forest/scrub/shrub swampy area flooded for part of the year. The entire drainage basin for this lake is only 7.4 square miles. With the small drainage size and few tributaries, lake turnover is longer than any of the other lakes in this watershed; 1.2 years as opposed to 2-4 months in the others (Table 3.2). Seasonal fluctuation of water level of Woahink Lake is only about 1.5 feet (Oregon Fish Commission, 1962)

Dunal Aquifer and Dunal Lakes

The average thickness of the sand deposit at the coastline is about 125 feet to bedrock. The saturated zone of this sand mantle creates a homogeneous, simple dunal aquifer that ranges anywhere from three to thirty feet from the surface throughout the dunes area of the watershed. Groundwater testing by Hampton (1963) showed a drop in the watertable of 2.5 feet from July 1 to October 1 and an increase of 5.15 feet from October 1 to March 1 during a period of 63.6 inches of rainfall in the area. In addition, it has been estimated that over 75% of average annual precipitation reaches the dunal aquifer (Brown and Newcomb,

1963; Hampton, 1963). Although lake levels of Siltcoos and Woahink are higher than the dunal watertable during summer, recharge of the aquifer from the lakes has not been found to be significant (Schlicker, et al, 1974).

Schlicker (1974) estimated that groundwater percolation to the ocean was about 50.3 million gallons per day or 56,400 acre-feet per year. He estimated that total annual discharge to surface water west and east would be 62,750 acre feet per year. Water quality is generally good from the dunal aquifer except for high iron content that requires some treatment.

Cleawox Lake is another coastal lake referred to as a crytodepression due to its depth below sea level. It is fed primarily by the dunal aquifer as well as a few surface tributaries and does not have an outlet. It has historically had very good water quality and studies have confirmed oligotrophic conditions, with high transparency and low productivity as compared to other lakes in the area. Like Woahink Lake, Cleawox also stratifies in summer.

The entire lake is encompassed by the dunal sheet with about half its western shore composed of actively advancing sand dune, once moving northward as much as 20 feet per year prior to vegetation stabilization (Johnson et al, 1985). There are signs that advancing dunes at the southwest corner are slowly filling Cleawox Lake. The remaining 2/3 of the Cleawox basin is vegetated by a pine and scrub complex. Small swampy areas are associated with the tributaries that come into this lake.

Threemile Lake is another dunal lake that is actually a pair of long, narrow lakes joined by a channel in its middle. It formed in a trough between an older, stabilized dune on its east side and an active dune on its west side, making it parallel to the shoreline of the Pacific Ocean. Similar to Cleawox Lake, it is a crytodepression without an outlet, and is fed by only a few surface tributaries and the dunal aquifer. Brush and trees cover most of its drainage basin with the exception of an unvegetated dune on the north end that is actively encroaching. Water quality on Threemile (mesotrophic) differs slightly from Cleawox (oligotrophic) due in part to strong winds on this lake that keep it from stratifying significantly. There are some small wetlands associated with the incoming tributaries to this lake.

Estuaries

Siltcoos River and Tahkenitch Creek estuaries make up the 66 acres of estuary in this watershed. A study of seasonal fish distribution in Siltcoos estuary was conducted in 1986 by the Oregon Department of Fish and Wildlife (Ely, 1987). This study revealed that Siltcoos estuary provides a migratory corridor to and from the lake and its tributaries for coho, cutthroat steelhead starry flounder and sturgeon. Similar to the Tenmile estuary south of this watershed, fish distribution is most diverse in the summer when saltwater is completely flushed with fresh water twice daily. Magnitude of salinity change as well as

rate of change has the greatest effect on fish distribution. In the fall and winter, fresh water dominates these estuaries, causing fish abundance to drop dramatically.

Both the Siltcoos River and Tahkenitch Creek estuaries are subject to becoming bar bound in the Fall. This propensity for bar formation at the mouth is much higher in Siltcoos River than in Tahkenitch Creek given that Tahkenitch Lake elevation above mean sea level is twice that of Siltcoos Lake (15.4 ft. vs 8 ft., respectively). Under natural conditions, bar formation dictated the extent and concentration of brackish water in these estuaries. Larger storms in the late fall and early winter then washed these bars out and allow anadromous fish passage and tidal influence in the estuary.

Historic Fish Distribution and Use

Historically a great amount of fish rearing habitat occurred in the lower unconfined areas of the major tributaries that empty into the coastal lakes (Map 9). This included approximately 8 miles of Maple and Fiddle Creeks, 10 miles of Fivemile Creek and 5 miles of Leitel Creek. However, the lakes probably provided the greatest rearing habitat for the coho salmon. Since the stocking of warmwater fish that prey on the anadromous fish in Siltcoos Lake beginning in the 1920s (ODF&W reports), the rearing conditions in the lower unconfined tributaries have become even more important.

In the late 1800s the low gradient, wide valley bottoms with highly sinuous streams moving back and forth were some of the first areas settled. With settlement came stream modification to accommodate agriculture and primarily livestock grazing. Diking, draining of wetlands, straightening of creeks and removal of large wood all contributed to the loss of rearing habitat in these homesteaded areas. Long time residents of the area interviewed for this watershed analysis described willows extensively lining the stream channels in the past on Maple and Fiddle Creeks, some 40 years after initial homesteading.

The lake systems supported commercial fisheries of about 5,000 adult coho salmon each in Siltcoos and Tahkenitch Lakes around the turn of the century. The adult coho that escaped the commercial and recreational fisheries spawned in the gravels of the upper reaches of the streams (Map 9). These spawning areas were generally where the stream gradient increased, the valley bottom became more confined and large wood was present in greater quantities to hold and sort the gravels from the finer sediments. Some coho salmon spawning continued in reaches greater than 4% gradient, but these areas were generally steelhead and cutthroat spawning reaches.

The Bulletin of the United States Fish Commission (1897) describes an evaluation of Siltcoos, Tahkenitch, and Woahink Lakes by a Dr. Meek to determine if they should stock the lakes with bass and other warmwater species. Dr. Meek concluded that it was not advisable for the commission to stock these fish in the lakes. He said that stocking the bass would be detrimental to the silver salmon fishery and he had concerns that the bass would

spread to the Siuslaw and Umpqua River systems. Dr. Meeks' advice was not taken and a non-native warmwater fishery was created. By the 1920's a very popular bass fishery was created and stocking of various fish species has continued through the present.

An estimate of coho spawner escapement for the last 4 decades (ODF&W) shows that populations in Siltcoos and Tahkenitch are well below levels that existed in the late 1890's that averaged 5,000 fish just in the commercial catch (Table 3.3).

Table 3.3.- Average estimated spawning coho salmon stock size by decade.

	Decade			
Lake Basin	1960's	1970's	1980's	1990's
Siltcoos	5,055	3,015	3,475	3,387
Tahkenitch	1,845	2,144	3,198	1,607
Tenmile	30,919	16,124 **	4,764	5,917

** Lake treatment and bass re-establishment occurred in this time period. Average stock size after 1971 when the bass reestablished was 6,500.

The effect of warmwater species introduction on the coho salmon population of a coastal lake is exemplified in Tenmile Lake just North of Coos Bay, Oregon. In 1968, this lake was treated with a pesticide to rid the lake of its warmwater species. In the years following the treatment, numbers of coho salmon dramatically increased for two years until the bass, bluegill and brown bullhead became established in the lake again. Subsequently the numbers of coho salmon again began to drop over the last 25 years that are about 19% of the coho stock size estimate of the 60's and 6% of those estimated around the turn of the century (ODF&W Tenmile Basin Fish Management Plan 1991). It is likely that the warmwater fish have similarly limited the coho salmon populations in Siltcoos and Tahkenitch Lakes basins.

CURRENT CONDITIONS

Dams on Siltcoos and Tahkenitch

The earliest documentation regarding dams in this watershed is a 1949 report by the State Game Commission (later Oregon Department of Fish and Wildlife). It states that the Coos Bay Pulp and Paper Company had been using an earthen dam at the Tahkenitch Lake outlet to raise water levels in summer, allowing tug boats to go further up the arms of Tahkenitch to retrieve log rafts. In 1949 they proposed an 8-10' high splash dam structure with concrete footings that would allow them to withdraw water during summer. Game Commission field biologists surveyed in Five-Mile Creek and determined that a 5-foot rise in summer water level would not impact spawning gravels since this lake level would be similar to winter levels. This report also documents that before the dam was put in,

natural lake levels fluctuated between 7 and 19 feet above mean sea level (OFC Memo, 1949).

In 1960, International Paper Company (I.P.) acquired a permit to divert water from Tahkenitch and Siltcoos Lakes to supply water to a pulp mill in Gardiner, Oregon. I. P. was given an authorized to divert 12.46 cubic feet/second (cfs) from Siltcoos Lake and 36.65 cfs from Tahkenitch Lake. Multi-gated dams for both lakes were constructed in 1963 under the guidance of the permit issued by the State Engineer which stipulated minimum flow and fish passage requirements. In 1966, minimum flow requirements were modified from 50 cfs to 20 cfs for Siltcoos dam and from 20 cfs to 15 cfs for Tahkenitch and these flow requirements remain in tact (Tables 3.5 and 3.6). The Water Master (State Water Resources Department) in Roseburg, Oregon, and Oregon Department of Fish and Wildlife have joint responsibility for ensuring I.P.'s compliance with the permit.

Interestingly, I.P. has drawn water from Siltcoos Lake six or fewer times over the last 34 years that the dams have been in operation. Siltcoos water is used only under emergency conditions when drought has impacted Tahkenitch Lake levels such that water can no longer be drawn. Although additional issues drive lake level maintenance, some advocates have questioned the need for a dam on Siltcoos Lake when weighing the ecological effects against the minimal lake withdrawls.

Construction of both dams included a fish ladder with a required flow of 12.5 cubic feet per second. In 1966, the Siltcoos fish ladder was altered to allow better passage for searun cutthroat. Fish passage requirements differ throughout the year for these two lake systems (Table 3.4). *(The table does not show any differences--clarify)*

Table 3.4. Fish migration through Siltcoos and Tahkenitch outlets.

Time of Year	**Fish Activity**
October 1 - February 1	Adult coho salmon entering
December 1 - April 1	Adult steelhead entering
July 1 - November 1	Adult sea-run cutthroat trout entering
January 1 - June 15	Juveniles of all three anadromous fish species leaving
Spring	Occasional citing of Sturgeon entering lakes

The original permit recommended periodic flushing in the Fall as needed to keep the mouths of Siltcoos and Tahkenitch Creeks open where sand bar formation has the potential to obstruct fish passage from the ocean. Under natural conditions, larger winter storms in December and January would eventually wash out these bars to allow fish passage. ODF&W documents *(need a better ref. citation here)* state that before the dams were

put in, these creek mouths often inhibited fish passage in the Fall and were dug out by heavy equipment or by hand on several occasions.

Several different points emerge about the practice of flushing the creeks. Some contend that artificially flushing the bars encourages the salmon to move upstream earlier then they would if flushing happened naturally, as with a large rain storm. With artificial flushing, the salmon may enter the spawning grounds before the flows are high enough to make many of the best spawning areas available to the fish. In the past this practice also allowed fishermen a longer fishing season for the salmon and increased license sales and revenue from fishing supplies and accommodations *(ODF&W reference?)*.

Some suspect that the flushing later in the year may be more advantageous for the salmon (*than what*?). On the other hand, timing of the salmon runs may have been shifted over the past 35 years to earlier in the Fall due to artificial flushing (*reference?)*. In addition, planted beach grass has changed the function of the dunes and may also be impacting bar formation.

Although letters from the Water Master on three separate occasions in 1992 and 1994 indicated non-compliance with the flushing stipulation of the permit, recent attention to the dams by I.P. has been more thorough. Bar formation is checked daily and strip charts from stage height recorders below both dams are sent to the Water Master in Roseburg to show compliance. The Siltcoos gage must show high tides each day to prove that its mouth is open. With the recent departure of ODF&W personnel from Florence, monitoring of permit compliance is currently limited to this reporting to the Water Master and infrequent visits he makes to the coast.

Based on stage height records taken on both lakes from the late 1950s before the dams were constructed, Tahkenitch and Siltcoos Lake are held at an average 3.0 to 4.5 feet higher than natural lake levels between April and November. The effect of less lake fluctuation on upstream ecology has not been studied, but intermittent wetlands that once dried up in summer are now innundated year round while floodplain areas once used for grazing by private landowners have either been abandoned, diked, and drained to accommodate seasonal grazing as in lower Maple Creek (Map 10). A local lakes group has documented the loss of groups of islands that were once used by waterfowl as well as erosion of saturated toe slopes into Siltcoos Lake, due most likely to the fact that water no longer recedes in this area during summer.

In addition to changes in resource function, lake level management has developed a social dimension. Some private homes and resorts along Siltcoos Lake are increasingly vocal about their desire to maintain lake levels that accommodate boat docks for a large portion of the year but also protect property from flooding. Following high water in the floods of 1996, a Coordinated Resource Management Planning (CRMP) process was facilitated by the Siuslaw Soil & Water Conservation District for the Siltcoos Lake area to address

concerns by residents and resorts on the lake. In October of 1996, this CRMP produced an interim agreement that maintains Siltcoos Lake at 8 feet from March 15 - September 1, drops lake level to 6 feet from September 1 to November 1, and then opens the gates to maintain a 6-foot level throughout winter. Given that these lake levels fall within the requirements of the State permit, no conflict of interest exists.

Table 3.5. Tahkenitch Dam Management by International Paper Company.

Dates	Maximum Lake Level	Flow Management	Minimum Lake Level	Minimum Flows
Nov 1 - Mar 31	15.4 ft. Mean Sea Level	If lake level exceeds 15.4 ft., all gates shall be fully opened until lake level reaches 15.4 ft.	10.0 ft. Mean Sea Level *	Fish Ladder: 12.5 cfs Total: 15 cfs
April 1 - Aug 31		Fully or partially open gates to maintain lake level at 15.4 ft. **	10.0 ft. Mean Sea Level *	
Sept 1 - Oct 31		Increase flows to maintain open channel. Fully or partially open gates to maintain lake level at 15.4 ft. **	8.0 ft. Mean Sea Level	

* As possible while maintaining authorized diversion and minimum flows.
** If lake level exceeds maximum allowable, fully open all gates until level reaches maximum.

Table 3.6. Siltcoos Dam Management by International Paper Company.

Dates	Maximum Lake Level	Flow Management	Minimum Lake Level	Minimum Flows
Nov 1 - Mar 31	8.0 ft. Mean Sea Level	If lake level exceeds 8.0 ft., all gates shall be fully opened until lake level reaches 8.0 ft.	5.0 ft. Mean Sea Level *	Fish ladder: 12.5 cfs Total: 20 cfs
April 1 - Aug 31		Fully or partially open gates to maintain lake level at 8.0 ft.**	5.0 ft. Mean Sea Level *	
Sept 1 - Oct 31		Increase flows to maintain open channel through sand bar at mouth of river. Check strip chart daily for evidence of tidal swing. Open gates if strip chart does not indicate high tide occurred. Fully or partially open gates to maintain lake level at 15.4 ft.**	3.0 ft. Mean Sea Level	

* As possible while maintaining authorized diversion and minimum flows.
** If lake level exceeds maximum allowable, fully open all gates until level reaches maximum.

Stream Modification

As many of these streams were relocated, straightened and confined with dikes, channel morphology and habitat for aquatic resources were greatly altered (Map 10). Appendix E provides estimates of the amount of channelized and diked mainstem in each subwatershed based on aerial photo analysis. Maple, Fiddle and Fivemile Creeks have been modified for a majority of their mainstem lengths (94, 89 and 69 percent, respectively) while Bear Creek has been moderately modified (44 percent) and Leitel none at all. Much of these modified areas are either currently being grazed or were abandoned for grazing some time in the past after lake levels were modified by the dams (Map 10).

Straightened channels are more efficient at transporting sediment than the meandering channels they replaced. Eroding stream banks in diked portions provide a steady source of sediment which can eventually be transported to the lakes below these streams. Evidence of this sedimentation is readily visible in aerial photographs of the mouth of Maple Creek where a delta has been forming and is beginning to cut off a 10-acre arm of Siltcoos Lake Appendix N. Although delta formation such as this is a natural phenomenon, the process is being sped up by several times due to the excess sediment in Maple Creek.

Large Woody Debris

The unique wide alluvial valley bottoms in combination with the coastal lakes makes interpretation of large wood potential and its effects to the streams and aquatic habitat much different than in previous watershed analyses completed on the Mapleton District. We believe that historically there were only scattered large trees present in the valley bottoms with occasional clumps that extended out from the slopes, possibly on old landslide deposits. The lack of standing large wood around these mainstem channels may not be new although areas where the stream is near the slope breaks on the edge of the valley historically had the highest potential for providing large wood to the stream. Currently these areas have been extensively logged and have little or no potential to supply large wood (Map 11).

In the future contributions of large wood will come from landslides, predominantly from federal lands where large standing trees remain. Farther upstream in the moderately confined reaches, the potential for large wood increases (Table 3.7).

The confined portions of the Fiddle and Fivemile subwatershed and the moderately confined portion of the Bear Creek subwatershed had the highest percentages of adequate supply of large wood. The moderately confined reaches of Siltcoos, Fivemile, Fiddle, and Maple subwatershed have the highest proportion of area not adequately supplying large woody debris (Table 3.7). At the reach level of analysis, the North Prong, upper Fiddle and upper Bell Creek areas have the greatest potential to supply large wood to the streams within the watershed (Map 11). *(Define adequate, near term, and not adequate.)*

Table 3.7. Proportion of confined and moderately confined stream reaches, and potential to supply large wood for subwatersheds in the analysis area.

Subwatershed	Confinement	Adequate	Near-Term	Not Adequate
MAPLE	moderate	30.5	4.7	64.8
MAPLE	confined	47.6	6.7	45.7
FIDDLE	moderate	30.7	0.3	69.0
FIDDLE	confined	57.9	2.3	39.9
BEAR	moderate	55.0	3.3	41.6
BEAR	confined	47.4	1.4	51.2
FIVEMILE	moderate	27.6	3.4	69.0
FIVEMILE	confined	57.2	8.1	34.7
LEITEL	moderate	25.1	32.1	42.8
LEITEL	confined	29.6	15.7	54.7
WOAHINK	moderate	20.8	35.1	44.1
WOAHINK	confined	26.3	31.4	42.3
SILTCOOS	moderate	31.9	10.4	70.2
SILTCOOS	confined	19.4	4.7	63.4
TAHKENITCH	moderate	33.0	28.1	38.9
TAHKENITCH	confined	16.5	23.2	60.3
THREEMILE	moderate	46.0	29.5	24.5
THREEMILE	confined	13.2	55.3	31.5
Total -- Appendix E		*Total*	*Total??*	*Total??*

***Unconfined reaches not shown because it would skew the picture of the function of the wide alluvial bottoms.**

Upland Water Quality and Fisheries

Maple Creek

Forest service ownership is limited to the upper two miles of the headwater mainstem of Maple Creek. Tributaries to Maple Creek which are managed by the Forest Service include Carter, Henderson, North Prong, Schultz, Tenmile and over half of Jordan Creek. From the mouth of Maple Creek at Siltcoos Lake, the first mile or so is in a wetland bog condition until near the confluence of Maple Creek and Schrum Creek. From that point up to the Forest Service boundary (about 8 miles *out of how many*?) the Maple Creek valley bottom (including tributary mouths) has been extensively diked, cleared, straightened and drained--and some of these activities continue today. Subsequently the stream has downcut and has many steep nearly vertical banks that are eroding as the stream tries to reestablish meanders and dissipate energy at its new base level. Few pieces of large wood remain in the channel since landowners were told in the past to remove the wood if they wanted to minimize flooding.

Grazing in this watershed continues to impact the fishery habitat of this stream. There are few areas along this stretch of creek where there is enough vegetation on the banks to stabilize them including a few willows that remain from the willows that naturally lined this channel. There may be temperature and algae bloom concerns in this creek due to the lack of riparian vegetation to provide shade and nutrient input from the agricultural activities in the valley bottoms, however, recent information on these problems has not been collected on private land ownership. In 1974, Lane County surveyed several sites in western Lane County and found that lower Maple Creek had the highest coliform counts in the basin due to agricultural uses. Counts were 100 organisms/100 ml while water considered unsafe for recreational use is 750 organisms/100 ml. Dissolved oxygen dipped to 9 mg/L in one sample while the Department of Environmental Quality (DEQ) minimum standard is 6 mg/L. Low dissolved oxygen was attributed to unagitated water and agricultural activities *(reference??)*

The low gradient continues up the mainstem of Maple Creek and tributaries until climbing into the headwater areas (20 percent gradient). North Prong and Upper Maple Creek appear to be the most productive stream reaches managed by the Forest Service. These are the areas where the majority of the spawning for coho, steelhead and cutthroat and probably a substantial amount of rearing occur (Map 9).

Coho spawning surveys have been conducted on Henderson, North Prong and Maple Creek. North Prong and Maple mainstem had the most fish and Henderson Creek had substantial numbers as well within the Maple Creek drainage (Table 3.8). Additional spawning information is available from ODF&W but was not easily retrievable for this analysis.

Table 3.8. Spawning survey information for WA area *(Give units. Surveys? Fish??).*

Spawn Surveys Coho	Henderson Creek	North Prong Creek	Maple Creek	Alder Creek	Fiddle Creek	Fivemile Creek	Leitel Creek
1960						73	168
1961						146	284
1962						230	272
1963	85	81	82	199	157		
1964	60	96	106				
1965-95	No data	No data	No data	No data	No data	No data	No data
1996	45	107	138	65	192	306	410
1997	22	39	53	25	166	210	358

Fiddle Creek

Forest Service ownership is limited to the upper 5 miles *(out of how many total mainstem miles?)* of the headwater mainstem of Fiddle Creek. The Upper Fiddle subwatershed is

listed as a Tier 1 Key Watershed under the Northwest Forest Plan (1994) and is the only Key Watershed in this analysis area. Tributaries to Fiddle Creek where the Forest Service has some management of the upper reaches of the stream include Bear Creek (3 miles mainstem and 1 mile South Fork), Billy Moore Creek (1 mile), and Alder Creek (1.5 mile)

From the mouth of Fiddle Creek at Siltcoos Lake the first mile or so flows through wetland/bog habitat until near the confluence of Fiddle Creek and Young Creek (near the Ada Grange). From that point up to at least the Forest Service boundary (~ 8 miles) the Fiddle Creek valley bottom (including tributary mouths) is used extensively for agriculture, primarily cattle grazing. Similar to Maple Creek, Fiddle Creek has been diked, cleared, straightening and the stream channels and valley bottom have been drained.. Similar raw banks with little or no woody vegetation are common and a lack of large woody debris limits pool habitat.

There has been some recent fencing to remove livestock from the streambanks in the upper areas of private and along Fiddle Creek and some areas where livestock grazing has been removed altogether and stream channel work and riparian plantings have begun in an effort to improve salmonid habitat. These areas are supporting more vegetation *(than what?)*. Woody plants such as willows will begin colonizing these areas as soils become exposed from the stream meanders and point bars that will form. Again like Maple Creek, fish habitat in mainstem Fiddle Creek may be temperature limited and high nutrient loads from agricultural practices may increase algae activity and decrease water quality. We have not collected any information on these problems because this area is privately owned, but since the county road runs along side the creek, windshield surveys are revealing.

Similar to Maple Creek, the low gradient continues well up the mainstem and tributaries before climbing into the headwaters (Map 7). Bear and Upper Fiddle Creek appear to have the most productive stream reaches managed by the Forest Service. These are the areas where the majority of the spawning for coho, steelhead and cutthroat, and probably a substantial amount of rearing occur. We suspect that some of the best rearing is located in the wetland/marshes in the first mile above Siltcoos Lake. Spawning counts have been taken in Alder and Upper Fiddle Creek, and the high numbers of returning coho to Fiddle Creek indicate why this area was selected as a key watershed (Table 3.8).

A stream survey completed on Forest Service managed lands on Fiddle Creek in 1997 divided the stream into three reaches:

- Reach 1 has a stream gradient less than 1% through a 150 foot wide valley bottom. The stream is deeply entrenched but highly sinuous. There are abundant gravels with a fair amount of sand especially in the lower part of Reach 1 where streambank erosion is high due to cutting of the steep banks. Woody riparian vegetation is lacking and the early seral vegetation present is not able to stabilize the streambanks. Low amounts of large wood were present in this reach but where they were, excellent fish habitat was

also present. Five beaver dams were counted and made up about 8% of the pool area. Many juvenile salmonids were observed in this reach.

- Reach 2 has a about 4% stream gradient through a 100 foot valley bottom bordered by terraces and steep hill slopes. The stream is predominantly bedrock substrate with some accumulations of sediment behind occasional logjams. Debris flow activity was more evident than in Reach 1. Mature conifer forest lies on both hillsides above this reach with alder and bigleaf maple directly along the stream.

- Reach 3 has about a 4% stream gradient through a narrow (less than 100 ft) valley directly bordered by steep hill slopes. Channel geometry is greatly affected by deposition behind debris jams, some of which are large. Gravel, cobble, boulders, and bedrock were present in roughly equal proportions through this reach with the largest substrate size present in greater proportion at the upper section of this reach. Mature conifers dominate the riparian area with substantial amounts of alder and bigleaf maple shading the stream.

In the 1970's parts of Reach 1 and Reach 2 were stream cleaned. That is, log jams were removed that were considered detrimental to fish migration at the time. This has had drastic effects, especially in Reach 2 where the substrate material that was present behind these debris jams was released downstream and consequently Reach 2 is predominantly bedrock with little fish habitat value and has little or no wood to accumulate substrate material in the future. Restoration efforts in this reach could greatly increase the numbers of coho in Fiddle Creek due to the currently limited creek sections that possess good spawning gravels.

Fivemile Creek

This stream contains one of the strongest runs of coho on the Oregon Coast. In 1996 and 1997 peak escapement counts were approximately 200 and 300 fish per mile, respectively. Fivemile Creek flows into the northeast corner of Tahkenitch Lake, meandering through about two miles of marsh/wetland habitat. The first 8 miles of the creek are in private ownership with the upper mile managed by the Forest Service. A 1997 fish habitat survey in this upper mile reach showed a riparian area dominated by alders and bigleaf maple. Stream bank stability is good and gravels are abundant. Rearing for salmonids is limited due to low flows during the summer, the overall lack of large wood present in the system and subsequent lack of deep pools developed with the large wood.

For about 1 mile below Forest Service managed land, Fivemile Creek continues through an alder dominated riparian zone with low gradient and probably abundant gravels for spawning. This section has more flow present during the summer, providing rearing more habitat for salmonids.

On the next 5 miles of Fivemile Creek vegetation has been cleared and the riparian area is currently used for grazing. It is likely that this area is similar to Maple and Fiddle Creek segments that have or are being grazed after being cleared of most woody vegetation. Stream banks are likely to be unstable in many places with a high amount of fine sediment present in the gravels of stream riffles. This area has not been diked as much as portions of Maple and Fiddle Creek but some diking and draining were observed in 1997 aerial photographs. Where the diking and draining have occurred, expect to find a more downcut channel with unstable banks where the stream is attempting to reestablish its meander pattern. There is probably a large reduction in fish habitat through this stream section and we would expect to see fewer juvenile coho rearing here than there would have been historically.

The main feature that is different about Fivemile Creek compared to Fiddle and Maple is the extent of marsh habitat in the lower 2 miles of the creek that has not been diked and drained, at least not lately. We suspect this area contains the majority of the summer rearing habitat for the coho in this stream. The stream meanders through this marshy area with overhanging banks and vegetation, acting almost like a slow backwater behind a beaver dam, where coho often thrive. Side channels look like they exist from the aerial photographs as well. There may be temperature and algae bloom concerns in this creek due to the lack of riparian vegetation, however, we have not collected temperature information because the area is privately owned.

Fivemile was the only creek we know to have had a hatchery within the analysis area. Located near the mouth of Harry Creek, written reports could not be found in ODF&W files detailing the years of operation or species handled at this hatchery. It is believed to have operated in the 1920s and '30s and may have been connected with the Knowles Creek hatchery in the Lower Siuslaw Watershed area (personal communication, George Westfall).

Bell Creek is a major tributary to Fivemile Creek. The lower mile of Bell Creek is privately owned and currently grazed. Much of the riparian vegetation has been removed, and streambank stability and the subsequent fine sediment accumulating on the gravel substrate are of concern. It appears from the aerial photographs that portions of Bell Creek have been pushed to the side of the valley to increase the amount of available pasture, probably sometime in the distant past.

The next mile of Bell Creek is under Forest Service management and about ¾ mile is being grazed under a special use permit. In this area most of the riparian vegetation is gone and streambanks are eroding. Valley floor width is about 300 feet. Deep pools are lacking due to the lack of large wood, although coho salmon juveniles are abundant in the pools that are present. Spawning gravels are abundant and rearing habitat could be greatly increased if streambank and riparian conditions were improved. There may be

temperature and algae bloom concerns in this reach due to the lack of riparian vegetation to provide shade. Temperature information is being collected in this reach for 1998.

After this 1 mile of Forest Service land the creek runs through about 1/3 mile of private lands that have been logged, leaving only a narrow band of bigleaf maple and alder along the stream. This reach of stream contains a fair amount of woody debris, primarily logging slash, and most is not stable enough to form long term fish habitat. In this reach the 1997 fish habitat survey indicated about 1000 feet of stream was dry due to the accumulation of sediment and gravels behind a log jam. Eventually this substrate will set up enough to support a perennial stream if large torrents of unconsolidated material do not come down in the next few years.

The next 1/3 mile of Bell Creek is managed by the Bureau of Land Management. The creek passes through natural stands where riparian areas are dominated by alder with some conifer near the creek, and dense stands of conifer are on the north side of the creek. Fish habitat is good in this stream reach with moderate amounts of large woody debris, associated deep complex pools, and abundant gravels. There is a large logjam present in this reach that is not a fish barrier but has accumulated large amounts of substrate material above the jam and has caused the stream to run subsurface in the summer for about 200 feet. Again, we believe this is a temporary condition that will set up and run perennial in the next few years if no other debris torrents come down. Coho salmon juveniles were abundant in this stream reach with lesser numbers of steelhead and cutthroat.

The next ½ mile of Bell Creek that was surveyed also runs through natural stands. The gradient increases to 5% and the canyon narrows up to about 50 feet.. This reach of stream was subject to a debris torrent, probably in February, 1996, that scoured a substantial amount of this reach. Occasional debris jams have caught substrate and formed pools that may support fish throughout the summer. The 1997 habitat survey showed that fish were present in this reach, probably cutthroat and steelhead juveniles. The substrate in this reach is composed of bedrock, boulders and primarily cobble with small accumulations of gravel behind debris jams. There is high potential for recruitment of large conifers from the upslope areas so the habitat conditions will probably improve in this reach in the future if left alone *(left alone? you mean no logging? no land slides*??).

Much of the higher production seen in Fivemile Creek is thought to be due to the greater complexity and extent of the wetlands in the lower part of Fivemile Creek compared to Maple and Fiddle. The lower amounts of diking, draining, and straightening of Fivemile Creek could also explain some of the differences in run strength.

Leitel Creek

Leitel Creek currently has the highest spawning escapement counts per mile of any stream in Oregon. In 1996 and 1997 peak spawning coho counts were 410 and 358 fish per mile

respectively. Leitel Creek is approximately 6 miles long and two miles of lower Leitel are in wetlands. These marshy areas have multiple channels and low growing shrubs with a few Sitka spruce and Douglas-fir lining the channel along the road. The next two miles of stream are low gradient, but with a more defined channel, narrower valley, and alder in the riparian area. The substrate is mixed gravel and fines for the first half of this reach and prime spawning gravels for this system in the second half of this reach. The last two miles of the creek are in a more confined valley that limits channel migration and the gradient steepens. Substrate size tends to be larger except where woody debris has collected and trapped gravels behind. This portion of Leitel is most important to the steelhead and cutthroat trout.

Leitel Creek is the stream system in the watershed that has been the least manipulated and most resembles a functioning stream. The major limits to Leitel Creek are the road that runs through the riparian area for most of the stream length and logging close to Leitel and its tributaries. Currently, the drainage ditch on the upper, steep portion of this road is not functioning due to debris and vegetation, causing water to drain on the road during winter. A stream crossing culvert at the bottom of the steep portion of this road also shows potential for clogging and failing into these same gravels and should be maintained or upsized to prevent this. This would help reduce the amount of sediment entering the stream and keep the gravels cleaner where the fish are spawning.

We talked to some loggers that worked on Leitel Creek in the 1970s pulling large timber out of the creek, yet Leitel has maintained high fish production. Since the wetlands in the lower end of the stream have remained fairly intact, this is probably the area that is responsible for the high production in this creek. This area would be used as rearing habitat for the coho salmon.

Riparian Vegetation and Water Temperature

Stream temperature is a function of several factors including solar intensity, vegetative and topographic shading, climate, channel shape and substrate type, the amount of channel directly exposed to sunlight and the presence of cool water inputs to channels. Many of these factors are either directly or indirectly related to the amount and type of riparian vegetation along stream banks of an area being considered.

Riparian vegetation was not mapped to a degree that would allow a thorough analysis of shade adequacy for the riparian zones of this watershed. A cursory analysis of riparian vegetation was conducted using aerial photography to obtain general percentages of the mainstems in full, partial or no shade in summer when stream temperature is of most importance to anadromous salmonids. (Map 12) (Appendix E). (*Possibly include bar chart with numbers; explain that Maple and Fiddle are most impacted, Bear and Fivemile - moderately, Leitel - not much).*

Fiddle Creek is the only stream in the watershed for which we have summer water temperature data (Map 12). Summer 1997 water temperature monitoring in upper Fiddle, about 2/3 of the way up the mainstem in a deposition reach indicates the seven-day average maximum temperature exceeded the State standard of 64° F by about 2 1/2 degrees. Peak daily temperatures exceeded the standard for just less than 50% of the days surveyed (Table 3.9). Reasons for high temperatures this high in the watershed are unlcear and, to some degree, unexpected. Riparian vegetation is dense above this monitoring site (Map 12). Some large wood removal upstream in the past caused one reach to scour to bedrock, but this confined reach is fully shaded, even after the scour. Verification with 1998 monitoring will determine if standard-exceeding temperatures truly exist in upper Fiddle Creek. If so, it suggests a need to pursue restoration efforts higher in this stream to create deep pools that can serve as thermal refugia for salmonids in this key watershed.

Table 3.9. Temperature monitoring for upper Fiddle Creek, Summer 1997

Sampling Period	Seasonal Max (& Date)	7-Day Avg. Max	Week of Max Temp.	Days > 58° F	Days > 64° F
6/24/97 => 9/17/97	68.4° F (8/14/97)	66.4° F	8/10/97 => 8/16/97	84 out of 86	41 out of 86

Summer temperature monitoring is presently occurring in seven locations throughout the watershed. Data will be available early in 1999 and added to this document.

Landslide Susceptibility and Roads

A model based on slope form and gradient indicate that midslope roads in high and extreme landslide susceptibility areas, especially roads built before 1975 with sidecast, and midslope roads in unstable areas such as headwalls are of greatest concern (Map 13) (Appendix C). Sidecast, midslope roads have the highest potential for failure during large storm events and require the most road maintenance. Two roads that are of concern for the reasons are the Sunset Road (2480) and the Popo Road (4830). These roads have the most ravel and cutbank failure of any two roads on the Mapleton District (personal communication Eli Adkisson, former Mapleton road manager). *(Describe ATM status and slope position status).* The stability analysis is based on a 1989 ortho photo and is missing roads built or reopened in the last nine years--primarily roads most recently reopened around Tahkenitch Lake as part of recent harvest.

Include table of Slides after 1996 storm by subwatershed.

Road densities is one indicator of whether or not watersheds are functioning for salmonid spawning and rearing used by The National Marine Fisheries Service (NMFS) (Appendix E). Road densities less than or equal to 2 mi./mi^2 are considered "functioning" while

densities greater than or equal to 3 mi./mi^2 are considered "not functioning", and densities between 2 and 3 is considered at risk. *Using this definition, explain the numbers.*

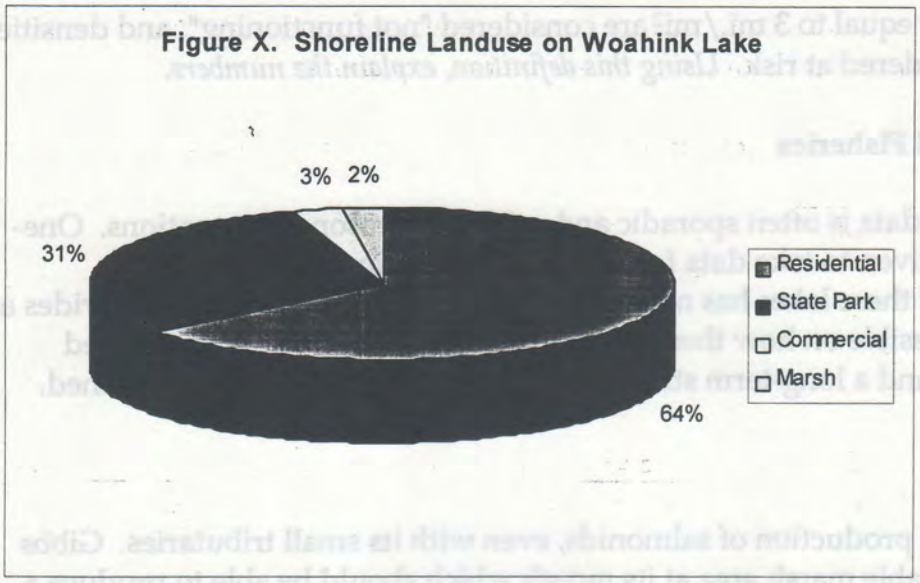
Lake Water Quality and Fisheries

Historical water quality data is often sporadic and subject to seasonal fluctuations. One-time grants were often given to take data for short periods of time, but long term, consistent monitoring of these lakes has not been undertaken. This discussion provides as much information as possible on how these lakes are being impacted so that the "red flags" can be identified and a long-term strategy for consistent monitoring established.

Woahink Lake

Woahink Lake has some production of salmonids, even with its small tributaries. Gibbs Creek has a very respectable marsh area at its mouth which should be able to produce a fair number of salmonids. Little Woahink is a small reservoir formed by a privately owned dam which does not allow fish passage without intervention of the STEP group. There may be a lack of gravels for spawning to produce high numbers of fish in these systems, especially streams on the Northwest and West sides of Woahink which flow in from the dunal formations. Warmwater species are present in Woahink Lake but their extent is limited by the deep water areas and lack of production relative to Siltcoos and Tahkenitch. This lake may have the potential for rearing salmonids over the summer especially in the deeper water areas.

Woahink Lake is probably the most susceptible to changes in water quality than any other lake in the watershed. Historically the most oligotrophic lake on the Oregon Coast, the most pressing threat to water quality is the amount of development occurring around Woahink Lake. Current and future conditions of water quality in Woahink Lake are directly tied to how this development has occurred and continues to occur (Figure 3.1).



There are signs that nutrient levels and therefore productivity are increasing in Woahink Lake to the detriment of water quality. Primary productivity changes over time in lakes that are increasing in nutrients. Mean primary productivity in 1991 was three times that measured in the late 1960s (Table 3.10). Given these numbers, it is believed that Woahink has shifted from oligotrophic to mesotrophic during the last two and a half decades (personal communication, Larson). While the eutrophication of lakes is a natural part of their succession, the changes in Woahink Lake are taking place far sooner than would naturally occur in this deep lake.

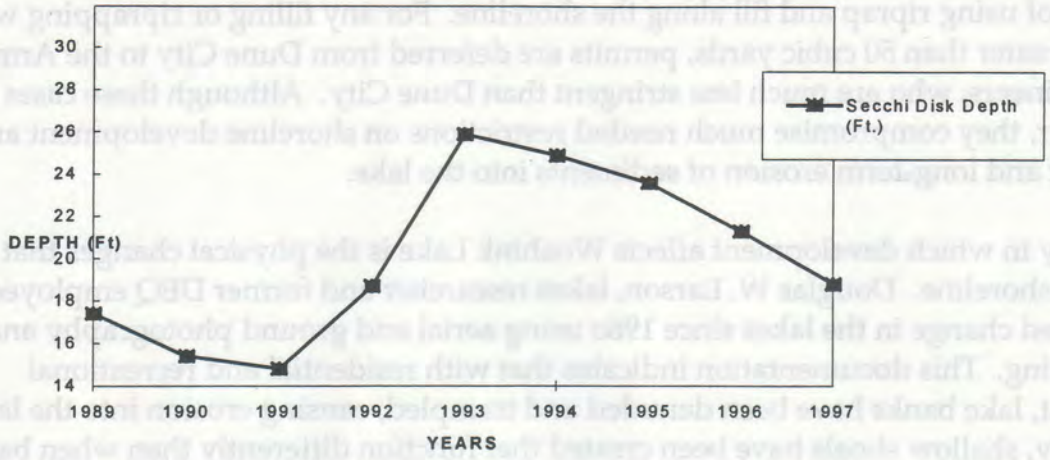
Table 3.10. Primary productivity in Woahink Lake for three years (mg C/m^2/hr).*

Year Measured	Number of Profiles	Max	Mean
1968	8	37.05	19.91
1969	9	45.96	21.01
1991	2	81.97	65.39

* Data taken from Larson, 1972 and an MS Thesis by Dagget, 1994

Another sign that productivity in Woahink Lake may be increasing is revealed in secchi disk measurements used to monitor water clarity. Depth of visibility decreased from 1989 to 1991 and from 1993 to 1997. Increases from 1991 to 1993 may be a result of changes in inputs from the watershed and the climatically driven cycle (Oliver et. al, 1998). The depth of sight, 1993 to 1997 decreased at a rate of 1.8 feet per year, which is a significant trend (Figure 3.2).

Figure 3.2. Mean secchi disk depth for Woahink Lake, 1989-1997.



Eutrophication of Woahink and Siltcoos Lakes is particularly alarming since development continues with neither area wide sewage nor water treatment facilities in this area. Currently, several housing developments around Woahink and Siltcoos lakes rely on small private water treatment facilities of varying size and effectiveness that draw their water from the lakes. Simultaneously the condition of septic tanks around the lake are in varies based on age and type. Thorough site evaluations take place by Lane County officials for the installation of new septic systems which must account for soil type and proximity to the lake, but a 1972 survey of septic tanks found that 26% of all tanks within 100 feet of the lake were performing unsatisfactorily (Lane County, 1978). Where systems had failed, sewage was coming to the ground surface very near the lake and in winter almost certainly drained there.

An additional source of nutrients to Woahink Lake is the runoff from lawns and driveways that lead directly into Woahink Lake. Sediment and fertilizer laden runoff from these areas are high in phosphorus and nitrogen and are key components of the eutophication now observed. Education and increased awareness of private shore owners is very important to limiting this nutrient source.

If nutrient levels continue to increase relatively unchecked by State or County officials, problems such as those in Tenmile Lake south of this watershed will begin to take place. In Tenmile Lake, toxic algal blooms (Microcystis) have made water unsafe for drinking or recreation during certain times of year with uncertainty of its long-term effects on public safety and the viability of local tourism. A rigorous monitoring program is currently being financed by DEQ.

Dune City has jurisdiction over some land use practices along portions of Woahink Lake within city limits. Its city plan includes rules that seek to protect vegetation and soil within 50 feet of the water and fines are levied for destructive practices done without a permit. Although the city is not financed to patrol the lakeshore for these activities,

concerned neighbors usually call to report these activities when they occur. One red flag is the practice of using riprap and fill along the shoreline. For any filling or riprapping with quantities greater than 50 cubic yards, permits are deferred from Dune City to the Army Corp of Engineers, who are much less stringent than Dune City. Although these cases seldom occur, they compromise much needed restrictions on shoreline development and lead to short and long-term erosion of sediments into the lake.

Another way in which development affects Woahink Lake is the physical changes that occur in the shoreline. Douglas W. Larson, lakes researcher and former DEQ employee, has monitored change in the lakes since 196o using aerial and ground photography and water sampling. This documentation indicates that with residential and recreational development, lake banks have been denuded and trampled, causing erosion into the lake. Subsequently, shallow shoals have been created that function differently than when banks descended steeply into the lake. Warmer water now supports aquatic vegetation where there was none before. An example of this is the north side of the lake where the East Woahink public boat launch and parking area continues to change with heavy use.

Site Specific Water Quality Concerns in the Woahink basin

A 1992 memo from the Oregon Department of Fish and Wildlife documented muddy water conditions in the northwest arm of Woahink Lake. It described the Foglio Trucking Company parking lot and shop area (approx. 4 acres) off Highway 101 as a "chronic sediment producer". Next to the trucking company is Siuslaw Automotive and Wrecking, a 3.5-acre lot of wrecked cars which is a potential source of petroleum pollutants, although no point sources have been reported.

In the same area from 1994-1996, Big Bear, Inc. (Nordahl) cleared approximately 18 acres of coastal forest for a proposed RV park next to the truck and wrecking yards and caused considerable sedimentation into the northwest arm of Woahink. A local lakes group documented that flow diverted toward Highway 101 flooded a private parcel with turbid water, flowed through the trucking company parking lot and drained into the northwest arm. Secchi disk (clarity) readings were only 1.5 feet where they had been up to 21 feet in the past.

Honeyman State Park is reviewing its septic systems throughout the park, some of which have an impact on lake water quality. Built in the 1930s, there are 7 separate drain fields that handle effluent, five on Woahink Lake and two large fields on the dunes near (personal communication, Eric Scott-- Mater Engineering).

The leach field at the East Woahink boat launch is about 50 feet from the water rather than the required setback under DEQ standards is 100 feet, and a group camping area may be expanded. Because soil types, this leach field would have to be relocated onto the other

side of Canary Road. The needed repairs will probably take place within the next two years, financed by lottery backed bonds.

Siltcoos Lake

Siltcoos Lake had a commercial fishery for coho salmon of about 5000 fish per year in the late 1800's. Run strength has declined as it has throughout the rest of the west coast since these times although the runs in this lake system are currently some of the most healthy in the state of Oregon. It is believed that these runs of coho would be more healthy if the Lake did not contain non-native warmwater fish such as large mouth bass and yellow perch that prey on young salmonids.

Summer temperature profiles of Siltcoos indicate that temperature is fairly constant from surface to bottom (68 degrees F in 1981 and 69 degrees F in 1961) and is near the upper threshold for salmonid survival. The recordings were taken at the end of July 1981 (Atlas of Oregon Lakes and Oregon State Game Commission 1966) so lake temperatures may have increased further into August. Temperatures in excess of 72 degrees F are considered to be entering the lethal range for salmonids.

During the extreme temperatures of July, August, and possibly September juvenile coho may seek out the cooler waters of the tributaries if they exist. We postulate that current juvenile coho use is primarily limited to winter rearing habitat since the fish that enter the lake when it is cooler and the bass are less active were at a selective advantage over those fish that evolved to go into the lake during the summer and were heavily predated.

Creel census in the 1968, 1970, 1971, 1982, and 1983 have all documented coho juveniles in the lake throughout the summer in the lake (Oregon State Game Commission reports 1968, Oregon Department of Fish and Wildlife Creel Survey report 1983). There is some indication in the older reports that a percentage of the juvenile coho remaining in the lakes are 2 year old fish, meaning they spend 2 years in fresh water instead of 1 which would allow them to attain a larger size prior to going to the ocean. Little is known about these fish which would be a useful research topic.

A recent study by Petersen (1997) compared trophic conditions in five Coastal Oregon lakes including Eel and Garrison Lakes south of this watershed, Siltcoos and Tahkenitch within this watershed, and Munsel Lake just north of this watershed. This study revealed that Siltcoos Lake is the most productive of these five lakes. Chlorophyl-a concentrations for Siltcoos Lake, representative of phytoplankton population densities are a good indication of lake productivity (Table 3.11). Generally, chlorophyll-a concentrations above 10 mg/m^3 are characteristic of
eutrophic lakes (Wetzel, 1983), and Siltcoos shows concentrations greater than 20 mg/m^3 in September. Petersen (1997) also reports that although Tahkenitch and Siltcoos have

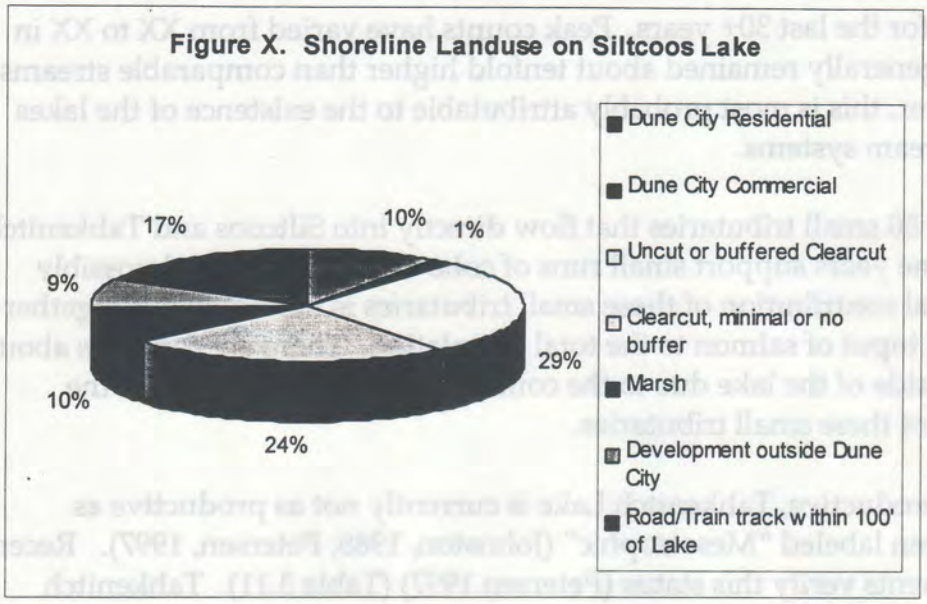
very similar morphometry, Siltcoos Lake is much more fertile, very likely having to do with the difference in land use patterns and development found on Siltcoos Lake.

Table 3.11. Levels of chlorophyll-a in five coastal lakes in Oregon*

Lake	Date	Chlorophyll-a average, mg/M³ (n)	Chlorophyll-a range (mg/M³)
Siltcoos Lake	**August 2**	**8.7 (4)**	**7.0-11.2**
	September 7	**22.1 (5)**	**18.9-23.8**
	October 5	**12.5 (5)**	**11.2-13.3**
Tahkenitch Lake	**August 3**	**6.0 (4)**	**5.6-6.3**
	September 5	**6.4 (4)**	**5.3-8.8**
	October 8	**8.5 (6)**	**7.4-10.2**
Eel Lake	August 4	5.5 (6)	4.2-7.4
	September 6	1.9 (6)	1.6-2.1
	October 7	4.2 (6)	2.3-5.6
Garrison Lake	August 5	3.8 (4)	2.7-5.3
	September 10	2.8 (4)	0.9-4.1
	October 9	3.8 (4)	3.2-4.9
Munsel Lake	August 3	6.5 (2)	6.3-6.7
	September 8	3.2 (4)	2.5-3.5
	October 6	6.7 (4)	3.9-8.4

* Data taken from Petersen, 1997

The extremely productive nature of Siltcoos Lake makes it attractive for sport fishing, and Westlake and North Beach on the northwest side of the lake have a number of resorts, fishing lodges, a marina and several private docks. The east side of the lake contains less dense development and includes a fishing lodge at Ada Station and the small community of Siltcoos. There is also a county park with a picnic area near Ada. Train tracks and trestles that cross arms of Siltcoos lake, and county roads closely follow most of the western shore. Harmony Bay is a small, isolated development of summer cabins on the South end of the lake, accessed by the County Line Road. There are also two islands that have limited development on them, Jernigan Island, which is privately owned, and Booth Island, which contains 21 very small lots zoned as residential on about 1/5 of the island. Lots are currently being sold on Booth Island.



About 1/3 of the lands around Siltcoos Lake have been logged recently on private land (Figure 3.3) most of which has a lake buffer of one tree width. The State of Oregon has not given adequate thought to the an appropriate width for lake buffer and simply applies stream rules. These do not seem adequate given the fact that the lakes provide drinking water for a number of residents (*Appendix?*).

Tahkenitch Lake

Tahkenitch Lake is very similar to Siltcoos Lake in respect to stocking history and salmonid use. Warmwater fish have been stocked and provide a productive recreational fishery. National bass fishing tournaments have been held at this lake, however, the coho salmon fishery has dwindled and is currently closed.

A July 1981 temperature profile showed characteristics similar to Siltcoos. Temperature was fairly constant through the profile and was measured at 69 degrees F, which again is approaching the lethal limit for salmonids. Therefore the use of the lake by coho salmon in the summer may be limited to tributary mouths or isolated cool deepwater areas. The warmwater species again have probably affected the salmonid use over the years

Public access is concentrated on two boat ramps off Highway 101 on the northwest side of the lake, one private and one Forest Service. Part of the Tahkenitch Campground is located near the Forest Service boat ramp. There are also some undeveloped access points off of County Road 49 on the south side of the lake (Mallard Arm). Aquatic weeds are currently a hindrance to recreational fishing in this lake.

Estimates of current run size have been made for Siltcoos and Tahkenitch (Table F.1.) and show that estimated spawning stock size has remained relatively constant for these 2 lake systems for the last 40 years. Spawning counts in various stream segments have been

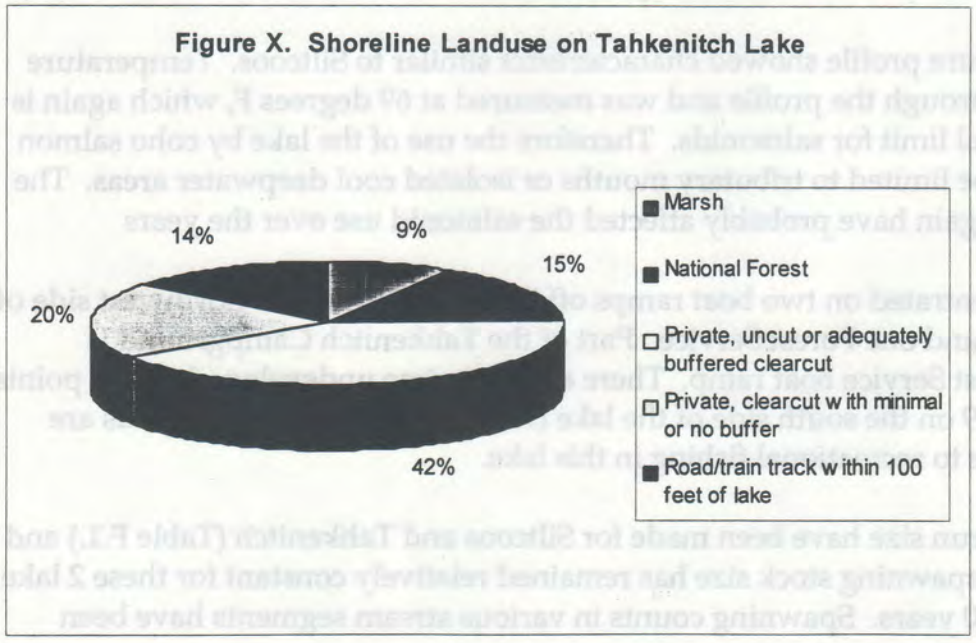
conducted sporadically for the last 30+ years. Peak counts have varied from XX to XX in various years but have generally remained about tenfold higher than comparable streams on the main Siuslaw River, this is most probably attributable to the existence of the lakes associated with these stream systems.

There are probably over 50 small tributaries that flow directly into Siltcoos and Tahkenitch Lakes that in at least some years support small runs of coho and cutthroat and possibly some steelhead. The total contribution of these small tributaries is unknown but together do provide a substantial input of salmon to the total population. There are concerns about fish passage on the east side of the lake due to the condition of the culverts under the railroad tracks on some of these small tributaries.

Although shallow and productive, Tahkenitch Lake is currently not as productive as Siltcoos Lake and has been labeled "Mesotrophic" (Johnston, 1985; Petersen, 1997). Recent chlorophyll-a measurements verify this status (Petersen 1997) (Table 3.11). Tahkenitch Lake appears to be phosphorus limited as Algal Growth Potential was greatly increased when phosphorus was added to samples in lab experiments (Curtiss, et. al 1984).

Tahkenitch is one of the few large coastal lakes near a populated area that does not have private housing development on the shoreline, however, about 50 houseboats on the lake range from currently occupied to abandoned and dilapidated. No additional houseboats will be allowed on Tahkenitch Lake. Septic systems are required to be self contained but the status of each is currently unknown to DEQ. Given the potential for inputs of Phosphorus and Nitrogen from raw sewage, the condition of these septic systems is important to monitor for the future.

Figure 3.4. Shoreline Landuse on Tahkenitch Lake



Past and current resource conditions around Tahkenitch Lake are closely tied to logging practices. Much of the land surrounding the lake was once owned singly by Crown Zellerbach, but has since been sold and resold by a number of small industrial timber companies. Intense logging of lake adjacent forest land without buffers began in the 1930s and continued through the late 1960s. Old growth spruce logs were downhill logged into the lake and were brought to lake-side mills by tug boats. Saltzman (1963) reported designated log boom areas on 30% of the shoreline in 1960. Downhill logging caused high sedimentation and skid trails created deep troughs leading to the lake, some of which can still be seen today.

Current logging of young second growth is once again occurring through this area, this time via a dense network of roads on this moderately steep landscape. There are locations where road densities are very high, especially where ground-based logging is on moderate slopes. Buffer widths between clearcuts and the lake are minimal in places.

Cleawox Lake

Direct influences that currently have potential to affect water quality on Cleawox Lake include Honeyman State Park on the south end, private development on the northeast side of the lake and Camp Cleawox, a girlscout camp on the east side. This lake would benefit from renovation of the outdated septic system at Honeyman State Park. In addition, there is concern over RV effluent from the dump site that contains formaldehyde which is a biocide, killing organisms that are crucial to leach field function. Filtration for this chemical will be a required as part of the improvements (personal communication, Daryl Johnston--ODEQ).

On the other side of Cleawox Lake, the concession area has an associated leach field that needs relocation due to its presence in soils with perched ground water. A terrace nearby would serve as a much better drainfield.

Lake-side homes on the northwest side are a combination of vacation and permanent residences that have, for the most part, left native trees and brush undisturbed. As most of the soils in the lake basin are well drained, sandy soils, properly functioning septic systems are especially critical where development has and will continue to occur. New systems are systematically field checked, but older systems in the area that may be failing.

In the mid-1980s, Honeyman State Park dredged a portion of Cleawox Lake to keep open the passage between the northern long, narrow arm of the lake and the wider, oval section to the south. The objective was to keep advancing dunes from cutting off boat passage between the two areas. Park officials no longer pay for this and it is assumed that Cleawox Lake will become two lakes in time.

Although Cleawox Lake has historically been known as an oligotrophic lake with low productivity, this may be changing. Due to the heavy recreation and increasing development around this lake, it is likely that Cleawox Lake will become more eutrophic over time. Septic improvements planned by State park officials will help to slow this process, but other septic conditions need to be surveyed in developed areas. *(Will there be any effect to fish? water quality?)*

Threemile Lake

During the 1930s, land near the south end of this lake was homesteaded and extensively logged in the 1930s and '40s. Currently, much of the basin has grown back to thick second growth coniferous forest. Access to the lake was gained by vehicle from the beach side during the 1960s but today vehicles are restricted and access can only be gained by hiking on the Tahkenitch Trail or by a one-mile trail from Sparrow Park Road to the south. Limited dispersed camping occurs around the lake at the north and south ends as well as a small penninsula on the west shore.

A 1993 report on Threemile Lake included a gillnet fish survey which did not mention bass in the fish totals. Based on a recent fisherman's catch, it appears bass have been introduced and are doing well in emergent vegetation on the north end of the lake. This report also mentions introduction of yellow perch and Cutthroat trout by former residents (Whereat and Merritt, 1993).

Ocean Tributaries and the Dunal Aquifer

Siltcoos River, Tahkenitch Creek and Threemile Creek are the three ocean tributaries in the watershed and all three drain through the dunal sheet. As such, their substrates are dominated by sand. Migration through these creeks is the main function for salmonids. Adults migrate through when the bar is flushed out by fall rains or dam releases. This usually occurs in October but sometimes not until December if left to open naturally, and is highly dependent on the amount and timing of the fall rains. Some cutthroat may move up these streams earlier in the fall or even late summer.

The main needs for adult fish in these streams during migration are deep pools with cover where they can rest and hide from predators (and poachers), and escape from the high velocity flows. From February to June, salmonids are smolting and moving down the river toward the ocean, and additional habitat elements are required such as slow velocity backwater to escape potential flood flows. Accumulations of wood for cover, velocity breaks, and food production are also crucial for the salmonids to be in the best shape possible before entering the ocean .

There is potential for impacts to recreational developments built within the floodplain of these creeks, and often mitigation of these impacts turn into detrimental impacts to fishery resource. An alternative is to find measures that would benefit both resources. For

Table 3.12

~~Appendix E.~~ Subwatershed Summaries for Coastal Lakes Watershed.

E.1 - Subwatershed summaries for the upland stream valleys

Subwatershed	Maple	Fiddle	Bear	Fivemile	Leitel
Acres	13,534	9,006	4,420	6,714	3,275
Ownership	Federal - 59% Indust. Pvt - 27% Small Pvt - 14%	Federal - 53% Indust Pvt - 40% Small Pvt - 7%	Federal - 76% Indust Pvt - 24%	Federal - 47% Indust Pvt - 43% Small Pvt - 10%	Indust Pvt - 100%
Tributaries	**Private:** Mills, Johns, Schrum, Carle, Roache, Grant, lower Carter, lower Jordan, Starkes, Stokes, Ryder, most of Maple mainstem **Federal:** Carter, upper Jordan, Henderson, N. Prong, Coleman, Schultz, Ten Mile, upper Maple Mainstem	**Private:** Young, King, Alder, lower Billy Moore, lower Fiddle mainstem **Federal:** upper Billy Moore, upper Fiddle mainstem	**Private:** lower Bear mainstem **Federal:** upper Bear mainstem, south fork Bear	**Private:** Perkins, lower Harry, lower Bell **Federal:** upper Harry, upper Bell	**Private:** all of eitel mainstem
Acres by LTA					
Source, Transport & Deposition in miles & (%)	So - 217 (86%) Tran - 10 (4%) Dep - 26 (10%)	So - 170 (89%) Tran - 8 (3%) Dep - 15 (8%)	So - 87 (89%) Tran - 3 (3%) Dep - 8 (8%)	So - 97 (84%) Tran - 6 (5%) Dep - 13 (11%)	So - 52 (85%) Tran - 4 (7%) Dep - 5 (8%)
Percent deposition by ownership	Small Prvt - 52% Roseburg - 23% Davidson - 17% USFS - 8%	Davidson - 37% Small Prvt - 30% USFS - 13% WilIndust - 12% Roseburg - 6% Rosebor. - 2%	Davidson - 86% USFS - 14%	Davidson - 38% Rosebor. - 31% USFS - 17% Small Prvt - 12% Hancock - 2%	Hancock - 68% Rosebor. - 17% Menasha - 9% PortBlakely - 6%
% mainstem re-channelized and diked	94%	89%	44%	69%	none
% mainstem with abandoned or current grazing	87% currently grazed 7% abandoned	65% currently grazed 24% abandoned	74.5% currently grazed	56% currently grazed 21% abandoned	none
% full, partial and no shading on mainstem	full - 10% partial - 34% no - 56%	full - 29% partial - 26% no - 45%	full - 26% partial - 34% no - 40%	full - 21% partial - 47% no - 32%	full - 29% partial - 66% no - 5%
Large wood potential (% by subwatershed and confinement)					
Landslide Susceptibility	High - 4% Mod - 10% Low - 86%	High - 7% Mod - 13% Low - 80%	High - 4% Mod - 14% Low - 82%	High - 7% Mod - 12% Low - 81%	High - 6% Mod - 11% Low - 83%
Road densities /1	3.7 mi/mi^2	2.7 mi/mi^2	2.8 mi/mi^2	2.2 mi/mi^2	3.6 mi/mi^2
System Road	Ridgetop - 25.3	Ridgetop - 17.6	Ridgetop - 11.2	Ridgetop - 13.7	Ridgetop - 7.5

miles by slope position	Midslope - 34.9 V. Bottom - 17.1	Midslope - 8.6 V. Bottom - 11.7	Midslope - 3.3 V. Bottom - 4.4	Midslope - 3.3 V. Bottom - 6.0	Midslope - 4.3 V. Bottom - 6.4
Culvert problems	Culvert with fish passage problem, Carter Cr., 2400 RD	2 partially plugged culverts, 4811 and 4811 957	none known	Partially plugged and damaged culvert on 4811 near 044 spur	Continued maint. needed just above spawning gravels. Storm-proof road crossing culverts
Stream Survey Info Available	1998 FS Lands	1997 FS Lands	1998 FS Lands	1997 FS & BLM Lands	None
Coho peak spawning counts #/mile	1996- 138 1997- 53	1996- 192 1997- 166	no counts made	1996- 306 1997- 210	1996- 410 1997- 358
Miles stream by fish species	coho - 18.3 steelhead - 20.8 cutthroat - 21.1	coho - 13.0 steelhead - 14.6 cutthroat - 14.6	coho - 6.4 steelhead - 7.7 cutthroat - 7.7	coho - 10.6 steelhead - 13.5 cutthroat - 13.5	coho - 5.4 steelhead - 5.6 cutthroat - 5.6
Potential veg (acres)	WILL HAVE FOR FINAL				
Current seral veg acres	WILL HAVE FOR FINAL WA				

1/ These numbers are likely underestimated due to the age of ortho photographs (1989) used for mapping.

E.2: Lake Basin and Dunes Subwatershed Summaries.

Subwatershed	Siltcoos	Tahkenitch	Woahink	Threemile	Dunes
Acres	12,728	11,397	4,934	2,490	14,076
Percent land ownership	Lake - 25% Residential - 21% Rosebor. - 19% Roseburg - 14% Davidson - 11% USFS - 10% County - 1%	Roseboro - 29% PortBlakely - 27% Lake - 18% USFS - 15% Menasha - 7% Small Prvt. - 3% Hancock - 1%	Residential - 46% Roseburg - 23% Lake - 15% State Park - 8% Davidson - 5% USFS - 3%	USFS - 50% PortBlakely - 45% Small Prvt. - 5%	USFS - 8 SmallPrvt. - 7% Rosboro - 4% County - 1% State Park 1%
Road densities	4.5 mi/mi^2	2.9 mi/mi^2*	4.6 mi/mi^2	1.1 mi/mi^2	2.4 mi/mi^2
Most serious water quality problems	Aquatic weeds	Aquatic weeds	Increased nutrients Reduced clarity	Recreation impacts	Recreation impacts
Landslide Susceptibility	Low - 98% Mod. - 2%	Low - 96% Mod - 3% High - 1%	Low - 99% Mod. - 1%	Low - 100%	Low - 100%
Potential veg (acres)	SEE FINAL WA				
Current seral veg acres.	SEE FINAL WA				

* Based on 1989 ortho quads. Recent logging in this subwatershed has probably pushed this over 3 mi/mi^2.

example rather than riprapping meander bends to stabilize a sand bank, use bioengineering techniques that create some fish habitat as well.

Impacts to the dunal aquifer have not been well studied in this area. It has been theorized that with the vegetating of the dunes for stabilization, litter buildup and decomposition has caused increased iron levels in percolating water. Present withdrawls are mostly north and south of the watershed, but future development in the area may cause expansion of aquifer withdrawal to this area. At present, water systems for communities in the Dune City and Glenada areas are poorly developed and are composed of systems that withdraw and treat water from the lakes for local housing developments. Future plans to pump from the aquifer in this area should utilize research recently done in the Coos Bay/North Bend area for information on saltwater intrusion and possible effects of over pumping.

Aquatic Weeds

Both Siltcoos and Tahkenitch Lakes are listed on DEQ's 303(d) List for "aquatic weeds or algae" and this designation is fitting for both lakes in terms of aquatic weeds. The aquatic weed known as Brazilian elodea (*Egeria densa, formerly elodea densa and anacharis densa*) is currently the most oppressive exotic in these lakes. Originating in South America, it is believed to have been first introduced to both these lakes in the early 1930s. Elodea found perfect conditions in Siltcoos and Tahkenitch with their shallow depths, higher nutrient levels and temperate coastal climate. Although levels have fluctuated in these lakes from year to year, growth in dense patches has been a problem for recreational and commercial users from the mid-1940s to the present.

A decrease in 1954 in Tahkenitch Lake was attributed to an increase in water level due to a temporary dam put in at the outlet that year (Bond, 1955). Another reference to lake level effect on weed growth appears in 1966 when field observers noted extreme growth after a 4-foot drop in summer lake level, most likely associated with draw down for inspection of wooden train tressels. It must be remembered, however, that control of elodea using lake level has not been successful to any significant degree in the past (Table 3.12).

Table 3.12. Estimated occurrence of Brazilain elodea (*Egeria densa*) in Siltcoos and Tahkenitch Lakes for selected years between 1945 and 1955. *(What are these units? Percent of lake?)*

	Estimated Infestation in Percent			
Lake	**1946**	**1948**	**1951**	**1954**
Siltcoos Lake	58%	74%	90%	43%
Tahkenitch Lake	43%	86%	-	68%

Pitney (1949) described Brazilian elodea as the most serious aquatic nuisance in Oregon due to a rate of development that is "almost beyond conception". It can grow at the

water's edge to as deep as 18 feet. Shading can limit elodea growth, but in experiments pieces shaded for three months resprouted after being re-exposed to light. In these coastal lakes, the period of most aggressive growth usually occurs from mid-May through April. An old, well established plant may consist of five or six stems up to 18 feet in length growing from a root crown which is often six or more inches below the surface of the soft mud. Up to twenty fibrous roots 8-24" anchor the plant. Root crowns over winter in shallow areas and some stems remain in tact in somewhat deeper areas to resume growth the following year. Fragments can be carried by boats, waterfowl, or floatplanes and pieces from a previous year can resprout and grow the following year (Bond, 1955).

By the mid to late 1940s, several experiments were being undertaken by the Oregon Agricultural Research Station to eradicate this nuisance weed, and both Tahkenitch and Siltcoos served as test lakes for these experiments. In 1947 and 1948, hundreds of chemicals were experimented with in laboratories, tanks and within Siltcoos and Tahkenitch Lakes themselves (Aldrich, 1953). Although copper sulfate was found to be most successful in experiments conducted during this time, use of a heavy metal compound that accumulates over time was assumed to be more deleterious to the health of the lakes than the Brazilian elodea itself (Pitney, 1949). However, this notion is debated by some who point out that copper is quickly bound up in clay particles that settle at the bottom of lakes with little to no toxic effect.

Testing of chemical methods for the eradication of Brazilian elodea continued through the mid 1960s, but successful chemicals showed harsh effects on resident salmonids and bluegill (Bond et al, 1966). Currently, there are at least six herbicides registered for safe use in Oregon for the control of noxious aquatic weeds. Under the correct conditions, these herbicides can be used to reduce infestations. However, private use that does not follow manufacturers guidelines can be a threat to aquatic resources and other lake users (personal communication, Sytsma).

Physical means of removing elodea from lakes can be effective but if done incorrectly, fragmentation of the weed spreads it further in the lake. Correct disposal of harvested weeds can also be troublesome. Large scale physical eradication has been attempted in Siltcoos Lake with little success. Removal in local areas still occurs, especially around resort boat docks where elodea becomes extremely thick.

Recent research has shown that Brazilian elodea throughout Oregon is genetically uniform which makes it susceptible to biological control. Portland State University is currently undertaking a study to identify South American fungi or insects that are a natural enemy to Brazilian elodea. Caution must be exercised with biological controls, however, due to other effects they may produce. One such experiment with a biological control introduced weed-eating carp (*Ctenopharyngodon idella*) into Devil's Lake on the Northern Oregon Coast to eradicate Eurasian watermilfoil (*Myriophyllum spicatum*). Six years into the project, weeds had not been significantly reduced, but liquefied fecal waste from the carp

had fueled new crops of weeds and algal blooms never before seen in the lake (Larson, 1996).

Another aquatic weed that was mentioned in a 1965 fieldtrip to Siltcoos Lake was *Brasenia schreberi* (water shield). It was described as "extremely heavy in several areas of the lake" (Bond et al, 1966). *Egeria densa* has also spread from Tahkenitch to Elbow Lake, most likely moving through Elbow Lake Creek which connects the two lakes.

Parrot feather *(Myriophyllum aquaticum*) was introduced to Siltcoos Lagoon before 1950 and control attempted in the 1950s was unsuccessful, due mainly to the fact that it does not respond to chemical controls. This weed is also present in Woahink and Siltcoos Lake and unless it is physically removed, will begin to cause problems in these areas in the future. It grows in shallow, backwater areas where it can create acidic conditions if ammonium is present. These acidic conditions can be harmful to coho salmonids using these same backwater areas.

Mercury levels in fish of the coastal lakes

In May 1997 fish samples from Siltcoos, Tahkenitch, Eel, North Tenmile, and South Tenmile Lakes were taken and analyzed to determine the amount of mercury present in the tissue. Mercury in minute concentrations can cause health problems for humans, especially for pregnant women or women who plan to have children in the near future. Mercury is a bioaccumulator and through the food chain, the levels of mercury increase from prey to predator. That is why the large fish that feed primarily on smaller fish are the ones that have the health advisory for consumption. The 1997 Coastal Lake lab samples were taken from largemouth bass, black crappie, bluegill, brown bullhead, rainbow trout, and yellow perch.

The federal standard set by EPA for mercury levels in fish tissue is 0.60 mg/kg wet weight while the State of Oregon's standard is 0.35 mg/kg wet weight. The largemouth bass, which are the top predator within the lake, had the highest concentrations of mercury in all 5 lakes sampled. The levels ranged from 0.27 - 0.63 mg/kg-wet weight of bass tissue, and were highest in Eel and South Tenmile Lakes and lowest in Tahkenitch and Siltcoos Lakes (Table F.3). Other fish species were appreciably lower (Table 3.13).

Table 3.13. Mercury levels in fish of the Central Oregon Coastal Lakes (1997). Mercury levels are reported in mg/kg-wet weight of fillet tissue.

	Tahkenitch	Siltcoos	Eel	North Tenmile	South Tenmile
Largemouth Bass	0.27	0.35	0.56	0.41	0.63
Black Crappie	0.1		0.18	0.18	0.15
Bluegill	0.07				0.12
Brown Bullhead		0.07	0.07		
Rainbow Trout	0.04				
Yellow Perch	0.13				

Current 303(d) Waterbody Listings

The Oregon Department of Environmental Quality is required by the federal Clean Water Act to maintain a list of stream segments that do not meet water quality standards (Table 3.14). The 303(d) List cites the section of the Clean Water Act requiring this information. Furthermore, the State of Oregon is required to set priorities and target resources for use

in developing Total Maximum Daily Loads (TMDLs) for addressing point and nonpoint sources of pollutants. This list along with priorities for TMDL development within two years are submitted to the U.S. Environmental Protection Agency every two years. TMDL development for listed streams and lakes in Oregon is expected to be accomplished within ten years.

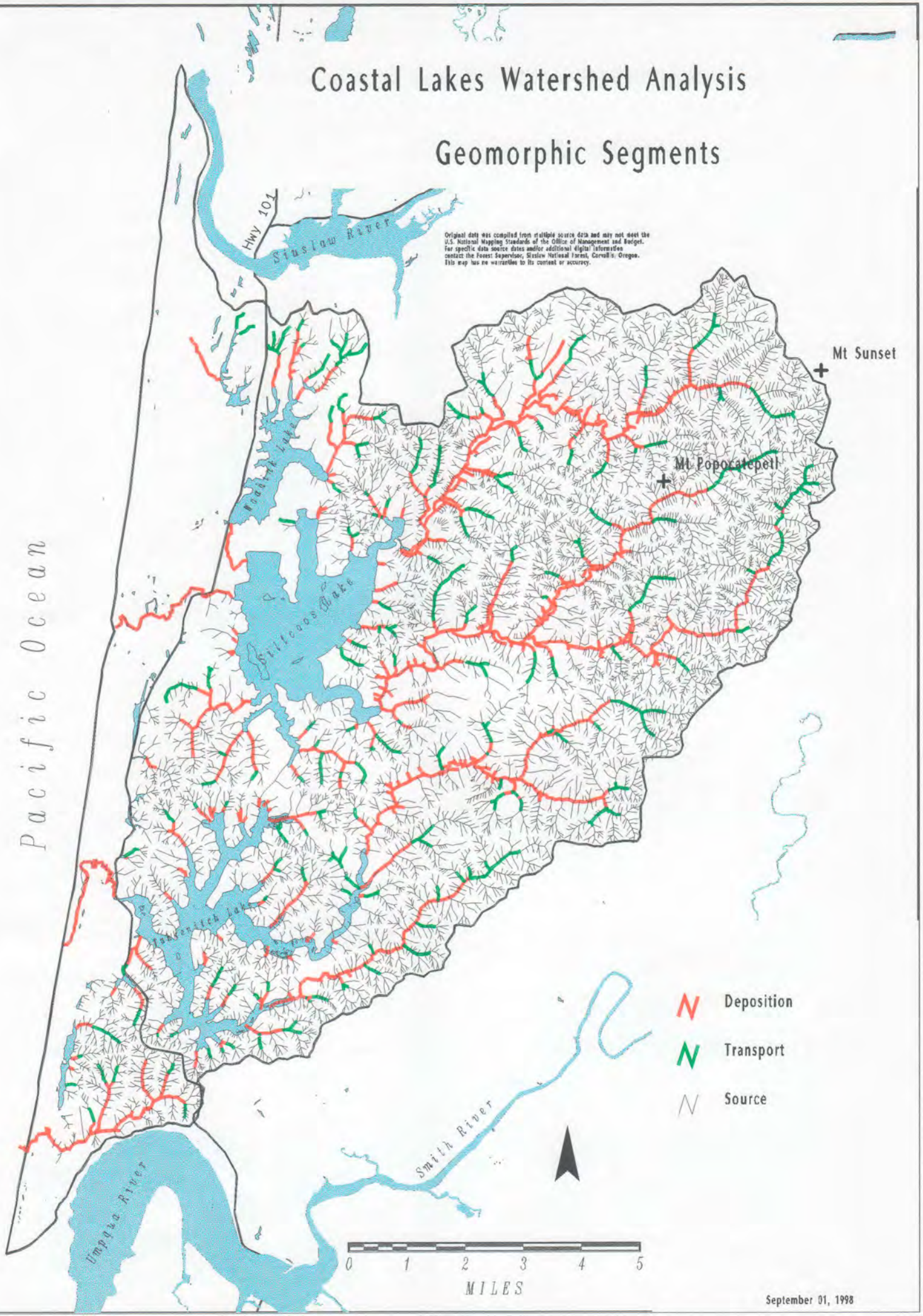
Priorities for TMDL development for sub-basins in Oregon are primarily driven by presence of threatened and endangered fish species within each sub-basin. This watershed analysis area represents the Siltcoos sub-basin which is part of the Mid Coast basin, and is included in the Priority 1 category as are all the coastal sub-basins in Oregon due to the presence of coho salmon in these waters. Table X gives a listing of the streams and lakes included on the Proposed 1998, 303(d) List. Extent of water quality problems on streams is often listed as "Mouth to Headwaters" where suspected water quality problems exist but little data has been collected to confirm this diagnosis. This begins the discussion over water quality showing that many gaps exist in the water quality data for this watershed area.

Table 3.14. - Waterbodies listed in 1996 and 1998 as water quality limited for the Siltcoos sub-basin, Mid Coast basin of Oregon.

Waterbody Name	Boundaries	Parameter
Maple Creek	Mouth to Headwaters	Habitat Modification Sedimentation Water Temperature
Fiddle Creek	Mouth to Headwaters	Habitat Modification Sedimentation Water Temperature
Siltcoos Lake	Lake	Aquatic Weeds or Algae
Tahkenitch Lake	Lake	Aquatic Weeds or Algae
Siltcoos River	Mouth to Siltcoos Lake	Aquatic Weeds or Algae Flow Modification

Coastal Lakes Watershed Analysis

Geomorphic Segments



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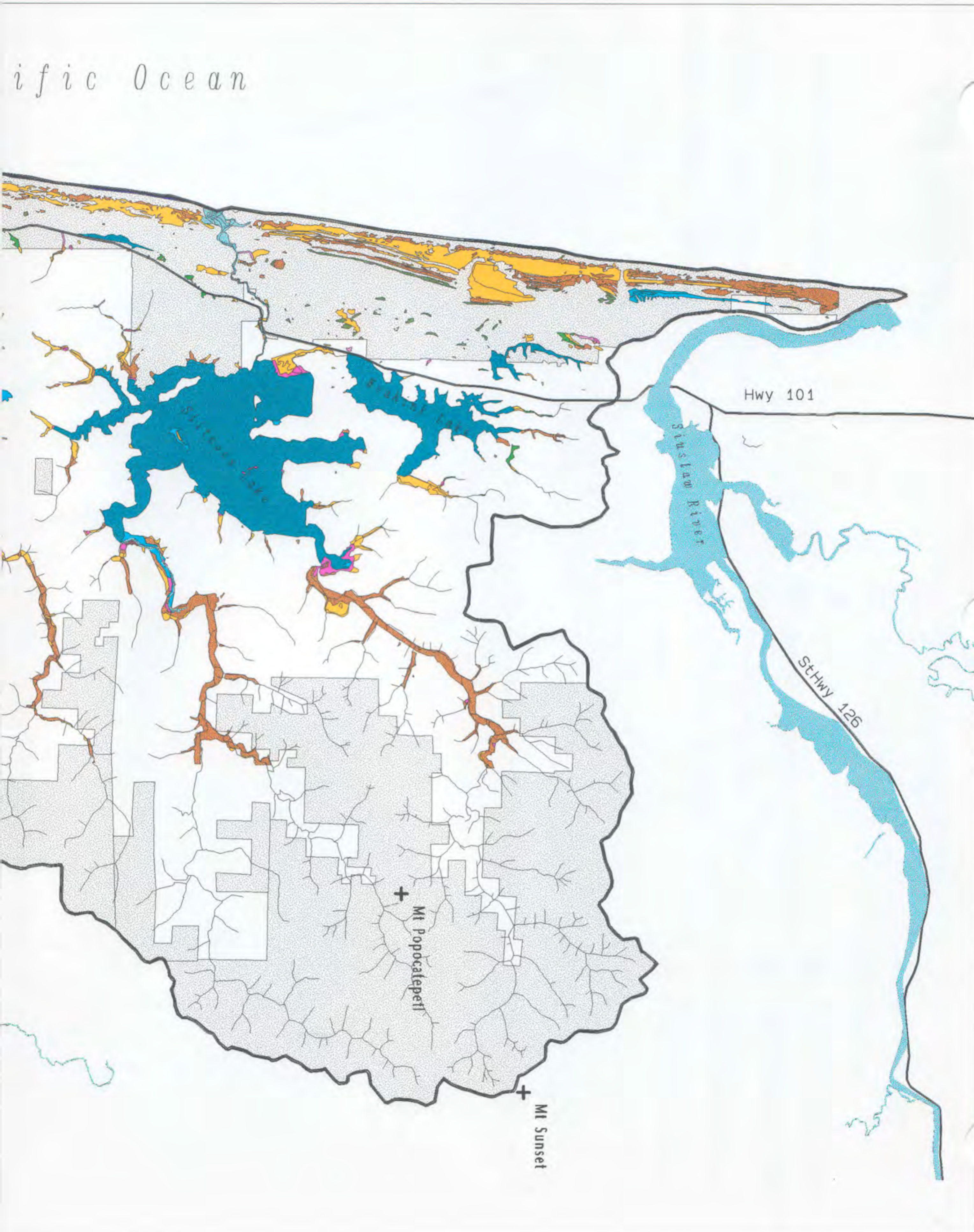
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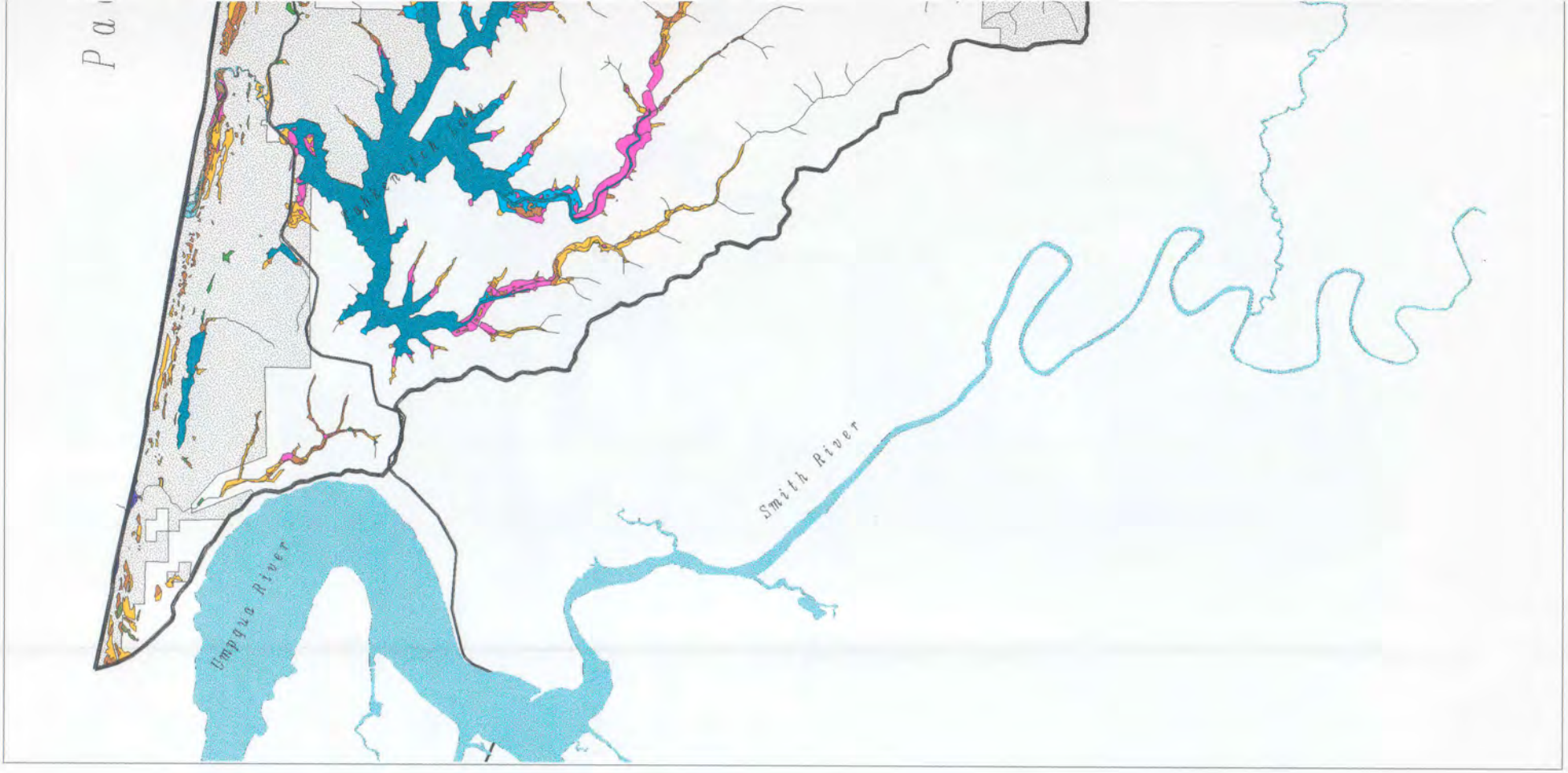
Hwy 101
Siuslaw River
StHwy 126
Mt Popocatepetl
Mt Sunset



Coastal Lakes Watershed Analysis
Wetlands and Deep Water Habitats

0 1 2 3 4

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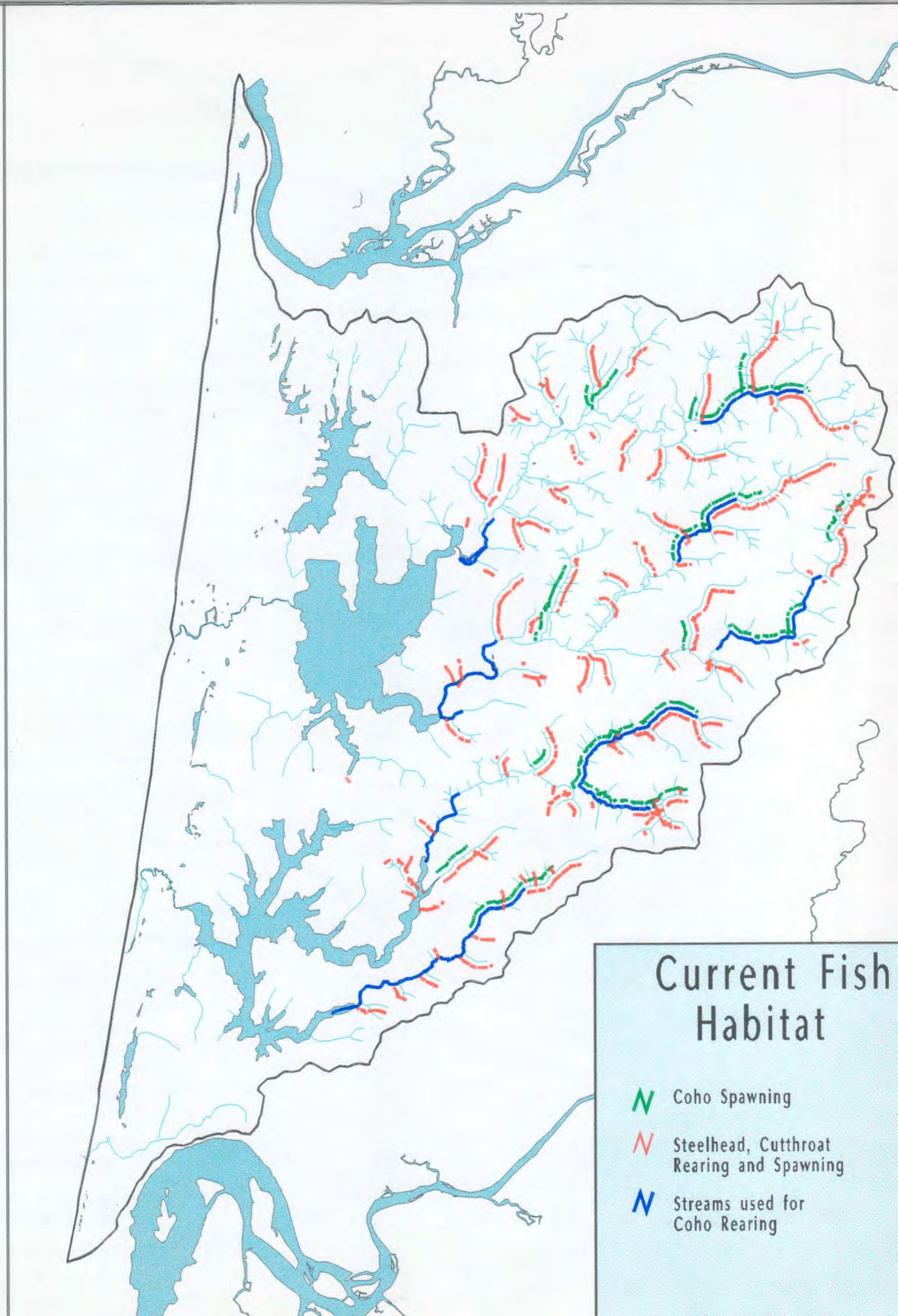
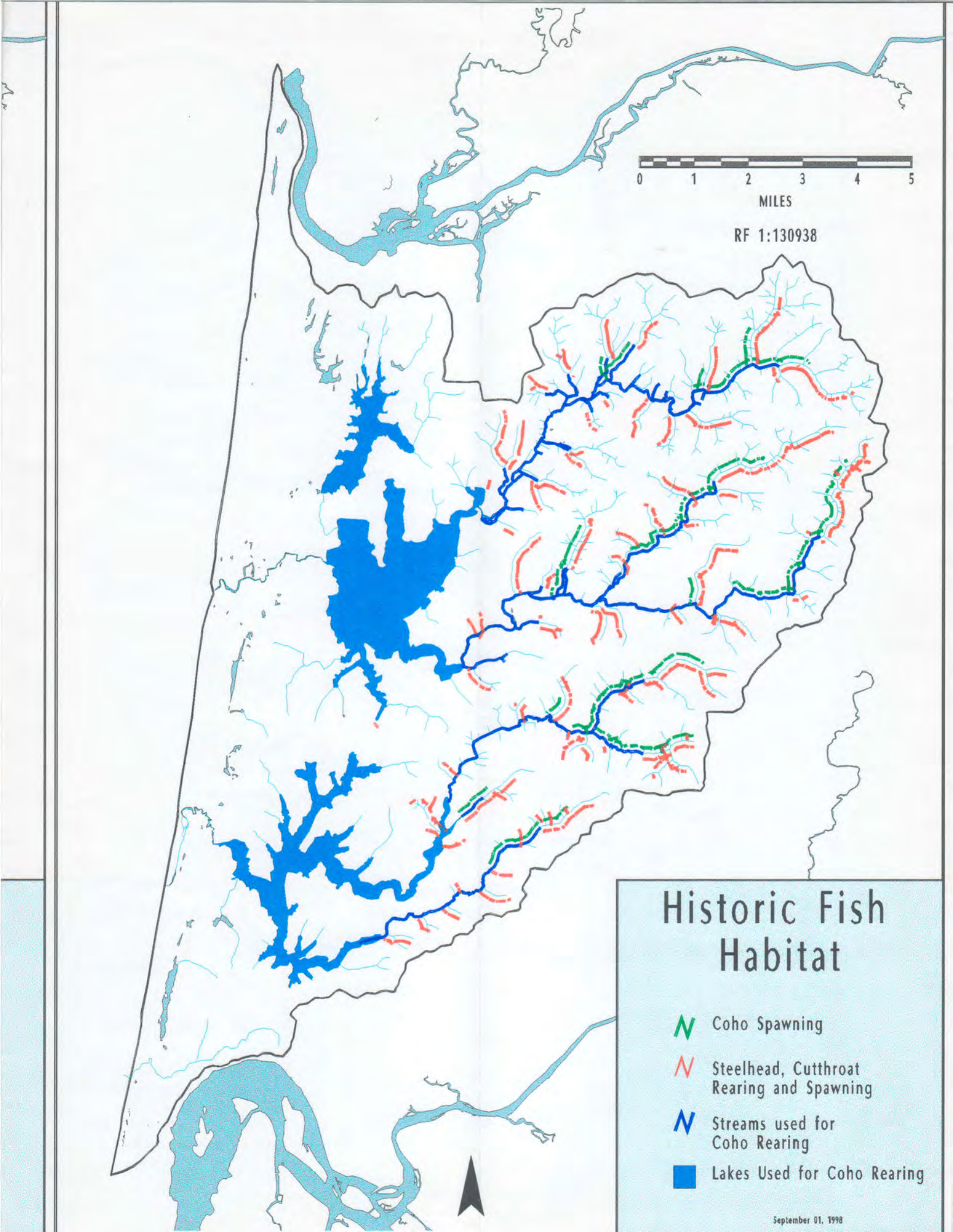
- Siuslaw NF
- Estuary, Subtidal and Intertidal
- Lacustrine, Limnetic (DeepWater Lake, ›2m)
- Lacustrine, Littoral (Lake Association Wetland, ‹2m)
- Marine, Intertidal
- Palustrine, Aquatic Bed
- Palustrine, Emergent Vegetation, Permanently and Semipermanently Flooded
- Palustrine, Emergent Vegetation Flooded Part of the Year
- Palustrine, Forest, Scrub, Shrub, Flooded Part of the Year
- Palustrine, Unconsolidated Bottom Permanently and Semipermanently Flooded
- Palustrine, Unconsolidated Bottom Flooded Part of the Year
- Riverine, Tidal
- Riverine, Low Gradient

August 31, 1998


Current Fish Habitat
Coho Spawning
Steelhead, Cutthroat Rearing and Spawning
Streams used for Coho Rearing


0 1 2 3 4 5
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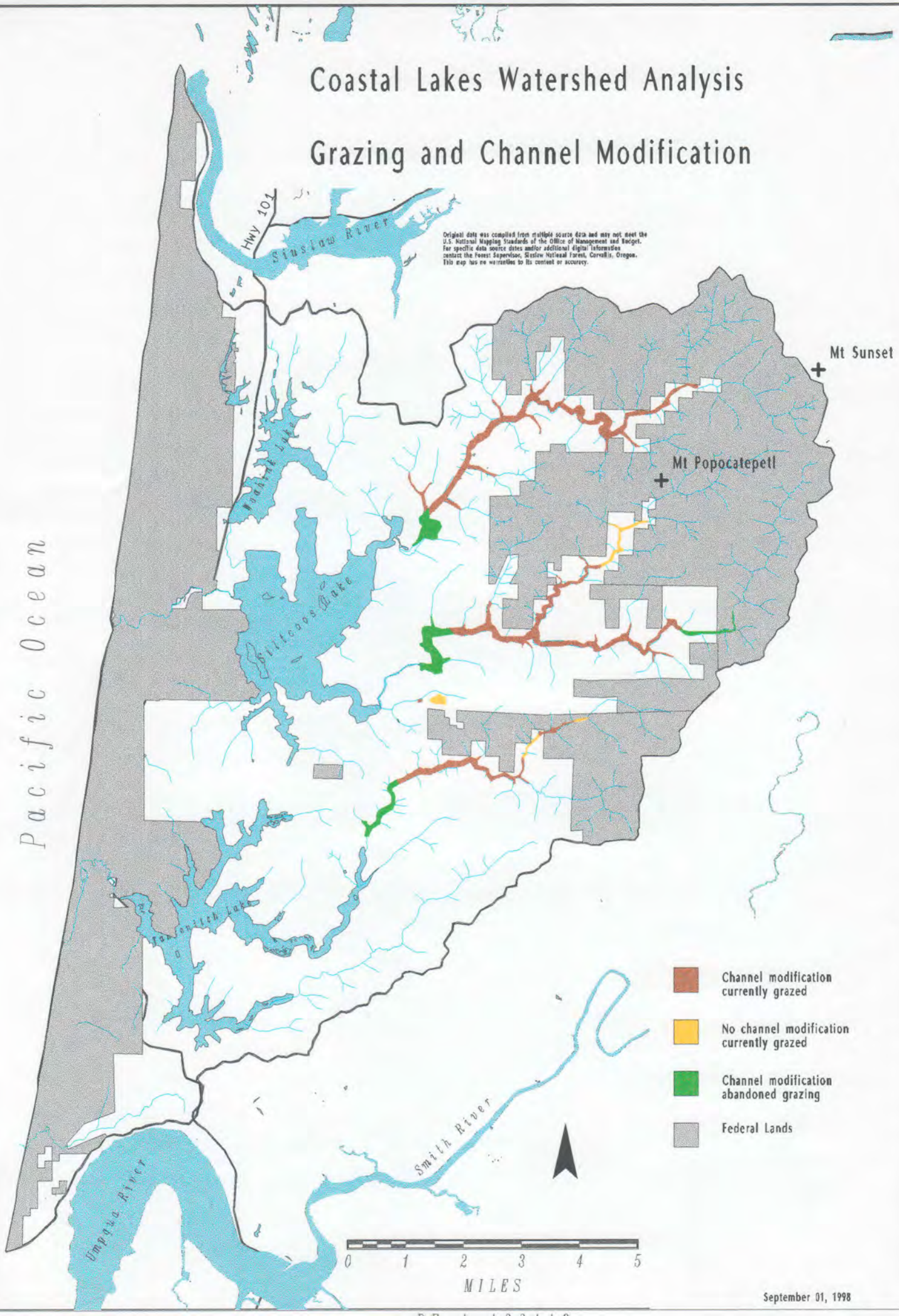
Historic Fish Habitat
Coho Spawning
Steelhead, Cutthroat Rearing and Spawning
Streams used for Coho Rearing
Lakes Used for Coho Rearing
September 01, 1998

Coastal Lakes Watershed Analysis

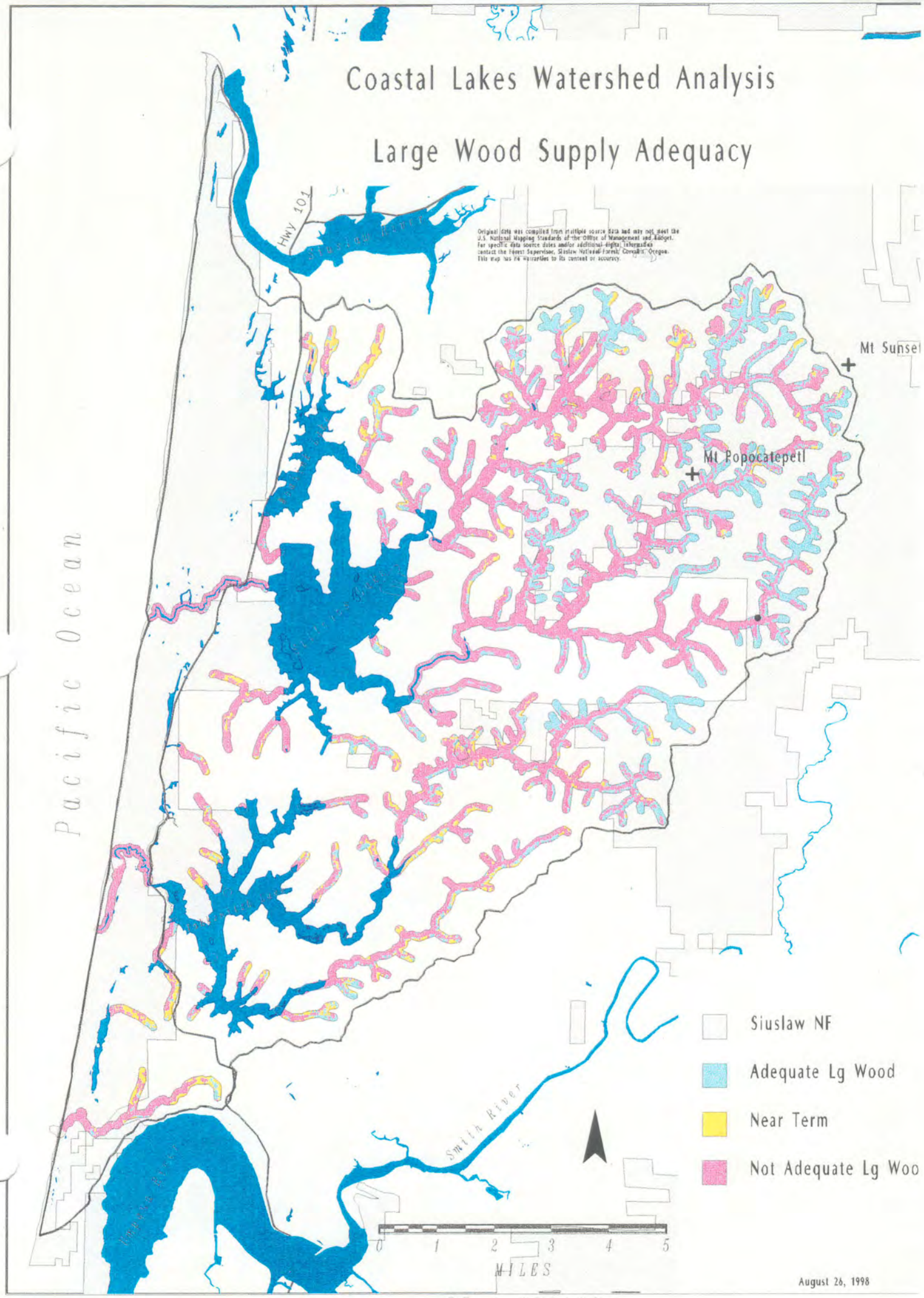
Grazing and Channel Modification



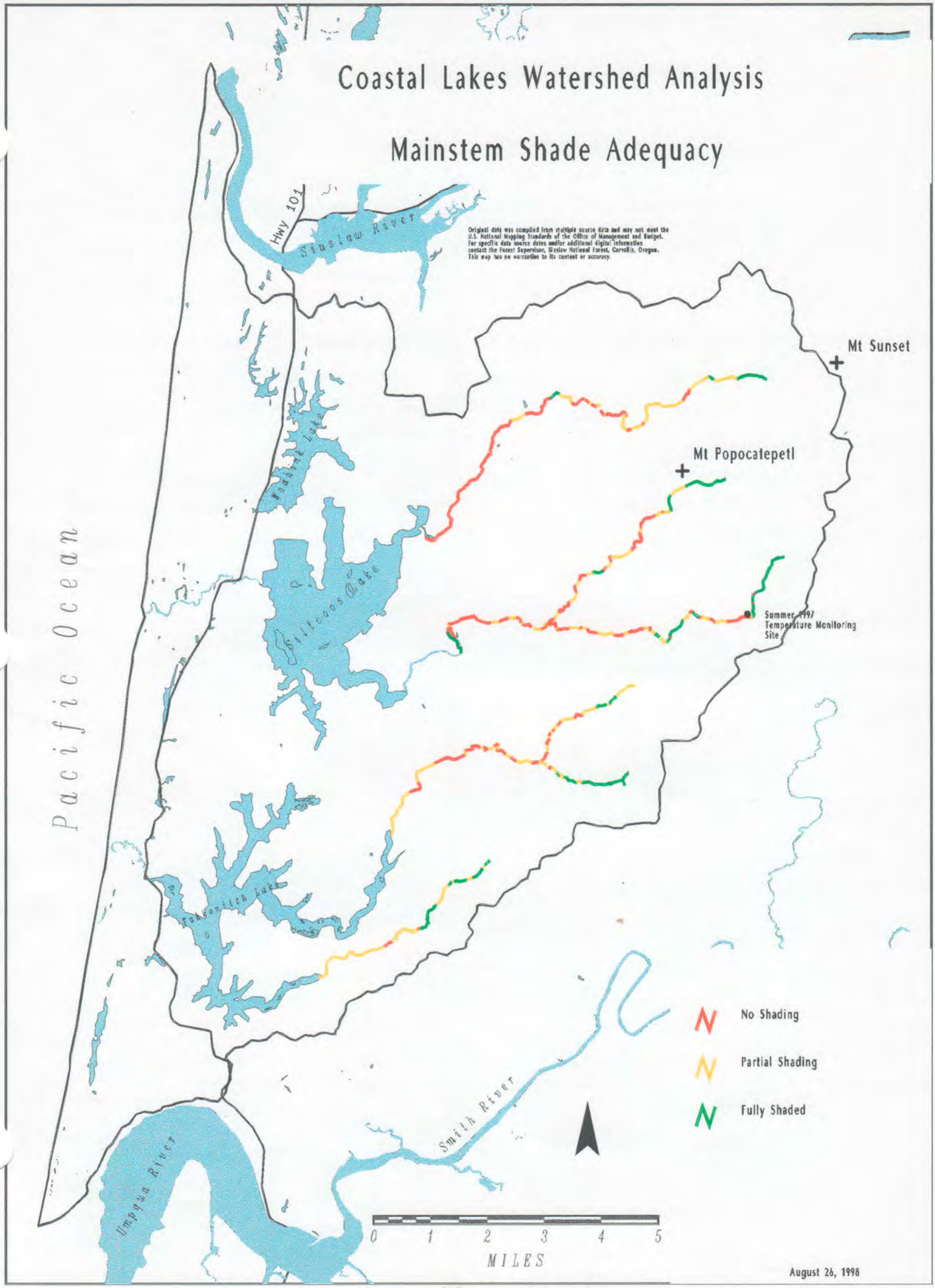
September 01, 1998

Coastal Lakes Watershed Analysis

Large Wood Supply Adequacy



August 26, 1998


Coastal Lakes Watershed Analysis
Mainstem Shade Adequacy
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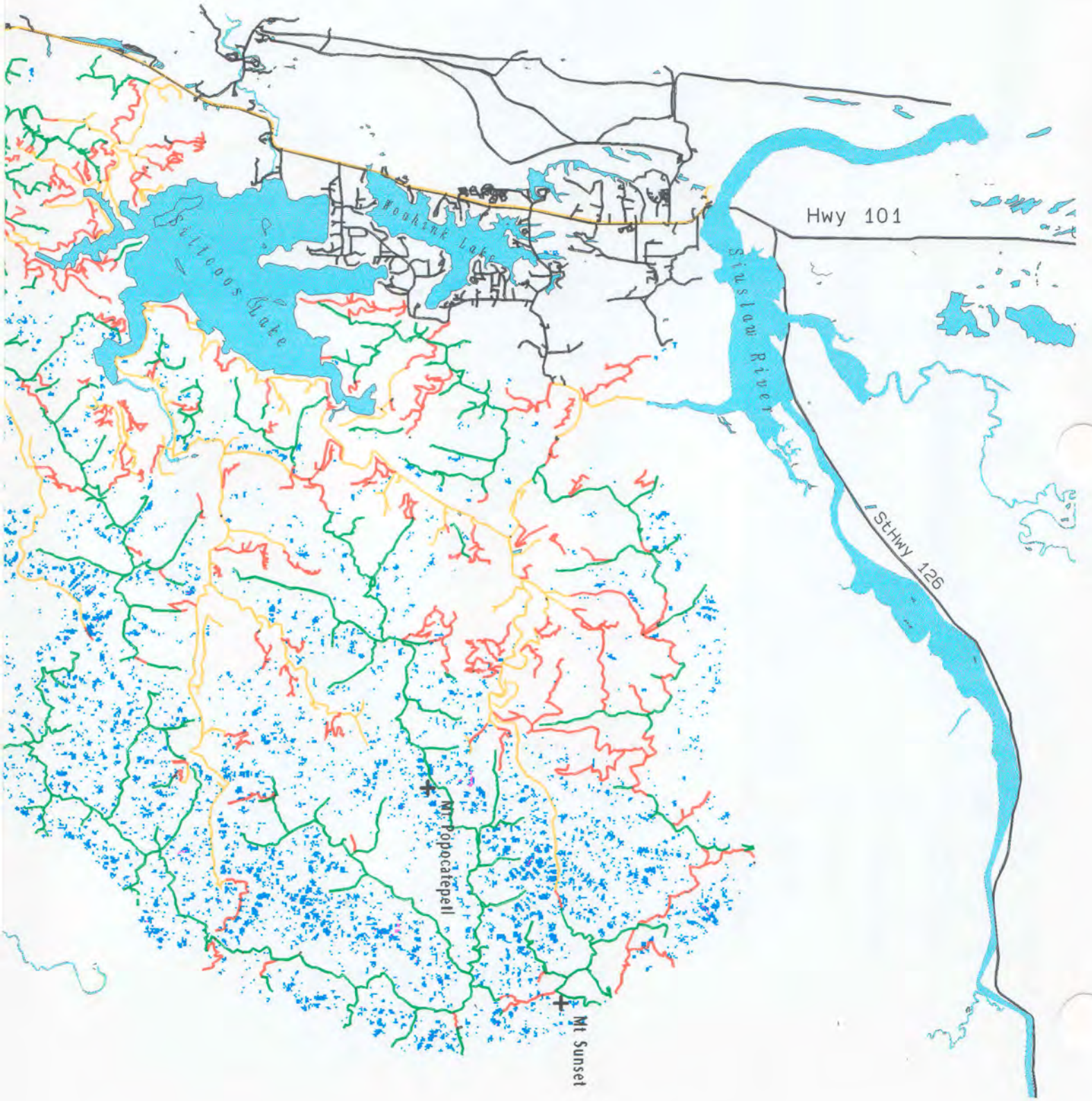
Hwy 101
Siuslaw River
Mt Sunset
Mt Popocatepetl
Summer 1997 Temperature Monitoring Site
Pacific Ocean
Woahink Lake
Siltcoos Lake
Tahkenitch Lake
Smith River
Umpqua River
No Shading
Partial Shading
Fully Shaded
0 1 2 3 4 5
MILES
August 26, 1998

ific Ocean



Coastal Lakes Watershed Analysis
Landslide Susceptibility

Valley Bottom
Midslope
Ridgetop
Dunes/Residential
Low to Moderate Susceptibility
High Susceptibility
Extreme Susceptibility

0 1 2 3 4
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RF 1:105552

August 26, 1998

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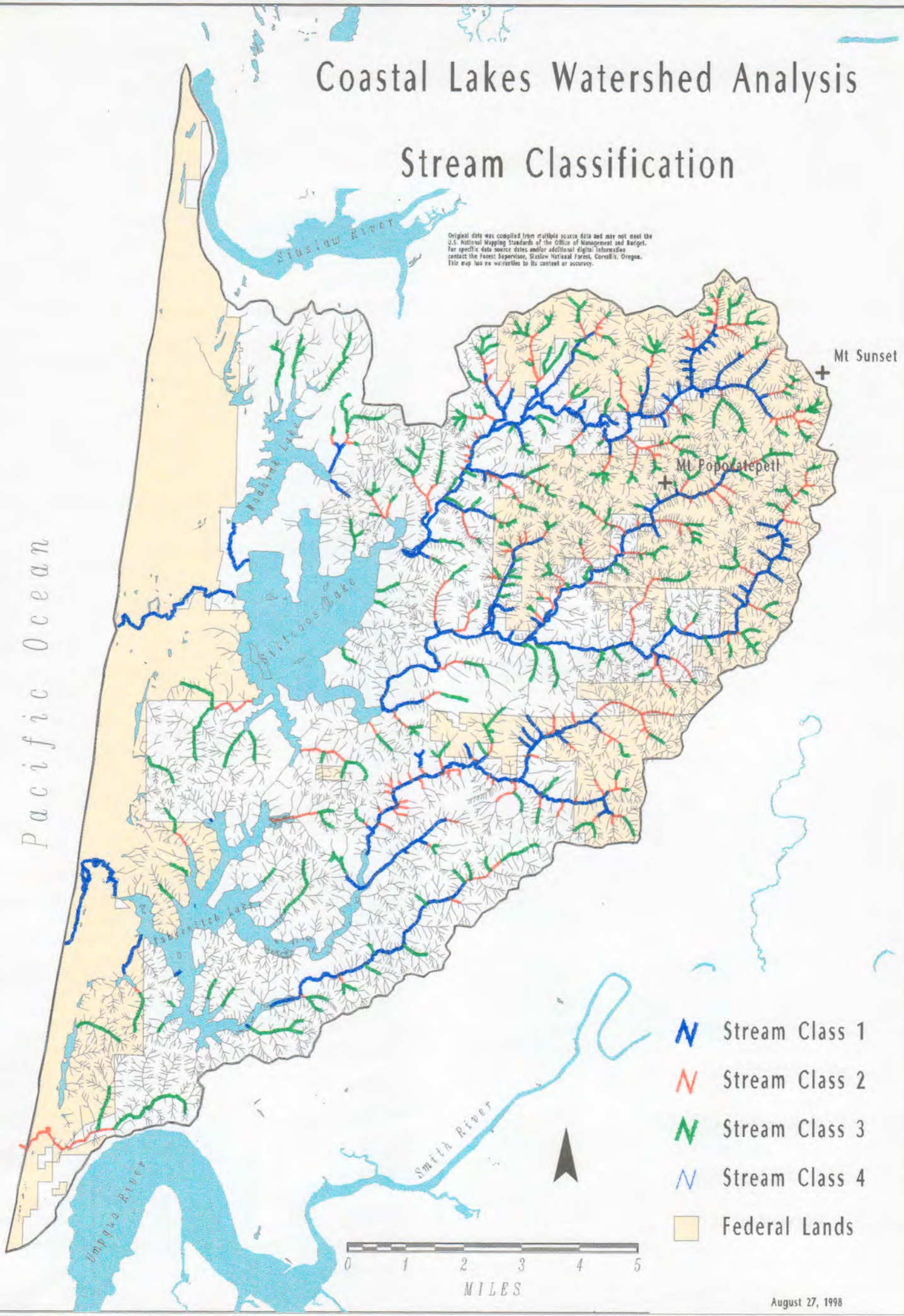
Coastal Lakes Watershed Analysis

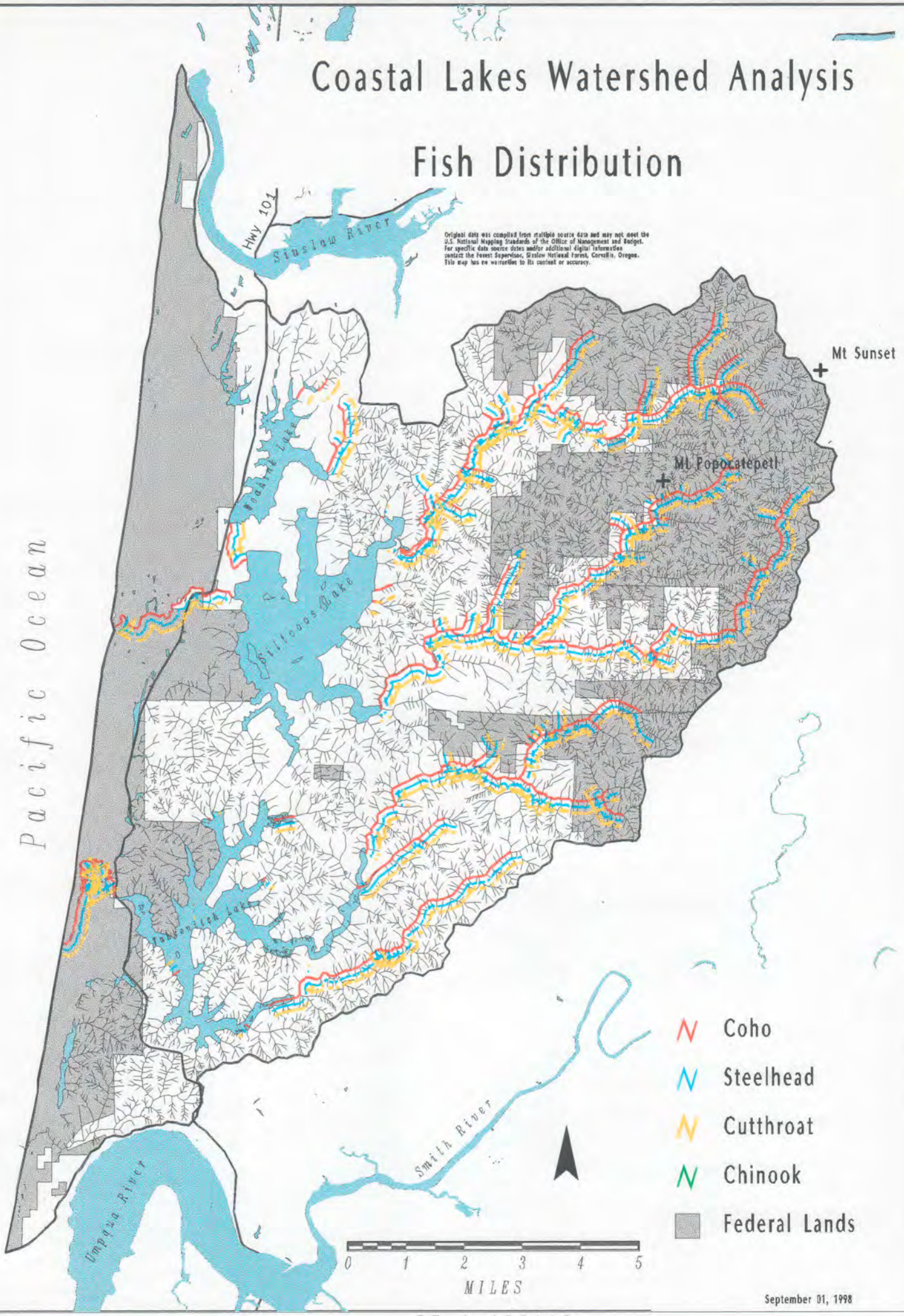
Stream Classification



August 27, 1998

Coastal Lakes Watershed Analysis

Fish Distribution



September 01, 1998

CHAPTER 4: VEGETATION

HISTORIC CONDITIONS

Plant Associations (potential vegetation)

The watershed boundary straddles two plant series: the Sitka Spruce Zone and the Western Hemlock Zone. These zones are descriptors of the environment, productivity levels, and forest types. The Sitka Spruce Zone, which generally coincides with the Coastal Fog Zone, extends far up the valleys in this watershed due to proximity to the coast and the gentle topography which allows the coastal fog to creep far inland. Spruce are found as far east as the headwaters of Leitel Creek. The Western Hemlock Zone occurs on the higher elevations near the top of the watershed in the headwaters of Maple, Five Mile, and Fiddle Creeks. Siuslaw National Forest plant association classification is based on theoretical climax stands (i.e. western hemlock or Sitka spruce dominated) although these stands have not yet developed (Hemstrom and Logan 1986) due to an extensive, catastrophic fire that swept most of the analysis area in 1850 (Map 15).

The Sitka Spruce Zone is considered the most productive forest zone on the Siuslaw National Forest. The moist air allows the trees to grow continuously during the day rather than shutting down to maintain their moisture. The moderate temperatures allow trees to grow most of the year.

The wet environments (salmonberry plant association groups) occur adjacent to stream channels and in the headwall areas, the moist environments (swordfern PAGs) occur on the mid slopes, and the dry environments (salal PAGs) occur in narrow strips along the tops of ridges. Within the Sitka spruce plant series the frequent summer fog moderates the effect of climate and the vegetation patterns associated with PAGs are less distinctive as indicators of the environment than in the hemlock plant series. The pattern may also be obscured, at least in part, by the constant influence of wind which blows down trees, overturns the soil, and accumulates large masses of downed logs which affects soil moisture and species composition (Map 15).

Table 4.1. Climate and Vegetation Influences in the Coastal Fog Zone and the Southern Interior Coast Range. This table emphasizes the relative differences between the two zones, but actually the difference within the watershed is a gradation.

	Coastal Fog Zone	Southern Interior Coast Range
Plant series (Dyrness and Franklin, 1976)	Sitka Spruce Series	Western Hemlock Series
Climate	Uniformly wet and mild. Fog and low clouds during relatively drier summer months ensure minimal moisture stresses.	Wet and mild, under considerable maritime influences but, experiences moisture stress in summer months
Fire regime	Infrequent (500+ yr.), stand replacing fires	Low to moderate frequency, moderate to high severity fires
Wind disturbance	Chronic wind disturbance. Mortality 2.8%/year of live biomass (Green, et al. 1992).	Little wind disturbance. Mortality rate 1/2 of one percent per year
Productivity	Higher than western hemlock zone (Franklin and Dyrness, 1973).	Moderate to high productivity, lower than Sitka spruce zone.
Succession	Pioneer species: Sitka spruce. Salt tolerant spruce and salal. Climax tree species: Western hemlock with a mix of spruce and cedar on wet sites. Spruce considered a "sub-climax".	Pioneer species: Douglas-fir. Climax species: Western hemlock. Shrubs not as dense as in Sitka spruce series (Franklin and Dyrness, 1973)
Stand Structure	Tree species diversity: higher than hemlock zone Canopy layers: More layering than hemlock zone Coarse woody debris: Higher accumulations than hemlock zone	Tree species diversity: fewer species present than spruce zone Canopy layers: Fewer layers than spruce zone Coarse woody debris: Lower accumulations than spruce zone

Dunes Plant Communities

Although sand dunes are not hospitable to many life forms, habitat is provided by a wide variety of plant communities within the Oregon Dunes NRA. The variety of communities is due partly to blending ocean and coastal forest ecosystems and the introduction of exotic species. Classification systems developed for plant and wildlife communities on the Oregon Dunes NRA reflect a combination of landforms and habitats (Map 16).

A landform is a specific land structure such as a foredune, deflation plain, hummock or oblique dune. These landforms may be completely unvegetated or may support one or more plant communities with associated wildlife species. The major landforms associated with plant communities include; beach, sand dunes, deflation plain, upland forests, aquatic and riparian, meadows and plantations. To simplify this analysis, several plant communities were combined on the Dunes Vegetation Map. However, this discussion will describe these plant communities in the broader context of landforms in order to tie the two together.

Beach: The beach includes the area between the ocean edge and the foredune. The land below mean high tide is managed by Oregon State Parks, while the Oregon Dunes NRA manages the land between mean high tide and the vegetation line.

Sand Dunes: A variety of sand-based landforms can be found on the Oregon Dunes NRA. Several are colonized by native and non-native plant communities. Others are constantly shifting and essentially devoid of vegetation. The foredune supports European beachgrass and American dunegrass communities. Hummocks are partially stabilized small dunes. European beachgrass is the dominate species with other herbaceous and shrub species present depending on soil wetness.

Wetlands: The Oregon Dunes NRA contains a variety of wetland types. These include mainly deflation plain wetlands and a minor amount of salt water and fresh water marshes, swamps and bogs. For purposes of this analysis, National Wetlands Inventory data was used to roughly define wetlands within the watershed. Deflation plain wetlands are included in both palustrine, emergent and palustrine, forest/shrub types (Map ??).

Much of the deflation plain is inundated with water in the winter; the degree to which an area is inundated influences the type of deflation plain community the area supports. Various plant communities with associated wildlife species can be found within the deflation plain depending on the water regime and successional stage. These communities are found in a mosaic across the deflation plain. Early seral stage habitats include grasses, rushes and sedge communities. The second successional stage includes low and tall shrub habitats. The shore pine forest is the final successional stage.

Aquatic/Riparian: Aquatic habitat support unique and diverse plant communities depending on characteristics of the water body and soils. Riparian zones are transitional areas between aquatic and upland habitats along the edges of creeks, rivers, lakes and ponds.

Estuaries: Estuaries are the most fertile naturally occurring areas in the world (USDA 1972). The fertility is a result of nutrients and organic matter from decaying vegetation both washed in by tides or downstream. These nutrients provide a for high amounts of plankton and invertebrates which are basis of the food chain in the estuary. Salt marshes and tidal flats are important components of many estuaries.

Shore Pine Forest: Shore pine forests can be found on stabilized dune surfaces, precipitation ridges and flood plains. Regardless of landform, this community is always dominated by shore pine although other trees may be scattered throughout. A very dense shrub layer, but no herbaceous layer, is present. Matsutake mushrooms, an important commercial species, are associated with shore pine.

Transition Forest: Similar to the shore pine forest, the transition community can be found on a variety of landforms from stabilized dunes to mountain fronts. Species composition is similar across these landforms, but trees growing in richer soils of floodplains and mountain fronts will have more closely spaced larger trees. A dense shrub layer and trees of various age classes provides for a diverse forest structure.

Plantations: Plantations of European beachgrass, Scot's broom and shore pine were planted on a variety of landforms between the 1880's and the mid 1900's. These plantations generally have a fairly dense cover of shore pine with an understory of Scot's broom, although the later begins to die in older plantations. the herbaceous layer is relatively sparse, particularly in older stands.

Fire

In the Coastal Lakes watershed a series of fires in the mid 1800's burned the landscape with varying levels of intensity, leaving a sea of snags and down wood, patches of unburned and partly burned sites, and isolated surviving trees. "Lands around Siltcoos and Woahink burned during the big fire in the 1830 - 1840 era" (U.S. Fish Commission, 1897). The land the settlers came upon consisted of "an endless expanse of dead, charred, big trees remaining from terrible forest fires that raged in the mid 1800's" (Siuslaw Pioneers, 1947 & 1951). Although fires increased in frequency in adjoining forests, dune vegetation was hardly affected. Human caused fires has not been an agent of change on the dunes landscape in the past 130 years (Weidemann 1984) (Map 17).

Old growth Sitka spruce and Douglas-fir escaped the fires on the south end of Siltcoos and the north end of Tahkenitch. "Lands around Tahkenitch did not burn in the big fires of 1830's and 1840's. There were large fir all around the lake" (U.S. Fish Commission, 1897). A land classification of National Forest lands and describes Section 13 & 24 as being covered with "a stand of old growth fir and spruce" with high timber volumes (Pagter, 1917) (Appendix B). Long time residents recall this area as having old growth up to 6 and 8 feet in diameter. Aerial photos from about the mid 1940s reveal a early cutting pattern that seems to correspond to where the old growth was. Estimated extent of this area is Township 20 S. Range 12 W. sections 1,3,4,9,10,11,12,13,14,15, 16,20,21,22, 23,24,25,26, part of 29 and 32, Township 20 S. Range 11 W. parts of sections 15, 16, 17, and 18. Another spot of unburned large trees noted in the Land Classification was the Henderson Creek area, Township 19 S. Range 11 W. parts of sections 1,2 10 and 11. Pagter states "a good body of second growth fir is found. . .which runs as high as 50 to 60 M feet B.M. per acre and which is between 100 & 200 years in age" (Pagter, 1917). It is unknown whether the Leitel creek area was part of the unburned tract or not.

In the burned over areas, the land regenerated. With scattered remnant trees for seed and a diverse seed bed ranging from mineral soil to head-high loads of wood, the results were a patchwork of age classes and densities. In 1917 areas along the coast were described as being composed of "scrubby fir, logepole pine and spruce, between 20 - 80 years old" and large areas of sand "wasteland". Areas more to the east were described as "virtually a fir type . . . with restocking to Douglas-fir with an occasional cedar, hemlock and spruce. The reproduction was well established and trees were between 20 and 80 years old. Dead, standing and down cedar comprised about 40 percent of the total estimated volume. Timbered areas were covered with almost impenetrable brush" (Pagter, 1917).

Insects, Disease, and Windthrow

Several diseases are endemic to the analysis area. None are of a concern since they all currently exist at minimal levels. These include laminated root rot *(Phellinus weirii)*, Swiss Needle Cast *(Phaeocryptopus gaumanni), Fomes annosus, Armillaria ostyoae,* and Hemlock dwarf mistletoe *(Arceuthobium tsugense)*. Insects endemic to the area include Douglas-fir beetle *(Dendroctonus pseudotsugae)*,spruce beetle *(Dendroctonus rufipennis)* the Sitka spruce tip weevil *(Pissodes strobi),* and the hemlock looper. Swiss Needle Cast is increasing in coastal forests, possibly as a result of several years with above-average precipitation. It is suspected that Douglas-fir within a few miles from the ocean (possibly within the Sitka spruce zone) are more at risk for defoliation and growth loss. (Hansen 1997). Swiss Needle Cast has had considerable impact in the northern part of the Forest (Hebo District) and is a growing concern across the Forest. Remotely sensed vegetation data indicate that Swiss Needle Cast is spreading southward, and its presence may become apparent in the analysis area in the next few years. It has primarily affected Douglas-fir plantations in the coastal fog/Sitka spruce zone, and has resulted in substantial economic losses on private industrial forest land. It is also found in mature forests and is a concern for the LSR. Little

is known about it, but if the levels reach high proportions in the Coastal Lakes area, it is expected to have similar effects in this area.

On the Dunes, earlier surveys found trees most susceptible to disease and insect damage are primarily confined to stabilized floodplain and dune areas (USDA, 1972). Problems were noted in the Siltcoos and Tahkenitch areas. Noted disease and insects included; Western gall rust, pine needle cast, red band needle blight, spruce needle rust, pitch nodule moth, pine engraver, pine root collar and feeding weevils and mosquitoes. Introduced tree species to this harsh environment may be more susceptible to insect and disease damage.

Winds of hurricane force (over 74 mph) strike the Oregon Coast several times each winter (Badura et al. 1974). Blowdown resulting from these storms can be substantial. Wind is the dominant disturbance factor in the Coastal Fog Zone. The effect is to cause small, 1-10 acre patches of trees to blow down, creating discrete openings in the forest and providing CWD inputs to the forest floor and stream channels. Less frequently surface winds occur that result in diffuse blowdown over large areas and widespread property damage. The most destructive winds are those which blow from the south, parallel to the mountain ranges. Within the analysis area, the area along Henderson Ridge and the Sunset Road have been hardest hit by winds, including the 1953 storm and the Columbus Day storm. According to sources on the Mapleton District, logging has followed windthrow up the drainage or it could be said windthrow has followed clearcutting up the drainage. Wind prone areas include Henderson, Jordon Creek, 5 mile and Tahkenitch Campground. The Columbus Day storm of 1962 blew down large spruce. The openings created by wind provide growing sites primarily for shade tolerant species, such as western hemlock and western redcedar, to become established, thus increasing species diversity stands and accelerating succession toward multistory and late-successional conditions.

Wind plays a major roll in shaping the dune landscape seasonally and through time. In the beginning, winds blew sand inland from the exposed ocean floor. Sand continually moved inward from the beach until foredune establishment. Later, the deflation plain was created from winds scouring behind the foredune. Seasonally, wind patterns change from northern and southern directions. Changing directions and velocities affect patterns of transverse dunes and to a lesser extent the movement of larger oblique and parabola dunes.

CURRENT CONDITION

Seral Stages and Landscape Pattern

Aerial photos of the watershed indicate that by the mid- to late-1940s the forest vegetation had already been significantly altered by post-European settlers. Fires and logging had fragmented the forest around Siltcoos and Woahink lakes. Both the large patches of old-growth had been acquired by private timber companies and clear-cut. The first patch was between the dunes and Siltcoos Lake, and the second was on the ridge separating Tahkenitch Lake and Smith River (Map 17).

The watershed is currently dominated by large mixed conifer-deciduous stands (11,142 acres),semi-open (9,946 acres), plantations, (9,646 acres) deciduous (8,975 acres), and open (8,401 acres). The seral classes with by far the fewest acres are very large conifer (131 acres). *Bring in Dunes numbers*

Figure 4.2. Seral class distribution by landowner. Total acres in the watershed by type of landowners (Appendix ?).

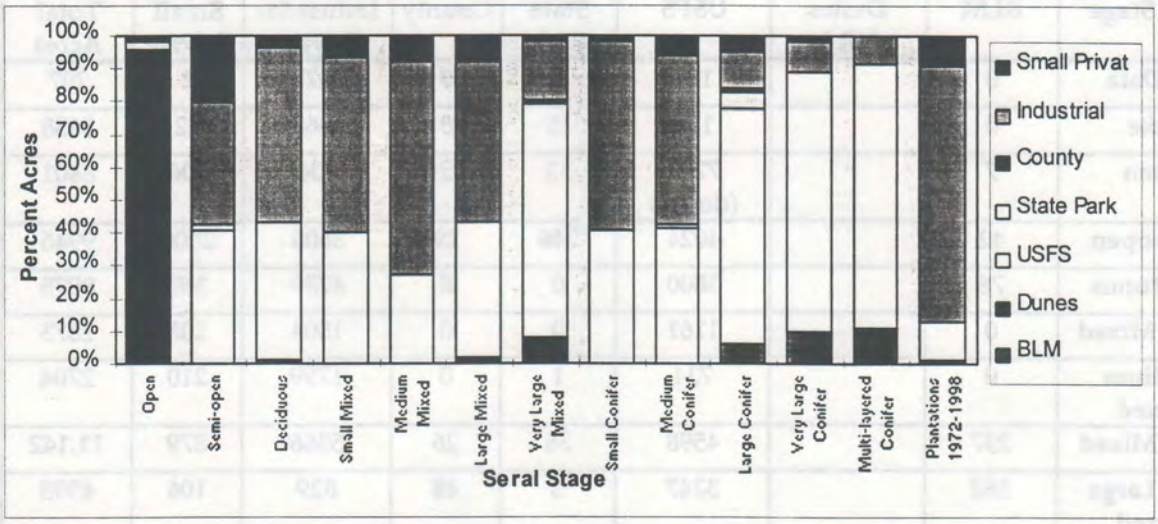
Seral Stage	BLM	Dunes NRA	USFS	State Park	County	Industrial Private	Small Private	Total Acres
No Data	0		144	4	0	57	2	207
Lake	0		178	15	0	5363	82	5638
Open	7		7792 (dunes)	33	159	204	206	8401
Semi-open	42		4024	246	29	3605	2000	9946
Deciduous	78		3800	0	8	4739	350	8975
Small Mixed	0		1161	0	0	1504	208	2873
Medium Mixed	0		734	1	0	1759	210	2704
Large Mixed	237		4598	36	26	5366	879	11,142
Very Large Mixed	360		3247	3	48	829	106	4593
Small Conifer	0		1396	0	0	1930	71	3397
Medium Conifer	0		2562	33	6	3157	368	6126
Large Conifer	203		2265	147	22	329	167	3133
Very Large Conifer	13		103	0	0	12	3	131
Multi-layered large conifer	117		896	0	0	98	2	1113
Plantations	1193		34037	518	312	54223	5475	9646
Total Acres								

Areas where old growth spruce remain include Ada County Park and Camp Baker. Remnant Douglas-fir are numerous in Henderson, Bell and North Prong Creeks. The Siltcoos Trail and Tahkenitch Dunes NRA land acquisition are developing into mature stands. In the future they will provide the best, and probably the only, late-successional forest and wildlife habitat around the lakes since the middle one-third of the watershed is owned primarily by industrial timber companies (Maps 2 and 18).

Timber harvest by the Forest Service began in the analysis area during the 1950's in the Henderson Creek area. According to the Land Classification (Appendix B) these areas had 200 year old trees.

The vegetation data is from remotely sensed satellite imagery taken in 1988 and updated in 1998 (CLAMs, 1998). The imagery provides consistent data across a large landscape and covers all the land ownerships in the analysis area. Accurately is best in areas that have conifer species and large trees. The information is not adequate for riparian areas and the dunes. Consequently, aerial photo and field mapping were used for riparian and dunes vegetation other than this broad watershed summary (Maps 16 and 18).

Figure 4.1. Vegetation seral classes, species composition, and tree size.



Managed Stands

The proportion of hardwoods in the watershed has probably been influenced by timber management and road building. These activities increase soil compaction and disturbance, due to road building and yarding, which favors alder over conifer. Alder tends to be more competitive than conifer on moist, disturbed sites. On the other hand, planting dense conifer plantations after logging has reduced the amount of time and presence of red alder in some areas relative to species composition and succession following natural disturbance, such as fire.

Table 4.3. Acres of US Forest Service plantations and other seral classes by age class (years).

Age Class of Plantations	Acres
0 - 14	297
15 - 24	2,700
25 - 29	1,395
30 - 39	1,555
40 +	337
SUBTOTAL	6,284
Unknown Age	267
Natural Stands	11,479
Administrative Sites	124
Brush	8
Meadow	69
Rock	7
TOTAL	18,238

Site Productivity is variable over the analysis area. Stand exams show site indices of 140 to 200 (Douglas-fir 100 year). Site quality is lower on the ridgetops and higher on mid to low slope positions. *Relate this to Management Recommendation Map (Map X--Final Draft) We expect dense/high priority typing on lower slopes...Does the map support that? Does Stu's map verify that pattern of understocked and clumpy plantations in the southern part of the watershed relative to the northern part??*

Several exotic conifer species were planted to stabilize and occupy the drifting sands. These include Monterey Pine (*Pinus radiata*) a fast growing pine from California, Maritime pine (*Pinus pinaster*) from the Mediterranean basin and Austrian Black pine (*Pinus nigra*) (personal communication, Dan Segotta). Native shorepine (*Pinus contorta)* was widely planted alone and to some extent interplanted with Scots broom with the intention that the pine would shade out the Scots broom, but that did not happen. Port Orford cedar has been found infrequently during cruises of the Tahkenitch land acquisition. Some noble fir

and southern pines have been planted on industrial forest ownerships (personal communication, Dave Beck).

The differences between managed and natural stands are that planted trees grow quickly and have large diameters early. They begin to slow down in growth by age 30. Decreased light results in shorter crowns, and self thinning begins to kill small suppressed trees and later, intermediate sized trees. Due to uniform spacing, plantation trees are in a sense stuck--they grow up evenly together with low mortality rates, and differentiation into different crown classes takes a longer time, resulting in tall, thin trees. Logging "reset" the successional clock, in a sense, by mimicking stand replacement events and accelerating the early seral stages through planting and tending of Douglas-fir. Under current management direction there is a desire for more species diversity. Lack of diversity in spacing and size of plantations is one of the largest discrepancies between the development of natural and planted stands.

Siltcoos Trail and Tahkenitch Land Acquisitions: The highest potential to develop late-successional habitat in the lakes stratification area is two forest patches that were logged in the 1930s by Tahkenitch Tree Farms, and recently acquired by the Dunes NRA.

The west side of the XX acre Siltcoos Trail area is primarily a Sitka spruce forest which is locally a favorite spot for picking chanterelles. The east side is western hemlock with a few Douglas-fir and western redcedar. A 1931 photo mosaic shows a sea of stumps, burnt snags, brush, and seedlings. The trees are now about 60 years old. Site productivity is high and there are many old cedar remnants and large stumps. The land is hummocky indicating a history of blowdown or deep seated failures. Blowdown is adding diversity and accelerating forest succession, especially along the boundary with private land.

The 1,500 acre Tahkenitch land acquisition was purchased and became part of the Dunes NRA in 1996. Most of the area had been planted in 1942 with Douglas-fir and reportedly was thinned by the previous owner, Murphy Company. Species include Sitka spruce, with western hemlock and a few Douglas-fir which have survived since planting. Trees on the main peninsula to the east of Tahkenitch Landing are slightly older and larger on average. There is some Port Orford cedar, and blocks of Monterey Pine (detectable on aerial photos) with thick understory brush due to the sparse foliage of these trees.

The Tahkenitch and Siltcoos Trail parcels are both developing natural stand structure. Although they were planted, the bulk of the live trees have grown from natural seedlings. The spacing is irregular and differentiation is occurring naturally. Stem exclusion has occurred in most places with suppression mortality producing some snags. The Tahkenich Land acquisition was not included in the 1994 Oregon Dunes Management Plan (personal communication ,Dave Braley). Timber cruises completed in August, 1991 indicated that volume was about 30 - 35 mbf/acre.

Eight to 12 year old plantations just south of the Siltcoos trail area were also acquired by the Dunes NRA. Tree densities and species composition are probably similar to Forest Service young stands, but they have not been surveyed.

Globally Significant Plant Communities

Plant communities of the Oregon Dunes NRA were surveyed in 1993 by the Oregon Natural Heritage Program. Data gathered during the surveys were used to describe and asses plant communities of the Oregon Dunes. A 5-point ranking system used by Natural Heritage Programs worldwide to assess rarity and imperilment of individual species and natural communities were used to assess the global, or "conservation priority" of each plant community. Global ranks are based on number, quality and condition of occurrences, narrowness of range and habitat, trends in populations and habitat, threats and fragility of the community or element being assessed. The global ranks are:

G1 - critically imperiled globally (typically 5 or fewer occurrences)
G2 - imperiled globally (typically 6 to 20 occurrences)
G3 - rare or uncommon but not imperiled (typically 21 to 100 occurrences)
G4 - not rare and apparently secure, but with cause for long term concern (usually more than 100 occurrences)
G5 - demonstrably widespread, abundant, secure

Two G1 ranked plant communities, red fescue and American dunegrass, and two G2 ranked communities, shore pine/hairy manzanita/kinnikinnik and bog blueberry/tufted hairgrass, are known to occur within the Lakes Watershed area. Descriptions of the plant communities and location of high quality occurrences within the watershed are as follows:

Red fescue (G1) - A long lived early seral plant community composed of coastal red fescue (*Festuca rubra var. littoralis*) with seashore lupine (*Lupinus littoralis*) scattered throughout. Once common on semi-stable dunes inland from the deflation plain, most stands have been overrun by European beachgrass. High quality sites are at least 5 acres in size and have no European Beachgrass. Within the watershed area, high quality red fescue areas are located on the Umpqua spit in the vicinity of the Clambed Road. Approximately 20 acres is located on private lands (recently patented sand mining claim) with approximately 6 acres occurring on NFS lands.

American dunegrass (G1) - Once the dominant species in native foredune communities from northern California to British Columbia, this community has largely been replaced by European beachgrass. In addition to American dunegrass (*Elymus mollis*), component species of the plant community often include; yellow sand verbena (*Abronia latifolia*); seashore bluegrass (*Poa macrantha*); American sea rocket (*Cakile edentula*), American glehnia (*Glehnia leiocarpa*); maritime pea (*Lathyrus japonicus*) and seashore lupine. Ongoing habitat restoration projects (European

beachgrass control) in foredune areas near the outlets of Tahkenitch Creek (36 acres) and the Siltcoos river (44 acres) have improved the quality and quantity of American dunegrass plant community from small (< 1/10 acre) isolated fragments to larger contiguous patches (some > 1 acre).

Shore pine/hairy manzanita/kinnikinnik (G2) - This long live pioneer community occurs on dry semi-stable sand ridges and slopes. Tree and shrub layers are dominated by shore pine (*Pinus contorta var. contorta*) and hairy manzanita (*Arctostaphylos columbiana*). Some evergreen huckleberry (*vaccinium ovatum*), salal (Gaultheria shallon) or Pacific rhododendron (*Rhododendron macrophyllum*) may be present. The ground layer is a mat of mosses, lichens and kinnikinnik (*Arctostaphylos uva-ursi*). The lichen flora is diverse and includes several rare species. High quality stands are greater than 20 acres, contain varied age classes of trees and shrubs and have no Scot's broom or recreational (OHV) damage. The community is declining throughout it's range due to succession, Scot's broom invasion, residential development and OHV damage. High quality stands are located on the Umpqua spit in the vicinity of the Clambed Road. Approximately 40 acres are located on private lands (recently patented sand mining claim) and 15 acres on NFS lands.

Bog blueberry/tufted hairgrass (G2) - This wetland community occurs infrequently in seasonally flooded depressions of old deflation plains, marine terraces and margins of shallow dune lakes. Tufted hairgrass (*Deschampsia cespitosa var. longiflora*) dominates the open areas with bog blueberry (*Vaccinium uliginosum*) forming low thickets around the margins or scattered though the interior. Sphagnum moss (*Sphagnum papilosum* and/or *S. imbricatum*) are almost always present. This community is declining throughout its range due to recreational and residential development and, possibly, dewatering of coastal aquifers by groundwater pumping. High quality site are 2-5 acres in size with less than 2% cover by introduced species. A relatively large, 4 acre, high quality stand is located in the shallow "narrows" between the north and south open water areas of Three Mile Lakes.

Special Status Plant Species

The following four plant species listed as sensitive in Region 6 are known to occur within the watershed.

Pink Sandverbena, *Abronia umbellata ssp. brevifolia* - occurring in high beach and foredune habitats this species was once thought to be extirpated from the Central Oregon Coast due to habitat loss resulting from the introduction and spread of European beachgrass. Using genetic material from healthy populations to the south (Port Orford), two reintroduction sites have been established within the watershed. Reintroduction sites are located in

foredune areas adjacent to the Siltcoos and Tahkenitch Estuaries where a European beachgrass control program has been implemented to restore plover nesting habitat and native plant communities. Reintroduction efforts have shown some promise with over wintering individuals and reproduction observed, however, neither population is yet self-sustaining and both require supplemental out planting of greenhouse stock and/or broadcast seeding.

Adder's Tongue, *Ophioglossum pusillum* - of the nine populations of this species that have been documented within the State of Oregon, two occur within deflation plain areas of this watershed. All other known populations are from Cascade Forests. Both populations within the watershed occur in dense slough sedge/hookers willow deflation plain on the Oregon Dunes NRA. One small population located north of the Siltcoos River has not been relocated since 1988. The second population, located north of the goosepasture area has been visited biannually since it's discovery in 1992. Both sites are protected under an approved conservation strategy for the species (February 1996). Although OHV use is allowed in adjacent open sand areas and "designated routes" through the deflation plain, no OHV intrusion has occurred in either site due to the density of surrounding vegetation. No additional protection measures appear to be warranted at this time. Long term monitoring of the Goosepasture site was initiated in 1996 following protocols established in the Conservation Strategy.

Whorled Marsh Pennywort, *Hydrocoytle verticillata* - one population of this rare wetland plant was documented within the watershed in 1990. The site is located off the Tahkenitch trail in an old cutoff creek channel dominated by hookers willow and slough sedge. The population was relocated in 1998 and appears to be stable.

Bog Clubmoss, *Lycopodium inundatum* - several populations of this sensitive plant species have been documented within the watershed. This species has been documented in deflation plain areas of the Umpqua Spit, Tahkenitch Creek, Goosepasture and Siuslaw Spit areas. It is generally associated with early seral deflation plain habitats and appears to be stable to increasing in most areas.

Humped Bladder-Wort, *Urticularia gibba* - a population of this sensitive aquatic species was documented in Cleawox Lake, Honeyman State Park, in 1992. Small clumps of bladder-wort were reported to be growing tangled within or on top of native aquatic plants in numerous locations along the lake edge. Most notable in the report was the absence of aggressive non-native aquatic weeds such as South American waterweed and Brazilian water-mil foil, which dominate the aquatic vegetation in the watershed's larger lakes. Introduction of non-native aquatic weeds, by recreational boaters, poses the greatest risk to this population. Inventory of remote lakes where weed introduction has not occurred (such as Threemile Lake), would likely yield more populations.

A number of sensitive plant species not documented within the watershed have a high probability of occurrence because suitable habitat is present within the watershed.

Table 4.4. Sensitive Species and specific habitat present within the watershed.

Species	Habitat
Frye's moss, *Limbella fryei*	Hookers willow bog w/ deep humus
Pohlia moss, *Pohlia sphagnicola*	Hummocks in sphagnum bogs
Indian rice lily, *Fritillaria canschatcensis*	Sphagnum bogs
Lessor bladder-wort, *Utricularia minor*	Shallow lake edges, aquatic
North Pacific plantain, *Plantago macrocarpa*	Bogs and lake edges
Bog anemone, Anemone *oregana var, felix*	Sphagmun bogs and marshes

Survey and Manage Plant Species

Vascular Plants - No survey and manage plant species have been documented on federal lands within the watershed. However, potential habitat is present for several species within the watershed. (????) Survey and manage species will be protected through implementation of the Survey and Manage guidelines (USDA and USDI, 1994).

One known site of Albatrellus caeruleoporus, a rare ecto-polypore, exists within Honeyman State Park on the east side of highway 101.

Non-Vascular Plants

As part of the Siuslaw National Forests Air Quality Monitoring surveys 1993-1997 12 sites within the watershed were surveyed for epiphytic macrolichens. 105 species were documented. (List Appendix XX)

Noxious Weeds and Non-Native Plant Species

The introduction of European beachgrass is probably the most extensive and far-reaching human impact in it's effect on the dune landscape. It' effect has been both geomorphological (effect on dune forms) and biological (creation of new habitats and competition with other species)(Wiedemann 1984). The extent of effects from this introduced species on the dunes is not well studied and may yet to be seen.

Many other plant species found on the coastal dunes were also introduced after European settlement. These plants also influenced the landscape and altered native plant communities. Almost all of the plants now present in the foredune area have been introduced (Weidemann 1984). Scot's and Portuguese broom are now present across the dunes. Fortunately, gorse, another exotic shrub, has only been found in isolated locations

on the Oregon Dunes NRA. Extensive plantations of shore pine and Scot's broom were established in the 1940's. In addition, 600 hectare of deflation plain were planted with annual and perennial grasses and legumes to provide wildlife forage.

The following noxious weeds are documented or suspected to occur within the watershed. List 1 includes species which, once established, have the capacity for long term site occupancy (20+ years) and disruption of natural plant successional development. List 2 includes species that aggressively colonize disturbed sites but require frequent disturbance (such as mowing or roadside brushing) for long term occupancy. Species on both lists are generally recognized as "problem species" of ecological or economic importance. Highlighted species are those currently on the Oregon Department of Agriculture's Noxious Weed List.

Table 4.5. Noxious weeds known or suspected in the watershed.

List 1: Species with potential for long-term occupancy

Scot's broom (d), *Cytisus scoparius*	**Terrestrial**
Portuguese broom (d), *Cytisus striatus*	**Terrestrial**
Gorse (d), *Ulex europaeus*	**Terrestrial**
Giant knotweed (d), *Polygonmun sachalinese*	**Riparian**
Japanese knotweed (d), *Polygonum cuspidatum*	**Riparian**
Himalayan knotweed (s), *Polygonum polystachyum*	**Riparian**
Purple loosestrife (d), *Lythrium salcaria*	**Aquatic, riparian**
South American waterweed (d), *Elodea densa*	**Aquatic**
Brazilian water-mil foil (d), *Myriophyllum brasiliense*	Aquatic
European beachgrass (d), *Ammophila arenaria*	Terrestrial
English ivy (d), *Hedera helix*	Terrestrial
English holly (d), *Ilex aquifolium*	Terrestrial
Himalaya berry (d), *Rubus discolor*	Terrestrial
Evergreen blackberry (d), *Rubus lacinatus*	Terrestrial
Reed canary grass (d), *Phalaris arundinacea*	Riparian
Yellow flag iris (d), *Iris pseudacorus*	Aquatic/riparian

List 2: Species of short-term site occupancy

Canada thistle (d), *Cirsium arvense*	**Terrestrial**
Bull thistle (d), *Cirsium vulgare*	**Terrestrial**
Tansy Ragwort (d), *Senecio jacobaea*	**Terrestrial**
St. Johnswort (d), *Hypericum perforatum*	**Terrestrial**
Poison Hemlock (d), *Conium maculatum*	**Terrestrial**
Australian fireweed (d), *Erichtites minima*	Terrestrial
Oxeye-daisy (d), *Chrysanthemum leucanthemum*	Terrestrial
Tree Lupine (d), *Lupinus aboreus*	Terrestrial

CHAPTER 5: WILDLIFE HABITAT AND SPECIES

UPLAND FOREST AND LAKES

Late Successional Habitat -

Currently only about 25% of the watershed or 20, 912 acres exists as mature conifer forest. This is undoubtedly much less than the amount that existed prior to Euroamerican settlement. The majority, 80% is within LSR R0267. Much of the remaining mature conifer forest exists on Federal Lands towards the eastern 1/3 of the watershed. Rural development and timber harvest are the main causes of reduced mature conifer habitat. The most significant reduction has been in the middle 1/3 of the watershed on private industrial forest lands where many stands are being harvested for the second time. Under current management direction levels of mature conifer on Federal land should gradually increase over time as managed stands develop. The amount of mature conifer habitat on private lands will most likely continue to decline as a result of timber harvest and human developments.

The middle part of the watershed poses a significant barrier to dispersal for many plants and animals. The presence of the three major lakes and Highway 101 coupled with the large amount of early seral forest types and human development limit the connectivity of late successional forest from east to west across the watershed.

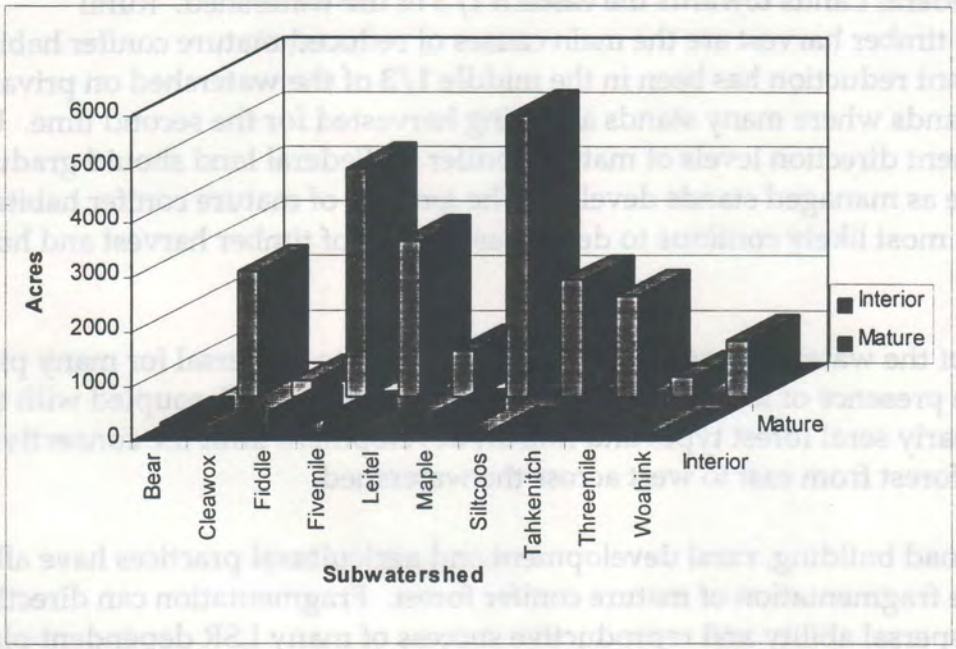
Timber harvest, road building, rural development and agricultural practices have all contributed to the fragmentation of mature conifer forest. Fragmentation can directly effect both the dispersal ability and reproductive success of many LSR dependent plants and animals. As patches of habitat become smaller and/or spaced farther apart plants and animals must move farther to colonize other patches. This can be physically limiting for many animals such as herptiles, small mammals, mollusks, and certain plants and can also expose them to predators or adverse environmental conditions leading to mortality. Fragmentation of mature conifer habitat can affect the reproductive success of some species such as the marbled murrelet and northern spotted owl by increasing their exposure to predators.

Interior Habitat - Of the approximate 20,910 acres of mature conifer habitat within the watershed only 1,442 acres (< 7 %) remains functioning as interior habitat. Fiddle, Maple, Fivemile and Bear Creek subwatersheds contain most of the remaining interior habitat. Of the 1,442 acres of interior habitat an estimated 1,339 acres are on Federal land.

Approximately 26% of the watershed is in mature forest types. 55% of the mature forest is on USFS lands. Map (?) and table (?) display distribution and quantity of the remaining mature and interior habitat within the watershed. The determination of interior forest habitat assumed that adjacent to all openings and hardwood dominated stands, a distance

of 500 feet was affected by a warmer and drier microclimate. This analysis represents a worse case scenario since different levels of edge severity were not taken into account. Currently, when all ownerships are considered only about 2% of the watershed is functioning as interior forest habitat. When only federal lands are considered approximately 4% is functioning as interior forest habitat. The largest remaining blocks of mature and interior forest are found in the eastern portion of upper Fiddle, Fivemile and Bear Creek subwatersheds (Figure 5.1).

Figure 5.1. Acres of interior habitat and mature forest by subwatershed.



The majority of larger blocks of mature forest habitat and interior forest habitat are on federal lands. While 33% of mature forest habitat is found on private industrial lands the majority exists as very small, highly fragmented patches.

Current ownership and seral patterns within the watershed will continue to influence the long term function of late successional conditions on federal lands. Patch size and connectivity of mature forest on federal lands will likely increase over time as plantations mature. The converse will be expected on private lands as remaining mature forest is harvested (Table 5.1).

Table 5.1. Mature and interior forest habitat.

Seral Class	USFS/ BLM	Private Industrial	State/ County	Other Private	Total
Acres of Mature Forest Habitat	12,049 (58%)	6,647 (32%)	286 (1%)	1,929 (9%)	20,912
Percent of Ownership that is Mature	34%	21%	33%	20%	
Acres of Interior Forest Habitat	1,340	102	0	0	1,442
Percent of Mature that is Interior	11%	1.5%	0	0	12.5
Percent of Ownership that is Interior	4%	0	0	0	

Bald Eagles -

Current Condition - One nesting pair of bald eagles is located within the watershed boundary on private land near Lane Creek, southeast of Siltcoos Lake. Two nest sites have been associated with this pair. The first nest site was established in 1972 and an additional site was established in 1996 after the original nest was downed. In the past 25 years this pair has produced 15 young.
Productivity has decreased over the past 10 or so years. The cause for this decrease is unknown. A 76 acre bald eagle management area has been set aside on federal land adjacent to the nest site.

One other eagle territory exists on Joyce creek just outside of the watershed boundary to the southeast. This pair is known to forage on Tahkenitch Lake particularly its Fivemile and Leitel Creek tributaries (personal communication, Isaacs). Established in 1978 this territory had been unoccupied for 8 years prior to fledging 2 young in 1997.

Two to four eagles have been observed each year on winter eagle counts for Woahink and Siltcoos lakes since 1993. This seems to indicate that the lakes support wintering resident eagles and their offspring. The lakes do not seem to be used as a wintering area for non-resident eagles. Large flocks of waterfowl, especially coots on Siltcoos lake, as well as resident fish, provide an easy source of prey for wintering bald eagles.

Continued harvest of the remaining mature conifer stands and short timber rotations will further limit eagle nesting opportunities on private lands in the future. In the future nesting habitat may be provided on the two large tracts of federal lands on the western shores of Siltcoos and Tahkenitch lakes. There may be existing unknown nests within the watershed. A helicopter survey is recommended to search out undocumented nest sites.

No bald eagle nest sites are known to occur on the Oregon Dunes NRA. However, potential nesting habitat exists in the recent Tahkenitch land acquisition and in older forests in nonmotorized areas near lakes (e.g. Threemile and Elbow) and the Umpqua River. Foraging habitat is available at estuaries, lakes and deflation plain wetlands. Bald eagles are often seen at Siltcoos estuary.

Spotted Owls -
Historic Condition - Prior to European settlement and before intensive commercial logging forest within the watershed were likely in larger contiguous blocks thus providing more stable habitat for spotted owls.

Current Condition - There are 5 spotted owl home ranges (4 pairs, 1 territorial single) on federal lands within the watershed. The average amount of habitat within the owl pair home ranges is 2,192 acres with a range from 1,850 to 2,489 acres. Owl activity centers that are below 40% mature conifer habitat (1,906 acres) within the median home range radius are below the threshold used by the U.S. Fish and Wildlife Service (USFWS) for establishing "take". One of the spotted owl home ranges is below this level. Two of the pairs have produced young in the last 5 years. Since formal nest surveys began in 1990 none of the pairs has ever consistently produced young (Table 5.2).

The northeastern portion of the watershed is within Critical Habitat Unit 50.

LSR lands are part of the CORE zone as described in the LSR Assessment for RO267, RO268, June 1997. The function of the LSR is to provide the genetic source for populations of late-successional species (especially those with large home ranges) within and to populations outside of the CORE surrounding this area. Connectivity for dispersal remains fair to good to the North and East.

Mature conifer stands on Federal lands will continue to provide the best spotted owl nesting habitat. Opportunities for owl nesting on private lands will most likely continue to diminish as mature conifer blocks are harvested.

Table 5.2. Spotted owl habitat and history.

Master Site # (SNF #)	Own	Location Name	Ac Habitat in 1.5mi Circle	Site History
3137 (76)	SNF	Bear Creek	1,850	Resident single 90 - Male 91 - Male 94 - Male 95 - Barred owl
0797 (117)	SNF	Bell Creek	2,073	Reproductive Pair 93 - Male only 94 - Male only 95 - Pair, Non nesting 96 - Pair, young 97 - Pair, no young fledged
3356 (96)	SNF	Mount Popo	2,242	Pair Site 91 - Male only 92 - Pair, nest unknown 93 - Male only 94 - Male? nest unknown 96 - Male only 97 - Pair, No young fledged
0788 (25)	SNF	North Prong	2,308	Reproductive Pair 90 - Pair, nest unknown 92 - Pair, non nesting 93 - Pair, young 94 - Pair, non nesting 95 - Pair,

				unknown nest 96 - Pair, young 97 - Pair, no young
3127 (54)	SNF	Upper Bear	2,489	Pair site 90 - Pair, young 94 - Pair, nest unknown 95 - Pair, non nesting

Marbled Murrelets - The marbled murrelet is a small seabird that nests in the canopies of large mature conifer or old growth trees. Nest sites are usually found on large broad limbs or platforms created by tree deformities or where two branches come together. Nests are typically placed where there is some overhead cover to protect it from predators and adverse weather. Interior habitat (mature conifer > 500 feet from and edge) may provide the most ideal nesting habitat by further protecting nests from predators and weather.

There are all or portions of 17 occupied murrelet sites within the watershed. All of these sites are located on Siuslaw National Forest lands. Most all of these surveys were conducted in association with 318 sales in the early 1990's, primarily near Bell Creek and Alder Creek.

Approximately 11,109 acres of mature conifer habitat (>18" dbh) remains on federal land. Only a portion of these acres are likely to provide structural habitat suitable for nesting. Patch size and lack of interior habitat may also degrade the suitability of some areas for nesting. The largest blocks of interior mature conifer are in the upper portions of Fivemile, Upper fiddle, Bear and Maple subwatersheds. The quality of murrelet habitat on federal lands is expected to slowly improve over time as managed stands mature and blend with existing interior forest blocks however, it may be many decades before this will occur.

Although an estimated 7,791 acres of mature conifer habitat remain on private land the majority is highly fragmented as a result of timber harvest and urban development, providing little or no interior habitat. Acres of mature conifer habitat available on private lands is expected to continue to decline as timber harvest and urban development increase.

The three mile lake area within the Dunes NRA may contain some large spruce trees that may develop into suitable marbled murrelet nesting habitat at some point in the future. The large blocks of conifer within the Tahkenitch parcel and Siltcoos trail area may also provide suitable murrelet nesting habitat in the future.

Sensitive Species -

White-footed vole - One record of a female collected on Three mile creek west of Highway 101 near Tahkenitch lake. Suspected to occur throughout the watershed in riparian alder habitats.

Northwestern pond turtle - Have been observed in Waxmyrtle wetland near the Siltcoos river outlet in 1993 and another was sighted by bass fisherman in Siltcoos Lake in 1995. The northwestern pond turtle is relatively numerous in the Tenmile lakes area which is located south of the watershed analysis area approximately 8 miles. With the sightings in Siltcoos, turtle presence in the Tahkenitch basin can probably be assumed. Surveys to determine the extent of their range within the watershed should be implemented if funding becomes available (personal communication, Van Dyke).

Other wildlife species of interest -

Elk - The eastern ½ of the Coastal Lakes Watershed is classified as having High Elk Capability as described in Appendix D.13 of the Federal Lands Assessment. Even though capability is high elk do not occupy large portions of the watershed and overall elk densities are low especially when compared to other areas within the Siuslaw management unit. The exact reason for the low elk density is unknown however high road densities could be a contributing factor. Studies have shown that as road densities increase beyond 1.0-1.5 mi/mi^2 effectiveness of habitat for elk declines. High road densities increase elk disturbance as well as increase the vulnerability of elk to hunting and poaching. Road densities within the watershed range from 1.4 to 4.5 mi/mi^2 with an average of just over 3 mi/mi^2 These road density figures are likely underestimated due to the age of the maps used to calculate the mileage. Due to the change in management emphasis and declining budgets several miles of road under federal ownership will be proposed to be closed within this watershed. Road management strategies on private lands are unknown.

Black Bear - Black bear exist at high densities >0.9/mi^2 throughout the watershed. Abundant forage is available due to the large number of fruit bearing shrubs present. In particular, the non-motorized deflation plain areas of the ODNRA are especially good black bear habitat due to their seclusion and abundant forage.

Great Blue Heron - Two great blue heron rookeries have been documented within the watershed. One site is located along the north shore of Tahkenitch lake north of the boat landing and the other is located southeast of the Fiddle Creek arm of Siltcoos lake in T19S, R11 W Sec. 7 NE ¼. It is unknown if either of these sites is currently active or if active how many nests they support.

Marten - There have been numerous sightings of marten within the watershed primarily around Siltcoos and Tahkenitch lakes. Most recently 5 marten were trapped in the booth road area by a local trapper during the winter of 1997/98. Marten prefer dense conifer forest with high levels of snags and coarse woody debris. They are also known to inhabit areas of lodgepole (shorepine)/rhododendron and lodgepole pine/salal and Sitka spruce/salal with occasional patches of mature conifer. Habitat for marten may improve on federal lands as forests mature and develop more late seral conditions.

Pacific Fisher - Fisher have most likely been extirpated from the Coast Range. There is one documented sighting from April 1973 near Fivemile creek. This is also the last documented sighting within the Oregon Coast Range. Loss of habitat, low reproductive rates and a low tolerance for human activity make it unlikely that fisher will recolonize the Coast Range.

Band-tailed pigeons - Band-tailed pigeon populations have declined for unknown reasons during the past several decades. Calcium springs or seeps are known to be critical to the band-tailed life cycle. Two mineral sites are known within the watershed and one other is suspected. Documented mineral sites include one near the mouth of Siltcoos river and the other on lower Tahkenitch Creek. One other area is suspected on private land on the north side of Fiddle Creek below the bridge. There may be other unknown mineral sites within the watershed.

* Herptiles - The introduction of non-native fish species may have had a detrimental effect on populations of various herptile species i.e. frogs, turtles and salamanders. No studies of herptiles have been done within the watershed.

Dunes

The Oregon Dunes is located in a transition zone between ocean and coastal forest. Wildlife present on the Oregon Dunes NRA is a reflection of the mixing of these two ecozones. The area contains many wildlife species from the two ecozones plus certain species found only in the transition zone. The number of species and densities of some species is greater in this transition zone than either of the adjacent life zones (USDA 1972).

The Oregon Dunes NRA and nearby offshore waters support 316 species of wildlife; 247 birds, 54 mammals, 12 amphibians and 3 reptiles (USFS 1972). Approximately 38% of the birds are year-round residents, 28% are winter residents, 28% are summer residents or visitors and 14% use the area on migration stopovers. The fifty species of terrestrial mammals are mostly year-round residents. All herptile species are year-round residents.

Birds are the most numerous and conspicuous wildlife species found on the ODNRA. Both number and abundance of bird species vary with the seasons. The coast is major migration route for many species of shorebirds, waterfowl and oceanic birds. A great number of these species over winter in ocean estuaries, marshes, lakes and rivers of the Oregon Dunes NRA.

At least fifty species of bird and mammals found on the Oregon Dunes NRA are classified as "game" or "furbearers". Hunting or trapping of these species is regulated by the Oregon Department of Fish and Wildlife.

Very little is known about the invertebrate fauna of the dunal system. Studies in other dune habitats indicate that sand dunes support many kinds of invertebrates with complex interactions.

Further descriptions of wildlife species found on the Oregon Dunes NRA are located in The Oregon Dunes NRA Resource Inventory (USDA 1972), The Ecology of Pacific Northwest Coastal Sand Dunes: A Community Profile (Weidemann 1984) and The Final Environmental Impact Statement - Dunes Management Plan (USDA 1994). Discussions of a few notable species or species groups and associations with various landforms/habitats follows.

Beach: The beach provides important foraging habitat for a variety of shore and ocean-going birds including; California brown pelicans (federally endangered), sanderlings and various gulls, terns and sandpipers. Western snowy plovers (federally threatened) rely on sandy areas above the high tide line for nesting habitat.

Sand Dunes: Few species use the foredune and none are directly dependent upon it. Hummocks are used extensively as travel corridors between open dunes and deflation plains. They provide shelter and some foraging opportunities as well. Large open dunes do not support vegetation and except for invertebrates there is no wildlife use other than those occasionally passing through.

Wetlands: Wildlife associated with the different wetland plant communities vary depending on presence of water and plant structure and diversity. Grass, rush and sedge communities provide unique habitat for 92 wildlife species. They are particularly valuable to waterfowl, shorebirds and avian predators. Low shrub areas have the most diverse vegetative composition of any of the communities at the Oregon Dunes NRA and provide valuable wildlife habitat especially for waterfowl and songbirds. Tall shrub habitats can become impenetrable thicket. In their earlier more open conditions they provide important habitat for deer, black bear and songbirds.

Salt and fresh water marshes, as well as swamps and bogs may be a minor component of the landscape, however, their importance to wildlife is high. These wetland types are relatively uncommon and are limited in general along the Pacific Coast.

Aquatic/Riparian: Aquatic and Riparian habitats provide a source of water for wildlife, as well as food and cover. Lakes, rivers, creeks and estuaries support not only water-dependent animal species, but provide escape cover for waterfowl. The numbers and kinds of wildlife present depends on location, size and water depth.

Many amphibians favor the cool, moist conditions found in riparian areas. Birds and small mammals benefit from the diverse and highly productive vegetation, the edge effect, high numbers of insects and the presence of water. Large mammals and birds use riparian areas as travel and migratory corridors.

Aquatic/riparian habitats are important for several special status species on the ODNRA including Aleutian Canada goose, Northern bald eagle, Northwestern pond turtle and red-legged frogs. A number of sensitive plant species are dependent on aquatic/riparian habitats including humped bladderwort, lesser bladderwort and water-meal.

Riparian habitats are somewhat limited on the Oregon Dunes NRA because many water bodies are bordered by open sand dunes. However, flood plains, deflation plains and forest habitats adjacent to aquatic systems typically contain riparian habitat. Important riparian stretches include the northern shore of the Umpqua River, upper stretches of Tahkenitch Creek, portions of the Siltcoos River and the banks of all forested lakes (USDA 1994).

Estuaries: Estuaries and tidal flats are frequented by 166 species; 70 fish, 88 birds and 8 mammals. Estuaries are important habitats for shore and ocean birds, waterfowl and wading birds especially during migration periods.

Shore Pine Forest: This plant community has a relatively open canopy and dense shrub layer that provides ideal breeding and foraging habitat for songbirds. The shore pine forest also provides cover for a variety of mammals and amphibians.

Transition Forest: Transition forests support the greatest number of wildlife species on the Oregon Dunes NRA. This diversity is a result of the multi-layered forest structure which includes open canopy, well-developed shrub layer and abundant snags and trees of various ages. When found in riparian zones, this community provides foraging, breeding and traveling corridors for many birds, mammals and amphibians.

Plantations: In general, older plantations are structurally more diverse and thus support more wildlife than younger stands. However, many plantations have little open canopy with no understory and few associated wildlife species.

Species of Interest:

Daphina: A unique species of black daphina (*Daphina* sp.) was recently discovered in ephemeral pools in open sand. Daphina are small freshwater crustaceans commonly called water fleas. Similar black daphina are known to occur only in the Arctic. Their discovery on the ODNRA is the first in a temperate climate.

Band-tailed Pigeons: Pacific Coast band-tailed pigeons, once an abundant neotropical migrant, primarily utilize forested habitat along the coast from Baja to British Columbia (Jarvis 1995). Band-tails have declined markedly and are now at their lowest levels since monitoring began. The Siltcoos River is anecdotally known as a historic band- tail pigeon site.

Marten: No intensive field studies have been conducted on the status of coastal marten. The Oregon coast range offers a markedly different array of habitat types at lower elevations than the Cascade Range, so extrapolations from previous studies are not supportable. Coast Range forests are also intensely managed and potential impacts of these practices need to be understood.

Several marten have been sighted or found dead on roads in recent years between Siltcoos River and Tahkenitch Creek. Challenge cost share studies have been proposed but thus far none have been funded.

Survey and Manage Wildlife Species -

Survey and manage species that occur in the Coast Range and could be present in the Coastal Lakes watershed are found in the Federal Lands Assessment, (Appendix I.5). Red tree vole habitat has been analyzed following the current protocol and found to be above (40%) what is needed to require survey prior to alteration of suitable habitat (conifer stands > 10" DBH). Acres included in the analysis were 3,501 acres of transition forest (predominately Sitka spruce > 10"DBH) on the Oregon Dunes and 15,944 acres of conifer over 10" (predominately Douglas-fir) on Federal lands in the eastern part of the watershed (Map 20). Red-legged frogs are found commonly throughout the watershed in deflation plain and other wetlands and moist forests. Formal surveys on the Oregon Dunes NRA have documented breeding in deflation plain wetlands. High numbers and large individuals have been noted in the Tahkenitch and Threemile trail areas.

Special Habitats - Special habitats found within the analysis area include: lakes, ponds, marshes, dunes, estuary and meadows and some human structures including buildings, mines, and certain types of bridges. The three large Coastal lakes and their associated wetlands are truly unique to the watershed. The Oregon Dunes NRA in itself is host to many unique plant and animal habitats not found elsewhere in the watershed. As part of a cooperative study of bat use of bridges two bridges within the watershed were identified

as being important to bats. One abandoned coal mine exists. The main shaft has collapsed but a smaller side shaft remains intact. It is unknown if this shaft provides suitable habitat for bats.

Botanical Resources -

Survey and Manage Plant Species

Only one known site of a survey and manage plant species exists within the watershed. *Albatrellus caeruleoporus*, a survey and manage fungi exists within Honeyman State Park on the east side of highway 101. This species is known to occur from the Washington Cascades and the Oregon Coast Ranges. It also occurs in the northeastern United States. *Albatrellus caeruleoporus* is closely associated with old growth forest, ranging from near sea level to montane. This species is known from only 5 sites within the range of the northern spotted owl and is a presumed ectomycorrhiza former. Mycorrhiza is the symbiotic, mutually beneficial association between a fungus and plant root. Threats to this species include removal of the hosts, *Picea* spp. and *Tsuga* spp., by logging, fire, road construction or other management activities.

Lichens

As part of the Siuslaw National Forests Air Quality Monitoring surveys 12 sites within the watershed were surveyed for epiphytic macrolichens between 1994 and 1997. No other surveys for other groups of non-vascular plants are known to have been conducted. Of the 105 species documented 16 have survey and manage status (List Appendix XX). The Oregon Dunes NRA provides unique habitats and pockets of exceptionally high diversity of rare lichen species. Several rare lichen species such as *Usnea hesperina* and three species of *Pseudocyphellaria* have been documented there.

Special Status Species

Ten species of animals classified as Threatened and Endangered (T&E) by the U.S. Fish and Wildlife Service or as sensitive by the Regional Forester have been documented on the Oregon Dunes NRA. Suitable habitat for an additional five T&E or sensitive species also exists, although presence of these species has not been documented (Figure ??).

An endangered plant species, the western lily, is known to occur near the southern half of the Oregon Dunes NRA. Five sensitive plant species; pink sand verbena salt-marsh bird's beak, water pennywort, bog clubmoss and adder's tongue are found on the Oregon Dunes NRA. An additional twelve??? plant species are suspected to occur because suitable habitats are present.

Appendix I provides a list and brief description on special status species of the Oregon Dunes NRA. Several species warrant further discussion due to their abundance or dependence on dune habitats. Brief discussion of natural histories, distribution and management considerations of these species follows.

Western Snowy Plover - The Pacific Coast population of the Western snowy plover is considered a distinct population and was federally listed as threatened in March 1993. Western snowy plovers nest, feed and winter on bare sandy areas along beaches or estuaries of the Pacific coast and bays. Nest sites are generally located near driftwood or other debris in open sand or sparsely vegetated dune backed beaches, sand spits and estuaries. Breeding occurs between March and September. The coastal population includes both resident and migratory individuals. Migratory birds may move to wintering sites north or south of their nesting area, but most tend to move to sites south of Bodega Bay, California (Page et al. 1986).

Historic records indicate that nesting western plovers were once more widely distributed. Nineteen nesting areas were reported in Oregon in 1974 (Oregon Coastal Conservation and Development Commission, 1974); only seven of those sites were used in 1997 (Castelein et al. 1997). Although the plover's decline is primarily linked to habitat loss, predation and human disturbance are also important factors (Woolington 1985).

Western snowy plovers have been documented during both breeding and wintering seasons on the Oregon Dunes NRA. Current breeding sites in the analysis area include the estuaries of and beaches near Siltcoos River and Tahkenitch Creek. Wintering plovers are noted near the same locations, though most often near the old breach site north of Siltcoos River. Currently, breeding activity at Siltcoos is consistent, but low. Tahkenitch has become the most productive nesting site on the Siuslaw NF after not being used for a long period prior to 1994.

The Oregon Dunes NRA Management Plan designated important plover habitats in a special management area. The desired goal for these management area is to maintain them as breeding habitat to help recovery of this species. Accompanying standards and guidelines provide direction toward this goal. Most of this direction is aimed at recreation management and habitat restoration. Since plan implementation, a habitat creation project using dredged material and ongoing beachgrass management at nesting sites have been undertaken. Recreation management has also intensified.

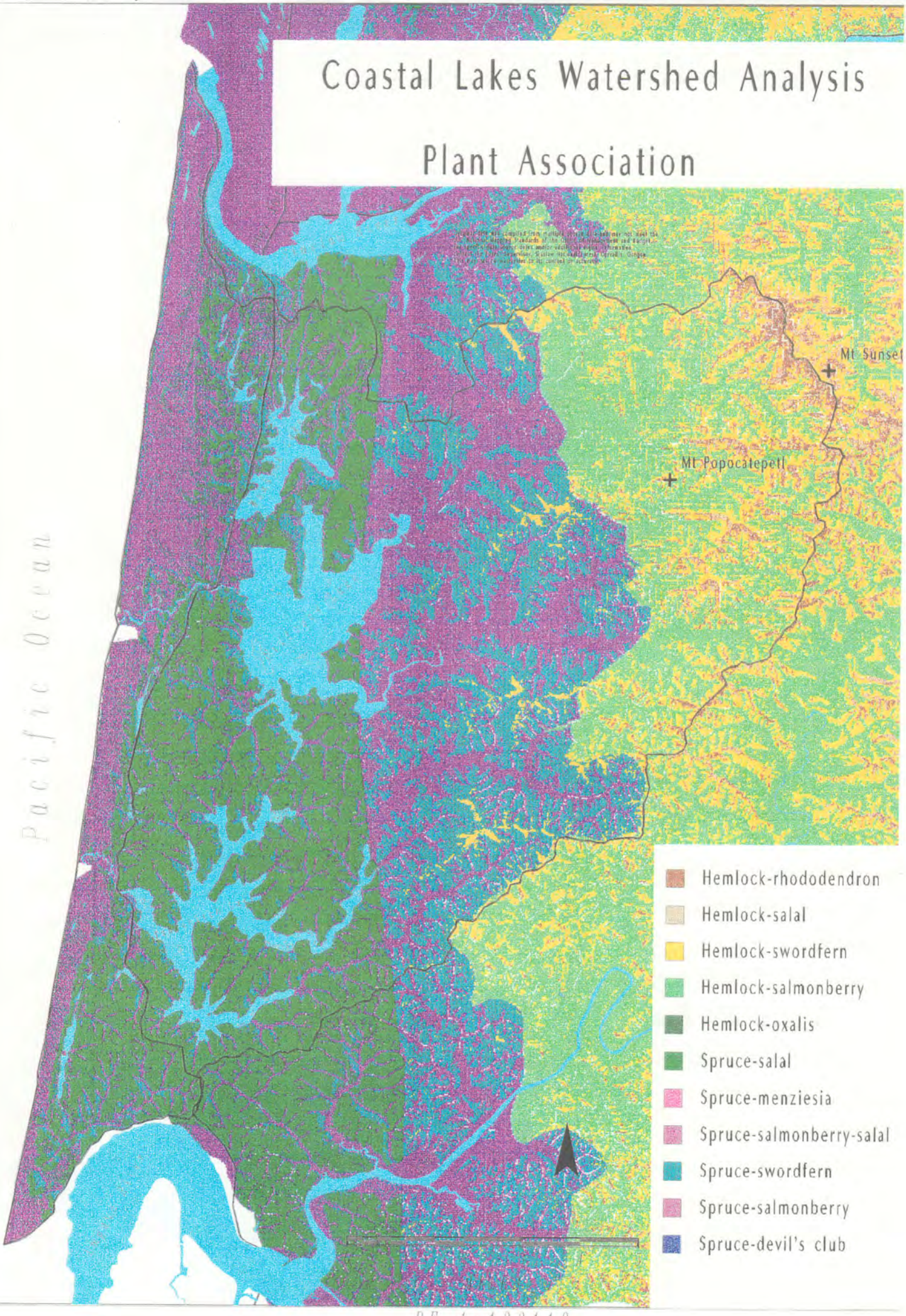
Introduced Species

As introduced plants have altered the ecosystem, introduced wildlife species have also had negative affects on native species. Most of introduced fish and wildlife species found in this watershed have spread on a regional or congenital scale (e.g. opossum, nutria). Therefore, their effects are broad and may be impossible to change. Fortunately, bullfrogs

populations have remained relatively low. Bullfrogs could drastically affect native amphibian species. Perhaps, cooler coastal temperatures may keep bullfrog populations from exploding in this area.

Coastal Lakes Watershed Analysis

Plant Association

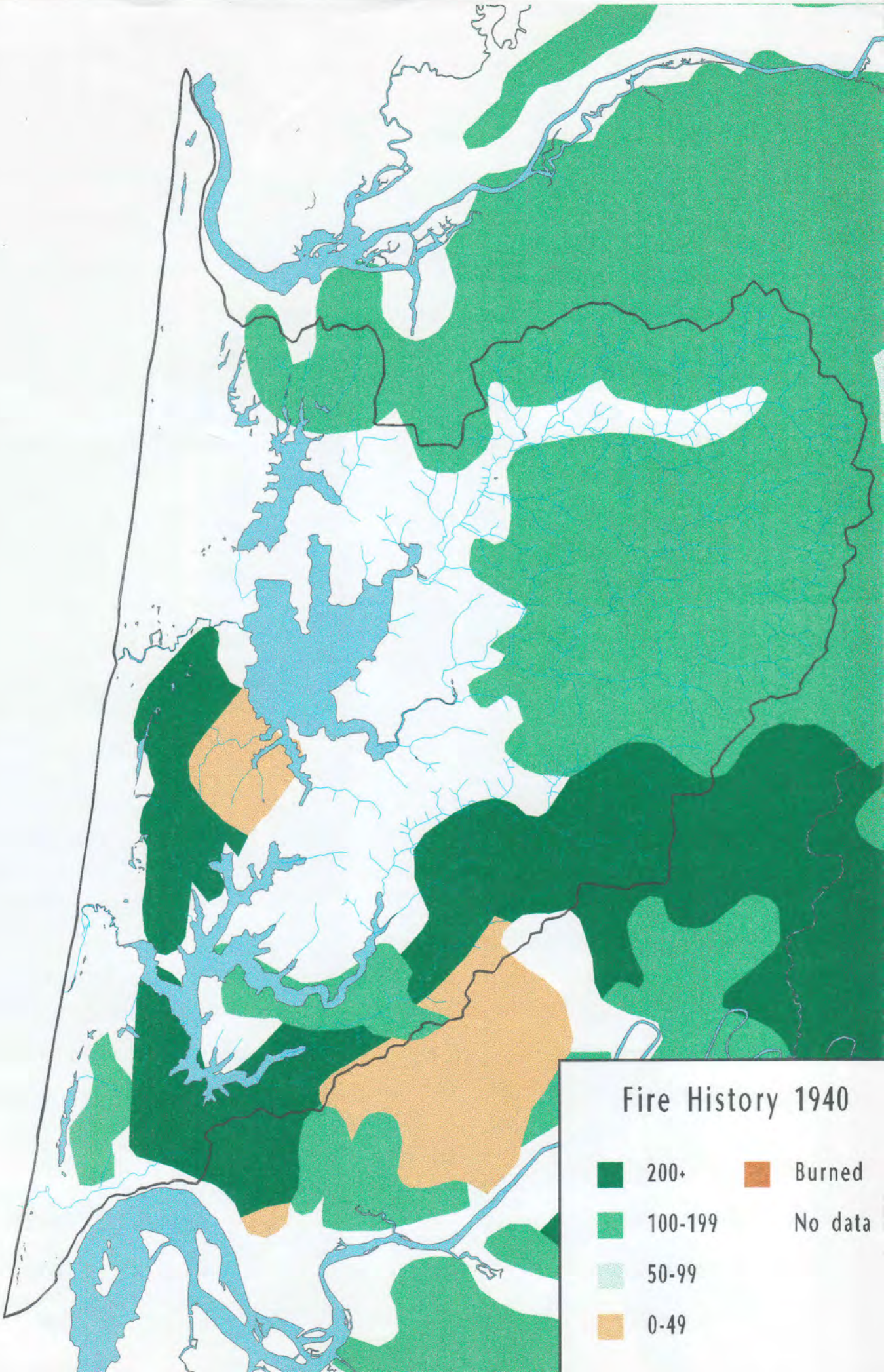


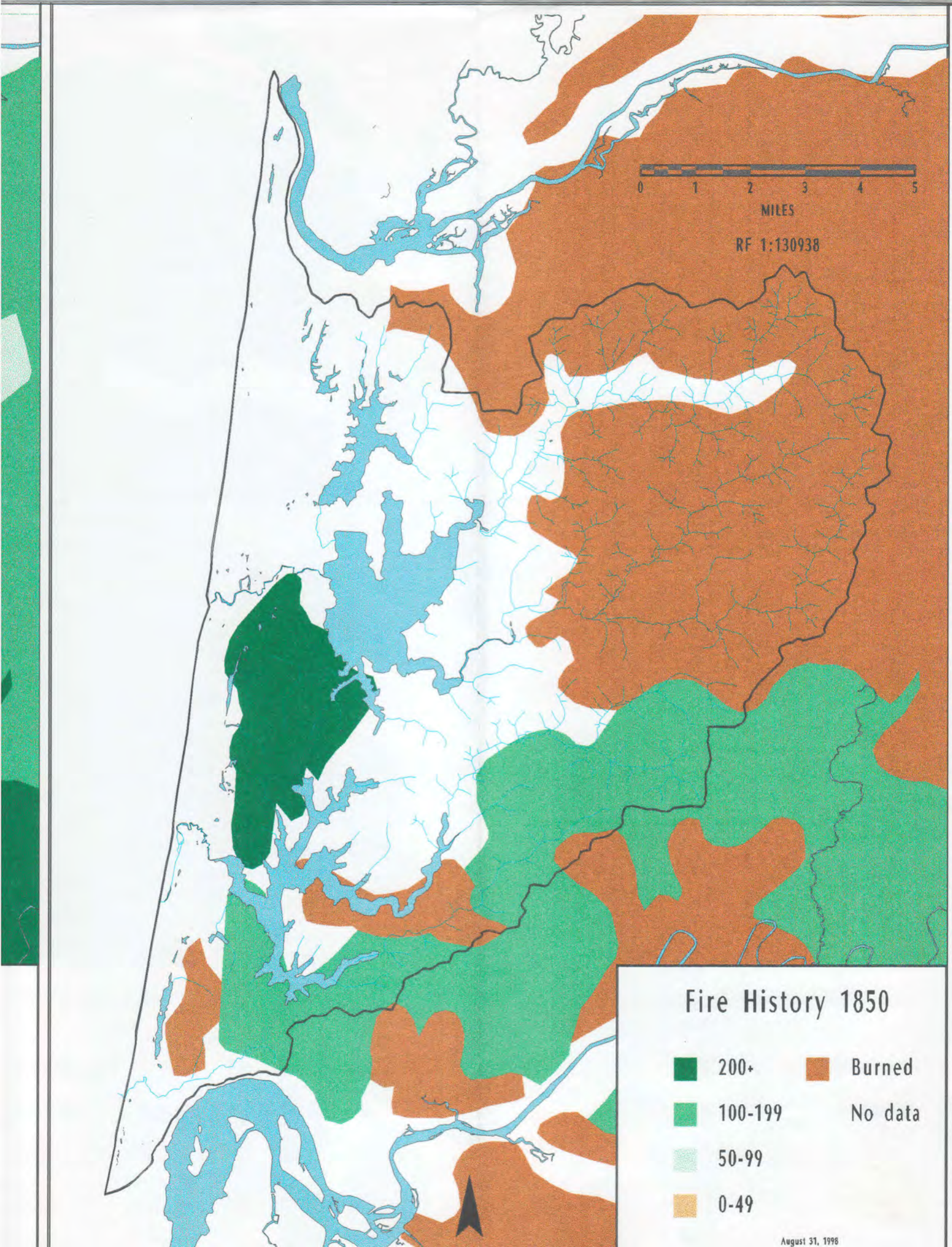
Lakes Watershed

Dunes Vegetation

- Class 1,2,3 Streams
- Grass
- Plantations
- Wetland Shrub
- Shrub
- Pine Forest
- Transition Forest
- Siuslaw NF
- Rivers, Lakes and Streams

August 31, 1998


Fire History 1940
200+
100-199
50-99
0-49
Burned
No data


0 1 2 3 4 5
MILES
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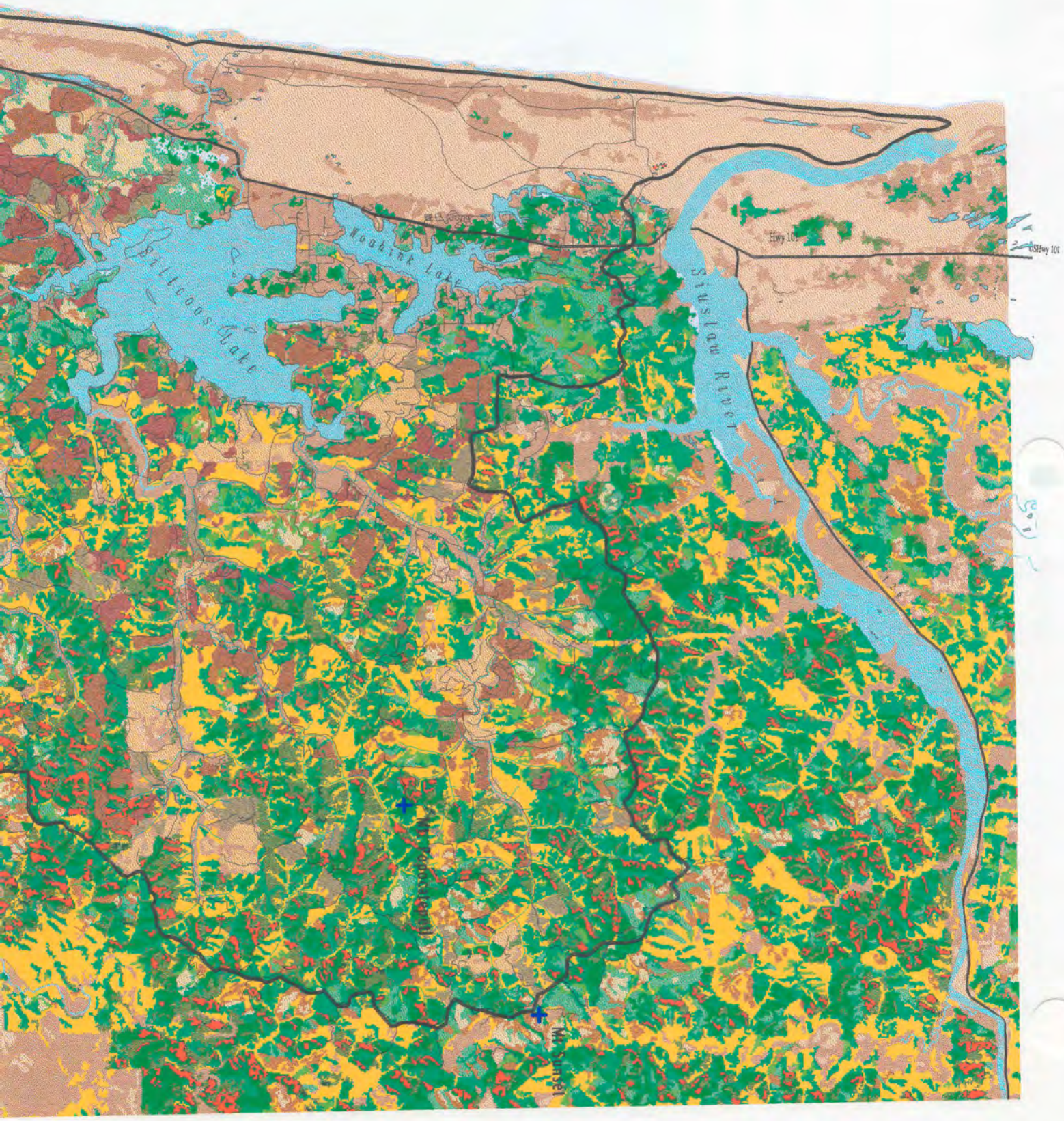
Fire History 1850
200+
100-199
50-99
0-49
Burned
No data
August 31, 1998

fic Ocean



Coastal Lakes Watershed Analysis
Current Seral Stages

0 1 2 3 4

MILES

RF 1:105552

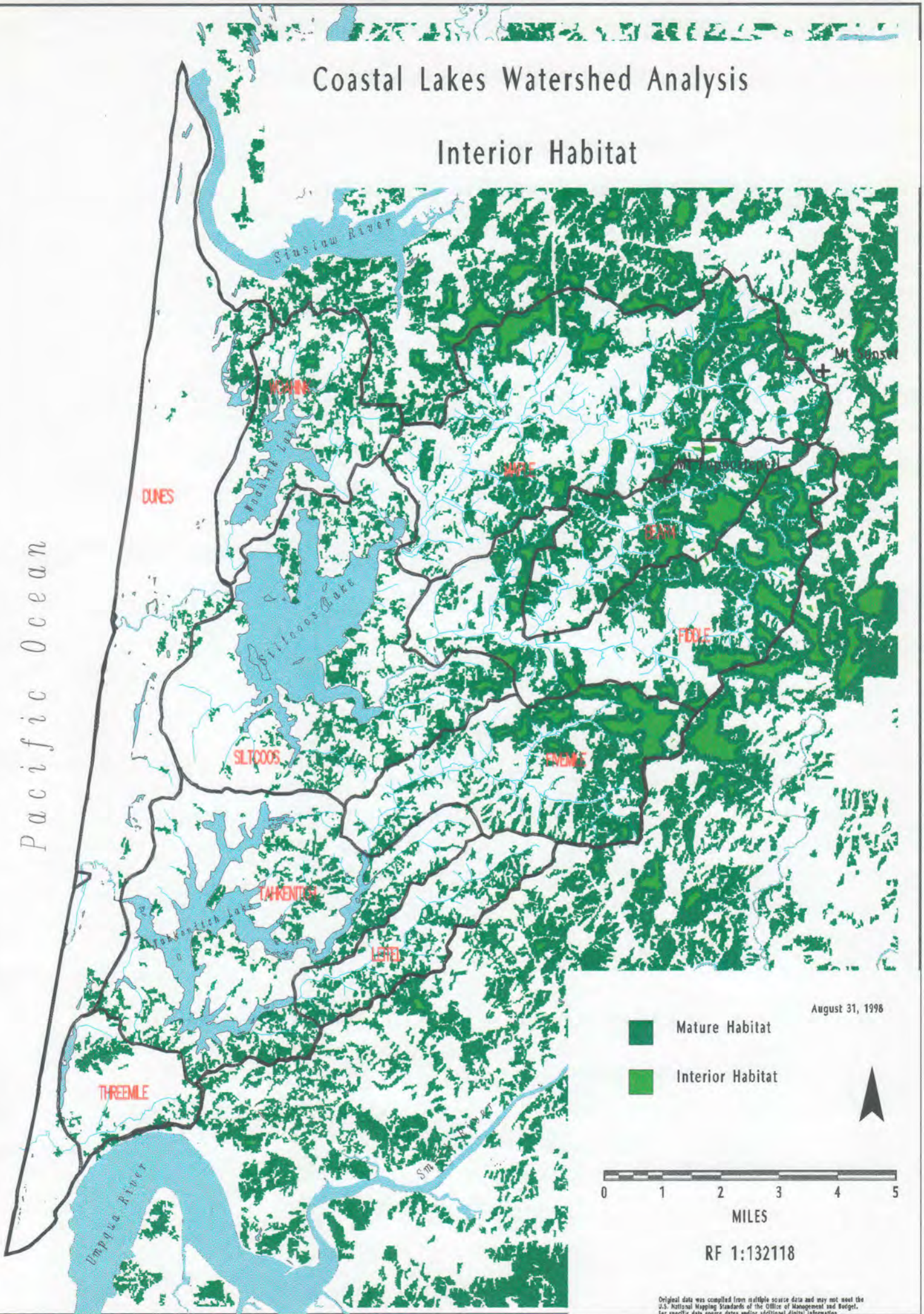
Original data was compiled from multiple source data and may not meet the U.S. National Mapping Standards of the Office of Management and Budget. For specific data source dates and/or additional digital information contact the Forest Supervisor, Siuslaw National Forest, Corvallis, Oregon. This map has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

- Open
- Semi-open
- Broadleaf
- Small mixed
- Small conifer
- Medium mixed
- Medium conifer
- Large mixed
- Large conifer
- Very large mixed
- Very large conifer
- Old Growth
- Plantations

August 31, 1998

Coastal Lakes Watershed Analysis

Interior Habitat



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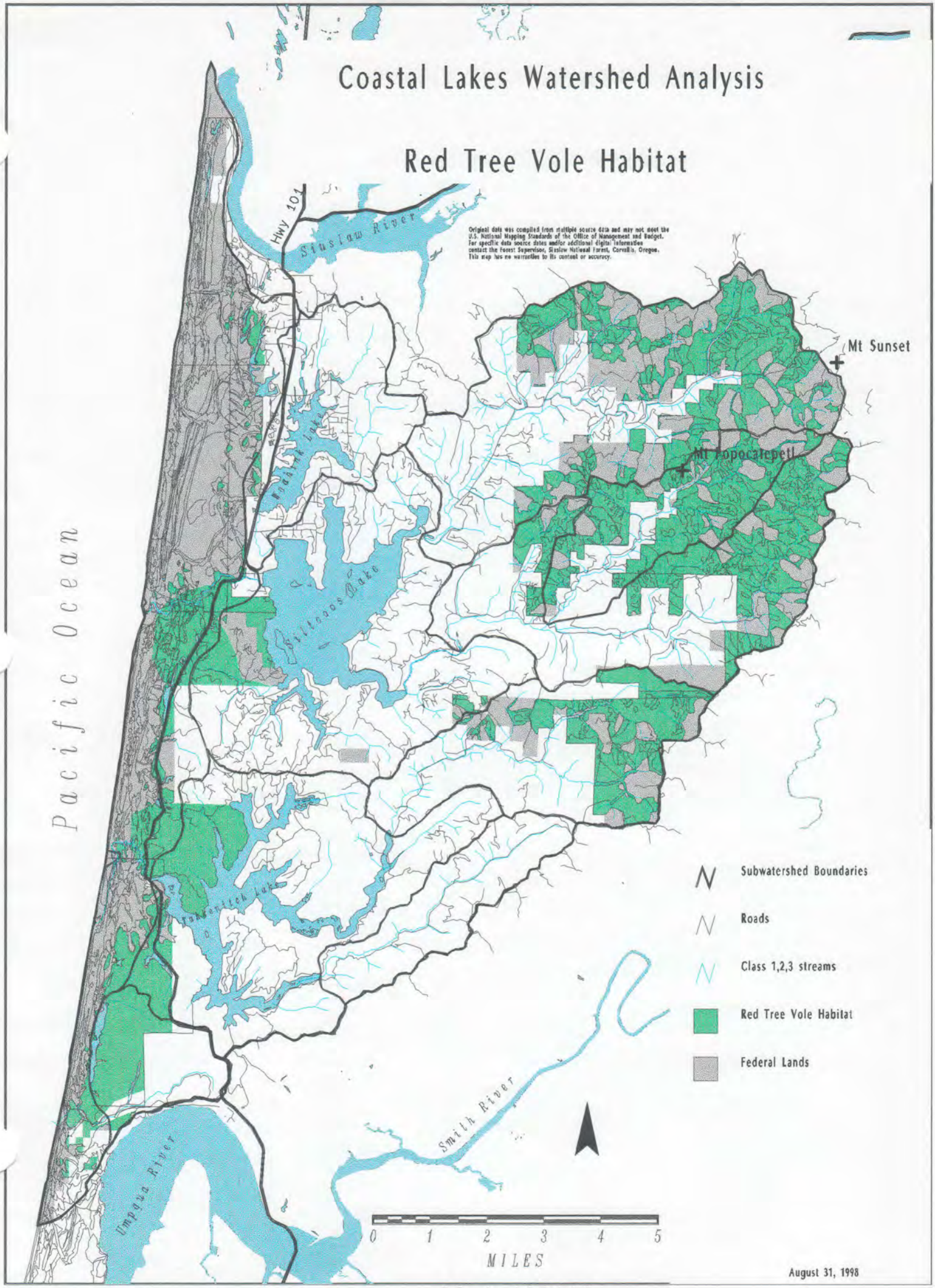
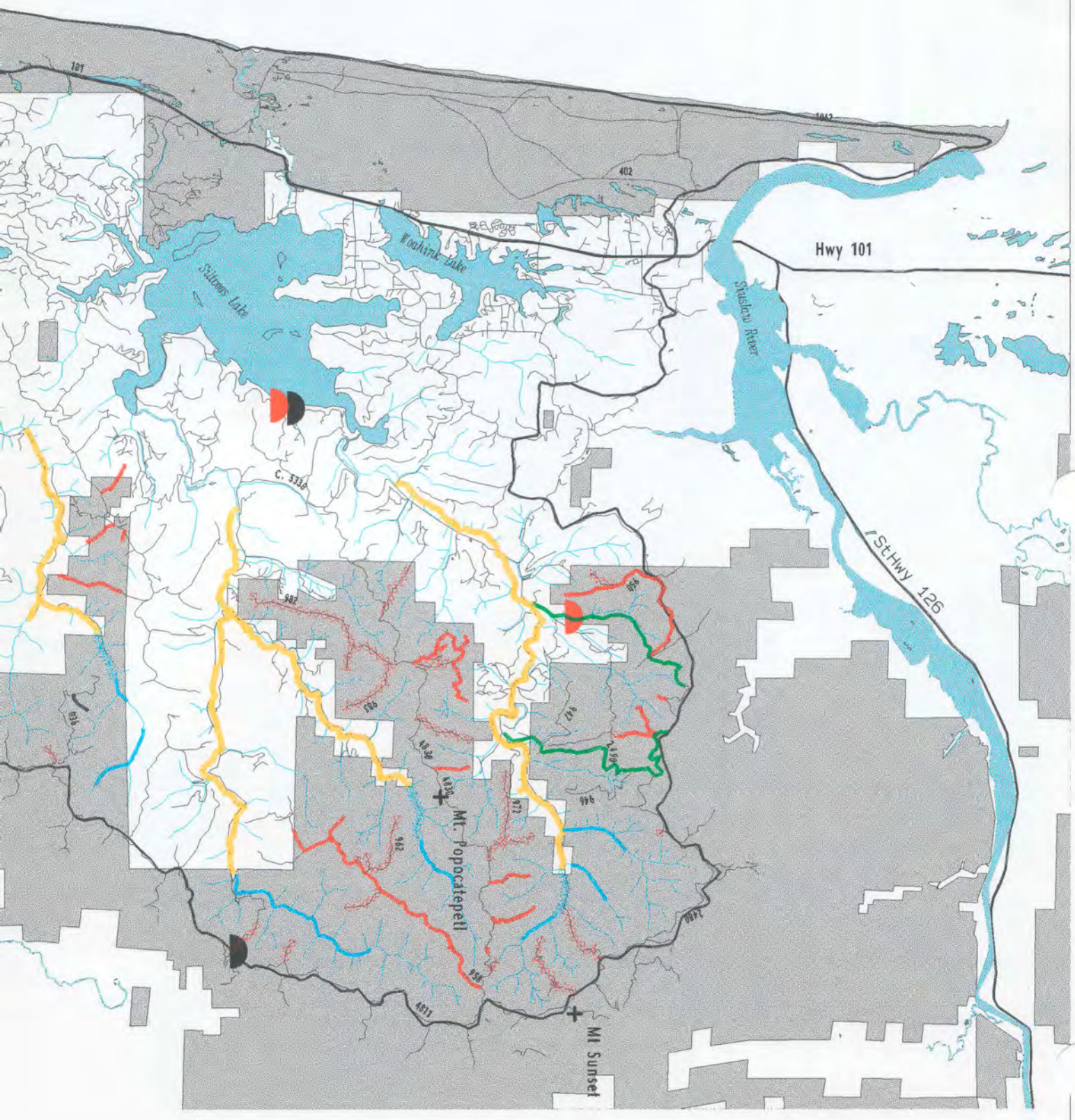

Coastal Lakes Watershed Analysis
Red Tree Vole Habitat
Original data was compiled from multiple source data and may not meet the U.S. National Mapping Standards of the Office of Management and Budget. For specific data source dates and/or additional digital information contact the Forest Supervisor, Siuslaw National Forest, Corvallis, Oregon. This map has no warranties to its content or accuracy.
Hwy 101
Siuslaw River
Mt Sunset
Mt Popocatepetl
Pacific Ocean
Siltcoos Lake
Tahkenitch Lake
Umpqua River
Smith River
Subwatershed Boundaries
Roads
Class 1,2,3 streams
Red Tree Vole Habitat
Federal Lands
0 1 2 3 4 5
MILES
August 31, 1998

ic Ocean


101
402
Hwy 101
Siuslaw River
Siltcoos Lake
Woahink Lake
C. 3330
St Hwy 126
Mt. Popocatepetl
Mt Sunset

Coastal Lakes Watershed Analysis Restoration Opportunities

Riparian Restoration and ccs Fish Projects w/Private

Fish Habitat Inprovements

Riparian Planting and Fish Habitat Inprovements

ATM Roads Needing Maintenance

Waterbar

Waterbar and Close

Close

Siuslaw NF

Culvert Problem

Fish Passage Problem

0 1 2 3 4

MILES

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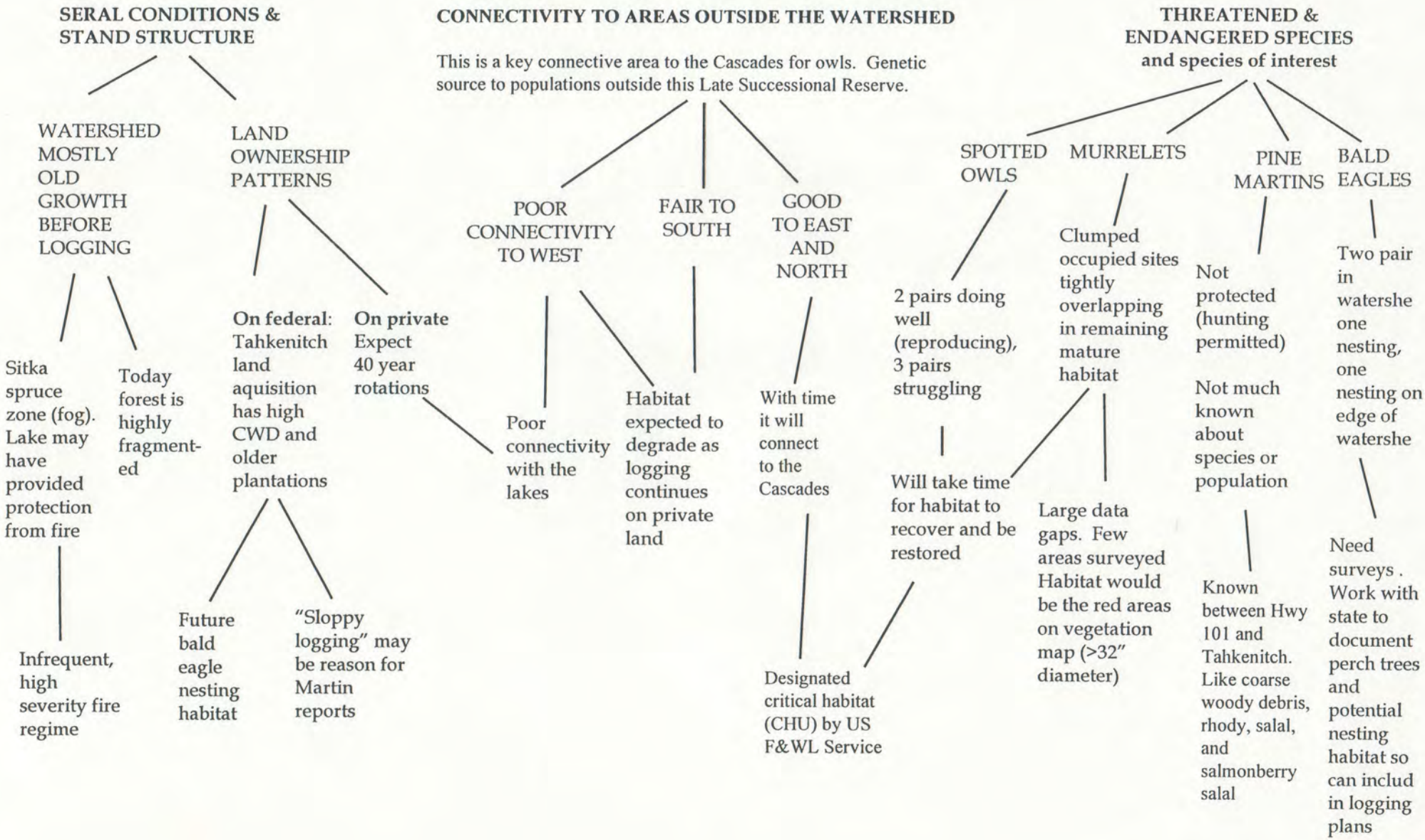
Original data was compiled from multiple source data and may not meet the U.S. National Mapping Standards of the Office of Management and Budget. For specific data source dates and/or additional digital information contact the Forest Supervisor, Siuslaw National Forest, Corvallis, Oregon. This map has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

August 31, 1998

ISSUE #1: LATE SUCCESSIONAL SPECIES

How can upland forests be managed to reduce fragmentation and support late-successional species of concern?



CHAPTER 6: RECOMMENDATIONS

QUESTION #1: What seral classes and patch sizes existed historically on this landscape? What natural disturbances led to those conditions? Have changes in natural disturbance regimes affected forest health?

FINDINGS	CAUSAL ACTIVITY	LOCATION	TREND	RECOMMENDATION
Infrequent, high-severity fires. The area west of Siltcoos and Tahkenitch Lakes escaped the widespread fires of the early post-European settlement period, and this may represent a typical fire pattern. The watershed had a high proportion of old-growth before logging began in the 1930s. The acres of mature forest today represent a much diminished amount from levels present prior to Euroamerican settlement.	Large lakes may have blocked fires fanned by east winds that burned most of the Coast Range during the 1800s. The coastal fog zone extends to the top of the watershed in all subbasins.	Entire watershed, especially fog influence zone.	Large old-growth was replaced with large early seral patches (0-40 years) around and west of the lakes.	Accelerate and maintain late-successional forest habitat on federal land, primarily in eastern portion of watershed (upland forest).
The Tahkenitch and Siltcoos Trail acquisitions offer the best opportunity to regain a sizable patch of large trees around the lakes. It will be several decades before these stands reach maturity and much longer before they become old-growth.	"Sloppy logging" in the 1930s. Most lakefront property is privately owned, especially by industrial timber landowners.	West of Tahkenitch and Siltcoos Lakes.	1500 ac Tahkenitch purchase (1996) is the only forested federal land adjacent to the lakes. Includes Tahkenitch Lake frontage	Land was logged in late 1930s and planted in 1942. Most stands are developing structural diversity on their own, though some may benefit from thinning. Retain some dense patches (not thinned) to imitate natural spatial diversity. Monitor disturbance to wildlife from recreation. Prevent wildfire in areas of Tahkenitch and Siltcoos Trails.
Swiss needle cast does not appear to be present in the watershed at this time.	Spruce and transition zone. Mostly private land.		Spreading from the north.	Monitor Swiss needle cast in Douglas-fir and keep up the research on its management.

QUESTION #2: Do the changes in vegetation patterns, stand structure, and composition that have occurred on the landscape over the past century affect the long-term health and sustainability of forest conditions and its ability to function as suitable wildlife habitat?

FINDINGS	CAUSAL ACTIVITY	LOCATION	TREND	RECOMMENDATION
Large blocks of land that were previously mature and old growth conifer have been converted to a patchwork pattern of early and mature seral forest. Early seral patches are large, but mature patches are small. Managed stands are typically evenly spaced with conifer and lack structural and species diversity. CWD and Snags are present at low levels or are absent. Some wildlife species associated with late-successional conifer habitat have suffered a decrease in available habitat, impaired dispersal ability and/or a decrease in reproductive success. Several wildlife species have been extirpated from the watershed as well as the Oregon Coast Range i.e. grizzly bear, wolf, lynx, wolverine and fisher.	Commercial logging on both Federal and Private land have fragmented late successional habitat and caused a corresponding decrease in interior forest habitat. Residential/agricultural development around lakes and valley bottoms	Watershed wide	Continual loss of Continued decrease of remaining mature conifer forest on private industrial lands. Slow recovery of mature conifer forest blocks is expected on Federal lands.	See question #7. Accelerate the development of late-successional habitats using the recommendations from FEMAT and Late-Successional Reserve Assessment #RO267, RO268.

QUESTION #3: How much of the current forest is mature conifer and how is it spatially distributed? How does late-successional forest habitat in the watershed function in the larger landscape? How much suitable habitat is available for spotted owls and marbled murrelets in their provincial home range? How doe current road densities affect these species?

FINDINGS	CAUSAL ACTIVITY	LOCATION	TREND	RECOMMENDATION
An estimated 20,900 acres of mature conifer currently remain within the watershed. The largest tracts of mature conifer habitat are in the upland portions of the east part of the watershed. The largest of these are only a few hundred acres. Smaller tracts exist throughout the watershed.	Land ownership patterns. Logging.	Watershed wide		Use Appendices C and D for specific recommendations. When setting priorities for treatment and stocking levels, use information about road closure priorities in Appendix C and D. If roads are going to be closed, thin heavier to maintain growth for a longer period of time. If windfirmness, future logging problems, etc. make re-entry unlikely, thin heavier at the

The medium to large blocks of mature conifer provide moderate to good connectivity for late-successional dependent species to the north into Lower Siuslaw watershed and to the east into Smith river watershed.				precommercial stage or even pole-sized stands in the 15 to 25 year range. Caution should be taken when manipulating 40-80 year old stands that are within 1.5 mile of an owl activity center.

QUESTION #4: How much of the current mature conifer is considered "interior mature habitat" (habitat >500 feet from edges)? What is the spatial distribution of the interior habitat?

FINDINGS	CAUSAL ACTIVITY	LOCATION	TREND	RECOMMENDATION
Approximately 12 and one-half percent of the existing (20,900 acres) of mature conifer within the watershed is functioning as interior mature habitat. Approximately 93% of interior habitat is on federal lands in the far eastern part of the watershed.	Land ownership patterns and differing management objectives between private and federal ownership.	Watershed wide	This trend will continue with a gradual increase of interior forest taking place on Federal lands over many decades if current management direction stays the same.	Protect existing interior habitat blocks where possible. Focus managed stand treatments near existing interior blocks. Consider road closures and limit new road construction.

QUESTION #5: Are there specific areas outside federal lands in the watershed which serve an important function for connectivity? Where are the key areas to target for land exchange potential?

FINDINGS	CAUSAL ACTIVITY	LOCATION	TREND	RECOMMENDATION
Connectivity of mature forest stands is good to the north and east, fair to the south, and poor to the west. Maintaining the blocks of mature forest in Fiddle Creek on private land (Davidson) would improve connectivity throughout the watershed (north and south).	Few forested acres remaining.	Fiddle Creek.	Logging and urbanization	Purchase/land exchanges when possible for mature forest on south side of Fiddle Creek (if not logged and fragmented first).

Mature habitat adjacent to large coastal lakes is critical for bald eagles.		Within 1/2 mile of lakes..		Purchase/land exchanges within 1/2 mile of large coastal lakes.

QUESTION #6: Where is the high quality bald eagle habitat?

FINDINGS	CAUSAL ACTIVITY	LOCATION	TREND	RECOMMENDATION
Scattered habitat exists around two of the large lakes. Numbers of local Bald Eagles is difficult to determine. Field work (on the lakes) during WA revealed far fewer eagles than expected. Mature forest within 1/2 mile is critical for bald eagles.	Primarily loss of habitat and disturbance	Tahkenitch & Siltcoos Lake Trail Areas	Trees will eventually develop into better habitat.	Try to accelerate development of isolated eagle trees along ridges by spacing. Protect large trees and snags on the lakes as they develop. Purchase/land exchanges within 1/2 mile of large coastal lakes.

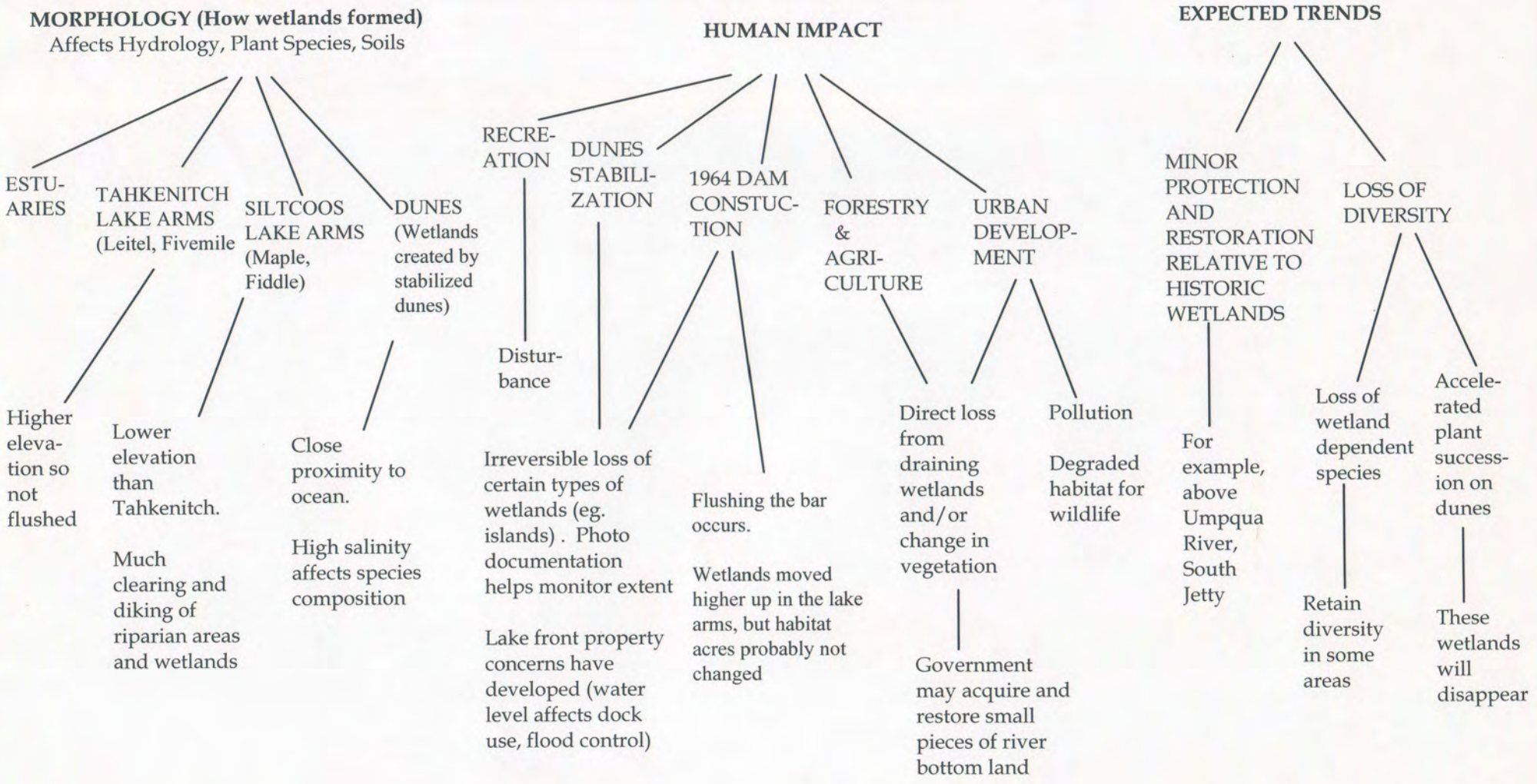
QUESTION #7: What vegetation management prescriptions are recommended for this Watershed?

FINDINGS	CAUSAL ACTIVITY	LOCATION	TREND	RECOMMENDATION
A number of plantations are densely stocked and could benefit from thinning (Appendix C and D).	Past Timber management has set trees on uniform path	Plantations with dense stocking	Northernmost plantations more densely stocked and larger trees than southern	Commercial thinning to increase tree size and accelerate late-successional characteristics (30 - 60 yr old stands).
The area is susceptible to windthrow as evidenced by acres of timber salvaged after 1962 Columbus Day Storm.	Distance from ocean and species diversity.	Henderson Area	Planted trees getting taller and more susceptible to windthrow.	Thin lightly, if at all in windprone areas. We advise running the wind model when stand exam data (tree species, mortality) is available prior to thinning. Monitor blowdown associated with different thinning prescriptions (tree spacing, clumpy spacing).
Records show there was a historic abundance of western redcedar stocking	Assume historically there was a large seed source for cedar. Much less today.	Watershed wide.	Cedar was removed in large quantities (Appendix A and B).	Emphasize underplanting of western redcedar when thin plantations and underplant. Try precommercial thinning 1/2 of Henderson Thin #1 and evaluate for a second commercial thin

Tahkenitch & Siltcoos Trail acquisitions are developing & differentiating along natural paths. Natural diversity is developing. A preliminary assessment indicates that about 1400 acres (matrix and LSR combined) are ready for thinning. Stands include mostly 30 - 45 year old trees with uniform, dense stocking.	Natural Regeneration	Lakes area.	Hemlock naturally occurs in dense stands and can carry higher numbers of stems per acre as compared to Douglas-fir. Stand exams and CWD transects ongoing in these stands (Map X). The data will be available for project planning	Evaluate Siltcoos Trail area plantations for precommercial thinning. Could thin with variable spacing No strong recommendation for overall commercial thin. Localized thinning could be done for visuals, to get larger diameters, etc. Forty percent live crown is considered optimum for western hemlock (Walkup 1975). A common rule-of-thumb is to remove no more than 30 percent of the basal area at the first commercial thinning (Ruth and Harris 1979). Stands of predominantly western hemlock also should not be thinned heavy to avoid blowdown problems. Western hemlock has the highest susceptibility to blowdown of the coastal conifers. Any thinning operation needs to minimize logging wounds, avoid spring time operations and not drastically opening up the stand to sunscald potential. Analyze plantations for age, windfirmness, logging feasibility including obvious riparian concerns and species composition (hemlock patches may be large enough to influence decisions- they can tolerate higher densities per acre, may be less windfirm, and so forth.)

ISSUE #2: RIPARIAN AND WETLANDS

How has wetland and riparian habitat abeen altered by past and current land use, and how can wetland habitat and ecological functions be protected and enhanced?



QUESTION #1: What would we expect for the natural vegetation structure and composition along rivers, lakes, streams and in wetlands in the watershed? How has it been affected by Euroamerican human land use?

FINDINGS	CAUSAL ACTIVITY	LOCATION	TREND	RECOMMENDATION
Natural vegetation along streams and wetlands included thick continuous willow and sedge with intermittent clumps of alder and spruce. Wetlands and their associated vegetation extended high up into the upland valleys. Lake associated wetlands were also extensive. Channels and lake edges have been greatly altered including loss of meanders, downcutting, bank erosion, vegetation loss, wetland loss and lake shoal erosion. (See map X, Grazing and Channel Modification).	Channels: Stream relocation for pasture creation, grazing, draining of wetlands for agriculture uses. Lakes: urban development, recreation, logging.	Maple, Fiddle, Bear, Fivemile creeks and many of their lower tributaries. Lakes: Woahink, Siltcoos, Tahkenitch and Cleawox primarily.	Channels: continued grazing, some draining of wetlands (Maple), lack of riparian vegetation Lakes: shoal erosion and continued logging.	Work cooperatively to fence stream channels and replant riparian vegetation on private land; continue vegetative rehab in Fiddle Cr. on Forest Service land; stop the practice of issuing permits for the draining of wetlands and diking of creeks, primarily on Maple Creek. Continue to enforce City and County rules on shore development; limit expansion of city limits around lakes; put more teeth in State riparian rules to buffer lakes better.

QUESTION #2: What are the major natural disturbances prior to Euroamerican human settlement; what are the major disturbances today? What are the relationships between upland and riparian disturbances?

FINDINGS	CAUSAL ACTIVITY	LOCATION	TREND	RECOMMENDATION
Natural: wind storms on ridgetops and debris torrents most common in the headwaters of the uplands that flow into riparian areas. Current additional disturbances: Agricultural practices in the upland valleys have modified sediment routing; logging in the headwaters has taken the large woody debris (LWD) component out of debris torrents; limited riparian vegetation at tributary mouths and riparian roads have changed delivery to mainstems	Natural: periodic major winter storms Current: Increased velocity of straightened streams, insufficient riparian buffers retained after logging, stream cleanout, lack of LWD in headwater areas after logging	Uplands	Storms will continue. Intensive forest management and agriculture will continue on private	Enforce State riparian rules on private land; continue to manage for late-successional reserve conditions on federal lands

QUESTION #3: How will restoration activities affect human uses of the watershed, *i.e.* grazing, access, recreation, navigation?

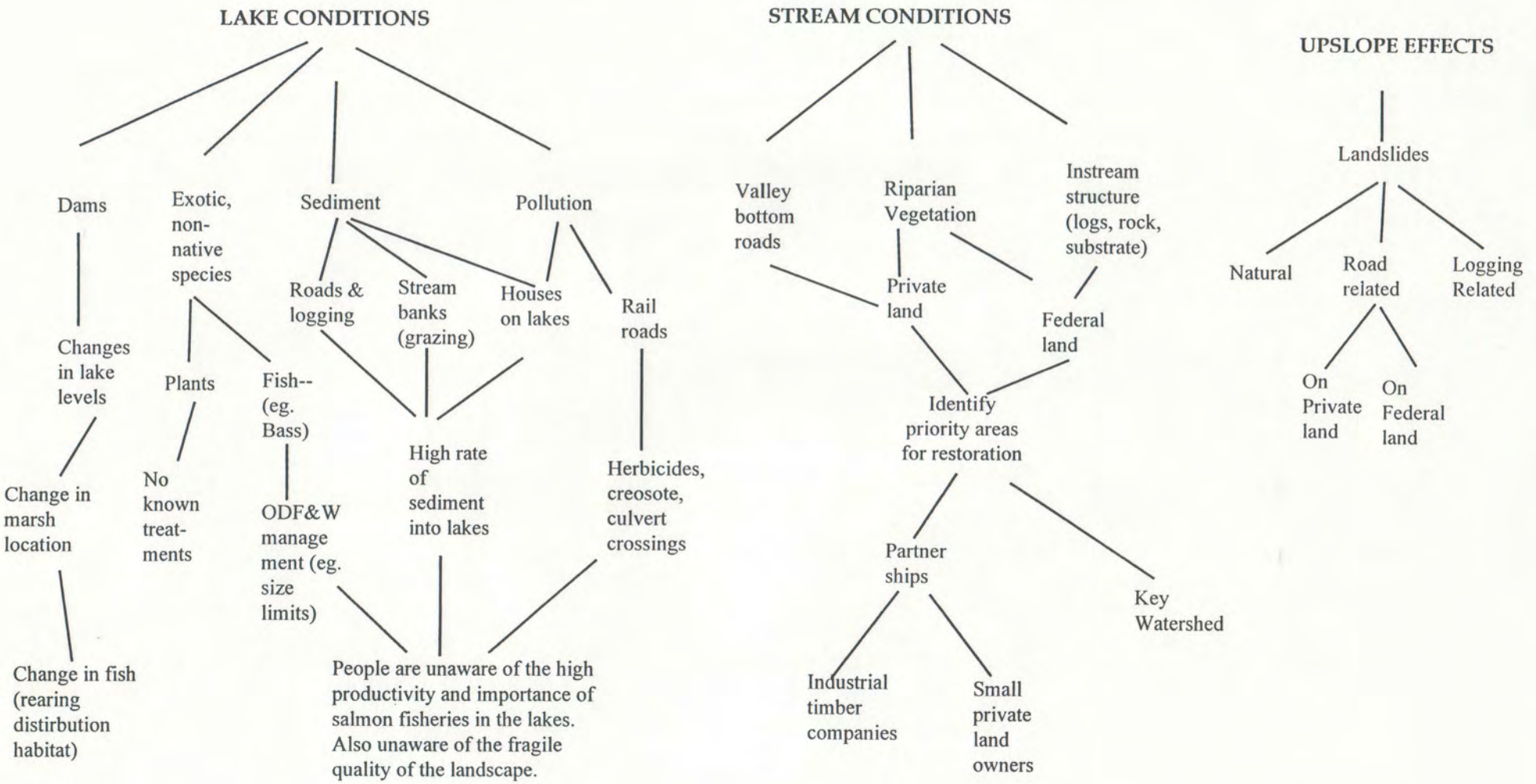
FINDINGS	CAUSAL ACTIVITY	LOCATION	TREND	RECOMMENDATION
Riparian restoration in some areas may cause loss of some grazing pasture.	Riparian fencing and planting	Where private landowners volunteer to limit grazing.	Increased participation in Fiddle Cr. and other locations	Pursue partnerships and provide money for riparian restoration using Wyden Amendment to spend federal dollars in upland valleys; work with SWCD and NRCS to establish partners.
Road closure in the headwaters may limit some access for recreation (see Map X for road restoration possibilities).	Road closure	Where near term use of roads is limited on federal land	More road closure due to less budget to maintain rds.	Do silvicultural and travel management planning to determine what roads are needed for the future; waterbar, stabilize and close rds. not needed in short term (See Appendix C).

QUESTION #4: What is the extent of marsh areas in the watershed? What role do they play in the function of aquatic and terrestrial habitats?

FINDINGS	CAUSAL ACTIVITY	LOCATION	TREND	RECOMMENDATION
(For historical extent, see Palustrine wetlands on Map X). Aquatics: We suspect that both historically and currently, these marshes serve(d) as high quality rearing habitat for coho salmonids, especially the eastern arms of Woahink, Siltcoos and Tahkenitch Lakes. Some of these marshy areas have been drained to create agricultural lands while the dams on Siltcoos and Tahkenitch have shifted marsh areas upward in the system.	Agricultural activity	Maple, Fiddle, Bear, Fivemile, (Bell)	None	Use Leitel Cr. to provide examples for restoration project design just above lakes (private land). It is relatively well-function, unimpacted wetland on private land.
	Dams	Siltcoos and Tahkenitch outlets	None	

ISSUE #3: FISHERIES

How can lakes and stream channel conditions be improved to protect existing habitat and provide better habitat for fish and other aquatic species?



QUESTION #1: How has function of lakes for coho changed in the last 100

FINDINGS	CAUSAL ACTIVITY	LOCATION	TREND	RECOMMENDATION
One of the greatest changes has been the transfer of coho rearing from the lakes to the marshy lake arms.	Warm water bass prey on salmon. Lack of appreciation/ awareness of the importance of these lakes for salmon production.	The three large lakes.	Limited rearing habitat for salmon. ODF&W currently protecting large bass with size limits.	Remove size limit on bass.

QUESTION #2: How are lake levels being managed at this time? Who is responsible for monitoring? How does current management of lake levels compare to historic levels and what is the biological effect on aquatic species? What effect do dams have on fish movement and productivity?

FINDINGS	CAUSAL ACTIVITY	LOCATION	TREND	RECOMMENDATION
Lake levels have been managed by International Paper Company since 1963 to allow water withdrawal for pulpmill operations. Compliance with a state permit is monitored by the District Water Master (Roseburg). Levels are held at an average of 3.0 to 4.5 feet higher than natural lake levels between April and November. Some seasonal island habitat at the east end of the lake has been lost because winter lake levels are maintained year round rather than seasonally. (See Table X for current lake levels on Siltcoos and Tahkenitch)	Dams	Outlets of Siltcoos and Tahkenitch Lakes	Water rights given to I.P. will stay in effect	Forest Service should work with the Water Master and I.P. to assure that fish passage is being maintained through fish ladders of the dams.

QUESTION #3: What is the current and historic relative abundance and distribution of species of concern in the watershed?

FINDINGS	CAUSAL ACTIVITY	LOCATION	TREND	RECOMMENDATION
Paul needs to fill in?? Or drop it.				

QUESTION #5: Where are our best opportunities for riparian restoration (riparian tree planting, commercial thinning)?

FINDINGS	CAUSAL ACTIVITY	LOCATION	TREND	RECOMMENDATION
Bell Cr. has special use grazing permit where specific permit conditions are currently not being met (maintaining stable stream banks, maintaining streamside woody vegetation.) Anadromous fish production, especially coho, is being lost due to these conditions.	Grazing and trampling vegetation in creek	Bell Creek	Destabilizing of stream banks and lack of overhanging cover and shade for creek.	Ambitious willow planting program in and long the stream. Plant conifer in clumps or fingers that come down to the stream. Discuss options with permittee: 1) Fence off riparian area and allow cows to use other parts of the meadow 2) Install a fence at the lower Forest boundary and allow limited grazing for purpose of controlling nonnative, noxious weeds in pasture 3) Fence off USFS land and suspend grazing for a period of time to allow recovery of vegetation 4) Fence off USFS land and cancel grazing permit and access potential for weed control of non-native noxious in this area which has very poor road access.
Two plantations upstream of occupied habitat potentially could supply long-term future wood, in debris torrents or landslide events.	Past logging removed large riparian conifer. Stream cleanout removed woody debris.	Headwaters Bell and Fivemile Cr. Bear Creek Fiddle Creek	Conifer developments slow in riparian areas.	Commercial thin 2 plantations in headwaters Bell and Fivemile Creek. Commercial thin 2 plantations in Bear Cr. Commercial thin 2 plantations in Fiddle Cr.
Fiddle Cr. riparian restoration efforts over past few years have had mixed success. Willows did excellent job of stabilizing stream banks and have spread outside the planting area to stabilize additional area. Conifer and hardwood have had poor survival.		Fiddle Creek--Forest Service managed portion		First mile USFS portion: Maintain existing fish rehab investments. Plant additional willow to help stabilize banks as stream continues to reach an equilibrium at its new base level. Release planted riparian conifers. Plant willow and conifer in riparian areas.
Upper Bear (Fiddle Cr. Drainage) lacks riparian vegetation. Poor access will add expense to project work.		Upper Bear Upper Maple		Upper Maple Cr.--Plant willows and conifer in

Lack of riparian vegetation	Grazing	North Prong, Schultz Tenmile		the riparian area. Stop the grazing at the USFS boundary which has no special use permit for grazing.
Five plantations have potential for thinning in the next 5-10 years that could substantially benefit fish in Maple Cr. drainage.		Maple Cr. and tributaries		High priority for thinning: 2 units in Carter Cr., 2 units on Henderson, and 1 unit in Upper Maple Cr. (Appendix C and D)

QUESTION #6: Where are our best opportunities for instream restoration?

FINDINGS	CAUSAL ACTIVITY	LOCATION	TREND	RECOMMENDATION
Special use grazing permit in Bell Cr. is creating lack of woody streamside vegetation.		Bell Creek	Lack of future sources of large wood.	After bank stabilizes (from riparian restoration efforts), cut or pull mature conifer down to stream to provide more complex habitat.
Area where debris torrent scoured the stream to bed rock on BLM and USFS land would benefit from wood additions.	Heavy rains	Upper Bell Cr.	Stable	Add large wood in stream from mature stands adjacent to stream.
Fiddle Cr. substrate is dominated by bedrock but mature conifer above creek could provide wood necessary to allow substrate to collect behind debris jams.	Stream cleaning	Fiddle Creek -- Forest Service managed portion	Stable. Gradually improving as mature conifer fall singly into creek.	Second Mile USFS Portion: Fall about 50-80 whole trees into creek (mostly in clusters) located below tributary junctions where gravels would be expected to enter mainstem. These would allow substrate to collect behind debris jams. Field locate to determine exact number of trees to fall.
Upper Bear (Fiddle Cr. Drainage) lacks large wood. Has poor access which will add expense to project work.	USFS Road 24.	Upper Bear Cr.	???	Check where grazing is occurring. Use 1998 stream survey data to determine grazing extent

QUESTION #7: Do any fish passage problems exist on federal land in the watershed?

FINDINGS	CAUSAL ACTIVITY	LOCATION	TREND	RECOMMENDATION
Carter Cr. culvert at crossing of USFS road 14 is a very long culvert with substantial drop that would limit juvenile fish passage (at a minimum).		Carter Cr. (Maple Cr. watershed)	Potential for catastrophic stream impacts and private land below if culvert plugs and washes out road fill	May need to build steps up into culvert and baffles. Deep fill over culvert would make it difficult and expensive to replace. Make sure this culvert is properly sized for 100 year storm.
Road 2490 (Henderson Tie Road) has some partially plugged culverts .	Lack of road maintenance (funds).	Road 2490	Potential for road failure increasing.	Maintain culverts.
Opportunities exist to aid salmon, trout, and other fish species move up and down stream and provide habitat and food.	Removal of logjams where wood historically collected results in lack of resting cover and food for migrant and resident fish.	Siltcoos River Tahkenitch Cr.		Use combinations of logs and boulders instead of bank riprap to meet fish, wildlife, and recreation objectives. In addition to benefiting resources, this would provide a showcase for public on resource-friendly ways to alleviate bank erosion problems on private land. Some opportunities for wood additions to provide cover.

QUESTION #8: Where are the highest priorities for land acquisition in the watershed?.

FINDINGS	CAUSAL ACTIVITY	LOCATION	TREND	RECOMMENDATION
Opportunities on mainstem Fiddle, Bear or Alder Cr. are very high priority for fisheries. Discussions with Rosboro Industries about acquiring the portion of Alder Cr. for one mile below USFS managed lands are currently in limbo .	The federal government owns few low gradient streams which potentially provide important anadromous fish habitat because valley bottoms were homesteaded in 1800s.	Fiddle Cr. Bear Cr. Alder Cr.	Lower Fiddle Cr. lands may be harder to acquire if parcels become available due to the location of this creek	Acquire these riparian areas when possible.

			outside Forest Boundary.	
Mainstem Maple Cr. would be high priority, especially the area where Canary Road first crosses Maple down to the Lake.		Maple Cr.		Return these grazed wetlands to functioning status, which would increase coho rearing dramatically.

QUESTION #9: Where are our best opportunities for private partners for restoration? What are the benefits and deterrents for partnering (from the perspective of landowners and Forest Service).

FINDINGS	CAUSAL ACTIVITY	LOCATION	TREND	RECOMMENDATION
Fivemile and Bell Cr. are some of the best coho producing streams in the state of Oregon.	Historic conditions. The presence of the coastal lakes, wetlands, and other components of the environment.	Bell and Fivemile Cr.		Work with private landowners to limit access of cows to the creek, and to plant woody vegetation (especially willow) on and along the creek. Maintain marshland in the lower 2 miles.
Leitel Cr. has the highest number of adult coho salmon spawners per mile in Oregon. This privately owned stream provides excellent opportunities for cooperative projects. Some land owners in the watershed are interested in partnerships in the watershed and present excellent opportunities for use of funds from Wyden Amendment	High road density	Leitel Creek	The road adjacent to Leitel Cr. is a source of undesirable instream sediment. Gravels may be limited in this system.	Upgrade culverts to pass 100 year flows as a way of storm proofing the creek. Waterbar old roads or apply other sediment reduction techniques to the numerous spurs that exist off the Leitel Creek Road Add large wood to the channel to create more complex habitat and hold more gravels in the system farther up the stream
Few opportunities for habitat restoration exist in Fiddle Cr. (key watershed) because most landowners are interested in limited restoration, even with tax incentives that are available.	Grazing in riparian area without fencing *(or keeping cows out in spring? PWright)*	Fiddle Cr.	Lack of natural creek sinuosity. Little riparian vegetation. Unfenced cattle along	Continue work with existing cooperating private land owners. Work with SWDS and NRCS to contact other landowners and encourage riparian planting and fencing

Maple Cr. has considerable opportunity for partnerships in some areas, while salmon rearing habitat conditions are worsening in other areas.	Draining and ditching of the river are currently underway.	Maple Cr. private lands	some sections. Declining habitat conditions.	Encourage Oregon Division of State Lands and NRCS to reevaluate draining and ditching permit process. Discuss limiting the extent of these actions as they are currently occurring along portions of Maple Cr. Work with industrial timber companies with riparian/wetland enhancement agreements and projects in lower Maple Cr.
Roads around Tahkenitch Lake pump substantial amounts of sediment into the lake during timber hauling, especially after winter road maintenance.	Roads draining water and sediment directly into lake.	Small tributaries flowing into Tahkenitch Lake.	Sediment input and accelerated eutrophication of lake.	Identify specific streams on which to develop partnerships with industrial timber companies. Consider sediment filter or barrier along the roads that border the lake to reduce sediment input. Maintain these filter/barriers.
Lack of passage of coho, steelhead, and cutthroat adults and juveniles due to culvert.	Possibly poorly installed.	Elbow Lake and Tahkenitch Lake		Work with Oregon Department of Transportation to improve the culvert between Elbow Lake and Tahkenitch Lake.
Residents who own property on some small tributaries that enter the lake have expressed interest in obtaining trees for riparian planting, improving fisheries and waterfowl habitat.	Citizens concern about lake water quality	Siltcoos Lake	Stable	Follow up with residents to provide riparian vegetation materials, waterfowl boxes, etc. Work with Lakes Association, Ada Grange, and other contacts made during WA.
There are fish passage problems with the railroad tracts that run along the east side of the lake				Contact railroad company about culverts.
Recreation and fish priority areas overlap in some areas. This presents opportunities for creative solutions..		Siltcoos River	A growing challenge in this watershed will be	Maintenance of recreation sites should incorporate fish and wildlife mitigation measures to provide habitat while alleviating problems such as erosion of stream banks. Use combinations of logs and boulders instead of bank riprap to meet fish, wildlife, and recreation objectives, and provides showcase

			protecting and restoring fish habitat are recreational developments in area.	for public on ways to alleviate bank erosion problems on private land.

QUESTION #10: What role do estuaries play for fisheries, especially coho?

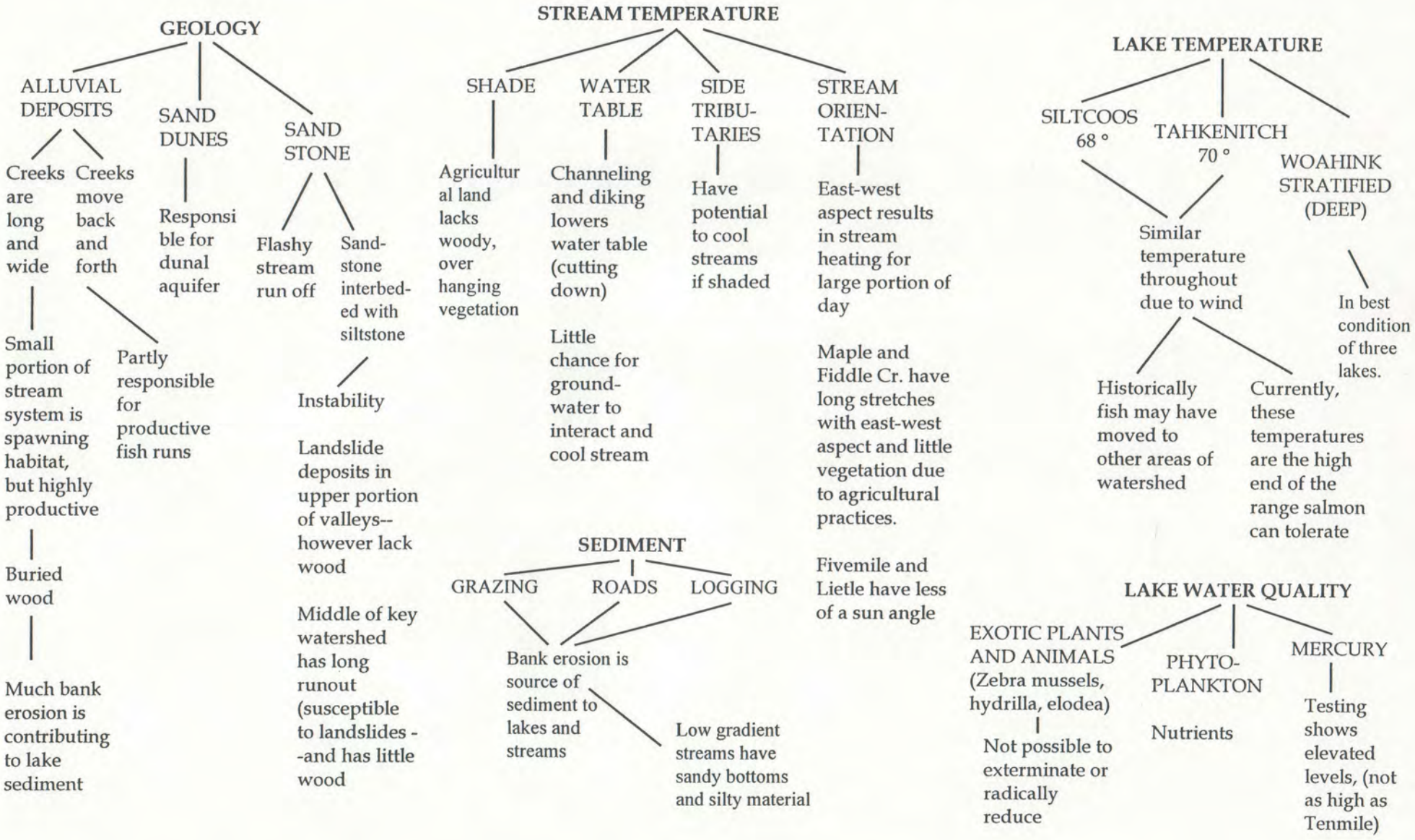
FINDINGS	CAUSAL ACTIVITY	LOCATION	TREND	RECOMMENDATION
The estuaries provides important transition zone for thousands of coho smolts and lesser numbers of steelhead, cutthroat trout, and sturgeon. Wood may be lacking in estuary.	.	Siltcoos River Tahkenitch Creek		More closely examine ways to expand or improve function of the estuary.

QUESTION #11: What is the best treatment of non-native plants and animals in the lakes?

FINDINGS	CAUSAL ACTIVITY	LOCATION	TREND	RECOMMENDATION
Zebra mussels (freshwater bivalve) and Hydrilla (a fast growing weed) are not known to occur now in the watershed, but are in lakes in adjacent states and county. The introduction of these species would pose considerable threat to the lakes and are of concern. See Appendix.	Inadvertently transported from lake to lake on bottoms of boats.	All lakes in watershed that allow boating.	Most boaters are not aware of these pest species.	Work with State Marine Board and ODEQ to post information about Zebra mussels and Hydrilla where boaters will see it.

ISSUE #4: WATER QUALITY

What is the current water quality condition? What are the impacts to water quality? What opportunities exist to improve water quality?



QUESTION #1: What are the riparian conditions for shade, bank stability and long-term large woody debris supply for the watershed? What are critical areas to restore to aid aquatic habitat?

FINDINGS	CAUSAL ACTIVITY	LOCATION	TREND	RECOMMENDATION
Riparian conditions are most impacted in the uplands and around the larger lakes. Map shade adequacy Map X LWD potential. Appendix G provides numbers on this information. In indicates that generally impacts to riparian vegetation and bank stability in streams are high in Maple, Fiddle and Bear Creeks, moderate to high in Fivemile Cr. and low in Leitel Cr.	Upland - stream modification, pasture clearing, grazing	Upland mainstems and some of their tributaries	Degraded conditions will continue unless restoration and changes in land management occur	Forest Service seek partnerships with private landowners, especially Industrial Private which owns large portions of mainstem on upland creeks. Work with SWCD and NRCS to make contacts. Use Wyden Amendment authority to spend federal dollars in critical areas on private.
Riparian vegetation condition around the largest lakes is included in landuse figures found on pages x, x, and x. Also, see water temperature monitoring question below.	Lakes - logging and urban development	Siltcoos, Tahkenitch and, Woahink Lakes primarily	Impacts to Lakes riparian vegetation will continue with logging and urbanization	It is the responsibility of State, County and City governments to monitor logging and urban development; should enforce existing regulations.

QUESTION #2: What is the condition of the dunal aquifer? What needs to be done to protect this water resource?

FINDINGS	CAUSAL ACTIVITY	LOCATION	TREND	RECOMMENDATION
The dunal aquifer in the watershed area can be described as a homogeneous, simple aquifer that ranges anywhere from three to thirty feet from the surface. It fluctuates seasonally about three feet. Water quality is good but some treatment is needed for high iron content. Currently, it is not being heavily pumped because most water systems in the dunal sheet of this watershed rely on lake water.		Dunal sheet	An increased need for water in the area that may result in pumping out of the aquifer	Future plans to expand urbanization and subsequent dunal aquifer withdrawal should seek to prevent excessive pumping that could cause salt water intrusion into the aquifer or could affect lake levels of the dunal lakes. Close attention should be paid to studies being done for Coos Bay/North Bend Water Board south of this watershed, who have been pumping from the aquifer with as many as 20 wells since 1957.

QUESTION #3: Are there any unique geologic or geomorphic conditions in this watershed that affect function of the terrestrial and aquatic systems (sediment and wood routing)? How were the dunes formed and what is unique about them in the region? How were the coastal lakes formed and what is unique about this formation in the region?

FINDINGS	CAUSAL ACTIVITY	LOCATION	TREND	RECOMMENDATION
The unique geomorphic qualities of this watershed are almost all related to the formation of the dunes. Accumulation of sediment in a coastal indentation, subsequent rise of the ocean after the last cycle of glaciation, and wave and wind action all contributed to formation of the dunes. Where river mouths (estuaries) were cut off by advancing dunes, coastal lakes were formed that are unique in the world. Slowing of drainage at the lakes and long-term erosion of sediments from the headwaters caused long, wide stream valleys to form above the lakes with an abundance of meandering streams and wetlands. Low gradient conditions in the uplands contributed to less movement of large wood through the system historically due to broad floodplains where material could be stored.	Dune formation	Western most edge of the watershed		

QUESTION #4: What type of soils exist in the watershed and how do these soils affect the hydrologic character of the watershed? (i.e. flow regimes and water tables).

FINDINGS	CAUSAL ACTIVITY	LOCATION	TREND	RECOMMENDATION
The dunes are made up of mostly siliceous subangular to rounded grains of sand ranging from very fine to medium grain sizes. There are clay lenses, peat strata and zones of weak cementation buried in places on the dunal sheet. Coastal lakes and surrounding hills generally have gravelly clay loams that are deeper in places and slightly more productive soils than in the uplands. Upland gravelly loam soils are much shallower in places with less water holding capacity and plant limiting soil moisture in summer, except on north-facing slopes. A shallower, porous soil mantle in the headwaters contributes to rapid delivery of precipitation to streams, causing hydrology to fluctuate quickly during storms.		1.Dunes 2. Coastal lakes and hills 3. Headwaters		

QUESTION #7: What is the extent of grazing in the watershed? What are the direct effects on water quality from grazing practices in the watershed? Where diking and channelization have occurred in depositional areas, how are aquatic resources affected? Where does diking restrict floodplain connection within the watershed?

FINDINGS	CAUSAL ACTIVITY	LOCATION	TREND	RECOMMENDATION
The upland stream valleys have the most impact from grazing and stream channel modification (Map X) Appendix provides percentages of these mainstems impacted by each practice and general ownership of these depositional areas. Primary effects to water quality from these practices include increases in water temperature and fecal coliform with associated effects to other parameters. Bank erosion and channel downcutting have increased sedimentation. Wherever straightening of channels has	Agricultural practices on private lands such as rechannelizing streams to create pasture, wetland draining, and grazing in streams and wetlands. Also permitted grazing on federal lands in Bell Cr.	Maple, Fiddle, Bear and Fivemile Creeks and some of their tributaries	The majority of channel modification was done in the past but some still continues on Maple Cr. Where grazing continues, sedimentation, elevated water	If the possible, pursue cooperative water quality monitoring at the mouths and at the upper extent of standing water in the creeks above the lakes. Work with DEQ to develop water quality management plans for drainages above the lakes.

occurred, downcutting has caused disconnection with floodplains. Water quality monitoring is very limited at present on both private and federal lands.			temps and elevated coliform counts are expected to continue	

QUESTION #6: What is the current status of water temperature in the watershed? Where should monitoring focus in the future?

FINDINGS	CAUSAL ACTIVITY	LOCATION	TREND	RECOMMENDATION
Maple and Fiddle Creeks are listed as impaired water bodies [Section 303(d)] for water temperature from mouth to headwaters, based on little data. Upper Fiddle Cr. is the only location that has been monitored for summer water temperature on Forest Service managed land but summer 1998 monitoring for Maple, Fiddle and Bell Creeks is underway. Upper Fiddle Cr. data for 1997 showed exceedence of the State standard high in the watershed about 50% of the monitoring period from late June to mid-September. 1998 data includes the same location on Fiddle Cr. to allow verification.	Unknown on Fiddle Cr. Lack of riparian vegetation causing direct solar radiation on portions of Maple, Fiddle, Bear and Fivemile	Upland streams	Gains in riparian vegetation as part of restoration occurring in Upper Fiddle Cr. - may take 10 years or more to become evident. Status quo elsewhere	Work cooperatively with willing private landowners to fence streams and plant riparian vegetation. Work with SWCD and NRCS to make contacts. Use Wyden Amendment authority to spend federal dollars in critical areas on private. Positive efforts on Fiddle Cr. have begun; continue looking for cooperators in this key watershed. Excellent riparian planting opportunities on federal lands in Bell Cr.

QUESTION #7: Where are the areas of high, moderate and low instability within the watershed? How do unstable areas affect both sediment and large wood routing in the watershed? Given these dynamics, where would structure placement be most effective in the watershed to enhance fish habitat?

FINDINGS	CAUSAL ACTIVITY	LOCATION	TREND	RECOMMENDATION
Areas of highest instability are in the headwaters of the watershed (See map X, p#). Particularly unstable areas occur in upper Ryder Cr. (off Maple), the North Prong/Coleman/Shultz area of upper Maple Cr., upper Fiddle Cr. (after Fiddle turns north), and the north side of Bell Cr. (off Fivemile). Results of the post-flood slide mapping from high elevation photos after the 1996 flood tend to be biased toward open, recently cut areas of upper Fivemile Cr. whereas areas listed above show less activity (see map x and table x in roads and stability section). Although heavily logged, the hills around the lakes have low to moderate susceptibility except for Tahkenitch which shows some hillslopes right above its eastern shoreline. Areas of highest instability mentioned above would have highest potential for delivery of sediment and LWD (where available). In stream structure placement simulating debris jams would best be placed at the bottom of Transport geomorphic segments and at the top of Deposition segments (Map 7)	Instability - steep slopes that are concave tend to have thinner soils and more concentrated groundwater. Instream structure placement would work well below transport reaches and at the top of deposition reaches because this is where sediment and wood would ordinarily hang up and produce a debris jam due mostly to changes in gradient.	Headwaters of the watershed, especially in headwalls Potential based on analysis = mid-North Prong, upper-most Maple, lower Shultz (private), upper Bear, upper Fiddle, mid Billy Moore (private), upper Bell (already has jams) Lower Young (off Fiddle - private) upper Leitel Cr.		Take into account predicted areas of high instability when planning thinning sales where old roads will be reopened and temporary roads will be built. Concentrate instream work in areas where sediment routing will produce the best storage behind structures. Highest priority should be Fiddle Cr. because of its status as a key watershed. Access may be difficult for N. Prong, upper Maple, upper Bear, upper Bell but agreements should be pursued with private landowners where right of way can ease this. Cooperative agreements would have to be forged to place structures in Shultz, Billy Moore and Leitel Creeks.

QUESTION #8: Where are there road problems that could be chronic fine sediment producers for the long term? Which roads are priorities to fix? maintain? Obliterate? Any opportunities to work with private industry to fix roads?

FINDINGS	CAUSAL ACTIVITY	LOCATION	TREND	RECOMMENDATION
Appendix C provides specific road recommendations based on known problems that came out of a USFS lands road assessment. In addition, roads that need waterbarring and closure were determined based on needs for silviculture and wildlife on USFS lands. The Sunset 2480) and Popo (4830) roads are two of the most ravelly roads on the Mapleton District. Restoration priorities include maintenance of lower 2400 and tie road 2400 945 (Henderson tie) which are both ATM roads that have culverts needing cleanout. No obliteration priorities have yet been identified. The private riparian road above spawning gravels in upper Leitel Cr. needs maintenance to keep sediment from covering gravels and the spur coming off this road at the top also has cracking sidecast that would fail into Leitel Cr.	Lack of road maintenance could cause sedimentation into streams in the watershed	Headwaters of the watershed	Increased cooperation to solve road related problems	District resource specialists should work with engineers and maintenance crew to solve identified problems. Also, secure KV and other funding to stabilize and close unused and unmaintained spur roads posing a risk to resources. Communication with private industrial landowners should increase to be able to share road problem information for the watershed. Use the Siuslaw Watershed Council as a place for these conversations since many of the landowners are there.

QUESTION #9: How is water quality in the Coastal Lakes being affected by: development? logging? grazing? recreation? What, if anything, can be done by the Forest Service to improve water quality? What monitoring has occurred in these lakes and what is needed for the future? What are the most important water quality parameters that need to be tracked for these lakes? What advice/public involvement can be given to the Dune City and Lane County planners to assist in protection of these lakes?

FINDINGS	CAUSAL ACTIVITY	LOCATION	TREND	RECOMMENDATION
In general, trophic state of Woahink, Siltcoos, Tahkenitch and other lakes is increasing due to use. Woahink Lake has the most impact from urbanization and recreation (has gone from oligotrophic to mesotrophic in 25 years) and Siltcoos is a close second. Siltcoos and Tahkenitch have both been heavily logged, both in the	Landuse practices such as urbanization, recreation, agriculture and intensive forest management are threats to these lakes. Monitoring - Neither	Primarily Woahink, Siltcoos and Tahkenitch Lakes All 19+ lakes in	Continued increases in trophic state. Unknown	Use this document and lake surveys done in 1992 by the Dunes NRA to identify red flags for these lakes. Also work with Oregon State and Portland State University specialists to help diagnose these problems. Then, establish a long-term, consistent monitoring strategy that uses established units for the parameters surveyed to allow for comparison. Plan for a

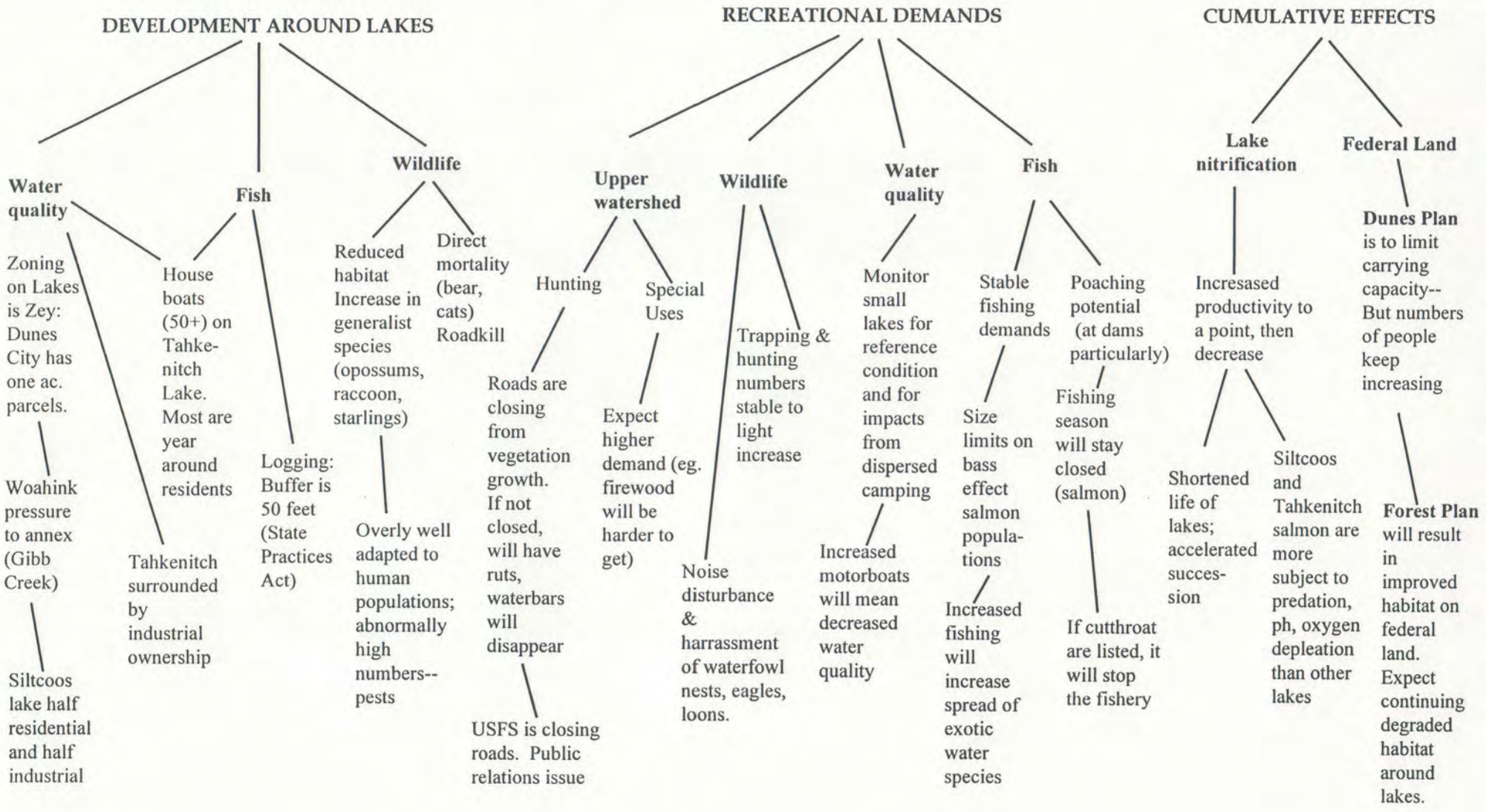
past and currently and both have aquatic weed problems. The degree to which Siltcoos and Tahkenitch are being impacted by upland agricultural, logging and stream modification practices is unclear due to lack of monitoring, but signs of sedimentation into Siltcoos Lake are apparent near the mouth of Maple Creek. Cleawox Lake has high recreation use and septic systems that are causing increases in productivity in a once oligotrophic lake. Threemile lake is relatively unimpacted but needs protection to keep conditions at status quo. Consistent, long-term monitoring is conspicuously absent for these lakes.	money nor time are a priority for any agency or entity other than small, grassroots efforts on some lakes and one-time research grants.	the watershed area		minimum monitoring period of 20 years and sample at least three times per year, preferably spring, summer and fall to catch seasonal variation in water quality. If only minimal money is available, sample primary productivity which is one of the best indicators of trophic status change (see Woahink Lake example in chapter 3). Also, rate lakes to be surveyed on a scale of low to high ability to handle impact and manage accordingly. This may mean NOT developing trails and access routes to the few remaining untouched dunal lakes or estuary areas left in the watershed.

QUESTION #10: Are there any relatively untouched areas that could serve as reference conditions in the watershed for terrestrial or aquatic ecosystems?

FINDINGS	CAUSAL ACTIVITY	LOCATION	TREND	RECOMMENDATION
None that stand out - North Prong possibly but field verification is not adequate at this time.				

ISSUE #5: POPULATION GROWTH, URBAN DEVELOPMENT & CUMULATIVE EFFECTS

What is the expected impact of continued population growth, urban development, and recreation in the watershed? How can human use be managed to minimize impacts on the sensitive dunal, wetland, and riparian ecosystems?



QUESTION #1: What increased uses on Federal forested lands in the upper portions of the watershed are expected over the next 20 years (*eg.* road use, special uses)? What added demands will those have on resources and wildlife?

FINDINGS	CAUSAL ACTIVITY	LOCATION	TREND	RECOMMENDATION
Water will become the most highly valued resource provided by the National Forest as population grows and demand for clean water increases. Disturbance and displacement of wildlife depending on where development occurs. Increase in species adapted to urban environments, possibly to undesirable levels. Demand by recreation users (camping, autotouring, fishing, hunting) is low. Reduced logging and roads closed to vehicular traffic may increase attraction for hiking.	Population growth. Urban development.	Upper watershed on federally owned land.	Concerns about water by local residents increasing. Demand for hunting and fishing stable. Most recreation use occurs on the Dunes NRA.	Work with Dunes City Council and public groups to convey the findings in this analysis, regarding overall conditions and pressures on the water resources.

QUESTION #2: What increased development will occur on the lakes in the watershed over the next 20 years? How will that affect water quality, wildlife, fish and other natural resources?

FINDINGS	CAUSAL ACTIVITY	LOCATION	TREND	RECOMMENDATION
Eutrophication is already occurring on the highly urbanized lakes. Dunes City is expected to continue to grow and subdivide. Expect housing development around lakes to increase.	Urbanization and recreation on the lakes Applications for zoning changes are made and granted.	Coastal and dunal lakes	Continued increases in nutrients to lakes If no septic system installed, algae blooms will occur as on Tenmile Lake.	Close attention should be paid to landuse practices and septic system maintenance in particular. Limit development along lakes. Do a survey of old septic systems within 100 feet of shoreline as was done in 1972 by Lane County. Develop sewage and water treatment facilities and an area-wide system before more detrimental effects to lakes occur. Limit zone changes.

QUESTION #3: What increased recreation demands will occur in the Dunes National Recreation Area over the next 20 years? How will that affect wetlands, water quality, wildlife, fish and other natural resources?

FINDINGS	CAUSAL ACTIVITY	LOCATION	TREND	RECOMMENDATION
(From Dunes Plan) The following trends between 1900 and present have greatly affected plant and wildlife habitat diversity on the Oregon Dunes NRA: •amounts of open beach and spit associated with stream mouths declined; •open water habitats declined; •vegetated deflation plain widths increased; •rapid succession of deflation plain vegetation from early seral wetland communities to shrub to forest condition; •amounts of open sand declined; •amounts of undisturbed habitat decreased as recreation use expanded; •increased habitat fragmentation from OHV paths and hiking trails. Although detailed survey information is not available, suspected associated change in wildlife use include: • •species associated with open sand and water declined; •species associated with early seral and shrub deflation plain habitats first increased, then decreased as succession proceeded; •species associated with habitats overtaken by exotic plant species declined; species requiring minimal disturbance or large unfragmented tracts decreased.	The main factors that have changed - and continue to change - plant and animal habitats and diversity are introduction of European beachgrass, natural succession and recreation use.	The Oregon Dunes Management Plan and associated Watershed Analysis were written recently enough that direction and potential projects identified are still, for the most part, applicable	Vegetation succession is, replacing early seral stages with later stages. Deflation plain vegetation advancing toward a forested condition. Over time, plant and animal diversity is expected to decline. Plant and animal associations will shift to those favoring later dunes successional stages.	of wetlands and forest. Based on decisions in Dunes Plan, the overall level of recreation use at the Oregon Dunes is expected to increase gradually over time, although use patterns may change. Those plant and animals species tolerant of high levels of human activity over those less tolerant of human disturbance will be favored. Non-native plant communities...

QUESTION #4: What will be the combined and cumulative effects on natural resources from the interaction and increased uses of resources by people on National Forest land, dunes, and lakes?

FINDINGS	CAUSAL ACTIVITY	LOCATION	TREND	RECOMMENDATION
The Coastal Lakes Watershed is highly fragmented in its land management and ownership. It is one of the only coastal watersheds that does not have a watershed council, which could act as a vehicle to share information and coordinate on projects that may benefit the watershed Water quality in the three large lakes will continue to degrade, while the smaller lakes on the Dunes NRA will remain more stable. Wildlife habitat on federal land will improve, especially for late-successional species, while wildlife populations and habitat will decrease on private land.	Steps have not been taken to form a council or join with the Siuslaw Watershed Council. Stake holders are quite diverse and disconnected from each other at this time	Watershed wide	Unknown	Start or join an existing watershed council. Siuslaw Watershed Council has discussed the possibility of incorporating the coastal lakes area and would be open to this request. Protect the ecological value of the lakes on the Dunes NRA by reducing recreation. Use them for monitoring as a "reference condition"--which is lacking in the watershed and on the Coast.

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Dave Beck, Oregon Dunes Nat. Recreation Area employee
Dave Braley, ODNRA employee,
Mark Buerhrig, Mapleton R.D. employee
John Carlson 997-3102
Brian Gray, Camp Cleawox Ranger 997-1069
Harold Grover 997-5986
Merle and Lorraine Worthylake Hansen 997-2564
Bob Jackson 997-3927
Mert Richardson 997-8024
Doug Singer, Camp Baker Ranger 997-3526
John and Joyce Smith, formerly of Fiddle Creek 997-3076
Phyllis Steeves, Siuslaw National Forest Archaeologist
TomTaylor, Mapleton R.D.employee
Van Dyke, ODF&W Charleston, OR

APPENDIX A: TIMELINE OF WATERSHED RESOURCES USE

Year	Native American History and Post-European Settlement	Wildlife Habitat and Terrestrial/Landscape Changes	Aquatic Habitat Lake and River Changes	Roads and Timber
10,000 -6000 BC			Dunes established. Rivers blocked. Coastal lakes formed.	
6000-1000 BC	Occupation of pre-historic village at Tahkenitch landing	Shift toward cool, moist climate. Presumably reduced fire frequency allowed mature western hemlock and redcedr to develop for first time.	Sea level subsides. Whale bones found in historic bay at Tahkenitch landing. Water has since been cut off by moving sand dunes.	
<1800 AD	Ancestors of Confederated Tribes of Coos, Lower Umpqua, and Siuslaw Indians lived in villages at mouths of Coastal streams	Records suggest substantial elk herds in area. Elk and deer used for food and the bones for tools.	Natives caught and collected large quantities of fish and shellfish. Salmon of primary importance.	As a whole the area was little traveled. Willamette Pacific RR tracks laid along east shore of Siltcoos and Tahkenitch Lakes. Count Road from Glenada to Lake Tsiltcoos. County road to Gardiner..
1828	First encounter between Natives and post-European settlers. at Tahkenitch landing.		Tsiltcoos and Tahkenitch Cr. consistently changing their course near mouths due to shifting sand filling up channel	Demand for cedar was high. 25% of timber is cedar in headwaters of Jordan and Prong Cr.
1850s	Post European settlers began moving into the Umpqua Basin. Limited efforts by missionaries in 1840s.	Extensive forest fires. Old-growth remained on north side of Tahkenitch and south side of Siltcoos lakes.. Largest trees were 6-8 feet in diameter. Area around Henderson also retained 200 year old trees.		

Year	Native American History and Post-European Settlement	Wildlife Habitat and Terrestrial/Landscape Changes	Aquatic Habitat Lake and River Changes	Roads and Timber
1855	Siletz Reservation created by Executive Order (1 million acres). Closed coastal area of Oregon to Native Americans from Lookout Point to Tahkenitch Lake outlet. Approximately 3000 Naives on Reservation			
1872	Approximately 200 natives on reservation do to small pox.			
1875	Reservation boundary reduced to area around Siletz. Siuslaw opened to white settlers.			Logging began around the lakes. Trees were logged downhill to the lakes and rafted to shore
1889	First formal census shows 606 natives on the reservation			
1889-1890	Much of the land from Glenada to Woahink Lake homesteaded. Settlers	Settlers found forest regenerating after large forest fires 30 years earlier. Pigeon, grouse, and ducks were plentiful.		
1890		Wind action and dune movement shifted the outlet of Woahink Cr.. from Pacific Ocean to Siltcoos Lake		
1893				First development in Dunes City--a sawmill at Tsiltcoos Lake., south of the present Fish Mill Lodge
1898		Deer beginning to become numerous.		
1907	Siuslaw National Forest created by Executive Order.			

Year	Native American History and Post-European Settlement	Wildlife Habitat and Terrestrial/Landscape Changes	Aquatic Habitat Lake and River Changes	Roads and Timber
1911-1917			Railroad ties floated down Fiddle creek at high water.	Resort operated on Siltcoos Lake
192-s			Large fish hatchery at Harry Cr. Cement dams on Leitel Cr. where Fish Commission collected fish. Aquatic weeds introduced to Tahkenitch Lake.	
1930s-	Dairying predominant industry in small valleys of Maple, Fiddle, and Fivemile Cr. CCC camp on Woahink Lake. CCC improvements at Honeyman Park.		Wetland at Darling's used as pasture.	Mill at Dunes city cut large spruce for airplanes used in World War I.
1933				Tillamook Spruce Veneer Co. builds large mill on pilings above the swamp on Booth Arm. Crown Zellerbach logging camp had 28 family houses, 300 residents, post office, store, hotel, and dancehall.
1940s		Extensive logging in 1930s-40s. Husby (Silver) Creek logged		Floating dancehall with gambling on Tahkenitch Lake. Coal mine near Jordan Creek operated briefly 1940s-'50s.
1943		Loggers wives trapped for a living--muskrats (sold for $4.50 each), mink ($38).	Fiddle, Five-mile, Maple Creek riparian areas dredged and converted to pasture.	Booth arm mill operations stopped and town and mill dismantled.

Year	Native American History and Post-European Settlement	Wildlife Habitat and Terrestrial/Landscape Changes	Aquatic Habitat Lake and River Changes	Roads and Timber
1948				Booth Island sold for $15,000 and logged (estimated one and a half million board feet timbers).
1940s-1950s	Dairying became common in valleys. Main creamery at Cushman.		Soil Conservation Service offered a cost-share service to straighten out creeks to increase pastureland and production.	1900-1950 Several small to medium intermittent mills scattered throughout watershed
1951		144 big trees blew down along Highway 101 between Gardner and Clearlake (Woahink).		
1959	Senator Newberger presented Dunes Bill to Congress by which the "spectacular lake country" from the Siuslaw River to Coos Bay would become a National Park. Residents of Lane County bitterly opposed bill.			
1960s			International Paper Company of Gardiner dammed Tahkenitch and Tsiltcoos outlets (1963).	Last of the logging of old-growth--some from Fivemile Cr. US Forest Service intensities road building and logging.
1962				Columbus Day Storm created considerable blowdown. XXX acres salvaged logged on Forest Service land.
1963	Dunes City incorporated (population 676).			

Year	Native American History and Post-European Settlement	Wildlife Habitat and Terrestrial/Landscape Changes	Aquatic Habitat Lake and River Changes	Roads and Timber
1968				Bell Divide Road focus of the controversy over road building on Mapleton District. Winter storms resulted in steep headwall failures.
1970s	Some dairy farmers s sold farms to Davidson Industries, but continued to lease the farm on 20 year contracts.			Logging suspension improved and increased logging on steep terrain on US Forest Service land.
1972	Oregon Dunes National Recreation Area created by US Congress.			
1980s	Many dairy farmers switched to beef operations.			
1998		Mouths of Siltcoos River and Tahkenitch Cr. Subject to becoming barbound in fall, increasing brackish water in estuaries (especially Siltcoos)		

APPENDIX B: HISTORIC LAND CLASSIFICATION

by Lawrence B. Pagter, 1917

T 18 S, R 10 W (In Watershed is 1 small piece, about 200 ac, at the headwaters N. Prong) Section 31.

"The age of the second growth varies from 10 to 60 years or more. There is quite a little dead cedar, both standing and down, which might be disposed of in the near future, as the demand for cedar is becoming more urgent. The area is very brushy throughout, with salal and fern predominating."

T 18 S, R 11 W (In Watershed are 2 Small pieces, about 100 ac each, at the headwaters Jordon Creek and headwaters N. Prong) Sections 34, 35, 36.

Land Classification of township

9,106 national forest land, (8,696 ac of timberland with 52,220 MBM and 410 ac of

woodland with 1,250 MBM.)

"The timberland belongs to the DF type, 2nd growth about 30 - 40 years in age and very dense in places. This area was thoroughly burned over and countless snags and down logs are found as testimonials of the havoc wrought by the fires of the past. Some dead cedar, both standing and down , is found and comprises bout 25% of the estimate given about under "Timber land". The 2nd growth is not merchantable at the present time as the mills have been cutting the old growth. The country is very brushy throughout and is almost impenetrable. Along the creeks and draws, alder, vine maple and other brush occur. This cover is also found on the hills but reproduction, mostly Douglas fir, is restocking these areas, so that they are virtually of the fir type

T 19 & 20 S, R 12 W Woahink, Siltcoos, Tahkenitch Lakes

These townships abut the Pacific Ocean and with the exceptions of Sections 13 & 24, they lie in the sand belt area along the ocean. As a whole these areas are but little traveled. A county road goes from Glenada to Lake Tsiltcoos, thru T. 19 s., R. 12 W. Vehicles can travel along the beach at low tide and this used to be a stage coach line from Florence to parts south. The Willamette Pacific Railroad passes along the east shore of these two lakes. West Lake, at the outlet of Siltcoos, is a post office and was becoming a well known summer resort.. Thru the east part of sect. 24, T. 20S., R. 12 W. The county road to Gardiner is found (49 rd).

II. History & III. Land Classification

About 69% of these townships were classified by the Secretary of Agriculture as chiefly valuable for forestry. (12,137 ac total within National Forest boundary):

8,215 National Forest Land

1,826 ac timberland with 30,330 MBM,

6,283 ac "barren land-shifting sands, nonvegetated".

106 ac left for intensive classification

Within Forest, Agricultural development is practically nil, even though over 2300 acres were alienated as homestead claims, the only evidences of settlement are a few old cabins on a few of the claims, which have little done in an agricultural way. These homesteads do include the best lands for future agricultural value (on the edge of the sand belt and have better soil qualities.)

Section 13 & 24 are distinctly different from the other areas. They are rough and hilly and are cut up by a series of ridges and draws. The north portions drain into Tsiltcoos & the south into Tahkenitch Lake, slopes range from 30 - 70 % +. These areas are heavily timbered.

The other sections are level stretches of sand or irregular sand hills from sea level to an elevation of 150' or more with steep slopes on the lee side and gentle slopes on the windward side.

Tsiltcoos & Tahkenich creeks are constantly changing their courses near their mouths on account of the shifting sands filling up their channels.

The sand was considered of no value for agriculture and it was considered essential to "reclaim this wasteland thru reforestation, to retard the invasion of the drifting sands from the west."

VI. Forest Values

Sections 13 & 24 are covered with a stand of old growth fir and spruce with second growth fir well established throughout. There is also a small area of mature spruce in the SE corner of Section 32. Other timbered areas are composed of rather scrubby fir, lodgepole pine and spruce, between 20 - 80 years old. It was theorized that the big fires resulted in this barren sand ands scrubby trees. Timbered areas are also covered with dense almost impenetrable brush.

TOWNSHIP 19 SOUTH, RANGE 11 WEST (Lower Maple Creek and Bear Creek)

Canary is a small station along the Willamette Pacific Railroad. Access includes the Glenada-Gardiner county road, the Maple Creek Road, the Fiddle Creek road

and a settler's trail from Maple over the divide to Bear Creek to a passable road to Fiddle Creek road. This township is fairly well traversed by roads and trails, all of which are difficult to travel over in heavy rains. "The Maple Creek and Fiddle Creek settlements are two of the best communities within this Forest. (mostly bottomlands) Dairying is the chief industry and several fo the place hvave between 14 & 20 milk cows. Some beef, a few goats and shepp are also raised for outside markets. Hay is raised for local consumlption.

Classification: 10,165 acres National Forest land (8,564 acres timberland with 81,750 M'B.M. and 1,121 acres of woodland with 3,360 M'B.M. and 480 acres in need of further examination.)

The topagraphy of the vacant lands is exceedingly steep. The area of bottomlands along the small creeks is negligible. These bottoms never exceed 2 chains in width and are generally 1/2 to 1 chain. the the streams practically take up all of the arable lands along them during the high waters of the winter months. But few benches occur, which are scattered and not readily accessible and furthermore are small in area, from 2 - 10 acres, a few as high as 20 acres but these are heavily timbered.

Little rock was found and outcrops are few. Clay loam.

Forest Values:
"A good body of second growth fir is found in the north sections (Henderson area?), some of which will runs as high as 50 to 60 M feet B.M. per acre and which is between 100 & 200 years in age." The rest of the township runs between 20 and 80 years in age. South of Maple Creek fir reproduction is well established. Dead, standing and down cedar comprise about 40 percent of the total estimate for the township, and it is probable that this will be disposed of within the next few years as the demand for cedar shingle, posts, grapevine stakes, poles etc is becoming more and more urgent. A 6 shingle machine is under construction at Lane. The woodland type consists of alder with vine maple, salmonberry, fern and salal densely intermixed. This is virtually a fir type and is restocking to Douglas-fir with an occasional cedar, hemlock and spruce.

TOWNSHIP 19 SOUTH, RANGE 10 WEST (Within this Watershed includes the Headwaters of Maple Creek and Headwaters of Bear and of Fiddle Creeks.) Sections 5,6,7,8,17,18,19,20,29,30,31.

The Wildcat/Glenada county road traverses the north portions of this township. Canary is a shipping point on the Willamette pacific.

18,545 acres National Forest Land: 17,129 ac timberland of 87,680 MBM., 1,256 ac woodland w/ 3,770 MBM. This township belongs to the DF type, 2nd growth fir with some cedar and hemlock. Age varies 10 - 80 yrs old. The average stand is about 5 MBM/acre. This area is part of a burn of several decades ago and innumerabe snags both standing and down testify to this, but is becoming well stocked. Dead cedar, down and standing, that is still merchantable is found. Woodland consists of alder, vine maple and brush.

TOWNSHIP 20 SOUTH, RANGE 11 WEST: Includes part of lower Fiddle, 5-mile and Bell, Perkins, and Leidle.

A wagon road follows up 5-mile creek for about 4 miles. An old unused trail leads from Smith River to Five Mile Creek and another trail also extends from 5-mile to Fiddle Creek. 5-mile contains agricultural development. National Forest Service Land 7,123 acres: 7,213 ac timberland of 69,800 MBM.

Forest Values: Old growth fir which escaped the fires of the past are found in places from 10 - 40 acres in extent. Its age is over 200 years. The reproduction on those areas is fir with occasional hemlock and cedar. The whole township is restocking well with 2nd growth fir. In places dense with 2-10 MBM per acre or better. Its age ranges from 10 - 80 years old in good condition. The brush is dense throughout and consists of fern, salal, huckleberry, salmonberry, thimbleberry, hazel, vine maple, etc. Alder throughout, esp along streams and draws.

TOWNSHIP 20 SOUTH, RANGE 10 WEST: Only about 40 acres in Harvy Creek in Lake WA

APPENDIX C -- ROAD TREATMENT AND FUTURE THINNING RECOMMENDATIONS

Road conditions, problems, and plantation acres by Forest Road. Plantations with patchy or low stocking density are not expected to require thinning within the next 20 years. Road closures are as directed in Forestwide Access & Travel Management (ATM) Plan.

Forest Road Number	Plantation acres ready for thinning in next 1-5 years, stocking density, and silviculture priority	Plantation acres ready for Thinning in 5-20 years or low stocking	Waterbars previously placed or needed now & road closure recommendations	Culvert Problems Identified in Roads Assessment	Road Topo-graphic Position
2400	184 ac - densely stocked, high priority 18 ac - densely stocked, medium priority	182 ac-≈ year 2010	ATM Road --primary use/maintenance	Fish passage problem (48") on Carter Cr. at MP 10.8 5 partially plugged culverts need maintenance	2/3 Mid-slope, 1/3 Ridgetop
2400-888	None	1 medium priority unit in Lower Siuslaw watershed. 12 acres patchy stocking			3/4 Ridgetop, 1/4 midsl.
2400-889	None	Partial access to patchy stocking unit on spur -888	Recommend waterbar and close	None	Midslope
2400-950	47 ac densely stocked, medium priority	151 ac ≈ year 2020	Recommend waterbar	None	2/3 Ridge 1/3 Midsl
2400-951	None	Partial access to unit on spur road 950	Recommend waterbar and close	None	Midslope
2400-952	15 ac - densely stocked, high priority	None	Previously waterbarred	None	Midslope
2400-949	Partial access above unit	Partial access to above 14 ac unit	Not previously waterbarred	None	Ridgetop
2400-937	None	Partial access to above unit	Recommend waterbar and close	None	midslope
2400-948	81 ac - densely stocked, high priority	20 ac patchy, low stocking	Recommend waterbars (will use road in 5 yrs.)	None	1/2 Ridgetop

	21 ac - densely stocked mediu priority				1/2 Midslope
2400-944	17 ac - densely stocked, medium priority	Partial access to 90 ac unit above	Previously waterbarred	None	Ridgetop
2400-953 Canary Road	None	3 units in Lower Siuslaw watershed	Previously waterbarred	3 partially plugged culverts at MP 1.0. Access from Canary Rd.	Predom. Ridgetop
2490 Henderson Tie Rd.	70 ac - densely stocked, high priority 143 ac - densely stocked, medium priority	Possible second thinning on Henderson units. 55 ac patchy and low stocking	None	3 partially plugged culverts. One completely plugged culvert with water diversion potential at MP 1.14	Midslope
2490-947 Henderson Spur	88 ac - densely stocked, high priority 58 ac densely stocked, medium priority	10 ac ≈ year 2010 100 ac low stocking	Previously waterbarred	2 partially plugged culverts on spur 947. Water diversion potential at MP 0.7	Midslope
2490-946 Henderson Spur	31 ac - densely stocked, high priority 25 ac - densely stocked, medium priority	30 ac ≈ year 2023 40 acres low priority and priority	Previously waterbarred Close for wildlife	3 partially plugged culverts on spur 946	Midslope
2480 Sunset Road	79 ac - densely stocked, high priority	149 ac ≈ year 2020 40 ac low priority and stocking	ATM Road --secondary use/ maintenance	None	1/2 Midsl. 1/2 Ridge
2480-935	None	101 ac ≈ year 2025	Recommend waterbar and close. Close for wildlife		3/4 Ridge 1/4 Midsl
2480-938	None	77 ac ≈ year 2010 Partial access to 2025 unit	Recommend waterbar *7 ac PROGENY SITE*	1 partially plugged culvert with water diversion potential	Ridgetop
2480-939?	None	1 unit ≈ year 2010	Previously waterbarred	None	Midslope
Road 4830 Mt. Popo Road	50 ac - densely stocked, high priority 203 ac - densely stocked, medium priority	41 ac ≈ year 2020 210 ac patchy stocking, low priority	ATM Road	None	Ridgetop

4830-958	143 ac - densely stocked, high priority 40 ac - densely stocked, medium priority	100 ac ≈ year 2010 120 ac ≈ year 2010 (although patchy) 65 ac low priority	Recommend waterbar Close for wildlife	None	Ridgetop
4830-961	None	15 ac ≈ year 2010 Partial access to large unit about year 2020	Recommend waterbar and close	None	Ridgetop
4830-962	None	60 ac ≈ year 2010	Recommend waterbar and close. Close for wildlife	None	Ridgetop
4830-963	None	50 ac ≈ year 2010	Recommend waterbar and close. Close for wildlife	None	Midslope
4830-964	None	Shares units with Spur 963	Recommend waterbar and close. Close for wildlife	1 culvert partially plugged with water diversion potential	Ridgetop
4830-965 (Private Access to Fiddle Cr.)	None (Use Spur-958)	22 ac ≈ year 2010	Recommend waterbar upper road segment	None	Ridgetop on USFS
4830-967	None	20 ac ≈ year 2020	Recommend waterbar and close. Close for wildlife	None	Ridgetop
4830-968	Shares densely stocked, medium priority unit with Road 4830	None	Recommend waterbar	None	Ridgetop
4830-969	Shares densely stocked, medium priority unit with Road 4830	132 ac ≈ year 2010	Recommend waterbar	None	Ridgetop
4830-970	Shares densely stocked, high priority unit with Road 4830	35 ac ≈ year 2010	Recommend waterbar	None	Ridgetop
4830-971	None	44 ac ≈ year 2010 52 ac patchy, low priority units	Recommend waterbar and close. Close for wildlife	None	Ridgetop
4830-972	None	118 ac ≈ year 2010	Recommend waterbar and close with Spur 971 Close for wildlife	None	Ridgetop

4830-975	Shares densely stocked, medium priority unit with Road 4830	None	Recommend waterbar	None	Ridgetop
4830-977	None	106 ac ≈ year 2010	Recommend waterbar and close. Close for wildlife	None	Ridgetop
4830-980	38 ac densely stocked, medium priority unit	18 ac ≈ year 2010 25 ac ≈ year 2020	Recommend waterbar Close for wildlife	None	Midslope
Unnamed spur off 4830-980	None	56 ac ≈ year 2010	Recommend waterbar	None	Midslope
4830-981	Shares densely stocked, medium priority unit with Spu 980	134 ac ≈ year 2010	Recommend waterbar	2 partially plugged culverts One has unspecified proble	Midslope
4830-979	None	Partial access to a unit 2010	Close lower road after treating Spur -980 Close for wildlife	None	Midslope
4830-978	None	Partial access to a unit about year 2010	Recommend waterbar and close	None	Ridgetop Midslope
4830-982	None	179 ac ≈ year 2010	Recommend waterbar and close. Close for wildlife	None	Ridgetop
4830-983	None	13 ac ≈ year 2010.	Recommend waterbar and close with Spur 982	None	Ridgetop
4830-984	None	Partial access to one of the units off spur 982	Recommend waterbar and close with Spur 982 Close for wildlife	None	Ridgetop
4830-990 ?	None	39 acres ≈ year 2025 (Sugar Maple)	Recommend waterbar and close	None	Ridgetop
Rd 4811	114 ac densely stocked, high priority 37 ac densely stocked, medium priority	50 ac ≈ year 2010 189 ac ≈ year 2015 117 ac patchy or low priority	ATM Secondary-High Clearance	1 partially plugged culvert at MP 3.09 with water diversion potential	Ridgetop
4811-957	None	46 ac ≈ year 2010	Recommend waterbar and close	1 partially plugged culvert with water diversion	Midslope

				potential. 1 culvert with problem (not specified)	
4811-956?	None	20 ac ≈ year 2010 102 ac patchy stocking	Recommend waterbar and close	1 culvert with problem (unspecified) and water diversion potential.	Midslope
4811-036	51 ac - densely stocked, high priority unit 23 ac densely stocked, medium priority unit	45 ac low priority, patchy stocking may thin after year 2010	Previously waterbarred	None	Ridgetop
4811-038	Shares densely stocked, high priority unit with -036 spur	None	Previously waterbarred	None	Ridgetop
4811-039?	None	None	Previously waterbarred	None	Ridgetop
4811-040	None	73 ac ≈ year 2010 17 ac ≈ year 2020	Previously waterbarred	None	Ridgetop
4811-041	None	20 ac ≈ year 2010	Previously waterbarred Recommend close Close for wildlife	None	Ridgetop
Unnamed spur off 4811-036	None	110 ac ≈ year 2010	Recommend waterbar and close Close for wildlife	None	Ridgetop
4811-042	Shares densely stocked, medium priority unit with Rd 4811	Partial access to above 110 ac unit. 12 ac patchy stocking possible thin after 2010	Previously waterbarred	None	Ridgetop
4811-044	None	None	Recommend waterbar and close	None	Ridgetop
4811-011	None	Possibly one unit about year 2010 (low stocking)	Previously waterbarred	One culvert problem (not specified)	Ridgetop
Unnamed spur off 4811-011	None	None	Recommend waterbar and close	None	Midslope
Road 4900	none	30 ac ≈ year 2015			Midslope

FS portion		27 ac patchy, low stocking			here
4900-057	None	143 ac ≈ year 2010	Recommend waterbar lower 1/3 of the road	6 partially plugged culverts (?)	Ridgetop
4900-056	None	Shares units with Spur 4900-057	Recommend waterbar and close	None	Ridgetop
4900-063	63 ac - densely stocked, medium priority unit	62 ac ≈ year 2015	Recommend waterbar	May be private road	Midslope
4900-059		20 ac dense lodgepole pine ≈ year 2010			Mostly Ridgetop
4900-060	None	Partial access to above unit	Waterbar USFS road segment	None	Ridgetop

APPENDIX D -- STAND HISTORY AND CWD MANAGEMENT

Tri Card	Tri Cell	Acres	Year of Origin	Timber Type Sold	mbf/ac Sold	Aspect	Burn Intensity	Owl/Mur Priority	Stocking Density-Priority
2261		50	1945	Unknown	80	S	Low		Untyped
2261		15	1945	238DF,.13C,126H	24	S (Cr.)	Low		Untyped
2261	48,63,96	96	1946	12,003	125	NE-E,WW,R	Low	M/L	partly CT in1985
2261	71,59,63	88	1948	Unknown	17	W,W,NE	Low	M/L	partly CT in1985
2261		30	1949	Unknown	63	W	Low		Untyped
2261		33	1949	2275DF,30C,328H	80	S (Cr.)	Low		Untyped
2261	53	26	1950	2895DF,2SS,42C,430H	130	N-NE	Low	H/H	Dense, High P
2261	111 (part)	20	1950	2OG,633DF,.25SS,10C,22H	33	W	Low	H/H	Untyped
2261		31	1952	1190DF,.26SS,9C,295H	48	S	Low		Untyped
2261		27	1952	1209DF,19,C,422H	61	E	Low		Untyped
2264	46	34	1974			NE	ridge not burned	H/L	Untyped
2266	20	133	1974			N,W,S	High	H/M	Untyped
2261	27	60	1974				High	H/H	Untyped
2263	23	77	1974			--	High	H/M	Untyped
2263	19	56	1975		unknown	E	High	H/H	Untyped
2265	4	40	1975			S	High	L/L	Untyped
2266	12	75	1975			W	High	H/H	Untyped
2266	13	20	1975			S	High	H/H	Untyped
2261	83	--	1976		unknown	E	High	H/M	Untyped

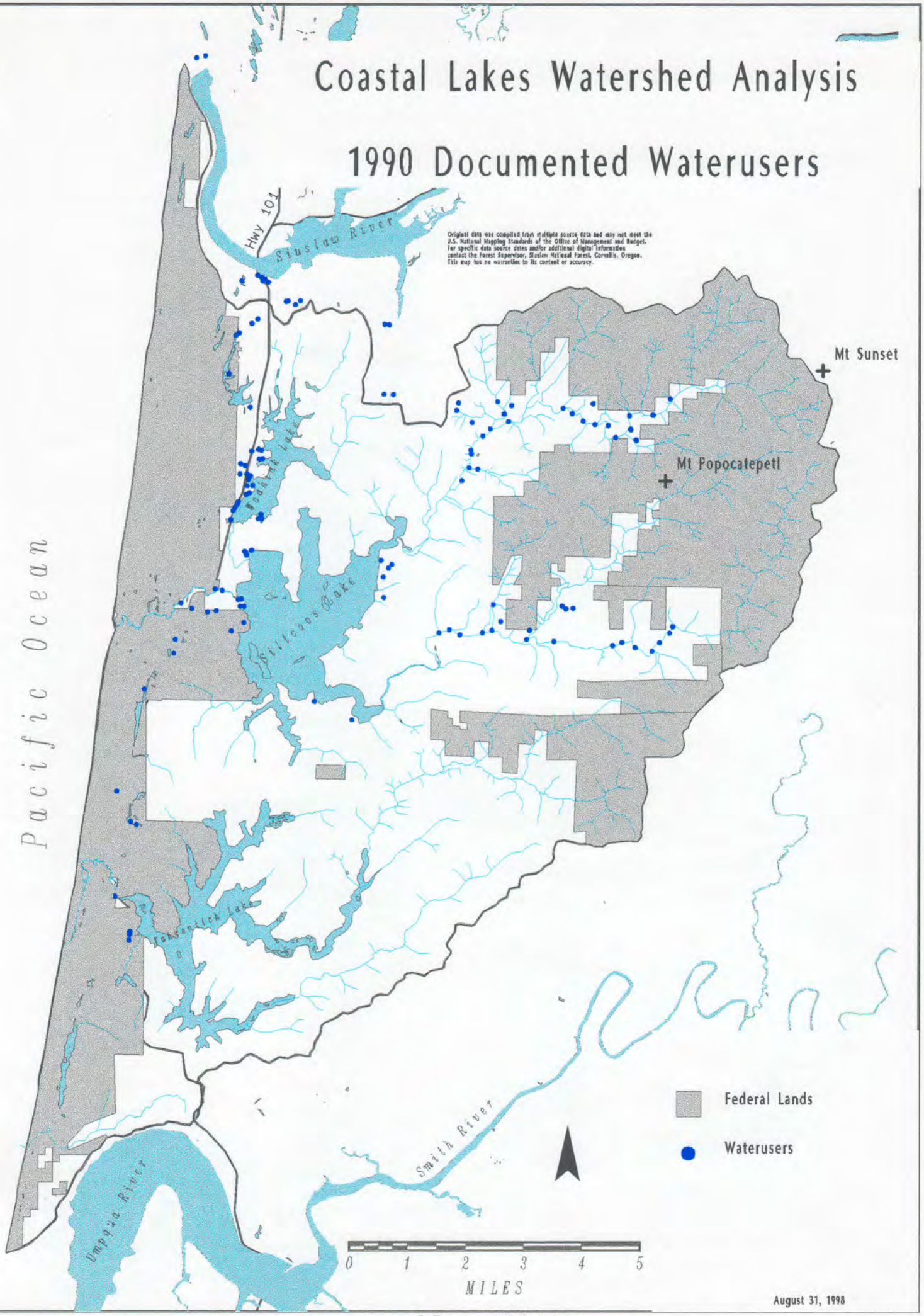
2262	14	90	1976			SW	High	H/L	Untyped
2261	54	--	1977		unknown	S	High	H/M	Untyped
2261	21	29	1977				High	L/L	Untyped
2262	20	39	1977			E	High	H/L	Untyped
2262	21	40	1977			W	High	H/L	Untyped
2261	19,20	--	1978		unknown	R	High	L/L	Untyped
2261	86,87,88	--	1978		unknown	S,W	High	H/M	Untyped
2261	77	134	1978				High	H/H	Untyped
2264	57	16	1978			S	High	H/M	Untyped
2264	58	40	1978			N	High	H/M	Untyped
2264	41	50	1979		unknown	W	High	H/M	Untyped
2264	42,43	60	1979		unknown	S	High	H/M	Dense-H, PrevThinned
2264	8	44	1979			N	High	H/H	Untyped
2264	24,25,26,60	49	1979			N	High	M/M	Untyped
2264	29	50	1979				High	M/M	Untyped
2264	28	78	1979			N	High	H/M	Untyped
2264	32	43	1979			NE	High	M/M	Untyped
2265	8	74	1979			NW,SE	High	L/L	Untyped
2265	1,2	88	1980			SE, W	no burn	L/L	Untyped
2265	13	20	1980			SE	High	L/L	Untyped
2262	13	7	1982		unknown	SE	Rdg L, TopH	H/L	Dense-M
2262	17,18	101	1982		unknown	NW-SW	MostH,EdgesM	H/M	Dense-H, Prev.Thinned
2263	48	2	1982		unknown	W	No Burn	L/L	
2262	29	83	1982		unknown	NW	MostH, Edges M	L/L	Low Stocking
2264	45	18	1982			E	no burn	H/L	Untyped
2264	54	10	1982			NW	no burn	L/L	Untyped

2264	62	5	1982			NW,NE	no burn	M/M	Untyped
2265	66	16	1983			N	High		Untyped
2266	39	19	1983			S	High	H/H	Untyped
2266	30	14	1985			NE,SW	High	H/M	Untyped
2262	45	41	1989	31DF,8H,3.5C		N	High	H/H	Untyped
2262	43	37	1989	68, 1.1 OG	68	N,SW	Low	H/L	Untyped
2262	48	40	1989	52DF,10C,7H	62	S,W	Low	H/L	Untyped
2261	102	--	1991	38DF,12H,1C		W	Low	H/L	Untyped
2261	104,107	17	1991				Low	L/L	Untyped
2261	109	41	1992				Low	H/M	Untyped
2261	108	--	1994		unknown	S	Low	H/H	Untyped
2261	110	--	1994		unknown	SW	Low	H/H	NA
2261	112	--	1996		unknown	E	Low	H/M	NA
2262	49,50	--	--	--	--	--	Low	H/M	Untyped
2264	9	44				S	Low	H/M	Untyped

APPENDIX E: WATER USERS

Coastal Lakes Watershed Analysis

1990 Documented Waterusers



APPENDIX F: STREAM GEOMORPHIC SEGMENTS

The processes that affect stream function are directly related to channel gradient and confinement of that channel by the surrounding hill slopes. As shown in Map X (Geomorpgic Segments) streams in the analysis area were separated into geomorphic segments (Appendix (?) that help to explain how water, wood and substrates move through the watershed (Montgomery and Buffington, 1993). In general, source reaches are where material comes from, transport reaches move material through and deposition reaches represent areas where material is deposited. Knowing where each of these geomorphic segments are located in the watershed can allow resource managers to know where highest potential for various fish habitats are located and, if needed, where restoration efforts can be focussed to be most successful.

Source reaches have gradients greater than 8% and are either confined or moderately confined. These reaches are generally 1st and 2nd order streams (class 4) that flow intermittently but respond quickly to storm events and are subject to periodic scour by debris torrents. Being confined and moderately confined, adjacent hill slopes are directly connected to the channel. Under natural conditions, these segments are important sources of cool water and pulses of substrates and wood to the rest of the stream system. Aquatic habitat is generally limited due to the steep, episodic nature of these areas, but cutthroat trout and steelhead do use lower portions for spawning, and cutthroat trout may remain as residents in some of these areas. Over 80% of streams in the analysis area are classified as source segments.

Transport reaches range from 4-8% and are confined or moderately confined. They are generally 2nd and 3rd order streams (classes 2 and 3) with perennial flow. Storage of substrates and wood in these reaches is only temporary until the next high intensity storm produces flow sufficient to move material to segments lower in the system. These reaches are relatively resistant to long term geomorphic change caused by wood and substrate inputs because of their transitory nature, but aquatic species tend to respond to these temporary accumulations. These areas are most frequently utilized by cutthroat and steelhead, although coho will spawn and rear here as long as jams exist to trap gravel and provide cover.

Deposition reaches have gradients less than 4% and are moderately confined or unconfined. Although most typical deposition reaches are less than 2%, deposition areas from 2-4% serve as transitional areas from transport reaches. Found lower in the watershed in both tributaries and mainstems, these deposition reaches are usually 3rd order or greater (classes 1 and 2) and experience significant changes in morphology as wood and substrates are deposited from upstream. If functioning properly, moderate deposition reaches have good interaction with their floodplain during high flow events and can shift laterally to create long term storage areas for substrates and wood. Gravels accumulated in these areas can provide excellent spawning and rearing habitat for coho, and steelhead.

APPENDIX G -- WETLAND CLASSIFICATIONS

This is a breakdown of systems, subsystems, classes and subclasses of wetlands and deepwater habitats by acres after classification done by Cowardin, et al, 1979 for the coastal lakes watershed analysis area, Mapleton District, Oregon.

Estuarine - Deepwater habitats and adjacent tidal wetlands that are usually semienclosed by land but have open, partly obstructed, or sporadic access to the open ocean , and in which ocean water is at least occasionally diluted by fresh water runoff from the land.

On Map 8, Estuarine includes:	Acres
Estuarine, subtidal, unconsolidated bottom	19
Estuarine, intertidal, emergent, regularly flooded	12
Estuarine, intertidal, unconsolidated shore, regularly flooded	22
Estuarine, intertidal, unconsolidated shore, irregularly flooded	13

Lacustrine - Wetlands and deepwater habitats with all of the following characteristics: (1) situated in a topographic depression or a dammed river channel; (2) lacking trees, shrubs, persistent emergents, emergent mosses or lichens with greater than 30% aerial coverage; and (3) total area exceeds 20 acres.

On Map 8, Lacustrine, limnetic includes:	Acres
Lacustrine, limnetic, unconsolidated bottom, permanently flooded	4,012
Lacustrine, limnetic, unconsolidated bottom, permanently flooded, diked/impounded	1,635

On Map 8, Lacustrine, littoral includes:	
Lacustrine, littoral, aquatic bed, permanently flooded	104
Lacustrine, littoral, aquatic bed, permanently flooded, diked/impounded	171
Lacustrine, littoral, unconsolidated bottom, permanently flooded	22
Lacustrine, littoral, unconsolidated shore, temporarily flooded	45
Lacustrine, littoral, unconsolidated shore, seasonally flooded	32
Lacustrine, littoral, unconsolidated shore, seasonally flooded, diked/impounded	7

Marine - Open ocean overlying the continental shelf and its associated high-energy coastline.

On Map 8, Marine, intertidal includes:	
Marine, intertidal unconsolidated shore, regularly flooded	24
Marine, intertidal unconsolidated shore, irregularly flooded	123

Palustrine - Nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean derived salts is below 5%.

On Map 8, Palustrine, aquatic bed includes:	Acres
Palustrine, aquatic bed, permanently flooded	21

On Map 8, Palustrine, emergent vegetation, permanently and semi-permanently flooded includes:

Palustrine, emergent, semipermanently flooded	123
Palustrine, emergent, semipermanently flooded, beaver	12
Palustrine, emergent, semipermanently flooded, diked/impounded	46
Palustrine, emergent, permanently flooded	94
Palustrine, emergent, permanently flooded, diked/impounded	230
Palustrine, emergent, regularly flooded	10
Palustrine, emergent, seasonal tidal	1

On Map 8, Palustrine, emergent vegetation, flooded part of the year includes:

Palustrine, emergent, temporarily flooded	512
Palustrine, emergent, seasonally flooded	414
Palustrine, emergent, seasonally flooded, beaver	14
Palustrine, emergent, seasonally flooded, diked/impounded	7

On Map 8, Palustrine, forest, scrub, shrub, flooded part of the year includes:

Palustrine, forested, temporarily flooded	80
Palustrine, forested, saturated	<1
Palustrine, forested, seasonally flooded	258
Palustrine, forested, seasonal tidal	2
Palustrine, scrub/shrub, temporarily flooded	55
Palustrine, scrub/shrub, saturated	<1
Palustrine, scrub/shrub, seasonally flooded	1546
Palustrine, scrub/shrub, seasonally flooded, beaver	11

On Map 8, Palustrine, unconsolidated bottom, permanently and semipermanently flooded includes:

Palustrine, unconsolidated bottom, semipermanently flooded	2
Palustrine, unconsolidated bottom, permanently flooded	49
Palustrine, unconsolidated bottom, permanently flooded, beaver	2
Palustrine, unconsolidated bottom, permanently flooded, diked/impounded	15
Palustrine, unconsolidated bottom, permanently flooded, excavated	<1

On Map 8, Palustrine, unconsolidated bottom, flooded part of the year includes:

Palustrine, unconsolidated shore, temporary flooding	74
Palustrine, unconsolidated shore, seasonal flooding	54

Riverine - Wetlands and deepwater habitats contained within a channel (open conduit, either natural or manmade), with two exceptions: (1) wetlands dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens, and (2) habitats with water containing ocean derived salts in excess of 5%.

On Map 8, Riverine, tidal includes:	Acres
Riverine, tidal, unconsolidated bottom, permanently tidal	32
Riverine, tidal, unconsolidated shore, regularly flooded	6
Riverine, tidal, unconsolidated shore, seasonally tidal	12

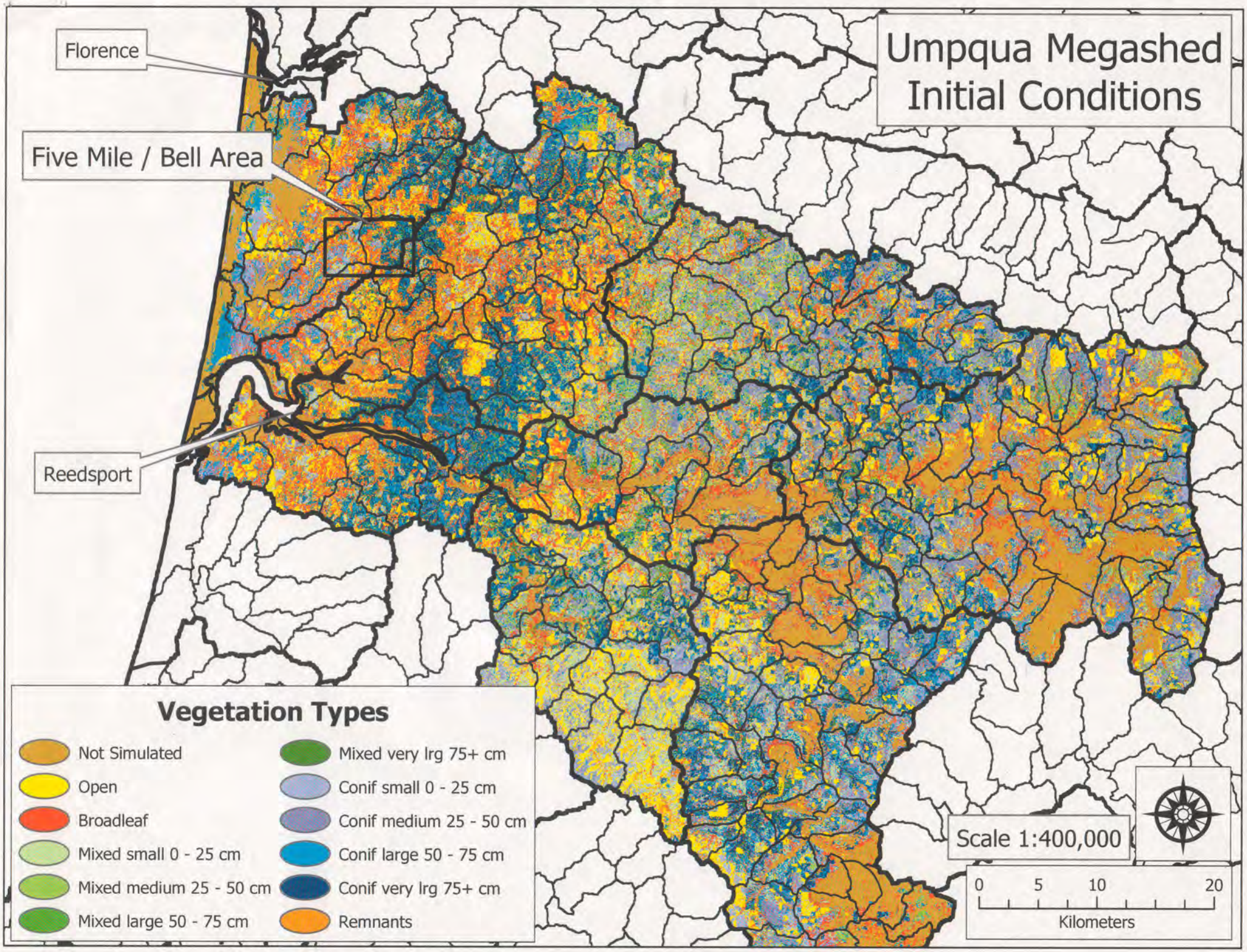
On Map 8, Riverine, low gradient includes:

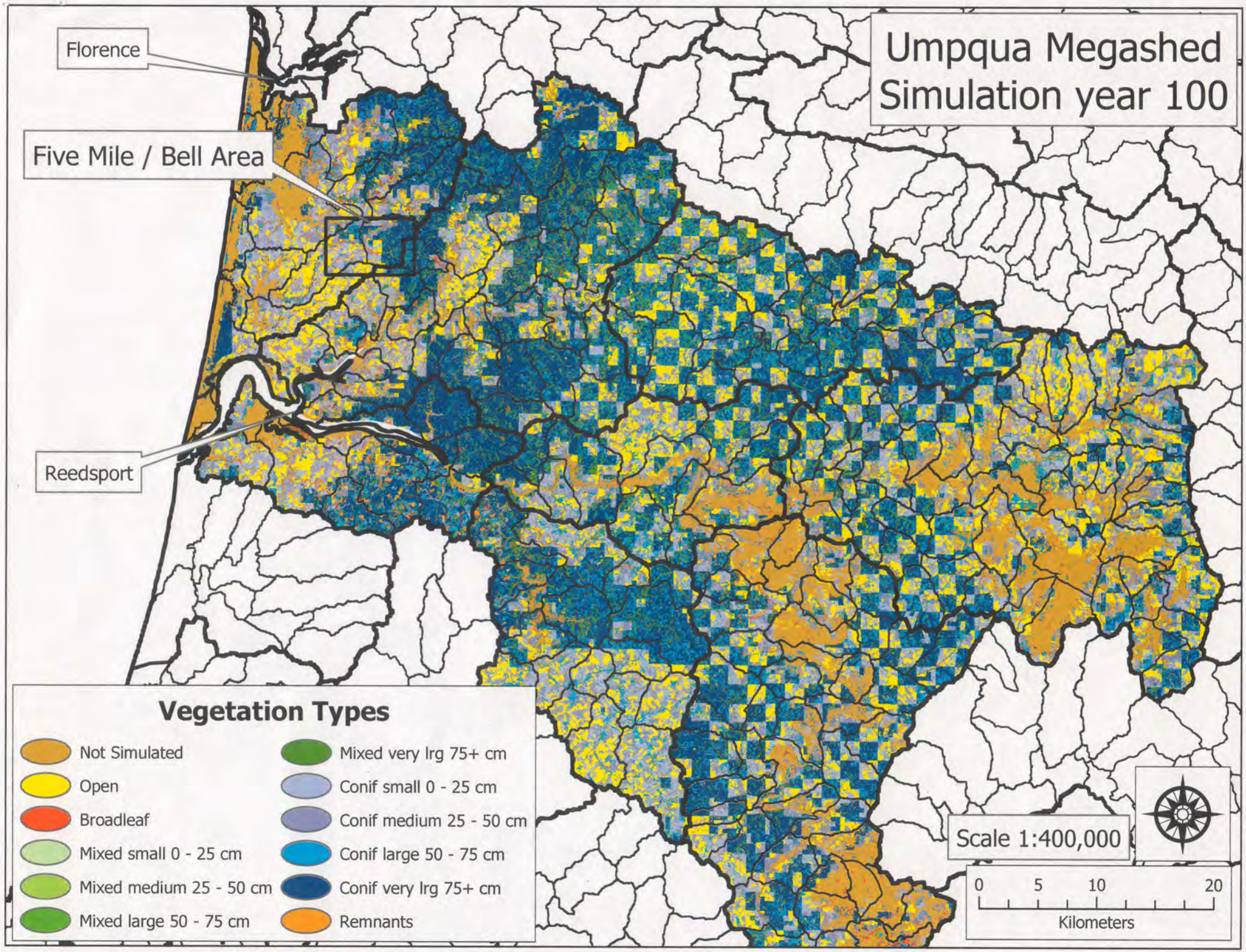
Riverine, lower perennial, aquatic bed, permanently flooded	5
Riverine, lower perennial, unconsolidated bottom	15

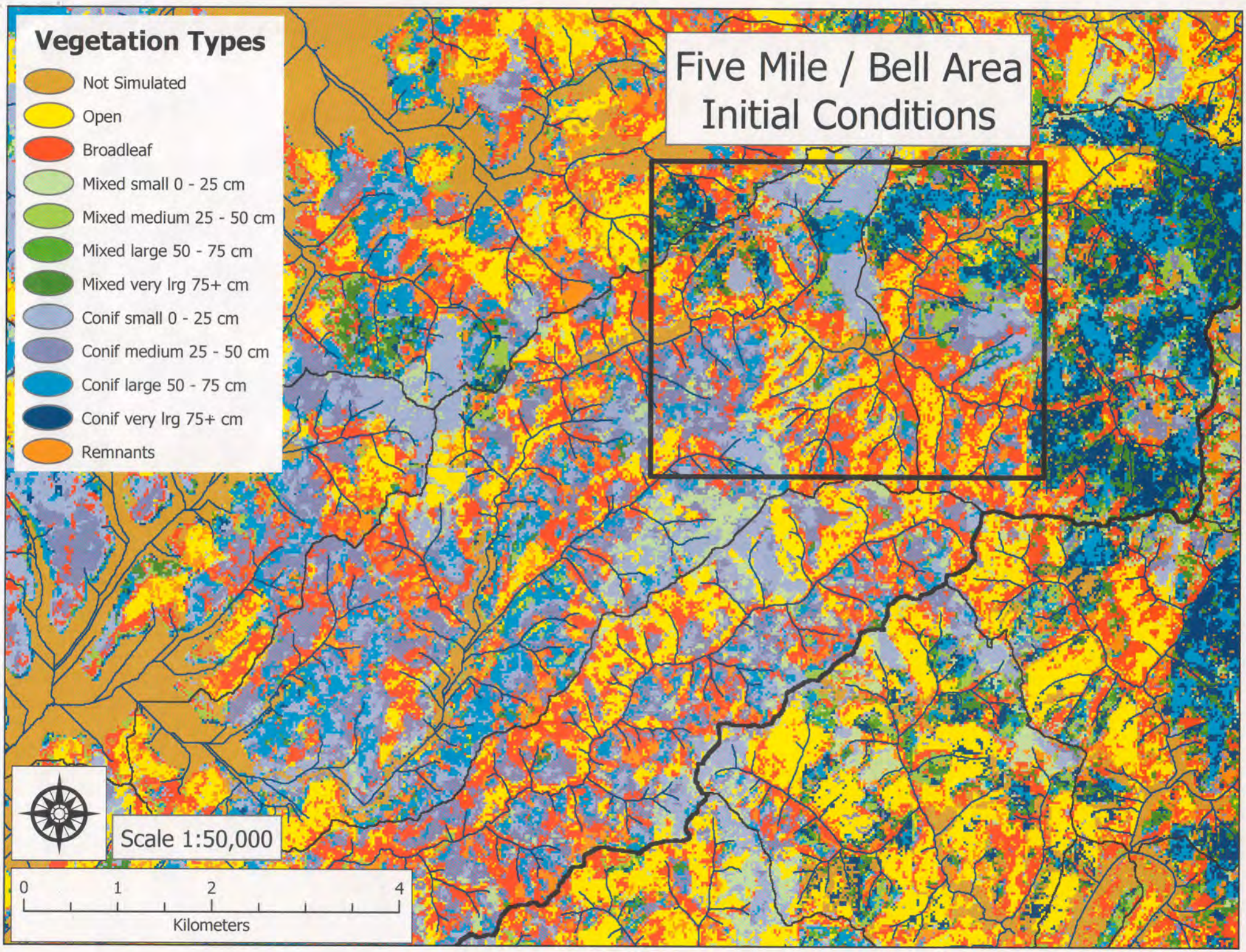
Riverine, lower perennial, unconsolidated shore, temporarily flooded	2
Riverine, intermittent, streambed, seasonally flooded	6

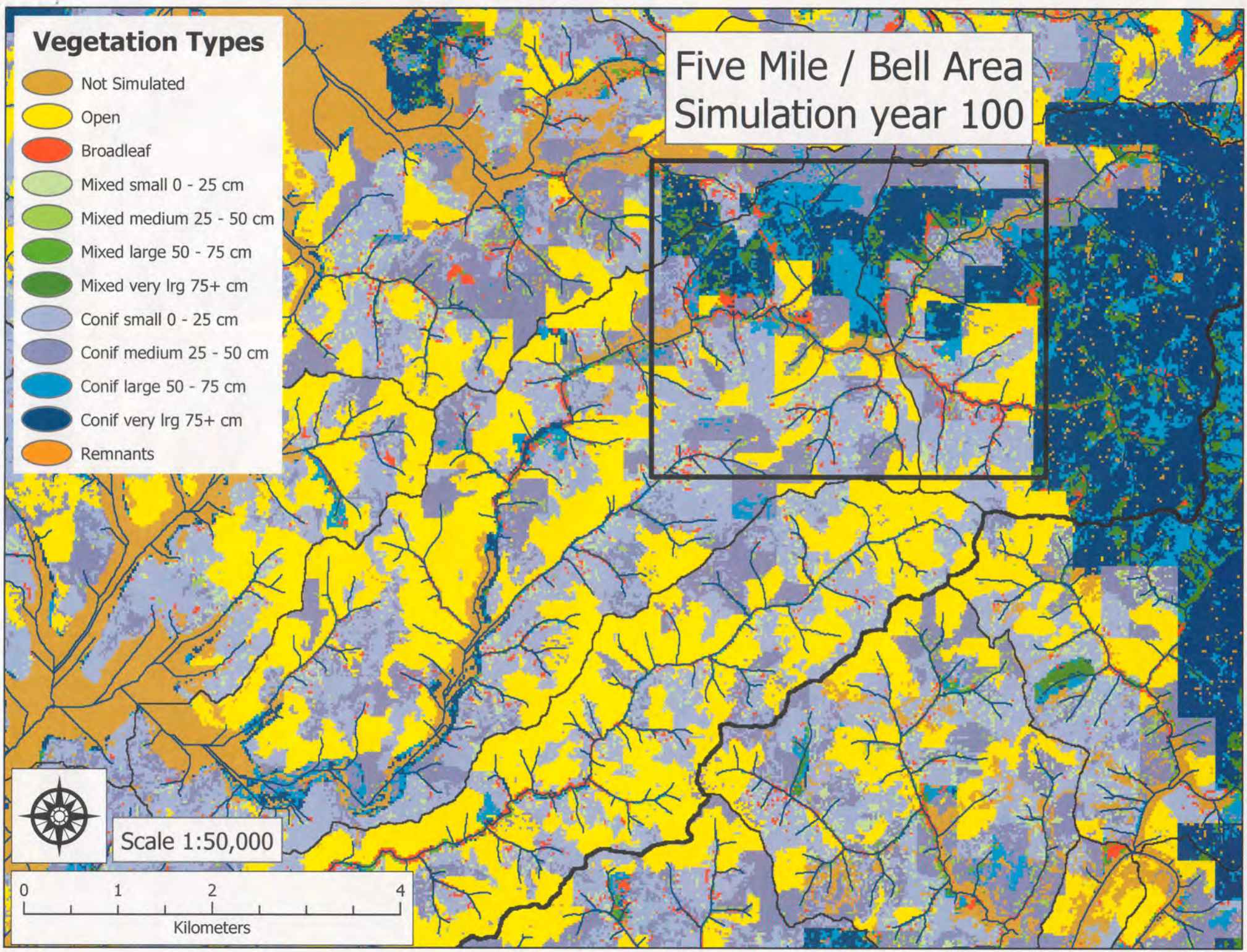
Appendix H: Wildlife Species, Designation and Occurrence in Watershed

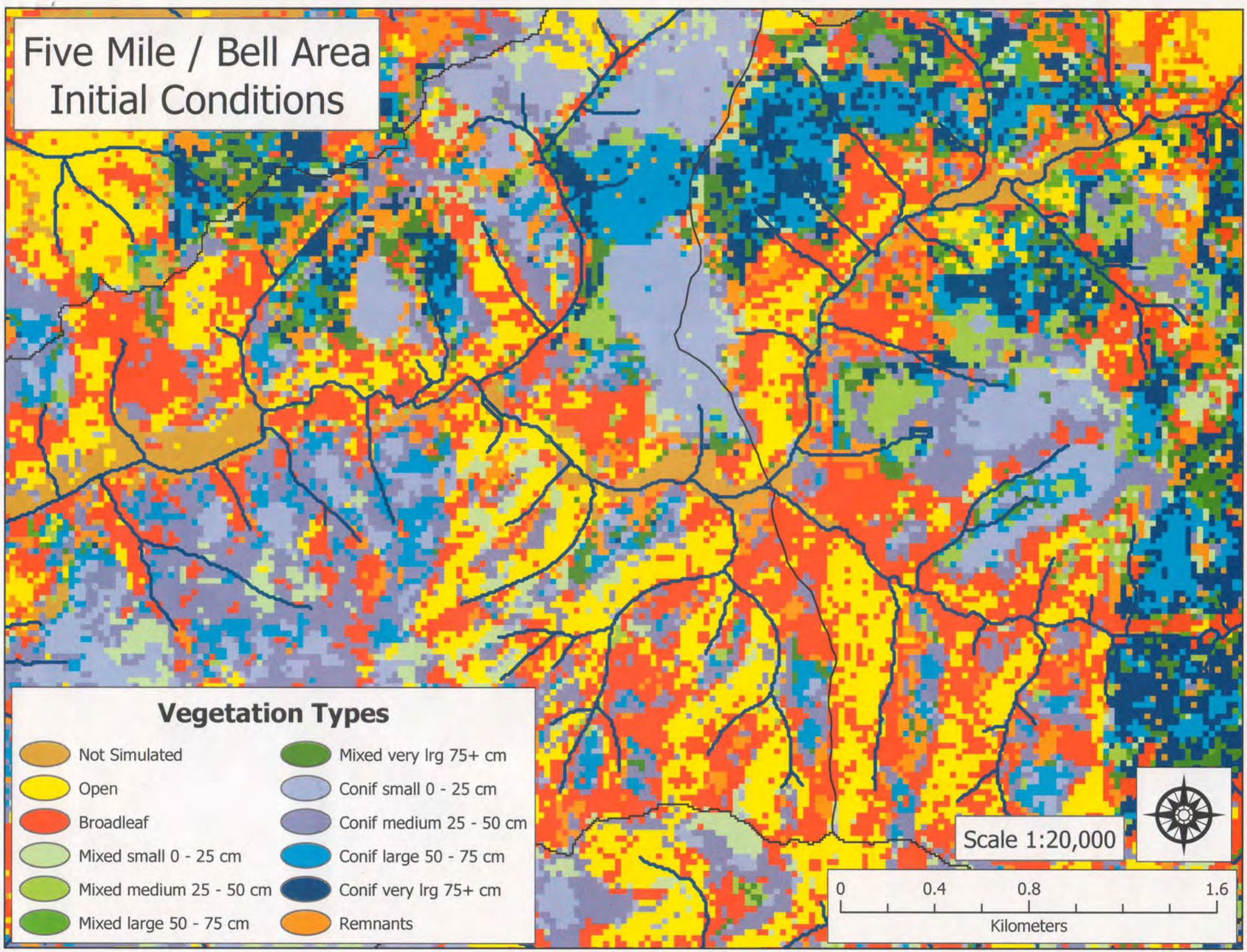
COMMON NAME	*SPECIES*	*DESIGNATION*	*OCCURRENCE*
ALSEA MICRO CADDISFLY	OCHROTRICHIA ALSEA	R-6 SENSITIVE	SMALL STREAMS, SPRINGS, AND SEEPS. SUITABLE HABITAT EXISTS ON THE NRA
ALEUTIAN CANADA GOOSE	BRANTA CANADENSIS	FEDERAL ENDANGERED; R-6 SENSITIVE	WINTER MIGRANT ALONG COAST IN ESTUARIES AND WETLANDS. HISTORICALLY DOCUMENTED MIGRANT ON THE NRA.
AMERICAN PEREGRINE FALCON	FALCO PEREGRINUS ANATUM	FEDERAL ENDANGERED; R-6 SENSITIVE	NO KNOWN NEST SITE; POTENTIAL FOREAGING HABITAT EXISTS. SEVERAL WINTER SIGHTINGS ON NRA
AMERICAN WHITE PELICAN	PELECANUS ERYTHORHYNCHOS	R-6 SENSITIVE	COASTAL SHORES AND OFF-SHORE ISLAND MIGRANT. SUITABLE RESTING HABITAT EXISTS ON NRA
CALIFORNIA BROWN PELICAN	PELECANUS OCCIDENTALIS	FEDERAL THREATENED; R-6 SENSITIVE	COMMON VISITOR ALONG COASTAL SHORES, OFF-SHORE ISLANDS; DOES NOT NEST IN OREGON. MANY FALL SIGHTINGS ON NRA
COMMON LOON	GUVIA IMMER	R-6 SENSITIVE	COASTAL LAKES, RIVERS AND ESTUARIES. DOCUMENTED NON-BREEDING SIGHTINGS ON THE NRA
LONG-BILLED CURLEW	NUMENIUS AMERICANUS	R-6 SENSITIVE	OREGON COAST MIGRANT USING SALT MARSHES, MUDFLATS AND BEACHES.MIGRATORY DOCUMENTATION ON NRA
MARBLED MURRELET	BRACHYRAMPHUS MARMORATUS	THREATENED;R-6 SENSITIVE	MATURE AND OLD GROWTH FORESTS. USES COASTAL STREAMS. SUITABLE

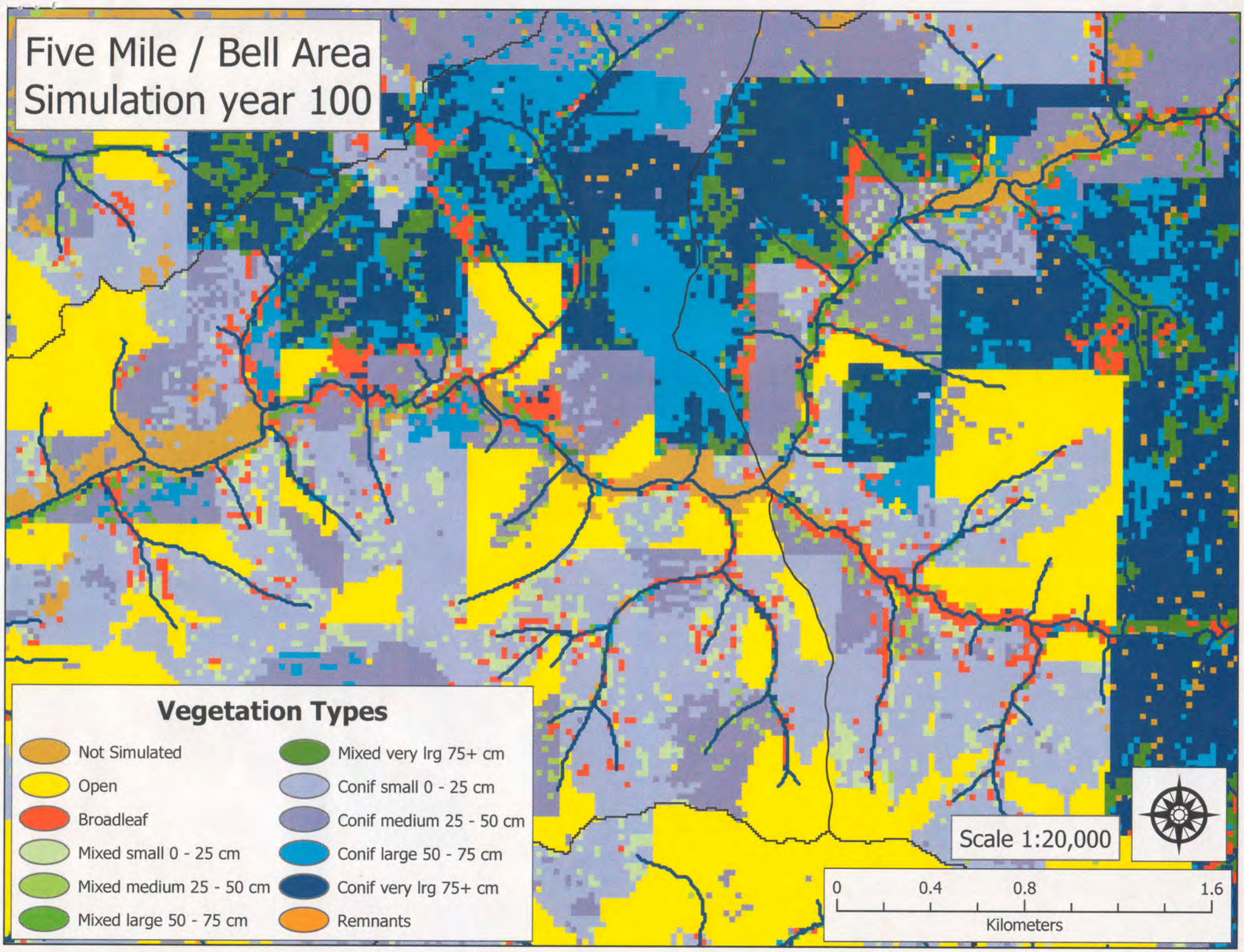

Florence
Five Mile / Bell Area
Reedsport
Umpqua Megashed
Initial Conditions
Vegetation Types
Not Simulated
Open
Broadleaf
Mixed small 0 - 25 cm
Mixed medium 25 - 50 cm
Mixed large 50 - 75 cm
Mixed very lrg 75+ cm
Conif small 0 - 25 cm
Conif medium 25 - 50 cm
Conif large 50 - 75 cm
Conif very lrg 75+ cm
Remnants
Scale 1:400,000
0 5 10 20
Kilometers


Florence
Five Mile / Bell Area
Reedsport
Umpqua Megashed
Simulation year 100
Vegetation Types
Not Simulated
Open
Broadleaf
Mixed small 0 - 25 cm
Mixed medium 25 - 50 cm
Mixed large 50 - 75 cm
Mixed very lrg 75+ cm
Conif small 0 - 25 cm
Conif medium 25 - 50 cm
Conif large 50 - 75 cm
Conif very lrg 75+ cm
Remnants
Scale 1:400,000
0 5 10 20
Kilometers


Vegetation Types
Not Simulated
Open
Broadleaf
Mixed small 0 - 25 cm
Mixed medium 25 - 50 cm
Mixed large 50 - 75 cm
Mixed very lrg 75+ cm
Conif small 0 - 25 cm
Conif medium 25 - 50 cm
Conif large 50 - 75 cm
Conif very lrg 75+ cm
Remnants
Five Mile / Bell Area
Initial Conditions
Scale 1:50,000
0
1
2
4
Kilometers


Vegetation Types
Not Simulated
Open
Broadleaf
Mixed small 0 - 25 cm
Mixed medium 25 - 50 cm
Mixed large 50 - 75 cm
Mixed very lrg 75+ cm
Conif small 0 - 25 cm
Conif medium 25 - 50 cm
Conif large 50 - 75 cm
Conif very lrg 75+ cm
Remnants
Five Mile / Bell Area
Simulation year 100
Scale 1:50,000
0
1
2
4
Kilometers


Five Mile / Bell Area
Initial Conditions
Vegetation Types
Not Simulated
Open
Broadleaf
Mixed small 0 - 25 cm
Mixed medium 25 - 50 cm
Mixed large 50 - 75 cm
Mixed very lrg 75+ cm
Conif small 0 - 25 cm
Conif medium 25 - 50 cm
Conif large 50 - 75 cm
Conif very lrg 75+ cm
Remnants
Scale 1:20,000
0
0.4
0.8
1.6
Kilometers


Five Mile / Bell Area
Simulation year 100
Vegetation Types
Not Simulated
Open
Broadleaf
Mixed small 0 - 25 cm
Mixed medium 25 - 50 cm
Mixed large 50 - 75 cm
Mixed very lrg 75+ cm
Conif small 0 - 25 cm
Conif medium 25 - 50 cm
Conif large 50 - 75 cm
Conif very lrg 75+ cm
Remnants
Scale 1:20,000
0
0.4
0.8
1.6
Kilometers

			FLIGHT CORRIDORS EXIST ON NRA. NESTING HABITAT DOCUMENTED THROUGHOUT WATERSHED
NORTHERN BALD EAGLE	HALIAEETUS LEUCOCEPHALUS	FEDERAL THREATENED; R-6 SENSITIVE	ONE KNOWN NEST SITES WITHIN WATERSHED UNKNOWN NEST SITES ARE SUSPECTED. SEVERAL KNOWN FORAGING LOCATIONS DCUMENTED
PACIFIC WESTERN BIGEARED BAT	PLECOTUS TOWNENDII TOWNSENDII	R-6 SENSITIVE	NO KNOWN ROOST SITES. SUITABLE FORAGING HABITAT EXISTS.
NORTHWESTERN POND TURTLE	CLEMMYS MARMORATA MARMORATA	R-6 SENSITIVE	LAKES, PONDS AND SLOUGHS OF LARGE RIVERS. TWO DOCUMENTED SIGHTINGS IN WA.
RED-LEGGED FROG	RANA AUROA	R-6 SENSITIVE	MOIST WOODED HABITATS AND RIPARIAN ZONES. BREADDING DOCUMENTED ON NRA AND SUSPECTED SUITABLE HABITAT THROUGHOUT WA
WESTERN SNOWY PLOVER	CHARADRIUS ALEXANDRINUS NIVOSUS	THREATENED; R-6 SENSITIVE	NESTS IN SANDY SPITS ASSOCIATED WITH ESTUARIES. DOCUMENTED DURING BOTH BREEDING AND WINTERING SEASON ON NRA
WHITE-FOOTED VOLE	ARBORIMUS ALLBIPES	R-6 SENSITIVE	WOODLAND SPECIES IN CONIFEROUS FORESTS. DOCUMENTED BREEDING ON NRA AND SUSPECTED ELSEWHERE IN WA.

APPENDIX I: EXOTIC SPECIES PREVENTION

.ebra mussels

Zebra mussels (Dreissena polymorpha) are freshwater bivalves that invaded the Great Lakes in about 1988, and although they are not believed to be in any of the Oregon Coastal lakes at this time, their prevention is of utmost importance. Populations currently exist in Nevada and they have been spotted in the Coos Bay area where they were suspected to have arrived on one of the many Asian ships that dock there.

With adhesive byssal threads, Zebra mussels are the only mollusk that can attach to any hard surface including other freshwater mussels which they will kill. Living together in very high densities, these pest organisms attach to water intakes and other water plumbing and can cause complete blockage of pipes. Mussel incrustations on boats can increase drag and can clog engine cooling systems.

Zebra mussels are less than 2-3 cm in length or about the size of a thumbnail and often have a "zebra-striped" coloration. There are several reasons for their rapid spread including the fact that they are highly prolific, first reproducing at an early age. Adults produce large numbers of sperm and eggs and high densities of adults facilitate successful fertilization. Larval stages are planktonic and float for two to three weeks. They develop from egg to adult in less than 3 months.

Hydrilla

Hydrilla is a fast growing weed that degrades water quality and fish habitat, and complicates boat navigation. It is currently being battled in 17 counties of California and in Washington but has not yet spread to Oregon. As with ·rently existing aquatic weeds in the coastal lakes, control measures are expensive and only slightly effective once this .ed has spread throughout a lake.

Hydrilla grows under water, producing long stems that branch out and form thick mats under the water surface. Features distinguishing it from other aquatic weeds are that it has spear-shaped leaves with sawtooth edges and small spines on the underside of the leaf on the center vein. It typically has five leaves encircling the stem in whorls and they produce whitish or yellowish, peanut-size tubers on its roots. A small fragment of the plant can grow into a lake choking mass in only a few weeks.

Education on Exotics

Currently in Oregon, the State Marine Board is working to educate boaters about Zebra mussels and Hydrilla through press releases and a newsletter that goes out to all boats registered in Oregon. Also concerned with these problems is Oregon Department of Environmental Quality, National Marine Fisheries and Environmental Protection Agency because prevention is part of the Clean Water Act which these agencies are required to uphold. The State Marine Board and ODEQ should be encouraged to post information which is not presently done to any significant degree in the watershed area.

Guidelines for prevention given by the State Marine Board include the following list:

* Drain all bilge water, live wells, bait buckets and any other water from boats and equipment on site. Throw all leftover bait away; do not reuse it.
* Inspect boat exteriors for any weeds or mussels; remove and discard them in the garbage, not back in the water, no matter how small they are.

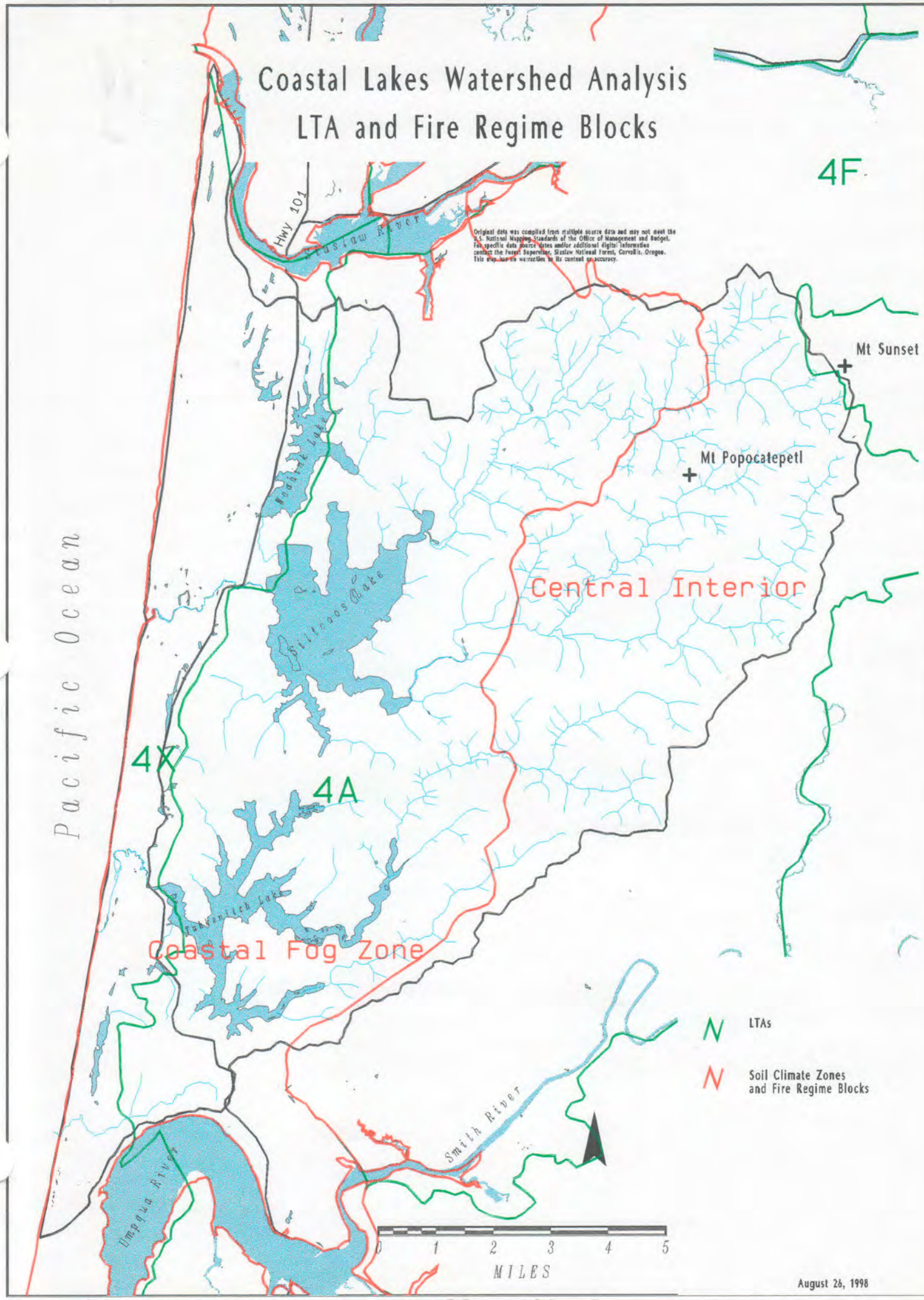
* Thoroughly flush engine cooling systems and clean live wells and pumping system bilges. Wash trailers, hitches, bait buckets and hulls with hot water, or tow boat and trailor through a do-it-yourself and use a high pressure hot water washer to clean up.
* Dry boats and trailers in the sun for 2-4 days before relauncing in Oregon waters.

APPENDIX J: LAND TYPE ASSOCIATIONS OF COASTAL LAKES WATERSHED

The Siuslaw National Forest has been divided into five soil/climate zones each based on landform, soil, geology, and climate. These are the land type associations in the analysis area.

Land Type Associations in the Coastal Lakes Watershed. Description is from Ellis-Sugai et al. (1997).

Land Type Association	4X - Eolian Coastal Dunes	4A - Coastal Hills and Lakes	4F - Fine-textured Fluvial Lands
Climatic Sub-Category	Coastal	Coastal	Coast Crest-Southern Zone
Geology	Active sand dunes along the coast, with Quaternary river deposits in the lowlands, Tyee Formation in uplands along the eastern edge	Mostly Tyee Formation	Tyee Formation with minor intrusions of basaltic dikes
Geomorphology	Coastal sand dunes with low relief, wet deflation planes between foredunes and active dunes, and small lakes	Coastal lakes present. Relatively low relief, highly dissected by streams	Moderate relief, with moderate drainage density and steep slopes.
Stream Density	11.64 miles/sq.mi.	8.71 miles/sq.mi.	6.17 miles/sq.mi.
Slope Description	Deep in lower slopes and valley bottoms. Moderately deep on bedrock ridges at higher elevations. Clay loans to gravely clay loams to sandy loams.	Moderately deep to deep on ridge systems. Very deep where scattered ancient earthflows present. Gravely loams on steep slopes to gravely clay loams where deeper soils occur.	Shallow to moderately deep on convex ridge slopes, moderately deep to deep in concave slope positions. Gravely loams on steep slopes to gravely clay loams where deeper soils occur.
Soil Productivity	Moderately productive where soil water is sufficient to allow plant growth. Soil moisture probably never limits plant growth except on areas of open sand and high relief.	Moderate to very productive. Moderate to high water holding capacities. Soil moisture rarely limits plant growth.	Moderately productive. Low water holding capacities. Soil moisture limits plant growth or survival on all but north slopes during most summers.
Soil Stability	Unstable soils are uncommon. They may occur on lower midslopes above incised channels. Ancient earthflow terrain in common, but slumps and small earthflows are uncommon. Fluvial erosion in channels is the primary hillslope erosion process.	Infrequent debris slides are primary hillslope erosion process. Local deep-seated landslides occasionally where earthflow terrain is incised by streams.	


Coastal Lakes Watershed Analysis
LTA and Fire Regime Blocks
4F
Siuslaw River
HWY 101
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.
Mt Sunset
Mt Popocatepetl
Central Interior
Pacific Ocean
Siltcoos Lake
4X
4A
Tahkenitch Lake
Coastal Fog Zone
Umpqua River
Smith River
LTAs
Soil Climate Zones and Fire Regime Blocks
0 1 2 3 4 5
MILES
August 26, 1998

APPENDIX K: LANDFORM/PLANT COMMUNITY CODES

Scientific Name	Scientific Name	Scientific Name
Alectoria vancouverensis	Hypogymnia inactiva	Parmotrema crinitum
Arthothelium spectabile	Hypogymnia physodes	Peltigera collina
Bacidia sp.	Hypogymnia tubulosa	Peltigera membranacea
Bryoria capillaris	Hypotrachyna sinuosa	Peltigera neopolydactyla
Buellia insignis	Kaernefeltia californica	Pertusaria glaucomela
Caloplaca cerina	Lecanora confusa	Physconia americana
Caloplaca holocarpa	Lecanora expallens	Platismatia glauca
Catillaria endochroma	Lecanora pacifica	Platismatia herrei
Cavernularia hultenii	Lecanora sp.	Platismatia lacunosa
Cavernularia lophyrea	Lecidea albofuscescens	Pseudocyphellaria anomala
Chaenotheca chrysocephala	Lecidea sp.	Pseudocyphellaria anthraspis
Chrysothrix candelaris	Lecidea sp. 2	Pseudocyphellaria crocata
Cladina portentosa	Lecidea sp. 3	Ramalina farinacea
Cladonia cervicornis	Lecidella euphorea	Ramalina menziesii
Cladonia coniocraea	Lepraria sp.	Ramalina roesleri
Cladonia ecmocyna	Leptogium corniculatum	Rinodina colobina
Cladonia fimbriata	Lobaria oregana	Rinodina sp.
Cladonia furcata	Lobaria pulmonaria	Sphaerophorus globosus
Cladonia gracilis	Loxosporopsis corallifera	Sticta limbata
Cladonia ochrochlora	Melanelia fuliginosa	Thelomma ocellatum
Cladonia pyxidata	Menegazzia terebrata	Thelotrema lepadinum
Cladonia sp.	Micarea prasina	Tuckermannopsis chlorophylla
Cladonia squamosa	Micarea sp.	Tuckermannopsis orbata
Cladonia verruculosa	Mycoblastus affinis	Usnea cornuta
Cliostomum griffithii	Nephroma bellum	Usnea fragilescens
Coccotrema pocillarium	Nephroma laevigatum	Usnea hesperina
Collema furfuraceum	Ochrolechia farinacea	Usnea longissima
Collema nigrescens	Ochrolechia juvenalis	Usnea madeirensis
Crust	Ochrolechia subpallescens	Usnea sp.
Diplotomma penichrum	Ochrolechia trochophora	Usnea subfloridana
Evernia prunastri	Opegrapha atra	Usnea wirthii
Fuscopannaria leucostictoides	Opegrapha protuberans	Xanthoria polycarpa
Graphis elegans	Parmelia hygrophila	Xylographa vitiligo
Hypogymnia apinnata	Parmelia saxatilis	
Hypogymnia enteromorpha	Parmelia sulcata	
Hypogymnia heterophylla	Parmotrema chinense	
Lichen surveys were made between 1994 and 1997 for the assessment of air quality.		
The lichens above were collected from the following Current Vegetation Survey points:		
1076028		
1080040		
1082032		
1082044		
1084032		
1084044		
And from the following off-grid plots:		
OD-1		
OD-2		
OD-6		
OD-7		
OD-10		
OD-11		