Nestucca Watershed Analysis

October 1994

USDA Forest Service
Siuslaw National Forest

Bureau of Land Management
Salem District

Environmental Protection Agency

National Marine Fisheries Service

Soil Conservation Service

U.S. Fish & Wildlife Service

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interest of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

BLM/OR/WA/PT-95/005+1792

Pilot Watershed Analysis

for the

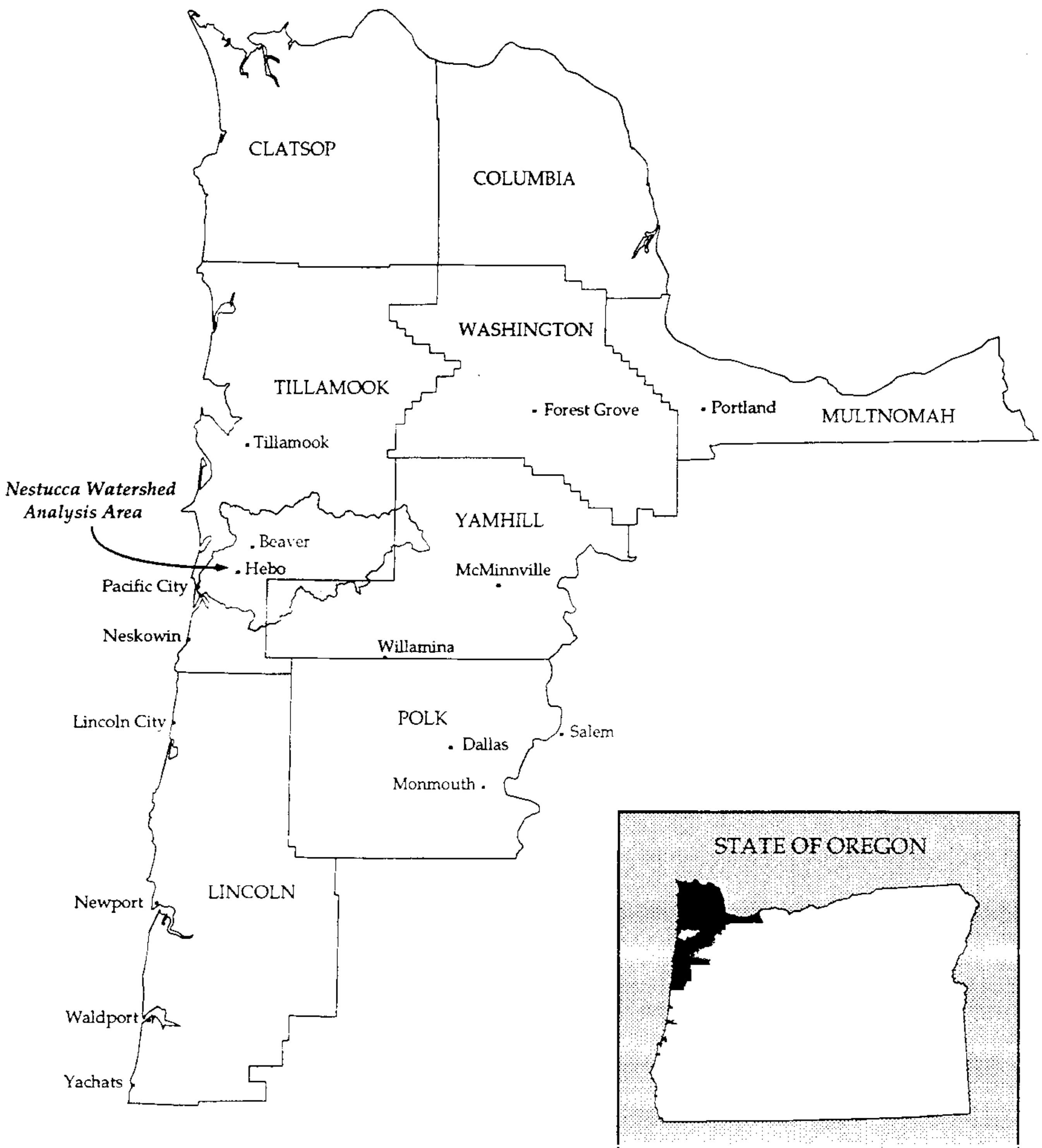
Nestucca River

Team Goal

"Keep the analysis focused on relevant issues
and ensure that the work is neither overly detailed nor uselessly vague"

(Pilot Guide page 9)

NESTUCCA WATERSHED ANALYSIS AREA AND VICINITY



point for developing analysis direction for the various resources. They were also distributed to the public and numerous government agencies for comment and review for the purpose of validating the CORE Team's perspective as well as identifying additional issues. Following is the final revised list of issues which evolved through the analysis process:

Wildlife Issues

Within the Nestucca Watershed, the current habitat condition, distribution, and particularly, the lack of late seral stage habitats are the major contributing factors leading to reduced population viability of some endemic wildlife species.

Focusing management on meeting long-term habitat objectives, as defined in our desired future condition, could negatively impact short-term habitat conditions. The most common example cited was the thinning of conifers to develop nesting habitat for spotted owls or murrelets twenty to fifty years from now, reduces spotted owl dispersal habitat for the next ten to fifteen years.

Managing for late-successional forest habitat will decrease the amount of forage available for deer and elk on federal land. This is likely to reduce or displace local deer and elk populations and increase foraging in private pastures and young conifer plantations.

Fisheries/Riparian Issues

Numerous native anadromous salmon and trout stocks are considered to be threatened and declining, and may be "at risk" of extinction. Coastal coho salmon and coastal steelhead, including those found in the Nestucca River drainage, have been petitioned for federal listing under the Endangered Species Act.

Habitat for anadromous and resident fish species, and other aquatic species is degraded and/or declining. Habitat problems include stream sedimentation, lack of large woody debris, lack of quality pools and spawning gravels, reduced stream flows, elevated water temperatures and low dissolved oxygen levels.

Riparian area modifications such as road construction; removal of riparian vegetation, large woody debris and complex structure; and physical alteration of the channels have adversely impacted fisheries habitat and water quality. Floodplains have been restricted and riparian area microclimates have been altered. Many riparian areas are deficient in large conifers, which are future sources of large woody debris.

Botany Issues

All management activities (including doing nothing and allowing nature to run its course) have the potential to modify microclimates and thus reduce or eradicate local populations of plant species.

Noxious and invasive non-native plant species reduce biological diversity by displacing native plant species, disrupt plant and animal community relationships which have evolved together, and contaminate the gene pool of existing native plant species.

Soils/Hydrology Issues

The Nestucca River and several tributaries have been identified as moderately to severely impaired for the following beneficial uses (ODEQ, 1988 Oregon Statewide Assessment of Water Pollution):

- domestic water supply
- municipal water supply
- cold water fisheries
- other aquatic life
- wildlife
- water contact recreation
- aesthetics

Fecal coliform levels exceed State Water Quality Standards in the lower river.

Road construction and timber harvest have increased landslide and general sedimentation rates over natural levels, adversely impacting water quality and aquatic species habitat.

Past timber harvesting and road construction may be altering the amount and timing of streamflow in some subwatersheds, thereby impacting stream channel conditions and beneficial uses.

Roads Issues

The system of federal roads needs to be reevaluated. Some roads may need to be closed or maintained/ improved to insure their stability.

Reducing the number of roads within the watershed will reduce driving access to resource values, and access for land management activities and fire suppression.

Road construction and maintenance standards may have to change to be consistent with the Aquatic Conservation Strategy in the Forest Plan.

Summary

The Nestucca Watershed is located on the north Oregon coast. The geology of the watershed is composed of a mixture of volcanic and sedimentary rocks. It is highly dissected by intermittent and perennial streams which feed into the mainstem Nestucca River. Streams in the upper portion of the watershed have higher gradients with steep, high ridges separating the streams. Lower portions of the river basin have broad, flat alluvial bottoms which were the focus of early settlement (both Native American and post-European) and, to this day, are the most populated portions of the watershed. They have a rich history of fishing, logging and agricultural/ dairy farming.

The high precipitation and mild climate of this watershed provide ideal growing conditions for a wide variety of plants, creating one of the most productive timber zones in the world. Trees and shrubs are abundant, dense and fast growing.

The major factors affecting ecosystem dynamics within the Nestucca Watershed are large, infrequent, high intensity fires, winds of hurricane force, storms that cause flooding and landslides.

As a result of fire history and past intensive timber management practices, the Nestucca Watershed currently provides very little habitat for those species which depend upon the following late-successional forest characteristics:

- large old trees with thick bark, large branches, and broken tops or decay pockets suitable for cavities
- a mixture of younger trees of a wide variety of ages, sizes and species which add to multistory structure
- numerous large snags and decaying logs on the ground

Approximately sixty percent of the watershed is in early seral stage habitat - areas of meadow, brush, young conifer stands less than 30 years old or stands which are predominately alder. Forty percent of the watershed provides early to mid-seral stage habitat comprised of immature or mature conifer stands, 30 to 100 years old. The majority of the mature forest habitat is very fragmented and is dominated by commercially thinned Douglas-fir stands which are even aged, very uniform, and deficient in both snags and down logs which are in the early stages of decay. Less than one percent of the Nestucca Watershed contains late seral stage habitat, as described above.

Nine federally threatened or endangered wildlife species are known or suspected to occur in the Nestucca Watershed. Three of these species, the bald eagle, northern spotted owl and marbled murrelet, are strongly associated with late-successional forest habitat. Two known bald eagle nests, four historical spotted owl sites and thirteen known occupied marbled murrelet sites are located in this watershed.

Terrestrial issues are focused around the concern for species which are closely associated with late-successional forest characteristics; their long-term survival in a landscape which is dominated by early to mid-seral stands and the ways in which current stands will achieve the characteristics of older forests.

This analysis identifies management opportunities which show promise of accelerating the development of older forest characteristics through active management, including variable density thinning, underplanting, conversion of older alder stands to conifer, and creation of snags and down woody debris.

The Nestucca River is one of the most productive anadromous fisheries in Oregon. However, all of the anadromous salmonid fish stocks, except fall chinook salmon, have declined. Many conditions have contributed to this decline, including conditions outside of this watershed or beyond the control of the Bureau of Land Management and the Forest Service. This analysis corroborates previous reports that the existing freshwater habitat conditions in this watershed are generally poor. This habitat is the most limiting factor for spawning and early smolt survival. Thus, fish populations cannot be restored without efforts to maintain and improve freshwater habitat conditions. These conditions are a result of natural events (fire and floods) and human interactions (agricultural and rural development, logging, grazing, and stream clean-out). Our analysis indicates that two key habitat features, large woody debris in the streams and high quality pools, are lacking throughout much of the watershed. Additionally, we analyzed water quality concerns and found that water temperature increases in unshaded portions of upland, perennial streams may be a problem for fish in the hot summer months.

These problems are directly tied to the condition of the riparian zone. Nestucca River riparian zones are generally dominated by alder or shrubs. Shrubs often do not provide adequate shading for streams during the hot summer months. Thus, this analysis recommends identification and planting of unshaded stream reaches as a high priority. Alder decays so rapidly that it does not provide adequate large woody debris for stream structure. The analysis recommends placing a high priority on reestablishing conifers in the riparian zones for long-term, large woody debris recruitment. As these projects will not be effective until the trees grow to a large size and begin falling into the streams, the analysis also recommends conducting in-stream structural improvement projects, such as the East Creek project, which have proven to be so successful in this watershed. In-stream structural projects are short-term, "stop gap" measures intended to help the Nestucca fisheries to survive and function until the riparian zones recover.

Sedimentation was identified as an issue in this watershed, however, little data is available on the current or historic sediment loading or the effects of this sediment in the Nestucca Watershed. The enclosed analysis characterizes the sediment sources in the Nestucca Watershed and identifies that most of the landslides analyzed resulted from timber harvest or road construction activities in the past 30 years. We were able to identify road problems which need to be site specifically analyzed for opportunities to reduce sedimentation. We characterized the factors which lead to high and extreme landslide potential to aid in identifying unstable slopes to avoid during road construction and timber harvest activities.

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Appendices

1. Introduction

This watershed analysis presents our current understanding of the processes and interactions occurring in the Nestucca River ecosystem, referred to hereinafter as the Nestucca Watershed. The analysis is intended to help us understand how land-use activities, the physical environment and the biological environment interact in the watershed. We recognize that additional data is needed for many of the resources, and further analysis of existing data may be needed to refine our perspective. As new data becomes available, the watershed analysis will be revised as needed (see section 14).

We have purposely chosen not to repeat information from other key documents unless absolutely essential to the analysis. Those who utilize this watershed analysis are expected to have detailed and intimate knowledge of the *Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl* (ROD) and the *Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl* (S&Gs), so repeating of portions of those documents would preclude us from reaching our team goal. Within this analysis the term "Forest Plan" is used to denote the document which contains the ROD and S&Gs.

We limited the scope of the analysis to that portion of the Nestucca Watershed from the point where it enters Nestucca Bay at river mile (RM) 0, to its headwaters. We did not have the time or expertise to include estuary analysis. The bay should be analyzed in conjunction with the *Little Nestucca River Watershed Analysis*, utilizing results of this watershed analysis as appropriate.

The scope was also limited to the extent that it focused on the entire watershed for most analysis, with a few stratifications where appropriate. Analysis by each of the individual 39 subwatersheds would have been impossible in the short time we had available. We do see further analysis by subwatershed as a logical and necessary continuation of the watershed analysis process, and expect the Bureau of Land Management (BLM) and the United States Forest Service (USFS) to continue in that direction as the need arises.

How This Analysis Can Be Used

It provides all land owners, land management agencies and other interested parties with a description of the Nestucca Watershed and its current condition.

It can help federal resource specialists and managers identify and prioritize potential project areas within the ecosystem.

It identifies areas of concern within the watershed.

It will help both the BLM and the USFS focus their annual work priorities based on current ecosystem needs of the lands they manage.

It provides ecosystem level scientific information that can be used for the "big picture" during site-specific environmental analyses. It also provides site-specific detail in the background information and maps used in the analysis, which are maintained in the BLM and USFS field offices and Geographic Information Systems (GIS).

It provides basic resource information for identifying potential cooperative projects between federal, state and private land owners.

It satisfies the requirements of the ROD that watershed analysis be completed prior to implementing certain activities. This analysis identifies certain types of projects which can be applied within the Nestucca Watershed which are consistent with the Aquatic Conservation Strategy and the appropriate S&Gs.

The analysis includes all information required for a Late-Successional Reserve Assessment (ROD C-11) except (4) a fire management plan, which is being developed for later inclusion, and (7) a proposed implementation schedule. These will be included at a later date and the watershed analysis will then serve as the Late-Successional Reserve (LSR) assessment for the Nestucca Watershed.

2. Description of the Nestucca Watershed

The Nestucca Watershed is located on the northern Oregon coast, approximately 25 to 55 miles west of Portland. Approximately 95 percent of the watershed is in Tillamook County and the remainder is in Yamhill County. The watershed is about 30 miles long, averaging eight miles in width and covers about 163,000 acres made up of 39 subwatersheds. (see location map and appendix C-7.1)

The headwaters of the Nestucca River originate in the Coast Range, west of McMinnville. The river flows west and slightly south to Nestucca Bay, which empties into the Pacific Ocean. The river is approximately 53 miles long and drains 255 square miles with an average gradient of 37 feet per mile.

Most of the Nestucca River is free flowing. McGuire Reservoir, which provides water for the city of McMinnville, is the only impoundment on the river and is located at river mile (RM) 49. Meadow Lake Dam, formerly located at RM 47, washed out in 1962 and has not been rebuilt.

The watershed has mild wet winters, and cool, relatively dry summers. The average high air temperature is 73°F and the average low is 36°F. Annual precipitation varies from 80 inches in the lower elevations to 100 inches in the upper elevations. Eighty percent of the precipitation occurs October through March. The average growing season in the agricultural area is 180 days.

Mt. Hebo is the highest point in the watershed with an elevation of 3,130 feet. The highest point on the river has an elevation of 2,200 feet where it drains into upland meadows in the Walker Flat and Old Meadow Lake Dam areas. From this point to Blaine (RM 25), the river drops 1,500 feet and the valley is quite narrow and steep. The gradient decreases near Blaine and the river corridor widens. Broad flat terraces occur above the current floodplain in areas where the river has experienced downcutting. The valley continues to broaden until it reaches Nestucca Bay. Tidal effect extends to RM 7 at Cloverdale.

Land ownership in the watershed is mostly federal. The USFS and BLM manage about 106,000 acres or 65 percent of the watershed. Industrial forest owners manage about 27,000 acres (17 percent) and Oregon Department of Forestry manages about 9,000 acres (5 percent). The remaining 23,000 acres (15 percent) are in small private holdings, dairy farms, small woodlots, and residential or rural residential properties (see appendix C-7.1 and map 12).

Historically, the federal, industrial forest and state forest lands (140,000 acres, 86 percent of the watershed) were managed primarily for timber production. Under the current Forest Plan which governs federal land management in this area, emphasis is placed on the restoration and maintenance of aquatic resources and late-successional forest habitat. Federal land allocations from the ROD include 105,598 acres of Adaptive Management Area, of which 78,816 acres are also Late-Successional Reserves. In addition, the Upper Nestucca Key 1 Watershed (O-304) has been identified in the ROD. There are also several administratively withdrawn areas on both BLM and USFS lands within the watershed.

Management of most of the 36,000 acres of industrial and state forest lands will continue to emphasize timber production in compliance with the Oregon Forest Practices Act.

The watershed, particularly the federal lands, is popular for hunting, hiking, fishing, horseback riding, bicycling, camping, motorcycle riding, sightseeing, wildlife watching and collecting of special forest products.

Most of the non-industrial private lands are concentrated along the major roads (U.S. Highway 101, Highway 22 and several county roads). Hebo, Woods, Blaine, Hemlock, Pacific City, Cloverdale and Beaver are the only communities in the watershed. Dairies and pasture are a major land use along the river, particularly in the lower stretches. Approximately 4,000 acres are managed for agricultural production including about 47 dairies.

3. Issues

Issue identification went through several stages during the analysis. First, the Core Interdisciplinary Team (CORE) brainstormed possible issues based on professional knowledge and personal experience, resulting in a thirty-two page list of several hundred "issues". This list was pared down to forty issues which the CORE believed to be critical to this analysis. These issues were then discussed by the CORE and refined into sixteen more broadly defined issues, each encompassing several of the specific issues. This was done primarily to keep the number of significant issues to a manageable number. Those sixteen draft issues were then used as a starting

Silviculture Issues

Late-successional stand characteristics can be enhanced by silvicultural treatments in stands which are less than 110 years old, however the amount of land that can or should be enhanced is debatable.

Recreation Issues

Some recreational uses result in conflicts with other resources, between different types of recreation users, and between recreationists and local landowners.

Many other issues were raised during the CORE team and public meetings.

Issues not Considered Further

The following issue may be significantly impacting natural resources within this watershed, but are beyond the scope of this analysis as it relates to BLM and USFS system lands:

- Anadromous fisheries are currently being adversely impacted by many factors which extend beyond the boundaries of the Nestucca River watershed. These factors include poor conditions in the Pacific Ocean where warm ocean currents have increased water temperatures and reduced food supplies, poor conditions in the Nestucca Bay estuary which are reducing the amount of habitat and food available, increased recreational and commercial fishing, impacts of fish hatcheries on wild fish stocks, and predation by federally protected seals and sea lions.

The following issue may be significant within this watershed, but were not analyzed due to time, funding and personnel limitations. As watershed analysis is intended to be an iterative process, these issues will likely be included in future analysis.

- High road densities have negative impacts on wildlife. This issue was viewed as a lower priority because timber harvests on federal lands within the watershed have declined significantly and most roads were developed, maintained and financed by the sale of timber. Without regular maintenance, many roads will soon become impassable; thus, the road density will decline significantly over the next several years (see section 9).

Some issues surfaced which should be acknowledged, but which the team considered impacts of the Forest Plan and outside the scope of this analysis. Two examples are:

- The primary emphasis for federal lands within the Nestucca Analysis Area is "management for restoration and maintenance of late-successional forest habitat". Such management will greatly increase the numbers of logs on the forest floor and snags left standing in the forest. Additionally, late-successional stands are characterized as having many different sizes and ages of trees. This is likely to create "fuel ladders" for wildfires to climb rapidly from the ground to the uppermost tree canopy. During times of high or extreme fire danger, the large, late-successional stands will make it more difficult to control wildfires.
- In this portion of the Oregon Coast Range, late-successional stands are characterized as having multiple-canopy layers of shade tolerant tree species such as western hemlock and Sitka spruce beneath the older, larger trees in the stand. These conditions increase the likelihood of outbreaks of such insects as hemlock looper and spruce beetle.

Finally, the forest products industry has developed over many years and is one of the primary industries supporting local communities. The harvest of timber and special forest products from federal lands in the Nestucca Watershed plays an important role in maintaining the economic stability of local communities. Forest Plan direction identifies this watershed as a part of the North Coast Adaptive Management Area, with its primary goal of "management for restoration and maintenance of late-successional forest habitat." Adaptive Management Areas are also designed to "provide social and economic benefits" to local communities. Close coordination will be required to achieve these two goals.

4. Past and Current Conditions

Knowledge of the current conditions of various resources and past activities in the watershed is helpful in the identification of management opportunities. Knowledge of past conditions of various resources is helpful in trying to identify the range of natural variability, so that desired future conditions of the various resources will be properly focused. This analysis focuses on the past and current conditions that are pertinent to understanding the present and future direction.

A. Water

General Historical Conditions

Several historical events have influenced stream channel conditions in the Nestucca River and its tributaries. Water quality and aquatic habitat conditions within the lower river have changed significantly since the mid to late 1800s. Surveyor records from 1879 indicate that there were few settlers in the area. Records also indicate that bottomlands were forested and many trees survived the 1850 fire that burned much of the watershed. On hills and mountain sideslopes, "heavy timber, fir and spruce mostly deadened by fire" was used to describe conditions. The Nestucca River was navigable by small raft and boat to Cloverdale during this period, which indicates that large woody debris was cleared from the channel to allow for boat passage.

It is difficult to know what the effects of historic fires were on surface erosion and sedimentation since no data exists. In a natural fire much of the combustion occurs in the tree crowns, unless there has been heavy blowdown, therefore the potential for surface erosion is rather low. Aerial photo analysis of the Nestucca Watershed indicates that fires were patchy and burn intensity on north facing slopes, draws and riparian areas was less severe or nonexistent. Increases in landsliding may have occurred after fires and stream temperatures likely increased until vegetation regrowth along streams provided sufficient shading to cool streams once again.

Aerial photos from 1939 show that much of the lower valley was cleared and farmed. Extensive diking of marshlands between the Nestucca Bay and U.S. Highway 101 and drainage ditches in the lowlands have significantly altered wetlands and tidal areas. Approximately 42 percent of the original surface area of the bay and associated wetlands has been diked and/or drained for pasturage.

As dairy farming became more of an industry in the lower valley, numerous creameries were constructed. They were usually built near stream channels to use the cool waters in processing the dairy products. Increases in fecal coliform contamination, loss of riparian vegetation and modification to channels were likely resultant of these activities.

Timber harvesting in the Nestucca began very early, as seen in 1939 aerial photos. The lower watershed and valleys were the first to be impacted by timber harvest and road construction because many of the trees which survived earlier fires were located in riparian areas. Harvest of these trees reduced stream shading and removed then and future large wood from streams and riparian areas. The first significant timber harvest occurred about 1960 and steadily increased until 1990. Construction of roads within riparian areas (such as the Nestucca Access Road and Highway 22) restricted channel movement and reduced stream shading and large woody debris supplies. Concern about logjam barriers to fish passage in the 1960s and 1970s also resulted in the removal of large quantities of woody debris from channels and floodplains.

Streambank erosion along the lower river is a natural process which has been accelerated by removal of riparian vegetation. Riprap, gabions and other structures have been placed to control bank erosion and loss of pasture lands. While these types of structures do armor the streambank and protect property, they also constrict channel movement and significantly reduce aquatic habitat.

Flooding has also influenced stream channels and aquatic habitat within the watershed. Major floods occurred most recently in 1945, 1950, 1955, 1964-65 and 1972. In November 1962, Meadow Lake Dam at RM 47 failed, causing channel scouring for miles downstream and flooding to the entire river below that point. Flooding in 1972 washed out bridges and closed U.S. Highway 101 and several county roads below Beaver. Floodplains were inundated with large quantities of logs, debris and silt (Schlicker 1972).

Past and Current Conditions

The Nestucca Watershed was divided into 39 subwatersheds ranging from 1,347 to 10,074 acres. These subwatersheds have been and will be used for cumulative effects analysis during project level planning. They also are of a manageable size for discussing conditions and effects on major tributary streams and groups of tributaries. The subwatersheds were grouped into "Blocks" in order to discuss conditions in specific areas of the watershed without having to discuss each of the 39 subwatersheds separately. Block discussions are at the end of this section.

All waters in the state of Oregon are publicly owned including streams, lakes and ground water. The Water Resources Commission determines which beneficial uses of water are available in a basin. There are eighteen basins in Oregon and the Nestucca Watershed is in the North Coast Basin.

Oregon Administrative Rules (OAR) Chapter 340, Division 41, Rule 642, lists the beneficial uses designated by Oregon Department of Environmental Quality (DEQ) for which water quality is to be protected in the North Coast Basin. For the Nestucca River these are: public domestic water supply, industrial water supply, irrigation, livestock watering, water contact recreation, aesthetic quality, boating, resident fish and aquatic life, salmonid spawning and rearing, anadromous fish passage, fishing, wildlife, hunting and hydropower.

The state of Oregon has set water quality standards and rules to protect the designated beneficial uses of water. These rules and standards protect the most sensitive uses such as fisheries, aquatic life and human water supplies. Water quality standards for the North Coast Basin, which includes the Nestucca River, are for temperature, dissolved oxygen, turbidity, Ph, fecal coliform, and toxic substances. In addition, chlorophyll a has a non-regulatory criteria value. The standards and beneficial uses for the Nestucca River and tributaries are listed in appendix C-1.1. The 1988 Oregon Statewide Assessment of Nonpoint Sources of Water Pollution conducted by DEQ listed portions of the Nestucca River as moderately to severely impaired without supporting data for the following beneficial uses: domestic water supply, municipal water supply, mining, cold water fisheries, other aquatic life, wildlife, water contact recreation and aesthetics. The only limitation that had data was in the Nestucca below Three Rivers (Lower Nestucca River subwatershed) which was severely impaired because of bacteria levels. An updated assessment for the North Coast Range was conducted in 1993 but the results were not available for this analysis.

Fecal Coliform

Fecal coliforms are a group of bacteria which are present in human and animal digestive systems, among other places, and are used as an indicator of contamination by human or animal waste. McDonald and Schneider (1992) found that possible sources of fecal coliforms in the Nestucca Watershed are: the sewage treatment plant outfalls at Hebo, Cloverdale, and Pacific City, all of which discharge into the Nestucca River; septic systems from homes within the watershed, which includes homes in Beaver; agricultural sources including small farms and commercial dairy operations; recreation sources from the four campgrounds and dispersed recreational uses; and wildlife sources, primarily deer and elk. Commercial dairy operations are the most likely source of fecal contamination in the watershed, with 47 dairies and approximately 7,000 dairy cows generating waste equivalent to a human population of 67,000 over a similar period of time. Manure and liquid waste application to pastures can result in fecal coliforms entering surface water through direct runoff during rainfall events or through groundwater movement into surface waters. The potential sources of fecal coliform contamination from forest lands in the watershed are very minor compared with the agricultural sources.

Water quality samples were collected by DEQ from the Nestucca River at Cloverdale during the summer months from 1977 to 1984. This provides some baseline information on water quality during the period of highest temperatures, lowest flows and greatest recreation use. McDonald and Schneider (1992) summarized the data and found that water quality standards were generally met with the exception of fecal coliform. Individual values exceeded 400 organisms per 100 ml 20 percent of the time during the summer months and 24 percent of the time annually. The highest levels were observed in the fall, which was attributed to overland flow caused by heavy rains which moved bacteria from dairy operations or inadequate septic systems into the river.

Additional sampling by DEQ in the summer months of 1980 to 1984 found that fecal coliform levels in Nestucca Bay and the lower river up to RM 4.3 usually exceeded the standard and showed an increasing trend upriver toward the nearest dairy operations.

In summary, fecal coliform levels have been determined to be in violation of water quality standards in the lower Nestucca River, primarily in the summer and fall. Animal waste from dairy operations is the most likely source of the bacteria, as there are only a few minor potential sources in the forested uplands.

Dissolved Oxygen

Dissolved oxygen was identified as a possible issue in the lower river based on the assumptions that water temperatures during low flow periods are sometimes excessive and therefore dissolved oxygen concentrations would be low. Low dissolved oxygen levels are caused by a number of factors, but primarily are a result of high water temperatures and high oxygen consumption by bacteria and/or algae. As discussed in the water temperature narrative, the temperatures in the mid and lower sections of the Nestucca appear to be excessive during the late summer months, which would support the theory that dissolved oxygen concentrations may be low during that period.

area) and 483 acres are open (4.8 percent of the total area). The remaining 8,199 acres provide shade within the density ranges expected in mature, forested riparian zones.

Water temperature data from the U.S. Geological Survey gauge at Beaver and from the DEQ (1988) indicate that temperatures in the past have been above the basin standard (58°F) and higher than optimum for spring chinook (68°F). During all 20 years of water temperature records at the Beaver gauge, water temperature (seven-day average maximum) exceeded 68°F (20°C) during the peak water temperature period (see table 4A2). This would indicate that any activities which increase water temperature during the peak temperature period (approximately July 15 to August 15) may be violating the standard.

Table 4A2 Long-Term Water Temperatures at Beaver

Year	Water Temp., °C[1]	Number of Days Above 20° C (68° F)
1965	21	39
1966	22	42
1967	23	47
1968	22	24
1969	19	1
1970	21	29
1971	21	9
1972	19	0
1973	19	1
1974	18	0
1975	19	0
1976	21	18
1977	22	24
1978	23	41
1979	22	22
1980	22	14
1981	21	30
1982	19	0
1983	19	4
1984	22	34

[1] Maximum annual value of seven-day average maximum water temperatures.

In an effort to address concerns outlined in McDonald and Schneider (1992) and Baker et al. (1986), the BLM, USFS and ODFW have entered into a cooperative venture to obtain water temperature information throughout the Nestucca Watershed. Full implementation is not completed, but in 1994, twenty six stations were installed (see map #7). The data for 1994 indicates that temperatures exceed 58°F from Walker Creek to Cloverdale during the normal peak temperature period. In the lower watershed, there was only a small temperature increase in the mainstem from the upper part of the Upper Nestucca subwatershed to the lower part of the Lower Nestucca subwatershed. Nearly all the tributaries monitored had lower temperatures than the mainstem. This indicates that most of the heating in the mainstem is occurring in the upper, forested portion of the watershed. Bear Creek, Niagara Creek, and East Beaver Creek had higher temperatures than the mainstem and are the source of at least some of the elevated temperatures in the mainstem. This may be due to a reduction in riparian canopy cover through recent timber harvesting and road construction activities in these subwatersheds.

In summary, analysis of water temperature records from the Beaver gauge indicates that temperatures regularly exceed the basin standard of 58°F. Monitoring at 26 sites in the watershed in 1994 showed that temperatures exceeded 58°F over the entire length of the Nestucca River and in many tributaries during the summer months.

Expanded monitoring of water temperatures in the tributaries will be needed to obtain a more complete picture of the sources of temperature increases, but the preliminary data indicate that the temperature increases are occurring in the forested portions of the upper watershed, and not in the lower mainstem through the agricultural zone.

Sediment

Sediment was identified as an issue in the Nestucca Watershed because the public believes that high turbidity levels evident during winter storms are an indicator of high suspended sediment concentrations. The perceived effect of these high sediment levels is the degradation of fish habitat through accumulation of fine sediment which fills pools, clogs spawning gravels, and suffocates eggs and preemergent fry. In an effort to characterize sediment in the watershed, an evaluation of sediment sources was conducted. A description of the methodology used for the evaluation is in appendix C-1.5.

Water quality data retrieved from the EPA STORET system in September 1994 is displayed in table 4A1. The only samples that violated the 90 percent seasonal saturation standard were taken at Cloverdale. While it is unknown exactly how many of the 74 samples taken exceeded the standard, the mean saturation was 101 percent and the minimum was 87 percent, which indicates that very few samples were less than the 90 percent standard. It is likely that during low flow periods there are pools in the lower river that become stagnant and exhibit high temperature and low dissolved oxygen levels. Otherwise, the available data do not support the theory that dissolved oxygen levels exceed water quality standards in the lower Nestucca River.

Table 4A1 Dissolved Oxygen Levels

Location (River Mile)	**Number of Samples**	**DO** (Saturation Percent) **mean**	**min.**	**max.**
Pacific City (RM 1.5)	6	112	97	140
Woods (RM 2.4)	5	103	94	110
Below Cloverdale (RM 5)	4	95	91	99
Cloverdale (RM 7)	74	101	87[1]	121
Near Hebo (RM 11)	4	99	90	105
Near Beaver (RM 16)	1	97	97	97
Above Beaver (RM 17.5)	3	105	104	107
Fairdale Gauge (RM 49.5)	2	106	105	107

[1] Exceeds Standard

Water Temperature

This issue is focused on water temperature within river reaches supporting Spring Chinook, primarily in the mainstem of the Nestucca to RM 40. Fish die-offs in the summer and fall of 1975 and 1988 have been attributed to a fungal infection, *Dermocystidium salmonis*, brought on in part by elevated temperatures. Summer low flows reduce the area of available habitat, concentrating temperature stressed adults which can encourage the spread of disease. The DEQ has not listed the lower mainstem of the Nestucca as temperature impaired however does recognize low dissolved oxygen (temperature related) as a moderate problem. The state water quality criteria for temperature in the Nestucca prohibits increasing water temperature when stream temperatures are above 58°F.

Stream temperature is affected by many natural factors including climate, solar intensity, shade, channel orientation, elevation, and ground water influence. Management can have a direct affect on stream temperature through removal of streamside vegetation which exposes the stream channel to solar radiation. Past land clearing for agricultural development, timber harvest, and road building have all contributed to removal of stream shade from the Nestucca Watershed. Natural events including wildfire and storms have resulted in flooding and landsliding which removed stream vegetation and reduced stream shade.

Historical records and photo analysis indicate that prior to the first homesteading in the mid to late 1880s, the riparian zones along the Nestucca and its tributaries were vegetated with conifer and hardwood trees. Homesteaders cleared the valley bottoms for pasture and crops, reducing riparian vegetation in the lower river to a narrow band of hardwoods and shrubs. The upper watershed was mostly forested, with the exception of the 1910 Mt. Hebo burn area. Further removal of trees through the 1950s left the riparian zone up to the Blaine area without large conifers or hardwoods. The flood following the Meadow Lake Dam failure, construction of the Nestucca Access Road, and logging in the upper watershed in the last 30 years have removed extensive areas of riparian vegetation, especially on the Nestucca and the Bear Creek, Testament Creek and Meadow Lake areas.

Since 1970, riparian shade in the lower river has increased as hardwoods have matured and shrubs have reclaimed some bare areas. Regrowth of conifer in these areas is not apparent. The quality of shade (density and overhang) is in a slow upward trend but tree species are not present to provide shade at historical levels. The height of the hardwoods is not adequate to provide summer shade to some mainstem reaches. In the tributaries shade is beginning to recover in the 20+ year old timber stands. Currently, 1,207 acres of riparian zone in all subwatersheds (excluding the mainstem), provide 11 to 40 percent canopy cover (12 percent of the total

Past and current sources of sediment within the Nestucca Watershed include:

Natural

Landslides

- Debris slides
- Debris flows
- Rotational failures
- Soil creep

Channel Erosion

- Streambank erosion

Management-Influenced

Landslides

- Debris slides - harvest and road-related
- Debris flows - harvest and road-related
- Rotational failures
- Soil creep

Surface Erosion

- Dry ravel
- Road surface and roadside

Channel Erosion

- Streambank erosion

Other sources not evaluated as part of this analysis but known to exist:

- Sedimentation within agricultural lands and non-forest private lands adjacent to streams.

Natural Landslides

The Nestucca Watershed is characterized by intermixed layers of volcanic and sedimentary rock on the upper slopes and ridge crests, sedimentary rock with scattered intrusions on the middle slopes and volcanic and baked sedimentary rock on the lower slopes of the canyons upstream from Blaine.

Mixing of bedrock types, rock competency, climatic conditions, ground water and tectonic activities that cause uplift (steep slopes) and earthquakes have all contributed to slope instability within the Nestucca.

Types of landslides found within the Nestucca drainage include debris slides, debris flows, earthflows, slumps, soil creep and rock falls. Debris slides and flows are the most common active landslide types found within the watershed. However, inactive or historical large rotational failures are pervasive within the weaker sedimentary rock. Many of these failures are thousands of acres in size and may have occurred when rainfall quantities were significantly higher than present levels, or as a result of earthquakes.

Rotational failures are large, deep-seated masses which move downslope on a curved basal plane and contain numerous back-tilted blocks. The resulting topography is hummocky; drainage patterns change and some depressions fill up with water to form sag ponds. North Lake and Cedar Lake are some examples of sag ponds. Numerous small wetlands can also be found within these landforms.

Debris slides are the most common type of active landslides found within the Nestucca Watershed. Debris slides occur on steep slopes covered with thin, granular soils, usually during heavy rainfall. Debris slides are easily activated by natural or human-made alterations in slope, soil water content or surface runoff.

Debris flows are the very rapid downslope movement of soil and rock material confined to stream channels; they tend to develop during heavy precipitation. Debris flows are usually initiated by debris slides. The overall downslope migration of material resembles a viscous fluid, often scouring first and second order channels to bedrock. Debris flows act as an important sediment transport link between slopes and stream channels. The recurrence of natural debris flows is not well understood within the Nestucca drainage, however studies within the Oregon Coast Range show an average landslide recurrence interval of 6,000 years (Benda 1987).

Soil creep is the slow, downslope movement of soil in response to gravity. An example of soil creep can be found within the Bear Creek subwatershed. This is discussed in more detail in a later section.

Rockfalls occur most commonly along steep talus slopes adjacent to the Nestucca River and in the upper headwaters of Three Rivers. They are a minor source of sediment.

Landslide Potential Analysis

To evaluate unstable and potentially unstable lands, slope angles and geologic types were used to rate the watershed for landslide potential using extreme, high, moderate, and low rating classes. For example, soft, fine-grained sedimentary rock of the Nestucca Formation was grouped into a weak rock competency class and when found on slopes of 35 to 55 percent had a moderate landslide potential.

Approximately 6 percent of the watershed (10,061 acres) has a high or extreme landslide potential. Subwatersheds with over 10 percent of the area in high or extreme classes are: East Beaver Creek, Moon Creek, Bays Creek, Alder/Buck Creek and Upper Three Rivers (see figure 4A1).

Further analysis shows there are 71 stream miles scattered throughout the watershed with a high potential for debris flow (see figure 4A2). Subwatersheds with the highest debris flow potential include: East Beaver Creek, Moon Creek, Alder/Buck, Upper Three Rivers, and Fan Creek. They are most commonly found within volcanic rock types and originate on steep slopes within first and second order channels.

Bear Creek Soil Creep

Soil creep in the Bear Creek subwatershed is a chronic source of sediment to both the lower portion of Bear Creek and the Nestucca River below Bear Creek. A thick layer of fine-textured soils formed in weathered sedimentary rocks are moving downslope over approximately 350 acres. The result of this creep activity is a continuous supply of soil material to the stream in the form of encroaching banks and small-scale bank failures. During high flows, material is carried into the stream by direct water erosion, undercutting and local bank slumping (Swanston and Swanson 1976).

Management activities on the zones of active soil creep have been limited to construction of one road and approximately 40 acres of timber harvest. The road does not appear to have altered the rate or extent of creep, but accumulation of intercepted groundwater into culverts and surface drainages below the road has probably been the reason for several road fill failures which have transported a small amount of sediment to Bear Creek. The timber harvest occurred in 1991 and as yet there are no observable effects on the area. Timber harvest is known to affect soil creep through loss of root strength and an increase in soil moisture which can lead to an increase in the rate of movement.

Observations during high streamflow events have indicated that Bear Creek has very high turbidity and probably suspended sediment concentrations relative to the other tributaries in the watershed. There is no available data on turbidity or sediment concentrations in Bear Creek, and this data gap needs to be addressed. Local land management personnel familiar with the area believe that Bear Creek is the single largest chronic source of suspended sediment in the Nestucca Watershed.

Management-Influenced Landslides

To better understand the relationship between rock type, flood events and management activities on the distribution and frequency of landslides, an inventory was conducted on Upper Three Rivers, Bible Creek, East Beaver Creek and Moon Creek subwatersheds. Aerial photos from 1965-67, 1977, and 1988-89 were used to frame periods of major storm events to assess current and past conditions. Active and inactive landslides were mapped on the photos and data on size, cause, etc. was put into a database for analysis. East Beaver and Moon Creek subwatersheds were selected for analysis because they are known to be the areas most susceptible to landslides in the Nestucca Watershed. They are characterized by Tillamook Volcanics bedrock (83 percent) and steep slopes, the combination of which makes for a high potential for debris slides and debris flows. Upper Three Rivers has a high occurrence of ancient landslide deposits, which are mostly unconsolidated material with a high potential for landslides when disturbed. The inventory documented a high landslide frequency on areas identified as high and extreme landslide potential areas. The following discussion focuses on landslides that were determined to have been caused by road construction and timber harvest activities.

There are 1,018 miles of road in the GIS database for the watershed. This includes all paved, gravel and dirt-surfaced roads on all ownerships. Based on aerial photo interpretation of the Moon Creek subwatershed, it is estimated that there are 407 miles of road in the Nestucca Watershed that are not in the GIS database. Only roads currently in the database were used for this analysis.

There are two processes by which roads can contribute sediment to streams: 1) by increasing the number of mass failures (Swanston 1971), or 2) by surface erosion of the road prism and transport of this material to streams (Wald 1975; Burroughs 1989). Both of these potential sources were analyzed using data in GIS.

Most of the roads in the watershed were built prior to 1970 when sidecasting of waste material was a common practice. Waste material can initiate mass failure on steep slopes and also be a source of sediment for years following road placement. Sidecasting is rarely done now on slopes in excess of 55 percent, however delivery of sediment by old roads into streams continues to occur. A 1967 aerial photo analysis of the Bible Creek watershed shows that along a 3.8 mile stretch of road, eight debris

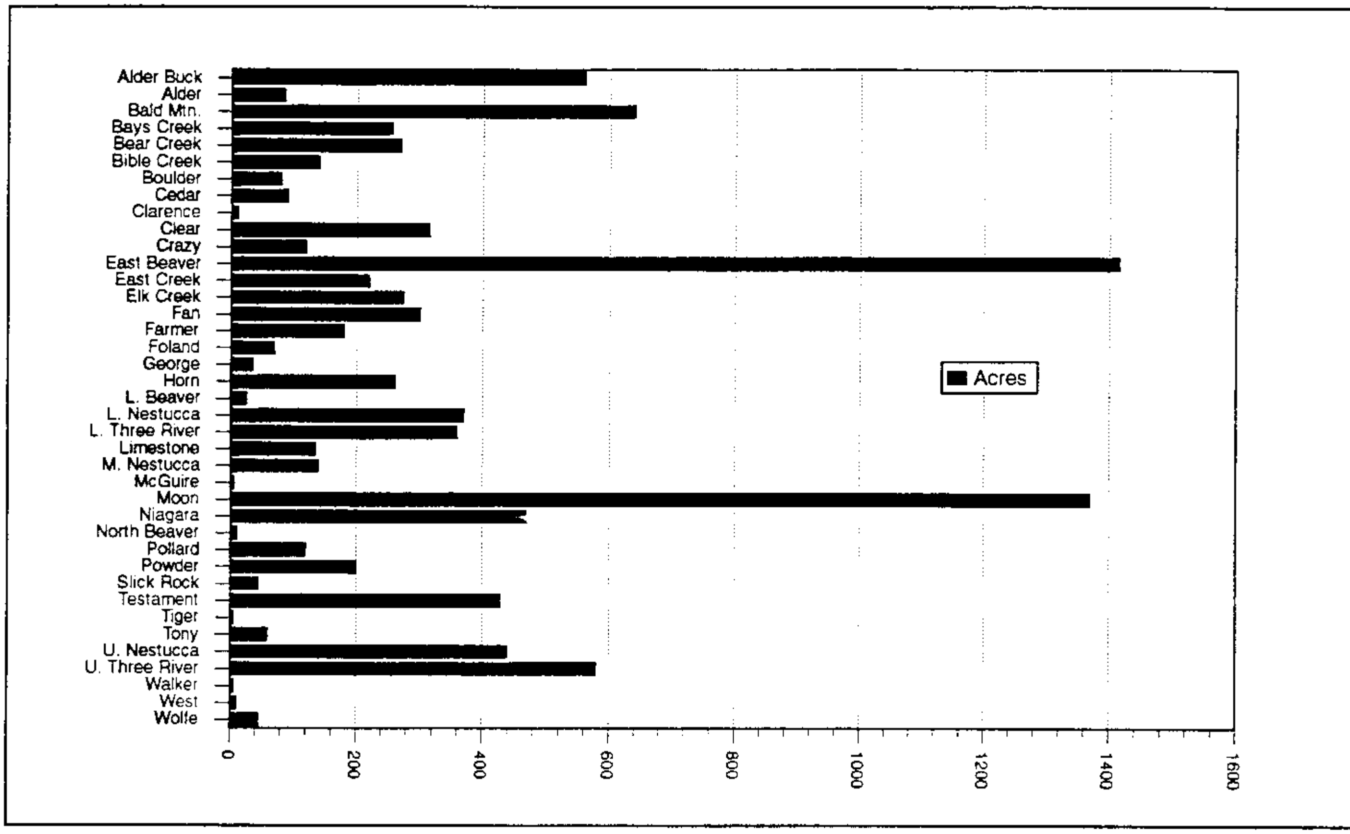

Figure 4A1 High and Extreme Debris Slide Potential

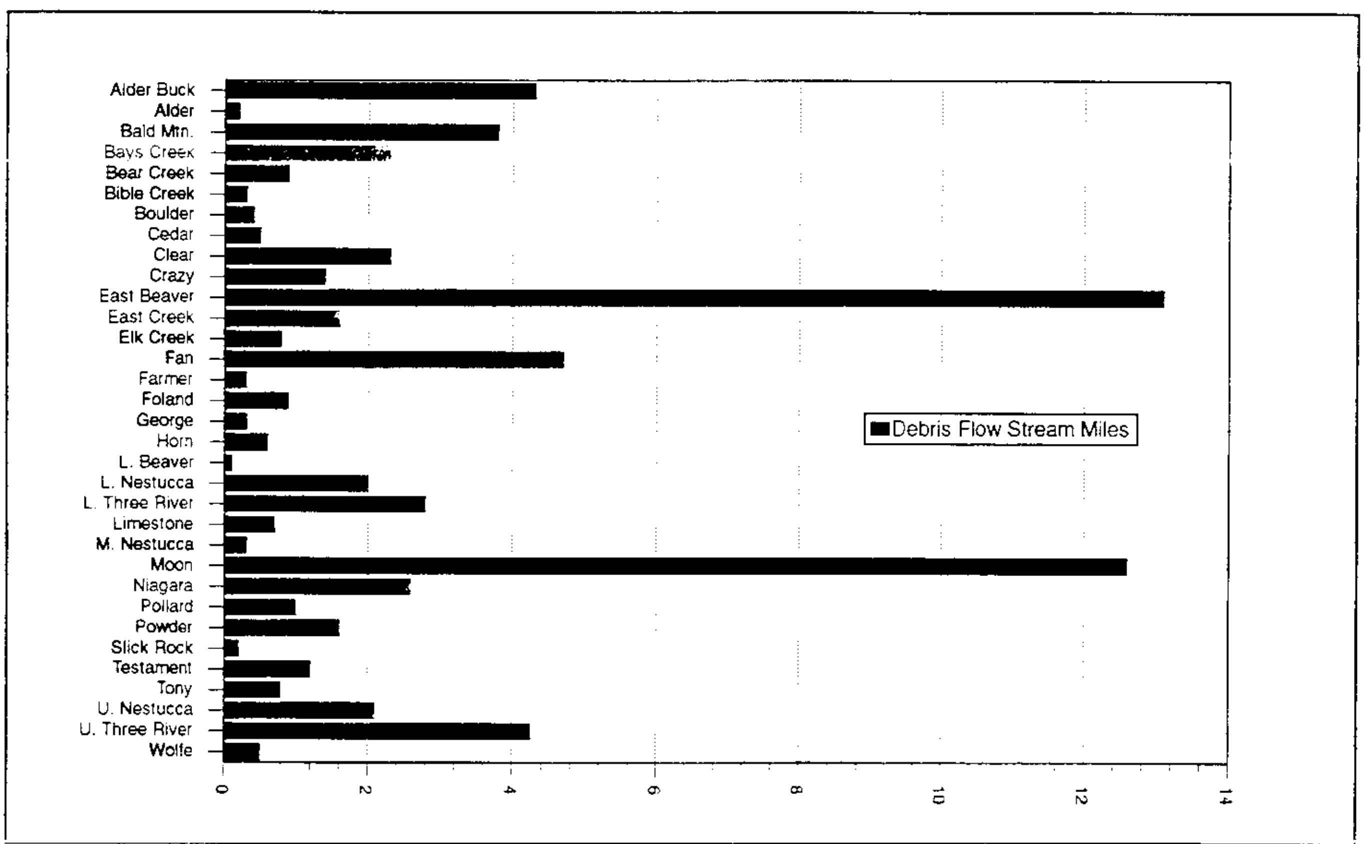

Figure 4A2 Debris Flow Potential by Subwatershed

slides and flows occurred in sidecast on steep slopes with over 90 percent of the sediments being delivered to stream channels.

Timber harvest has also had a significant impact on the number of debris flows and slides in some areas. Over 30 percent of the watershed has been harvested in the past 30 years. Vegetation contributes to slope stability on most soils. Roots add strength to the soil by anchoring through the soil mass into fractures in the bedrock and tying the slope together across zones of instability (Swanston and Swanson 1976).

Debris Flows

Between 1965 and 1977, debris flows caused by road construction within the East Beaver and Moon Creek subwatersheds increased threefold while the number of natural debris flows remained low (see figure 4A3). Most active debris flows originated in first and second order channels on steep slopes and affected an average of 230 feet of channel; over 90 percent of sediments were delivered to the stream. Increased precipitation and runoff during the 1972 flood event, poor road location and construction, and road surface runoff increased failure rates.

Timber harvest and roads caused significant increases in the number of debris flows from 1965 to 1977 within the East Beaver and Moon Creek subwatersheds. The flood events of 1965 and 1972 also likely increased the number of failures. In contrast, within the Upper Three Rivers subwatershed much of the road building and timber harvest did not begin until the late 1970s. Sidecasting of waste material was not done and vegetation leave areas protected some riparian areas and unstable slopes. Landslide potential is high within this area, however only six active slides were assessed in the landslide inventory.

Debris Slides

Between 1965 and 1977 in the East Beaver and Moon Creek subwatersheds, the landslide inventory showed significant increases in the number of active debris slides caused by roads (see figure 4A4). As of 1989, there were 153 active slides caused by roads, most of them in the upper headwaters, with an average of 65 percent of the sediments being delivered to channels.

The landslide survey documented a high landslide frequency within harvest units of the East Beaver and Moon Creek subwatersheds, particularly in the upper drainages. There are currently a total of 215 active debris slides within timber harvest units. Most of these slides are less than 100 square meters in size and found on stream-adjacent slopes with an average of 71 percent of the mobilized sediment being delivered to channels.

Landslide failure rate and sediment transport will be greater where roads cross high or extreme landslide potential and debris flow areas and where roads cross drainages and/or parallel within 100 meters of streams. A summary of road miles that cross landslide and debris flow potential areas by subwatershed can be found in table 4A3.

Table 4A3 Summary of Potential Sediment Sources from Roads that Cross Landslide Areas and Debris Flow Streams

Subwatershed	Roads Crossing High and Extreme Landslide Areas (miles)	No. of Times a Road Crosses High Debris Flow Potential Stream (no. of crossings)
Alder/Buck	0.53	2
Alder1	0.32	2
Bald Mtn. Fork	0.77	1
Bays Creek	0.16	0
Bear Creek	0.54	2
Bible Creek	0.66	1
Cedar	0.46	4
Clear	0.21	1
East Beaver Creek	3.30	15
East Creek	0.40	2
Elk Creek	1.61	2
Fan Creek	0.33	4
Farmer	0.27	0
Foland	0.02	0
Horn	0.13	0
L. Nestucca River	0.81	6
L. Three Rivers	0.49	0
M. Nestucca River	0.57	2
Moon Creek	4.40	24
Niagara	0.23	1
North Beaver1	0	0
Powder	0.27	0
Slick Rock	0	0
Testament Creek	0.43	3
Upper Nestucca River	0.06	0
Upper Three Rivers	1.13	6
West	0.05	0

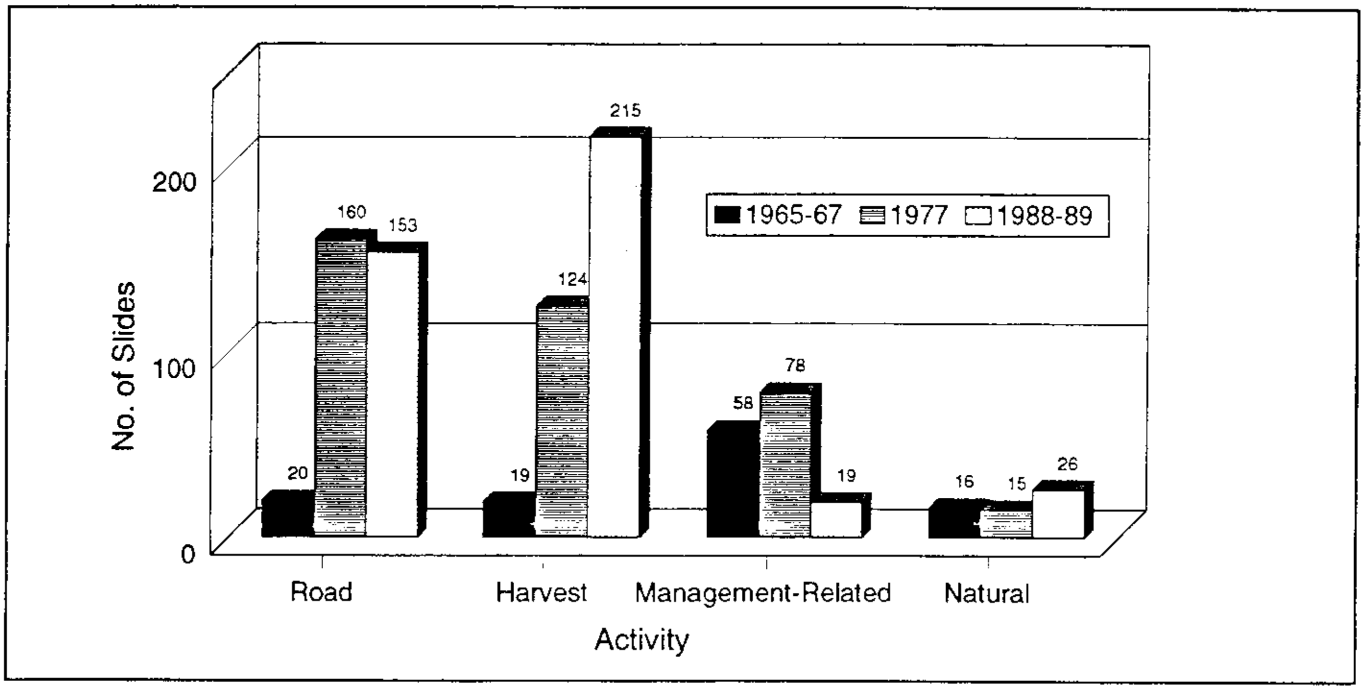

Figure 4A3 East Beaver and Moon Creek Active Debris Slide by Activity and Photo Year
Management-related debris slides are associated with road and harvest activities, however, a probable cause was not evident on aerial photos.

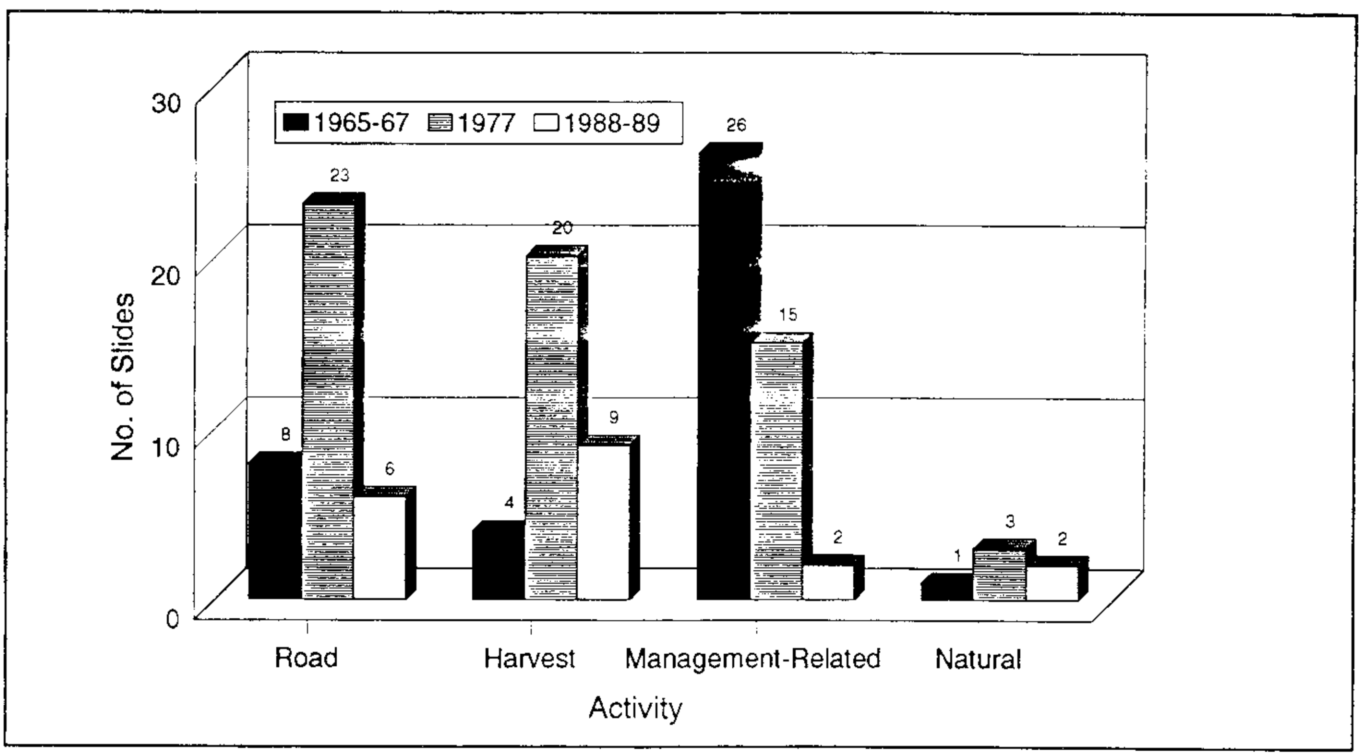

Figure 4A4 East Beaver and Moon Creek Active Debris Slide by Activity and Photo Year
Debris flows caused by management activities increased after 1972 storm event.
Management-related debris slides are associated with road and harvest activities, however, a probable cause was not evident on aerial photos.

Roads and Soil Erosion

Erosion from roads is another source of sediment in streams. Transport of sediment from the road prism can come from four sources: road surfaces, fillslopes, cutslopes and roadside ditches. Recent soil erosion studies done on granitic soils show that about 60 percent of the sediment produced from roads comes from fillslopes, 25 percent from travelways, and 15 percent from cutslope and ditch (Burroughs 1989). Other studies done in the Cascade mountains show that nearly 60 percent of the road lengths route water directly to preexisting stream channels or gullies and roads extend the stream channel network by as much as 40 percent (Wemple 1994)

A greater potential for surface erosion exists where road and stream densities are highest. To better understand the potential for soil erosion from road surfaces the number of road crossings of first, second and third order stream channels was analyzed using GIS. First, second and third order channels are considered to be sediment transport channels and they were intersected with road surface type. Results show that there are 2,585 crossings and 69 percent are on gravel surfaces (see appendix C-1.4). The 72 percent of the crossings which are on fine textured soils have a higher potential to produce sediment than those on coarser textured soils. Subwatersheds with the highest number of stream crossings are: Fan Creek, East Beaver Creek, Lower Nestucca, Lower Three Rivers and Bear Creek.

Blaine Road Improvement Project

Improvement of the Blaine Road from MP 10.7 to 14 began in 1993 and should be completed in 1994. The project involved widening and realignment of the road and replacement of some culverts, most notably in Clarence Creek and Slick Rock Creek where the existing culverts were partial barriers to fish passage. Just upstream from Clarence Creek the road crosses the toe of a large inactive slump. This area has experienced cutbank failures and subsidence of the road prism for a number of years. The improvement work was intended to widen the road while stabilizing the cutbank to reduce sloughing. The road was widened and the cutbanks excavated to a gentler angle in 1993. During the winter of that year there were a number of cutbank failures which deposited soil and rock on the road surface, and in some cases across the road, and caused an unknown amount of suspended sediment to enter the mainstem of the Nestucca, primarily during high runoff events. The effect of this was to temporarily increase turbidity and suspended sediment concentration in the Nestucca below this point. The magnitude of these increases is unknown, as no sampling was performed for turbidity until after the last winter storms had passed. The Federal Highway Administration conducted turbidity sampling at a number of sites above and below the slump area beginning in June 1994 and preliminary results showed no apparent increase in turbidity from construction activities, which is to be expected as there had been little or no rainfall to date since June.

Surface Erosion

Soils within the Nestucca Watershed typically have high porosity and high water holding capacities that reduce surface runoff and revegetate quickly after disturbance. These factors greatly reduce the potential for surface erosion. Surface erosion under natural conditions on vegetated sites is considered to be extremely low.

Dry ravelling is a type of surface erosion that involves the sloughing of soil, organic materials and rock on steep slopes during dry periods and is the dominate surface erosion process on coastal soils on slopes greater than 60 percent (Bennett 1982). Ravel occurs when the cohesive forces holding soil particles on a slope are reduced. Timber removal and slash burning increase the potential for ravel. Bennett's study determined that on slopes greater than 60 percent ravelling processes moved an average of 224 m^3/ha of soil the first year after burning. On slopes less than 60 percent, 29 m^3/ha of soil material moved the first year after burning.

For this analysis, the effects of ravelling on steep slopes along stream channels was evaluated. Results show that potential for surface erosion is greatest within the East Beaver Creek, Moon Creek, East Creek and Farmer Creek subwatersheds (see appendix C-1.3).

Bank Erosion

Bank erosion is one of the direct processes of sediment introduction into the stream channel. Bank erosion can occur at both natural and accelerated rates. Some of the most important factors affecting bank erosion include bank resistance, stream flow, sediment load, and mans influence on riparian vegetation, channel form and floodplain access. In terms of the overall watershed, bank erosion contribution to the sediment budget is felt to be minor in comparison with the landslide and road related inputs. Bank erosion potential and process are greatest in the lower river where soils are less cohesive and root masses are not as persistent as forested headwaters. Past statewide studies of streambank erosion have identified the Nestucca

River as a high priority for streambank rehabilitation work (Soil and Water Conservation Commission 1972). Photo interpretation done in 1972 for this study estimated that the main Nestucca contained 5.7 miles of eroded streambank. There are no on-the-ground quantified rates of bank erosion or delivery to the channel.

A historic photo inventory was conducted on the lower Nestucca River (RM 0-24) to characterize riparian and streambank change over time. The length of streambank erosion was estimated from aerial photos taken in 1953, 1961, 1965/67 and 1977. Length of river bank eroded was used as a reflection of change in exposure of a sediment source; it is not equivalent to volume of sediment delivered to the channel.

In summary, this inventory (see table 4A4) reflects a incremental increase in the length of streambank erosion over time. The upward trend appears to be related to riparian degradation (tree removal and grazing impacts) and high energy flood events. Data suggests that flows of high magnitude and duration acting on chronic bank erosion locations account for most of the increase over space and time.

Table 4A4 Streambank Erosion

Photo Year	Length of Eroded Bank	Prior Flood Year (recurrence interval)
1953	10,700 ft.(2.03 mi.)	1945 (unknown) 1950 (unknown)
1961	13,800 ft.(2.61 mi.)	1955 (unknown)
1965/67	23,100 ft.(4.38 mi.)	1962 (approx. 75 yr.) 1964/65 (100 year)
1977	27,000 ft.(5.11 mi.)	1972 (50 year)

Recent on-site data (Paul Pedoni USDA SCS, personal communication 1994) showed that between RM 7 and 21, 4.5 miles of river bank showed evidence of active streambank erosion. Cattle had access to the stream in 20 locations. Accounting for the difference in river miles, this is equivalent to no net increase in estimated length of bank erosion from the 1977 period to 1991. This suggests that measurable increases in length of eroded bank may not have occurred in the past 20 years. This is possibly related to the lack of storm flow events during this period. Based on the trends of the past, this lack of increase supports the premise that bank eroded areas as a whole are not stabilizing but are remaining chronic over time.

Summary

In summary, an analysis of potential and known sediment sources was conducted in an attempt to characterize the type and distribution of such sources. Potential sources were determined using soils, geology, slope, roads and streams data in GIS to identify areas with the highest potential for different types of landslides and other sediment sources. Subwatersheds known to be the largest producers of sediment were selected for a more detailed analysis. These are East Beaver Creek, Moon Creek, and Upper Three Rivers. Aerial photo mapping of debris slides and debris flows indicated that East Beaver Creek and Moon Creek had a preponderance of the identifiable landslides in the analysis area. The vast majority of the landslides identified were caused by timber harvest or road construction activities which took place over the last 20 years. Subwatersheds with similar topography and bedrock types that are known to have high landslide rates and sediment production relative to the rest of the Nestucca Watershed are Wolfe Creek, Bays Creek and East Creek. These areas should be priorities for management opportunities to reduce sediment production caused by management activities.

The other subwatershed known to be a major source of sediment is Bear Creek. A large area of soil creep has encroached on the stream and is a chronic source of sediment in the upper watershed. The Bear Creek soil creep area is believed to be the single largest chronic source of sediment in the entire watershed.

A short-term sediment source is the Blaine Road improvement project, which has led to some cutbank sloughing and turbidity increases in the mainstem Nestucca.

Streamflow

The primary streamflow issue identified for analysis in the Nestucca Watershed focused on reduced flows in relation to aquatic habitat in the lower river during the low flow season. The reduced flow issue has been identified primarily in relation to the potential reduction in wetted habitat, concentrating fish in limited holding areas and encouraging the spread of disease. The effect of potential reduction in wetted habitat goes beyond holding pools for spring chinook to also include other life stages such as juvenile rearing. Baker et al. (1986) identify that rearing habitat for juvenile fish is limited in the mainstem and tributaries due in part to low summer flows. The low flow period historically occurs between mid-July to early October.

The Nestucca River is a designated State Scenic Waterway from McGuire Dam downstream to its confluence with Moon Creek at Blaine. As such, the state has determined the recommended scenic waterway flows for the low flow period (July-October). As a result, OWRD may not issue permits for new water uses that would reduce flows below levels needed in the scenic waterway. Recommended scenic waterway flows exceed the average flow in August and September. Flows for these months were determined from the current ODFW in-stream water right determinations.

Minimum streamflows for the Nestucca have been converted to in-stream water rights for the purpose of supporting aquatic life. These rights have been granted to ODFW with a priority date of May 9, 1973. These streamflows were based on the biological requirements of fish and existing flows (ODFW 1968, refined in 1972). Each flow was intended to provide the average condition over gravel bars that meets the minimum depth and velocity requirements of fish (ODFW 1968). The minimum flows which were recommended and ultimately became in-stream water rights were intended to support a reasonable level of fish production through maintaining a minimum desirable level of natural production.

Streamflow during the critical low flow period is affected by climatic inputs such as precipitation and losses ranging from tree evapotranspiration to water withdrawal for drinking and agriculture. Measurable reductions in low flow (outside of natural variability) occurs in the Nestucca through diversion of water from the channel (e.g., irrigation, drinking water). Past studies (Harr and Krygier 1972) have shown measurable increases in streamflow during the summer low flow period due to removal of forest vegetation. These studies in small basins reflect that increases are relatively short lived as revegetation occurs. McDonald and Schneider (1992) conducted an analysis of low flow changes due to logging as measured at the Beaver gauge. This analysis showed no measurable changes in low flows after timber harvest. This was attributed to the "dilution" effect in a large basin, errors in assumptions and/or error in measurement. The cumulative increase to the lower river from increases in low flow due to harvest is not known.

A summary of existing streamflow record including gauge location, period of record and pertinent statistics are provided in table 4A5. A summary of low flow data for these stations is provided in table 4A6. Additional summary is available in McDonald and Schneider (1992).

There is no streamflow record on the Lower Nestucca prior to human development. The record for the Nestucca River at McMinnville is assumed to have been recorded prior to major timber harvest and road building in the upper watershed. This 12 square mile watershed had no major diversion above the measure point (slightly regulated by Meadow Lake Dam; USGS). The period of streamflow record is assumed to reflect the natural variability of streamflow affected by stand age and species composition. There is no data available to quantify variation in precipitation. Mean annual 30-day low flow was estimated to be 2.46 cubic feet per second (cfs) for the period of record. Based on this, the average 30-day low flow for this watershed is estimated at 0.21 cfs/mile^2. In comparison, the smaller watersheds of Tucca Creek (a tributary to Elk Creek) and Nestucca at Fairdale (a small watershed on the mainstem below the old meadow lake site) provide a record of post timber management flows. Low flows for these areas were 0.38 and 0.46 cfs/mile^2, respectively. Although this data has questionable comparable relationship due to the natural climatic variability of the time periods, it may reflect the potential difference between flow values under natural conditions and managed stands. Instantaneous minimums are provided in the table to show "worst case" of record and the relative effect on the aquatic habitat in headwater areas.

The USGS streamflow gauge near Beaver is the lowest gauge in the system, with a drainage area of approximately 180 square miles. This gauge provides a cumulative look at flows for the whole watershed. The 30-day low flows for the period of record range from 45-120 cfs. There have been no major diversions (regulation) of water from the watershed prior to March 1969 when McGuire Reservoir was filled. There are irrigation diversions upstream and downstream of the station. The low flow period for the Nestucca coincides with the maximum period of irrigation withdrawals which can represent the bulk of lower river out-of-stream use. Past and present illegal water withdrawals from the river and its tributaries are unquantified.

Minimum flow at the Beaver gauge equaled or exceeded 72 and 71 cfs during August and September, respectively, 80 percent of the time during the 23 years of record (Moffatt 1990). The minimum discharge during this period was 32 cfs on September 14, 1967 which can occur on a 50- to 100-year recurrence interval. The highest seven-day average maximum temperatures on record (23 years) occurred during the 1967 low flow period with 47 days above 68°F. This occurred on a below average precipitation year with an extremely dry spring.

Table 4A5 Summary of Streamflow Gauge Record[1]

Gauge Name	USGS #	Period of Record	Average Annual Flow (cfs)	River Mile	Average Annual Yield (acre feet)	Area (miles^2)
Nestucca near Beaver	14303600	64-91	1,068	13.5	773,800	180
Nestucca near McMinnville	14303000	28-44	43.6	37.5	31,590	12
Nestucca near Fairdale	14302900	60-93	32.1	49.3	23,260	6.18
Tucca Creek near Blaine	14303200	84-93	14.6	Elk Cr. trib.	10,570	3.09

[1] Data for this and other flow analysis were derived in whole or part from "Statistical Summaries of Streamflow Data in Oregon", Vol 1 & 2, 1990 and 1993, Moffatt, Wellman and Gordon), and published USGS Yearly and Monthly Summaries.

Table 4A6 Summary Low Flow Record

Gauge Name	Period of Record Used for Analysis	Mean Annual 30-day Low Flow (cfs)	Instant. Low Flow[1] (cfs)(date)	Low Flow (cfs/miles^2)	Area (miles^2)
Nestucca near Beaver	65-86	85.87	32.0 9/67	0.48	180
Nestucca near McMinnville	28-44	2.46	1.0 10/29	0.21	12
Nestucca near Fairdale	61-82	2.83	0.41 9/86	0.46	6.18
Tucca Creek near Blaine	84-93	1.18	0.46 9/87	0.38	3.09
McGuire Dam released	85-93	0.82 **	0.0 10/89 **	0.29 **	2.85

[1] Instantaneous low flow.

** Average of August and September controlled release for each year of record.

Diversions out of channel during the low flow period can be categorized into two distinct types; the diversion at McGuire Reservoir which is used for a municipal water supply for the City of McMinnville (totally consumptive) and the irrigation, domestic and general agricultural in lower watershed area (remains in watershed). Located at RM 49, McGuire is the only existing impoundment on the Nestucca River. This impoundment stores water from approximately one percent of the area of the Nestucca Watershed. It has a capacity of 1,230 million gallons (401 acre feet) of water. This structure uses an out-of-watershed transfer of water from McGuire Reservoir to Idlewild Creek in the Willamette basin. McMinnville Water and Light Department has one water right with a 1958 priority date which grants 6.4 cfs diversion (live flow) from the Nestucca River and a 9.6 cfs diversion from Walker Creek (total 16 cfs). There is an application pending for increasing McGuire Reservoir capacity to utilize the full consumptive diversion.

Average daily diversion from McGuire Reservoir ranged from 3.8 to 9.3 cfs for August through September during the 1985 to 1993 period. This variability in discharge is primarily due to changes in McMinnville municipal demand (Nichols, personal communication 1994).

McGuire Reservoir discharge records for the low flow months (August, September) of 1985-1993 indicate an average daily flow of 0.82 cfs released to the Nestucca River from the reservoir. By comparison, estimated average daily low flow for this subwatershed in August and September (without the reservoir) would be 1.1 cfs using a low flow discharge of 0.39 cfs/mile^2 for the subwatershed. This is derived from eight years of streamflow record before the reservoir was constructed. The difference between these discharge rates falls within the margin of error in the measurement of streamflow during low flow conditions. McMinnville Water and Light Department's water right for McGuire Reservoir does not require any release of water into the Nestucca. Releases from the reservoir that have occurred in the past have been voluntary.

Data obtained from the DEQ, Water Resources Division (WRD), indicate that there are approximately 360 valid water rights for surface water in the Nestucca Watershed. Total water appropriated is 216 cfs, of which 122 cfs is for operation of the Cedar Creek Fish Hatchery in the Three Rivers subwatershed. Table 4A7 summarizes water rights by type and amount of water appropriated.

Table 4A7. Water Rights Summary

Type	Number	Amount (cfs)
Domestic	174	8.6
Municipal	13	23.6
Irrigation	118	32.9
Agriculture	7	0.1
Industrial	7	4.4
Livestock	19	0.2
Fish	14	129.1
Power	3	9.5
Recreation	3	7.4
Miscellaneous	2	less than 0.1
Total	360	215.8

These water rights are concentrated in the lower portions of the watershed, with 88 percent (190.3 cfs) of the diversions located downstream of Beaver. This is important to the discussion of streamflows later in this document because the lowest gauging station in the watershed is just below Beaver, hence the effects of water withdrawals on low flows are for the most part not captured by the available streamflow records.

Municipal water rights have been granted to McMinnville, Beaver, Pacific City and Hebo. The city of McMinnville has appropriated 6.4 cfs of water stored behind McGuire Reservoir and another 9.6 cfs of water in Walker Creek. These are the only known water uses that have the potential to remove water from the watershed, other than occasional, short-term withdrawals for fire suppression or similar activities.

In-stream water rights have been issued to Oregon Department of Fish and Wildlife (ODFW) for the purpose of aquatic habitat on the mainstem and major tributaries of the Nestucca. These water rights will only have an effect on other rights which are issued with a priority date (the date of initial use of the water) that is later than 1973.

Appendix C-1.2 provides the out-of-channel water rights of record for the subwatersheds within the Nestucca Watershed. These do not include in-channel rights which do not remove water from the channel (e.g., aquaculture). The actual amount of diversion use is unknown. An analysis was made of water availability based on assumed rates of consumption (cumulative water rights of record), In-stream water right for fish and an 80 percent exceedance low flow for the August, September and

October period (Beaver gauge) (OWRD 1994). From approximately the confluence of Beaver Creek downstream the net water available is negative or nonexistent for the three-month low flow period (in-stream water right is greater than net flows after withdrawals). In effect, since the in-stream water right for fish is the junior right (most recent) in the watershed, this equates to a potential decrease in the available wetted area for habitat needs as identified by ODFW (1972). If all senior water rights were to exercise full legal use of water or flows were below normal such as in 1967, reduction would be greater. Using the 80 percent exceedance value of 72 cfs, there is a 50 percent chance that flows will be below this value (72 cfs) for a seven-day consecutive period.

OWRD has set state scenic waterway flows based on "fisheries flows" and calculated 80 percent exceedance at the Beaver gauge (Fuji, personal communication 1994). These apply to flow at RM 13.5 (Beaver gauge) and have been adopted by the Water Resource Commission; August - 123 cfs, September - 250 cfs, October - 250 cfs (OWRD 1992). These are considerably higher than the net minimum flows (minus diversion and storage), estimated natural streamflow and the existing "Aquatic Life" in-stream water right. In essence, there is little likelihood of future water rights being granted in the watershed.

Summary

The streamflow issue is directed at low flows in the lower Nestucca River and the effects on aquatic habitat. Low flows were described through analysis of existing streamflow records in the watershed. In-stream water rights for aquatic life have been granted to ODFW, and for the months of September and October these In-stream rights exceed streamflows 80 percent of the time. State scenic waterway flows have also been set for the Nestucca above Blaine and these are also higher than historical streamflows for the low flow months. This will make it very unlikely that future water rights will be granted in the watershed.

A comparison of the amount of water released from McGuire Reservoir and the water that would be produced from that watershed above the dam indicates that the reservoir is releasing approximately the same amount of water during the low flow period as would be available if the dam were not there. This release of water is not required by the water right permit and could cease at the discretion of McMinnville Water and Light Department.

Subwatershed Blocks

To facilitate discussion, the 39 subwatersheds have been recombined into six "blocks" based on geomorphic properties and physical location (see map 1). The blocks are: Beaver Creek and Three Rivers, which are the largest tributaries in the watershed; Moon Creek, which includes the bulk of the volcanic rock types and oversteepened slopes outside of Beaver Creek; and the Lower, Middle and Upper Blocks which represent the intertidal portion of the mainstem, the remainder of the unconfined and low gradient portion of the mainstem, and the higher gradient, more confined portion of the mainstem, respectively. Discussion of conditions in the blocks is presented here.

Beaver Creek Block

The Beaver Creek Block includes all of the Beaver Creek watershed (East Beaver Creek, West Beaver Creek, and Lower Beaver Creek subwatersheds) with an area of 20,332 acres (31.8 square miles). The mouth of the watershed is located near RM 15. Refer to appendix C-1.3 for a summary of data for this block.

East Beaver Creek flows from Tillamook Volcanics, a volcanic rock deposited under saltwater, with the remaining area occupied by marine sediments. Specifically, East Beaver Creek contains a combination of steep slopes, unstable geology, erodible soils and high precipitation resulting in the highest landslide potential in the Nestucca watershed. East Beaver Creek is generally a low gradient, unconfined channel with high fish production potential in 13.4 miles of stream reach (see Fisheries discussion). Sediment from landslides associated with timber harvest and road building (late 1960s) followed by the 1972 storm event (75-year) aggraded the stream channel in these productive areas. Channelization, road restoration and debris removal following this storm have significantly altered the productivity of these areas by reducing the amount of quality pools. There are 183 active debris slides and flows within this subwatershed which continue to be a chronic source of sediment. This, along with 202 stream crossings and 17 miles of road landslide potential, make this subwatershed the highest within the Nestucca Watershed for potential sediment production. It is unknown how much sediment may have been transported and deposited in the productive reaches. In general, the headwater channel with mass movement have been scoured to bedrock resulting in loss of riparian vegetation and potential increases in stream temperatures to the main channel. East Beaver Creek water temperatures (approximately 64°F. - 1994) are higher than all other subwatersheds within this block. The BLM, USFS, and ODFW have restored pool habitat for chinook, coho and steelhead salmon in portions of the main channel of East Beaver Creek. Spawning surveys have indicated that there are currently not enough returning adults to occupy available habitat.

In contrast other subwatersheds within the Beaver Creek Block have a relatively low potential for producing sediment and increasing Beaver Creek and the Nestucca River water temperatures.

Three Rivers Block

The Three Rivers Block includes all of the Three Rivers watershed. It has an area of 24,339 acres or 38.0 square miles. The mouth of the watershed is located near RM 10. Refer to appendix C-1.3 for a summary of data for this block.

Large, ancient landslides are more common within the Three Rivers Block, specifically in the Cedar Creek and Upper Three Rivers subwatersheds, than anywhere else in the Nestucca Watershed. Ancient landslides formed during the Pleistocene era are recognized by gently sloping topography, displacement of underlying rock strata, springs and deranged drainage patterns. The Yamhill, Tyee and Nestucca Formations dominate the remainder of the block and produce weak incompetent rock which has a high potential for landsliding on steep slopes. This can be seen in the Upper Three Rivers and Alder/Buck subwatersheds where a high landslide potential exists on 1,143 acres. A 1989 landslide inventory of the Upper Three Rivers watershed showed only six active landslides caused by timber harvest or road construction, however numerous natural or inactive landslides were recorded. Most road construction and timber harvest did not begin until the late 1970s when management practices protected some riparian areas and steep slopes resulting in fewer human-caused landslides.

Landslide topography, deep soils with high water holding capacities and high precipitation have produced a landscape with high stream densities. Within this block there are an average of 8.8 stream miles per square mile.

Nearly 21 percent of the forestland in this block has been harvested in the past 30 years and 156 miles of road have been constructed, making this block the least impacted by management of all the blocks. Potential sediment production from management activities is greatest in the Lower Three Rivers subwatershed where road and stream densities are highest.

The potential for fish production within Three Rivers is high with 10.7 miles of low gradient stream, however fish migration has been restricted for decades by a weir at the Cedar Creek Fish Hatchery, operated by ODFW. Riparian areas have been impacted by timber harvest, agricultural development and road construction. Highway 22 has constricted the channel and removed riparian vegetation along much of the mainstem of Three Rivers.

The high occurrence of hardwood-dominated stands has resulted in a shortage of large woody debris in most of the streams. The result of these management activities is a reduction in habitat complexity and stream shading. Monitoring in 1994 showed water temperature increasing from the upper reaches to the mouth of Three Rivers. Cedar Creek had the lowest temperatures measured in the Nestucca Watershed, ranging from 51 to 57°F.

High stream densities, steep slopes and high landslide potential in combination with management activities could potentially affect productive flats. Visual observations suggest that channel aggradation has not occurred, however additional monitoring needs to be done to better understand the relationship between productive flats and sediment.

Moon Creek Block

The Moon Creek Block includes Moon Creek, East Creek, Wolfe Creek and Bays Creek subwatersheds. It has an area of 17,362 acres or 27.1 square miles. A number of small "frontal" streams drain directly into the Nestucca River. Refer to appendix C-1.3 for a summary of data for this block.

Streams in this block flow predominately from Tillamook Volcanics, which have a high potential for landsliding. Steep slopes, shallow soils, weak rock and high rainfall combine to produce extensive debris slides and flows. A high or extreme landslide potential rating exists on 10 percent of the total area and is especially high in the Moon Creek and Bays Creek subwatersheds. In a 1988/89 landslide inventory of Moon Creek, 170 active debris slides and flows were found, 85 percent caused by road and harvest activities. Most debris slides were less than 1,000 square meters in size, however this is an average of 19.3 slides per square mile which is higher than what was found in East Beaver Creek. This, along with 9.4 miles of roads crossing high landslide potential areas and 14.7 miles of high soil ravel potential make this subwatershed the second highest for potential sediment production within the Nestucca Watershed.

Extensive landsliding in Moon Creek has scoured headwater channels to bedrock resulting in sediment loading to streams, loss of riparian vegetation and potential increases in stream temperature. There was no water temperature data available for any of the streams in this block. The effects of sediment on the productive flats in this block and further downstream in the Nestucca River are unknown. Changes in channel geometry and streambed composition occur when sediment quantities exceed the stream channels capacity to transport sediment.

Lower Block

The Lower Block includes the Lower Nestucca River, Horn Creek, Farmer Creek, Clear Creek and George Creek subwatersheds. It extends from RM 0 to approximately RM 12 and contains 21,843 acres or 34.1 square miles. Tidal effects extend to RM 7 at Cloverdale. Refer to appendix C-1.3 for a summary of data for this block.

Numerous dairies, small towns and homes are along the broad floodplain of the lower Nestucca River. Upper slopes are forested and generally dominated by mixed layers of marine sediments and volcanic rock. Ancient landslides are common, and a high landslide potential exists on 1,167 acres. Many landslides occur at the contact between volcanic and sedimentary rock on steep slopes. Timber harvesting on non-federal lands has been extensive within the past five years, and 26 percent of the forest lands have been harvested in the past 30 years. Most of the lowlands were once forested but past land clearing practices have removed most of the riparian vegetation. There are currently over 300 acres of non-forest openings along the lower 30 miles of river; most of this occurs below Farmer Creek. The loss of riparian vegetation has increased the potential for bank erosion and thermal pollution. Loss of riparian habitat within the 25.5 miles of productive flats has also affected fish populations.

Bank erosion potential is highest in the Lower Nestucca subwatershed where soils are loose and easily eroded, riparian vegetation has been removed and the effects of high energy flood events can be seen. A historic photo inventory conducted on the lower Nestucca (RM 0-24) showed that the length of eroded banks increased 2.5 times between 1953 and 1977. Increases since 1977 have not been significant.

Temperature monitoring in 1994 showed that stream temperatures in the Nestucca were higher at RM 12 than at RM 7 even though there is little riparian vegetation along this segment of river. Cooler water from Three Rivers, Farmer Creek and Horn Creek may be lowering temperatures in the main Nestucca, and the summertime fog and cool winds in this area may be factors as well.

Fecal coliform levels are high in the lower Nestucca watershed because of numerous septic systems, sewage treatment plant outfalls which discharge into the Nestucca River and agricultural sources such as small farms and commercial dairy operations.

Middle Nestucca Block

The Middle Nestucca Block contains 38,574 acres or 60.3 square miles of land. It includes the mainstem of the Nestucca River from approximately RM 13 to RM 34, and the Foland, Tony, Boulder1, Alder1, Limestone, Powder, Niagara Clarence and Slick Rock Creek subwatersheds. The river valley is narrow and steep above the community of Blaine as the river flows through the Siletz River Volcanics, which are some of the oldest rocks in the Coast Range. Stream gradient decreases below Blaine and the river corridor widens as it flows through recent sediment deposits. Broad flat terraces occur above the current floodplain in areas where the river has experienced downcutting. Refer to appendix C-1.3 for a summary of data for this block.

Weak, incompetent rock of the Nestucca and Yamhill Formations dominate geologic types found within this block. The somewhat resistant volcanic rock layers mixed with sedimentary rock layers is commonly the source of landslides on steep slopes. Debris slide and flow potential is scattered (1,723 acres) throughout this block although higher potential areas can be seen in the Niagara subwatershed and on steep slopes below Mt. Hebo. Extensive fires have produced a landscape dominated by alder in the area surrounding Mt. Hebo. There are an average of 7.1 miles of stream per square mile within this block and average road densities are less than five per square mile. Road density and harvest is low within the Powder, Tony and Limestone Creek subwatersheds.

The Middle Nestucca has 35 miles of low gradient, unconfined channel which provides a high potential for fish production. Potential for sources producing sediment was low to moderate with no particular subwatershed being high in any one of the source categories. Stream temperature data collected in 1994 showed an increase of approximately 2°F between RM 13 and 23. Niagara Creek had the highest temperatures in this block and is the source of some of the temperature increase in the main river. There is no temperature data available for most of the streams in this block, and this needs to be remedied by future monitoring.

Upper Block

The Upper Block includes the Bible Creek, Testament Creek, Bear Creek, Elk Creek, Fan Creek, Bald Mountain Fork, Walker Creek and McGuire Reservoir subwatersheds and extends from RM 33 to the headwaters above McGuire Reservoir. Refer to appendix C-1.3 for a summary of data for this block. There are 40,656 acres or 63.5 square miles within the Upper Block. McGuire Reservoir is the only impoundment on the river and is located at RM 49. The highest point on the river has an elevation of 2,200 feet where it drains the old Meadow Lake Dam area. From this area to near Blaine the river drops 1,500 feet in elevation and flows through a narrow valley. The river has been confined by the Nestucca Access Road through much of this area, which limits channel migration, increases stream velocity and reduces its value as overwintering habitat for fish.

The underlying bedrock in this block is a mixture of Siletz River Volcanics in the valley bottom and mixed sedimentary and volcanic rocks of the Nestucca and Yamhill formations in the higher elevations. The Bear Creek soil creep area is an area of deeply weathered sedimentary rocks that has encroached on Bear Creek and is a chronic sediment source. Landslide potential is relatively low in this block because of gentler slope gradients.

Management activities have been intense in this block with 36 percent of the forest lands harvested in the last 30 years and 472 miles of road constructed, for a road density of 7.4 miles of road per square mile, the highest in the Nestucca Watershed. Bible Creek, Elk Creek and the Nestucca River up to RM 47 have been impacted the most by road construction through confinement or road-related landslides.

Riparian areas are mostly dominated by alder. Large woody debris is lacking in most streams. Fish habitat conditions in the block are generally fair for anadromous fish, mostly because of extensive restoration work which has been performed on Elk Creek, Bear Creek, and the Nestucca River. Riparian enhancement involving underplanting with conifer species has been accomplished on the same streams, and this will improve the long-term stream shade and large woody debris.

B. Vegetation

Settlement patterns, fire history, major flood and windstorm events, and past management have influenced vegetation conditions within the Nestucca Watershed.

Since the mid to late 1800s, land has been cleared to make land suitable for farming, increase pasturage, keep down brush and make hunting easier (Munger 1944). Timber harvesting in the Nestucca Watershed began very early, as illustrated in 1929 aerial photographs. The lower watershed was the first to be impacted by timber harvest, with no significant timber management taking place in the upper drainage until about 1960 (McDonald and Schneider 1992).

Construction of the Nestucca Access Road (1958-1960) constricted the stream channel and removed riparian vegetation. Much of the large woody debris in stream channels was removed during construction of the access road. Concern about logjam barriers in the 1960s and 1970s also prompted the removal of large quantities of woody debris. Timber harvesting and road construction has had a significant impact on some portions of the watershed by removing riparian vegetation, and causing landsliding and slumps.

Impacts of Fire

Fire probably does not have a regular cyclical frequency in this area (Teensma et al. 1991). Before the first settlers arrived, Native Americans used fire to maintain a diverse assemblage of plants for food and fiber products (Kentta 1994). Every year or two, Native Americans set fire to established 80 to 100 acre plots, for purposes such as increasing feeding habitat for deer and elk and creating hazel straight enough for making baskets. Generally, the burns were cool and did not burn adjacent forests. These localized fires did not impact the Nestucca Watershed to the same extent as the large fires which occurred between the mid 1800s and 1919. The 1910 Hebo Burn consumed 50,000 acres, many of which are in the Nestucca Watershed. Later fires in 1934 and 1939 burned in Niagara Creek and in the upper headwaters of the tributaries from East Beaver Creek to Cedar Creek, respectively. In the northern portion of the Nestucca Watershed, most areas have had only one fire within the last 100 years. Many of the alder areas in the southern part of the Nestucca Watershed burned two or three times.

Impacts of Wind

Winds of hurricane force (over 74 miles per hour) strike the Oregon Coast several times each winter and occasionally exceed 100 m.p.h. at the top of Mt. Hebo. Blowdown resulting from these storms can be substantial. For instance, the Columbus Day Storm (October 12, 1962) blew down 11 billion board feet of timber in Washington and Oregon (Hemstrom and Logan 1986). Generally the intensity of these storms dissipates quite rapidly as they move inland from the Pacific Ocean. Thus, most blowdown occurs in small patches, which speeds successional development by opening the canopy and releasing suppressed understory climax species (Dale et al. 1983). The holes and openings that result can greatly add to biodiversity of the landscape.

Impacts of Flooding

Major floods occurred in 1945, 1950 and 1955, although the impacts of these floods are largely undocumented. In November 1962, Meadow Lake Dam on the upper Nestucca River failed, causing flooding along the entire Nestucca mainstem. Additional flooding in 1964-1965 and 1972 caused extensive impacts to some portions of the Nestucca Watershed, such as East Beaver Creek (Baker et al. 1986).

As a consequence of flooding, streamside vegetation is generally dominated by hardwoods, especially red alder, since this species is able to rapidly colonize recently disturbed soils and streambanks and is maintained by frequent disturbances. Red alder is able to fix nitrogen from the atmosphere, which gives it a competitive edge on disturbed mineral soils. In addition, it is more tolerant of inundation and is able to grow in riparian areas where groundwater is relatively close to the surface (Reiter and Beschta 1994). In low-elevation riparian zones, Sitka spruce is also common on relatively wet sites since it is able to tolerate inundation.

Other Impacts

Insect epidemics and forest diseases have impacted the Coast Range in the past at various scales. Following the 1933 Tillamook Fire, a beetle epidemic killed a large number of trees between 1935 and 1937 (Teensma et al. 1991). Small local pockets of trees are currently impacted by bark beetles, spruce tip weevils and root rot diseases. While mistletoe infestations can be found in localized areas within the watershed, they are not widespread. Small scale impacts, created by combinations of these various disturbance, can result in small openings and altered growth forms which may be pockets of diversity within otherwise homogeneous stands.

The impacts of timber management are discussed under current vegetation patterns.

Current Vegetation Patterns

The Nestucca Watershed lies within the Western Hemlock and Sitka Spruce Vegetation Zones, named for the "climax species" which eventually dominates the forested plant community. Within each zone are plant associations which vary along moisture gradients, as influenced by elevation, aspect, topography, soil type, and slope position. Disturbances such as fires, floods, windstorms, landslides, insects, pathogens and human activity determine the seral and successional pathways the landscape will follow. Depending on the frequency or intensity of disturbance, there can be several successional pathways within a plant association.

Although Douglas-fir is a subclimax species in the Nestucca Watershed, it is by far the most dominant tree. Douglas-fir, in various growth stages, depending upon timing of the last fire or clearcut, is evident across most landscapes. Those federal lands which have been commercially thinned or clearcut over the past 30 to 40 years are characterized by healthy and rapidly growing even-aged stands, primarily of Douglas-fir. In many cases, other species do not exist in these stands and snags, defective trees and down wood have been removed. Red alder and bigleaf maple dominate along most river valleys and streams, while lodgepole pine (locally known as shore pine) is a subclimax tree species in oceanfront forests (Franklin and Dyrness 1973).

Each plant community has vegetation in a range of age classes and occurs over a range of successional stages. Old growth, mature, young conifer, hardwoods, shrubs and grasses/forbs occur in a variety of patch sizes.

The Coast Range is characterized by a pattern of large scale (some greater than 20,000 acres), infrequent (150-300 year mean fire return interval) stand replacement fires typical of cool moist climates where lightning is uncommon (Agee 1990; Teensma 1991). Historically, large patches of similar seral stages were covering the Nestucca Watershed (see map 14). Within each larger patch, both natural and human disturbances have created smaller scale patches of seral diversity.

Repeated disturbance maintains the early and mid-seral communities, favoring the hardwoods. Wind storms, insect pathogens, small scale fires, debris flows and short rotation harvest have acted to continually cycle the Nestucca Watershed through the early to mid-seral stages. The majority of the late seral stands have been harvested in the past 30 to 40 years, while only a small amount of forest in the mid-seral communities has developed into the late seral stage. Immediately following large scale disturbance, early seral stages predominate and late seral stages are deficit. As succession occurs, early seral stages give rise to mid-seral stages; late seral stages develop slowly. The majority of the Nestucca Watershed is currently within the early and mid-seral stages (see table 4B1). The spatial distribution of the various seral stages is not uniform throughout the watershed (see map 5) and is heavily dependent upon several factors including fire history and past management.

Forest management activities and the associated roads have had a significant effect upon the character of the stands within the watershed and the ecosystem of the larger landscape. The first clearcuts within the watershed removed the majority of the old growth which had survived the fires. Within the second growth stands, thinning, clearcut harvesting and blowdown salvaging programs, have left a landscape largely made up of fragmented second growth conifers which are frequently deficient in large snags and down woody debris, and extensive tracts of pure or mixed alder stands.

Due to fires and timber harvest, less than 1 percent of the stands in the Nestucca watershed (approximately 1,200 acres) are over 130 years old; about 200 acres of old-growth vegetation greater than 200 years old exist within the entire watershed. This small amount of old growth sharply contrasts to an estimated 62 percent of the prelogging forests being old growth in the Pacific Northwest (Booth 1991).

Table 4B1 Seral Stage Distribution Within the Nestucca Watershed

	Acres by Seral Stage				
Vegetation Type	**Very Early**	**Early**	**Early/ Mid**	**Mid**	**Mid/Late /Mid**
Non-forest/ agricultural	13,558				
Herb/forb/ meadow	13,279				
Shrub	16,922				
Pure hardwood		21,222			
Sapling pole		32,969			
Hardwood-dominated mix			11,471		
Conifer/ hardwood mix			18,100		
Small conifer			7,609		
Mature conifer				27,000	
Old growth/ mature					1,259
Total Acres	43,759	54,191	37,180	27,000	1,259

Within the last 80 years most of the wildfire-impacted or logged areas on USFS land have been restocked with planted trees. Some of the early planting attempts were done using, either off-site Douglas-fir or Sitka spruce seedlings or exotic, non-adapted species, such as eastern white pine, Norway spruce or redwood (Munger 1944). While nearly all of the exotic species plantations failed completely, the off-site Douglas-fir has survived but is growing slowly, does not respond as rapidly to silviculture treatments, and is more susceptible to insect and disease problems than adjacent local seed-source stands. These off-site stands are primarily located in the Mt. Hebo, Niagara and Little Hebo areas.

The Nestucca Watershed has been grouped into seven distinct zones of similar plant community types or **Major Habitat Zones** resulting from fire history, past management practices and location within the Nestucca River watershed (see map 6 and appendix C-3.6 for acreages). Each zone may include several seral stages. The following discussion pertains to those mapped Major Habitat Zones.

The fog belt near the coast supports the Sitka Spruce Zone, which is characterized by two successional stages discussed below: mature mixed conifer on the ridges and north slopes and red alder-dominated forest elsewhere. The mature conifer in this zone is a mix of Sitka spruce, western redcedar, Douglas fir, and western hemlock. All four species are long-lived and apt to be found in older stands. Succession tends toward western hemlock, with western redcedar and Sitka spruce on moist to wet sites; Sitka spruce is perpetuated in natural openings in the canopy; much of the forest regeneration occurs on rotting conifer logs in this area especially in moist brushy areas.

Located in two blocks in the southwestern corner and along the northwestern edge of the Nestucca Watershed, the **Mature Mixed Conifer Area** comprises 5 percent of the river watershed. Much of the area was last burned about 1850, and is now dominated by mature conifers which established naturally following the fire. Old-growth Douglas-fir trees are scattered throughout the conifer stands. Both portions of this area, managed primarily by USFS, are contiguous with mature conifer outside the watershed boundary. In the last 30 years the major disturbance factors have been clearcut harvest, thinning and harvest-related windthrow.

The **Alder-Dominated Area** comprises 23 percent of the Nestucca Watershed, and is located primarily in the southwestern one-third of the watershed. Red alder invaded after this area was disturbed by the multiple fires between 1851 and 1934. Red alder has the ability to disseminate seed over large distances, grows rapidly on repeatedly disturbed forest land and can overtop conifer regeneration, resulting in nearly pure alder forest with dense shrubby understories of salmonberry. From the alder-dominated forest, the successional pattern moves to semipermanent brushfields or to open stands of conifers which germinate on rotting conifer logs, primarily Sitka spruce and western hemlock. Douglas-fir and Sitka spruce trees are scattered individually or in small clumps throughout the landscape. Private land owners have been aggressive in converting much of the alder to Douglas-fir plantations. The USFS has converted alder-dominated ground to young Douglas-fir stands in smaller patches scattered across the landscape.

Comprising 5 percent of the Nestucca Watershed, the **Agricultural and Residential** land is located in the valleys of the western third of the watershed, clumped along the Nestucca River and its major tributaries. This zone consists of primarily of dairy farms, residential homes and small woodlots. It is assumed that agricultural land will be maintained in early seral stages.

Inland from the fog belt, the predominance of Sitka spruce decreases and the environment supports the Western Hemlock Vegetation Zone. The large fires of 1890 and 1910 influenced the vegetation patterns. Red alder is less common and usually a subordinate species, except on recently disturbed sites or specialized habitats, such as riparian areas. Approximately 30 percent of the Nestucca Watershed is within the **Conifer-Dominated Hardwood Mix Area**, which covers the valley slopes in the central portion of the watershed.

Approximately 30 percent of the Nestucca Watershed is within the **Mature Douglas-fir Area**, another successional stage in the development of the western hemlock climax forest. The south-central portion of the area is contiguous with mature Douglas-fir on USFS land outside of the watershed boundary. On dry sites, Douglas-fir is frequently the dominant species, and on wet sites, western redcedar is included with hemlock in the climax forest. The understory also varies along a moisture gradient; dry sites tend to have a predominance of salal, while on moist sites, swordfern, wood sorrel, vine maple, and huckleberry are common. After disturbances, such as fire and logging, the early-successional stage contains many of the residual species from the pre-disturbance stand plus invading herbaceous species. Following the herb/forb stage is the shrub-dominated stage, with residual brush species such as vine maple, salal, salmonberry, thimbleberry, and huckleberry. The early seral stages develop into mid-seral stands dominated by red alder, bigleaf maple, Douglas-fir, western redcedar or western hemlock, depending on site moisture conditions and seed sources. Douglas-fir is intolerant of shade, but can grow in stands with western redcedar and western hemlock. Two other successional patterns are (1) open stands of Douglas-fir with understories dominated by salal or vine maple, and (2) the dense, even-aged Douglas-fir stands that result from planting after logging and/or fires. Without management, these Douglas-fir stands do not develop the characteristic understory species until natural mortality sufficiently opens up the stand; western hemlock may not invade a dense Douglas-fir stand for 100 to 150 years.

Although once more common, a few western white pine are found in the watershed. They are believed to be remnants which survived an outbreak of the introduced white pine blister rust several decades ago. In isolated high elevation sites within the watershed, noble fir is the climax species although it does not exist in sufficient quantity to warrant a discussion of the plant association.

A small portion of the Mature Douglas-fir Area, approximately 5 percent of the Nestucca Watershed, is the **Mt. Hebo Young Mature Conifer Area**, located on USFS land in the south-central portion of the Nestucca Watershed. The area burned twice between 1851 and 1910. Open stands of Douglas-fir developed on the western portion of the area. The rest was planted with exotic tree species or Douglas-fir stock adapted to growing conditions outside of the Oregon Coast Range. Trees in these plantations grow more slowly and tend to be shorter and smaller than native Douglas-fir of the same age. Much of the area has been commercially thinned and/or clearcut.

Another small portion of the Mature Douglas-fir Area, 2 to 3 percent of the Nestucca Watershed, was consumed during the **Tillamook Burn** of 1933. This area includes primarily BLM and ODF lands along the northern border of the Nestucca Watershed and is contiguous with the Tillamook State Forest. The Tillamook State Forest contains 480,000 acres of forestlands, approximately 3 percent of which currently support trees older than 80 years. Large fires in 1933, 1939, and 1945 burned a total of 345,936 acres. Subsequent salvage operations and reforestation have created a relatively homogeneous forest, with stands 30 to 50 years of age. Older forest stands outside the burned area, now fragmented by timber harvest, contain the remaining late seral stage habitat.

Between the Nestucca Watershed and the eastern foothills of the Coast Range, federal (BLM) lands are isolated blocks surrounded primarily by private forest land. The agricultural lands of the Willamette Valley begin approximately six miles east of the watershed. Except for agricultural lands along the river valleys lands to the south of the watershed are forested and have been managed for timber production on USFS, Grande Ronde Indian Agency and private lands.

Late seral stands in the Nestucca Watershed are primarily located within the **Mature Mixed Conifer** and **Mature Douglas-fir** habitat zones discussed earlier. Old-growth trees are sparsely scattered within the **Conifer-Dominated Hardwood Mix** and **Alder-Dominated Zones**. Of the 4,500 acres of old growth that existed in the watershed in 1955, approximately 1,180 acres of old growth and conifer over 130 years remain, primarily on federal land. Only one third of these late seral stands is large enough to have an interior core. An interior core is that portion of the stand separated from early and mid-seral habitat by 200 feet of late seral buffer. Within the entire watershed, there are only 39 late seral stands with interior core areas; these core areas average five acres in size, an area too small to support many of the species dependent upon late seral interior habitat.

Prior to harvest, 46 percent of the **Mature Douglas-fir Area** was in stands of mid- and late seral mature conifer (over 75 years old) which averaged 845 acres in size. In 1994, 28 percent of this area is in mature stands which average 55 acres in size. Fragmentation caused by timber harvest has affected the quantity and patch size of interior core areas. Prior to harvest, there were 63 interior core areas averaging 511 acres in size. At present, there are 231 core areas averaging 11 acres in size (see appendix C-3.5). This has negatively impacted those species dependent upon interior forest habitat, especially those with large home ranges, i.e., spotted owl, pine marten.

Patch and interior core area sizes of mature conifer (over 75 years old) increase with the addition of stands within the conifer-dominated hardwood seral stage to stands within the mature conifer seral stage. Conifer-dominated hardwood ranges from 51 to 80 percent conifer and can function as mature conifer habitat of the same stand age. Prior to harvest, there were 46 interior core areas averaging 594 acres in size. At present, there are 240 core areas averaging 20 acres in size (see appendix C-3.5). As discussed above, fragmentation caused by timber harvest has resulted in an increase in the number of interior core areas but a significant decrease in their size.

Threatened, Endangered, and Sensitive Plant Species (TES)

There are a number of plant species of special interest (called Species of Concern) that are known or likely to occur in the Nestucca Watershed. Species of Concern include Threatened, Endangered, or Sensitive species, noxious or other invasive non-native species, species identified in the President's Plan (Record of Decision) that are to be protected through survey and management strategies, and other plant species that are not on official lists but which are unique or uncommon. In addition to Species of Concern, the watershed contains several areas established for protection of botanical resources (see Botanical Resource Areas below).

Management of sensitive species is complicated in the Nestucca Watershed due to differing TES plant lists and management guidelines between agencies. Appendices C-2.1 to C-2.3 list TES plant species that are known or likely to occur in the Nestucca Watershed. Populations of species in appendix C-2.1 are required to be protected on both USFS and BLM lands, whereas populations of species listed in appendices C-2.2 and C-2.3 may be protected, depending on agency guidelines and priorities. Of the species listed in appendix C-2.1, populations of the following plant species occur in the Nestucca Watershed:

Scientific Name	Common Name
Cardamine pattersonii[1]	Saddle Mt. bittercress
Erythronium elegans	elegant fawn lily
Filipendula occidentalis	queen-of-the-forest
Poa laxiflora	loose-flowered bluegrass
Sidalcea hirtipes	hairy-stemmed checkermallow
Sidalcea nelsoniana	Nelson's checkermallow

[1] This species was documented as occurring on Mt. Hebo, yet recent surveys have not located any populations.

Nelson's checkermallow (*Sidalcea nelsoniana*), was listed as Threatened by the U.S. Fish and Wildlife Service in 1993 and a recovery plan for the species is being prepared. This member of the mallow family, one of several species of checkermallows found in western Oregon, is endemic to the northern Willamette Valley and the eastern slopes of the Oregon Coast Range. The largest known population occurs in the Nestucca Watershed in the proposed Walker Flat Area of Critical Environmental Concern. In addition, in the Nestucca Watershed, there are three naturally-occurring populations on private lands owned by the City of McMinnville, and two transplant populations (one on BLM land, called the South McGuire site, and one on private land). Concerns about the rarity of the species and effects of proposed management activities (the Walker Flat site was in direct conflict with plans by the McMinnville Water and Light Department to construct a dam on Walker Creek) instigated a decision to establish new populations by transplanting propagules, and to monitor both transplant and natural populations for ten years (1985-1996). BLM lands are being monitored by BLM botanists; private lands are being monitored by CH_2MHill (a private consulting firm).

Elegant fawn lily (*Erythronium elegans*) occurs within the Mt. Hebo Scenic Botanic Special Interest Area. This population is one of only five known populations of this recently described plant species, which is endemic to the northern Oregon Coast Range Mountains (Hammond and Chambers 1985). The Berry Botanic Garden is conducting a study of USFS and BLM populations of elegant fawn lily in order to determine the status and stability of these populations.

Three populations of hairy-stemmed checkermallow (*Sidalcea hirtipes*) occur in the Nestucca Watershed in open meadows on the Siuslaw National Forest. This species is a candidate for listing as Threatened or Endangered by the state of Oregon, and on the 1994 Oregon Natural Heritage Program's List 1, which includes plant species that are endangered or threatened throughout their range. One meadow, which supports the largest hairy-stemmed checkermallow population in the watershed, was grazed by cattle from 1959 to 1991. Since cattle grazing ended, the meadow has been mowed to reduce encroachment by invasive plants in order to provide elk habitat. USFS botanists initiated monitoring in 1993 to compare the effects of mowing on the reproductive vigor of hairy-stemmed checkermallow. However, follow-up monitoring in 1994 was not done due to limited personnel. All three populations may be threatened by invasion of aggressive, weedy plant species, such as Himalaya blackberry and bracken fern. In 1994, the Native Plant Society of Oregon funded some initial gathering of baseline information of populations of hairy-stemmed checkermallow. Additional monitoring is needed to determine the health and status of these populations.

Loose-flowered bluegrass (*Poa laxiflora*) occurs in general forested habitats throughout the Nestucca Watershed. The Oregon Coast Range represents the center of distribution for *Poa laxiflora* and contains the majority of known sites. Threats to this species are now minimized on federal lands due to reduced clearcutting of forests. The Siuslaw National Forest developed a Conservation Strategy for this species that identifies populations for protection (USDA Forest Service 1993). Populations have been selected, yet additional review of these populations is needed to determine if the selected populations are the best choices. Selected populations do occur in the Nestucca Watershed, and protection from management activities is required under the guidelines outlined in the Conservation Strategy.

Appendix C-2.4 lists vascular TES plant species (for the Nestucca Watershed) by habitats to help plan future TES plant surveys within the watershed.

Noxious Weeds

The following invasive plant species, listed as Noxious Weeds by the Oregon Department of Agriculture (1994) are known to occur in the Nestucca Watershed: Canada thistle (*Cirsium arvense*), bull thistle (*Cirsium vulgare*), Scot's broom (*Cytisus scoparius*), St. Johnswort (*Hypericum perforatum*), and tansy ragwort (*Senecio jacobaea*).

Canada and bull thistles, St. Johnswort and Scot's broom are well established and beyond eradication. Populations of tansy ragwort have been successfully contained as a result of biological control efforts. More than 90 percent of tansy ragwort populations have been eradicated, though scattered plants still occur in disturbed areas, such as roads and landings.

Of special concern in the Nestucca Watershed is the potential establishment of populations of gorse (*Ulex europeaus*) and purple loosestrife (*Lythrum salicaria*). Gorse, usually associated with coastal habitats, was recently found growing at about the 2,000-foot elevation near Zigzag, Oregon. This species has the potential to become established throughout western Oregon (Isaackson 1994). There are no reported locations of purple loosestrife in the Nestucca Watershed.

Japanese knotweed (*Polygonum cuspidatum*), listed as a noxious weed by the state of Oregon, may occur in the watershed though there are currently no reported locations. Two other invasive knotweed species which could potentially occur in the Nestucca Watershed are giant knotweed (*Polygonum sachalinense*) and Himalayan knotweed (*Polygonum polystachyum*).

Species in the Record of Decision (ROD)

Appendix C-2.5 lists the species which occur or are likely to occur in the Nestucca Watershed that are to be protected through survey and management, as designated in the President's Plan. A complete understanding of the current condition is unavailable for many of these species, particularly the non-vascular plants (fungi, lichens and bryophytes). Currently, only four of these species are documented in the watershed: *Cantherellus* sp., *Clavulina crista, Endogone oregonensis*, and *Thaxterogaster* sp. nov. #Trappe 4867. The following factors have contributed to our limited knowledge about these species:

- Survey and inventory has predominantly been limited to vascular plants.
- Sightings are few and widespread for some species, indicating large gaps in range information.
- Only the most rudimentary of ecology data is available for many species; therefore, habitat requirements are essentially unknown for most of these species.
- Sighting location information is often general, lacking specific information (e.g., "Lane County", with no additional information).

Unique or Uncommon Plant Species

The Nestucca Watershed contains plant species that are considered uncommon and of special interest (see appendix C-2.6). Several of these are discussed below (see Botanical Resource Areas).

Under the Oregon Wildflower Law (State of Oregon 1963), it is unlawful to export or sell or offer for sale or transport all members of the following plant species:

Scientific Name	Common Name
Calochortus spp.	mariposa lilies
Calypso spp.	lady's slipper
Cypripderium spp.	lady's slippers
Erythronium spp.	fawn lilies
Fritillaria spp.	mission bells
Lewisia spp.	bitterroots
Rhododendron spp.	native azaleas and rhododendrons

Botanical Resource Areas

The Nestucca Watershed contains four designated and one proposed BLM Areas of Critical Environmental Concern (ACEC) and one USFS Special Interest Area (SIA). Four of five of these areas were established, at least in part, for their important botanical resources, which are summarized below:

Nestucca River ACEC

Five plant species, which are considered uncommon and of special interest, occur in this ACEC: fringed pinesap (*Pleuricospora fimbriolata*), gnome plant (*Hemitomes congestum*), calypso orchid (*Calypso bulbosa*), phantom orchid (*Eburophyton austiniae*), and weak bluegrass (*Poa marcida*). The world's largest known concentration of fringed pinesap is in the upper watershed of the Nestucca River within this ACEC, and has been the focus of several research projects (Friedman 1981; Luoma 1982; Roberts 1990). Management actions identified in the Area of Critical Environmental Concern Management Plan (USDI Bureau of Land Management 1984) require inventories and research to learn more about the botanical resources (see Recommended Management Opportunities).

Sheridan Peak ACEC

Established primarily to protect habitat for weak bluegrass (*Poa marcida*), though loose-flowered bluegrass (*Poa laxiflora*) also occurs within this area. Both plant species are endemic to the Pacific Northwest.

High Peak - Moon Creek ACEC and Research Natural Area

Contains a stand of old-growth western hemlock and Douglas-fir (about 500 years old) which is the last major concentration of western hemlock zone old growth from ten miles south of Mt. Hebo to the north end of the old Tillamook Burn. Also contains a number of plant community associations typical of Coast Range forests, and scattered populations of weak bluegrass (*Poa marcida*) and fetid adder's tongue (*Scoliopus hallii*).

Proposed Walker Flat ACEC

Contains the largest and healthiest population of the Federally Threatened Nelson's checkermallow (*Sidalcea nelsoniana*) as well as important marsh habitat.

Mt. Hebo Scenic Botanic SIA

A variety of special habitats, including rock outcrops, bogs, and meadows, contains unique plant species and communities. One of five known populations of elegant fawn lily (*Erythronium elegans*).

Special Forest Products (SFP)

Special forest products in the Nestucca Watershed have been utilized by humans ever since the first Native Americans arrived. Besides berries, mushrooms and various plants used for eating and medicinal purposes, spruce roots and willow bark were used for baskets, reeds and coarse grasses were made into mats, and cedar logs were scraped, burned and shaped with hot rocks and water into canoes (Tillamook Pioneer Association 1972). Most of these vegetation uses were shared with subsequent settlers.

A variety of plants are currently harvested as special forest products in the Nestucca Watershed. Landscape transplants and floral greenery in the form of mosses, ferns, tree boughs and Christmas trees contribute to the local economy. Other products range from firewood to posts and poles. In addition, seed cones, burls, conks, red alder "puddle" sticks and cedar shake bolts are items extracted from forest stands. Due to the increasing demand for these products and the need to ensure that harvesting is consistent with current management goals and direction, the Siuslaw National Forest has convened an interdisciplinary team to develop an environmental assessment (EA) of special forest products harvesting on its lands. This EA is due to be completed in the fall of 1995.

Mosses, which are harvested for use by the floral industry, are one of the main special forest products harvested in the Nestucca Watershed. For example, in 1993, permits were issued for 26,450 bushels of moss on the Siuslaw National Forest; 24,200 of the bushels were issued on Hebo District within the watershed. Oregon Department of Forestry, which allows approximately 1,200 pounds of any special forest product, including mosses, to be harvested at a cost of $50.00, is in the process of developing a management plan for special forest products (Teran 1994). Information is lacking on how much moss can be harvested sustainably, what species are being harvested, the effects of moss harvesting on ecosystem health and plants, animals, and insects which may require moss mats for habitat.

Native Species Policy

The BLM does not have a formal policy on native species but the ROD specifies that non-native species will not be introduced into Late-Successional Reserves.

In 1994, the USFS Region 6 (Oregon and Washington) implemented a policy to use native plant species to meet management objectives, such as revegetating disturbed sites (USDA Forest Service 1994). This policy outlines priority areas for using limited native plant materials; within the Nestucca Watershed this would include those sites in and adjacent to streams, wetlands, around documented sightings of sensitive plants, and Special Interest Areas, such as Mt. Hebo. In order to comply with this regional policy, Siuslaw National Forest botanists developed several revegetation prescriptions to be used in 1994 while native plant materials are not available (Miller and Grenier 1994). These prescriptions, based on erosion potential, presence or absence of noxious weeds, and site conditions, are being tested in revegetation test trials. In addition, the Siuslaw National Forest is developing a Native Plant Species Program which will work towards generating native plant materials for revegetation projects.

C. Wildlife

Special Habitats Within the Nestucca Watershed

Special habitats possess features which support unique assemblages of plants and animals. Special habitats within the Nestucca Watershed include the following:

Remnant Old-Growth Patches

Within the watershed, the few existing patches of old growth may provide very limited habitat for a number of old-growth/later seral stage dependent species with low mobility or small home ranges. The scarcity of later seral stage habitat is the major contributing factor to the declining population viability of many species of wildlife within the watershed including bryophytes, fungi, lichens, vascular plants, arthropods, mollusks, amphibians and some species of mammals and birds including red tree voles and marbled murrelets.

Less than 1 percent of the watershed (approximately 1,200 acres) is forested by stands older than 130 years. These patches of later seral stage habitat are located primarily on federal land in 66 scattered tracts averaging 18 acres in size.

Mt. Hebo

Mt. Hebo, rising to an elevation over 3,100 feet (the highest point in the Nestucca Watershed) is a two and a half mile long rock escarpment with unique habitats for plant and animal species. Unique plant assemblages have evolved on the rock outcrops and a federally threatened butterfly is found in USFS-maintained meadows. A plan combining recreation potential and protection of the butterfly and unique plant communities is being developed.

Meadows (Natural, Created or Homestead Remnants)

The majority of meadows that are not seasonal wet areas are old homesteads. These meadows were often heavily grazed by cattle and sheep through the 1930s or, in the case of former grazing allotments on USFS land, through the 1980s. Mowing or slashing of noxious weeds and encroaching vegetation is often required to maintain these meadows. As the surrounding forest matures, meadows will become increasingly important for deer and elk foraging, calving, and bedding habitat, as well as providing a permanent network of habitat for early seral stage species, such as certain plants, snakes, lizards, meadow voles and sparrows. A network of closely connected meadows will ensure a seed source for plant species and dispersal routes for species with low mobility or small home ranges.

Rocky Outcrops and Talus Slopes

In the Coast Range, rocky outcrops and talus slopes are more closely associated with unique plant communities than with wildlife. A few species of birds nest on rocky ledges, e.g., the peregrine falcon and common raven, and certain herptiles, e.g., the northern alligator lizard, Dunn's salamander and western redback salamander commonly live in talus.

Riparian Areas

Riparian areas and wetlands provide some of the most important wildlife habitat in forestlands of western Oregon. Some species such as the red-legged frog, beaver, muskrat, and many waterfowl species are totally dependent upon riparian or wetland areas. Species such as the roughskinned newt, ruffed grouse, willow flycatcher, striped skunk, and dusky-footed woodrat may live in other habitats but reach maximum population densities in riparian or wetland areas. Still other species occupy a broad array of habitats including riparian zones and wetlands but at sometime during their life cycle spend a significant amount of time in these areas. Examples of such species are Pacific tree frog, western toad, Cooper's hawk, yellow warbler, bobcat, and Roosevelt elk. Many species with significant economic importance, such as most of the furbearers, are products of riparian zones and wetlands (Brown 1985).

The vegetation present within the riparian zone defines the number and types of wildlife habitats present. Large dead and down trees not only store nutrients, but provide seed beds for various tree species, provide habitat for various wildlife and, when incorporated into streams, control channel structure and stability.

Prior to logging, road construction, stream cleaning efforts, and the failing of the Meadow Lake Dam, the general stream complexity and diversity of aquatic habitats within the watershed were much greater. The complexity found in stream structure included quiet alcoves and side-channels located off the main course of the streams and deep holes associated with large accumulations of woody debris. These diverse aquatic habitats are not only important to healthy fish populations, but also many species of wildlife e.g., several species of amphibians, western pond turtle, river otter, beaver, heron, kingfisher and bald eagle.

Additional discussions on specific riparian habitats, or on general riparian habitat types follows.

McGuire Reservoir

McGuire Reservoir represents a unique habitat type within the Nestucca Watershed. Seasonally, the amount of water held in the reservoir fluctuates greatly; generally in the fall and winter it is empty, and in the spring or summer it is at its fullest, covering approximately 130 acres. As well as providing habitat for some of those species utilizing small ponds and rivers within the watershed, it provides habitat for additional species including western grebe, common loon, many species of shorebirds and increased numbers and species of waterfowl especially during the spring migrations.

Ponds, Springs, Seeps and Seasonal Wet Areas

There are a number of springs and shallow ponds, both permanent and seasonal, in the watershed. Some of the seasonal wet areas become grassy meadows in the summer and are heavily used by deer, elk, and bear. The springs, seeps and seasonal wet areas are habitat for the red-legged frogs, garter snakes, voles, shrews and several species of salamander. These areas are used for foraging by bats, weasels, hawks, sparrows, warblers and flycatchers. The small impoundment on Walker Creek, and ponds the size of North Lake and South Lake also provide foraging habitat for wood ducks, mallards, mergansers, kingfishers, herons and swallows.

Other ponds in the Nestucca Watershed have been formed by roads, dikes, beavers, landslides or by a combination of the four. Some of these ponds have been stocked with fish by the Oregon Department of Fish and Wildlife and others have native cutthroat trout.

Nestucca Bay

Although the bay has a very significant impact upon the species potentially found within the watershed, for the purposes of this analysis it is not being considered within the analysis area. Numerous species are found only in that portion of the watershed in or near the extreme lower reach of the river, in close proximity to the bay, e.g., northern sealion, California brown pelican, Aleutian Canada goose, rhinoceros auklet, old squaw, tufted puffin, several species of gulls, and pelagic and Brandt's cormorant.

Wildlife Species

The Nestucca Watershed supports diverse wildlife populations typical of the Northern Oregon Coast Range (see species list, appendix C-3.2).

Wildlife Guilds

For the purpose of this analysis, a wildlife guild is being defined as a representative group of species which occupy or are dependent upon, a similar seral stage, vegetation type or habitat type (see appendix C-3.3). While individual species within a particular guild may be "keying in on" or utilizing different combinations of various habitat features or characteristics, (i.e., snags, down woody debris, brush, tree height, openness, temperature or humidity) all guild members have been identified as using that seral stage or vegetation type as their primary feeding and/or breeding habitat (Brown 1985).

Special Status Wildlife Species

Sixty-three special status wildlife species (SSS), (species either listed by USFWS, or having BLM and/or USFS status) are suspected to occur within the Nestucca Watershed (see appendix C-3.2 for Nestucca Watershed species list).

Northern Spotted Owl (FT) Federally Threatened

Critical habitat for the spotted owl has been designated which encompasses lands within the Nestucca Watershed (see map 3).

A North Coast Range Landscape Perspective

The spotted owl population within the Oregon Coast Range Province is extremely low and in a significant decline (*The Draft Recovery Plan For The Northern Spotted Owl 1991*). This is especially true in the northern three-fourths of the province (north of Highway 38) where suitable habitat is very limited, poorly distributed and highly fragmented. In general, owls within the province are poorly distributed and exist at very low densities with many pairs isolated by more than ten miles.

The northernmost Late-Successional Reserve in the Oregon Coast Range Province, "the Kilchis Block", is located approximately six miles to the north-northwest of the Nestucca Late-Successional Reserve. It contains approximately 8,500 federal (BLM) acres which are interspersed with state and private lands. There are four known owl sites within, or in very close proximity to, the Kilchis Late-Successional Reserve; one of which produced two young as late as 1992. Simpson Timber Company and Oregon Department of Forestry own virtually all the land between these two Late-Successional Reserves. The portion of the Tillamook State Forest which was a part of the Tillamook Burn, currently may function as owl dispersal habitat. Approximately three miles south of the Nestucca Watershed on Grande Ronde Indian Reservation lands, there are two spotted owl pair sites. Approximately one to three miles to the east and northeast of the Nestucca Watershed there are two additional owl sites located on lands owned by BLM and the City of McMinnville.

Historical Perspective of Owl Surveys

The first northern spotted owl surveys conducted on BLM lands within the Nestucca Watershed were conducted in 1975. At that time, two pairs of owls were located (Elk Creek and Nestucca River sites). At the Moon Creek site, a single male was found in 1986, and a pair in 1990. In 1984, the USFS began conducting owl surveys within the watershed, and in 1990 found a pair of owls at the Niagara Creek site.

Spotted owl surveys conducted by the BLM and USFS during the first few years were conducted primarily to determine if proposed timber sales were in conflict with areas used by spotted owls. Additionally, the four known owl sites within the watershed have been monitored, with varying levels of survey effort, during most years since the time of initial identification (see appendix C-3.4).

An estimated 75 percent of the suitable spotted owl habitat on USFS land within the watershed has been surveyed to protocol for at least one year since 1987. All suitable habitat on BLM land within the watershed has been surveyed to protocol. The acres of spotted owl habitat within the Nestucca Watershed based on ownership and land allocation are shown in table 4C1.

Spotted Owl Density Study

In cooperation with USFS Pacific Northwest Research Station, lands in the Nestucca Watershed were selected to be a survey area in a northern spotted owl density study due to their position in the North Coast Range, the "blocked up" federal ownership, the low owl population, and relatively poor condition of the owl habitat; the study area roughly coincided with HCA-036 as identified in *The Draft Recovery Plan For The Northern Spotted Owl* (1991).

Surveys for the Nestucca River Spotted Owl Density Study began in 1990 with a "pilot season". After study design modifications, intensive surveys (covering each station three times per year) were conducted from 1991 through 1993. In 1990 and 1991 the study area covered approximately 78,000 acres. The national forest portion of the study area, approximately 23,000 acres in size, was dropped from the study leaving approximately 55,000 acres to be surveyed as a part of the density study in 1992 and 1993. While the national forest parcel of land was dropped from the density study, it was surveyed to USFS protocol from 1990 to 1992.

During the 1991-1993 period, 4,008 individual "survey attempts" were made resulting in nine positive responses (seven in 1991, and one each in 1992 and 1993). No positive responses resulted in a confirmation on subsequent follow-up visits; no occupied owl sites were located within the Density Study Area.

Known Sites and Reserved Pair Areas

Using guidance from the ROD (pg D-16), Reserve Pair Areas (RPAs) have been delineated for the four identified spotted owl activity centers described above (see map 4). All acres are within a Late-Successional Reserve designated in the Forest Plan. RPAs are intended to be used as a tool to focus the development and application of silvicultural prescriptions, and minimize risk of adverse impacts to historic sites. While these areas may not be currently occupied by an owl pair, or even a resident single, they are the areas within the watershed most recently occupied by owls and may be expected to be among the first areas to be reoccupied as the watershed recovers.

Table 4C1 Estimated Acres of Spotted Owl Habitat within the Nestucca Watershed Based on Primary Ownerships and Land Allocations

Spotted Owl Habitat Classification	Ownership and/or Land Allocation							
	Oregon Dept.of Forestry	Private	BLM		USFS		Total Federal Acres	Total Acres
			AMA[1]	AMR[2]	AMA [1]	AMR[2]		
"Non-Habitat"	7,409	36,748	1,365	17,991	7,822	11,724	38,902	83,059
Dispersal Habitat[3]	663	8,981	862	4,976	11,861	11,116	28,815	38,459
Nesting, Roosting or Foraging (NRF) Habitat	492	3,228	630	11,312	4,242	21,697	37,881	41,601
Total Acres	8,564	48,957	2,857	34,279	23,925	44,537	105,598	163,119

1 AMA = Adaptive Management Area
2 AMR = LSR within the AMA
3 Dispersal Habitat Calculations Do Not Include NRF Habitat

Specific information about RPAs is summarized in table 4C2. Annual monitoring results relative to each known site are summarized in appendix C-3.4.

Marbled Murrelet
Federally Threatened (FT)

The USFWS has a draft proposal (dated January 27, 1994) for Marbled Murrelet Critical Habitat which may change when finalized, (see map 3). The basic intent of the proposal declares the Late-Successional Reserve (LSR) blocks, within 35 miles of the coast, as critical habitat; this would include all Late-Successional Reserves within the Nestucca Watershed.

Occupied sites were first found in the Nestucca Watershed in 1989 by Kim Nelson's crew from Oregon State University. More intensive surveys have continued since that time, especially in areas proposed for timber harvest.

As of the end of the 1994 survey season, 13 marbled murrelet occupied sites have been identified within the Nestucca Watershed; three on BLM land and the rest on USFS land. Most of these sites have not been monitored annually or monitoring efforts have been variable/minimal.

As directed by the ROD (pg. C-10), a murrelet LSR incorporates a 0.5 mile radius around occupied murrelet sites, including all contiguous existing and recruitment habitat (i.e., stands capable of becoming habitat within 25 years). Five murrelet LSRs have been designated in this manner within the Nestucca Watershed (see map 4). The remaining eight occupied murrelet sites in the watershed are within designated LSRs, and have been mapped where the half mile radius extends beyond the designated LSR or are outside of the watershed but are close enough for the LSR to be partially within the watershed.

Additional occupied murrelet sites are likely within the mature conifer and conifer-dominated alder habitat types, especially on the western half of the watershed.

Marbled Murrelet Habitat

The Nestucca Watershed ranges up to approximately 29 miles from the ocean, and is located within "Murrelet Zone 1" as identified in the Forest Plan.

Potential habitat is defined as (1) mature (with or without an old-growth component) and old-growth coniferous forests; *and* (2) younger coniferous forests

Table 4C2 Specific Characteristics of Delineated Spotted Owl Reserved Pair Areas (RPAs) within the Nestucca Watershed

RPA Characteristic	RPA Name			
	Elk Creek	Nestucca River	Moon Creek	Niagara Creek
Number of BLM acres	6,345	7,109	4,339	0
Number of USFS acres	0	0	2,011	6,594
Total federal acres	6,345	7,109	6,350	6,594
Percent of RPA within Nestucca Watershed	100%	95%	99%	91%
Acres of suitable habitat in RPA (% of RPA) [1]	2,992 (47%)	2,891 (41%)	3,829 (60%)	4,330 (65%)
Acres of dispersal habitat in RPA (% of RPA) [2]	3,601 (56%)	3,336 (47%)	4,790 (75%)	5,460 (82%)
Miles to nearest RPA center in the Nestucca Watershed	3.5	3.5	5.5	8.0
Approx. miles to nearest known owl site not in Nestucca Watershed	8.5	6.5	10	5.0
Other T&E known sites within the RPA	Bald eagle, murrelet	none known	Murrelet	none known
Ownership of center of activity	BLM	BLM	BLM	USFS

[1] Suitable habitat = Nesting, Roosting and Foraging (NRF) Habitat
[2] Dispersal Habitat Calculations Include NRF habitat

that have deformations or structure suitable for nesting. The addition of (2) above is based on the discovery of a chick on the forest floor and documented subcanopy behaviors in natural (created by wildfire), "younger" (40 to 80 years) forests in the Oregon Coast Range (Ralph et al. 1994). All of these younger stands had remnant trees (≥ 26 inches dbh) and other older forest structures (snags, woody debris) that survived or were created by fire (Grenier and Nelson, in press.).

The majority of the potential murrelet habitat within the watershed is located on federal land primarily in the Mature Douglas-Fir, Mature Mixed Conifer, and Conifer-Dominated Hardwood Mix Zones (see map 6). Summaries of these habitat acres are shown in table 4C3. On-the-ground habitat evaluations are often necessary to determine if trees within a particular stand possess the specific habitat characteristics required for murrelet nesting (proper limb development, presence of platforms).

Table 4C3 Estimated Acres[1] of Potential Marbled Murrelet Habitat on Federal Land within the Nestucca Watershed Based on Ownership and Land Allocation

Total Non-Federal Acres	USFS		BLM		Total Federal Acres
	AMA[2]	AMR[3]	AMA[2]	AMR[3]	
3,720	4,242	21,697	630	11,312	37,881

[1] Acres depicted on this table reflect conifer stands older than 75 years old, or mixed stands dominated by conifer and are most likely overestimates.
[2] AMA = Adaptive Management Area.
[3] AMR = Late-Successional Reserve within the Adaptive Management Area.

The amount of murrelet habitat within the watershed will not appreciably increase over the next 25 years; however, the suitability of existing habitat will increase as the stands continue to age (see appendix C-3.5).

Bald Eagle
Federally Threatened (FT)

Critical habitat for the bald eagle has not been designated.

Eagles forage in the vicinity of Nestucca Bay during all seasons of the year. During the winter or early spring months, eagles (usually singles) are frequently observed flying or roosting in large trees along the Nestucca River. Eagles have been observed up Bays Creek, Moon Creek, East Creek and Niagara Creek at various times of the year. There are two historical nest sites up East Creek. The first site (Township 3 South, Range 8 West, section 21) was known to be active in 1972. The second site was discovered in 1975 (Township 3 South, Range 8 West, section 27) after it had been abandoned.

There are two active bald eagle nest sites within the Nestucca Watershed. Both are located on land designated as Late-Successional Reserve and are monitored annually. The following is a brief narrative account of these two identified eagle nest sites.

Elk Creek and the Nestucca were identified as Key Areas in *The Recovery Plan for the Pacific Bald Eagle* (1986).

Elk Creek Bald Eagle Nest Site

Bald eagles (two pairs in the early years) have been observed in the Elk Creek drainage since the early 1950s. Nesting activities within the drainage have produced at least 15 fledglings from three known nest sites since 1970. Although eagles are observed yearly within the Elk Creek drainage, most often in association with yearly nesting attempts, the last successful nesting occurred in 1982.

The Elk Creek bald eagle nest site is located on BLM land. A 2,058 acre Area of Critical Environmental Concern (ACEC), which encompasses the nest site, has been delineated. It includes 415 acres in the primary zone and 1,643 acres in the secondary zone. Refer to *Cooperative Management Plan for the Elk Creek Bald Eagle Area* (BLM, ODF, Willamette Industries 1989) for further details.

Salal Point Bald Eagle Nest Site

The Salal Point bald eagle nest site was located in 1977 on USFS land east of Nestucca Bay. At least seven nestlings were produced from two known nests between 1979 and 1987.

A management plan has been written for the area but it has not been consulted on with the USFWS.

Peregrine Falcon
Federally Threatened (FT)

The peregrine falcon forages within the watershed. Observations have been recorded on Mt. Hebo and near pastures along the Nestucca.

Aleutian Canada Goose
Federally Threatened (FT)

In the winter, the Aleutian Canada goose forages in diked pastures within the watershed near Pacific City.

Western Snowy Plover
Federally Threatened (FT)

The western snowy plover uses unvegetated areas along sandy beaches in close proximity to the analysis area. This habitat type is not in the watershed.

California Brown Pelican
Federally Endangered (FE)

During the late summer and fall, the California brown pelican may be found in the marine environments outside the analysis area, and may less commonly forage or rest in the Nestucca Bay and mouth of the river.

Northern (Steller) Sealion
Federally Threatened (FT)

Within Tillamook County, northern sealions most commonly haul out at Three Arch Rocks and Cascade Head. They may periodically forage into the Nestucca Bay and estuary.

Oregon Silverspot Butterfly
Federally Threatened (FT)

The meadows on top of Mt. Hebo support the largest known population of the Oregon silverspot butterfly (*Speyeria zerene hippolyta*). The adult butterflies feed on the nectar of wildflowers blooming in August and September, while the larvae feed on the leaves of the blue violet (*Viola adunca*) in the spring. The USFS maintains habitat for the silverspot by mowing or slashing the vegetation which would shade out the violet. The USFWS is currently working on a recovery plan for the butterfly.

Survey and Manage Species

The following five vertebrate wildlife species are suspected to occur within the Nestucca Watershed, and were specifically identified within the ROD and subsequent amendment, as species to be protected through survey and management standards and guidelines.

Red Tree Vole

The red tree vole is listed in the ROD as a "Survey and Manage" species due to its vulnerability to habitat fragmentation and dependence on mature Douglas-fir. The voles are unable to maintain viable populations in stands less than 100 years old. The dusky subspecies has a very small range of distribution being found only in portions on the north and central Oregon Coast Range, including Tillamook County. Red tree voles produce few young each year and are poor dispersers, requiring large contiguous areas of suitable habitat or corridors connecting areas of suitable habitat. Highly fragmented areas with many clearcuts may not serve as dispersal corridors. In the Coast Range, the mean stand size used by red tree voles is 475 acres (75-acre minimum) with 59 Douglas-fir trees per acre (at least 20 greater than 39 inches dbh and 34 greater than 20 inches dbh) (Maser 1981; Huff, Holthausen and Aubry 1992).

The red tree vole is an important prey species for the northern spotted owl.

Bats

One of the leading factors in the decline of worldwide bat populations is the destruction of roost sites and hibernacula. Most bat species occurring in the Pacific Northwest roost, reproduce and hibernate in protected crevices which fall within a narrow range of temperature and moisture conditions. Sites commonly used by bats include caves, mines, snags, decadent trees and large down logs with loose bark, wooden bridges, and old buildings.

In the Oregon Coast Range, bat activity is approximately 2.5 to 9.8 times higher in old-growth than in young-growth stands. The timing of this activity suggests that bats use the old growth only for roosting and forage elsewhere (Thomas 1988). Riparian areas are important foraging habitat.

There are four "Survey and Manage" bat species known or suspected to occur within the Nestucca Watershed. All four species are associated with coniferous forests.

- Silver-haired bat
- Long-eared myotis
- Fringed myotis
- Long-legged myotis

Species of Concern (other than SSS)

Black-Tailed Deer

The black-tailed deer is an important game species within the watershed.

Deer browse on a variety of brush species, especially salmonberry.

There is a perceived public concern that as forests in the watershed mature, deer populations will be drastically reduced. Based on the large proportion of federal land within the watershed and the federal management practice of rarely using herbicides to eradicate brush, ODFW does not expect to see reduced deer populations in the Nestucca Watershed to the same degree they would expect to see as if herbicides were as widely used on federal lands as on private (ODFW personal communication 7/22/94).

Roosevelt Elk

In the late 1800s, elk populations were drastically reduced due to market hunting. The local population has since recovered and the elk is an important game species within the watershed.

The changes predicted for public lands management were factored into ODFW's proposed elk management objectives for Coastal Management Units. ODFW reduced the high density carrying capacity from ten elk/square mile (current population level) to eight elk/square mile. Overall, ODFW feels that reduced timber harvest on public lands will not significantly change elk populations in the next five years.

Managing for later seral stages will alter the distribution of elk forage on federal land. In the Olympics, even-aged coniferous stands less than 150 years old received little elk use except for stands 6 to 15 years old, which were heavily used during the winter due to the abundance of forage. Succession of young coniferous stands to pole-size and mature stands typically reduces forage quantity due to canopy closure. Uneven-aged management and commercial thinning can be used to create foraging areas within even-aged forests. Mature hardwood forests and coniferous/hardwood stands are important foraging areas for elk (Schroer, Jenkins and Moorhead 1993). The potential decrease in elk forage availability will be moderated by the large hardwood and conifer/hardwood component in the Nestucca Watershed, although foraging could increase on private pastures and in young managed stands, possibly resulting in increased special hunts for problem elk.

Barred Owl

Barred owls are rapidly expanding their range and have the potential to displace and/or cross with spotted owls. They have not yet been identified within the Nestucca Watershed although they have been found in the Coast Range both to the north and the south of the watershed.

Northern Flying Squirrel

The northern flying squirrel is an important prey species for the northern spotted owl. Although flying squirrels will nest on tree limbs, they usually nest in cavities in snags (over 35 inches dbh) or live trees (over 49 inches dbh). Population levels in the Nestucca Watershed are unknown, but are expected to be low due to the lack of available habitat.

Neo-Tropical Migratory Birds

Certain species of neo-tropical migrant birds (those wintering between The Tropic of Capricorn and The Tropic of Cancer) are thought to have been decreasing in abundance throughout their breeding range for a prolonged period (25 years or more) and are a cause for immediate concern. Species which may be decreasing within the Nestucca Watershed include but are not limited to Vaux's swift, bandtailed pigeon, western tanager, purple martin, and chipping sparrow.

Effects of Roads on Wildlife

Road density within the Nestucca Watershed average 5.7 miles per square mile. Road density is not evenly distributed throughout the watershed; average densities within subwatersheds range from a low of 1.6 to a high of 8.9 miles of road per square mile. Roads provide increased access to recreational users, but decrease the quality of habitat for some species by interrupting natural dispersal routes and travel corridors, and by increasing general fragmentation. Roads also introduce disturbance caused by traffic noise and increased access for hunting and poaching. Roads may function as natural openings and travel corridors for some wildlife, such as reptiles, bats, marbled murrelets, elk, deer, bears, and porcupines and may result in road-kills.

D. Fish

The Nestucca River is one of the most productive fishery resources in Oregon. The diverse assemblage of anadromous salmonids includes chum salmon, coho salmon, spring and fall runs of chinook salmon, summer and winter runs of steelhead trout, and sea-run cutthroat trout (see table 4D1). Seasonal upstream migrations result in year-round usage of the Nestucca Watershed by adult anadromous salmonids (see map 11 for historic distribution). Resident cutthroat trout populations are found throughout the watershed, including above barriers to anadromous fishes (see table 4D2). Other freshwater species occurring in the Nestucca River watershed include brook lamprey, river lamprey, Pacific lamprey, dace, and sculpins. Crayfish are also found in the watershed.

Catch statistics from 1923 to 1926 showed an average annual harvest of 219,000 pounds of chinook, 215,784 pounds of coho, 54,810 pounds of steelhead, and 17,952 pounds of chum salmon. In the 1920s, the estimated escapement of coho salmon spawners averaged 75 fish per mile.

During the late 1960s-early 1970s, the steelhead catch averaged an estimated 13,429 fish. From the late 1980s-early 1990s, the steelhead harvest has dropped to an estimated 2,650 fish, and it is estimated that 80 percent of these are hatchery fish. In-river harvest of salmon has remained at 4,000 fish over the past 20 years, supported mostly by healthy runs of fall chinook salmon. Coho salmon escapement has declined to an estimated five fish per mile in 1993.

Table 4D1 Taxonomic List of Freshwater and Anadromous Fish Found in the Nestucca Watershed

Scientific Name	Common Name
Oncorhynchus keta	Chum salmon
Oncorhynchus kisutch	Coho salmon
Oncorhynchus tshawytscha	Chinook salmon
Oncorhynchus mykiss	Steelhead trout
Oncorhynchus clarki	Cutthroat trout
Cottus spp.	Sculpin species
Lampetra richardsoni	Brook lamprey
Lampetra tridentatus	Pacific lamprey
Lampetra ayresi	River lamprey
Rhinichthys sp.	Dace

Table 4D2 Estimated Miles of Anadromous and Resident Salmonid Habitat in the Nestucca River Watershed

Species	Miles of Habitat	Percent of Perennial Streams
Coho salmon	202.8	27
Chum salmon	9.6	1
Fall chinook salmon	75.0	10
Spring chinook salmon	50.0	7
Winter and summer steelhead	203.6	27
Sea-run cutthroat trout	171.0	23
Resident cutthroat trout	574.5	76

Salmonid Species Assessments and Distribution

Predation by marine mammals and birds affects populations of all anadromous fish stocks to some degree. Predation by certain marine mammals has some potential to limit natural production under conditions of severely depressed fish populations and altered aquatic environments. Marine mammal populations have increased substantially in recent years and a high proportion of returning hatchery fish show evidence of marine mammal bites. It has been assumed that marine mammal predation has been a relatively minor influence historically at more "normal" population levels of anadromous fish. Juvenile anadromous fish that reside in the estuary may be impacted by avian predation where releases of large numbers of hatchery smolts attract unusually large numbers of predatory birds.

Coho Salmon

Status: Depressed population.

The primary influences on coho salmon population levels in the Nestucca drainage are believed to be ocean conditions and freshwater habitat conditions (see table 4D3). Survival of coho salmon has been correlated with ocean upwelling and temperature (Nickelson et al. 1992). In the freshwater environment, numerous high quality pools (summer and winter rearing) and spawning gravel (spawning) are important habitat requirements.

Commercial harvest has had a significant impact on coho populations in the past, however commercial harvest rates have been reduced since 1984. In 1994, no harvest, commercial or sport, will be allowed. Freshwater harvest has had only a moderate impact during "normal" population levels because no real target fishery for coho has developed in the Nestucca River.

The influence of hatchery coho salmon is not believed to have affected the wild coho stocks very much. Relatively low numbers of Trask River stock coho were released into the Nestucca River between 1982 and 1992, but these releases have been discontinued.

Distribution: Coho salmon are found in over 200 miles of streams in the Nestucca River watershed (see table 4D2 and map 11). All major tributaries have at least some habitat available to coho. The distribution of coho salmon is limited only by falls that are complete fish barriers to passage.

Chum Salmon

Status: Depressed population.

The primary influences affecting chum salmon populations are ocean conditions, estuary habitat and freshwater habitat (see table 4D3). Freshwater habitat is important for spawning only, since chum salmon fry migrate to the estuary for rearing as soon as they emerge from the gravel. Both the size of the chum salmon run and the number of miles of stream producing chum salmon have declined markedly over many years. Presently only two streams support significant numbers of chum salmon spawners.

There is no marine or freshwater harvest of chum salmon in Oregon, however, a substantial incidental catch of chum salmon has been recorded in high-seas driftnet fisheries. If this incidental catch includes a substantial number of Nestucca chum salmon there could be moderate to high impacts on the population. All chum salmon populations in the Nestucca Watershed are wild.

Distribution: Chum salmon are found only in the lower portions of the Nestucca River watershed (see map 11). Spawning occurs in about ten miles of tributary streams, all of which are downstream of Beaver Creek. The only two streams that currently support substantial chum salmon runs are Horn Creek and Clear Creek. Chum salmon are poor swimmers and are restricted to low-gradient stream reaches. Most of the available spawning habitat for chum salmon occurs in what is now agricultural areas and has been degraded by channel alterations, livestock grazing and gravel mining.

Table 4D3 Summary of Influences That Affect Population Levels of Salmonid Fishes in the Nestucca River

	Population Influences						
Species	Ocean Habitat	Marine Harvest	Freshwater Harvest	Marine Predators	Hatchery Influences	Estuary Habitat	Freshwater Habitat
Coho salmon	High	Medium	Medium	Low	Low	Medium	High
Chum salmon	High	unknown	n/a	Low	n/a	High	High
Chinook salmon (fall)	Medium	High	Medium-High	Low	Low	High	Medium
Chinook salmon (spring)	Medium	High	Medium-High	Low	Low-Medium	High	Medium
Steelhead trout (winter)	High	Low	Medium	Low	Medium	n/a	High
Steelhead trout (summer)	High	Low	High	Low	High	n/a	n/a
Cutthroat trout (sea-run)	Medium	n/a	Low	Low	Medium	High	High
Cutthroat trout (resident)	n/a	n/a	Low-Medium	n/a	n/a	n/a	High

Source: Keith Braun, ODFW.

Fall and Spring Chinook Salmon

Status: Fall chinook - Healthy and stable population.
Spring chinook - Fluctuating, relatively low population.

Estuary habitat is critical to both fall and spring chinook because juvenile chinook rear in the estuary (see table 4D3).

Hatchery influences have been minor for fall chinook and low-moderate for spring chinook.

Harvest, both commercial and sport, may have potentially high impacts on both the fall and spring chinook salmon. Sport angling for chinook is popular in the Nestucca and harvest is high, especially for fall chinook. Ocean harvest of Nestucca River chinook off Alaska, British Columbia, and Washington is potentially very high.

Distribution: Spring and fall chinook both utilize the mainstem Nestucca River and its larger tributaries for spawning (see table 4D2 and map 11). Juvenile chinook remain in freshwater for only a short period of time before they migrate downstream to the estuary for rearing.

Spring chinook salmon enter the Nestucca River in April (Nicholas and Hankin 1988) and must hold in large pools until ready to spawn in the fall. Holding pools are found in the mainstem up to about RM 40 on the mainstem, Beaver Creek, and the lower portions of Three Rivers, East Beaver Creek and Moon Creek. The extent of spring chinook habitat is limited by the availability of large pools for summer holding habitat.

Fall chinook utilize about 75 miles of the mainstem and larger tributaries. Their distribution is similar to the spring chinook, but also includes portions of Clear Creek, Three Rivers (including Alder Creek), Farmer Creek, North Beaver Creek, Bays Creek, East Creek, Elk Creek, and the mainstem to RM 45.

Winter and Summer Steelhead

Status: Winter steelhead - Depressed population.
Summer steelhead - Introduced, hatchery stock, depressed.

Summer steelhead are a hatchery introduced stock and there is no known wild reproduction of these fish in the Nestucca Watershed.

The primary influences on Nestucca River winter steelhead population levels are believed to be ocean conditions and freshwater habitat conditions (see table 4D3).

Secondarily, fish harvest and hatchery influences are rated as moderate influences.

Distribution: Like coho salmon, steelhead trout are found in over 200 miles of the Nestucca River mainstem and tributary streams (see table 4D2 and map 11). Steelhead trout enter the river during the highest winter flows and are able to ascend further upstream than any other anadromous species in the watershed.

Sea-run and Resident Cutthroat Trout

Status: Sea-run cutthroat - Unknown, probably depressed.
Resident cutthroat - Unknown.

Freshwater habitat conditions (sea-run and resident) and estuary habitat conditions (sea-run) are influences that can potentially limit cutthroat trout populations. Some sea-run cutthroat trout remain in freshwater for up to five years before they migrate to the sea while others may never migrate.

Stocking of hatchery produced sea-run cutthroat trout has been stopped.

Harvest is thought to have a low impact on sea-run cutthroat trout populations because there seems to be little interest in a sea-run fishery in the Nestucca River. Harvest of resident cutthroat trout is probably low in most streams, but maybe moderate in some of the accessible reaches of the Nestucca River mainstem.

Distribution: The distribution of sea-run cutthroat trout in the Nestucca Watershed is not well known. It is estimated that sea-run cutthroat trout inhabit about 171 miles of the Nestucca River and its tributaries, with a distribution that is similar to coho salmon (see table 4D2). Adult sea-run cutthroat trout return to freshwater the same year they migrate to the sea. Adults spend a variable amount of time in the estuary and tidewater areas before moving upstream to spawn (Nickelson et al. 1992)

Resident cutthroat are assumed to be present in nearly all perennial streams in the watershed (see table 4D2). While their actual distribution is unknown, it is estimated that they occur in about 575 miles of streams.

Summary

Nearly all of the salmonid fish species present in the Nestucca River watershed have depressed populations. The only stock of fish in healthy condition, the fall chinook salmon, is a species which relies on freshwater habitat only for spawning. Chum salmon is another species which uses freshwater only for spawning purposes, however, chum salmon populations are severely depressed compared to historical levels. One of the possible reasons is that the chum salmon's spawning habitat is found in very low gradient stream reaches which are close to the intertidal zone. The streams used by chum salmon historically have been degraded by channelizing, diking, loss of riparian habitat, loss of streambank stability, and displacement of the channel.

With the exception of the fall chinook salmon and the chum salmon, all the other salmonids require the use of freshwater habitat for extended periods of time. As a result, freshwater habitat is a limiting factor for their production. The relatively poor quality of the freshwater habitat in the Nestucca Watershed has been previously documented (Baker et al. 1986). While other factors, such as ocean conditions and harvest, may have limiting effects on anadromous salmonids, the populations of these fish in the Nestucca Watershed cannot be restored without efforts to maintain and improve freshwater habitat conditions.

Anadromous fish runs into the Three Rivers subwatershed have been impacted because of the fish weir at the Cedar Creek Fish Hatchery. The Cedar Creek Hatchery was established in 1924. A weir was constructed across Three Rivers to aid in the collection of brood fish. Some fish were able to move over the weir during high flows and the weir was opened once the egg quotas were obtained. In the early 1980s, an electric weir was installed which effectively stopped all fish passage until the egg quotas were met.

No anadromous fish access is allowed into Cedar Creek itself, the primary water supply for the hatchery. In summer, additional water is drawn from Three Rivers when Cedar Creek has low flow. The purpose for preventing fish from migrating above the weir is to insure that diseased fish do not get above the hatchery and introduce the disease into the hatchery water supply.

The operation of the weir on Three Rivers has resulted in very little natural reproduction of anadromous fish above the weir and runs have been correspondingly depressed. In recent years, Oregon Department of Fish and Wildlife has allowed wild fall chinook salmon, coho salmon, and winter steelhead trout to pass the weir and spawn in Three Rivers above the hatchery. Spring chinook, summer steelhead, and hatchery winter steelhead will be held below the hatchery weir for brood stock and sport harvest.

Existing Conditions - Fish Habitat

There is an estimated total of 760 miles of perennial streams in the Nestucca River watershed (see map 8). For the purposes of this watershed analysis it has been assumed that all perennial streams are also fish-bearing streams. This is primarily because there is insufficient information about the actual extent of resident fish populations in the tributary streams. Most stream inventories rely on visual observations of fish to locate the upper extent of fish use, however, species such as sculpins hide in the substrate and are not usually visible to passing observers. Previous work has shown that there is a high likelihood that fish will inhabit most perennial streams in the Coast Range (Boehne and House 1983).

Since 1978, approximately 110 miles of streams in the Nestucca Watershed have been inventoried for fish habitat by the BLM, USFS and ODFW. Nearly all of these surveys have been targeted at reaches inhabited by anadromous fish. These surveys cover 41 different streams. However, surveys of 31 miles on 10 streams, were completed prior to the development of the microhabitat based inventory procedures in which data on individual habitats (i.e., length, width, depth, large wood, etc.) is collected. All further analysis of habitat characteristics will be based only on the 79 miles (31 streams) of streams which were surveyed with the microhabitat based procedures.

A point of concern regarding the fish habitat inventory data is that no consistent survey procedure has been used. Each agency has their own microhabitat survey procedure, and each agency has changed their procedure at least once in the last few years. While there are many similarities in the procedures, there are enough inconsistencies in the way data was collected that the creation of a unified database was very difficult at best. An excellent example of this is the data on large woody debris (LWD). LWD is considered to be one of the most important elements of habitat for anadromous fish in Pacific Northwest streams. Yet, each agency has a different procedure for how data on LWD is to be collected. Improved procedures and consistency between agencies must be instituted because of the high number of watersheds with multiple ownerships.

A major concern with the existing stream inventory data is the obvious gaps in areas surveyed. Nearly all the data is from USFS and BLM lands. The lack of surveys on private lands is particularly evident in the Beaver and Three Rivers watershed blocks. These two watershed blocks offer some of the potentially best habitat, with some of the potentially greatest impacts, yet remain unsurveyed. It should be noted that the USFS has older inventory data on most of its streams in the Three Rivers watershed block, but the data is not in the newer microhabitat format.

An additional concern with the BLM surveys is that many of the surveys were completed nearly ten years ago and may not adequately represent the habitat conditions at present. These surveys need to be updated.

In 1986, an interagency team completed the *Nestucca River Basin Anadromous Salmonid Habitat Overview* (Baker et al. 1986). This document contains much valuable information concerning the historical and existing condition of the anadromous fish habitat. It also includes general habitat and limiting factors evaluations for each stream in the watershed.

Data on riparian vegetation was taken from satellite imagery. The data used in the analysis represents a 100-foot wide corridor on each side of the stream and was collected on all third order and larger streams in the watershed. Site specific riparian data, collected on the ground, is not available. Two different databases, one from Pacific Meridian Resources (PMR- a private consulting firm) and the other from Pacific Northwest Research Station (PNW), were used to develop the data on the riparian vegetation. As a result, some data were combined using the closest matching data groups in each database, and in some cases the data were not exactly the same. For example, in the PMR database the tree size class "small" is 9.0 to 20.9 inches dbh, while in the PNW database the "small" size class is 12 to 21 inches dbh.

The PNW tree size class field includes an undefined category for "closed". There is no indication for the size class of these trees. When used in the "Riparian Condition" portion of the Fisheries analysis the category "closed" was arbitrarily combined with the category "small".

Historical Perspective on Fish Habitat

A number of historical events have heavily impacted the fish habitat of the Nestucca Watershed (Baker et al. 1986). From the mid 1800s to 1919 the Nestucca drainage was repeatedly burned. Increased landsliding, erosion and sediment production, as well as changes in runoff and stream temperature probably occurred after the fires.

Floods, both natural and human-caused, have also exerted a major influence on fish habitat conditions. Major floods occurred in 1945, 1950, 1955, 1964-65 and 1972. In November 1962, Meadow Lake Dam on the upper Nestucca River failed, causing extensive flooding to the entire Nestucca mainstem.

In the mid to late 1800s land clearing for agriculture began. Timber harvest has occurred throughout much of the watershed. Construction of the Nestucca Access Road constricted the stream channel and removed riparian vegetation. Concern about fish passage in the 1960s and 1970s prompted the removal of large quantities of woody debris. Gravel removal operations began in the lower Nestucca River in the early 1950s between RM 8 and RM 11 and are still in operation.

Riparian Condition

Riparian zones are the areas of transition between the aquatic ecosystem and the terrestrial ecosystem. Riparian zones are characterized by the presence of a relatively high water table because of their close proximity to the aquatic ecosystem, certain soil characteristics associated with moist conditions, and the presence of vegetation that requires free water or conditions that are more moist than in the adjacent upland areas. In the Nestucca River watershed the riparian zones are associated primarily with stream corridors since there is little wetland or standing water conditions.

Streams are closely linked to riparian zones through several processes. This linkage occurs throughout the watershed but is closest in the small to medium sized streams. In these streams the dense riparian vegetative canopy shields the stream from solar radiation and keeps the water cool. The microclimate of the riparian zone tends to be cooler and moister than the surrounding upland areas, which tends to increase the overall diversity and productivity of the riparian zone. Streambank vegetation protects the banks from erosion and acts as a filter during high flows to trap organic and inorganic materials. Litterfall from coniferous and deciduous plant species provides a source of nutrients and energy for the aquatic ecosystem. The riparian zone is the source area for most large woody debris in the stream channel. The value of large woody debris in providing roughness and stability to the stream channel, storing sediments and nutrients, and creating pools for fish habitat is well documented. Large wood also retards the downward flow of water, thus helping to maintain moist soil conditions along the stream in the summer and causing localized flooding during high flows. This flooding results in the building of floodplain.

Riparian ecosystems are influenced by the adjacent terrestrial ecosystem. The adjacent upland areas affect on the riparian microclimate by buffering wind and moderating solar input. Downed trees from the adjacent uplands are a source of nursery logs in the riparian area and large woody debris on floodplain. The extent of influence of these adjacent uplands is estimated to be at least the distance of two site potential trees away from the stream (FEMAT 1993).

The present characteristics of the riparian zones in the Nestucca Watershed reflect the history of the drainage. Riparian vegetation along the lower mainstem has been altered by human activities for nearly a century. By the 1920s, many of the riparian processes were no longer functioning in the lower drainage because of removal of the riparian vegetation on the floodplain as land was cleared for agricultural uses and the channels were stabilized and channelized. Much of the lower ten miles of the mainstem Nestucca River is devoid of native riparian tree species. Grazing impacts to riparian vegetation along the lower tributaries is a continuing problem.

Fires and floods have been major influences on the riparian vegetation throughout much of the watershed, particularly along the mainstem Nestucca River and in the middle subwatersheds. The natural succession of vegetative types following these disturbances determines the kinds of vegetation that will occur along streams. Red alder, a pioneer species, typically dominates most of the riparian zones in the watershed. While the fires killed many large conifers that eventually fell into the channels, there is presently little future source for coniferous large wood recruitment to the channels. The existing large wood will eventually decay or be transported out of the system. As the red alder matures, and falls into the streams, it will provide some structure to the stream channel, but alder wood rots quickly.

Generally a mixture of hardwoods dominated by large coniferous trees is the most desirable composition for riparian zones in the Pacific Northwest. Both the size of the riparian trees and the type (conifer or hardwood) are important. The riparian zones of most of the watershed are heavily dominated by smaller, younger trees (see table 4D4 and appendix C-4.1). Throughout the watershed the riparian vegetation is dominated by trees less than 12 inches dbh. An exception is the Upper Nestucca watershed block in which 35 percent of the vegetation is over 21 inches dbh and slightly more than 70 percent is larger than 9 inches dbh.

Table 4D4 Size Distribution of Riparian Zone Vegetation in the Nestucca Watershed, Based on the PMR and PNW Satellite Imagery

Estimates are for a 100-foot width on each side of the streams in the watershed blocks

	Percent of Block		
Watershed Blocks	**<9 inch dbh**	**9-21 inch dbh**	**>21 inch dbh**
Lower Nestucca	87	10	3
Three Rivers	84	13	3
Beaver Creek	85	12	3
Middle Nestucca	76	17	6
Moon Creek	72	20	8
Upper Nestucca	28	37	35

The pattern of hardwood-dominated riparian zones is consistent with the pattern of tree size. Hardwoods dominate in all the watershed blocks except the Upper Nestucca (see table 4D5 and appendix C-4.2). The highest proportions of hardwood-dominated stands occur in the central portion of the watershed, including the Three Rivers, Middle Nestucca and the Moon Creek watershed blocks. The high percentage of hardwoods in the south-central portion of the watershed is reflective of its fire history. Interestingly, the Powder Creek, Alder Creek, and Limestone Creek drainages, which had the highest quantities of large woody debris, have some of the highest percentages of alder dominated riparian zones. Most of the large woody debris in these streams is a result of the fires or is residual from before the fires.

The lack of conifers in the Lower Nestucca, Three Rivers, and Beaver Creek watershed blocks is also a reflection of the agricultural activities in these blocks. Fully 26 percent of the riparian vegetation in the Lower Nestucca watershed block is in the grass/shrub/agricultural category. There are over 300 acres of non-forest openings along the lower 30 miles of the mainstem Nestucca River, most of which occurs downstream of Farmer Creek.

Riparian zones along large rivers interact in different ways with the aquatic ecosystem than those along smaller streams. Large woody debris does not play a major role in providing in-stream habitat in large mainstem rivers like the lower Nestucca River. Heavy canopies of large trees provide some shade; vegetated riparian zones tend to keep the main channel confined; and the largest down trees remain along the stream to provide important summer and winter fish habitat. Active floodplains with functioning riparian areas contain an array of side channels, overflow channels, and isolated pools. Riparian vegetation stabilizes the banks of the river during flood events. Though less important for fish habitat, it is still important to have functioning riparian zones along the lower river.

The obvious conclusion that is derived from the amount of small-sized, red alder-dominated stands throughout the watershed is that there is little opportunity for both short-term and long-term recruitment of large woody debris into adjacent stream channels. Even though much of the forested portion of the watershed is covered with stands of Douglas-fir, little coniferous large wood is available along the streams. Most streams in the watershed have very low to low amounts of large woody debris at present, which is limiting their ability to produce fish. This situation is not going to change without efforts to restock many miles of riparian zones with conifers. On federal lands, the best locations for riparian restoration are along the low gradient reaches of East Beaver Creek, Moon Creek, East Creek and Niagara Creek.

Table 4D5 Percentage of Vegetation Types within the Riparian Zones in the Nestucca Watershed, Based on the PMR an PNW Satellite Imagery

Estimates are for a 100-foot width on each side of the streams in the watershed block

Watershed Block	Percent of Block: Conifer	Mixed	Hardwood	Grass/ Shrub
Lower Nestucca	21	21	25	26
Three Rivers	23	11	56	10
Beaver Creek	28	25	31	14
Middle Nestucca	28	14	47	12
Moon Creek	26	24	40	10
Upper Nestucca	44	39	7	1

Productive Flats

In studies on the Elk River in southwestern Oregon, Reeves (1988) found that several low gradient reaches supported particularly diverse fish populations and accounted for a high percentage of the fish production. Low velocity riffles and side channels provide habitat for post-emergent cutthroat, steelhead, and coho fry. Pools, and especially deep pools associated with large woody debris, are inhabited by coho, chinook, steelhead fry and juveniles, and older cutthroat trout. Young-of-the-year trout occupy shallow riffles while juvenile and older trout are found in higher gradient riffles.

Flats are areas where the channel tends to widen, large wood accumulates, pools are scoured, and water velocities are lowered. Floodplains, which dissipate high-flow energy and provide crucial quiet water habitat for juvenile fish during floods, are associated with these unconfined reaches. These low gradient reaches are sensitive to increases in sediment and temperature, and decreases in large wood.

Low-gradient reaches are relatively abundant in the Nestucca Watershed (see map 9). In that portion of the watershed that is available to anadromous fish there are approximately 73 miles of stream with a gradient of less than 2 percent and another 44 miles of channel with gradients between 2 percent and 4 percent (see table 4D6). The largest extent of flats (low gradient, unconfined channel) occur on the mainstems of the Nestucca River, Three Rivers, and Beaver-North Beaver Creeks. Tributary streams with relatively large amounts of flats are primarily in the lower half of the watershed: Horn Creek, Alder Creek (Three Rivers), Tiger Creek, East Beaver Creek, Bays Creek and Moon Creek.

However, habitat conditions in the mainstem do not provide quality habitat like the tributary streams. Based on general channel characteristics, the mainstem Nestucca River below Blaine, Oregon would appear to provide potentially good habitat since the channel gradient is low. Because confinement is based on the relationship between the channel width and the valley width (an unconfined stream has a valley width that is two and one-half times as wide as the channel width), there are portions of the lower and middle reaches of the mainstem that appear to be unconfined, but are in fact, confined. Throughout these reaches the mainstem channel is often entrenched between broad valley terraces which are presently used for fields and pastures. During normal high flow events the river is unable to raise out of its channel and flood over these terraces. When flood waters are confined within the constrained channel, water velocities in the channel become too great for most fish, especially juveniles, and they are washed downstream. These larger river sections are also poor areas for large wood retention, due to the river's ability to float and move large material. As a result, these areas provide very poor winter habitat for fish.

Table 4D6 Distribution of Flat and Low Gradient Stream Reaches Accessible to Anadromous Salmonids in the Nestucca Watershed

Watershed Block	Flat Gradient[1] (miles)	Low Gradient[2] (miles)	Percent of Total Flat/Low Miles
Lower Nestucca	18.1	5.5	21
Three Rivers	10.2	3.4	12
Beaver Creek	15.8	12.7	25
Moon Creek	4.9	5.6	9
Middle Nestucca	18.5	12.5	26
Upper Nestucca	5.4	4.5	8

[1] Less than 2 percent slope
[2] 2 to 4 percent slope

Channel morphology can be used to estimate the *potential* habitat quality for anadromous and resident trout and salmon (Washington Forest Practices Board 1993) (see appendix C-4.5). There are, however, many other elements of habitat that effect salmonid production, such as large woody debris, flows, presence of high quality pools, spawning gravels, temperature, etc. Generally, unconfined and moderately confined channels up to gradients of 4 percent can provide good spawning and winter rearing habitat for anadromous species, while gradients over 8 percent usually provide poor habitat conditions. Good spawning and winter habitat for resident trout can exist in streams with gradients up 12 percent if the channels are not geomorphically confined. For summer rearing, stream gradients up to 8 percent, for anadromous species, and gradients to 12 percent for resident species, are considered good.

Approximately 60 percent of the anadromous fish habitat in the Nestucca Watershed is considered to be *potentially* good for spawning and winter rearing (<4 percent gradient, unconfined or moderately confined channels), while about 95 percent is considered *potentially* good for summer rearing (see table 4D7). It is estimated that resident fish occupy nearly twice the stream miles that anadromous fish occupy. Since resident fish are found in many steeper headwater streams, it would be expected that more of the resident trout habitat would be considered only fair or poor. The mainstem Nestucca River and its larger tributary streams provide about 65 percent of the available trout habitat. As previously stated, the mainstem Nestucca River provides little quality habitat. The low-gradient reaches of the larger tributary streams provide much of the best available habitat since the channels are larger and flows are better than many of the smaller perennial streams. Within these larger streams, about 50 percent is *potentially* good trout habitat.

Unconfined and moderately confined channels with gradients up to 4 percent provide the highest potential salmonid habitat and are therefore the most important reaches to consider for habitat restoration. Relatively little of this habitat is on federal lands, most of which occurs in East Beaver Creek, Moon Creek, East Creek and Niagara Creek.

The upper mainstem Nestucca River, above Bible Creek, has a low gradient (2 to 4 percent), but is generally confined. In some areas, the river is able to use a small amount of floodplain, though some of the floodplain have been constricted by the Nestucca Access Road. This area would rate as fair habitat for anadromous species. The BLM has done extensive habitat restoration work in this area which has provided high quality pool habitat.

The land ownership along the Nestucca River follows a consistent pattern. The lower mainstem of the Nestucca River (to RM 35) and the downstream reaches of the tributaries in the lower watershed are typically in private ownership. The upper portions of these lower mainstem tributaries are commonly located within the Siuslaw National Forest. The upper mainstem of the Nestucca River, and most of the associated tributaries are located on land administered by the BLM. The approximately 203 miles of anadromous fish producing streams in the watershed have the following adjacent ownerships:

- Private landowners - 115 miles (56 percent)
- National Forest - 55 miles (27 percent)
- Bureau of Land Management - 32 miles (16 percent)
- State of Oregon - 3 miles (1 percent)

Table 4D7 Estimates of Habitat Potential for Anadromous and Resident Salmonids in the Nestucca Watershed

	Miles Available	Good	Fair	Poor
		Spawning and Winter Rearing (miles)		
Anadromous	202	124	68	11
Resident[1]	575	266	63	48
		Summer Rearing (miles)		
Anadromous	202	191	11	0
Resident[1]	575	299	49	30

[1] Only 377 miles of resident trout habitat was rated

Because floodplains are relatively flat and highly productive for agricultural development, many miles of productive flats in the lower portion of the watershed have been altered and degraded. Stream channels have been diked, channelized, rerouted, riprapped, and cleared of wood debris. Riparian vegetation has been removed and since the early 1930s, gravel removal operations have occurred in the lower mainstem Nestucca River.

Because so little of the productive flats and low-gradient reaches are on federal lands, and since some of these reaches are in relatively good condition or have already received some in-stream enhancement work, the greatest opportunities for habitat enhancement are on non-federal lands.

Large Woody Debris in the Channel

Large woody debris (LWD) is recognized as one of the most important elements in the function of streams in the Pacific Northwest. LWD affects the channel morphology and therefore affects fish habitat.

Functionally, LWD helps to dissipate stream energy, retains gravels, increases stream sinuosity and length, provides diversified habitat for fish and other aquatic organisms, and slows down the nutrient cycling process. LWD not only provides a direct source of in-stream and overhead cover, but it also functions as an in-stream agent to provide and maintain quality pools, surface turbulence, and locations for catchment of small woody debris.

LWD deposited on floodplain and in off-channel habitat provides protective cover for juvenile salmonids during winter high flows (Everest et al. 1985). Because of the high energy in coastal streams during winter storm events it is necessary that individual pieces of woody debris be large enough to remain stable in fish-bearing streams. It has been recommended that LWD pieces should be at least 24 inches in diameter and greater than 50 feet in length (USFS and BLM 1994) (see appendix C-4.4).

Large wood enters the stream channel through landslides, by transport from upstream sites, and from the adjacent riparian areas. Processes which deliver LWD from the riparian area include blowdown, fire, natural mortality, slides, and channel undercutting.

The duration of time in which LWD remains in the channel depends on the quality of the LWD and natural events. Long pieces of wood are more stable at high flows because they tend to hang up on boulders, other LWD, streamside trees, etc. Coniferous species such as cedar and Douglas-fir are more long lasting than hardwood species, such as red alder. High flood events may float away LWD, but floods also act as agents to transport LWD from upstream sites.

Historically, most of the Nestucca River watershed has been burned. In some locations, these burns may have been hot enough to consume much of the down wood in the channels. Landslides and debris torrents that occurred as a result of the loss of hillside vegetation scoured out the remaining wood in some channels. In some areas the abundance of fire-killed trees along the stream channels eventually fell into the channel, thus providing new or additional LWD.

Several natural floods, and the flood caused by the collapse of the Meadow Lake Dam, resulted in the removal of large quantities of large wood from the mainstem and some tributaries, particularly East Beaver Creek. Timber harvest activities, particularly in the last 40 years, in the northern and upper portions of the watershed have removed riparian vegetation and down logs from many channels. Anadromous stream sections on federal lands were extensively stream cleaned in the 1970s. All large woody debris was removed because it was believed that it was a barrier to spawning fish.

Analysis of stream survey data from throughout the watershed indicates that, overall, the Nestucca Watershed is deficient in LWD when compared to a standard of 80 pieces of LWD per mile which are at least 24 inches in diameter (see table 4D8). Fully 90 percent of the surveyed stream miles did not come within 75 percent of the standard.

The 80 pieces per mile standard was met in only two watershed blocks, Three Rivers and the Middle Nestucca. However, only two streams in the Three Rivers drainage were analyzed; one stream exceeded the standard and the other had very little LWD (the mean of both streams exceeded 80 pieces per mile). Most likely the Three Rivers block, in general, is deficient in LWD, especially when the private lands are considered. Much of the riparian area along the mainstem of Three Rivers and Alder Creek has been cleared for homes and small farms and has no overstory or is composed of red alder.

The Middle Nestucca watershed block is in the best shape overall from the perspective of LWD in the streams. However, only 28 percent of the surveyed stream miles in the watershed block met the LWD standard. The best stream reaches for LWD loading were Powder Creek, Limestone Creek, and Alder Creek. The other streams surveyed actually fell far short of the 80 pieces per mile standard. The history of the Middle Nestucca watershed block may explain why LWD tends to be more present here than in other

Table 4D8 Quantities of Large Woody Debris in Streams in the Six Subwatershed Blocks of the Nestucca Watershed

Watershed Block	Pieces LWD Per Mile (mean)	Miles Surveyed	Miles Meeting Standard[1]	Miles Meeting 75% Standard[2]
Lower Nestucca	36.3	8.5	1.6	0.2
Three Rivers	83.4	2.4	1.1	0
Beaver Creek	7.9	9.7	0	0
Moon Creek	24.6	6.6	0	0.2
Middle Nestucca	90.1	17.5	4.9	0
Upper Nestucca	11	32.7	0	0.2

[1] Standard is 80 pieces per mile
[2] 60 to 80 pieces per mile

watershed blocks. The existing LWD may be residual LWD remaining from the past fires and the toppling of nearby fire-killed trees. Much of the LWD in these streams is located in older logjams or is blowdown. The streams in this area tend to be steep, and long pieces of LWD tend to be more stable in steeper, more confined stream channels. This watershed block is also mostly unroaded and has received little of the impacts of timber harvest and road building.

The very low amounts of LWD in the Beaver Creek and Upper Nestucca watershed blocks is due to past flooding and stream clearance activities. East Beaver Creek was almost devoid of LWD when surveyed.

Some stream reaches in the Lower Nestucca watershed block had intermediate levels of LWD, but the surveys were done on the headwaters portions of the streams and don't reflect conditions in the lower stream reaches which are important for chum salmon.

Quality Pool Habitats

A primary factor influencing the diversity of fish in streams is habitat complexity. The more complex the habitat, the more diverse the fish assemblage and the aquatic community. Attributes of habitat diversity include a range of depths and velocities, the number of pieces and size of wood, the frequency of habitat units, and a variety of substrates (FEMAT 1993).

The size and frequency of pools within a stream is critical for optimum survival of anadromous salmonids. Relatively large and deep pools should be frequent and well distributed, and should be persistent during the lowest flows. Pools over three feet deep are considered to be the most important for fish survival. Deep pools provide protection from predators, cool water refugia in summer months, and slow velocity refugia during high flow events.

The primary reasons for the loss of pools are filling by sediments, loss of pool-forming structures such as boulders and large wood, and loss of sinuosity by channelization. Reduction of LWD in the channel, either by past or present activities and events, generally reduces pool quantity and quality. Constricting naturally unconfined channels with streamside roads reduces meandering and off-channel habitat, and decreases pools formed by stream meanders that undercut banks. Mass failures from roads and timber harvest on unstable slopes can result in loss of pools due to sediment influxes. Large floods can simplify stream channels by removing LWD. Simplified channels are often wider and shallower. However, disturbed channels may also contain greater numbers of pools, but they will be smaller and shallower.

The ability of a stream to create and maintain pools is partially determined by the underlying geology, its substrate, the gradient, and by the size of the stream. Since the ability of a stream to create pools is related to the energy available at high flows, the potential depth of pools can be related to the size of the stream, i.e., smaller streams will have smaller pools than larger streams. In forested areas wood is a major pool forming element in streams. In low gradient stream reaches, pools form at meander bends; and at scour points associated with boulders or large wood pieces or jams. In moderate to high gradient streams the size and number of pools is primarily determined by the substrate. But large wood can "force" pools in moderate gradient channels either through scour or by physically damming the channel. In small headwater streams large wood may physically overwhelm the available energy of the stream and again become a dominant factor.

Several pool quality indices were used to rate the pools in each stream reach. These include the total number of pools per mile, the percent of pool area, the number of quality pools per mile, the percentage of quality pool area, the mean maximum depth of the pools/reach, and the number of quality pools with large wood cover (see appendix C-4.4). Quality pools were based on maximum depth, on a sliding scale based on the wetted width of the stream:

- For streams <8 feet wide - quality pool depth = 1.5 feet
- For streams 8-12 feet wide - quality pool depth = 2.0 feet
- For streams >12 feet wide - quality pool depth = 3.0 feet

Of the 31 streams surveyed, only 7 have pool quality indices that consistently rated as good (met or exceeded standards) and, in some cases, only certain reaches qualified as good overall (see table 4D9). A total of 26.6 miles of stream are rated as good. Of the 26.6 miles, 22.6 miles, or 83 percent, are located in flat or low gradient (<4 percent slope) reaches. The high percentage of reaches with quality pool habitat that are located in low gradient areas only underscores the value of these low gradient reaches.

These quality pool reaches represent about 33 percent Of the total miles of surveyed streams, however 35 percent of these high quality reaches are found on the upper mainstem Nestucca River. The upper mainstem Nestucca River is the largest stream that has been surveyed in the watershed. Because of the size of the upper mainstem (16 to 37 feet average width), the river is capable of maintaining large pools even though the channel was severely impacted by the flood when Meadow Lake Dam failed.

If only the tributary streams are considered, the amount of quality pool reaches represents about 25 percent of the surveyed miles. The majority of the tributary streams do not provide quality pool habitat. Powder Creek, East Creek, Moon Creek and Testament Creek have reaches which rated fair to good in the amount of quality pools per mile or the percentage of area in quality pools, but they did not consistently rate high in other pool indices.

Quality pool habitat and abundant LWD are not associated in the Nestucca Watershed. None of the stream reaches with consistently high rating for pool quality had desired amounts of LWD. The majority of the streams with the best amounts of LWD (Alder Creek, Powder Creek, Limestone Creek and Pollard Creek) are in the portion of the watershed that has burned. These streams are dominated by higher gradient reaches with typically boulder-cobble substrates and bedrock. The LWD in these streams occurs as logjams and blowdown which overhangs the channel. These kinds of LWD situations are not conducive to pool formation.

Existing In-stream Enhancement Projects

Since 1986, several intensive fisheries improvement projects have been completed in the Nestucca Watershed. These in-stream projects are located on the upper mainstem Nestucca River, Elk Creek, Niagara Creek, East Creek, Tony Creek, and East Beaver Creek. In 1994, a major project will be completed on Bear Creek (upper Nestucca River tributary).

Three of these projects, Elk Creek, East Creek, and East Beaver Creek have been monitored intensively (House et al. 1991; Crispin et al. 1993). The ODFW has monitored juvenile salmonid populations and smolt production from East Creek since 1988 (M. Solazzi, ODFW, unpublished data).

Approximately 400 structures have been placed in Elk Creek and the upper Nestucca River. Numerous in-stream structures and off-channel alcoves were constructed in East Creek and in East Beaver Creek.

Smolt monitoring by ODFW indicates that increased overwinter survival and overall production is occurring for coho salmon, steelhead trout, and cutthroat trout in the enhanced East Creek versus the non-enhanced Moon Creek (M. Solazzi, ODFW, unpublished data).

The enhanced reaches of East Creek, Elk Creek, and the upper Nestucca River have been resurveyed. The results indicate substantial increases in rearing habitat. Pool quality indices were applied to data from these enhanced reaches (see table 4D10). All of the enhanced reaches rated consistently high in almost all of the indices. It is believed that the excellent pool habitat created by these projects will increase salmonid production, and this belief has been substantiated with the smolt production results on East Creek, and by smolt monitoring in Lobster Creek (Alsea River

Table 4D9 Pool Quality Ratings for Seven Streams with High Quality Pools in the Nestucca Watershed

Data was collected prior to restoration work in some streams.
Ratings are for each reach within the stream section with good pool habitat.

Stream	Length Rated Good (miles)	Length Rated Good in Flat/Low Miles	Pool Quality Indices Rating: Pool/ Mile	Percent Pool	Quality Pool/ Mile	Percent Quality Pool	Max. Depth	Quality Pool w/ LWD
E. Beaver Creek	1.2	1.2	**	**	G,G	F,G	P,G	**
Horn Creek	4.5	3.7	G,P,P,G,P	F,P,P,G,F	**	G,P,P,E,E	G,F,G,P,P	**
Niagara Creek	5.1	5.1	**	F,G,P,P	F,G,G,G	G,G,G,G	**	NA
Bays Creek	3.2	1.6	**	**	G,G,G,P,P	G,G,G,G,P	F,G,G,G,P	**
Elk Creek	2.7	2.7	F,P	F,P	F,G	G,E	**	F,G
Ginger Creek	0.6	0	E	F	G	G	**	G
U. Nestucca River	9.3	9.3	G,P,F,G,F, P,P,P	**	F,F,G,G,G, G,G,G	F,F,G,F,E, G,G,G	P,F,G,P,G, G,P,F	P,P,P,F,P, F,P,P

Note: P = poor, F = fair, G = good, E = excellent

Niagara Creek data was not available to rate quality pools with LWD

** All reaches rated as poor

basin), which has also received habitat restoration work (M. Solazzi, ODFW, unpublished data).

Compared to other streams in the Nestucca Watershed, including the seven with good pool habitat, it is apparent that the enhanced reaches provide a very high level of quality pool habitat. Most of the enhanced reaches rated achieved good ratings in nearly all pool indices, and many were rated as excellent.

Summary of Fish Habitat Conditions

The existing habitat conditions for fish in the Nestucca River basin are generally poor (see table 4D11). These conditions are a result of human interactions (agricultural and rural development, logging, grazing, stream clearing) and natural events (fire, floods). Existing inventory data is limited in quality and quantity. Inventory data is very limited in the lower half of the basin and particularly lacking from private lands.

Table 4D10 Pool Quality Rating for Three Enhanced Streams in the Nestucca Watershed

Stream	Reach	Length Rated Good (miles)	Pool/ Mile	Pool Quality Indices Rating: Percent Pool	Quality Pool/ Mile	Percent Quality Pool	Max. Depth	Quality Pool w/ LWD
East Creek	1	1.3	G	G	G	E	G	G
East Creek	2	0.3	G	G	G	E	F	G
Elk Creek	1	0.6	G	G	G	E	P	G
Elk Creek	2	1.3	G	G	G	E	F	G
Elk Creek	3	0.9	G	G	G	G	P	G
U. Nestucca River	5	0.8	P	G	G	E	G	F
U. Nestucca River	6	1.5	P	G	G	F	F	F
U. Nestucca River	7	1.5	P	F	G	E	G	P
U. Nestucca River	8	1.6	P	P	G	G	G	F

Note: P = poor, F = fair, G = good, E = excellent

Table 4D11 Percentage of Inventoried Stream Miles with Fish Habitat Ratings of "Good" or Better

Watershed Block	Fish Habitat Element: Large Woody Debris	Pools/ mile	Percent Pools	Quality Pools/mile	Percent Quality Pools	Max. Depth
Lower Nestucca	19	36	11	0	36	24
Three Rivers	55	0	0	0	0	0
Beaver Creek	0	0	30	13	6	6
Moon Creek	0	13	0	25	63	23
Middle Nestucca	28	9	9	26	38	4
Upper Nestucca	0	18	0	30	28	17
Mainstem	0	27	0	72	61	38
Tributaries	0	14	0	14	15	5

E. Transportation

Past Condition

During the early years of exploration and settlement in northwestern Oregon, travel was tied closely to the major river systems and to the existing network of Indian trails running throughout the area. Centuries-old aboriginal trails extended north and south through the Willamette Valley and ran from the coast eastwardly to the Cascade Range. They served as trade routes, provided access to fishing, hunting and gathering territories, and were essential routes between Indian bands on either side of the Coast Range. When the settlers arrived and began to displace the Native American populations, aboriginal trails were taken over and used by the settlers. Many of these trails, particularly along the rivers, became wagon roads including the Trask Stage Road, Yamhill Tillamook Trail, Bald Mountain-Walker Flat Trail, Moon Creek Trail, Grass Flat Road, Old Bald Mountain Wagon Road, Wilson River Road Trail, and the Rye Mountain Trail. The settlers also began building their own trail systems to reflect the changes in settlement patterns they were creating. In 1854, a route was sought to connect the valley with the village of Hebo. It followed the ridge from Grand Ronde, over the summit of Mt. Hebo and down to the Nestucca River, for a distance of 30 miles. After Hebo, the route followed an old Indian trail for 20 miles to Tillamook.

Other than foot or horse travel, stages were the only means of cross-country transportation until the development of the railroads. The 1874 Government Land Office (GLO) survey plat showed the Dolph Toll Road in existence, its building date unknown. It extended from the city of Grand Ronde to Dolph. Other routes were the Coast Range Trail by way of Mt. Hebo and the Cloverdale-Woods road, just south of the Nestucca Watershed. Counties assumed primary responsibility for road construction by the end of the 19th century. Many of the early trails were converted to all weather roads as county resources permitted and were used for the removal of timber. The Dolph Toll Road, near Hebo, was surfaced in the 1920s and is today a part of Oregon State Highway 22. By 1922, the Coast Highway was already paved between Beaver and Tillamook.

Many of the old roads were reconstructed from Indian trails.

In 1935, a road was constructed up Niagara Creek from the Nestucca River, a more dependable route during the rainy season than either the route over Mt. Hebo or from Willamina.

Major access roads on BLM and state lands were constructed in the 1960s, and BLM added numerous logging roads during that period to support an extensive commercial thinning program. Most USFS and private industrial roads were constructed in the 1970s. Most of these roads were built to less stringent construction standards than exist today (see discussion below).

Roads on both federal and private timber lands have seen an evolution in construction standards. Prior to 1973 and the development of the Northwest Oregon Forest Practice Rules, there was not much concern about road placement. Road systems were often located next to waterways because the ground was flat and readily filled. In 1969, "best road location" became an objective. End-hauling, which is the hauling of excavation material to a site away from the road construction, was seldom practiced until the early 1970s. Instead, excavation material was pushed over the outer edge of the road (sidecast). In 1974, after the Forest Practice Rules came into effect, end-hauling was required by BLM, especially on head walls. Standards for culvert installation no longer permitted culverts which jutted out over the fill slope, locally called "shotgun" or "cannon" culverts, causing erosion problems when the plunging water hit the ground beneath it.

The Forest Practices Rules were developed by the state of Oregon to regulate road construction and maintenance on non-federal forest lands. Though the objective was to minimize impacts of roads on the land base, the original rules were not definitive and were open for interpretation. Through the ensuing years, the Practice Rules have become more stringent, are open for less interpretation, and have expanded on their requirements. The federal agencies have developed standards which go beyond the Practice Rules.

Current Condition

Estimates of mileages in the following discussion were based on Geographic Information System (GIS) records Many old roads are not identified in GIS (see discussion in section 4A).

BLM

The BLM has approximately 300 miles of roads. This equates to 5 miles per square mile. There are some natural surface roads not inventoried. The inventoried roads are maintained either on a continual program or on a rotational system. They are designed, constructed and maintained according to BLM manual requirements.

Unless gated or barricaded, the BLM roads connecting to state or county roads are open to the public. If a parcel of private land separates the federal land from a county or state road, the public generally can cross over the private parcel to reach the BLM road. The BLM has an active program for obtaining and granting access.

A transportation plan has not been developed for the BLM roads in the Nestucca Watershed, but is to be completed by 1996.

USFS

The USFS has approximately 466 miles of road, including about 51 miles of "logger spurs". This equates to about 4 miles per square mile. Most forest roads are designed, constructed and maintained according to USFS manuals. Logger spurs are temporary roads which were built by a timber sale purchaser with approval of the USFS. These roads were constructed to a lower standard and sometimes do not have ditches or culverts. While originally planned to be obliterated at the completion of the sale, forest managers often decided to keep them open for silvicultural treatments and access for fuelwood harvesting and fire protection.

Unless gated or barricaded, the roads on national forest lands which connect directly to a state or county road are generally open to the public. If a parcel of private land separates the federal land from a county or state road, the USFS usually has an easement which provides public access. The USFS has an extensive program which permits private and industrial use of roads under special cost and maintenance agreements.

A transportation plan has not been completed for the USFS roads in the Nestucca Watershed. However, an Access and Travel Management Guide has been developed for the Siuslaw National Forest. It proposes a long-term permanent system of roads open for public travel. "Primary" roads are those maintained for passengers cars, and reflect the main access routes through the forest. "Secondary" roads facilitate additional interforest access and will be maintained at a lower standard. There are approximately 60 miles of such roads within the Nestucca Watershed. The other roads in the analysis area will be evaluated on a project basis; some may be closed, obliterated, or remain open.

The USFS completed a "road assessment" within the watershed in 1994. This assessment displays information about stream crossings, culvert condition, and slope stability. This inventory was completed for all USFS roads in the watershed, including "logger spurs". In the road assessment process, recommendations were made on how to treat these spurs.

Oregon Department of Forestry

The Oregon Department of Forestry (ODF) maintains approximately 26 miles of road in the Nestucca Watershed. This equates to about 2 miles per section. However, ODF estimates they may have as much as 5 miles per square mile. The department's goal is to build no more roads than is necessary. Roads are not being obliterated, although this is up for reconsideration. Most roads are surfaced. Roads are designed, constructed and maintained in accordance with the requirements of the State Forest Practices Act and associated rules. The Oregon Department of Fish and Wildlife reviews and provides input to road construction plans.

Unless gated or barricaded, the roads are open to the public, although motorcycle use is restricted in some areas.

Private Industrial Forest Lands

For the analysis, based on conversations with three private industrial forest landowners, these lands were estimated to have about 5 miles per square mile for a total of approximately 227 miles. Most of the roads needed in the future are already built. Additional roads will be built as needed for timber harvest. The companies do not have a maximum number of miles per section. They design, locate and construct roads in accordance with the Forest Practices Act. The roads are maintained as needed. There was no discussion of maintenance on roads not being used. They are not obliterating roads.

It is a company's option to allow the public use of their roads.

Blaine Project

The Federal Highway Administration (FHWA), in cooperation with the USFS, initiated a road improvement project on Blaine Road, along the Nestucca River in 1993. The objective was realignment to achieve a uniform 35 miles-per-hour standard. Phase 1 began at Powder Creek Road and went east for about 3 miles. It should be completed in late 1994. Phase 2, scheduled to begin in 1996, goes west about 4 miles from Powder Creek to the town of

Blaine. It will take about two years to complete. FHWA engineers have revised the design plans for Phase 2 in response to landslide and sedimentation problems experienced in Phase 1

Roads in General

While roads open up the watershed for beneficial purposes, such as fire suppression, recreation and general access, there are also undesirable impacts. Roads allow dispersal of exotic and weedy plant species by seeds carried on machinery, humans and animals. They facilitate trespass, theft and the dumping of garbage. Roads reduce the amount of land which will grow vegetation in the ecosystem. Improperly installed culverts can impede fish passage.

Some old roads are causing slope instability and water quality problems. Many are not maintained and have grown over with trees, are impassible or in many cases unlocatable. Some culverts are clogged and rusting. Log culverts may have decomposed in the stream causing the stream to realign itself. Analysis of aerial photography revealed roads located in extreme or high landslide areas on highly unstable soils (Group 1) which have not been maintained or decommissioned and have regressed into debris avalanches.

Private, state and federal landowners have different overall objectives for their roads, and construct them to different standards to meet their management objectives. Impacts from roads vary across the ownerships. On private land, a 25-year flood event culvert design is standard. Federal agencies design for a higher flood frequency. The majority of existing culverts on BLM meet the 50-year flood event standards or higher. Federal, state and private logging roads are either ditched or outsloped. Oregon Department of Forestry revealed their roads which are greater than 8 percent slope are ditched; less than 8 percent are outsloped. Many of their roads have a grade greater than 20 percent. When determined safe for water quality, private and state use sidecast road construction on slopes less than 50 percent. Excavation is end-hauled on slopes greater than 50 percent. Federal agencies use sidecast construction on slopes up to 45 percent unless conditions warrant otherwise. On less steep slopes, where construction material may reach a stream, material would be end-hauled.

Access to meet ecosystem management needs, including public access, is generally available to all BLM and USFS lands in the watershed.

F. Recreation

Historical recreational use within the Nestucca Watershed was primarily centered on the coast. Pacific City, at the extreme western edge of the watershed, was known for its popularity as a tourist resort and summer vacation home community. Recreational activities focused on clamming and pleasure walking. By 1937, Tillamook County was promoting its recreational opportunities and natural beauty. River frontage was acquired by the county to develop water related recreational opportunities.

The Nestucca River has been fished for salmon, steelhead and trout. Hunting in the watershed was prevalent for elk, deer and bear. When hunting evolved from subsistence, market or nuisance control into a sport is not clear, but sometime after 1938 hunting for elk was reopened after the species was almost eradicated. To date, Oregon Department of Fish and Wildlife reports high population levels of elk and issues tags for sport hunting for both elk and deer. Bear are hunted also. Fishing in recent years has been significantly reduced due to restrictive fishing regulations aimed at boosting "stocks at risk".

Currently, within the Nestucca Watershed there are eight developed campgrounds, two established hiking trails, one developed motorcycle trail system and one BLM National Back Country Byway (see appendix C-6).

The BLM Alder Glen Campground was built in 1956; Dovre and Fan Creek Campgrounds and Elk Bend Day Use Area were built in 1966. Elk Bend has become a walk-in campground.

The USFS has a long history of recreation vision in the Nestucca Watershed. In about 1930, land was traded to acquire what is now Hebo Lake. The vision was to create a fresh water fishing lake near the coast with camp sites. The lake is a man-made lake built by the Civilian Conservation Corps. The two campgrounds in the Mt. Hebo locality are: Mt. Hebo Campground, built in the mid 1930s, and the Hebo Lake Campground, built in 1935, both by the Civilian Conservation Corps. Prior to campground development, dispersed recreation (camping outside of developed facilities) was prevalent on Mt. Hebo. Rocky Bend campground, on the Nestucca River, began as a natural spot for people to camp, and became a USFS campground in the late 1950s. Castle Rock Campground was built in 1964, at the site of a historic way station on the old Grand Ronde-Hebo road.

BLM lands are classified as either Extensive Recreation Management Areas (ERMA) or as Special Recreation Management Areas (SRMA). In the Nestucca Watershed, the only SRMA is along the Nestucca River itself and coincides generally with the Oregon scenic waterway boundary and the area of the river where the existing recreation facilities are located. All the rest of the watershed is ERMA, which merely denotes dispersed recreation. Camping is allowed in the ERMA for up to 14 days as long as fire and sanitary laws are obeyed. Most lands in the ERMA are open to off-highway vehicles, although most lands are not physically accessible to them due to steep and brushy terrain (see appendix C-6).

All USFS lands, unless specifically closed to recreation, are classified based on "camping type". Dispersed Recreation lands are those where camping occurs outside of developed facilities, while Developed Recreation land pertains to the specific camping facilities. Most USFS lands are also open to off-highway vehicles, with similar physically accessible problems as BLM lands due to steep and brushy terrain.

Demand

The extent people use recreation opportunities is demand. Future demand is estimated from population and recreation behavior trends. Need is expressed as the difference between the desire to participate and the availability of facilities or opportunities. The current situation at most BLM and USFS recreation sites in the Nestucca Watershed shows demand that exceeds available facilities on all holiday weekends and heavy demand during summer. Overflow campers tend to camp in areas not designed for camping. Statistics from the 1988 Oregon Statewide Outdoor Recreation Plan indicated four to eight times more need than existing facilities could provide for campsites (not RV), off-highway vehicle areas, and hiking trails.

Current Conflicts

Various conflicts have surfaced related to recreation: between users and natural resources, between users and local landowners and between users with different interests. The following conflicts surfaced during public meetings and field trips.

- Private forest industry is concerned that as roads are closed on the public lands, the present users will go onto their lands. They comment that they may need to block their roads if impact to their lands is likely. This is an example of the expected imbalance between recreational demand and realistic capabilities of the land, especially with regards to different policies of various landowners.
- Blocking of private or federal roads will not allow hunters their traditional access opportunities.
- Private property owners adjacent to resources used by the public for recreation are often impacted by trespass, litter, vandalism, and offensive behavior.
- Local residents expressed during public meetings that politicians and government agencies are not sensitive to the local residents when making land use decisions which could affect their lives, whether with recreation policy or other activities.
- There is a perception by some people that "outsiders' " wants are directing the recreational use of the land.
- Presence of existing recreation facilities and proposals for new ones within Riparian Reserves presents a potential conflict with the recently approved ROD Aquatic Conservation Strategy.
- Recent experience has indicated that hunters and hikers have conflict with motorcycle users, even in areas designated for motorcycle use.
- Water quality and riparian habitat is currently being degraded by indiscriminate and often illegal dispersed camping along rivers and in other areas. Regulations are not sufficiently enforced due to lack of law enforcement personnel. There are no toilets outside established campgrounds. There is also increased fire risk and undesirable destruction of vegetation, often in riparian areas, causing localized ecosystem degradation.
- There is a finite land base for a growing recreation demand.
- Demand is never satisfied. Developing facilities for the identified demand stimulates others to want the recreation experience, therefore creating a new level of demand.

G.Social/Economic

Several communities in Tillamook and Yamhill counties are influenced in one way or another by activities in the Nestucca River watershed. In Yamhill County, the communities of Carlton, McMinnville, Sheridan, Willamina, Valley Junction, Grand Ronde, and Grand Ronde Agency are homes of woods workers and lumber mill workers who have historically depended on harvest of trees from the Nestucca Watershed. In addition, these communities are access points for many tourists and recreationists who utilize the Nestucca Watershed for leisure activities. In Tillamook County, the communities of Beaver, Hebo, Cloverdale, Woods, Hemlock, and Pacific City are located within the watershed and the city of Tillamook is just north but very accessible to the area. These communities have similar relationships to those in Yamhill County, but with the additional interest of being part of the ecosystem within the watershed, depending on water for domestic use and other resources for their livelihood.

The Nestucca Watershed itself is sparsely populated. About 83 percent of the watershed is in Tillamook County and the remaining 17 percent is in Yamhill County. All of the residents are located in the middle and lower portions of the watershed along the major valleys, waterways, inlets and estuaries emptying into the Pacific Ocean.

Douglas-fir forests with mixed hemlock, cedar and Sitka spruce provide the basis for the area's major manufacturing industry: lumber and wood products. Alder products are finding increased use by local manufacturers also. Harvest of special forest products such as moss and mushrooms seems to be increasing. The Nestucca Watershed has an established dairy industry, with associated pasture over a large part of the middle and lower parts of the watershed. Economies of the local communities are now heavily dependent upon seasonal tourism, as well as a growing number of retirees moving into the area. Fishing and seafood processing industries in the area have experienced major declines over the past 15 years.

It is expected that Tillamook County will have an increase in retirees, who tend to contribute to the stability of local economies, since many have sources of income not readily affected by fluctuations in the business cycle. We can also assume that this will mean that the local population as a whole will be more dependent on tourism and retiree-related businesses than on manufacturing businesses related to the forest lands in the watershed. In Tillamook County, non-manufacturing employs far more workers (78 percent) than do the manufacturing (18 percent) or agriculture (4 percent) sectors. Non-manufacturing employment has increased over the past several decades while manufacturing workforces have declined. The most significant drop in Tillamook County has been in the wood manufacturing industry.

The BLM and USFS can probably expect to see increased use of forest lands by recreationists as well as by collectors of special forest products, even as timber harvest declines under the Forest Plan.

The rural interface that exists within the watershed provides some potential for conflict between federal land managers and local residents over issues such as timber harvesting, road building, stream enhancement work, mining, recreational use, open space, viewsheds, domestic water quality and privacy in general. A list of locations where private homes are immediately adjacent to federal lands is included in appendix C-7.2

Both the Confederated Tribes of Grand Ronde and the Confederated Tribes of the Siletz have historic interest in the Nestucca Watershed area. Only the Grand Ronde have any reservation land or established hunting/fishing rights with the state of Oregon within the watershed. Representatives of both tribes expressed a generic concern about protection of cultural values in the watershed.

The Confederated Tribes of Grand Ronde have identified many plants and animals within the watershed which are currently utilized, many for traditional purposes. Allowed under tribal license: hunting of elk, deer, bear; fishing in accordance with current state regulations; gathering crawfish, fresh water mussel, lamprey. Some of the plants currently used by the tribes include:

- carving woods
  vine maple, alder, cedar, yew, willow, ocean spray
- special forest products
  cascara, moss, swordfern, Oregon grape, mushrooms, firewood
- food plants
  blackberries, strawberries, salmonberries and shoots, Ik-nish-wild celery, miners lettuce, camas, sour clover, hazel nuts, huckleberries
- medicines
  cedar, licorice fern, mint, Labrador tea, chittum-cascara, skunk cabbage
- clothing
  cedar bark, bigleaf maple bark
- basketry materials
  hazel switches, spruce root, maidenhair fern, cedar root, cedar bark, cattails, bulrush, bear grass
- shelter
  cedar planks, posts

5. Condition Trends and Potential Effects on Future Land Management Options

- our best guess

To fully appreciate the management implications of desired future conditions it is necessary to look at current trends. Managers should consider the answers to the following questions:

- If current trends continue, would we reach the desired future condition?
- Where is management needed?
- What types of projects will help us attain these conditions?
- What are the opportunities for adaptive management demonstrations?
- For example, where could we try new silvicultural techniques to promote late-successional conditions?

A. Water

Fecal Coliform

It is anticipated that fecal coliform contamination in the lower Nestucca will be reduced through federal programs which provide cost-share and technical assistance to dairy operators for waste management. Construction of manure storage facilities which are protected from rainfall and capable of storing enough waste will allow operators to be selective when choosing application periods to reduce runoff into water courses. Another program which has the potential to improve water quality in the lower Nestucca is the Methane Energy and Agricultural Development project (MEAD). This project will collect animal waste from participating dairies and convert it into several products, including electricity, dry fertilizer, potting soil and organic liquids. The project will reduce waste application to the extent that dairies participate in it and bacterial contamination of the river will be reduced to the same degree.

Temperature

Riparian species composition in the lower agricultural areas along the unconfined portions of the Nestucca mainstem is not expected to change in the near future. Increases in shade will predominately be attained through the slow expansion of the dominant hardwood stand. Riparian zones devoid of trees will require control of cattle to establish trees which can provide long-term shade benefits. Since it appears that most warming is occurring in the upper watershed, any increase in shade overhang in the middle and lower river will effectively be providing additional localized cooling and favored cover refuge.

Private and state forest lands make up a small percentage of the total riparian ecosystem within the Nestucca Watershed, and most of these lands have been harvested within the past 30 years. Riparian vegetation will continue to mature, and stream shading will increase at least until the next harvest occurs. It is uncertain how recent changes to the forest practices regulations will promote the stability of water temperature and adherence to state water quality standards on state and private forest lands. Implementation of the Aquatic Conservation Strategy objectives in regard to riparian reserves should provide for proper functioning condition and long-term shade benefits to riparian ecosystems on federal lands. This scenario should bring temperatures to levels which reflect the natural variability of climatic events.

Sediment

The federal lands in the watershed will have reduced timber harvest and road construction activities as well as increased road stabilization projects, which will reduce landslides, surface erosion and sediment delivery rates. Natural landslides and soil creep such as that in Bear Creek will continue and sediment volumes will vary considerably.

Harvest levels on non-federal lands are expected to remain near current levels. Landslide rates and sediment production will continue at approximately the same level as at present.

On the Blaine Road Phase I project area, revegetation of cut slopes will reduce surface erosion and sedimentation. Cutbank sluffing will likely continue in the slide area but amount, duration and effects are not predictable.

There are plans to improve the Blaine Road from milepost 6.8 to 10.7 beginning in 1996, which will likely cause an increase in sediment to the river during and for a period of time after construction.

The magnitude of this sediment increase and its effects are unknown.

Streamflow

On federal lands, vegetation growth in previously harvested areas and road obliterations will reduce whatever effects timber harvest and road construction have had on stream flows. Non-federal forest lands will continue to be harvested and stream flows may be affected to a small degree. Continued withdrawals of water in the watershed will contribute to flow reductions in the lower watershed, but the magnitude of these withdrawals is unknown at present.

B. Vegetation

Private Lands

Private forest lands within the watershed will be managed in accordance with state of Oregon's Forest Practices Act (FPA) standards in place at the time of harvest. While management strategies vary between ownerships, the general trend on industrial forest lands within the watershed is to manage all stands under a 35 to 60-year rotation and to control competing vegetation by the application of herbicides.

Approximately two trees per acre are retained for use by wildlife. These trees are commonly located on the edge of units and/or next to riparian buffers. Under the existing FPA standards, the riparian buffers may decrease in size (width) in the future. This is due to riparian widths being based upon the amount of tree volume (especially conifer basal area) adjacent to the stream channel. As trees adjacent to the stream grow on size (volume increases), trees can be cut and consequently, riparian buffer zones may decrease in width. Approximately 4 to 5 percent of private lands fall within riparian buffers.

Federal Lands

Because trends in vegetation patterns are heavily dependent upon management direction, it is appropriate to mention the relevant management objectives for Adaptive Management Area (AMA) and Late-Successional Reserve (LSR) land allocations from the Forest Plan.

AMA Management for restoration and maintenance of late-successional forest habitat, consistent with marbled murrelet guidelines (ROD p. D-15).

LSR Late-Successional Reserves are to be managed to protect and enhance conditions of late-successional and old-growth forest ecosystems, which serve as habitat for late-successional and old-growth related species including the northern spotted owl. These reserves are designed to maintain a functional, interacting, late-successional and old-growth forest ecosystem (ROD p. C-11).

The primary factor impacting future vegetation patterns within the Nestucca Watershed is the change in management direction on federal lands from timber production (primarily through clearcut harvesting) to the development of late-successional habitat.

Other factors which influence vegetation patterns from the small patch to landscape level scale, are wind storms, the suppression or occurrence of fire, forest diseases and insect outbreaks.

C. Wildlife

Early Seral

As early seral habitat decreases on federal land, there will be less habitat for species dependent upon grasses, forbs, shrubs, hardwood and young conifer stands (see Guild - appendix C-3.3).

The red alder habitat type is an early successional stage that does not replace itself without a major disturbance. In general, alders die at about 80 to 120 years of age. In the absence of down woody debris to act as nurse logs primarily for Sitka spruce, western hemlock or western redcedar, the successional pattern, especially on moister sites, moves toward semipermanent brushfields as the alder stand breaks up. As alder acreages are decreased within the watershed (either through natural forest succession or active management) habitat for species dependent on the hardwood habitat types will be reduced (see Guild - appendix C-3.3).

Mid/Late Seral

In general as stands on federal land within the watershed mature, there will be an increased quality and quantity of mid/late seral stage habitat. This will benefit many wildlife species dependent upon later seral stage habitats, such as the bald eagle, spotted owl and marbled murrelet (see Guilds - appendix C-3.3).

The aging of stands across the broad landscape will change the nature of the vegetation pattern within the watershed. Contrasting edges between current clearcuts and mature timber will diminish, forest fragmentation will be reduced, and the size of contiguous forested stands, including interior core areas, will increase; however the increase in core areas size will not be evident within the next 25 years (see FRAGSTATS data, (+25 years) in appendix C-3.5).

Managed Timber Stands

Young plantations forty years old or younger, and commercially thinned stands 40 to 100 years old, exist over much of the watershed. If left alone, these even-aged stands may be delayed in their progression toward late-successional forest habitat. Manipulation of existing managed stands may be used to accelerate development toward late-successional forest characteristics such as multistory structure, multiple tree species, snags and down woody debris.

Spotted Owl Habitat

Within the next 25 years, the quality and quantity of spotted owl habitats within the watershed will increase as stands currently within the "non-habitat", sapling/pole stage develop into dispersal habitat and as current dispersal habitat develops into suitable roosting and foraging habitat. Stands which are currently suitable roosting and foraging habitat may improve in quality in the next 25 years as snags and down woody debris levels increase (either naturally or artificially) and thus are capable of supporting an increased prey base. Although exceptions certainly may exist, and future management may play an active role, the majority of the currently suitable roosting and foraging habitat within the watershed will not have developed into suitable nesting habitat within the next 25 years.

While the identified Spotted Owl Reserved Pair Areas within the watershed may not be currently occupied by an owl pair, or even a resident single, they are the areas within the watershed most recently occupied by owls and may be expected to be among the first areas to be reoccupied as the watershed recovers.

Marbled Murrelet Habitat

The quantity of marbled murrelet habitat within the basin is not expected to increase appreciably in the next 25 years. Stands which are currently considered to be suitable or marginally suitable will continue to develop desired habitat characteristics and may increase in quality.

D. Fish

The future habitat conditions for fish in most of the Nestucca River basin are expected to be in a slowly deteriorating trend. The primary reason for this downward trend is that fish habitat conditions are largely dependent upon riparian vegetation, particularly as a source for large woody debris.

Smaller sized (5 to 12 inches dbh) hardwoods dominate most of the riparian stands throughout the basin. These stands offer little future supply of large woody debris in both the short term (<50 years) and long term (>50 years). Within the Coast Range, red alder riparian stands commonly have a thick understory of brush species, typically salmonberry. Research is indicating that as the red alder matures and dies out, the thick brush understory will become the dominate riparian vegetation. Conifer species, and particularly Douglas-fir, are unable to establish themselves in these brushy riparian areas. The brushy riparian vegetation then will become a stable, long-term condition.

Without human intervention, the long-term trend in riparian vegetation suggests there will be little recruitment of large-diameter coniferous debris to the stream channels.

The Upper Nestucca watershed block is the only portion of the drainage where large wood recruitment may not become a serious problem. Conifer and hardwood/conifer mixed stands dominate most of the riparian stands in this watershed block. A relatively large percentage (32 percent) of the riparian stands are classified as having trees with diameters greater than 21 inches dbh. Since many of these stands consist of healthy, vigorous trees, there could be a shortage of large wood recruitment in the short term. As these stands mature, and mortality begins to increase, the recruitment potential for large wood will also increase.

The future management of federal lands within the basin will include riparian restoration activities. Silvicultural treatments could be used to establish conifers within riparian stands that are presently hardwood dominated. If these treatments are implemented successfully, the long-term trend for large wood recruitment should improve.

Recruitment of large, coniferous woody debris from private lands is not expected to increase much in the future. The potential for improvement exists, however, if the private landowners carry out riparian restoration projects on their lands

Since there is little potential for short-term recruitment of large wood, there will likely be a downward trend in the present quantities of large woody debris. The existing large woody debris is decomposing and has varying risks of being transported downstream by flood events. The rate at which existing large woody debris levels will decline is unknown.

Quality pool habitat is expected to decline because of decay, downstream transport, and the lack of short-term recruitment of large woody debris.

Channel restoration projects to improve pool habitat and large woody debris levels should be considered only as short-term solutions to improve fish habitat. These projects are only appropriate in certain stream reaches and will need maintenance to remain functional. Properly functioning riparian zones are necessary for long-term improvements in fish habitat.

Little change in stream habitat conditions are expected in streams within the non-forested portions of the basin. Diked and channelized streams will continue to provide only a small amount of their historic habitat potential. Some riparian fencing has occurred on agricultural lands in the lower portions of the basin, and there are opportunities for additional fencing. If the present fencing is maintained, and additional fencing is added, there will be an improving trend in fish and riparian habitat in the lower portion of the drainage.

Depressed anadromous fish populations are expected to continue. These fish are subject to a multitude of influences in both their freshwater and marine habitats. Improvements in ocean conditions, combined with reduced harvest levels, should help increase population numbers. However, freshwater habitat is critical for healthy populations of these species. Substantial improvements in freshwater habitat conditions are not likely in the short term.

E. Transportation

In the past, most federal forest roads were maintained using collections from timber sales. As the timber program decreased, the maintenance done on the road system decreased. Under new land allocations in the Forest Plan, this trend will continue. The overall condition of the road system will deteriorate, because the road condition is reflective of the decreased budget. Some roads currently driveable by passengers cars will, in the future, be only driveable by high clearance vehicles. Road maintenance on "secondary" roads will concentrate on resource protection rather than user comfort. Some roads may be brushed less frequently than in the past, limiting sight distance and safe driving speed. Stream crossings may be modified to improve fish passage and reduce the risk of failure.

There is a trend toward closing roads which cannot be maintained or which are not needed for resource management in the near future. This will be further evaluated under management opportunities.

The Access and Travel Management (ATM) guide on the Siuslaw National Forest describes a system of roads intended to be open for public travel on a long-term basis. The other roads on the Forest Development System will likely decrease over time, as project analysis is completed, and the long-term need for these roads identified. Some may be obliterated, most will be waterbarred, and some will be maintained for future project work. Future maintenance priorities will likely have some focus on the ATM system. Resource protection will continue to be a focus of road maintenance. Both the USFS and the BLM have plans to initiate more comprehensive transportation management plans.

There is a trend to bring roads into compliance with the Standards and Guidelines specified in the following sections of the Forest Plan:

- Aquatic Conservation Strategy, pages B-19 and B-31
- Adaptive Management Areas, pages D-1 through D-12 and D-15
- Standard and Guidelines, pages C 7, C-16, C-32, and C-33

6. Desired Future Condition

Much of the desired future condition of the Nestucca Watershed was decided in the Forest Plan. Emphasis statements under the North Coast Adaptive Management Area, Late-Successional Reserves, Riparian Reserves and the Aquatic Conservation Strategy will not be repeated here, but are incorporated by reference.

The desired future conditions contained in this analysis are more specific objectives designed to achieve the goals of the Forest Plan, and which can be specifically addressed during environmental analysis and project development. The specificity of the individual desired future conditions is directly related to the amount of data available.

The desired future conditions recognize that the mix of ownerships and the associated land patterns do not provide the opportunity to develop an optimum array of ecosystem functions across the landscape. For example, early and mid-seral stages will be occur more frequently on private lands due to their different management objectives. We have assumed that current management direction on private forest lands will continue.

A. Water

All applicable state water quality standards are met or exceeded, especially the standards for stream temperature, dissolved oxygen concentration, fecal coliform and turbidity.

Provide adequate water quantity and quality to support identified existing and potential beneficial uses.

Vegetation along perennial and intermittent streams provides shade, nutrients, large organic debris and a buffer from potential impacts of management activities.

The physical integrity of the aquatic system, including shorelines, stream banks and stream channel configurations is within the range of natural variability.

Landslide rates, quantities and composition of landslide materials are within the range of natural variability for the watershed.

B. Vegetation

Noxious weeds and other invasive non-native plant species do not proliferate above an acceptable level.

Watershed exhibits the full range of natural disturbances (i.e., animal damage, fire, landslides, insect outbreaks, windthrow, disease) and late seral/old growth vegetative development processes and ecological functions.

Stands will contain moderate to high accumulations of fungi, lichens and bryophytes.

Harvests of timber and special forest products are based on local site conditions, sustainability, compatibility with ecosystem health and site productivity.

C. Wildlife

The watershed has an array of habitat conditions that maintains the viability of native species.

Large, contiguous areas of federal forests are growing toward a late-successional forest condition characterized by diverse, multi-species, uneven-aged stands with a complex multi-storied structure, moderate to high canopy closure, variable tree spacing and stocking levels; trees of a wide range of diameter sizes, including very large trees with characteristics such as broken, forked or dead tops, large limbs and hollow cavities; and numerous large snags and accumulations of large down woody debris in varying decay classes.

Road densities are decreased from the current level to protect wildlife and their habitat.

Lands within the watershed are characterized by large blocks of contiguous forest supporting increased amounts of interior, late-successional forest habitat.

Inter and intra-watershed corridors facilitate the movements of a large variety of species.

Recovery Plan goals are met for threatened and endangered species.

D. Fish

Watershed conditions lead toward the recovery of "stocks at risk", sensitive species and other depressed stocks of anadromous and resident fish. An adequate number of all life stages of these species are well distributed throughout the watershed. Chum salmon would normally be restricted to the lower watershed.

- The peak spawning ground counts of adult spawning coho salmon achieve the Oregon Department of Fish and Wildlife's goal of at least 20 spawners per mile. Chum salmon spawning counts achieve a goal of 100 spawners per mile. Fall chinook salmon peak spawner counts are 55 spawners per mile. Spring chinook salmon escapement is 2,000 fish. Winter steelhead trout escapement is 7,000 to 10,000 fish.

Productive stream systems for mixed salmonid communities contain a broad diversity and complexity of habitat features. Habitats maintain a balance between high quality pools, riffles, glides, and side channels. Cover features such as large woody debris, boulders, overhanging vegetation, and deep water are abundant in all reaches. Channels are free of all unnatural obstructions that interfere with the upstream and downstream movements of adult and juvenile salmonids. Spawning gravels contain low percentages of fine sediments.

- Large woody debris in forested reaches meets or exceeds a standard of 80 pieces per mile, >24 inches minimum diameter and >50 feet in length.
- Pool frequency (pools/mile) and quality meet goals based on stream size. In larger streams, quality pools are greater than three feet in depth.
- Summer water temperatures from upper watershed tributary streams are low enough that temperatures in the mainstem are acceptable for holding habitat for adult spring chinook (see Water Temperature, section 4).

Forested riparian areas contain large conifers or a mixture of large conifers and hardwoods as identified below:

	Conifers/Acre		Hardwoods/Acre	
Size Class	**Live**	**Dead**	**Live**	**Dead**
<12 inches	18.5	0	0	0
12-20 inches	23.6	0	2.4	3.9
>20 inches	22.3	0.8	4.3	3.0

These objectives were developed from data collected from coastal streams in the Tillamook area. This is the best data that we have at this time but should only be used as a guide, not as an absolute goal (Val Crispin, personal communication).

E. Transportation

A minimum road network which provides access to federal land for recreation and ecosystem management, and access to private and state lands.

Roads are designed, constructed and maintained to standards that meet the Aquatic Conservation Strategy and minimize environmental impacts.

F. Recreation

Recreation use within the Nestucca Watershed is consistent with ecosystem goals while considering public demands for recreation.

G. Social/Economic

Timber and special forest products harvesting contributes to the support of local communities.

Landowners, residents and interested publics are well informed of and involved in ecosystem management issues.

7. Management Opportunities on Federal Lands

This section brings all of the analysis together and identifies opportunities for maintaining, improving, restoring, and enhancing various aspects of the ecosystem. Some of the opportunities identified in the analysis may be fairly specific, whereas others will focus on those resources or geographical areas where opportunities exist, but still need more site-specific analysis for actual projects. In any case, each of the opportunities has the potential of being identified as a future project, which would then be analyzed on its specific merits. Data developed in this watershed analysis would be used in assessing the impacts of individual projects on the Nestucca Watershed ecosystem.

Management opportunities which deal with inventory needs, filling of data gaps and monitoring are discussed in sections 10 and 11.

A. Road Projects

Obliterate unnecessary or undesirable roads by pulling back sidecast material, removing culverts, outsloping where needed, subsoiling where needed to restore infiltration, and revegetating the road surface and other disturbed areas with native or sterile species. Priority roads are midslope, sidecast construction with high likelihood of failure impacting streams (see appendices C-5.2 through C-5.6). Priority subwatersheds are:

- East Beaver Creek
- Bays Creek
- Wolfe Creek
- Moon Creek
- East Creek
- Farmer Creek
- Horn Creek
- Upper Three Rivers
- Alder/Buck

Maintain or improve road drainage by cleaning culverts, replacing decaying culverts and bridges, and installing downspouts on "shotgun" culverts. Replace culverts that inhibit fish passage or are unable to accommodate a 100-year flood event (see appendices C-5.2 through C-5.6).

Reduce road mileage in the Upper Nestucca River Key Watershed (S&G C-7) and reduce road densities across the analysis area to decrease disturbance to wildlife. Use closure techniques or obliteration, as appropriate.

B. Stream Channel Projects

Because of the status of various anadromous stocks and the existing poor habitat conditions in the Nestucca Watershed, we identified the following stream channel opportunities in an effort to do all that we can to maximize high quality anadromous fish habitat on federal lands. These are "stop gap" measures until riparian areas recover to provide this habitat, but immediate implementation is essential to prevent further decline of existing fish stocks.

Maintain the existing channel restoration projects to ensure that they continue to function properly.

Increase large woody debris levels in the Lower Nestucca, Beaver Creek, Moon Creek and Upper Nestucca watershed blocks. In spite of the higher levels of large wood in the inventoried streams of the Three Rivers and Middle Nestucca watershed blocks, there are site-specific needs for channel restoration work; both to improve woody debris levels and to improve pool habitat.

Restore channels and develop off-channel pools (alcoves) in lower gradient reaches to improve pool quantity and quality. Give priority to the flat and low gradient stream reaches because they have the potential to be the most productive habitats. Potential streams for channel restoration projects on federal lands include:

- Farmer Creek
- East Creek
- Clarence Creek
- Limestone Creek
- Niagara Creek
- Mina Creek
- Bible Creek
- Testament Creek

Moon Creek and Bays Creek should be deferred until after their use as control streams is not needed.

While Upper Three Rivers and its tributaries and Alder Creek (Nestucca River tributary) have some deficiencies in large wood and pool habitat, they are lower priority. Anadromous fish runs into the Three Rivers drainage have been very depressed due to the operation for the Cedar Creek Hatchery fish weir (see section 7). If fish runs are allowed to pass the weir and these runs begin to build in size and more fully seed the habitat on federal lands, then improvement projects should be considered. Anadromous fish runs in Alder Creek may be restricted due to a dam.

C. Riparian Projects

A deficiency in the amounts of large woody debris and quality pool habitat has been identified in many stream reaches within the Nestucca Watershed. Many miles of riparian zones are dominated by red alder and are incapable of providing for future large woody debris needs. Stream channel restoration projects are relatively short-term stopgap measures to help sustain fish "stocks at risk" until longer term restoration techniques take hold. Riparian restoration techniques are a more permanent, more natural and more cost-effective means of creating and sustaining productive habitats for fish over the long term. Planting and/or releasing conifers in alder dominated areas is the most promising riparian restoration technique.

Plant and maintain native conifers in riparian areas where existing vegetation is not adequate for stream shading, channel stability and large wood recruitment. Priority subwatersheds are East Beaver, Bear and Niagara Creeks. Additional inventory will identify other high priority areas.

Maintain those USFS and BLM projects where conifers have been planted in alder-dominated riparian zones.

Implement riparian underplanting in the Upper Nestucca Key Watershed which presently has the best riparian conditions in regards to the amount of conifer in the riparian zones but which has site-specific needs throughout the area. The Tillamook Resource Area (BLM) has completed a review of riparian underplanting needs in the Upper Nestucca watershed and has developed a plan for planting projects. This plan should be implemented.

Alder-dominated riparian zones also exist on nearly all streams in the other watershed blocks in the mid and lower portions of the basin. Further analysis of existing data needs to be completed and plans developed for site-specific projects for conifer underplanting in these blocks. Priority locations for riparian improvement projects are the low gradient stream reaches. Other priority locations include sites where the lack of riparian vegetation has opened the streams to sun light and water temperature increases. These sites are located primarily in the upper portions of the basin where the more intense solar warming occurs.

Priority streams for riparian conifer planting are:

- East Beaver Creek
- Bays Creek
- Wolfe Creek
- East Creek
- Niagara Creek
- Powder Creek
- Limestone Creek
- George Creek
- Boulder Creek
- Farmer Creek
- Upper Nestucca River and tributaries

Lower priority should be given to planting riparian areas in Alder Creek (Nestucca River tributary) and to streams in the Three Rivers drainage, until blockages to anadromous fish passage at the Cedar Creek Fish Hatchery are removed. However, we recommend that this project should still be completed within the next five to ten years to improve stream temperatures and habitat for resident fish species.

D. Upland Habitat Projects

Use genetically local native plant materials in the revegetation of disturbed areas, especially in and adjacent to USFS Special Interest Areas, BLM Areas of Critical Environmental Concern, wetlands, and other special habitats. If these materials are not available, use revegetation methods that do not encourage the introduction or spread of invasive, non-native plant species (Miller and Grenier 1994).

While late-successional forests take hundreds of years to develop naturally, site-specific silvicultural treatments may be able to hasten the development of older forest characteristics and uneven-aged stands. Variable-spaced thinnings can accelerate the development of large diameter trees with full crowns and large limbs, as well as provide openings for the development of multilayered stands by natural regeneration of conifer seedlings and vine maple or by planting of shade-tolerant species. Snags and down wood can be created by the girdling, topping or felling of trees.

Mt. Hebo off-site plantations have been referred to previously in this report. These areas represent a unique opportunity to change the poorly adapted Douglas-fir to local stock. Due to the slow-growing and small crown condition of these trees, the existing stands may not be capable of developing late-successional characteristics. In order to hasten development of late-successional forest in this area, these plantations could be converted to conifers adapted to local conditions. This could be accomplished with a range of silvicultural prescriptions, such as a series of small one-half to three acre clearcuts or varied thinning prescriptions, retaining a range of 30 to 100 trees per acre. Thinning prescriptions would depend, in part, upon site-specific wind conditions, windfirmness of the trees, existing stand characteristics, stand accessibility and visual considerations. Thinned stands could be underplanted with shade-tolerant species, such as western hemlock and western redcedar. Small clearcuts could be planted with a mix of locally adapted species.

Develop and/or maintain small meadows for use by many species including reptiles, voles, deer and elk where a need is confirmed. Focus on existing meadows or old homesteads (usually areas that were heavily grazed by cattle and sheep) which are easier to maintain as meadows than created meadows.

Provide down wood and snags in the size and decay class distribution reflective of the stand age. In moving toward late seral habitat, the desired level of snags and down wood would be at least the level at which they are found in natural mature conifer stands (see tables 6C1 and 6C2). Until more data is available, use levels shown in the tables below with the exception that snags be a minimum of 40 feet tall. This will assist in meeting the general objective of moving stands toward a late seral habitat condition.

Provide connectivity to a known spotted owl site within BLM's Yamhill Resource Area to the east of the Nestucca Watershed in Kutch Creek. Our best opportunity for developing connectivity will occur when the Kutch Creek Reserve Pair Area is delineated.

Table 6C1 Average Number of Snags per Acre in Natural Stands in the Siuslaw National Forest (>20 feet tall)

Seral Stage	Size Class (inches dbh)				
(stand age)	>40"	30-40"	20-30"	10-20"	Total
Mature Conifer (75-130 years)	0.8	0.6	0.8	2.8	5.0
Old Growth /Mature (>130 years)	1.2	0.9	0.7	0.8	3.6

Table 6C2 Average Number of Logs per Acre in Natural Stands in the Siuslaw National Forest (>20 feet long)

Seral Stage (stand age)	Size Class (inches dbh) >40"	30-40"	20-30"	10-20"	Total
Mature Conifer (75-130 years)	0.6	1.4	4.3	12.2	18.5
Old Growth /Mature (>130 years)	2.9	4.4	8.2	11.5	27.0

Manage alder stands to maintain biological diversity, converting some alder stands to conifer or mixed conifer to hasten the development of late-successional forest. Alder conversion opportunities are primarily located on USFS lands in the western and southern portions of the Nestucca Watershed.

E. Other Management Opportunities

The greatest opportunity to increase low flow is through storage during high runoff periods and release during the low flow period. Since McGuire Reservoir has an application pending for increasing capacity, there is a potential opportunity to negotiate for a minimum flow release during the low flow period. If natural flow discharge or additional flow could be released this could have a measurable effect on habitat in the upper mainstem, particularly coho-rearing habitat. There would be added benefit as this flow could provide a cooling influence on the mainstem. The amount of benefit to the lower river would depend on volumes released.

To effectively increase the amount of water available to the lower Nestucca, the next best measurable benefit would be obtained through acquisition of existing water rights or brokering (leasing) of water during periods of critical need (drought). Before acquisition and/or negotiation of flows, an in-stream flow study (IFIM), particularly in the lower river, is absolutely necessary to quantify the needs of the aquatic resources.

Block up federal ownership through land exchanges or acquisitions. Where BLM and USFS lands are adjacent, consider the advantages of leaving federal ownership intact, especially in areas/habitats occupied by threatened and endangered species or in Key Watersheds.

The BLM and USFS are considering administrative jurisdiction changes for scattered parcels throughout the Nestucca Watershed to facilitate federal management of those parcels.

While the BLM and USFS are legally required to protect all known cultural resources, some concerns were expressed by the two Confederated Tribes that not all cultural resources were being adequately protected. Since a dialogue has begun, it is timely to enter into discussions with the tribes to identify additional sites or resources that the BLM or USFS may need to protect.

Both BLM and USFS have the opportunity to maintain habitat for the plant and animal species used by the tribes such as including willows in streamside planting projects.

Maintain close coordination with the Confederated Tribes during trail location along the Nestucca River to assure that cultural resources are protected and that cultural values of the trail are enhanced.

Survey for noxious and invasive weeds. The Oregon Department of Agriculture recommends that detection and preventative programs be designed and implemented within the Nestucca River basin for the following noxious weeds:

Scientific Name	Common Name
Centaurea calcitrapa	purple starthistle
Centaurea diffusa	diffuse knapweed
Centaurea iberica	Iberian starthistle
Centaurea pratensis	meadow knapweed
Cytisus monspessulanus	French broom
Lythrum salicaria	purple loosestrife
Polygonum cuspidatum	Japanese knotweed
Polygonum polystachyum	knotweed
Polygonum sachalinense	giant knotweed
Silybum marianum	milk thistle
Spartina alterniflora	smooth cordgrass
Ulex europeaus	gorse

Reduce the amount and distribution of introduced invading vegetation, including Reed's canary grass, Himalayan blackberry and English ivy.

An example of an early detection program is to educate agency employees how to identify gorse and to differentiate it from other similar-looking species, such as Scot's broom. If populations can be detected early, there is a greater chance of eradicating them.

In addition to detection and prevention programs, the state wants to work with the agencies to release biological control agents they become available to eradicate or contain the following species: Canada thistle, bull thistle, Scot's broom, St. Johnswort, and poison hemlock (*Conium maculatum*).

Existing recreation sites should be evaluated for compliance with the Aquatic Conservation Strategy in the ROD. Identify and implement restoration actions which are needed to maintain compliance.

Complete the USFS implementation plan for the Mt. Hebo Scenic-Biological Area, a Special Interest Area of 1,684 acres.

Encourage forest ecology research in the High Peak-Moon Creek Area of Critical Environmental Concern. This area provides great opportunities to study forest ecology, and could become parallel to the H.J. Andrews site in the Cascade Range.

8. Management Opportunities on Non-Federal Lands

One of the most frequent comments during public meetings was the concern about what this watershed analysis meant to private landowners. They made it quite clear that they did not want their property to be impacted by any proposals made in the analysis. We assured them that the Forest Plan was applicable only to federal lands and we had no intent or desire to manage private lands. We did mention that the analysis might show some potential areas on private lands with good opportunities for habitat restoration, especially in the area of fisheries and riparian habitat. We told them that we would merely identify those opportunities as such to be applied as they desired.

There are several sources of expertise and funding for projects on private lands which could be used for the opportunities identified below. Oregon Department of Fish and Wildlife and state Restoration and Enhancement (R&E) funds are available for restoration work on streams. U.S. Fish and Wildlife Service receives money from congress that can only be spent on private lands for restoration of riparian and stream habitat. The Soil Conservation Service, working with Soil and Water Conservation Districts has access to federal funds for improvement, particularly of the dairy related problems in the lower watershed. This availability of state and federal funding should encourage private landowners to join in the effort to improve the Nestucca Watershed ecosystem.

A. Road Projects

Obliterate unnecessary or undesirable roads by pulling back sidecast material, removing culverts, outsloping where needed, subsoiling to restore infiltration, and revegetating the road surface and other disturbed areas with native species. Priority roads are midslope, sidecast construction with high likelihood of failure impacting streams.

Maintain or improve road drainage by cleaning culverts, replacing decaying culverts, and installing downspouts on "shotgun" culverts.

B. Stream Channel Projects

Much of the low gradient stream habitat in the Nestucca River and its tributaries, which has the potential of providing some of the best fish habitat, is on private land. At this time, much of this habitat is probably not producing fish at its potential. Habitat inventories have been conducted on vary few of these stream reaches; additional surveys are needed to assess habitat condition. There are significant opportunities for private landowners to improve habitat in these stream reaches.

A deficiency in the amounts of large woody debris and quality pool habitat has been identified in many stream reaches within the Nestucca River basin. Many miles of riparian zones are dominated by red alder and are incapable of providing for future large woody debris needs.

There are likely numerous opportunities on private lands for channel restoration projects. However, most of these lands have not been surveyed and the potential for in-stream projects is unknown. A likely assumption on private lands is that there is probably little large wood in the streams. The following list of potential streams for improvement is based on the analysis of channel gradient and confinement. These stream reaches contain favorable low gradient sections that may be acceptable project sites. Further stream inventory work needs to be completed before any projects are planned.

- Testament Creek
- Three Rivers mainstem
- Alder Creek (Three Rivers tributary)
- Beaver Creek mainstem
- North Beaver Creek
- Tiger Creek
- Bays Creek (lower)
- Wolfe Creek (lower)
- Moon Creek (lower)
- Powder Creek (lower)
- Nestucca River mainstem below McGuire Reservoir

There may be opportunities along the lower portions of Horn Creek, Clear Creek, Farmer Creek and West Creek to improve channel stability. Projects proposing in-stream structures should be designed to allow chum salmon passage.

Recent USFS surveys indicate that there may be a dam on Alder Creek (Nestucca River tributary) which may be a total barrier to anadromous fish. Historically, anadromous fish were able to spawn in Alder Creek. This dam should be checked to determine if fish passage is practical and cost effective. There is an opportunity for a cooperative project between the private Landowner and the federal and state governments.

C. Riparian Projects

Riparian needs exist on many private lands, especially in the lower watershed, along the middle mainstem Nestucca River and the lower tributaries, and in the Three Rivers drainage. Chum salmon spawning streams, Horn Creek and Clear Creek, are priority areas. Riparian fencing is needed along streams where livestock grazing has been allowed along the stream corridors. Riparian plantings, both for shade and streambank stabilization, is needed along many miles of private stream sections. Potential project sites include:

- Testament Creek
- Nestucca River mainstem below Blaine, Oregon
- Farmer Creek (lower)
- Horn Creek (lower)
- Saunders Creek
- Clear Creek (lower)
- West Creek (lower)
- Three Rivers mainstem
- Alder Creek (Three Rivers tributary)
- Beaver Creek mainstem
- North Beaver Creek

Potential project sites, continued:

- East Beaver Creek (lower)
- Tiger Creek
- Wolfe Creek (lower)
- Foland Creek (lower)
- Moon Creek (lower)
- East Creek (lower)
- Boulder Creek (lower)
- Powder Creek (lower)
- Nestucca River mainstem below McGuire Reservoir

Nearly all of the existing fish habitat inventory available is from federal lands. However, most of the potentially best fish habitat is on private lands. Habitat surveys are needed for private stream sections along the mainstem Nestucca River, particularly the middle and lower reaches, and in the Three Rivers and Beaver Creek basins. Specific needs are:

- Nestucca River mainstem below Blaine, Oregon
- Farmer Creek (lower)
- Three Rivers mainstem
- Alder Creek (Three Rivers tributary)
- Beaver Creek mainstem
- North Beaver Creek
- Tiger Creek
- Foland Creek
- Moon Creek (lower)
- East Creek (lower)
- Nestucca River mainstem below McGuire Reservoir

D. Upland Habitat Projects

Work with other agencies to develop and maintain dispersal corridors to other spotted owl sites, critical habitat units (CHU), and Late-Successional Reserves outside of the Nestucca Watershed.

- Provide a corridor(s) of older forest through Oregon Department of Forestry land, from the Nestucca Watershed north to BLM's "Kilchis Block" (designated both as a Late-Successional Reserve and Spotted Owl CHU OR-39). This may best be done in the areas of Edwards Creek, Joyce Creek and/or the South and East Forks of the Trask River.
- Provide a corridor(s) of older forest, from the Nestucca Watershed south to Grande Ronde Agency lands.

E. Other Management Opportunities

Establish a local watershed council for the Nestucca Watershed to bring together cooperating landowners to identify and solve water quality and quantity problems.

Cooperate with other landowners to coordinate transportation planning. This could prevent unnecessary road construction.

Monitor stream temperature and turbidity/suspended sediment on non-federal lands.

The BLM and the Simpson Timber Company are currently evaluating the possibilities of exchanging lands within Tillamook and Lincoln counties, with some Nestucca Watershed BLM lands going to Simpson in exchange for lands in the Little North Fork Wilson River watershed.

Oregon Department of Forestry has expressed interest in additional land exchanges where they would exchange out of their holdings in the Nestucca Watershed for isolated BLM tracts within the Tillamook State Forest.

The USFS is in the process of exchanging for land in the Niagara drainage that is currently owned by the Confederated Tribes of the Grand Ronde Community.

Oregon Department of Environmental Quality should determine if a Total Maximum Daily Load (TMDL) for temperature on the Nestucca River is needed to rectify water temperature problems. This could help identify priority areas for temperature monitoring and restoration projects.

9. Guidance for Project-Level Planning

The Nestucca CORE team proposes the following specific guidance for project-level planning. The detailed maps and data referred to in appendix D may be useful in completing site-specific analyses.

A. Road Guidance

All roads should be evaluated on a project basis, to determine the need and standard for the road. If a road is no longer needed, or can't be maintained open, it should be considered for closure and/or obliteration. Obliteration should include culvert removal and proper road drainage. Unsurfaced roads may need to be subsoiled to restore infiltration.

When planning projects in areas with potential landslide problems seriously consider the use of helicopters or other aerial systems to reduce sediment from road construction and soil disturbance. Minimize road and landing locations in Riparian Reserves.

B. Riparian Reserves

Riparian Reserves are to be delineated on the ground during implementation of site-specific projects based on analysis of the critical processes and features of each site. It is anticipated that Riparian Reserve widths on perennial streams will not differ substantially from the interim widths, in order to meet Aquatic Conservation Strategy objectives. Riparian Reserve widths may be adjusted on intermittent streams based on site-specific information including location of unstable and potentially unstable areas, riparian and channel condition and function, habitat for riparian-dependent species and corridors for terrestrial species. Riparian Reserve widths for intermittent streams in the East Beaver Creek, Bays Creek, Moon Creek, East Creek, Niagara Creek, Farmer Creek and Bear Creek subwatersheds should be maintained at or near interim widths because of unstable slopes and water temperature concerns.

Ensure that alder is retained as a vegetative component, well-distributed along streams.

Limit harvest of special forest products, such as moss, in Riparian Reserves until the functions and significance of these products in the ecosystem is better understood and inventories have been completed to identify quantities and distribution.

C. Uplands
(outside of Riparian Reserves)

Riparian Reserves will not necessarily serve as dispersal corridors for all upland species, especially where clearcuts are present. Certain species such as the red tree vole, a "Survey and Manage" species, require a minimum density of conifers, especially Douglas-fir. Therefore, in project areas where core areas or dispersal habitat appear to be lacking, maintain adequately stocked cores and corridors within stands 80 to 110 years old, for species such as the red tree vole. Riparian and upland corridors should connect core areas, forming a network throughout the landscape (analogous to the hub and spokes of a wheel). Focus density management projects outside of the cores and corridors and vary density prescriptions to meet Adaptive Management Area objectives.

In order to maintain linkage between known spotted owl sites, corridors of dispersal habitat should link known sites and Reserved Pair Areas (RPAs) to sites within and outside of the Nestucca Watershed.

Active management within the RPAs should be based on site-specific evaluations and focus on accelerating the development of older forest characteristics in young plantations which are "non-habitat" for spotted owls, as well as in stands of currently suitable habitat. Within the young plantations, treatments (consistent with Late-Successional Reserve management standards and guidelines) may include density management or fertilization to encourage or maintain rapid tree growth, or the addition of down woody debris into plantations which are currently deficient. Direction in the ROD (pg. D-16) states - "Reserve all suitable habitat in [the RPAs] from timber harvest"; therefore, in stands of currently suitable habitat, any prescribed treatments should "fine tune" the habitat, providing habitat components determined to be lacking (e.g., down woody debris and snags), while protecting the stand's current habitat value.

Within the subwatersheds currently dominated by hardwoods, focus alder conversion opportunities in areas of greatest fragmentation and around existing conifer stands, converting not more than 10 percent of the subwatershed per decade and maintaining the most contiguous hardwood-dominated stands. On USFS lands, focus around core areas set up for marten and pileated woodpeckers under the Siuslaw National Forest Land Management Plan. When converting alder stands to conifer, leave standing all conifer and scattered alder, bigleaf maple and cascara to maintain biodiversity. Leave all hardwood and conifer snags.

In areas identified for alder conversion prioritize by the age of the stand. While old alder stands contribute to biodiversity, they also transition into brush fields very quickly when the alder begins dying. Replant with a mixture of conifers and/or hardwoods, depending on site conditions.

When designing proposed silvicultural and habitat enhancement projects consider the following:

- Proximity of the proposed project to special habitats such as wetlands.
- Proximity of the proposed project to the known sites and habitats of Threatened and Endangered and Survey and Manage species. Condition of the habitat.
- How the proposed project will affect dispersal corridors for various species.

10. Information Management and Data Gaps

One of the primary obstacles in completing this watershed analysis on a timely basis was the wide variety of data formats, languages, computer hardware and software used by the USFS, BLM and other agencies with similar data. The data currently resides in an assortment of locations (see appendix D) and in several formats. The portion of this analysis that deals with access to information about the watershed, where information will be stored, how it will be accessed, and how (and by whom) it will be updated, is a project in itself. This is probably a more significant issue in watersheds with both BLM and USFS ownerships.

Numerous data gaps were identified during the course of the analysis. The importance of filling them varies depending on the resource and the issues. The following list of identified data gaps will provide direction for future inventory, data standardization and revised watershed analysis.

A. Water

There is little data on suspended sediment concentrations or turbidity levels, and no data on the effects of sediment on aquatic life in the watershed. Since sediment could have major ramifications on ecosystem health, collection of sedimentation data should be high priority.

The extent and locations of all roads in the watershed is unknown.

The expected life and conditions of all culverts and bridges needs to be identified.

The locations of sidecast material which have the potential to fail and deliver sediment to streams is unknown.

The locations of all streams and the extent of perennial streams are only projections from maps and computer programs. We need actual locations "ground truthed".

Locations of all wetlands is unknown, and suspected sites need verification.

Water temperatures in most of the major tributaries need to be measured and analyzed.

The quantity of water being diverted for out-of-channel use, especially during low flow periods, is unknown.

While existing landslides have already been mapped for East Beaver and Moon Creek subwatersheds, mapping of other existing landslides and areas of high potential for management-induced landslides needs to be conducted.

B. Vegetation

The locations and descriptions of vegetation on non-federal lands are gross estimates and need further analysis.

Information on coastal old-growth stands and their characteristics is lacking. Reliance on research from Cascade Range old-growth stands needs to be replaced with solid knowledge of coastal differences.

Inventory and map riparian vegetation for vascular and non-vascular plant species to develop baseline data and better plan riparian enhancement projects.

Maps are not available for most of the modules identified in the Pilot Watershed Guide for the following reasons:

- Lack of location information on noxious weeds, or weeds are so widespread that mapping is time-consuming and difficult;
- TES plant surveys have been conducted for 10+ years and only documented populations have been mapped. On a majority of areas where no TES plants were found, no mapping is available.
- Little is known about historical locations of TES plants in the watershed; and
- Uncommon or unique species often have not been mapped.

Status of hairy-stemmed checkermallow (*Sidalcea hirtipes*) populations, effects of management activities (e.g., mowing meadows to maintain elk habitat) and encroachment by invasive weedy plant species on these populations need to be identified.

Information on distribution and habitat requirements of species listed in the ROD is unknown.

Ecological roles of mosses and lichens, and how much can be harvested sustainably is unknown.

C. Wildlife

The effects of recreation activity on wildlife needs further analysis.

More information is needed to determine the adequate/desired levels of snag and down woody debris density, size and decay class distribution, range of natural variability in various seral stage.

Information is needed on minimum suitable habitat patch size relative to different species.

Investigate the effects of the special forest products program upon wildlife habitat (i.e., moss, mushrooms, boughs and firewood).

Need inventory of invertebrates within the watershed.

Map all unique habitat types/appropriate buffers. (FSEIS pg. B-11)

Identify/Organize/Analyze known "habitat data" - snags, down woody debris. One way of getting at part of this, perhaps by sampling and making some general assumptions, could be to map areas which have been commercially thinned.

Gather more complete habitat data/inventory - density and distribution of snags and down woody debris.

Information of value of meadows in a late-successional forest ecosystem.

Information on the population health of spotted owl prey species within the watershed.

Information is lacking to complete the "trends" section on the Species List (see appendix C-3.2). Further analysis/information is needed to address the habitat condition and requirements of those species with decreasing trends.

The range of natural variability relative to wildlife populations and habitats is unknown - Are we currently within those ranges?

D. Fish

The Nestucca River Basin Anadromous Salmonid Habitat Overview (Baker et al. 1986) indicates that spawning gravel may be limiting in several streams, primarily in the tributaries in the Middle Nestucca watershed block. Stream survey reports completed by the USFS identify this problem in streams such as Limestone Creek, Alder Creek, Powder Creek, Boulder Creek, etc. This may also be a problem in some Three Rivers tributaries. Substrate data has not been analyzed.

Some USFS stream survey reports indicate erosion along the stream channels, however they do not quantify the amounts. No data exists that can be used to determine if there is a sediment problem that impacts salmonid spawning habitat in the Nestucca River drainage. There is a problem with how the data is collected. The substrate data collected is meant to give a general description of the substrate - only dominant and subdominant substrate is recorded. The streambed may indicate that fines are above expected levels, however if the fines aren't the #1 or #2 most abundant substrate in a habitat they won't show up in the data. There is also scientific controversy over the question of whether or not visual observations of fines provide any useful value in assessing impacts to spawning.

Very little data on fish habitat has been collected on private lands. Since much of the potentially good fish habitat, and likely some of the most impacted habitat, exists on private lands, it is impossible to accurately assess the total fish habitat conditions in the watershed. Additional habitat surveys of private lands is needed.

Site-specific information on the vegetative structure and composition of riparian areas is needed.

Data is needed on streambank stability.

USFS fish habitat inventories have been limited to anadromous fish streams. No data is available for resident fish streams or stream reaches above anadromous fish barriers which contain resident fish.

Several USFS streams have old survey information that is invaluable, but these streams need to be resurveyed with the newest USFS surveys protocols. USFS surveys are needed on the following streams: Clear Creek, West Creek, Wolfe Creek, Clarence Creek, upper Three Rivers and tributaries, and all resident fish streams and reaches above anadromous fish barriers which contain resident fish.

BLM streams surveys include microhabitat information, but many of the surveys are old and out of date. Any surveys completed between 1983 and 1990 should be repeated, with priority given to the oldest surveys: Moon Creek, Testament Creek, Ginger Creek, Elk Creek, upper Nestucca River mainstem, and Walker Creek.

Limited spawning ground data is available for most anadromous fish species. Additional surveys are most needed for chum and coho salmon.

More information is needed on the short-term impacts of in-stream restoration projects on aquatic habitat or fish stocks present.

E. Transportation

There is a need for GIS and other computer data bases, consistent between USFS and BLM, of all roads in the watershed. Data should be appropriate for watershed analysis, but not necessarily all encompassing...that is to say...not every piece of information about a road needs to be in GIS.

There is a need for more information on computer data bases on road attributes such as easements, cost share, rights-of-way, special use permits, surfacing, ownership, control, culvert locations, problem areas, stream crossings, maintenance levels, fish blockages, sidecast, slumping and amount of fill. Some information on private roads would be helpful in future analysis.

Both BLM and USFS need to develop transportation plans to develop a safe, efficient and cost-effective transportation system that protects natural resources while providing people with access into and through the forest. It will be necessary to decide which roads need to remain open to meet public access and land management objectives and which need to be closed to meet other resource objectives.

Not all federal roads have been recently evaluated for maintenance problems, closure or obliteration potential or maintenance needs. This information needs to be updated during transportation planning and site-specific project analysis.

11. Monitoring Plan

This section is limited primarily to monitoring related to outcomes of this watershed analysis. Monitoring items required by agency planning documents, various conservation strategies and recovery plans are not included.

A. Water

Establish a monitoring program for the watershed to establish baseline conditions and assure that water quality standards are being met. Special emphasis should be placed on water temperature and turbidity monitoring in the forested lands. This would include establishment of a gauging station in the upper watershed to monitor streamflow in the Nestucca River. Continuation of the stream gauges at Beaver, Tucca Creek and Fairdale should be a priority.

Temperature monitoring should focus on identifying the source(s) of high temperature water. This would involve annual monitoring of all the major tributaries in the watershed to identify those with temperature concerns. More intensive monitoring of individual streams should then be accomplished to determine the specific areas and/or management practices contributing to elevated temperatures. In those areas that receive treatments to lower water temperatures there should be pre- and post-treatment monitoring to determine the effectiveness of such treatments.

Continue biomonitoring on Powder Creek and Bear Creek, currently done by the Department of Environmental Quality (DEQ), and expand this program to the mainstem of the Nestucca River, particularly in the lower reaches.

Continue monitoring by DEQ for fecal coliform levels in the lower river.

B. Vegetation

Monitor effectiveness of various silvicultural prescriptions to determine whether objectives, such as improving tree growth through density management, improving species composition through interplanting and other practices designed to speed development of old forest characteristics, are being met.

Monitor projects closely to assure that implementation reflects the prescription and that we are actually able to do what we design.

Monitor response of understory plant species to different silvicultural prescriptions designed to speed forest succession.

Monitor overall movement of watershed toward late-successional habitat condition over time, at intervals of about ten years. Look at down woody debris, snags, tree species diversity, multistory structure, canopy closure, fragmentation and patch size.

Rigorous population demographic monitoring of Nelson's checkermallow (*Sidalcea nelsoniana*) in the proposed Walker Flat Area of Critical Environmental Concern to determine if the population is stable, increasing, or declining. Data gathered in such a project can be used to answer questions about the structure of populations (e.g., how many are reproductive, what proportion are juvenile, reproductive success of individuals, seedling establishment and survival, and life span).

Monitoring of hairy-stemmed checkermallow (*Sidalcea hirtipes*) populations to determine effects of management activities and encroachment by invasive plant species.

One important item will be to monitor the presence and quantities of those plants which are important to the local Confederated Tribes for traditional uses.

C. Wildlife

Periodically monitor historic/known threatened and endangered sites to identify any long-term changes in occupancy.

Periodically repeat the density study for the northern spotted owl to evaluate changes in population size resulting from changes in habitat. When other species are identified which are better suited to monitoring needs and are better indicator species, conduct density studies to monitor their population levels.

Monitor disturbance of threatened and endangered species caused by human activities.

D. Fish

Spawning Runs

Oregon Department of Fish and Wildlife (ODFW) annually conducts spawning ground surveys for fall chinook salmon, coho salmon, and chum salmon within the Nestucca River basin.

In addition to the ODFW surveys, BLM annually counts coho salmon spawners in Elk Creek (effectiveness monitoring for habitat enhancement). The BLM should continue to monitor spawning coho salmon in Elk Creek and renew the chinook salmon spawner count on the upper Nestucca River mainstem, above Bear Creek.

The USFS should monitor spawning coho salmon: recommended streams would be East Beaver Creek, Niagara Creek, and a stream within the Three Rivers drainage.

Project Monitoring

The BLM should continue the intensive fish population monitoring of the Elk Creek channel restoration project. Annual population estimates are made for juvenile coho salmon and steelhead trout and for adult and juvenile cutthroat trout.

The USFS should complete intensive habitat monitoring (Level 3) before and after channel restoration project work on one project per year in each district. This monitoring is to assess the effectiveness of the project in creating the desired habitat conditions. This monitoring will be done on projects in the Nestucca River basin as per the Hebo Ranger District schedule.

All in-stream projects should be periodically monitored to determine if the structures are functioning properly and if maintenance is needed.

ODFW has operated smolt traps on East Creek and Moon Creek since 1988. This is one of the only long-term efforts to monitor smolt production on the coast. The study was started to monitor the effectiveness of habitat enhancement on East Creek. In 1994, the BLM funded the cost of operating the traps. The BLM and ODFW should work cooperatively to continue this monitoring effort. Valuable information is collected on smolt production of coho salmon, steelhead trout, and cutthroat trout.

The BLM should continue to monitor winter pre-smolt numbers in Elk Creek and East Beaver Creek.

Riparian underplanting projects should be monitored to assess seedling survival and growth. Different planting/thinning combinations should be monitored to determine which prescriptions are the most successful.

Stream Inventories

BLM and USFS should continue to survey fish habitat on all federal lands. BLM surveys should be updated every ten years.

The USFS should complete habitat monitoring on selected streams every three years. The streams to be monitored in the Nestucca River basin include: Alder Creek (Nestucca River tributary), Bays Creek, Bear Creek (Beaver Creek tributary), Niagara Creek, and Pollard Creek. These recurring surveys are intended to monitor for long-term changes in habitat condition.

Site-specific riparian monitoring should be completed on all federal lands.

12. Criteria for Revision

As noted in the ROD, watershed analysis will be an ongoing, iterative process that will help define important resource and information needs. Thus, as existing information is refined, as new data becomes available, as new issues develop, when significant changes in the watershed occur or as management needs dictate, the watershed analysis will be updated. Whether the update is for the entire analysis or only a specific part, an interdisciplinary team will evaluate the proposed revisions. A team should consider reviewing the analysis every five years if no changes have occurred during that time period.

Appendix A
Public Participation

The attached "Public Participation Plan" was developed at the outset of the project. The plan was designed to be used as the general direction for public participation, realizing that it would be adaptive throughout the analysis process since the project was breaking new ground in the area of public involvement in federal forest management activities.

The first public meeting was held at the Beaver fire hall on April 28, 1994. It was advertised through the Tillamook newspaper, a mailer sent to about 1,200 addressees, with flyers posted at key local bulletin boards and on cable TV for several days. The 1,200 addressees were selected from the BLM and USFS mailing lists most likely to reach interested persons as well as the Beaver, Oregon ZIP code residences. We had 28 members of the public attend the meeting as well as several federal employees. We briefed them on the ROD and watershed analysis process. We also shared the initial efforts at issue identification and asked for their input. Some new issues arose but for the most part they appeared to agree with our initial efforts. We provided drafts of our efforts at defining the desired future condition and asked them to review and comment as they felt impressed. A follow-up Open House was held on July 12 at Beaver but only five people attended.

We held public tours of the Nestucca Watershed on May 6 and 7 and June 3 and 4. We had a total of 39 people attend the tours. While numbers were relatively few, communication was ideal. We had a variety of interests represented. It was informative to both the public and the watershed analysis team members who listened and discussed various issues.

Four mailers were sent out to keep people informed of progress. They also provided a form to allow interested persons to express their interest in various aspects of the project, including remaining on the mailing list. Eventually we managed to get the mailing list down to about 120 interested persons toward the end of the analysis.

On June 9 we held a soils/hydrology work meeting open to any interested members of the public. We held the meeting because we had received several comments from the public that they wanted to get more involved in the analysis process. Some felt we were hiding information from the public. The meeting went extremely well and there was a broad spectrum of interest groups represented. Information flowed easily in all directions, and we received several positive comments from the group. Feedback indicated we were successful in communicating our process and our progress satisfactorily. We held similar work meetings on July 22 for wildlife and fisheries, with similar results. Several contacts were made with the Confederated Tribes of the Siletz and the Confederated Tribes of the Grand Ronde to assure that current use and resources of concern were identified, as well as to inform them about the watershed analysis process. The analysis area is most closely associated with the Grand Ronde.

Appendix B

List of Team Members / Contributors

The following individuals contributed time, technical expertise and knowledge to the analysis:

Chuck Hawkins	BLM Co-Team Leader
Wayne Patterson	USFS Co-Team Leader
Val Crispin	BLM - CORE Team - Fish
Steve Bahe	BLM - CORE Team - Wildlife
Bob McDonald	BLM - CORE Team - Soils/Hydrology
Chris McDonald	USFS - CORE Team - Soils/Hydrology
Dan Johnson	USFS - CORE Team - GIS
John Caruso	BLM - CORE Team - Ecology/Silviculture
Lynn Trost	BLM - CORE Team - Transportation
Paul Henson	USFWS - CORE Team - Agency Representative
Tom Robertson	EPA - Agency Representative
Michelle Day	NMFS - Agency Representative
Steve Rychetsky	SCS - Agency Representative
Tim Livengood	USFS - Fish Biology/Aquatic Resources
Bob Metzger	USFS - Fish Biology/Aquatic Resources
Bob Ruediger	BLM - Fish Biology/Aquatic Resources
Chester Novak	BLM - Hydrology
Courtney Cloyd	USFS - Geology
Cal Wettstein	USFS - GIS Support
Mark Koski	BLM - GIS Support
Carol Murdock	USFS - GIS Support
Peter Eldred	USFS - GIS Support
Marjorie Victor	USFS - Social Assessment
Cynthia Leonard	USFS - Public Involvement
Katie Grenier	USFS - Botany
Jane Kertis	USFS - Ecology
Carol Bickford	USFS - Wildlife
John Dillingham	USFS - Transportation
Tracy Calhoun	USFS - Geology
Warren Tausch	BLM - Silviculture
George Kral	BLM - Silviculture
John Hanks	BLM - Transportation
Chuck Hurliman	BLM - Transportation
Paul Pedoni	SCS - Geology
Laura Graves	BLM - Recreation
Bill Klinkner	USFS - Transportation
Debra Carey	BLM - Document Desktop Publishing

Many others provided support to the team. We appreciate their help.

Appendix C

Data Used to Support Analysis

This appendix only contains that summary data that is appropriate to maintain within the analysis document to support and clarify discussions in the text. Other maps and data which were too cumbersome or too detailed to include here are retained in the field offices as background material.

Appendix C-1.1

Water Quality Standards

Standard	Beneficial Use
Dissolved Oxygen	
90% saturation seasonal low	Salmonid fish
95% saturation in spawning areas	Salmonid spawning and early stages life
Turbidity	
No more than a 10% cumulative increase relative to upstream	Drinking water Aquatic life
Temperature	
No more than a 2°F incr. relative to upstream when temp. is 56°F or less, a 0.5°F incr. when temp. is 57.5°F or less, no incr. when temp. is 58°F or more.	Salmonids Other aquatic life
Fecal Coliform	
200/100ml - log mean	Shellfish harvesting
400/100ml - 90 percentile	Contact recreation
Ph	
6.5 - 8.5 estuarine/freshwater	Aquatic life
7.0 - 8.5 marine waters	Aquatic life
Toxic Substances	
No increase over natural background levels	Salmonid fish Aquatic life
Chlorophyll a (Non-Regulatory Criteria)	
0.015 mg/l	Salmonid fish Aquatic life

Appendix C-1.2

Nestucca Water Rights Summary

Out-of-Channel Uses[1] as of July 24, 1994

Subwatershed	cfs
Lower Nestucca River	17.75
Mid Nestucca River	5.245
Upper Nestucca River	1.178
Horn Creek	2.7
Clear Creek	1.4
Lower Three Rivers	3.105
Cedar Creek	0.185
Pollard	0.005
Upper Three Rivers	0
Alder/Buck	4.39
Crazy Creek	0.01
Farmer Creek	0.698
Lower Beaver Creek	1.03
West Beaver Creek	1.075
Tiger Creek	0.360
East Beaver Creek	1.814
Foland Creek	1.640
Wolfe Creek	0.860
Tony Creek	0.140
Boulder Creek	1.20
Alder Creek	0.010
East Creek	0.470
Moon Creek	0.730
Powder Creek	0.460
Niagara Creek	0.010
Slick Rock Creek	0.010
Testament Creek	0.38
Fan Creek	1.00
Walker Creek	9.60
McGuire Reservoir	6.40
Total =	63.85 cfs

[1] Out-of-channel uses are all uses except for power production and fish production.

Appendix C-1.3

Watershed Summary by Block

BLOCK NAME	ACRES: TOTAL	ACRES: MI^2	STREAM: TOTAL MILES	STREAM: DENSITY MI/MI^2	ROADS: TOTAL MILES	ROADS: MI/MI^2 DENSITY	HARVEST <30 YEARS: TOTAL ACRES	HARVEST <30 YEARS: % FOREST LAND <30 YEARS	PRODUCTIVE FLAT (Stream miles)	HIGH EXTREME LANDSLIDE (acres)	DEBRIS FLOW (miles)	SOIL RAVEL STREAM (miles)	ROAD STREAM CROSSINGS (number)	BANK EROSION (miles)	ROAD LANDSLIDE POTENTIAL (miles)
LOWER	21843	34.1	231	6.8	187.1	5.5	4858	27%	25.6	1167	5.5	21.1	313	4.7	1.4
THREE RIVERS	24340	37.9	334	8.8	155.7	4.1	4981	21%	15.6	1837	14.2	11.2	436	.1	2.6
MIDDLE	38574	60.2	429	7.1	291.6	4.8	11599	32%	35.7	1723	9.8	18.9	407	3.2	1.5
BEAVER	20332	31.7	243	7.6	158.5	5.9	9285	48%	34.2	1449	13.2	55.4	342	2.3	17.0
MOON	17362	27.2	206	7.6	148.5	5.5	6836	40%	11.5	1889	17.0	32.7	242	- -	10.0
UPPER	40656	63.6	438	6.9	472.2	7.4	14598	36%	19.5	2061	11.7	23.8	750	- -	4.3
TOTALS	163107	254.7	1881	7.4	1413.6	5.7	52157	34%	142.1	10126	71.4	163.1	2490	10.3	36.8

ROAD MILES ESTIMATED FROM GIS

Appendix C-1.3

Watershed Summary by Block, continued

WATERSHED NAME	ACRES		STREAM		ROADS		HARVEST <30 YEARS		PRODUCTIVE FLAT	HIGH EXTREME LANDSLIDE	DEBRIS FLOW	SOIL RAVEL STREAM	ROAD STREAM CROSSINGS	BANK EROSION	ROAD LANDSLIDE POTENTIAL
	TOTAL	MI²	TOTAL MILES	DENSITY MI/MI²	TOTAL MILES	MI/MI² DENSITY	TOTAL ACRES	% FOREST LAND <30 YEARS	(Stream miles)	(acres)	(miles)	(miles)	(number)	(miles)	(miles)
ALDER/BUCK	4493	7.0	73	10.4	24.7	3.5	859	19%	3.4	560	4.3	6.4	81	- -	.5
CEDAR	3681	5.7	46	8.1	28.7	5.0	539	15%	.4	91	.5	- -	73	.1	.5
CRAZY CREEK	3608	5.6	49	8.7	15.8	2.8	725	20%	3.1	118	1.4	1.5	39	- -	- -
L. THREE RIV	5182	8.1	76	9.4	40.6	5.0	1553	34%	7.3	363	2.8	2.9	129	- -	.5
POLLARD	2187	3.4	31	9.1	12.9	3.8	368	17%	1.2	122	1.0	.2	46	- -	- -
UP THREE RIV	5189	8.1	59	7.3	33.0	4.1	937	18%	.2	583	4.2	.2	68	- -	1.1
TOTALS	24340	37.9	334	8.8	155.7	4.1	4981	21%	15.6	1837	14.2	11.2	436	.1	2.6

ROAD MILES ESTIMATED FROM GIS

WATERSHED NAME	ACRES		STREAM		ROADS		HARVEST <30 YEARS		PRODUCTIVE FLAT	HIGH EXTREME LANDSLIDE	DEBRIS FLOW	SOIL RAVEL STREAM	ROAD STREAM CROSSINGS	BANK EROSION	ROAD LANDSLIDE POTENTIAL
	TOTAL	MI²	TOTAL MILES	DENSITY MI/MI²	TOTAL MILES	MI/MI² DENSITY	TOTAL ACRES	% FOREST LAND <30 YEARS	(Stream miles)	(acres)	(miles)	(miles)	(number)	(miles)	(miles)
BALD MTN.	5174	8.1	57	7.1	52.5	6.6	1884	36%	.4	644	3.8	4.3	65	- -	.8
BEAR CREEK	6253	9.8	59	6.0	79.5	8.2	2617	42%	3.1	270	.9	4.5	124	- -	.5
BIBLE CREEK	4777	7.5	38	5.1	50.5	6.7	1336	28%	1.8	139	.3	1.0	68	- -	.7
ELK CREEK	6445	10.1	58	5.7	68.0	6.7	2389	37%	2.6	276	.8	4.0	- -	- -	1.6
PAN CREEK	8844	13.8	139	10.7	112.9	8.2	3523	40%	3.5	300	4.7	6.9	299	- -	.3
MCGUIRE RES.	1871	2.9	26	9.0	25.7	8.9	339	18%	5.5	- -	- -	- -	66		- -
TESTAMENT	5367	8.4	38	4.5	57.7	6.9	2062	39%	.9	432	1.2	3.0	78		.4
WALKER	1925	3.0	23	7.6	25.4	8.5	448	23%	1.7	- -	- -	- -	50		- -
TOTALS	40656	63.6	438	6.9	472.2	7.4	14598	36%	19.5	2061	11.7	23.7	750	- -	4.3

ROAD MILES ESTIMATED FROM GIS

Appendix C-1.3

Watershed Summary by Block, continued

WATERSHED NAME	ACRES		STREAM		ROADS		HARVEST <30 YEARS		PRODUCTIVE FLAT	HIGH EXTREME LANDSLIDE	DEBRIS FLOW	SOIL RAVEL STREAM	ROAD STREAM CROSSINGS	BANK EROSION	ROAD LANDSLIDE POTENTIAL
	TOTAL	MI^2	TOTAL MILES	DENSITY MI/MI^2	TOTAL MILES	MI/MI^2 DENSITY	TOTAL ACRES	% FOREST LAND <30 YEARS	(Stream miles)	(acres)	(miles)	(miles)	(number)	(miles)	(miles)
ALDER	1347	2.1	15	7.1	12.7	6.0	531	39%	- -	87	.2	.2	15	- -	.3
BOULDER 1	2806	4.4	36	8.2	20.9	4.7	1190	44%	2.1	79	.4	1.5	43	- -	- -
CLARENCE	2131	3.3	22	6.6	27.9	8.4	1237	(58%)	1.4	9	- -	.3	51	- -	- -
POLAND	2165	3.4	27	8.0	12.7	3.7	793	39%	2.8	71	.9	4.6	15	.7	- -
LIMESTONE	1994	3.1	29	9.3	17.1	5.5	256	13%	.2	133	.7	.2	11	- -	- -
M.NESTUCCA RIV	5680	8.9	59	6.6	51.4	5.8	1777	41%	11.4	137	.3	5.7	84	2.2	.6
NIAGARA	8032	12.5	87	6.9	54.9	4.4	1709	21%	6.4	469	2.6	1.6	74	- -	.2
POWDER	3717	5.8	48	8.3	10.8	1.9	472	13%	1.5	201	1.6	.1	8	- -	.3
SLICK ROCK	2299	3.6	23	6.4	25.6	7.1	1392	61%	.6	43	.2	.9	32	- -	- -
TONY	1737	2.7	26	9.6	8.5	3.2	498	29%	.9	55	.8	2.2	9	.3	- -
UP NESTUCCA	6666	10.4	57	5.5	49.1	4.7	1744	28%	8.4	439	2.1	1.6	65	- -	.1
TOTALS	38574	60.2	429	7.1	291.6	4.8	11599	32%	35.7	1723	9.8	18.9	407	3.2	1.5

ROAD MILES ESTIMATED FROM GIS

WATERSHED NAME	ACRES TOTAL	ACRES MI²	STREAM TOTAL MILES	STREAM DENSITY MI/MI²	ROADS TOTAL MILES	ROADS MI/MI² DENSITY	HARVEST <30 YEARS TOTAL ACRES	HARVEST <30 YEARS % FOREST LAND <30 YEARS	PRODUCTIVE FLAT (Stream miles)	HIGH EXTREME LANDSLIDE (acres)	DEBRIS FLOW (miles)	SOIL RAVEL STREAM (miles)	ROAD STREAM CROSSINGS (number)	BANK EROSION (miles)	ROAD LANDSLIDE POTENTIAL (miles)
HORN	3557	5.6	34	6.1	23.1	4.1	898	26%	3.8	263	.6	3.0	32	1.3	.1
CLEAR	3408	5.3	39	7.3	34.1	6.4	1056	35%	1.9	315	2.3	3.6	72	- -	.2
FARMER	3146	4.9	34	6.9	28.0	5.7	1316	42%	2.0	183	.3	11.4	41	.1	.3
GEORGE	1658	2.6	29	11.2	4.2	1.6	301	18%	.7	33	.3	.1	5	- -	- -
L.NESTUCCA RIV	10074	15.7	95	6.0	97.7	6.2	1287	20%	17.2	373	2.0	3.0	163	3.3	.8
TOTALS	21843	34.1	231	6.8	187.1	5.5	4858	27%	25.6	1167	5.5	21.1	313	4.7	1.4

ROAD MILES ESTIMATED FROM GIS

Appendix C-1.3

Watershed Summary by Block, continued

WATERSHED NAME	ACRES		STREAM		ROADS		HARVEST <30 YEARS		PRODUCTIVE FLAT	HIGH EXTREME LANDSLIDE	DEBRIS FLOW	SOIL RAVEL STREAM	ROAD STREAM CROSSINGS	BANK EROSION	ROAD LANDSLIDE POTENTIAL
	TOTAL	MI^2	TOTAL MILES	DENSITY MI/MI^2	TOTAL MILES	MI/MI^2 DENSITY	TOTAL ACRES	% FOREST LAND <30 YEARS	(Stream miles)	(acres)	(miles)	(miles)	(number)	(miles)	(miles)
NORTH BEAVER	4947	7.7	62	8.0	18.0	6.2	1516	33%	10.2	5	- -	- -	73	2.3	- -
TIGER	1990	3.1	20	6.4	20.6	6.6	1258	58%	6.0	- -	- -	- -	22	- -	- -
EAST BEAVER	9928	15.5	122	7.9	84.0	5.4	4626	48%	13.4	1419	13.1	50.00	202	- -	17.00
WEST	1683	2.6	18	6.8	18.1	6.9	598	38%	1.5	5	- -	4.70	26	- -	- -
L.BEAVER CREEK	1784	2.8	21	7.5	17.8	6.4	1287	85%	3.1	20	.1	.70	19	- -	- -
TOTALS	20332	31.7	243	7.6	158.5	5.9	9285	48%	34.2	1449	13.2	55.40	342	2.3	17.00

ROAD MILES ESTIMATED FROM GIS

WATERSHED NAME	ACRES		STREAM		ROADS		HARVEST <30 YEARS		PRODUCTIVE FLAT	HIGH EXTREME LANDSLIDE	DEBRIS FLOW	SOIL RAVEL STREAM	ROAD STREAM CROSSINGS	BANK EROSION	ROAD LANDSLIDE POTENTIAL
	TOTAL	MI^2	TOTAL MILES	DENSITY MI/MI^2	TOTAL MILES	MI/MI^2 DENSITY	TOTAL ACRES	% FOREST LAND <30 YEARS	(Stream miles)	(acres)	(miles)	(miles)	(number)	(miles)	(miles)
MOON	5621	8.8	67	7.6	49.5	5.6	2091	39%	3.8	1368	12.6	14.7	88	- -	9.4
EAST CREEK	6824	10.7	72	6.7	68.0	6.4	2870	43%	3.6	221	1.6	9.9	97	- -	.4
WOLFE	1852	2.9	28	9.7	12.5	4.3	834	46%	2.3	44	.5	1.1	23	- -	- -
BAYS CREEK	3065	4.8	39	8.1	18.5	3.8	1041	34%	1.8	256	2.3	7.0	34	- -	.2
TOTALS	17362	27.2	206	7.6	148.5	5.5	6836	40%	11.5	1889	17.0	32.7	242	- -	10.0

ROAD MILES ESTIMATED FROM GIS

Appendix C-1.4

Number of Road/Stream Crossings by Surface Type

Subwatershed	# Dirt	Gravel	Paved	Total #	Percent Fine
Alder/Buck	20	45	16	81	94
Alder 1	5	10		15	13
Bald Mtn. Fork		49	16	65	66
Bays Creek	8	26		34	68
Bear Creek		118	6	124	81
Bible	1	67		68	76
Boulder	19	24		43	33
Cedar	13	49	11	73	61
Clarence	23	18		51	72
Clear	29	39	4	72	71
Crazy		39		39	97
East	10	87		97	71
E. Beaver	21	149	32	202	29
Elk		95		95	53
Fan		273	26	299	69
Farmer	1	40		41	88
Foland	7	7	1	15	6
George	3	2		5	100
Horn	30	1	1	32	87
L. Beaver Creek	9	2	8	19	100
L. Nestucca	85	29	49	163	85
L. Three Rivers	28	60	41	129	68
Limestone		11		11	100
M. Nestucca	53	13	18	84	84
McGuire Reservoir		62	4	66	100
Moon Creek		82	6	88	34
Niagara	10	64		74	90
North Beaver	48	17	8	73	94
Pollard		44	2	46	48
Powder	2	6		8	100
Slick Rock	10	22		32	100
Testament		72	6	78	76
Tiger	21	1		22	100
Tony	4	5		9	22
U. Nestucca	30	7	28	65	57
Upper Three Rivers		68		68	54
Walker		50		50	86
West	5	6		26	92
Wolfe		23	12	23	87
Totals	495	1,782	295	2,585	

Appendix C-1.5

Methodology Used in Analysis of Landslides and Other Sediment Sources

Debris Slide Potential

Debris slide potential was analyzed by stratifying the watershed into zones of similar landslide potential based on geology and slope steepness in ARC/INFO. Geologic types were grouped by rock competency (resistance to weathering) into unconsolidated, weak, intermediate and resistant categories (see table 1) Slope steepness was derived from USGS Digital Elevation Models (DEMs) using ARC/INFO to generate the following slope classes: 0-15%, 16-35%, 36-55%, 56-75%, and greater than 76%. The slope classes were then overlain with the rock competency classes to give debris slide potentials as seen in table 2. The high and extreme ratings were reported by acreage for each subwatershed.

Table 1 Lithologic Units and Rock Competency

Lithologic Unit Formation (Symbol)	Competency Class
Yamhill (Ty)	Weak
Nestucca (Tn)	Weak
Marine Sediments (Toem)	Weak
Pacific City Sandstone (Tubs)	Weak
Tyee Sandstone (Tt)	Weak
Siletz Volcanics (Tsr)	Intermediate
Tillamook Volcanics (Ttv)	Intermediate
Tillamook Volcanics (Ttsb)	Intermediate
Basaltic Sandstone (Tbs)	Intermediate
Depoe Bay (Tidb)	Intermediate
Cascade Head (Tcv)	Intermediate
Astoria (Taa)	Intermediate
Tertiary Intrusive Volcanics (Ti)	Resistant
Quaternary Sediments (Qs)	Unconsolidated
Quaternary Landslide Deposit (Ql)	Unconsolidated

Table 2 Debris Slide Potential Matrix

	Debris Slide Potential			
Slope Class/Rock Type	Resistant	Intermediate	Weak	Unconsolidated
0-15%	Low	Low	Low	Low
16-35%	Low	Low	Moderate	Moderate
36-55%	Moderate	Moderate	Moderate	High
56-75%	Moderate	High	High	Extreme
> 76%	High	Extreme	Extreme	Extreme

Debris Flow Potential

Lands with a high or extreme landslide potential rating were intersected with stream channels in the GIS database and the result was the streams with a high or extreme debris flow potential. The number of miles of stream with these ratings were reported for each subwatershed.

Road Landslide Potential

Lands with a high or extreme landslide potential rating were intersected with roads in the GIS database. The number of miles of road with these ratings were reported for each subwatershed. This analysis and the road and debris flow potential stratification showed road areas that have a high potential for landsliding.

Road and Debris Flow Potential

Streams with a high or extreme debris flow potential rating were intersected with roads in the GIS database. The number of times a road crosses a high debris flow potential stream were reported for each subwatershed.

Road and Stream Crossing Erosion Potential

Roads were intersected with third order and less streams in the GIS database. The results were then intersected with soils grouped into coarse or fine textured groups. This gave the number of times that roads cross streams by soil texture group. The results were reported for each subwatershed.

Bank Erosion Potential

Streams fourth order and higher were intersected with soils that have a high probability of bank erosion. For the Nestucca Watershed these are soils in the Nestucca soil series. These are soils that are found within floodplains and are non-cohesive (loose, unconsolidated material). The number of miles of streams that intersected with these types of soils were reported for each subwatershed in appendix C-1.3.

Surface Erosion Potential

Surface erosion (dry ravel) potential was analyzed by selecting soils from the GIS Soils coverage that were located on slopes greater than 60% and had gravelly or fine surface textures. These soils were then intersected with all clearcut units in the GIS that were less than 30 years old. The result was intersected with streams in the GIS database to give the miles of stream with adjacent soils that are prone to surface erosion that had been disturbed within the last 30 years.

Appendix C-2.1

Threatened, Endangered and Sensitive Plants That Could Be Found in the Nestucca Watershed

Species which are considered Threatened, Endangered, or Sensitive (TES) by the state of Oregon, Forest Service or BLM. This includes Forest Service and BLM Sensitive species, but not BLM Assessment species. Species listed as sensitive by the Forest Service may only be listed as Assessment species by the BLM (see below), which results in different management actions on BLM lands than on Forest Service lands. This includes Oregon Natural Heritage Program List 1 species (= species which are endangered or threatened throughout their range or which are presumed extinct). Surveys for the species in this category are conducted prior to any ground-disturbing activities. If populations are located, measures are taken to protect populations. * = Documented populations in the Nestucca River Basin; includes a Federally listed Threatened species, *Sidalcea nelsoniana*.

Scientific Name	Common Name
Anemone oregana var. felix	Oregon bog anemone
**Cardamine pattersonii*	Saddle Mt. bittercress
Carex pluriflora	several-flowered sedge
Carex macrochaeta	large-awn sedge
Cimicifuga elata	tall bugbane
Dodecatheon austrofrigidum	shooting star
Dryopteris filix-mas	male fern
Erigeron peregrinus ssp. peregrinus var. peregrinus	wandering daisy
**Erythronium elegans*	elegant fawn lily
**Filipendula occidentalis*	queen-of-the-forest
Geum triflorum var. campanulatum	western red avens
Lewisia columbiana var. rupicola	rosy lewisia
**Poa laxiflora*	loose-flowered bluegrass
Pohlia sphagnicola	Pohlia moss
Saxifraga hitchcockiana	Saddle Mt. saxifrage
Senecio flettii	Flett's groundsel
Scirpus cyperinus	wool grass
**Sidalcea hirtipes*	hairy-stemmed checkermallow
**Sidalcea nelsoniana*	Nelson's checkermallow
Utricularia gibba	humped bladderwort
Utricularia minor	lesser bladderwort
Wolffia columbiana	Columbia watermeal
Wolffia punctata	dotted watermeal

Appendix C-2.2

BLM Assessment Plant Species That Could Be Found in the Nestucca Watershed

These are equivalent to the Oregon Natural Heritage Program's List 2 species (= species which are threatened, endangered, or possibly extirpated in Oregon, but are more common or stable elsewhere), and only include species which are not listed on appendix C-2.1. Generally, these species will be added to USFS Sensitive Species Lists when these lists are officially updated by the Regional Forester. BLM management directions state that presence of populations of these species may not necessarily affect a proposed project, but, where possible, steps should be taken to protect the species.

Scientific Name	Common Name
Calypogeia sphagnicola	liverwort
Carex livida	
Eriophorum chamissonis	Chamisso's cotton grass
Lophozia laxa	liverwort
Microseris bigelovii	coast microseris
Polystichum californicum	fern
Polytrichum strictum	moss
Tetraplodon mnioides	moss

Appendix C-2.3

Species Listed by the Oregon Natural Heritage Program Which Are Not Officially Managed by State and Federal Agencies

Often called "Watch List Species", this includes species on the Oregon Natural Heritage Program's List 3 (= more information is needed before status can be determined) and 4 (= species of concern which are not currently threatened or endangered). Typically, these species do not get listed as sensitive or assessment species by the federal agencies. Plants on List 3 are listed as "Tracking Species" by the BLM and are supposed to be monitored as much as budget and personnel allow. Forest Service and BLM Botanists do document information about known populations.

Scientific Name	Common Name
Adiantum jordanii	maidenhair fern
Barbilophozia barbata	liverwort
Castilleja ambigua	johnny-nip
Cephaloziella spinigera	liverwort
Cyperus acuminatus	short-pointed flatsedge
Cyperus bipartitus (= *C. rivularis*)	flatsedge
Darlingtonia californica	California pitcher-plant
Dulichium arundinaceum	dulichium
Eleocharis parvula var. parvula	spike rush
Elodea nuttallii	water-weed
Encalyptra brevipes	moss
Erythronium revolutum	coast fawn lily
Honkenya peploides	sea purslane
Lloydia serotina	alpine lily
Metzgeria temperata	liverwort
Myrica gale	sweet gale
Najas guadalupensis	water nymph
Poa marcida	weak bluegrass
Poa unilateralis	
Polygonum punctatum	water smartweed
Rhinanthus crista-gallii	yellow rattle
Rhytidium rugosum	moss
Samolus parviflorus	
Scirpus subterminalis	water club rush
Stellaria humifusa	spreading starwort
Synthyris schizantha	fringed kittentails
Subularia aquatica	awlwort
Tofieldia glutinosa	tofieldia
Vaccinium oxycoccos	swamp cranberry

Appendix C-2.4

Vascular TES Plant Species Habitats

Scientific Name	Common Name
Moist forests	
Adiantum jordanii	maidenhair fern
Cimicifuga elata	tall bugbane
Dryopteris filix-mas	male fern
Erythronium elegans	elegant fawn lily
Erythronium revolutum	coast fawn-lily
Polystichum californicum	California swordfern
Bogs, marshes	
Anemone oregana var. felix	Oregon bog anemone
Cardamine pattersonii	Saddle Mt. bittercress
Carex livida	pale sedge
Carex macrochaeta	large awned sedge
Carex pluriflora	several-flowered sedge
Cyperus acuminatum	short-pointed flatsedge
Cyperus bipartitus	flatsedge
Cyperus rivularis	shining flatsedge
Dulichium arundinaceum	dulichium
Darlingtonia californica	California pitcher-plant
Eriophorum chamissonis	cotton grass
Fritillaria camschatcensis	chocolate lily
Hydrocotyle verticillata	whorled marsh pennywort
Limbella freyi	Frye's moss
Lycopodium inundatum	northern bog clubmoss
Myrica gale	sweet gale
Ophioglossum vulgatum	adder's tongue
Plantago macrocarpa	Alaska plantain
Pohlia sphagnicola	Pohlia moss
Rhinanthus crista-gallii	yellow rattle
Scirpus cyperinus	wool grass
Tofieldia glutinosa	tofieldia
Fresh water, slow moving to standing	
Elodia nuttallii	water-weed
Najas guadalupensis	water nymph
Polygonum punctatum	water smartweed
Scirpus subterminalis	water club rush
Subularia aquatica	awlwort
Utricularia gibba	humped bladderwort
Utricularia minor	lesser bladderwort
Wolffia columbiana	Columbia watermeal
Wolffia punctata	dotted watermeal

Scientific Name	Common Name

Ridges, outcrops

Cardamine pattersonii	Saddle Mt. bittercress
Dodecatheon austrofrigidum	shooting star
Erigeron peregrinus ssp. peregrinus var. peregrinus	wandering daisy
Erythronium elegans	elegant fawn lily
Lewisia columbiana ssp. rupicola	rosy lewisia
Lloydia serotina	alpine lily
Saxifraga hitchcockiana	Saddle Mt. saxifrage
Senecio flettii	Flett's groundsel
Syntheris schizantha	fringed kittentails

Moist meadows

Carex macrocheata	large-awned sedge
Dulichium arundinaceum	dulichium
Microseris bigelovii	coast microseris
Myrica gale	sweet gale
Samolus parviflorus	
Sidalcea nelsoniana	Nelson's checkermallow
Tofieldia glutinosa	tofieldia

Lake margins

Anemone oregana var. felix	Oregon bog anemone
Carex macrochaeta	large-awned sedge
Limbella freyi	Frey's moss
Ophioglossum vulgatum	adder's tongue
Plantago macrocarpa	Alaska plantain
Pohlia sphagnicola	Pohlia moss
Polygonum punctatum	water smartweed
Scirpus cyperinus	wool grass
Tofieldia glutinosa	tofieldia
Myrica gale	sweet gale

Riparian

Cardamine pattersonii	Saddle Mt. bittercress
Carex macrochaeta	large awned sedge
Carex pluriflora	several-flowered sedge
Cimicifuga elata	tall bugbane
Cyperus rivularis	shining flatsedge
Dodecatheon austrofrigidum	shooting star
Dryopteris filix-mas	male fern
Elodea nuttallii	water-weed
Erythronium revolutum	coast fawn lily
Filipendula occidentalis	queen of the forest
Limbella freyl	Frey's moss
Plantago macrocarpa	Alaska plantain
Poa laxiflora	loose-flowered bluegrass
Pohlia sphagnicola	Pohlia moss
Scirpus subterminalis	water club rush
Subularia aquatica	awlwort
Tofieldia glutinosa	tofieldia

Appendix C-2.4, continued

Scientific Name	Common Name
Forest openings	
Cimicifuga elata	tall bugbane
Dodecatheon austrofrigidum	shooting star
Microseris bigelovii	coast microseris
Syntheris schizantha	fringed kittentails
Sphagnum bogs	
Carex pluriflora	several-flowered sedge
Vaccinium oxycoccos	swamp cranberry
Springs, seeps	
Adiantum jordanii	maidenhair fern
Cardamine pattersonii	Saddle Mt. bittercress
Filipendula occidentalis	queen of the forest
Rhinanthus crista-gallii	yellow rattle
Samolus parviflorus	
High elevation grassy/rocky meadows	
Cardamine pattersonii	Saddle Mt. bittercress
Carex macrochaeta	large-awned sedge
Erigeron peregrinus ssp. peregrinus var. peregrinus	wandering daisy
Erythronium elegans	elegant fawn lily
Geum triflorum var. campanulatum	western red avens
Lewisia columbiana ssp. rupicola	rosy lewisia
Sidalcea hirtipes	hairy-stem checkermallow

Appendices

List of Appendices

Appendix C-2.5

Species Identified in the Record of Decision (CITE) that are to be Protected through Survey and Management Strategies, and are Likely to Occur in the Nestucca River Basin

See Attached

ROD Species Occurrence on Nestucca Watershed

Occurrence information, found in the column OC, was determined as follows:
- Present (P): Sitings are documented
- Highly probable (H): Sitings are documented within 10 miles of Nestucca watershed
- Suspected (S): Known habitat occurs within the watershed; species range includes Nestucca
- Remote possibility (R): Habitat and/or range data suggests that species is unlikely to occur, but cannot be ruled out
- Unknown: Range and/or habitat data is unclear; cannot determine likelihood of occurrence

Elevation data, obtained from Appendix J-2 of the FSEIS, was determined to be:
- l = below transient snow zone
- m = transient snow zone
- u = sub-alpine & alpine

SCIENTIFIC NAME	OC	HABITAT	EL	SERAL STAGE	ASSOC SP	SPECIES CATEGORY
Albatrellus avellaneus	S	coastal		OG	conifer/hardwood mix	Rare Ecto-Polypores
Albatrellus ellsii	S	coastal		OG	mixed conifer/hardwood	Uncommon Ecto-Polypores
Albatrellus flettii	S	coastal		OG	mixed conifer/hardwood	Uncommon Ecto-Polypores
Aleuria rhenana	U	well-developed forest litter	l,m,h		conifer	Rare Cup Fungi
Aleurodiscus farlowii	U	on wood, humus, litter, stumps & dead roots				Rare Resupinates and Polypore
Arcangeliella sp. nov. #Trappe 12359	S	old-growth legacy of coarse woody debris in fog belt	l,m	mat-OG	PISI, TSHE	Undescribed Fungal Taxa
Asterophora lycoperdoides	U	fruit bodies of other fungi		LS		Parasitic Fungi
Asterophora parastica	U	fruit bodies of other fungi		LS		Parasitic Fungi
Baeospora myriadophylla	U	litter, humus or dead wood		LS	conifer	Uncommon Gilled Mushrooms
Boletus piperatus	S	coarse woody debris	l,m	OG	conifers	Low Elevation Boletes
Boletus pulcherrimus	S		l	mat-OG	conifer	Rare Boletes
Bryoria tortuosa	S	coast & mesic	l,m		oaks, conifers	Rare Forage Lichen
Calicium abietinum	S			OG	conifer	Pin Lichens
Calicium adaequatum	S	high atmospheric humidity provided by forest conditions; substrate & texture specific		OG	conifer	Pin Lichens
Calicium adspersum	S			OG		Pin Lichens
Calicium glaucellum	S			OG		Pin Lichens

OCCURRENCE CODES:
- P = Present
- H = Highly probable
- S = Suspected
- R = Remote
- U = Unknown

SERAL STAGE CODES:
- mat = mature
- OG = old growth
- LS = late successional

SCIENTIFIC NAME	OC	HABITAT	EL	SERAL STAGE	ASSOC SP	SPECIES CATEGORY
Calicium viride	S	high atmospheric humidity provided by forest conditions; substrate & texture specific		OG		Pin Lichens
Cantharellus cibarius, subalbidus, tubaeform	P		l,m	mat-OG	coniferous	Chanterelles
Catathelasma ventricosa	U	details of habitat requirements not completely known				Uncommon Gilled Mushrooms
Cetrelia cetrarioides	S	foggy, riparian forest on older hardwood trees	l,m	OG	conifers	Riparian Lichens
Chaenotheca brunneola	S			OG		Pin Lichens
Chaenotheca chrysocephala	S			OG		Pin Lichens
Chaenotheca ferruginea	S			OG		Pin Lichens
Chaenotheca furfuracea	S			OG		Pin Lichens
Chaenotheca subroscida	S			OG		Pin Lichens
Chaenothecopis pusilla	S			OG		Pin Lichens
Chamonixia pacifica sp. nov. #Trappe 12768	S		l,m	mat-OG	TSHE, PISI, PSME	Undescribed Fungal Taxa
Choiromyces venosus	R		l,m		mixed conifer/hardwood	Rare Truffles
Chroogomphus loculatus	R		um	OG	Pinaceae	Rare Gilled Mushrooms
Cladonia norvegica	U	unknown				Additional Lichen Species
Clavariadelphus sp.	U	cool/cold moist well developed litter layer		LS	hardwood or conifer	Club Coral Fungi
Clavicorona avellanea	S	moist with coarse woody debris & large diameter partially decayed logs	l,m	LS		Coral Fungi
Clavulina cinerea	H	well-developed litter layer		LS		Branched Coral Fungi
Clavulina cristata	P	well-developed litter layer		LS		Branched Coral Fungi
Clavulina ornatipes	S	well-developed litter layer		LS		Branched Coral Fungi

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S = Suspected
R = Remote
U = Unknown

SERAL STAGE CODES:
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OG = old growth
LS = late successional

SCIENTIFIC NAME	OC	HABITAT	EL	SERAL STAGE	ASSOC SP	SPECIES CATEGORY
Clitocybe senilis	S	moist, with a deep humus and litter layer	l	LS	conifers	Rare Gilled Mushrooms
Clitocybe subditopoda	S	moist, with a deep humus and litter layer	l	LS	conifers	Rare Gilled Mushrooms
Collema nigrescens	S	foggy riparian forest, mostly on QUGA	l,m	OG	QUGA	Riparian Lichens
Collybia bakerensis	U	recently fallen stumps and logs		LS	conifer	Uncommon Gilled Mushrooms
Collybia racemosa	U	fruit bodies of other fungi		LS		Parasitic Fungi
Cordyceps capitata	U	fruit bodies of other fungi		LS		Parasitic Fungi
Cordyceps ophioglossoides	U	fruit bodies of other fungi		LS		Parasitic Fungi
Cortinarius azureus	U	details of habitat requirements not completely known				Uncommon Gilled Mushrooms
Cortinarius boulderensis	U	details of habitat requirements not complete known				Uncommon Gilled Mushrooms
Cortinarius canabarba	S	diverse forest with heavy litter/humus layer and associated coarse woody debris		LS	conifer	Rare Gilled Mushrooms
Cortinarius cyanites	U	details of habitat requirements not completely known				Uncommon Gilled Mushrooms
Cortinarius magnivelatus	U	details of habitat requirements not completely known				Uncommon Gilled Mushrooms
Cortinarius olympianus	U	details of habitat requirements not completely known				Uncommon Gilled Mushrooms
Cortinarius rainierensis	S	diverse forest with heavy litter/humus layer and associated coarse woody debris		LS	conifer	Rare Gilled Mushrooms
Cortinarius spilomius	U	details of habitat requirements not completely known				Uncommon Gilled Mushrooms
Cortinarius tabularis	U	details of habitat requirements not completely known				Uncommon Gilled Mushrooms
Cortinarius valgus	U	details of habitat requirements not completely known				Uncommon Gilled Mushrooms

OCCURRENCE CODES:
- P = Present
- H = Highly probable
- S = Suspected
- R = Remote
- U = Unknown

SERAL STAGE CODES:
- mat = mature
- OG = old growth
- LS = late successional

SCIENTIFIC NAME	OC	HABITAT	EL	SERAL STAGE	ASSOC SP	SPECIES CATEGORY
Cortinarius variipes	S	diverse forest with heavy litter/humus layer and associated coarse woody debris		LS	conifers	Rare Gilled Mushrooms
Cudonia monticola	U	duff		mat	conifer	Rare Resupinates and Polypore
Cyphelium inquinans	S			OG		Pin Lichens
Cyphellostereum laeve	U	moist; specific details of ecology lacking			mosses	Moss Dwelling Mushrooms
Dermocybe humboldtensis	U	details of habitat requirements not completely known				Uncommon Gilled Mushrooms
Dendriscocaulon intricatulum	R	wet, boreal riparian	l,m	LS	conifers	Rare Nitrogen-fixing Lichens
Destuntzia fusca	S	mature coastal forest	l,m	mat-OG	SESE,PSME,Abies,TSHE,LI	Rare False Truffles
Destuntzia rubra	S	mature coastal forest	l,m	mat-OG	SESE,PSME,LIDE,TSHE,Ab	Rare False Truffles
Dichostereum granulosum	U	on wood, humus, litter, stumps & dead roots				Rare Resupinates and Polypore
Diplophyllum plicatum	S	coastal forest; on bark, decaying wood & thin soil over rock; cool, moist		OG	PISI	Lichens
Douinia ovata	S	foggy forest; ridges & rock outcrops or coniferous canopy on underside of limbs foggy forest	l,m	OG	conifer	Lichens
Elaphomyces sp. nov. #Trappe 1038	H	Old-growth legacy of coarse woody debris in coastal fog belt	l,m	mat-OG	TSHE, PISI, PSME	Undescribed Fungal Taxa
Encalypta brevicolla var. crumiana	S	shaded foggy rock outcroppings	l,m	OG		Mosses
Endogone oregonensis	P	coast & coast ranges	l	mat-OG	PISI, TSHE	Rare Zygomycetes
Fayodia gracilipes (rainierensis)	U	litter, humus or dead wood		LS	conifer	Uncommon Gilled Mushrooms
Galerina atkinsoniana	U	moist; specific details of ecology lacking			mosses	Moss Dwelling Mushrooms
Galerina cerina	U	moist; specific details of ecology lacking			mosses	Moss Dwelling Mushrooms
Galerina heterocystis	U	moist; specific details of ecology lacking			mosses	Moss Dwelling Mushrooms

OCCURRENCE CODES:
P = Present R = Remote
H = Highly probable U = Unknown
S = Suspected

SERAL STAGE CODES:
mat = mature
OG = old growth
LS = late successional

SCIENTIFIC NAME	OC	HABITAT	EL	SERAL STAGE	ASSOC SP	SPECIES CATEGORY
Galerina sphagnicola	U	moist; specific details of ecology lacking			mosses	Moss Dwelling Mushrooms
Galerina vittaeformis	U	moist; specific details of ecology lacking			mosses	Moss Dwelling Mushrooms
Gastroboletus imbellus	S		u-m(50(		Pinaceae	Rare Boletes
Gastroboletus turbinatus	S	thick humus and abundant large coarse woody debris	l,m,h	mat-OG	PISI, TSHE, Abies	Boletes
Gautieria otthii	R	mid to upper-mid elev.; ectomychorrizal with Pinaceae	m,um	mat-OG	mixed conifer	Rare False Truffles
Glomus radiatum	S	mesic to wet, thick humus, abundant coarse woody material	l,m,h	mat-OG	SESE & CHNO	Rare Zygomycetes
Gomphus bonarii, clavatus, floccosus, kauffn	S	rich humus layer	l,m,h	OG	conifer	Chanterelles - Gomphus
Gymnomyces sp. nov. #Trappe 4703, 5576	S		um		ABPR	Undescribed Fungal Taxa
Gymnopilus puntifolius	U	well decayed stumps and logs		LS	conifer	Uncommon Gilled Mushrooms
Gyromitra californica	U	decaying matter in soil & rotten wood		mat		Rare Resupinates and Polypore
Gyromitra esculenta	U	rotten wood		SG		Rare Resupinates and Polypore
Gyromitra infula	U	decaying matter in soil & rotten wood		mat		Rare Resupinates and Polypore
Gyromitra melaleucoides	U	decaying matter in soil & rotten wood				Rare Resupinates and Polypore
Gyromitra montana (syn. G. gigas)	U	decaying matter in soil & rotten wood		mat		Rare Resupinates and Polypore
Hebeloma olympiana	U	details of habitat requirements not completely known				Uncommon Gilled Mushrooms
Helvella compressa	U	riparian or wet	l,m	LS		Rare Cup Fungi
Helvella crassitunicata	U	riparian or wet	l,m	LS		Rare Cup Fungi
Helvella elastica	U	riparian or wet	l,m	LS		Rare Cup Fungi
Helvella maculata	U	riparian or wet	l,m	LS		Rare Cup Fungi
Herbertus aduncus	S	fog-drenched rocks and tree-trunks		OG		Lichens

OCCURRENCE CODES:
P = Present
H = Highly probable
S = Suspected
R = Remote
U = Unknown

SERAL STAGE CODES:
mat = mature
OG = old growth
LS = late successional

SCIENTIFIC NAME	OC	HABITAT	EL	SERAL STAGE	ASSOC SP	SPECIES CATEGORY
Herbertus sakurali	S	fog-drenched rock faces in foest		OG		Lichens
Heterodermia sitchensis	U	unknown				Additional Lichen Species
Hydnum repandum	S			LS	conifer & hardwood	Tooth Fungi
Hydnum umbilicatum	S			LS	conifers & hardwoods	Tooth Fungi
Hydrothyria venosa	S	clear, cold streams	l,m	pristine OG		Aquatic Lichen
Hygomnia vittiata	U	unknown				Additional Lichen Species
Hygrophorus caeruleus	U	details of habitat requirements not completely known				Uncommon Gilled Mushrooms
Hygrophorus karstenii	U	details of habitat requirements not completely known				Uncommon Gilled Mushrooms
Hygrophorus vernalis	U	details of habitat requirements not completely known				Uncommon Gilled Mushrooms
Hypogymnia duplicata	S	wet, foggy, windy coast & maritime sites	l		conifers	Rare Leafy (arboreal) Lichens
Hypomyces luteovirens	U	fruit bodies of other fungi		LS		Parasitic Fungi
Iwatsukella leucotricha	S	bark		OG		Mosses
Kurzia makinoana	S	well-shaded rotten wood & humic soil	l,m	OG		Lichens
Leptogium burnetiae var. hirsutum	S	foggy riparian forest on older trees	l,m	OG	hardwood	Riparian Lichens
Leptogium cyanescens	S	foggy riparian forest on older hardwood trees	l,m	OG		Riparian Lichens
Leptogium rivale	S	streams	l,m	OG		Aquatic Lichen
Leptogium saturninum	S	boreal riparian forest on older hardwood trees	l,m	OG		Riparian Lichens
Leptogium teretiusculum	H	foggy riparian forest on older hardwood trees	l,m	OG		Riparian Lichens
Leucogaster citrinus	S	stands with an abudant legacy of large, coarse woody debris	l,m	mat-OG	PSME,TSHE,CACH,LIDE	Rare False Truffles
Leucogaster microsporus	S	stands with an abudant legacy of coarse woody debris	m	OG	PSME	Rare False Truffles

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SERAL STAGE CODES:
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OG = old growth
LS = late successional

SCIENTIFIC NAME	OC	HABITAT	EL	SERAL STAGE	ASSOC SP	SPECIES CATEGORY
Lobaria linita	S	moist forest		OG	PSME	Rare Nitrogen-fixing Lichens
Lobaria hallii	S	wet,foggy forest on large diam. hardwoods & on shrubs	l,m	LS	conifers	Rare Nitrogen-fixing Lichens
Lobaria oregana	H	open coastal forests		OG (>200 yr	conifers	Nitrogen-fixing Lichens
Lobaria pulmonaria	H	moist, hardwood forest & swamps		OG		Nitrogen-fixing Lichens
Lobaria scrobiculata	H			OG (>140 yr		Nitrogen-fixing Lichens
Macowanites chlorinosmus	H	large course woody material	l	mat-OG	PISI,PSME,TSHE	Uncommon False Truffles
Macowanites mollis	R		l	mat-OG	PSME, possibly Pinaceae	Rare False Truffles
Marasmius applanatipes	U	litter, humus or dead wood		LS	conifer	Uncommon Gilled Mushrooms
Martellia idahoensis	S		m,um	mat-OG	Abies, Pinaceae	Rare False Truffles
Microcalicium arenarium	S			OG		Pin Lichens
Mycena hudsoniana	U	litter, humus or dead wood		LS	conifer	Uncommon Gilled Mushrooms
Mycena lilacifolia	U	rottings stumps and logs		LS	conifer	Uncommon Gilled Mushrooms
Mycena marginella	U	rotting stumps or logs		LS	conifer	Uncommon Gilled Mushrooms
Mycena monticola	U	litter, humus or dead wood		LS	conifer	Uncommon Gilled Mushrooms
Mycena overholtsii	U	rotting stumps or logs		LS	conifer	Uncommon Gilled Mushrooms
Mycena quinaultensis	U	litter, humus or dead wood		LS	conifer	Uncommon Gilled Mushrooms
Mycena tenax	U	litter, humus or dead wood		LS	conifer	Uncommon Gilled Mushrooms
Mycocalicium subtile	S			OG		Pin Lichens
Mythicomyces corneipes	U	litter, humus or dead wood		LS	conifer	Uncommon Gilled Mushrooms
Neolentinus kauffmanii	S	occurs only on logs or stumps of PISI		LS	PISI	Uncommon Gilled Mushrooms

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SCIENTIFIC NAME	OC	HABITAT	EL	SERAL STAGE	ASSOC SP	SPECIES CATEGORY
Nephroma bellum	H	open forest		OG		Nitrogen-fixing Lichens
Nephroma helveticum	H	coastal & montane forests woodlands and valleys		OG		Nitrogen-fixing Lichens
Nephroma isidiosum	U	unknown				Additional Lichen Species
Nephroma laevigatum	H	coastal forest	l	OG		Nitrogen-fixing Lichens
Nephroma occultum	S			OG (>400yrs		Rare Nitrogen-fixing Lichens
Nephroma parile	H	moist	l		coniferous & deciduous	Nitrogen-fixing Lichens
Nephroma resupinatum	H	coast & montane shady forests	l,m	OG	conifers	Nitrogen-fixing Lichens
Octavianina macrospora	S	mesic	l	mat-OG	PSME,TSHE	Rare False Truffles
Octavianina papyracea	S	fog belt	l	mat-OG	PISI,TSHE,PSME,SESE	Rare False Truffles
Otidea leporina	S	duff in moist-wet forest	m,l	LS	conifer	Rare Resupinates and Polypore
Otidea onotica	S	duff in moist-wet forest	l,m	LS	conifer	Rare Resupinates and Polypore
Otidea smithii	S	duff in moist-wet forest	l,m	LS	conifer	Rare Resupinates and Polypore
Oxyporus nobilissimus	S	large stumps, snags, living trees; requires large diameter substrate; not found on logs	um	OG	Abies, esp. ABPR	Noble Polypore
Pannaria leucostictoides	H	open coastal forest	l	OG		Nitrogen-fixing Lichens
Pannaria mediterranea	S			OG (>140yrs		Nitrogen-fixing Lichens
Pannaria rubiginosa	S	bases of trees		mat		Rare Nitrogen-fixing Lichens
Pannaria saubinetii	H			OG (>140yrs		Nitrogen-fixing Lichens
Peltiger pacifica	S			OG (>140yrs		Nitrogen-fixing Lichens
Peltigera collina	H	coast forests	l,m	OG		Nitrogen-fixing Lichens
Peltigera neckeri	H			OG (>140yrs		Nitrogen-fixing Lichens

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ROD Species Occurrence on Nestucca Watershed

SCIENTIFIC NAME	OC	HABITAT	EL	SERAL STAGE	ASSOC SP	SPECIES CATEGORY
Phaeocollybia ssp.	H		l,m			Phaeocollybia
Phellodon atratum	H			LS	conifers & hardwoods	Tooth Fungi
Phlogoitis helvelloides	S	riparian zones, upper headwater seeps, & intermittent streams with large woody debris			conifers	Jelly Mushroom
Phollota albivelata	U	litter, humus or dead wood		LS	conifer	Uncommon Gilled Mushrooms
Phytoconis ericetorum	S	dead, decorticated wood & large woody debris in well lit forest with altern. high/low moisture			Botryodina (alga)	Mushroom Lichen
Pilophorus nigricaulis	S	talus rock patches in forest with low fire frequency		OG		Rare Rock Lichens
Plagiochila satoi	S	cliffs, rocks &conifer bark		OG	conifer	Lichens
Plagiochila semidecurrens var. crumniana	S	fog-drenched cliffs, bark & shaded thin soil over rock		OG		Lichens
Platismatia lacunosa	S	moist forest on decidious & hardwood trees	l,m	OG		Riparian Lichens
Plectania melastoma	U	forest duff		LS-OG	conifer	Rare Resupinates and Polypores
Podostroma alutaceum	U	partly-decayed wood fragments in duff		mat	conifer or mixed conifer	Rare Resupinates and Polypores
Polyozellus multiplex	S	along intermittent streams/seeps		mat-OG	Picea, Abies	Rare Chanterelles
Pseudaleuria quinaultiana	S	wet	l	LS	conifer	Rare Cup Fungi
Pseudocyphellaria anomala	H	coast forests	l,m	OG		Nitrogen-fixing Lichens
Pseudocyphellaria anthraspis	H	open forest	l,m	OG	conifers	Nitrogen-fixing Lichens
Pseudocyphellaria crocata	H			OG (>140yrs		Nitrogen-fixing Lichens
Pseudocyphellaria rainierensis	S	trunks		OG (>200yrs	PSME	Rare Nitrogen-fixing Lichens
Ptilium californicum	S	boles		OG	conifers	Lichens

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SCIENTIFIC NAME	OC	HABITAT	EL	SERAL STAGE	ASSOC SP	SPECIES CATEGORY
Racomitrium aquaticum	R	shaded rocks & streambanks (splash zone)		OG		Mosses
Ramalina pollinaria	S	coastal forest with sandstone outcroppings	l			Additional Lichen Species
Rhizopogon brunneiniger	S	dry to moderate	l,m,h	mat-OG	TSHE, PSME, Abies & Pinus	Rare False Truffles
Rhizopogon exiguus	S	moist-dry with an abundant legacy of coarse woody material		mat-OG	PSME, TSHE	Rare False Truffles
Rhizopogon flavofibrillosus	R		m	mat-OG	Pinaceae	Rare False Truffles
Rhodocybe nitida	S	moist, with a deep humus and litter layer	l	LS		Rare Gilled Mushrooms
Rickenella setipes	U	moist; specific details of ecology lacking			mosses	Moss Dwelling Mushrooms
Russula mustelina	U	details of habitat requirements not completely known				Uncommon Gilled Mushrooms
Sarcodon fuscoindicum	S			LS	conifers & hardwoos	Tooth Fungi
Sarcodon imbricatus	S			LS	conifers and hardwoods	Tooth Fungi
Sarcosoma mexicana	S	Coastal forests	m		conifers	Rare Resupinates and Polypore
Sarcosphaera eximia	U	chalky soils (European strain)			conifers & Fagaceae	Rare Resupinates and Polypore
Scouleria marginata	S	splash zone of streams		OG		Mosses
Sparassis crispa	S	large trees	l,m	LS	PSME	Cauliflower Mushroom
Spathularia flavida	U	duff layer		mat	conifer	Rare Resupinates and Polypore
Stagnicola perplexa	U	litter, humus or dead wood		LS	conifer	Uncommon Gilled Mushrooms
Stenocybe clavata	S	high atmospheric humidity provided by forest conditions; substrate & texture specific		OG		Pin Lichens
Stenocybe major	S			OG		Pin Lichens
Sticta arctica	S	rock outcrops in foggy wet coast forest		OG		Rare Rock Lichens

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ROD Species Occurrence on Nestucca Watershed

SCIENTIFIC NAME	OC	HABITAT	EL	SERAL STAGE	ASSOC SP	SPECIES CATEGORY
Sticta beauvoisii	S			OG (>140yrs		Nitrogen-fixing Lichens
Sticta fuliginosa	H	coast & moist forests	l	OG	conifers	Nitrogen-fixing Lichens
Sticta limbata	H	coast forests	l,m	OG		Nitrogen-fixing Lichens
Tetraphis geniculata	S	moist rotting wood; shaded	l,m	OG		Mosses
Thaxterogaster sp. nov. #Trappe 4867, 6242	P	coarse woody debris in fog belt	l,m	mat-OG	PISI, TSME, PSME	Undescribed Fungal Taxa
Tholurna dissimilis	S	subalpine fog zone on stunted TSME, canopy of old-growth PSME			TSME/PSME	Rare Leafy (arboreal) Lichens
Tricholoma venenatum	S	diverse forests with heavy humus layer and course woody material		LS	conifers	Rare Gilled Mushrooms
Tritomaria exsectiformis	S	moist shaded rocks, primarily in riparian areas	l,m,h	OG		Lichens
Tritomaria quinquedentata	S	moist, shaded rocks	l,m,h	OG		Lichens
Tuber sp. nov. #Trappe 12493	S	coarse woody debris in fog belt	l,m	mat-OG	PISI, TSHE, PSME	Undescribed Fungal Taxa
Tuber sp. nov. #Trappe 2302	S	coarse woody debris in fog belt	l,m	mat-OG	PISI, TSHE, PSME	Undescribed Fungal Taxa
Tylopilus pseudoscaber	S	moist forest with coarse woody debris	l	OG	PISI	Low Elevation Boletes

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Appendix C-2.6

Unique or Uncommon Species Not Listed in Other Appendices

Scientific Name	Common Name
Corallorhiza mertensiana	
Eburophyton austiniae	phantom orchid
Hemitomes congestum	gnome plant
Iris tenax var. gormanii	
Scopiopus hallii	
Pleuricospora fimbriolata	fringed pinesap

Appendix C-3.1

Nestucca Watershed USFS/BLM Stem Size/Age Correlation

The USFS and the BLM utilize different data classifications to characterize their stands. The USFS generally uses size class averages while the BLM uses birth date. It was necessary to merge these differing data classifications to develop the seral distribution map (see map 5) in GIS. Private forest lands were either assumed to be in early seral stages or aged with the use of aerial photographs. All acres in the watershed were placed into one of the seral stages listed below.

Seral Stage	Age in Years	BLM Birth Date	USFS Birth Date or Size Class
OG/Mature (late/mid-seral)	130+	≤1864 & >0	Estimated from Field Knowledge, Aerial Photos and MOMS* data
Mature (mid-seral)	75 - 129	1865 - 1919	18 - 48 inches dbh
Small Conifer (early/mid-seral)	35 - 74	1920 - 1959	10 - 17.9 inches dbh
Sapling/Pole (early seral)	15 - 34	1960 - 1979	5 - 9.9 inches dbh
Shrub (early seral)	6 - 14	1980 - 1988	1980 - 1988
Herb/Forb (early seral)	0 - 5	1989 - 1994	1989 - 1994 This stage also includes managed USFS meadows
Conifer/Hardwood (early/mid-seral)	**	***	51% - 80% conifer
Hardwood/Conifer (early/mid-seral)	**	***	51% - 80% hardwood
Alder Dominated (early seral)	**	***	Conifer < 20%
Agricultural Lands (early seral)	n/a	Agricultural lands were mapped using aerial photographs	

* = USFS Mature and Over Mature Survey
** = All age stands were lumped
*** = Complex Sort routines were used to classify timber types

Appendix C-3.2

Species List for the Nestucca Watershed

The following list contains those species which are believed (1) to be current year-round or seasonal residents of the watershed, (2) to migrate through the area, (3) to be occasional or irregular visitors to the watershed, or (4) to have historically occupied the watershed. Those invertebrates listed include only the special status species believed to occur within the watershed.

Legend

Abundance
C - Common
U - Uncommon
R - Rare
O - Occasional or Irregular

Trend
S - Stable
I - Increasing
D - Decreasing
X - Extirpated from the watershed

Origin
N - Native
E - Exotic

Federal (USFWS)
E - Endangered
T - Threatened
PE - Proposed Endangered
PT - Proposed Threatened
C1 - Sufficient information to support a proposal to list as Threatened or Endangered under the ESA.
C2 - Additional information needed to support a proposal to list as Threatened or Endangered under the ESA.

State
E - Endangered
T - Threatened
C - Critical
V - Vulnerable
P - Peripheral or Naturally Rare
U - Undetermined
X - Extirpated from Oregon

ONHP (Oregon Natural Heritage Program)
1 - Threatened with extinction or presumed to be extinct throughout entire range.
2 - Threatened with extirpation or presumed to be extirpated from the state.
3 - More information needed before status can be determined; may be Threatened or Endangered in Oregon or throughout their range.
4 - Taxa which are of concern, but are not currently Threatened or Endangered.

BLM
FL - Federally Listed
BS - Bureau Sensitive
BA - Bureau Assessment
BT - Bureau Tracking

USFS-R6
S - Sensitive

CLASS	SP_CODE	COMMON_NAM	SCIENTIFIC	ABUNDANCE	TREND	ORIGIN	FEDERAL	STATE	ONHP	BLM	USFS_R6
Amphibian	AMGR	Northwestern Salamander	Ambystoma gracile	C	S	N					
Amphibian	AMMA	Long-toed Salamander	Ambystoma macrodactylum	C	S	N					
Amphibian	ANFE	Clouded Salamander	Aneides ferreus	C		N		U	3	BS	
Amphibian	ASTR	Tailed Frog	Ascaphus truei	C	D	N		V	3	BS	
Amphibian	BUBO	Western Toad	Bufo boreas	C	D	N		V	3		
Amphibian	DITE	Pacific Giant Salamander	Dicamptodon tenebrosus	C	S	N					
Amphibian	ENES	Ensatina	Ensatina eschscholtzii	C	S	N					
Amphibian	PLDU	Dunn's Salamander	Plethodon dunni	C	S	N					
Amphibian	PLVE	Western Redback Salamander	Plethodon vehiculum	C	S	N					
Amphibian	PSRE	Pacific Treefrog	Pseudacris regilla	C	S	N					
Amphibian	RAAU	Red-legged Frog	Rana aurora	C	D	N	C2	U	3	FL	S
Amphibian	RACAT	Bullfrog	Rana catesbeiana	C	S	E					
Amphibian	RAPR	Spotted Frog	Rana pretiosa	R	D	N	C1	C	1	FL	
Amphibian	RHKE	Columbia Torrent Salamander	Rhyacotriton kezeri	C		N		V	3	BS	
Amphibian	TAGR	Rough-skinned Newt	Taricha granulosa	C	S	N					
Bird	ACCO	Cooper's Hawk	Accipiter cooperii	U	S	N					
Bird	ACGE	Northern Goshawk	Accipiter gentilis	R		N	C2	C	3	FL	S
Bird	ACST	Sharp-shinned Hawk	Accipiter striatus	U	S	N					
Bird	ACMA	Spotted Sandpiper	Actitis macularia	U		N					
Bird	AECL	Clark's Grebe	Aechmophorus clarkii	R		N					
Bird	AEOC	Western Grebe	Aechmophorus occidentalis	C		N					
Bird	AEAC	Northern Saw-whet Owl	Aegolius acadicus	C		N				BT	
Bird	AGPH	Red-winged Blackbird	Agelaius phoeniceus	C		N					
Bird	AISP	Wood Duck	Aix sponsa	U		N					
Bird	AMBE	Sage Sparrow	Amphispiza belli	O		N					
Bird	AMBI	Black-throated Sparrow	Amphispiza bilineata	O		N					
Bird	ANAC	Northern Pintail	Anas acuta	C		N					
Bird	ANAAM	American Wigeon	Anas americana	C		N					
Bird	ANCL	Northern Shoveler	Anas clypeata	U		N					
Bird	ANCR	Green-winged Teal	Anas crecca	C		N					
Bird	ANCY	Cinnamon Teal	Anas cyanoptera	U		N					
Bird	ANDI	Blue-winged Teal	Anas discors	R		N					
Bird	ANPE	Eurasian Wigeon	Anas penelope	O		N					
Bird	ANPL	Mallard	Anas platyrhynchos	C		E					
Bird	ANST	Gadwall	Anas strepera	U		N					
Bird	ANAL	Greater White-fronted Goose	Anser albifrons	U		N					
Bird	ANRU	American Pipit	Anthus rubescens	C		N					
Bird	APCO	Scrub Jay	Aphelocoma coerulescens	U		N					
Bird	APVI	Surfbird	Aphriza virgata	C		N					
Bird	AQCH	Golden Eagle	Aquila chrysaetos	R		N					
Bird	ARHE	Great Blue Heron	Ardea herodias	C		N					
Bird	ARIN	Ruddy Turnstone	Arenaria interpres	C		N					
Bird	ARME	Black Turnstone	Arenaria melanocephala	C		N					
Bird	ASFL	Short-eared Owl	Asio flammeus	U	S	N					
Bird	ASOT	Long-eared Owl	Asio otus	O		N					
Bird	AYAF	Lesser Scaup	Aythya affinis	C		N			4		
Bird	AYAM	Redhead	Aythya americana	R		N					
Bird	AYCO	Ring-necked Duck	Aythya collaris	C		N			4	BT	
Bird	AYMA	Greater Scaup	Aythya marila	C		N					
Bird	AYVA	Canvasback	Aythya valisineria	C		N					
Bird	BOCE	Cedar Waxwing	Bombycilla cedrorum	C	S	N					
Bird	BOGA	Bohemian Waxwing	Bombycilla garrulus	O		N					
Bird	BOUM	Ruffed Grouse	Bonasa umbellus	C		N					

CLASS	SP_CODE	COMMON_NAM	SCIENTIFIC	ABUNDANCE	TREND	ORIGIN	FEDERAL	STATE	ONHP	BLM	USFS_R6
Bird	BOLE	American Bittern	Botaurus lentiginosus	U		N					
Bird	BRMA	Marbled Murrelet	Brachyramphus marmoratus	U		N					
Bird	BRBE	Brant	Branta bernicla	C		N	T	C	1	FL	S
Bird	BRCA	Canada Goose	Branta canadensis	C		N					
Bird	BRCALE	Aleutian Canada Goose	Branta canadensis leucopaveia	R		N	T	E	1	FL	S
Bird	BRCAOC	Dusky Canada Goose	Branta canadensis occidentalis	U		N			4	BS	
Bird	BUVI	Great Horned Owl	Bubo virginianus	C		N					
Bird	BUIB	Cattle Egret	Bubulus ibis	U		E					
Bird	BUAL	Bufflehead	Bucephala albeola	C		N		P	2	BA	
Bird	BUCL	Common Goldeneye	Bucephala clangula	C		N					
Bird	BUIS	Barrow's Goldeneye	Bucephala islandica	R		N		P	4	BA	
Bird	BUJA	Red-tailed Hawk	Buteo jamaicensis	C	I	N					
Bird	BULA	Rough-legged Hawk	Buteo lagopus	U		N					
Bird	BULI	Red-shouldered Hawk	Buteo lineatus	U		N					
Bird	BUSW	Swainson's Hawk	Buteo swainsoni	R	S	N		V	3	BS	
Bird	BUST	Green-backed Heron	Butorides striatus	U		N					
Bird	CAME	Lark Bunting	Calamospiza melanocorys	O		N					
Bird	CALA	Lapland Longspur	Calcarius lapponicus	U		N					
Bird	CAMEL	Pectoral Sandpiper	Calidris melanotos	U		N					
Bird	CAAC	Sharp-tailed Sandpiper	Calidris acuminata	R		N					
Bird	CALAL	Sanderling	Calidris alba	C		N					
Bird	CAALP	Dunlin	Calidris alpina	C		N					
Bird	CABA	Baird's Sandpiper	Calidris bairdii	U		N					
Bird	CACANU	Red Knot	Calidris canutus	U		N					
Bird	CAFE	Curlew Sandpiper	Calidris ferruginea	R		N					
Bird	CAHI	Stilt Sandpiper	Calidris himantopus	R		N					
Bird	CAMAU	Western Sandpiper	Calidris mauri	C		N					
Bird	CAMI	Least Sandpiper	Calidris minutilla	C		N					
Bird	CAPT	Rock Sandpiper	Calidris ptilocnemis	U		N					
Bird	CAPU	Semipalmated Sandpiper	Calidris pusilla	U		N					
Bird	CACAL	California Quail	Callipepla californcia	R		N					
Bird	CAAN	Anna's Hummingbird	Calypte anna	U		N					
Bird	CAFL	Common Redpoll	Carduelis flammea	O		N					
Bird	CAPI	Pine Siskin	Carduelis pinus	C		N					
Bird	CAPS	Lesser Goldfinch	Carduelis psaltria	O		N					
Bird	CATR	American Goldfinch	Carduelis tristis	C	D	N					
Bird	CARME	House Finch	Carpodacus mexicanus	C		N					
Bird	CARPU	Purple Finch	Carpodacus purpureus	C		N					
Bird	CAAL	Great Egret	Casmerodius albus	U		N		U	4		
Bird	CAAU	Turkey Vulture	Cathartes aura	C	D	N					
Bird	CAGU	Hermit Thrush	Catharus guttatus	U	S	N					
Bird	CAUS	Swainson's Thrush	Catharus ustulatus	C	D	N					
Bird	CASE	Willet	Catoptrophorus semipalmatus	U		N					
Bird	CECO	Pigeon Guillemot	Cepphus columba	C		N					
Bird	CEMO	Rhinoceros Auklet	Cerorhinca monocerata	C		N					
Bird	CEAM	Brown Creeper	Certhia americana	C		N					
Bird	CEAL	Belted Kingfisher	Ceryle alcyon	C	D	N					
Bird	CHVA	Vaux's Swift	Chaetura vauxi	C	D	N					
Bird	CHFA	Wrentit	Chamaea fasciata	C		N					
Bird	CHSE	Semipalmated Plover	Charadrius semipalmatus	C		N					
Bird	CHVO	Killdeer	Charadrius vociferus	C		N					
Bird	CHCA	Snow Goose	Chen caerulescens	R		N					
Bird	CHRO	Ross' Goose	Chen rossii	O		N					

CLASS	SP_CODE	COMMON_NAM	SCIENTIFIC	ABUNDANCE	TREND	ORIGIN	FEDERAL	STATE	ONHP	BLM	USFS_R6
Bird	CHNI	Black Tern	Chlidonias niger	R		N	C2		4		
Bird	CHGR	Lark Sparrow	Chondestes grammacus	O		N					
Bird	CHMI	Common Nighthawk	Chordeiles minor	U	S	N					
Bird	CIME	American Dipper	Cinclus mexicanus	C		N					
Bird	CICY	Northern Harrier	Circus cyaneus	C	I	N					
Bird	CIPA	Marsh Wren	Cistothorus palustris	C	S	N					
Bird	CLHY	Oldsquaw	Clangula hyemalis	R		N					
Bird	COVE	Evening Grosbeak	Coccothraustes vespertina	C		N					
Bird	COAM	Yellow-billed Cuckoo	Coccyzus americanus		X	N		C	2	BS	
Bird	COAU	Northern Flicker	Colaptes auratus	C		N					
Bird	COFA	Band-tailed Pigeon	Columba fasciata	C	D	N					
Bird	COLI	Rock Dove	Columba livia	U		E					
Bird	COBO	Olive-sided Flycatcher	Contopus borealis	C	D	N					
Bird	COSO	Western Wood-pewee	Contopus sordidulus	C	D	N					
Bird	COBR	American Crow	Corvus brachyryhnchos	C		N					
Bird	COCA	Northwestern Crow	Corvus caurinus	R		N					
Bird	CORCO	Common Raven	Corvus corax	C		N					
Bird	CYCR	Blue Jay	Cyanocitta cristata	O		N					
Bird	CYST	Steller's Jay	Cyanocitta stelleri	C		N					
Bird	CYPS	Parakeet Auklet	Cyclorrhynchus psittacula	O		N					
Bird	CYBU	Trumpeter Swan	Cygnus buccinator	R		N					
Bird	CYCO	Tundra Swan	Cygnus columbianus	C		N					
Bird	CYNI	Black Swift	Cypseloides niger	R		N		P	3	BA	
Bird	DEOB	Blue Grouse	Dendragapus obscurus	U		N					
Bird	DECA	Black-throated Blue Warbler	Dendroica caerulescens	O		N					
Bird	DENCO	Yellow-rumped Warbler	Dendroica coronata	C	S	N					
Bird	DEMA	Magnolia Warbler	Dendroica magnolia	O		N					
Bird	DENI	Black-throated Gray Warbler	Dendroica nigrescens	C	S	N					
Bird	DEOC	Hermit Warbler	Dendroica occidentalis	U	S	N					
Bird	DEPA	Palm Warbler	Dendroica palmarum	U		N					
Bird	DEPEN	Chestnut-sided Warbler	Dendroica pensylvanica	O		N					
Bird	DEPE	Yellow Warbler	Dendroica petechia	C	S	N					
Bird	DEST	Blackpoll Warbler	Dendroica striata	O		N					
Bird	DETO	Townsend's Warbler	Dendroica townsendi	U	S	N					
Bird	DOOR	Bobolink	Dolichonyx oryzivorus	O	S	N		V	4		
Bird	DRPI	Pileated Woodpecker	Dryocopus pileatus	U		N		V	4	BS	
Bird	EGTH	Snowy Egret	Egretta thula	R		N		V	2		
Bird	ALCA	Black-shouldered Kite	Elanus caeruleus	R		N			3	BT	
Bird	AHDI	Pacific-slope Flycatcher	Empidonax difficilis	C	D	N					
Bird	EMHA	Hammond's Flycatcher	Empidonax hammondii	U	D	N					
Bird	EMMI	Least Flycatcher	Empidonax minimus	O		N					
Bird	EMOB	Dusky Flycatcher	Empidonax oberholseri	R	I	N					
Bird	EMTR	Willow Flycatcher	Empidonax traillii	C	D	N					
Bird	ERAL	Horned Lark	Eremophila alpestris	O		N					
Bird	EUCA	Rusty Blackbird	Euphagus carolinus	O		N					
Bird	EUCY	Brewer's Blackbird	Euphagus cyanocephalus	C	S	N					
Bird	FACO	Merlin	Falco columbarius	U		N				BA	
Bird	FAPE	Peregrine Falcon	Falco peregrinus	U		N	E	E	1	FL	S
Bird	FASP	American Kestrel	Falco sparverius	U	D	N					
Bird	FRCI	Tufted Puffin	Fratercula cirrhata	C		N					
Bird	FUAM	American Coot	Fulica americana	C		N					
Bird	GAGA	Common Snipe	Gallinago gallinago	C		N					
Bird	GAAD	Yellow-billed Loon	Gavia adamsii	O		N					

CLASS	SP_CODE	COMMON_NAM	SCIENTIFIC	ABUNDANCE	TREND	ORIGIN	FEDERAL	STATE	ONHP	BLM	USFS_R6
Bird	GAIM	Common Loon	Gavia immer	C		N			2	BA	S
Bird	GAPA	Pacific Loon	Gavia pacifica	C		N					
Bird	GAST	Red-throated Loon	Gavia stellata	C		N					
Bird	GETR	Common Yellowthroat	Geothlypis trichas	C	S	N					
Bird	GLGN	Northern Pygmy Owl	Glaucidium gnoma	U		N		U	3	BT	
Bird	GYCA	California Condor	Gymnogyps californianus		X	N	E	X	1	FL	
Bird	HABA	American Black Oystercatcher	Haematopus bachmani	U		N					
Bird	HALE	Northern Bald Eagle	Haliaeetus leucocephalus	U	I	N	T	T	1	FL	S
Bird	HEIN	Wandering Tattler	Heteroscelus incanus	U		N					
Bird	HIME	Black-necked Stilt	Himantopus mexicanus	O		N					
Bird	HIPY	Cliff Swallow	Hirundo pyrrhonota	C	S	N					
Bird	HIRU	Barn Swallow	Hirundo rustica	C	D	N					
Bird	HIHI	Harlequin Duck	Histrionicus histrionicus	U		N	C2	P	2	FL	
Bird	ICVI	Yellow-breasted Chat	Icteria virens	R	S	N					
Bird	ICCU	Hooded Oriole	Icterus cucullatus	O		N					
Bird	ICGA	Northern Oriole	Icterus galbula	O	D	N					
Bird	IXNA	Varied Thrush	Ixoreus naevius	C		N					
Bird	JUHY	Dark-eyed Junco	Junco hyemalis	C		N					
Bird	LAEX	Northern Shrike	Lanius excubitor	U		N					
Bird	LAAR	Herring Gull	Larus argentatus	U		N					
Bird	LACA	California Gull	Larus californicus	C		N					
Bird	LARCAN	Mew Gull	Larus canus	C		N					
Bird	LADE	Ring-billed Gull	Larus delawarensis	C		N					
Bird	LAGL	Glaucous-winged Gull	Larus glaucescens	C		N					
Bird	LAHE	Heermann's Gull	Larus heermanni	C		N					
Bird	LAHY	Glaucous Gull	Larus hyperboreus	R		N					
Bird	LAOC	Western Gull	Larus occidentalis	C		N					
Bird	LAPH	Bonaparte's Gull	Larus philadelphia	C		N					
Bird	LAPI	Franklin's Gull	Larus pipixcan	R		N		P	2	BA	
Bird	LATH	Thayer's Gull	Larus thayeri	U		N					
Bird	LEAR	Rosy Finch	Leucosticte arctoa	O		N					
Bird	LIGR	Short-billed Dowitcher	Limnodromus griseus	C		N					
Bird	LOSC	Long-billed Dowitcher	Limnodromus scolopaceus	C		N					
Bird	LIFE	Marbled Godwit	Limosa fedoa	C		N					
Bird	LILA	Bar-tailed Godwit	Limosa lapponica	R		N					
Bird	LOCUC	Hooded Merganser	Lophodytes cucullatus	U		N					
Bird	LOXCU	Red Crossbill	Loxia curvirostra	C		N					
Bird	LOLE	White-winged Crossbill	Loxia leucoptera	O		N					
Bird	MELE	Lewis' Woodpecker	Melanerpes lewis		X	N		C	3	BS	
Bird	MEFU	White-winged Scoter	Melanitta fusca	C		N					
Bird	MENI	Black Scoter	Melanitta nigra	U		N					
Bird	MEPE	Surf Scoter	Melanitta perspicillata	C		N					
Bird	MEGA	Wild Turkey	Meleagris gallopavo	U	I	E					
Bird	MEGE	Swamp Sparrow	Melospiza georgiana	U		N					
Bird	MELI	Lincoln's Sparrow	Melospiza lincolnii	U	S	N					
Bird	MELME	Song Sparrow	Melospiza melodia	C		N					
Bird	MERME	Common Merganser	Mergus merganser	C		N					
Bird	MESE	Red-breasted Merganser	Mergus serrator	C		N					
Bird	MIPO	Northern Mockingbird	Mimus polyglottos	R		N					
Bird	MNVA	Black-and-white Warbler	Mniotilta varia	R		N					
Bird	MOAT	Brown-headed Cowbird	Molothrus ater	C	D	N					
Bird	MYTO	Townsend's Solitaire	Myadestes townsendi	U		N					
Bird	MYCI	Ash-throated Flycatcher	Myiarchus cinerascens	O	S	N					

Appendix C-3.2, continued

CLASS	SP_CODE	COMMON_NAM	SCIENTIFIC	ABUNDANCE	TREND	ORIGIN	FEDERAL	STATE	ONHP	BLM	USFS_R6
Bird	NUCO	Clark's Nutcracker	Nucifraga columbiana	O		N					
Bird	NUAM	Long-billed Curlew	Numenius americanus	U		N			4	BS	S
Bird	NUPH	Whimbrel	Numenius phaeopus	C		N					
Bird	NYNY	Black-crowned Night-heron	Nycticorax nycticorax	U		N					
Bird	OPTO	MacGillivray's Warbler	Oporornis tolmiei	C	D	N					
Bird	ORPI	Mountain Quail	Oreortyx pictus	U		N	C2		4	FL	
Bird	ORMO	Sage Thrasher	Oreoscoptes montanus	O	I	N					
Bird	OTKE	Western Screech-owl	Otis kennicottii	U		N					
Bird	OXJA	Ruddy Duck	Oxyura jamaicensis	C		N					
Bird	PAHA	Osprey	Pandion haliaetus	U	I	N					
Bird	PAAM	Northern Parula	Parula americana	O		N					
Bird	PAAT	Black-capped Chickadee	Parus atricapillus	C		N					
Bird	PAGA	Mountain Chickadee	Parus gambeli	O		N					
Bird	PARU	Chestnut-backed Chickadee	Parus rufescens	U		N					
Bird	PADO	House Sparrow	Passer domesticus	C		E					
Bird	PASA	Savannah Sparrow	Passerculus sandwichensis	C	S	N					
Bird	PAIL	Fox Sparrow	Passerella iliaca	C		N					
Bird	PAAMO	Lazuli Bunting	Passerina amoena	U		N					
Bird	PACY	Indigo Bunting	Passerina cyanea	O		N					
Bird	PEOC	California Brown Pelican	Pelecanus occidentalis	U	I	N	E	E	2	FL	S
Bird	PECA	Gray Jay	Perisoreus canadensis	U		N					
Bird	PHAU	Double-crested Cormorant	Phalacrocorax auritus	C		N					
Bird	PHPE	Pelagic Cormorant	Phalacrocorax pelagicus	C		N					
Bird	PHPEN	Brandt's Cormorant	Phalacrocorax penicillatus	C		N					
Bird	PHFU	Red Phalarope	Phalaropus fulicaria	C		N					
Bird	PHLO	Red-necked Phalarope	Phalaropus lobatus	C		N					
Bird	PHTR	Wilson's Phalarope	Phalaropus tricolor	R		N					
Bird	PHCO	Ring-necked Pheasant	Phasianus colchicus	U		E					
Bird	PHLU	Rose-breasted Grosbeak	Pheucticus ludovicianus	O		N					
Bird	PHME	Black-headed Grosbeak	Pheucticus melanocephalus	C	I	N					
Bird	PHPU	Ruff	Philomachus pugnax	R		N					
Bird	PIPI	Black-billed Magpie	Pica pica	O		N					
Bird	PIAL	White-headed Woodpecker	Picoides albolarvatus	O		N		C	3		
Bird	PIPU	Downy Woodpecker	Picoides pubescens	U		N					
Bird	PIVI	Hairy Woodpecker	Picoides villosus	U		N					
Bird	PIER	Rufous-sided Towhee	Pipilo erythrophtalmus	C		N					
Bird	PILU	Western Tanager	Piranga ludoviciana	C	D	N					
Bird	PLNI	Snow Bunting	Plectrophenax nivalis	R		N					
Bird	PLDO	Lesser Golden-plover	Pluvialis dominica	U		N					
Bird	PLSQ	Black-bellied Plover	Pluvialis squatarola	C		N					
Bird	POAU	Horned Grebe	Podiceps auritus	C		N		P	4	BA	
Bird	PODGR	Red-necked Grebe	Podiceps grisegena	U		N		C	2	BS	
Bird	PODNI	Eared Grebe	Podiceps nigricollis	U		N					
Bird	POPO	Pied-billed Grebe	Podilymbus podiceps	C		N					
Bird	POOGR	Vesper Sparrow	Pooecetes gramineus	U	S	N		U	3		
Bird	POCA	Sora	Porzana carolina	U		N					
Bird	PRSU	Purple Martin	Progne subis	U	D	N		C	3	BS	
Bird	PSMI	Bushtit	Psaltriparus minimus	C		N					
Bird	PTAL	Cassin's Auklet	Ptychoramphus aleuticus	C		N					
Bird	RALI	Virginia Rail	Rallus limicola	U		N					
Bird	REAM	American Avocet	Recurvirostra americana	O		N					
Bird	RECA	Ruby-crowned Kinglet	Regulus calendula	C	S	N					
Bird	RESA	Golden-crowned Kinglet	Regulus satrapa	C		N					

CLASS	SP_CODE	COMMON_NAM	SCIENTIFIC	ABUNDANCE	TREND	ORIGIN	FEDERAL	STATE	ONHP	BLM	USFS_R6
Bird	RIRI	Bank Swallow	Riparia riparia	O	S	N		U	3		
Bird	RIBR	Red-legged Kittiwake	Rissa brevirostris	R		N					
Bird	RITR	Black-legged Kittiwake	Rissa tridactyla	C		N					
Bird	SAOB	Rock Wren	Salpinctes obsoletus	O		N					
Bird	SANI	Black Phoebe	Sayornis nigricans	O		N			4		
Bird	SAYSA	Say's Phoebe	Sayornis saya	O	I	N					
Bird	SENO	Northern Waterthrush	Seiurus noveboracensis	O		N			3		
Bird	SERUF	Rufous Hummingbird	Selasphorus rufus	C	D	N					
Bird	SESA	Allen's Hummingbird	Selasphorus sasin	R		N			4		
Bird	SERUT	American Redstart	Setophaga ruticilla	O		N			4		
Bird	SICU	Mountain Bluebird	Sialia currucoides	O	D	N				BT	
Bird	SIME	Western Bluebird	Sialia mexicana	U		N		V	4	BS	
Bird	SITCA	Red-breasted Nuthatch	Sitta canadensis	C		N					
Bird	SICAR	White-breasted Nuthatch	Sitta carolinensis	R		N					
Bird	SPRU	Red-breasted Sapsucker	Sphyrapicus ruber	U		N					
Bird	SPAR	American Tree Sparrow	Spizella arborea	O		N					
Bird	SPPAL	Clay-colored Sparrow	Spizella pallida	O		N					
Bird	SPPA	Chipping Sparrow	Spizella passerina	U	D	N					
Bird	STSE	Northern Rough-winged Swallow	Stelgidopteryx serripennis	U	S	N					
Bird	STELCA	Calliope Hummingbird	Stellula calliope	O	D	N					
Bird	STCA	Caspian Tern	Sterna caspia	C		N			4	BT	
Bird	STEL	Elegant Tern	Sterna elegans	R		N					
Bird	STFO	Forster's Tern	Sterna forsteri	R		N			3	BT	
Bird	STHI	Common Tern	Sterna hirundo	U		N					
Bird	STPA	Arctic Tern	Sterna paradisaea	U		N					
Bird	STOCCA	Northern Spotted Owl	Strix occidentalis	U		N	T	T	1	FL	S
Bird	STVA	Barred Owl	Strix varia	R	I	E					
Bird	STUNE	Western Meadowlark	Sturnella neglecta	U		N					
Bird	STVU	European Starling	Sturnus vulgaris	C	S	E					
Bird	SYAN	Ancient Murrelet	Synthliboramphus anitquus	U		N					
Bird	TABI	Tree Swallow	Tachycineta bicolor	C	D	N					
Bird	TATH	Violet-green Swallow	Tachycineta thalassina	C	S	N					
Bird	THBE	Bewicks's Wren	Thryomanes bewickii	C		N					
Bird	TRFL	Lesser Yellowlegs	Tringa flavipes	C		N					
Bird	TRME	Greater Yellowlegs	Tringa melanoleuca	C		N			2	BA	
Bird	TRSO	Solitary Sandpiper	Tringa solitaria	R		N			3	BT	
Bird	TRAE	House Wren	Troglodytes aedon	U	S	N					
Bird	TRTR	Winter Wren	Troglodytes troglodytes	C		N					
Bird	TRSU	Buff-breasted Sandpiper	Tryngites subruficollis	R		N					
Bird	TUMI	American Robin	Turdus migratorius	C	D	N					
Bird	TYTY	Eastern Kingbird	Tyrannus tyrannus	O	S	N					
Bird	TYVE	Western Kingbird	Tyrannus verticalis	R	S	N					
Bird	TYAL	Barn Owl	Tyto alba	U		N					
Bird	URAA	Common Murre	Uria aalge	C		N					
Bird	VECE	Orange-crowned Warbler	Vermivora celata	C	D	N					
Bird	VEPE	Tennessee Warbler	Vermivora peregrina	O		N					
Bird	VERU	Nashville Warbler	Vermivora ruficapilla	R	S	N					
Bird	VIGI	Warbling Vireo	Vireo gilvus	C	S	N					
Bird	VIHU	Hutton's Vireo	Vireo huttoni	C		N					
Bird	VIOL	Red-eyed Vireo	Vireo olivaceus	O	D	N					
Bird	VISO	Solitary Vireo	Vireo solitarius	U	S	N					
Bird	WICI	Hooded Warbler	Wilsonia citrina	O		N					
Bird	WIPU	Wilson's Warbler	Wilsonia pusilla	C		N					

CLASS	SP_CODE	COMMON_NAM	SCIENTIFIC	ABUNDANCE	TREND	ORIGIN	FEDERAL	STATE	ONHP	BLM	USFS_R6
Bird	XAXA	Yellow-headed Blackbird	Xanthocephalus xanthocephalus	O	S	N					
Bird	XESA	Sabine's Gull	Xema sabini	U		N					
Bird	ZEMA	Mourning Dove	Zenaida macroura	U	D	N					
Bird	ZOAL	White-throated Sparrow	Zonotrichia albicollis	R		N					
Bird	ZOAT	Golden-crowned Sparrow	Zonotrichia atricapilla	C		N					
Bird	ZOLE	White-crowned Sparrow	Zonotrichia leucophrys	C	D	N					
Bird	ZOQU	Harris' Sparrow	Zonotrichia querula	R		N					
Mammal	APRU	Mountain Beaver	Aplodontia rufa	C		N					
Mammal	CALAT	Coyote	Canis latrans	C		N					
Mammal	CALU	Gray Wolf	Canis lupus		X	N	E	E	2	FL	
Mammal	CASCAN	Beaver	Castor canadensis	C		N					
Mammal	CEEL	Elk	Cervus elaphus	C		N					
Mammal	CLCA	Western Red-backed Vole	Clethrionomys californicus	C		N					
Mammal	DIVI	Opossum	Didelphis virginianus	C	I	E					
Mammal	ENLUNE	Southern Sea Otter	Enhydra lutris		X	N	T		2	FL	
Mammal	EPFU	Big Brown Bat	Eptesicus fuscus	C		N					
Mammal	ERDO	Porcupine	Erethizon dorsatum	U		N					
Mammal	EUJU	Northern Sealion	Eumetopias jubatus	U	S	N	T	V	3	FL	
Mammal	EUTO	Townsend Chipmunk	Eutamias townsendi	C		N					
Mammal	FECA	Feral House Cat	Felis catus	C		E					
Mammal	FECO	Mountain Lion	Felis concolor	U		N					
Mammal	GLSA	Northern Flying Squirrel	Glaucomys sabrinus	U		N					
Mammal	GUGU	Wolverine	Gulo gulo		X	N	C2	T	2	FL	S
Mammal	LANO	Silver-haired Bat	Lasionycteris noctivagans	U		N					
Mammal	LACI	Hoary Bat	Lasiurus cinereus	U		N					
Mammal	LEAM	Snowshoe Hare	Lepus americanus	U		N					
Mammal	LUCA	River Otter	Lutra canadensis	C		N					
Mammal	LYRU	Bobcat	Lynx rufus	C		N					
Mammal	MAAM	Pine Marten	Martes americana	R	D	N		C	3	BS	
Mammal	MAPEPA	Fisher	Martes pennanti	R		N	C2	C	2	FL	S
Mammal	MEMEP	Striped Skunk	Mephitis mephitis	U		N					
Mammal	MILO	Long-tailed Vole	Microtis longicaudus	U		N					
Mammal	MIOR	Creeping Vole	Microtis oregoni	C		N					
Mammal	MITO	Townsend's Vole	Microtus townsendii	C		N					
Mammal	MUMU	House Mouse	Mus musculus	C		E					
Mammal	MUER	Short-tailed Weasel (Ermine)	Mustela erminea	C		N					
Mammal	MUFR	Long-tailed Weasel	Mustela frenata	U		N					
Mammal	MUVI	Mink	Mustela vison	C		N					
Mammal	MYCO	Nutria	Myocastor coypus	U		E					
Mammal	MYCA	California Bat	Myotis californicus	C		N					
Mammal	MYEV	Long-eared Bat	Myotis evotis	C		N					
Mammal	MYLU	Little Brown Bat	Myotis lucifugus	C		N					
Mammal	MYTH	Fringed Myotis	Myotis thysanodes	R		N		V	1	BS	
Mammal	MYVO	Long-legged Bat	Myotis volans	U		N					
Mammal	MYYU	Yuma Bat	Myotis yumanensis	U		N					
Mammal	NECI	Bushy-tailed Woodrat	Neotoma cinerea	C		N					
Mammal	NEGI	Shrew-Mole	Neurotrichus gibbsii	C		N					
Mammal	ODHE	Black-tailed Deer	Odocoileus hemionus	C		N					
Mammal	ONZI	Muskrat	Ondatra zibethicus	U		N					
Mammal	PEMA	Deer Mouse	Peromyscus maniculatus	C		N					
Mammal	PHAL	White-footed Vole	Phenacomys albipes	R		N	C2	U	3	FL	S
Mammal	ARLO	Red Tree Vole	Phenacomys longicaudus	U		N					
Mammal	PHVI	Harbor Seal	Phoca vitulina	C		N					

CLASS	SP_CODE	COMMON_NAM	SCIENTIFIC	ABUNDANCE	TREND	ORIGIN	FEDERAL	STATE	ONHP	BLM	USFS_R6
Mammal	PLTO	Townsend's Big-eared Bat	Plecotus townsendii	R	D	N	C2	C	2	FL	S
Mammal	PRLO	Raccoon	Procyon lotor	C		N					
Mammal	RANO	Norway Rat	Rattus norvegicus	C		E					
Mammal	RARA	Black Rat	Rattus rattus	U		E					
Mammal	SCOR	Coast Mole	Scapanus orarius	C		N					
Mammal	SCTO	Townsend Mole	Scapanus townsendii	C		N					
Mammal	SOBE	Marsh Shrew	Sorex bendirei	C		N					
Mammal	SOOB	Dusky Shrew	Sorex obscurus	U		N					
Mammal	SOTR	Trowbridge's Shrew	Sorex trowbridgii	C		N					
Mammal	SOVA	Vagrant Shrew	Sorex vagrans	C		N					
Mammal	SPBE	Beechey Ground Squirrel	Spermophilus beecheyi	C		N					
Mammal	SPGR	Western Spotted Skunk	Spilogale gracilis	U		N					
Mammal	SYBA	Brush Rabbit	Sylvilagus bachmani	C		N					
Mammal	TADO	Douglas' Squirrel	Tamiasciurius douglasii	C		N					
Mammal	THMA	Mazama Pocket Gopher	Thomomys mazama	C		N					
Mammal	URCI	Gray Fox	Urocyon cinereoargenteus	U		N					
Mammal	URAM	Black Bear	Ursus americanus	C		N					
Mammal	URAR	Grizzly Bear	Ursus arctos		X	N	T		1	FL	
Mammal	VUVU	Red Fox	Vulpes vulpes	U		N					
Mammal	ZACA	California Sealion	Zalophus californianus	U		N					
Mammal	ZATR	Pacific Jumping Mouse	Zapus trinotatus	C		N					
Reptile	CHBO	Rubber Boa	Charina bottae	R		N					
Reptile	CLMA	Northwestern Pond Turtle	Clemmys marmota marmota	R		N	C2	C	2	FL	S
Reptile	COLCO	Racer	Coluber constrictor	U		N					
Reptile	COTE	Sharptail Snake	Contia tenius	R		N		C	2	BS	
Reptile	ELCO	Northern Alligator Lizard	Elgaria coerulea	C		N					
Reptile	EUSK	Western Skink	Eumeces skiltonianus	R		N					
Reptile	SCOC	Western Fence Lizard	Sceloporus occidentalis	R		N					
Reptile	THOR	Northwestern Garter Snake	Thamnophis ordinoides	C		N					
Reptile	THSI	Common Garter Snake	Thamnophis sirtalis	C		N					
Insect	OCAL	Alsea Micro Caddisfly	Ochrotrichia alsea			N	C2		3	FL	S
Insect	RHHA	Haddock's Caddisfly	Rhyacophila haddocki			N	C2		3	FL	S
Insect	SPZE	Oregon Silverspot Butterfly	Speyeria zerene hippolyta			N	T		1	FL	S

References Used for Development of Nestucca Watershed Species List

Brown, E. Reade. 1985. Management of Wildlife and Fish Habitats in Forests of Western Oregon and Washington. USDA, Forest Service. Portland, Oregon. 2 vols. 635 pp.

Burt, William H. and Richard P. Grassenheider. 1964. Field Guide to the Mammals. Houghton Mifflin Company, Boston, Massachusetts. 284 pp.

Leonard, William P., Herbert A. Brown, Lawrence L.C. Jones, Kelly R. McAllister, and Robert M. Storm. 1993. Amphibians of Washington and Oregon. Seattle Audubon Society, Seattle, Washington. 168 pp.

Marshall, David B. 1992. Sensitive Vertebrates of Oregon. Oregon Department of Fish and Wildlife. Portland, Oregon.

Maser, Chris, Bruce R. Mate, Jerry F. Franklin, and C.T. Dyrness. 1981. Natural History of Oregon Coast Mammals. USDA, Forest Service General Technical Report PNW-133, 496 p. Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

Nussbaum, Ronald A., Edmund D. Brodie, Jr., and Robert M. Storm. 1983. Amphibians and Reptiles of the Pacific Northwest. University Press of Idaho, Moscow, Idaho. 332 pp.

Oregon Natural Heritage Program. 1993. Rare, Threatened, and Endangered Plants and Animals of Oregon. Oregon Natural Heritage Program, Portland, Oregon. 79 pp.

Puchy, Claire A. and David B. Marshall. 1993. Oregon Wildlife Diversity Plan. Oregon Department of Fish and Wildlife, Portland, Oregon.

Scott, Shirley L. 1987. Birds of North America. The National Geographic Society, Washington D.C. 464 pp.

Sharp, Brian E. 1992. Neotropical Migrants on National Forests in the Pacific Northwest. USDA, Forest Service.

Stebbins, R.C. 1966. A Field Guide to Western Reptiles and Amphibians. Houghton Mifflin Co., Boston, Massachusetts. 279 pp.

Appendix C-3.3
Wildlife Guilds

Common Name	Scientific Name
Species Breeding and/or Feeding in Hardwood Forests or Hardwood Riparian Areas	
Cedar waxwing	*Bombycilla cedrorum*
American goldfinch	*Carduelis tristis*
Yellow warbler	*Dendroica petechia*
Downy woodpecker	*Picoides pubescens*
Bushtit	*Psaltriparus minimus*
Bewick's wren	*Thryomanes bewickii*
Warbling vireo	*Vireo gilvus*
Townsend's vole	*Microtis townsendii*
White-footed vole	*Phenacomys albipes*
Marsh shrew	*Sorex bendirei*
Pacific jumping mouse	*Zapus trinotatus*
Species Breeding in Early Seral Stage Habitats	
Short-eared owl	*Asio flammeus*
Northern harrier	*Circus cyaneus*
Mountain quail	*Oreortyx pictus*
Western bluebird	*Sialia mexicana*
Rufous hummingbird	*Selasphorus rufus*
Long-tailed vole	*Microtus longicaudus*
Townsend's mole	*Scapanus townsendii*
Beechey ground squirrel	*Spermophilus beecheyi*
Brush rabbit	*Sylvilagus bachmani*
Northern alligator lizard	*Elgaria coerulea*
Northwestern garter snake	*Thamnophis ordinoides*
Species Breeding and/or Feeding in Late-Successional/Old Growth Coniferous or Coniferous/Hardwood Mixed Forests	
Columbia torrent salamander	*Rhyacotriton kezeri*
Marbled murrelet	*Brachyramphus marmoratus*
Brown creeper	*Certhia americana*
Vaux's swift	*Chaetura vauxi*
Olive-sided flycatcher	*Contopus borealis*
Western wood-pewee	*Contopus sordidulus*
Common raven	*Corvus corax*
Hermit warbler	*Dendroica occidentalis*
Pileated woodpecker	*Dryocopus pileatus*
Hammond's flycatcher	*Empidonax hammondii*
Northern pygmy owl	*Glaucidium gnoma*

Appendix C-3.3, continued

ımmon Name	Scientific Name
Species Breeding and/or Feeding in Late-Successional/Old Growth Coniferous or Coniferous/Hardwood Mixed Forests, continued	
Northern bald eagle	*Haliaeetus leuocephalus*
Varied thrush	*Ixoreus naevius*
Chestnut-backed chickadee	*Parus rufescens*
Gray jay	*Perisoreus canadensis*
Hairy woodpecker	*Picoides villosus*
Western tanager	*Piranga ludoviciana*
Ruby-crowned kinglet	*Regulus calendula*
Red-breasted nuthatch	*Sitta canadensis*
Northern spotted owl	*Strix occidentalis*
Winter wren	*Troglodytes troglodytes*
Red tree vole	*Arborimus longicaudus*
Northern flying squirrel	*Glaucomys sabrinus*
Hoary bat	*Lasiurus cinereus*
Marten	*Martes americana*
California bat	*Myotis californicus*
Little brown bat	*Myotis lucifugus*
Long-legged bat	*Myotis volans*
Yuma bat	*Myotis yumanensis*
Species Strongly Associated with or Breeding in Riparian Habitats	
thwestern salamander	*Ambystoma gracile*
ong-toed salamander	*Ambystoma macrodactylum*
Tailed frog	*Ascaphus truei*
Western toad	*Bufo boreas*
Pacific giant salamander	*Dicamptodon tenebrosus*
Dunn's salamander	*Plethodon dunni*
Pacific tree frog	*Pseudacris regilia*
Red-legged frog	*Rana aurora*
Columbia torrent salamander	*Rhyacotriton kezeri*
Rough-skinned newt	*Taricha granulosa*
Red-winged blackbird	*Agelaius phoeniceus*
Wood duck	*Aix sponsa*
Belted kingfisher	*Ceryle alcyon*
American dipper	*Cinclus mexicanus*
Marsh wren	*Cistothorus palustris*
Willow flycatcher	*Empidonax traillii*
American coot	*Fulica americana*
Common snipe	*Gallinago gallinago*
Common merganser	*Mergus merganser*
Red-breasted merganser	*Mergus serrator*
Ruddy duck	*Oxyura jamaicensis*
Pied-billed grebe	*Podilymbus podiceps*
Beaver	*Castor canadensis*
River otter	*Lutra canadensis*
Mink	*Mustela vison*
sh shrew	*Sorex bendirei*

Appendix C-3.4

Results of Annual Monitoring of Known Spotted Owl Sites Within the Nestucca Basin

Table 3

Site	'75	'76	'77	'78	'79	'80	'81	'82	'83	'84	'85	'86	'87
	Year												
Elk Creek	P	0	F	--	F	0	0	0	0	0	M/F	0	0
Nestucca	P	F	F	F	F	F	0	--	F	F	0	M	--
Moon Creek	--	--	--	--	--	--	--	--	--	--	--	M	M
Niagara	--	--	--	--	--	--	--	--	--	--	--	--	--

Additionally, in 1978, a male and a female were separately located in the Bear Creek/Crazy Cougar area.

Table 3, continued

Site	'88	'89	'90	'91	'92	'93	'94	'95	'96	'97	'98	'99	'00
	Year												
Elk Creek	0	0	0	M	U	0	0						
Nestucca	0	0	0	M	0	0	0						
Moon Creek	M	M	P	F/U	0	U	0						
Niagara	--	--	P	U	M	M	--						

0 = no response
M = male response
F = female response
U = response from unknown sex
P = pair
J = confirmed juvenile
-- = no surveys or no records

Ap,   ndix C-3.5

Amount and Distribution of Mature Conifer (MC) in the Mature Conifer and Conifer/ Hardwood Mix Zones of the Nestucca Watershed (data derived from Fragstats)

Seral Stage and Habitat Zone	Time	MC Acres within Zne (% of Zone)	Number of Stands w/in Zone	Mean Stand Size (ac)	Contrast Between Stand Edges	Acres in Cores (% of Zone)	Number of Core Areas	Mean Size of Core Areas (ac)	Clumpiness of Stand Distributio
Mature Con over 75 yrs in Mature Con Zone	1949	22,790 (46%)	27	845	Med-Low	13,788 (28%)	63	511	Low
	Current	13,750 (28%)	249	55	Medium	2,723 (5%)	231	11	Low
	+25 yrs								
Mature Con & Con/Hrdwd in Mature Con Zone	1949	34,199 (69%)	40	855	Med-Low	23,747 (48%)	46	594	Low
	Current	17,262 (35%)	239	72	Med-High	4,524 (9%)	240	20	Low
	+25 yrs	17,440 (35%)	223	79	Med-Low	5,738 (12)	194	25	Medium
Mature Con over 75 yrs in Con/Hrdwd Mix Zone	1949	5,365 (13%)	103	52	Med-Low	1,960 (5%)	50	20	Low
	Current	4,546 (9%)	300	15	Medium	406 (0.8)	87	1.4	Low
	+25 yrs								
Mature Con & Con/Hrwd in Con/Hrwd Mix Zone	1949	29,575 (70%)	106	279	Low	18,300 (43)	94	173	Low
	Current	16,630 (35%)	286	59	Medium	5,701 (12)	175	20	Low
	+25 yrs	16,445 (34%)	290	57	Medium	5,676 (12)	170	20	Low

Appendix C-3.6

Acreages of Major Habitat Zones Within the Nestucca Watershed

Major Habitat Zone	Percent of Watershed	Acres
Tillamook Burn	3	4,833
Mature Douglas-Fir	30	48,233
Conifer-Dominated Hardwood Mix	29	46,789
Alder Dominated	23	37,780
Mature Mixed Conifer	5	7,990
Mt. Hebo Young Mature	5	8,382
Agricultural/Residential	5	8,625
Total	100	162,632

Appendix C-4.1

Distribution of Riparian Vegetation (acres) by Size Classes in the Nestucca River Basin

STR_NAM	SUBBASIN	TOT_AC	CLEARCU	GR_SH_A	LARGE	POLE	SEED_SAP	SMALL
					>21"	5-12"		9-21"
L.BEAVER	BEAVER	103	0	17.7	0.9	45.7	33.3	6.9
N.BEAVER	BEAVER	378	0	67.4	4.3	206.6	60.7	44
WEST	BEAVER	88	0	21.9	0.1	36.9	28.7	2.1
TIGER	BEAVER	166						
E.BEAVER	BEAVER	558	0.5	61.5	36.1	257	106.2	98.7
		1293	0.5	168.5	41.4	546.2	228.9	151.7
			0%	13%	3%	42%	18%	12%
HORN	LOWER	150	0	28.8	15.1	63.5	19	27
L.NESTUC	LOWER	788	33.6	406.1	18	173.5	80.1	68.2
CLEAR	LOWER	176	0.4	58.2	14	57.6	25.8	21.3
FARMER	LOWER	177	0	18.2	2.6	102.4	50.6	7.5
GEORGE	LOWER	134	0	0.9	0.1	109.3	11.2	12.8
		1425	34	512.2	49.8	506.3	186.7	136.8
			2%	36%	3%	36%	13%	10%
M.NESTUC	MIDDLE	302	0	40.6	7.4	112.4	122.6	23.3
POWDER	MIDDLE	267	0	10.5	21.1	162.4	13.9	60.8
SLICKROC	MIDDLE	88	0	5.5	5.4	46.4	18.6	13.6
LIMESTON	MIDDLE	171	0	2.9	8.5	108.5	15	34.1
TONY	MIDDLE	122	0	6	3.3	67.7	22.8	21.4
''.NESTUC	MIDDLE	306	0	30.2	21.7	120.3	76.6	57.7
\GARA	MIDDLE	405	0	20.3	54.8	183.1	44	99.6
.DER	MIDDLE	89	0	0	4.3	60.5	9.1	16.7
FOLAND	MIDDLE	155	0	14.2	4.5	85.5	39.5	9.7
CLARENC	MIDDLE	114	0	6.9	1.7	87.1	11.6	7.2
BOULDER	MIDDLE	202	0	11.9	5.1	81.5	89.1	17.6
		2221	0	149	137.8	1115.4	462.8	361.7
			0%	7%	6%	50%	21%	16%
EAST	MOON	343	0	6.9	23.6	200	38.7	73.9
MOON	MOON	317	0.8	47.3	48.6	77	45.8	100.8
BAYS	MOON	148						
WOLFE	MOON	130	0	26.5	0.7	53.9	43.5	8.6
		938	0.8	80.7	72.9	330.9	128	183.3
			0%	9%	8%	35%	14%	20%
CEDAR	THREE	199	0	2.9	11.9	127.9	23.3	34.1
CRAZY	THREE	199	0	8.3	7.5	126.5	32.4	27.1
L.THREER	THREE	366	0	33.6	7.1	190.7	106.4	28.5
U.THREER	THREE	221	0	6.3	9.5	145	14.3	49.5
ALD_BUC	THREE	329	0	29.5	4.1	193.3	73.2	30.4
POLLARD	THREE	148	0	2.7	3.8	100.3	27.9	14
		1462	0	83.3	43.9	883.7	277.5	183.6
			0%	6%	3%	60%	19%	13%
FAN	UPPER	574	14	0	227.4	12.5	107	219.8
BALD_MT	UPPER	292	11.1	27.6	153.6	0	0	100.2
WALKER	UPPER	121	0	0	62.7	0.3	17.1	39
MCGUIRE	UPPER	217	4.5	0	18.5	0.6	5.1	15.1
'IBLE	UPPER	233	0.6	17.4	51.8	61.6	38.7	65.1
AR	UPPER	282	0.8	16	49.5	63.2	29	125.3
K	UPPER	343	8.6	0	123.3	5.1	55.4	153.6
TESTAME	UPPER	188	0.6	4	39.1	46.3	31.9	67.8
		2250	40.2	65	725.9	189.6	284.2	785.9
			2%	3%	32%	8%	13%	35%
TOTAL AC IN BASIN		9589						

Appendix C-4.2

Distribution of Riparian Vegetation (acres) by Vegetation Type

STR_NAM	SUBBASIN	TOT_AC	CLEARCU	CONIFER	GR_SH_A	HARDWD	MIXED	ROCK
E.BEAVER	BEAVER	558	0	150.1	61.9	218.2	125.5	0
WEST	BEAVER	88	0	19.5	25.5	25.6	17	0
TIGER	BEAVER	166	0	36.8	14.4	24.9	85	4.6
N.BEAVER	BEAVER	378	0	130.4	51.4	100.2	88.8	5.3
L.BEAVER	BEAVER	103	0	31.4	25.9	38.3	6.7	0
		1293	0	368.2	179.1	407.2	323	9.9
		13%	0%	28%	14%	31%	25%	1%
L.NESTUC	LOWER	788	33.2	128.1	245.8	111	208.8	59.7
GEORGE	LOWER	134	0	14.3	2.8	102.4	13.9	0
FARMER	LOWER	177	0	50.3	23.4	75.6	27.8	0
HORN	LOWER	150	0	57.7	31.6	37.6	22.6	0
CLEAR	LOWER	176	0	50.7	66	34.3	23.6	0
		1425	33.2	301.1	369.6	360.9	296.7	59.7
		15%	2%	21%	26%	25%	21%	4%
M.NESTUC	MIDDLE	302	0	126.6	88.6	91.2	23.1	0
BOULDER	MIDDLE	202	0	47.5	18.6	97.8	31.9	0
NIAGARA	MIDDLE	405	0	118.6	28.3	201.7	56.3	0
LIMESTON	MIDDLE	171	0	40.2	9.2	96.3	25	0
POWDER	MIDDLE	267	0	53.7	13.9	158.6	40.8	0
ALDER	MIDDLE	89	0	18.7	0.9	55.2	13.3	0
FOLAND	MIDDLE	155	0	37.2	24.8	76.7	16.1	0
U.NESTUC	MIDDLE	306	0	99.3	47	119	40.5	0
SLICKROC	MIDDLE	88	0	25.6	9.2	39.2	13.9	0
TONY	MIDDLE	122	0	20.8	12.2	67.9	20.8	0
CLARENC	MIDDLE	114	0	30.2	9.6	46	28.2	0
		2221	0	618.4	262.3	1049.6	309.9	0
		23%	0%	28%	12%	47%	14%	0%
MOON	MOON	317	0	91.9	39.9	69.7	114.4	0
BAYS	MOON	148	0	31.2	14.6	86.3	15.7	0
WOLFE	MOON	130	0	24.2	27.8	67.3	10.4	0
EAST	MOON	343	0	91.9	11.7	154	85.4	0
		938	0	239.2	94	377.3	225.9	0
		10%	0%	26%	10%	40%	24%	0%
CEDAR	THREE	199	0	53.9	8.2	111.6	25.3	0
CRAZY	THREE	199	0	36.8	11.5	128.9	21.7	0
ALD_BUC	THREE	329	0	77.3	44.4	176.3	30.9	0
POLLARD	THREE	148	0	33.1	7.8	92.2	14.8	0
U.THREER	THREE	221	0	40.9	7	135.2	37.8	0
L.THREER	THREE	366	0	92.6	62.9	176.4	32.6	0
		1462	0	334.6	141.8	820.6	163.1	0
		15%	0%	23%	10%	56%	11%	0%
TESTAME	UPPER	188	0	59.2	5.2	45.9	76.5	0
WALKER	UPPER	121	0	71.6	0	0	48.9	0
ELK	UPPER	343	8.6	147.1	0	0	169.8	17.5
BALD_MT	UPPER	292	11.1	146	0	0	118.8	7.6
FAN	UPPER	574	13.8	291	0	0	239.9	28.1
BIBLE	UPPER	233	1	81.1	13.5	66.9	70.8	0
BEAR	UPPER	282	1	108.3	13.2	55	104.3	0.5
MCGUIRE	UPPER	217	17.5	98.8	0	0	49.1	4.9
		2250	53	1003.1	31.9	167.8	878.1	58.6
		23%	2%	45%	1%	7%	39%	3%
TOTAL AC IN BASIN		9589						

Appendix C-4.3

ummary of Fish Habitat Parameters in the Nestucca River Basin

Summary of fish habitat parameters in the Nestucca River basin												
E-excellent	G - good	f - fair										
STR_NAME	REACH	YEAR	MN LGTH	AVG WD	subbasin	LWD	POOL/M	% POOL	QUAL PL/M	QUAL PL %	PL MAX DP	PL WD CVR
E BEAVER	5	90	1.5	25.4	beaver							
E BEAVER	2	90	0.7	25.2	beaver							
E BEAVER	1	90	2.2	20.3	beaver							
E BEAVER	3	90	0.8	22.8	beaver		F		F			
E BEAVER	4	90	0.2	21.9	beaver			F				
E BEAVER	2	90	2.9	17.1	beaver			G				
E BEAVER	1	90	0.3	17.4	beaver							
E BEAVER	4_BEAV00	1992	0.5	8.8	beaver				G	G	G	
E BEAVER	5_BEAV00	1992	0.7	10.3	beaver				G	F		
			9.7									
FARMER C	1	93	0.9	15.8	lower		E	F				
FARMER C	2	93	1.6	8.3	lower	G						
GEORGE C	1	92	0.8	12.7	lower							
GEORGE C	2	92	0.7	12.6	lower					F		
HORN CR	1	92	1.3	13.9	lower		G	F		G	G	
HORN CR	6	92	0.8	15.2	lower			F		E		
HORN CR	4	92	0.7	14.6	lower						G	
HORN CR	2	92	0.8	14.4	lower						F	
HORN CR	8	92	0.9	15.0	lower		G	G		E		
HORN CR	10	92	0.2	6.7	lower	F						
			8.5									
ALDER CR	5	91	0.1	12.1	middle	G						
ALDER CR	1	91	0.2	16.3	middle						G	
ALDER CR	7	91	0.1	6.4	middle	G		G			F	
ALDER CR	4	91	0.4	13.2	middle	G						
ALDER CR	2	91	0.4	15.0	middle						F	
ALDER CR	3	91	0.5	11.9	middle	G					G	
ALDER CR	6	91	0.8	9.2	middle	G	F					
BOULDER	1	93	0.7	12.5	middle							
BUELAH C	1	90	0.9	8.9	middle							
FOLAND C	1	93	0.7	12.2	middle		E	F				
LIMESTON	2	91	0.3	11.2	middle	G						
LIMESTON	3	91	0.8	11.3	middle	G	E	F				
LIMESTON	1	91	0.3	15.8	middle	G	F					
LIMESTON	4	91	0.3	8.0	middle	G						
NIAGARA	2	90	0.8	16.7	middle			F	F	G		
NIAGARA	3	90	0.6	10.5	middle				G	G		
NIAGARA	4	90	2.4	10.2	middle				G	G		
NIAGARA	1	90	1.5	22.8	middle			G	G	G		
ASANT	1	90	1.3	9.5	middle							
DER	1	91	1.4	19.6	middle							
DER	2	91	1.5	10.1	middle	G				E		
NY CR	2	93	0.8	13.4	middle							
TONY CR	1	93	0.3	13.7	middle			F				
TONY CR	3	93	0.8	11.6	middle							
			17.5									
BAYS CR	3	91	1.0	11.1	moon				G	G		
BAYS CR	1	91	0.7	12.5	moon					G	F	
BAYS CR	2	91	0.9	15.9	moon						G	
BAYS CR	5	91	0.2	6.9	moon	F			G	G	G	
BAYS CR	4	91	0.4	8.4	moon				G	G	G	
EAST CR	5_EAST00	1989	1.0	11.9	moon			F		G		
EAST CR	5_EAST00	1989	0.9	12.1	moon							
MOON CR	4_MOON0	1984	0.8	8.6	moon		F		F	G		F
MOON CR	4_MOON0	1984	0.8	12.4	moon		G	F				
			8.6									
BUCK CR	1	93	0.3	10.8	three							
BUCK CR	1	93	0.9	12.8	three							
POLLARD	2	91	0.6	12.7	three	G						
POLLARD	1	91	0.5	13.2	three	G						
			2.4									
BALDMTN	4_BALD00	1992	1.4	8.3	upper							
BALDMTN	4_BALD00	1992	0.9	9.6	upper							
BEAR CR	4_BEAR00	1987	0.7	10.0	upper							
BEAR CR	4_BEAR00	1987	1.1	12.4	upper						G	
BEAR CR	4_BEAR00	1987	0.9	13.2	upper			F	F		G	G
BEAR CR	4_BEAR00	1987	1.3	12.9	upper						F	
BIBLE CR	1	90	1.0	14.4	upper							
ELK CR	5_ELKC00	1985	1.3	11.9	upper		F		F	G		F
ELK CR	5_ELKC00	1986	1.3	13.7	upper							
ELK CR	5_ELKC00	1986	1.4	7.8	upper			F	G	E		G
ELK CR	5_ELKC00	1985	1.1	15.0	upper							
FAN CR	4_FANC00	1992	1.2	8.5	upper							
FAN CR	4_FANC00	1992	0.4	5.9	upper						F	F
GINGER C	3_GING00	1985	0.8	6.5	upper		E	F	G	G		G
JOE CR	4_JOEC00	1991	1.3	8.0	upper		E	F				
MINA CR	1	93	0.5	7.4	upper							
MULETAIL	1	90	0.2	6.2	upper	F						
NESTUCC	6_NEST00	1984	1.1	25.4	upper		G		G	F		F
NESTUCC	6_NEST00	1984	1.4	18.8	upper		G		F	F		
NESTUCC	6_NEST00	1984	1.2	36.9	upper				G	G	F	
NESTUCC	6_NEST00	1984	1.2	36.0	upper				G	G	G	F
NESTUCC	6_NEST00	1984	0.9	38.3	upper				G	G		
NESTUCC	6_NEST00	1984	1.4	23.7	upper		F		G	G	G	
NESTUCC	6_NEST00	1984	1.2	23.3	upper				F	F	F	
TUCC	6_NEST00	1984	0.9	32.9	upper		F		G	E	G	
KPIL	3_STOC00	1991	1.0	7.0	upper		G					
AMEN	4_TEST00	1985	0.7	8.5	upper							F
AMEN	4_TEST00	1985	0.9	10.0	upper				G			F
ESTAMEN	4_TEST00	1985	0.8	10.7	upper				F			F
TESTAMEN	4_TEST00	1985	0.3	10.9	upper		G					G
TUCCA CR	3_TUCC00	1988	0.3	8.4	upper							
TUCCA CR	3_TUCC00	1988	0.7	7.0	upper							
TUCCA CR	4_TUCC00	1988	1.0	11.1	upper							G
TUCCA CR	4_TUCC00	1988	1.1	12.2	upper						F	
			32.7									
Total miles surveyed in the basin			122.1									

Appendix C-4.4

Description of Rating Criteria Used to Evaluate Fish Habitat

Each of the surveyed stream reaches was evaluated for the size and quantity of large woody debris and for the quantity and quality of pool habitat. This appendix will include a short description of each criteria used in the evaluation.

Large Woody Debris

Standard: The standard for large woody debris (LWD) was taken from the PACFISH guidelines (USFS and BLM 1994). This standard is for 80 pieces per mile; each piece should be at least 24 inches diameter and 50 feet long.

Rating criteria

Good - meets standard, 80+ pieces/mile
Fair - 60 to 80 pieces/mile

Pools/Mile

PACFISH guidelines (USFS and BLM 1994) for pools/mile vary with the low flow, wetted width of the stream:

For wetted widths of:	Desired # pools/mile:
5 feet	184
10 feet	96
15 feet	70
20 feet	56
25 feet	47
50 feet	26

For widths in between the PACFISH parameters, i.e., 17 feet wide, we interpolated the number of pools/mile between the number of pools/mile at 15 feet and at 20 feet.

Standard: For the Nestucca analysis we used the following: the existing number of pools/mile falls within 20% of the PACFISH guideline. This was because the potential pool frequency in the Nestucca basin is believed to be lower than the PACFISH values due to flood damage, loss of large wood, bedrock channels, and historic debris slides.

Rating criteria

Excellent - two times PACFISH standard
Good - meets "Nestucca" standard
Fair - within 25% of "Nestucca" standard

Percent (%) Area in Pools

Standard: The standard used is that presented by Washington Forest Practices Board (1993).

Rating criteria

	Habitat Quality		
Reach Gradient	Poor	Fair	Good
<2%	< 40%	40 - 55%	> 55%
2-5%	< 30%	30 - 40%	> 40%
> 5%	< 20%	20 - 30%	> 30%

Quality Pools/Mile

Quality pools are those pools that are deep pools at base flows. The depth criteria for qualifying as a quality ᄀls is based on wetted stream width:

.: wetted widths of:	Quality Pool depth:
< 8 feet	1.5 feet deep
8 - 12 feet	2.0 feet deep
> 12 feet	3.0 feet deep

Standard: 25% the "Nestucca" standard for pools/mile are quality pools (for the width class).

Rating criteria
Good - meets standard
Fair - meets 80% of standard

Percent (%) Area in Quality Pools

Standard: This criteria is based on the Washington Forest Practices Board (1993) criteria for Percent Pools (see above), which change with stream gradient. The criteria for the Nestucca analysis are based on one-third (33.3%) of the values for Percent Pools being in quality pools.

Rating criteria

	Habitat Quality			
Reach Gradient	Poor	Fair	Good	Excellent
<2%	< 13.3%	13.3 - 18.3%	> 18.3%	> 36.6%
2-5%	< 10%	10 - 13.3%	> 13.3%	> 26.6%
⁻%	< 6.7%	6.7 - 10%	> 10%	> 20%

Mean Maximum Depth of Pools

This criteria is the mean of the maximum depths for all pools in a stream reach. Because of the wide range of stream sizes in the Nestucca River basin this criteria was adjusted for stream width.

Rating criteria

	Stream Width Class			
Rating	< 10 ft.	10 - 15 ft.	15 - 25 ft.	> 25 ft.
Good	> 1.8 ft.	> 2.3 ft.	> 2.8 ft.	> 3.5 ft.
Fair	> 1.6 ft.	> 2.1 ft.	> 2.5 ft.	> 3.1 ft.

Quality Pools with Large Wood Cover

This criteria considers the additional habitat value of quality pools which also contain large wood cover. Due to the different ways that large woody debris was collected by the three agencies (BLM, FS, and ODFW), the following parameters were used to analyze the data:

For BLM data: quality pools which had at least three pieces of LWD (BLM data includes all pieces greater than 6 inches) or in which the primary cover was classified as LWD.

USFS data: quality pools with at least one piece of 12 inches x 25 feet LWD or in which the primary cover classified as LWD.

For ODFW data: quality pools with a WOOD_CLASS rating of ">3".

Standard: 25% of the quality pools/mile value (see above) should have LWD cover as specified above.

Rating criteria
Good - the number of quality pools/mile with LWD is two times the standard
Fair - meets standard

Appendix C-4.5

otential Fish Habitat Quality Rating
ased on Channel Gradient and Confinement

Table F-2: Potential habitat quality rating based on gradient and confinement. Note: this table should only be used for a Level 1 assessment when limited data are available. Rating in the upper left of each box applies to anadromous salmon species. Rating in the lower right of each box applies to resident forms of trout and char species.

Spawning and Winter Rearing

CHANNEL CONFINEMENT	GRADIENT					
	<2%	2-4%	4-8%	8-12%	12-20%	>20%
Unconfined (VW>4CW)	GOOD GOOD	GOOD GOOD	FAIR GOOD	POOR GOOD	POOR FAIR	POOR POOR
Moderately Confined (2CW≤VW≤4CW)	GOOD GOOD	GOOD GOOD	FAIR GOOD	POOR GOOD	POOR FAIR	POOR POOR
Confined (VW<2CW)	FAIR GOOD	FAIR GOOD	POOR FAIR	POOR FAIR E-GOOD	POOR POOR E-FAIR	POOR POOR

E = rating for East of Cascade crest

Summer Rearing

CHANNEL CONFINEMENT	GRADIENT					
	<2%	2-4%	4-8%	8-12%	12-20%	>20%
Unconfined (VW>4CW)	GOOD GOOD	GOOD GOOD	GOOD GOOD	FAIR GOOD	POOR FAIR	POOR POOR
Moderately Confined (2CW≤VW≤4CW)	GOOD GOOD	GOOD GOOD	GOOD GOOD	FAIR GOOD	POOR FAIR	POOR POOR
Confined (VW<2CW)	GOOD GOOD	FAIR GOOD	FAIR GOOD	POOR GOOD	POOR FAIR	POOR POOR

VW = Valley Width
CW = Channel Width (bankfull)

Errata Sheet

Source: Washington Forest Practices Board 1993

Appendix C-5.1

Key

BLM

Other	=	roads that surface type is unknown but probably gravel and pit run BLM symbol: blank or dash line
Gravel	=	smaller rock BLM symbol: ABC & ASC
Pit Run	=	large rock BLM symbol: PRR
BST	=	bituminous BLM symbol: BST

USFS

Primary	=	primary highways 2-3 lane as State Highway 22 USFS attribute: 101
2 Lane	=	2-3 lanes secondary highway USFS attribute: 103
Unknown	=	on GIS but without data USFS attribute: 0
Dirt	=	dirt road USFS attribute: 105
4-Wheel (high clearance)	=	unimproved road USFS attribute: 106
Gravel	=	gravel USFS road USFS attribute: 517
Pave	=	paves USFS Road USFS attribute: 518

Road Inventory 1 - On Federal and Some Private Lands

Miles By Subwatersheds on GIS Road Inventory

Subwatersheds

Alder/Buck

USFS

2-Lane	=	3.10 miles
Dirt	=	0.09 miles
4-Wheel	=	3.50 miles
Gravel	=	10.73 miles
total		17.43 miles

Alder 1

USFS

4-Wheel	=	2.77 miles
Gravel	=	6.19 miles
Pave	=	0.24 miles
total		9.20 miles

Bald Mountain Fork

BLM		
Other	=	28.63 miles
Gravel	=	4.41 miles
BST	=	4.23 miles
total		37.27 miles

Bays Creek

BLM		
Other	=	4.36 miles
Gravel	=	0.12 miles
subtotal		4.49 miles
USFS		
Dirt	=	0.31 miles
4-Wheel	=	2.61 miles
Gravel	=	5.72 miles
subtotal		8.63 miles
	----------	
total		13.12 miles

Bear Creek

BLM		
Other	=	46.85 miles
Gravel	=	6.63 miles
BST	=	2.92 miles
PRR	=	0.56 miles
total		56.45 miles

Bible Creek

BLM		
Other	=	29.20 miles
Gravel	=	3.79 miles
BST	=	0.38 miles
subtotal		33.37 miles
USFS		
Dirt	=	0.12 miles
4-Wheel	=	0.14 miles
Gravel	=	2.16 miles
subtotal		2.42 miles
	---------	
total		35.79 miles

Boulder I

USFS		
2-Lane	=	0.63 miles
Dirt	=	0.73 miles
4-Wheel	=	5.88 miles
Gravel	=	7.30 miles
Pave	=	0.36 miles
total		14.91 miles

Cedar

USFS		
2-Lane	=	0.05 miles
Dirt	=	1.34 miles
4-Wheel	=	2.48 miles
Gravel	=	10.77 miles
Pave	=	5.85 miles
total		20.49 miles

Clarence

USFS		
2-Lane	=	0.10 miles
Dirt	=	0.38 miles
4-Wheel	=	6.15 miles
Gravel	=	13.31 miles
total		19.94 miles

Clear

USFS		
Primary	=	0.74 miles
2-Lane	=	1.02 miles
Dirt	=	1.79 miles
4-Wheel	=	6.05 miles
Gravel	=	14.64 miles
total		24.24 miles

Crazy Creek1

USFS		
4-Wheel	=	0.58 miles
Gravel	=	10.58 miles
total		11.16 miles

East Beaver Creek

BLM		
Other	=	15.90 miles
Gravel	=	4.49 miles
Pit Run	=	0.75 miles
subtotal		21.47 miles
USFS		
2-Lane	=	7.52 miles
Dirt	=	0.92 miles
4-Wheel	=	6.50 miles
Gravel	=	23.60 miles
subtotal		38.53 miles
	-----------	
total		60.00 miles

East Creek

BLM

Other	=	31.78 miles
Pit Run	=	0.86 miles
subtotal		32.64 miles

USFS

Unknown	=	1.39 miles
Dirt	=	0.006mile
4-Wheel	=	4.54 miles
Gravel	=	10.10 miles
subtotal		16.04 miles
total		48.68 miles

Elk Creek

BLM

Other	=	39.77 miles
Gravel	=	7.77 miles
BST	=	0.04 miles
Pit Run	=	0.65 miles
total		48.24 miles

Fan Creek

BLM

Other	=	63.87 miles
Gravel	=	7.17 miles
BST	=	7.49 miles
Pit Run	=	1.55 miles
total		80.09 miles

Farmer

USFS

Primary	=	0.13 miles
Dirt	=	0.44 miles
4-Wheel	=	2.44 miles
Gravel	=	16.90 miles
total		19.91 miles

Foland

USFS

2-Lane	=	0.48 miles
4-Wheel	=	4.05 miles
Gravel	=	4.60 miles
total		9.12 miles

George

USFS

Dirt	=	0.14 miles
4-Wheel	=	0.56 miles
Gravel	=	2.31 miles
total		3.00 miles

Horn

USFS

2-Lane	=	0.44 miles
4-Wheel	=	7.39 miles
Gravel	=	8.33 miles
total		16.15 miles

Limestone

USFS

4-Wheel	=	0.10 miles
Gravel	=	3.35 miles
total		3.45 miles

L Beaver Creek

USFS

Primary	=	2.77 miles
Unknown	=	0.10 miles
2-Lane	=	0.16 miles
Dirt	=	0.09 miles
4-Wheel	=	7.36 miles
Gravel	=	2.18 miles
total		12.66 miles

L Nestucca River

USFS

Primary	=	5.30 miles
2-Lane	=	11.60 miles
Dirt	=	13.58 miles
4-Wheel	=	28.85 miles
Gravel	=	9.89 miles
total		69.22 miles

L Three Rivers

USFS

Primary	=	1.04 miles
2-Lane	=	4.92 miles
Dirt	=	2.09 miles
4-Wheel	=	4.33 miles
Gravel	=	14.47 miles
Pave	=	1.85 miles
total		28.70 miles

M Nestucca River

USFS

Primary	=	2.58 miles
2-Lane	=	5.84 miles
Dirt	=	6.14 miles
4-Wheel	=	14.81 miles
Gravel	=	7.41 miles
total		36.77 miles

McGuire Reservoir

BLM

'her	=	13.66 miles
.ravel	=	3.88 miles
BST	=	<u>0.69 miles</u>
total		18.24 miles

Moon Creek

BLM

Other	=	18.70 miles
Gravel	=	2.80 miles
Pit Run	=	<u>8.61 miles</u>
subtotal		30.12 miles

USFS

2-Lane	=	1.69 miles
4-Wheel	=	0.64 miles
Gravel	=	<u>2.71 miles</u>
subtotal		5.04 miles
		----------
total		35.16 miles

Niagara

USFS

Dirt	=	1.87 miles
4-Wheel	=	1.92 miles
Gravel	=	<u>35.42 miles</u>
total		39.21 miles

North Beaver 1

USFS

Primary	=	0.72 miles
2-Lane	=	2.68 miles
Dirt	=	2.64 miles
4-Wheel	=	18.16 miles
Gravel	=	<u>10.13 miles</u>
total		34.32 miles

Pollard

USFS

Unknown	=	0.89 miles
2-Lane	=	0.59 miles
Dirt	=	0.12 miles
Gravel	=	<u>7.48 miles</u>
total		9.09 miles

Powder

USFS

Dirt	=	2.22 miles
4-Wheel	=	1.01 miles
Gravel	=	<u>4.52 miles</u>
total		7.74 miles

Slick Rock

BLM

Other	=	6.62 miles

USFS

Unknown	=	0.03 miles
2-Lane	=	0.04 miles
4-Wheel	=	5.01 miles
Gravel	=	<u>6.55 miles</u>
subtotal		11.64 miles
		----------
total		18.26 miles

Testament Creek

BLM

Other	=	31.56 miles
Gravel	=	4.09 miles
BST	=	2.56 miles
Pit Run	=	<u>2.72 miles</u>
total		40.93 miles

Tiger

USFS

Primary	=	1.24 miles
2-Lane	=	0.09 miles
Dirt	=	3.40 miles
4-Wheel	=	8.10 miles
Gravel	=	<u>1.91 miles</u>
total		14.74 miles

Tony

USFS

Primary	=	0.10 miles
4-Wheel	=	2.02 miles
Gravel	=	<u>3.99 miles</u>
total		6.11 miles

U Nestucca River

BLM

Other	=	1.01 miles
BST	=	<u>0.74 miles</u>
subtotal		1.75 miles

USFS

2-Lane	=	8.77 miles
Dirt	=	1.68 miles
4-Wheel	=	12.85 miles
Gravel	=	<u>9.99 miles</u>
subtotal		33.28 miles
		----------
total		35.03 miles

Upper Three River

USFS

Dirt	=	0.51 miles
4-Wheel	=	1.44 miles
Gravel	=	19.81 miles
Paved	=	1.64 miles
total		23.40 miles

Walker Creek

BLM

Other	=	14.03 miles
Gravel	=	2.66 miles
BST	=	0.76 miles
Pit Run	=	0.64 miles
total		18.09 miles

West

USFS

Unknown	=	0.43 miles
Primary	=	0.20 miles
2-Lane	=	3.61 miles
Dirt	=	0.65 miles
4-Wheel	=	3.80 miles
Gravel	=	4.23 miles
total		12.93 miles

Wolfe

USFS

Dirt	=	0.15 miles
4-Wheel	=	1.45 miles
Gravel	=	7.41 miles
total		9.02 miles

Inventory 2 - On Federal Land

GIS Miles and Miles per Section by Subwatershed

(Sections are calculated as 640 acres and not to actual surveyed secton corners) Ownership of roads is not implied by location.

Alder/Buck

USFS = 8.74 miles = 1.24 mile per section
(7.02 sections)

Alder1

USFS = 7.07 miles = 3.35 miles per section
(2.11 sections)

Bald Mountain Fork

BLM = 32.70 miles = 4.04 miles per section
(8.09 sections)

Bays Creek

BLM = 1.61 miles
USFS = 5.27 miles
total 6.88 miles = 1.44 miles per section
(4.79 sections)

Bear Creek

BLM = 41.71 miles = 4.27 miles per section
(9.77 sections)

Bible Creek

BLM = 15.68 miles
USFS = 4.49 miles
total 20.17 miles = 2.70 miles per section
(7.46 sections)

Boulder I

USFS = 4.55 miles = 1.04 miles per section
(4.39 sections)

Cedar

USFS = 18.82 miles = 3.27 miles per section
(5.75 sections)

Clarence

BLM = 0.49 miles
USFS = 11.15 miles
total 11.64 miles = 3.50 miles per section
(3.33 sections)

Clear

USFS = 13.89 miles = 2.61 miles per section
33 sections)

Crazy Creek

USFS = 8.85 miles = 1.57 miles per section
(5.64 sections)

East Beaver Creek

BLM = 8.32 miles
USFS = 23.29 miles
total 31.61 miles = 2.04 miles per section
(15.51 sections)

East Creek

BLM = 17.62 miles
USFS = 9.35 miles
total 26.97 miles = 2.53 miles per section
(10.66 sections)

Elk Creek

BLM = 36.84 miles = 3.66 miles per section
(10.07 sections)

Fan Creek

M = 48.39 miles = 3.50 miles per section
.82 sections)

Farmer

USFS = 16.29 miles = 3.32 miles per section
(4.91 sections)

Foland

USFS = 3.38 miles = 1.00 mile per section
(3.38 sections)

George

USFS = 2.29 miles = 0.88 mile per section
(2.59 sections)

Horn

USFS = 9.27 miles = 1.67 miles per section
(5.56 sections)

Limestone

BLM = 0.18 miles
USFS = 2.92 miles
total 3.10 miles = 0.99 mile per section
12 sections)

L Beaver Creek

BLM = 0.22 miles
USFS = 2.46 miles
total 2.68 miles = 0.96 mile per section
(2.79 sections)

L Nestucca River

USFS = 9.00 miles = 0.57 mile per section
(15.74 sections)

L Three Rivers

USFS = 12.70 miles = 1.57 mile per section
(8.10 sections)

M Nestucca River

BLM = 0.15 miles
USFS = 3.69 miles
total 3.84 miles = 0.43 mile per section
(8.88 sections)

Moon Creek

BLM = 11.71 miles
USFS = 3.28 miles
total 14.99 miles = 1.70 miles per section
(8.79 sections)

McGuire Reservoir

BLM = 8.23 miles = 2.82 miles per section
(2.92 sections)

Niagara

USFS = 38.43 miles = 3.06 miles per section
(12.55 sections)

North Beaver 1

USFS = 4.67 miles = 0.60 miles per section
(7.73 sections)

Pollard

USFS = 8.28 miles = 2.42 miles per section
(3.42 sections)

Powder

USFS = 5.81 miles = 1.00 mile per section
(5.81 sections)

Slick Rock

BLM = 3.03 miles
USFS = 5.68 miles
total 8.71 miles = 2.43 miles per section
(3.59 sections)

Testament Creek

BLM = 20.38 miles
USFS = 1.78 miles
total 22.16 miles = 2.64 miles per section
(8.39 sections)

Tiger

USFS = 0.29 miles = 0.09 miles per section
(3.11 sections)

Tony

USFS = 1.33 miles = 0.49 miles per section
(2.71 sections)

U Nestucca River

BLM = 1.34 miles
USFS = 11.61 miles
total 12.95 miles = 1.24 miles per section
(10.42 sections)

Upper Three Rivers

USFS = 22.30 miles = 2.75 miles per section
(8.11 sections)

Walker Creek

BLM = 13.01 miles = 4.32 miles per section
(3.01 sections)

West

USFS = 7.92 miles = 3.01 miles per section
(2.63 sections)

Wolfe

USFS = 7.70 miles = 2.66 miles per section
(2.89 sections)

Appendix C-5.2

BLM Road Candidates for Obliteration

Wildlife Poor Location Structurally Unsound	Not Needed	Unsure of Future Need
		3-6-18.3
3-6-4.0	3-6-19.1	3-7-9.0
3-6-6.1	3-6-19.2	3-7-30.3
3-6-7.0	3-6-19.3	3-7-32.1
3-6-7.3	3-6-19.4	3-7-36.0
3-6-17.1 end of	3-6-19.5	3-8-3.1
3-6-17.5	3-7-15.8	3-8-20 Moon
3-6-18.1	3-7-21 end of	Creek
3-6-18.2	3-7-22.1	4-7-5.0
3-6-30.3	3-7-22.2	4-7-21.3
3-6-30.5	3-7-22.4possible gate	
3-7-2.3 end of	3-7-24.1	
3-7-7.3 end of	3-7-27.3	
3-7-11 & cat road (see a.)	3-7-33.3	
3-7-13.4	3-7-36.1	
3-7-13.5	3-7-36.3	
3-7-13.6	3-7-36.4	
3-7-14.7 & cat road (see b.)	3-8-11.2	
3-7-15.4 & cat road (see c.)	3-8-15.2	
3-7-17.0		
3-7-17.1 end of		
3-7-17.3		
3-7-19.0		
3-7-19.1		
3-7-19.2		
3-7-19.3		
3-7-19.4		
3-7-19.5		
3-7-19.7		
3-7-20.0		
3-7-20.1		
3-7-20.2		
3-7-21.0		
3-7-21.5		
3-7-22.0		
3-7-22.5		
3-7-23.0		
3-7-23.4 end of		
3-7-28.1 end of		
3-7-28.2		
3-7-30.1		
3-7-30.3		
3-7-36.0		
3-7-36.1		
3-7-36.9		
3-8-6.3		
3-8-7.1 High Peak		
3-8-11.1		

3-8-14.1
3-8-15.1
3-8-15.2
3-8-24.1
4-7-4.2 end of
4-7-9.2

cat road location:
(a) T3S R7W S14 N1/2 of NE1/4

(b) T3S R7W S14 N1/2 of SW1/4

(C) T3S R7W S15 N1/2 of S15

BACKGROUND

Appendix C-5.2, continued

8/17/94

BLM RIP & SEED

ROAD	M.P.	CRITICAL ELEMENT HIGH	MED	LOW
Bike Trail T3R6S5	Junction with 3.6	X		
3-6-7.3				
17.1				
17.2				
17.5				
18.1				
18.2				
30.3				
30.5				
3-7-19.0				
19.1				
19.2				
19.7				
21	Block .03 m in			
22.5				
30.3	Pull landing			
36.1				
36.9				

Appendix C-5.3

BLM Sidecast/Culvert Information

8/17/94

			SIDECAST			CULVERT				
ROAD	M.P.	TC MILE	H	M	L	PLUG	REPLACE	REPAIR	SHOTGUN	>75%= HIGH RISK
2-8-35	0.00-1.00	1	X							
3-6-5		.5			X					
3-6-5.1	Problems									
3-6-7	.10-20	.10		X						
3-6-8	2.00-3.40	1.40	X						X	M
3-6-8.1	.80-1.60	.80		X						
	1.35-1.90	.55	X							
	2.00-2.45	.45		X						
3-6-13	T3SR6WS8	.33			X					
	8.85								X	M
	9.11								X	M
	14.25								X	L
	15.00								X	M
	16.55								X	L
	18.5								X	L
	18.5							X		
3-6-15.1	.09								X	L
	2.1-2.2	.10		X						
3-6-17.1	1.30-1.50	.20			X					
	1.60-1.90	.30			X					
	1.95	.01			X					
	2.30-2.60	.30		X						
3-6-20.1	.50								X	L
	.70								X	L
	.80					X				
	1.30								X	L
	1.55								X	L
	1.60								X	L
	1.80								X	L
	1.75-1.95	.20		X						
	2.30-2.80	.40			X					
3-6-30.4	Niles clocked from beginning of 30.2 road									
	1.4-1.60	.2			X					
	1.90						X			
	2.05							X		
	1.80-2.00	.2	X							
	2.10-2.70	.6		X						

Appendix C-5.3, continued

			SIDECAST			CULVERT				
ROAD	M.P.	TC MILE	H	M	L	PLUG	REPLACE	REPAIR	SHOTGUN	>75%= HIGH RISK
3-7-1	All		X							
3-7-2	All		X							
3-7-5.1	0.3-0.7	.40	X							
3-7-6	0.2-0.8	.60		X						
	.8						X			
3-7-8	All	.5	X							
3-7-8.1	0+00-1.20	1.20	X							
3-7-8.2	.40-.80	.40	X							
3-7-9.2	.50-.60	.10		X						
	.90								X	L
3-7-12.1	.55-.65	.10			X					
	.71-.90	.19			X					
3-7-14.7	Burn Landing									
	.30	.01	X							
3-7-16	4.70-5.25	.55			X					
	5.25-6.40	1.15		X						
3-7-17.1	.40-.50	.10			X					
	.70-.80	.10			X					
3-7-18.0	0.40					X				
	.70-1.00	.30	X							
3-7-18.5	.15-.30	.15			X					
3-7-19.5	0.25	.01			X					
	0.30	.01		X						
3-7-20	Seg B	.40			X					
	Seg E	1.20	X							
	0.10								X	L
3-7-20.2	0.00-0.20	.20			X					
3-7-20.4	0.20-0.30	.10			X					
	Blocked 1.10									
3-7-27.1	2.14								X	L
	2.24								X	L
	2.64								X	M
	2.94							X		H

ROAD	M.P.	TC MILE	SIDECAST H	SIDECAST M	SIDECAST L	CULVERT PLUG	CULVERT REPLACE	CULVERT REPAIR	CULVERT SHOTGUN	>75%: HIGH RISK
3-7-21.1	.42-1.00	.58			X					
3-7-22.1		.10			X					
3-7-23.1	1.00						X	X		
3-7-23.3	Est .60-.70	.10			X					
3-7-24	.30-.40	0.10		X						
3-7-27	3.70-5.20	1.5		X						
	1.30								X	L
	1.45								X	L
	1.65								X	L
	1.75								X	L
	1.82								X	L
	4.00						X			
3-7-28	2.35-4.00	1.65		X						
3-7-28.1	.20-.30	.10		X						
	1.20-1.40	.20	X							
3-7-28.2	0.15-0.70	.55		X						
3-7-31	.05-.95	.90			X					
3-7-32.0	.05								X	M
	.15								X	M
	0.35-0.55	.20		X						
	0.55-1.10	.55	X							
3-7-32.1	0.05						X			
	.40-1.15	.65	X							
3-8-6	0.10-0.25	.15	X							
ODF	0.25-0.40	.15	X							
"	0.45-0.85	.40		X						
3-8-6.1	1.80-2.10	.4	X							
High Peak										
3-8-7.1	0.20-1.00	.8		X						
	.60							X		
3-8-15.0	2.3						X			

Appendix C-5.3, continued

			SIDECAST			CULVERT				
ROAD	M.P.	TC MILE	H	M	L	PLUG	REPLACE	REPAIR	SHOTGUN	>75%= HIGH RISK
3-8-15.3	.70-1.40	.7	X							
	1.40-1.80	.4			X					
	1.80-1.95	.15	X							
	1.95-2.15	.20			X					
	2.15-2.80	.65	X							
	1.95								X	M
	2.15								X	H
	2.80								X	L
	0.45							X		
	4.40						X			
Need Bridge	0.2									
3-8-20.0	6.10								X	L
	6.60								X	
	7.55							X		
	5.00				X					
	1.75-9.80	7.05	1.50	6.55						
3-9-02	1.25-3.10	1.85	X							
	3.75-4.20	.45	X							
	4.70-5.60	.90	X							
	1.45								X	L
	2.31								X	M
	2.70								X	L
	3.10								X	L
	5.00							X	X	L
	1.65							X		
	3.05							X		
	3.80							X		
4-7-4.2	.40-1.35	.95		X						
4-7-6	0+00+1.3	1.3			X					
4-7-22	0.55-3.15	2.60	X							
	3.15-3.70	.55		X						
	1.40								X	H
	2.30								X	L
	2.75								X	L

Appendix C-5.4

USFS Critical Inventory I and II

CRITICAL INVENTORY I

SITE#	T	R	S	RD NAME	M.P.	PROBLEM	OP SPUR
1	3	7	6	8505	2.	Slump Fail	- -
				8505114	0.1		- -
2	3	8	25	8535110	.75	Slide	- -
3	3	8	25	8335113	.25 (300')	Slump Fail	- -
4	3	8	28	8376113	1.7	Across canyon rotat. slump	- -
5							
6	3	8	27	8376113	.03	Sidecast	- -
7	3	8	21	8376117	1.25		- -
7a	3	8	22	8376123	.1 (61')	Sidecast	- -
8	3	8	22	8377117	.2	Failure	- -
9	3	8	22	8377139	.4	Slump sidecast	- -
10	3	8	22	8377139	.2	Sidecast	- -
11	3	9	2	8172	4.9 (1700')	Sidecast	- -
12	3	9	17	8170111	.36	Wrong place & size, CMP move	- -
13	3	9	17	8170111	0 to EOR	Sidecast oblit	- -
14	3	9	8	8170113	.5	CMP oblit	- -
15	3	9	8	8170113	.6	Remove road	- -
16	3	9	4	8171-77	0.00-6.00	Remove CMP, road oblit, Water quality Pacific City	X
17	4	10	4	1023112	0-.7	Sidecast	- -
18	3	10	26	1004137	0.1 (500')	Sidecast	- -
19	4	8	34	2202111	.20 (300')	Slide, sidecast	- -
20	5	10	10	See Chris McDonald - survey for timber sale -	0 to end	Sidecast	- -
21	5	9	13	1588115	0+.8	Oblit	- -
22	5	10	14	1588	0.15 0.13	Pull CMP's, sidecast oblit	- -
23	3	10	4	1136	1.4-1.8	Sidecast	- -
24	3	10	6	1136114-115	.2 & 1.7	Sidecast	- -
25	3	10	5	1136111	0-.4	Sidecast	- -
26	4	9	34	2285	0.7 (100')	River	- -

Appendix C-5.4, continued

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CRITICAL INVENTORY II

SITE#	T	R	S	RD NAME	M.P.	PROBLEM	OP SPUR
1	4	9	28	1491-119	X	Fracture	X
2	4	9	4	8595120	2.05 (250')	Breaking	X
3	4	9	4	8595121	.50 (250')	Sidecast	- -
4	4	9	34	X	0+00-9+00 (400')	Sidecast	X
5				8590	0+00-2500		X
6	4	9	2	8596	.45 (50')	Crack	- -
7	4	9	11	8596	0+00-30+00	Sidecast	X
8				8596	0+00-2.0	Sidecast, shotgun	- -
9	4	9	12	8593115	0+00-1.1		- -
10	4	8	3	8594111	.3-7.5	Sidecast	- -
11	4	8	16	8594	.45 (100')	Rotation slump	X
12	4	8	13	8533121		Obliterate	- -
13	4	8	24	8533125	0-.65	Sidecast, CMP	- -
14	4	8	35	1400134	0-.5		- -
15	4	8	34	1400	1700'		- -
16	4	8	27	2283112	.05 (110')	Sidecast	- -
17	4	8	27	2283		Rip rap	- -
18	4	8	21	2283	2.9	Sidecast	- -
19	4	8	20	Spur 62283	.1	Obliterate	X
20	4	8	10	8533	.7	Sidecast	- -
21	3	8	18	8563111	0-1.3	Sidecast	X
22	3	9	13	8573	.7 (60')	Slump	- -

Appendix C-5.5

USFS Culvert Information

CULVERTS "SHOULD DO"

T	R	S	RD #	M.P.	SHOT GUN	HEIGHT OF CULVERT ABOVE GROUND	NEED CLEANING	OTHER COMMENTS
3	9	4	8171	1.2	X	6	X	
4	9	12	8593	1.25		6	X	
4	9	12	8395	1.60	X	20		
3	9	34	8590	.25		10	X	Fish, domestic water
4	9	12	8593115	.73		2		
4	9	12	8593115	.09				
4	8	13	8533121	.05				
4	8	13	33121	.55				
4	8	34	2202111	.20	X	12		
5	10	14	1588	.15				
5	10	14		.13				

Appendix C-5.6

'SFS Culvert Inventory

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T	R	S	ROAD	M.P.	SHOT GUN	OUTLET HGT FROM GROUND (FEET)	NEEDS CLEANING
4	9	23	Op Spur	.02	- -	2	- - -
5	9	21	2284	.36	- -	3	- - -
5	9	28	2273	.44	- -	2	- - -
5	9	23	2234-126	.41	- -	2	- - -
4	9	29	2210	4.80	- -	2	- - -
4	9	20	1400-118	.75	- -	2	- - -
3	9	35	8593	.8	- -	3	- - -
4	9	11	8596	1.0	- -	2	- - -
4	9	11	8596	1.05	- -	3	X
4	9	11	8596	1.3	- -	4	- - -
4	9	11	8596	1.3	- -	3	- - -
4	9	1	8593	.55	- -	3	- - -
4	9	12	8593	1.70	- -	2	- - -
4	8	9	8598	2.9	- -	2	- - -
4	8	12	1124125	.15	- -	2	- - -
4	8	24	8533125	.65	- -	- -	X
4	8	34	2283	X	- -	3	- - -
4	8	27	2283	1.2	- -	2	- - -
4	8	20	2283	3.85	- -	3	- - -
4	8	27	2283	.2	- -	3	- - -
X	X		8573	.9	- -	2	- - -
3	9	4	8171111	2	- -	2	- - -
3	9	15	8172	.3	- -	3	- - -
3	8	23	8376	4.0	- -	2	- - -
3	9	22	8578121		- -	4	- - -
3	9	4	8171	1.7	- -	2	X
5	9	1	1503		- -	3	- - -
3	9	2	8170	6.6	- -	2	- - -
3	9	X	8170	1.05	- -	2	- - -
3	9	9	8170	2.0	- -	2	- - -
3	10	24	1004	1.5	- -	2	- - -
3	10	35	1034	4.1	- -	2	- - -
4	10	3	1034	1.1	- -	2	- - -
3	10	26	1106	3.26	- -	2	- - -
3	10	29	1004159	.05	- -	2	- - -
4	8	34	2283	.05	- -	3	- - -
4	9	17	1491	1.03	- -	2	- - -
4	9	17	1491	1.19	- -	2	Too small
4	9	16	1491	1.65	- -	2	- - -
4	9	X	1491	1.84	- -	2	- - -
4	9	16	1491	1.87	- -	2	- - -
4	9	16	1491	1.88	- -	2	- - -
4	9	21	1491	2.6	- -	3	- - -
4	9	21	X	2.6	- -	3	- - -
4	9	21	1491	2.75	- -	2	- - -
4	9	27	1410	1.52	- -	2	- - -

4	9	16	1432	.16	- -	- -	Too small
4	9	21	1432	.69	- -	2	Old
4	9	29	1432	1.62	- -	- -	Old
4	9	27	1411	.54	- -	- -	X
3	7	31	8505512	.05	- -	5	- - -
3	9	22	8573121	.45	- -	4	- - -
3	8	21	8377	.X	X	2	X
3	8	22	8377139	.2	- -	10	- - -
3	8	22	8376118	X	- -	0	X
3	8	24	8320119	.6	- -	18	- - -
3	9	9	8170	225	- -	5	- - -
3	9	17	8170111	.2	- -	10	- - -
3	9	17	8170	.4	X	4	- - -
3	9	15	8172	.2	- -	5	- - -
3	10	35	1034	5.5	- -	5	- - -
3	8	23	8376	4.5	X	5	- - -
3	9	X	8171111	1	- -	6	- - -
3	8	25	8335113	.1	X	2	- - -
3	9	4	8171	1.6	- -	4	- - -
3	9	4	8171	1.2	X	6	- - -
3	10	24	1004	2.1	- -	4	- - -
3	10	26	1004137	.9	- -	10	- - -
3	10	35	1034	4.5	- -	10	- - -
3	10	29	1004159	.3	- -	10	- - -
5	10	14	1588	.3	- -	200	- - -
5	10	14	1588	.2	- -	Infinity	- - -
3	10	9	1136	.9	- -	- -	X
3	10	4	1136	2.0	- -	200	- - -
3	10	5	1136	2.7	- -	- -	X
3	10	5	1136	3.1	- -	200	X
3	10	6	1136112	.13	- -	- -	X
3	10	6	1136112	.22	- -	- -	X
4	10	15	1107	1.5	- -	250	- - -
4	9	16	1491-112	.55	- -	- -	X
4	9	29	1491	37+50	X	6	- - -
4	9	29	1491	40+50	X	6	- - -
5	9	16	2284	2.78	X	6	- - -
4	8	X	2283-120	.11	X	10	- - -
3	9	35	8593	.55	- -	5	- - -
4	9	2	8596	.5	- -	15	- - -
4	9	12	- -	- -	- -	6	X
4	9	12	8593	1.75	- -	6	- - -
4	9	1	8598	1.11	- -	4	- - -
4	8	6	8598	2.7	- -	4	- - -
4	8	9	8598	3.8	- -	4	- - -
4	8	9	8598	3.85	- -	3	- - -

Appendix C-5.6, continued

4	8	12	8530	.5	- -	6	- - -
4	8	25	1400	16.95	- -	6	- - -
4	8	27	2283	.21	- -	6	- - -
4	8	35	121	.03	- -	6	- - -
4	8	27	2283	.7	- -	4	- - -
4	8	21	2283	3.25	- -	6	- - -
4	8	21	2283	3.5	- -	4	- - -
4	8	20	2283	392	- -	8	- - -
4	8	20	2283	4	- -	4	- - -
4	8	10	8533	.45	- -	5	- - -
3	8	19	8563	.4	- -	6	- - -
3	9	13	8573	.7	- -	4	- - -
3	9	14	8573	2.0	- -	5	- - -
4	9	9	8595120	.9	- -	3	X
4	8	13	33121	.58	- -	- -	- - -

Appendix C-7.1

Land Ownership Summary

The following information is summarized from the accompanying worksheets which used GIS subbasin overlay with the land ownership overlay purchased from Atterbury Assoc. The information needs updating to show recent land ownership changes, but is sufficiently accurate for this analysis.

Acreage Totals by Subbasin

Subbasin	Acres	Subbasin	Acres
Alder/Buck	4,493	L. Nestucca River	10,074
Alder1	1,348	L. Three Rivers	5,183
Bald Mountain Fork	5,175	Limestone	1,994
Bays Creek	3,065	M. Nestucca River	5,680
Bear Creek	6,252	McGuire Reservoir	1870
Bible Creek	4,777	Moon Creek	5,623
Boulder1	2,807	Niagara	8,032
Cedar	3,681	North Beaver1	4,947
Clarence	2,132	Pollard	2,188
Clear	3,408	Powder	3,718
Crazy Creek1	3,608	Slick Rock	2,299
East Beaver Creek	9,928	Testament Creek	5,367
East Creek	6,823	Tiger	1,990
Elk Creek	6,445	Tony	1,737
Fan Creek	8,845	U. Nestucca River	6,667
Farmer	3,145	U. Three Rivers	5,190
Foland	2,165	Walker Creek	1,926
George	1,658	West	1,684
Horn	3,558	Wolfe	1,852
L. Beaver Creek	1,785	Total All Subbasins	163,119

Acreage Totals in Nestucca Watershed by Owner

wner	Acres
Bureau of Land Management	36,919
Boise Cascade Corp.	1,461
Cavenham Forest Products	2,643
City of McMinnville	1,236
Oregon Dept. of Transportation	5
Hampton Tree Farms	1,198
Grand Ronde Indian Reservation	81
Other Private	22,211
Simpson Timber Co.	15,757
Cape Kiwanda State Park	64
Oregon Dept. of Forestry	8,678
Stimson Timber Co.	2,507
United States Forest Service	68,119
Willamette Industries, Inc.	2,240
Total all Owners	163,119

Acreage Totals in Nestucca Watershed by Group

Group	Acres	
deral Government	105,038	(64%)
ther Government	1,305	(1%)
State Government	8,678	(5%)
Indian Reservation	81	(<1%)
Private Industrial	25,806	(16%)
Private Other	22,211	(14%)
Total all Groups	163,119	

Appendices C-7.2A through C-7.2C

The following appendices show detailed information of landownership by owner. Abbreviations reflect the following:

BLM	Bureau of Land Management
BOISE	Boise Cascade Corp.
CAVEN	Hanson Natural Resources Co. (previously Cavenham)
CITY	City of McMinnville
DOT	Oregon Department of Transportation
HAMPT	Hampton Tree Farms
INRSV	Grand Ronde Indian Reservation
PRIVT	Assorted residential, rural residential agricultural, and small woodlot parcels
SIMPS	Simpson Timber Company
SPARK	State Park (Cape Kiwanda)
STATE	State of Oregon - mostly Oregon Department of Forestry
STIM	Stimson Timber Company
USFS	United States Forest Service
WLTIN	Willamette Industries, Inc.

GF	Government - Federal. This includes all BLM and USFS acres.
GO	Government - Other. This includes all the city and state lands except Oregon Department of Forestry.
GS	Government - State. This includes all lands assumed to be Oregon Department of Forestry lands which are all forest lands.
IN	Indian Reservation lands
PI	Private - Industrial forestry lands owned by major industrial forestry companies
PO	Private - Other. These include all private residential, rural residential, small woodlot and agricultural lands not otherwise coded. Those marked with an asterisk on the attached worksheet were not labeled in the GIS data base and are assumed to be private.

Appendix C-7.2A

Nestucca Watershed Analysis and Ownership Worksheet

Sorted by Subbasin

Subbasin	Owner	Group	Acres	Subbasin Totals
Alder/Buck	HAMPT	PI	146	
Alder/Buck	PRIVT	PO	508	
Alder/Buck	SIMPS	PI	195	
Alder/Buck	USFS	GF	3,644	4,493
Alder1	PRIVT	PO	45	
Alder1	SIMPS	PI	168	
Alder1	USFS	GF	1,135	1,348
Bald Mountain Fork	BLM	GF	4,647	
Bald Mountain Fork	BOISE	PI	9	
Bald Mountain Fork	SIMPS	PI	158	
Bald Mountain Fork	STATE	GS	361	5,175
Bays Creek	BLM	GF	648	
Bays Creek	HAMPT	PI	36	
Bays Creek	PRIVT	PO	69	
Bays Creek	SIMPS	PI	277	
Bays Creek	STATE	GS	279	
ys Creek	USFS	GF	1,756	3,065
Bear Creek	BLM	GF	5,062	
Bear Creek	HAMPT	PI	41	
Bear Creek	SIMPS	PI	450	
Bear Creek	STATE	GS	444	
Bear Creek	STIM	PI	193	
Bear Creek	WLTIN	PI	62	6,252
Bible Creek	BLM	GF	2,259	
Bible Creek	BOISE	PI	121	
Bible Creek	HAMPT	PI	318	
Bible Creek	PRIVT	PO	748	
Bible Creek	STATE	GS	445	
Bible Creek	STIM	PI	114	
Bible Creek	USFS	GF	772	4,777
Boulder1	PRIVT	PO	234	
Boulder1	SIMPS	PI	755	
Boulder1	USFS	GF	1,818	2,807
Cedar	PRIVT	PO	363	
Cedar	USFS	GF	3,318	3,681
Clarence	BLM	GF	145	
Clarence	PRIVT	PO	8	
Clarence	SIMPS	PI	432	
Clarence	STATE	GS	110	
rence	STIM	PI	317	
arence	USFS	GF	1,120	2,132

Sorted by Subbasin

Subbasin	Owner	Group	Acres	Subbasin Totals
Clear	HAMPT	PI	20	
Clear	PRIVT	PO	442	
Clear	SIMPS	PI	727	
Clear	USFS	GF	2,219	3,408
Crazy Creek1	BOISE	PI	314	
Crazy Creek1	PRIVT	PO	274	
Crazy Creek1	USFS	GF	3,020	3,608
East Beaver Creek	PRIVT*	PO*	39	
East Beaver Creek	BLM	GF	1,655	
East Beaver Creek	PRIVT	PO	1,039	
East Beaver Creek	SIMPS	PI	988	
East Beaver Creek	STATE	GS	1,567	
East Beaver Creek	STIM	PI	450	
East Beaver Creek	USFS	GF	4,190	9,928
East Creek	BLM	GF	2,531	
East Creek	PRIVT	PO	754	
East Creek	SIMPS	PI	999	
East Creek	STATE	GS	1,055	
East Creek	USFS	GF	1,484	6,823
Elk Creek	BLM	GF	5,222	
Elk Creek	STATE	GS	1,166	
Elk Creek	WLTIN	PI	57	6,445
Fan Creek	PRIVT*	PO*	244	
Fan Creek	BLM	GF	5,493	
Fan Creek	BOISE	PI	148	
Fan Creek	CITY	GO	298	
Fan Creek	PRIVT	PO	132	
Fan Creek	STATE	GS	558	
Fan Creek	STIM	PI	432	
Fan Creek	WLTIN	PI	1,540	8,845
Farmer	PRIVT	PO	286	
Farmer	SIMPS	PI	357	
Farmer	STATE	GS	57	
Farmer	USFS	GF	2,445	3,145
Foland	BLM	GF	33	
Foland	PRIVT	PO	242	
Foland	SIMPS	PI	588	
Foland	STATE	GS	181	
Foland	USFS	GF	1,121	2,165
George	PRIVT	PO	124	
George	SIMPS	PI	10	
George	USFS	GF	1,524	1,658
Horn	PRIVT	PO	185	
Horn	SIMPS	PI	730	
Horn	USFS	GF	2,643	3,558

Sorted by Subbasin

Subbasin	Owner	Group	Acres	Subbasin Totals
L. Beaver Creek	BLM	GF	43	
L. Beaver Creek	PRIVT	PO	696	
L. Beaver Creek	SIMPS	PI	417	
L. Beaver Creek	STATE	GS	325	
L. Beaver Creek	USFS	GF	304	1, 785
L. Nestucca River	PRIVT*	PO*	4	
L. Nestucca River	PRIVT	PO	6,177	
L. Nestucca River	SIMPS	PI	1,676	
L. Nestucca River	SPARK	GO	64	
L. Nestucca River	USFS	GF	2,153	10,074
L. Three Rivers	PRIVT	PO	1,430	
L. Three Rivers	SIMPS	PI	647	
L. Three Rivers	USFS	GF	3,106	5,183
Limestone	BLM	GF	6	
Limestone	PRIVT	PO	44	
Limestone	SIMPS	PI	25	
Limestone	USFS	GF	1,919	1,994
M Nestucca River	BLM	GF	162	
M Nestucca River	BOISE	PI	234	
Nestucca River	PRIVT	PO	2,709	
M Nestucca River	SIMPS	PI	952	
M Nestucca River	STATE	GS	647	
M Nestucca River	USFS	GF	976	5,680
McGuire Reservoir	BLM	GF	769	
McGuire Reservoir	CITY	GO	541	
McGuire Reservoir	HAMPT	PI	83	
McGuire Reservoir	PRIVT	PO	245	
McGuire Reservoir	WLTIN	PI	232	1,870
Moon Creek	BLM	GF	2,746	
Moon Creek	HAMPT	PI	16	
Moon Creek	PRIVT	PO	561	
Moon Creek	SIMPS	PI	765	
Moon Creek	STATE	GS	885	
Moon Creek	USFS	GF	650	5,623
Niagara	INRSV	IN	81	
Niagara	PRIVT	PO	42	
Niagara	STIM	PI	161	
Niagara	USFS	GF	7,748	8,032
North Beaver1	PRIVT*	PO*	269	
North Beaver1	BOISE	PI	82	
North Beaver1	CAVEN	PI	1,813	
North Beaver1	DOT	GO	5	
th Beaver1	PRIVT	PO	641	
rth Beaver1	SIMPS	PI	1,647	
North Beaver1	USFS	GF	490	4,947

Sorted by Subbasin

Subbasin	Owner	Group	Acres	Subbasin Totals
Pollard	PRIVT	PO	220	
Pollard	USFS	GF	1,968	2,188
Powder	PRIVT	PO	281	
Powder	USFS	GF	3,437	3,718
Slick Rock	BLM	GF	499	
Slick Rock	HAMPT	PI	369	
Slick Rock	PRIVT	PO	52	
Slick Rock	SIMPS	PI	568	
Slick Rock	STATE	GS	114	
Slick Rock	USFS	GF	697	2,299
Testament Creek	BLM	GF	3,361	
Testament Creek	HAMPT	PI	53	
Testament Creek	PRIVT	PO	630	
Testament Creek	SIMPS	PI	159	
Testament Creek	STATE	GS	225	
Testament Creek	STIM	PI	530	
Testament Creek	USFS	GF	409	5,367
Tiger	PRIVT*	PO*	22	
Tiger	CAVEN	PI	830	
Tiger	PRIVT	PO	223	
Tiger	SIMPS	PI	842	
Tiger	USFS	GF	73	1,990
Tony	PRIVT	PO	108	
Tony	SIMPS	PI	408	
Tony	USFS	GF	1,221	1,737
U. Nestucca River	BLM	GF	600	
U. Nestucca River	HAMPT	PI	116	
U. Nestucca River	PRIVT	PO	1,540	
U. Nestucca River	SIMPS	PI	602	
U. Nestucca River	STATE	GS	65	
U. Nestucca River	STIM	PI	310	
U. Nestucca River	USFS	GF	3,434	6,667
U. Three Rivers	PRIVT*	PO*	51	
U. Three Rivers	BOISE	PI	158	
U. Three Rivers	USFS	GF	4,981	5,190
Walker Creek	BLM	GF	1,038	
Walker Creek	BOISE	PI	1	
Walker Creek	CITY	GO	397	
Walker Creek	PRIVT	PO	82	
Walker Creek	STATE	GS	59	
Walker Creek	WLTIN	PI	349	1,926

Sorted by Subbasin

Subbasin	Owner	Group	Acres	Subbasin Totals
West	BOISE	PI	394	
West	PRIVT	PO	161	
West	SIMPS	PI	74	
West	STATE	GS	135	
West	USFS	GF	920	1,684
Wolfe	PRIVT	PO	287	
Wolfe	SIMPS	PI	141	
Wolfe	USFS	GF	1,424	1,852
Total			163,119	163,119

Appendix C-7.2B

Nestucca Watershed Analysis
Land Ownership Worksheet

Sorted by Owner and Group

Subbasin	Owner	Group	Acres	Watershed Total by Owner
Bible Creek	BLM	GF	2,259	
Foland	BLM	GF	33	
Bays Creek	BLM	GF	648	
East Beaver Creek	BLM	GF	1,655	
L. Beaver Creek	BLM	GF	43	
Walker Creek	BLM	GF	1,038	
U. Nestucca River	BLM	GF	600	
Elk Creek	BLM	GF	5,222	
Moon Creek	BLM	GF	2,746	
Fan Creek	BLM	GF	5,493	
Testament Creek	BLM	GF	3,361	
McGuire Reservoir	BLM	GF	769	
Limestone	BLM	GF	6	
East Creek	BLM	GF	2,531	
Bear Creek	BLM	GF	5,062	
Clarence	BLM	GF	145	
Bald Mountain Fork	BLM	GF	4,647	
Slick Rock	BLM	GF	499	
M. Nestucca River	BLM	GF	162	36,919
Crazy Creek1	BOISE	PI	314	
North Beaver1	BOISE	PI	82	
Bald Mountain Fork	BOISE	PI	9	
Walker Creek	BOISE	PI	1	
Fan Creek	BOISE	PI	148	
U. Three Rivers	BOISE	PI	158	
M. Nestucca River	BOISE	PI	234	
West	BOISE	PI	394	
Bible Creek	BOISE	PI	121	1,461
Tiger	CAVEN	PI	830	
North Beaver1	CAVEN	PI	1,813	2,643
Fan Creek	CITY	GO	298	
McGuire Reservoir	CITY	GO	541	
Walker Creek	CITY	GO	397	1,236
North Beaver1	DOT	GO	5	5
Moon Creek	HAMPT	PI	16	
McGuire Reservoir	HAMPT	PI	83	
Clear	HAMPT	PI	20	
Bible Creek	HAMPT	PI	318	
U. Nestucca River	HAMPT	PI	116	
Slick Rock	HAMPT	PI	369	

Sorted by Owner and Group

Subbasin	Owner	Group	Acres	Watershed Total by Owner
Alder/Buck	HAMPT	PI	146	
Testament Creek	HAMPT	PI	53	
Bays Creek	HAMPT	PI	36	
Bear Creek	HAMPT	PI	41	1,198
Niagara	INRSV	IN	81	81
Farmer	PRIVT	PO	286	
George	PRIVT	PO	124	
Fan Creek	PRIVT	PO	132	
Wolfe	PRIVT	PO	287	
Powder	PRIVT	PO	281	
Tony	PRIVT	PO	108	
U. Nestucca River	PRIVT	PO	1,540	
Cedar	PRIVT	PO	363	
Alder/Buck	PRIVT	PO	508	
Horn	PRIVT	PO	185	
Walker Creek	PRIVT	PO	82	
East Beaver Creek	PRIVT	PO	1,039	
East Creek	PRIVT	PO	754	
Pollard	PRIVT	PO	220	
ck Rock	PRIVT	PO	52	
estone	PRIVT	PO	44	
Nestucca River	PRIVT	PO	2,709	
L. Three Rivers	PRIVT	PO	1,430	
West	PRIVT	PO	161	
Bible Creek	PRIVT	PO	748	
Clarence	PRIVT	PO	8	
North Beaver1	PRIVT	PO	641	
Testament Creek	PRIVT	PO	630	
Alder1	PRIVT	PO	45	
Bays Creek	PRIVT	PO	69	
Boulder1	PRIVT	PO	234	
Niagara	PRIVT	PO	42	
Foland	PRIVT	PO	242	
Tiger	PRIVT	PO	223	
Crazy Creek1	PRIVT	PO	274	
Moon Creek	PRIVT	PO	561	
McGuire Reservoir	PRIVT	PO	245	
L. Beaver Creek	PRIVT	PO	696	
L. Nestucca River	PRIVT	PO	6,177	
Clear	PRIVT	PO	442	
East Beaver Creek	PRIVT	PO*	39	
Fan Creek	PRIVT*	PO*	244	
North Beaver1	PRIVT*	PO*	269	
Tiger	PRIVT*	PO*	22	
Nestucca River	PRIVT*	PO*	4	
hree Rivers	PRIVT*	PO*	51	22,211

Sorted by Owner and Group

Subbasin	Owner	Group	Acres	Watershed Total by Owner
George	SIMPS	PI	10	
Limestone	SIMPS	PI	25	
Horn	SIMPS	PI	730	
Testament Creek	SIMPS	PI	159	
Clear	SIMPS	PI	727	
Wolfe	SIMPS	PI	141	
U. Nestucca River	SIMPS	PI	602	
Bald Mountain Fork	SIMPS	PI	158	
L. Nestucca River	SIMPS	PI	1,676	
Clarence	SIMPS	PI	432	
Farmer	SIMPS	PI	357	
M. Nestucca River	SIMPS	PI	952	
L. Three Rivers	SIMPS	PI	647	
Moon Creek	SIMPS	PI	765	
West	SIMPS	PI	74	
Tiger	SIMPS	PI	842	
L. Beaver Creek	SIMPS	PI	417	
Bear Creek	SIMPS	PI	450	
Alder1	SIMPS	PI	168	
Alder/Buck	SIMPS	PI	195	
Boulder1	SIMPS	PI	755	
East Creek	SIMPS	PI	999	
North Beaver1	SIMPS	PI	1,647	
Slick Rock	SIMPS	PI	568	
Foland	SIMPS	PI	588	
Bays Creek	SIMPS	PI	277	
Tony	SIMPS	PI	408	
East Beaver Creek	SIMPS	PI	988	15,757
L. Nestucca River	SPARK	GO	64	64
Testament Creek	STATE	GS	225	
East Creek	STATE	GS	1,055	
Foland	STATE	GS	181	
M. Nestucca River	STATE	GS	647	
U. Nestucca River	STATE	GS	65	
Bald Mountain Fork	STATE	GS	361	
Farmer	STATE	GS	57	
East Beaver Creek	STATE	GS	1,567	
Bays Creek	STATE	GS	279	
Bible Creek	STATE	GS	445	
Clarence	STATE	GS	110	
Walker Creek	STATE	GS	59	
Elk Creek	STATE	GS	1,166	
Bear Creek	STATE	GS	444	
West	STATE	GS	135	
L. Beaver Creek	STATE	GS	325	

Sorted by Owner and Group

ˏbbasin	Owner	Group	Acres	Watershed Total by Owner
Slick Rock	STATE	GS	114	
Moon Creek	STATE	GS	885	
Fan Creek	STATE	GS	558	8,678
U. Nestucca River	STIM	PI	310	
Niagara	STIM	PI	161	
Fan Creek	STIM	PI	432	
East Beaver Creek	STIM	PI	450	
Bible Creek	STIM	PI	114	
Testament Creek	STIM	PI	530	
Clarence	STIM	PI	317	
Bear Creek	STIM	PI	193	2,507
L. Beaver Creek	USFS	GF	304	
Foland	USFS	GF	1,121	
Farmer	USFS	GF	2,445	
Powder	USFS	GF	3,437	
Slick Rock	USFS	GF	697	
North Beaver1	USFS	GF	490	
Nestucca River	USFS	GF	3,434	
ȝara	USFS	GF	7,748	
ˏider/Buck	USFS	GF	3,644	
Wolfe	USFS	GF	1,424	
East Creek	USFS	GF	1,484	
Tiger	USFS	GF	73	
U. Three Rivers	USFS	GF	4,981	
L. Three Rivers	USFS	GF	3,106	
East Beaver Creek	USFS	GF	4,190	
L. Nestucca River	USFS	GF	2,153	
Crazy Creek1	USFS	GF	3,020	
Bays Creek	USFS	GF	1,756	
West	USFS	GF	920	
Clear	USFS	GF	2,219	
Testament Creek	USFS	GF	409	
Clarence	USFS	GF	1,120	
M. Nestucca River	USFS	GF	976	
Cedar	USFS	GF	3,318	
Tony	USFS	GF	1,221	
Alder1	USFS	GF	1,135	
Pollard	USFS	GF	1,968	
Boulder1	USFS	GF	1,818	
Limestone	USFS	GF	1,919	
Moon Creek	USFS	GF	650	
Horn	USFS	GF	2,643	
‾ˀle Creek	USFS	GF	772	
rge	USFS	GF	1,524	68,119

Sorted by Owner and Group

Subbasin	Owner	Group	Acres	Watershed Total by Owner
Fan Creek	WLTIN	PI	1,540	
Bear Creek	WLTIN	PI	62	
Walker Creek	WLTIN	PI	349	
Elk Creek	WLTIN	PI	57	
McGuire Reservoir	WLTIN	PI	232	2,240
Total			163,119	163,119

Appendix C-7.2C

Nestucca Watershed Analysis
and Ownership Worksheet

Sorted by Group

Subbasin	Owner	Group	Acres	Watershed Total by Group
Niagara	USFS	GF	7,748	
Fan Creek	BLM	GF	5,493	
Elk Creek	BLM	GF	5,222	
Bear Creek	BLM	GF	5,062	
U. Three Rivers	USFS	GF	4,981	
Bald Mountain Fork	BLM	GF	4,647	
East Beaver Creek	USFS	GF	4,190	
Alder/Buck	USFS	GF	3,644	
Powder	USFS	GF	3,437	
U. Nestucca River	USFS	GF	3,434	
Testament Creek	BLM	GF	3,361	
Cedar	USFS	GF	3,318	
L. Three Rivers	USFS	GF	3,106	
Crazy Creek1	USFS	GF	3,020	
Moon Creek	BLM	GF	2,746	
orn	USFS	GF	2,643	
t Creek	BLM	GF	2,531	
mer	USFS	GF	2,445	
Bible Creek	BLM	GF	2,259	
Clear	USFS	GF	2,219	
L. Nestucca River	USFS	GF	2,153	
Pollard	USFS	GF	1,968	
Limestone	USFS	GF	1,919	
Boulder1	USFS	GF	1,818	
Bays Creek	USFS	GF	1,756	
East Beaver Creek	BLM	GF	1,655	
George	USFS	GF	1,524	
East Creek	USFS	GF	1,484	
Wolfe	USFS	GF	1,424	
Tony	USFS	GF	1,221	
Alder1	USFS	GF	1,135	
Foland	USFS	GF	1,121	
Clarence	USFS	GF	1,120	
Walker Creek	BLM	GF	1,038	
M. Nestucca River	USFS	GF	976	
West	USFS	GF	920	
Bible Creek	USFS	GF	772	
McGuire Reservoir	BLM	GF	769	
Slick Rock	USFS	GF	697	
Moon Creek	USFS	GF	650	
ays Creek	BLM	GF	648	
estucca River	BLM	GF	600	
k Rock	BLM	GF	499	

Sorted by Group

Subbasin	Owner	Group	Acres	Watershed Total by Group
North Beaver1	USFS	GF	490	
Testament Creek	USFS	GF	409	
L. Beaver Creek	USFS	GF	304	
M. Nestucca River	BLM	GF	162	
Clarence	BLM	GF	145	
Tiger	USFS	GF	73	
L. Beaver Creek	BLM	GF	43	
Foland	BLM	GF	33	
Limestone	BLM	GF	6	105,038
McGuire Reservoir	CITY	GO	541	
Walker Creek	CITY	GO	397	
Fan Creek	CITY	GO	298	
L. Nestucca River	SPARK	GO	64	
North Beaver1	DOT	GO	5	1,305
East Beaver Creek	STATE	GS	1,567	
Elk Creek	STATE	GS	1,166	
East Creek	STATE	GS	1,055	
Moon Creek	STATE	GS	885	
M. Nestucca River	STATE	GS	647	
Fan Creek	STATE	GS	558	
Bible Creek	STATE	GS	445	
Bear Creek	STATE	GS	444	
Bald Mountain Fork	STATE	GS	361	
L. Beaver Creek	STATE	GS	325	
Bays Creek	STATE	GS	279	
Testament Creek	STATE	GS	225	
Foland	STATE	GS	181	
West	STATE	GS	135	
Slick Rock	STATE	GS	114	
Clarence	STATE	GS	110	
U. Nestucca River	STATE	GS	65	
Walker Creek	STATE	GS	59	
Farmer	STATE	GS	57	8,678
Niagara	INRSV	IN	81	81
North Beaver1	CAVEN	PI	1,813	
L. Nestucca River	SIMPS	PI	1,676	
North Beaver1	SIMPS	PI	1,647	
Fan Creek	WLTIN	PI	1,540	
East Creek	SIMPS	PI	999	
East Beaver Creek	SIMPS	PI	988	
M. Nestucca River	SIMPS	PI	952	
Tiger	SIMPS	PI	842	
Tiger	CAVEN	PI	830	
Moon Creek	SIMPS	PI	765	
Boulder1	SIMPS	PI	755	
Horn	SIMPS	PI	730	

Sorted by Group

bbasin	Owner	Group	Acres	Watershed Total by Group
Clear	SIMPS	PI	727	
L. Three Rivers	SIMPS	PI	647	
U. Nestucca River	SIMPS	PI	602	
Foland	SIMPS	PI	588	
Slick Rock	SIMPS	PI	568	
Testament Creek	STIM	PI	530	
Bear Creek	SIMPS	PI	450	
East Beaver Creek	STIM	PI	450	
Fan Creek	STIM	PI	432	
Clarence	SIMPS	PI	432	
L. Beaver Creek	SIMPS	PI	417	
Tony	SIMPS	PI	408	
West	BOISE	PI	394	
Slick Rock	HAMPT	PI	369	
Farmer	SIMPS	PI	357	
Walker Creek	WLTIN	PI	349	
Bible Creek	HAMPT	PI	318	
Clarence	STIM	PI	317	
Crazy Creek1	BOISE	PI	314	
Nestucca River	STIM	PI	310	
s Creek	SIMPS	PI	277	
M. Nestucca River	BOISE	PI	234	
McGuire Reservoir	WLTIN	PI	232	
Alder/Buck	SIMPS	PI	195	
Bear Creek	STIM	PI	193	
Alder1	SIMPS	PI	168	
Niagara	STIM	PI	161	
Testament Creek	SIMPS	PI	159	
U. Three Rivers	BOISE	PI	158	
Bald Mountain Fork	SIMPS	PI	158	
Fan Creek	BOISE	PI	148	
Alder/Buck	HAMPT	PI	146	
Wolfe	SIMPS	PI	141	
Bible Creek	BOISE	PI	121	
U. Nestucca River	HAMPT	PI	116	
Bible Creek	STIM	PI	114	
McGuire Reservoir	HAMPT	PI	83	
North Beaver1	BOISE	PI	82	
West	SIMPS	PI	74	
Bear Creek	WLTIN	PI	62	
Elk Creek	WLTIN	PI	57	
Testament Creek	HAMPT	PI	53	
Bear Creek	HAMPT	PI	41	
Bays Creek	HAMPT	PI	36	
estone	SIMPS	PI	25	
r	HAMPT	PI	20	
oon Creek	HAMPT	PI	16	

Sorted by Group

Subbasin	Owner	Group	Acres	Watershed Total by Group
George	SIMPS	PI	10	
Bald Mountain Fork	BOISE	PI	9	
Walker Creek	BOISE	PI	1	25,806
L. Nestucca River	PRIVT	PO	6,177	
M. Nestucca River	PRIVT	PO	2,709	
U. Nestucca River	PRIVT	PO	1,540	
L. Three Rivers	PRIVT	PO	1,430	
East Beaver Creek	PRIVT	PO	1,039	
East Creek	PRIVT	PO	754	
Bible Creek	PRIVT	PO	748	
L. Beaver Creek	PRIVT	PO	696	
North Beaver1	PRIVT	PO	641	
Testament Creek	PRIVT	PO	630	
Moon Creek	PRIVT	PO	561	
Alder/Buck	PRIVT	PO	508	
Clear	PRIVT	PO	442	
Cedar	PRIVT	PO	363	
Wolfe	PRIVT	PO	287	
Farmer	PRIVT	PO	286	
Powder	PRIVT	PO	281	
Crazy Creek1	PRIVT	PO	274	
McGuire Reservoir	PRIVT	PO	245	
Foland	PRIVT	PO	242	
Boulder1	PRIVT	PO	234	
Tiger	PRIVT	PO	223	
Pollard	PRIVT	PO	220	
Horn	PRIVT	PO	185	
West	PRIVT	PO	161	
Fan Creek	PRIVT	PO	132	
George	PRIVT	PO	124	
Tony	PRIVT	PO	108	
Walker Creek	PRIVT	PO	82	
Bays Creek	PRIVT	PO	69	
Slick Rock	PRIVT	PO	52	
Alder1	PRIVT	PO	45	
Limestone	PRIVT	PO	44	
Niagara	PRIVT	PO	42	
Clarence	PRIVT	PO	8	
North Beaver1	PRIVT*	PO*	269	
Fan Creek	PRIVT*	PO*	244	
U. Three Rivers	PRIVT*	PO*	51	
East Beaver Creek	PRIVT*	PO*	39	
Tiger	PRIVT*	PO*	22	
L. Nestucca River	PRIVT*	PO*	4	22,211
Total			163,119	163,119

Appendix C-7.3

Federal Lands Adjacent to Private Property With Homes

This is a list for quick reference. For more detailed project analysis, it is more appropriate to create a large scale GIS map with land ownership, as well as cross checking local records for specific ownership of the private parcels so direct dialogue can occur with individuals. Managers need to be sensitive to local issues to recognize when a broader group of owners may need to be involved than just those with adjacent lands.

Township 03 S, Range 06 W, Sec.22, N 1/2, SW 1/4
Township 04 S, Range 07 W, Sec.01, NW 1/4, SW 1/4
Township 03 S, Range 08 W, Sec.32, SW 1/4, NW 1/4
Township 03 S, Range 08 W, Sec.32, SW 1/4, SE 1/4
Township 03 S, Range 09 W, Sec.19, NE 1/4, NW 1/4
Township 04 S, Range 07 W, Sec.06, 1/4, SE 1/4
Township 04 S, Range 08 W, Sec.02, NE 1/4, SW 1/4
Township 04 S, Range 08 W, Sec.02, SW 1/4, NW 1/4
Township 04 S, Range 08 W, Sec.03, SW 1/4, SW 1/4
Township 04 S, Range 08 W, Sec.04, NW 1/4, SE 1/4
Township 03 S, Range 08 W, Sec.19, SE 1/4, NE 1/4
Township 03 S, Range 08 W, Sec.29, SW 1/4, SW 1/4
Township 03 S, Range 08 W, Sec.29, NW 1/4, NW 1/4
Township 03 S, Range 08 W, Sec.31, 1/4, SE 1/4
Township 03 S, Range 09 W, Sec.36, NW 1/4, NE 1/4
Township 03 S, Range 09 W, Sec.36, NW 1/4, NW 1/4
Township 04 S, Range 10 W, Sec.01, SW 1/4, SW 1/4
Township 04 S, Range 10 W, Sec.02, NW 1/4, NE 1/4
Township 04 S, Range 10 W, Sec.15, NW 1/4, SE 1/4
Township 04 S, Range 10 W, Sec.34, NW 1/4, NE 1/4
Township 03 S, Range 09 W, Sec.19, SE 1/4, NW 1/4
Township 04 S, Range 09 W, Sec.18, SW 1/4, SW 1/4
Township 04 S, Range 09 W, Sec.19, NE 1/4, NW 1/4
Township 04 S, Range 09 W, Sec.19, SW 1/4, NE 1/4
Township 04 S, Range 09 W, Sec.19, SW 1/4, SW 1/4
Township 04 S, Range 09 W, Sec.29, SW 1/4, SE 1/4
Township 04 S, Range 09 W, Sec.29, SE 1/4, NE 1/4
Township 04 S, Range 09 W, Sec.30, SW 1/4, SE 1/4
Township 04 S, Range 09 W, Sec.31, NE 1/4, NE 1/4
Township 04 S, Range 09 W, Sec.32, NW 1/4, SE 1/4
Township 04 S, Range 09 W, Sec.33, SW 1/4, SW 1/4
Township 04 S, Range 10 W, Sec.24, SW 1/4, NE 1/4
Township 05 S, Range 09 W, Sec.04, N 1/2, NW 1/4
Township 05 S, Range 09 W, Sec.16, SE 1/4, NW 1/4
Township 05 S, Range 09 W, Sec.17, NW 1/4, SE 1/4

Appendix D

List of Support Maps/Data Not Included in Document But Used in the Watershed Analysis

During the course of the watershed analysis, there were numerous intermediate working maps and base data used to get to the summary data presented in this analysis document. These maps/data have significant value for future project analysis when site specific information is needed, so they are being maintained as background information. Copies of appropriate maps/data are being maintained at the BLM Tillamook Resource Area office and the USFS Hebo Ranger District office. Certain GIS data will be maintained at the Siuslaw National Forest and Salem District Office until hardware capability exists to maintain them at the local level. The available maps and documents are listed below.

Documents:

1. Species of concern, a botanical input by Katie Grenier, Siuslaw National Forest.
2. Native Americans, a cultural assessment of the Confederated Tribes of the Grand Ronde and the Confederated Tribes of the Siletz, by Lynn Trost, BLM, Tillamook.
3. Characterization of the Social Setting - several inputs by Marge Victor, Siuslaw National Forest.
4. Information on Tillamook County History by Lynn Trost, BLM, Tillamook.
5. Draft Guidance for determination of site-potential tree heights to establish riparian reserve widths dated July 1994.
6. Description of GIS analysis procedures by Carol Murdock
7. Water Temperature monitoring data in Lotus 123 dfiles.
8. Water Temperature draft report for the Nestucca River by Chester Novak, BLM, Salem.
9. Streamflow draft report for the Nestucca River by Chester Novak, BLM, Salem.
10. STORET data for the Nestucca River and Nestucca Bay from Oregon DEQ.

Maps:

1. Maps showing the GIS process used to analyze landslide potential.
2. Map of first and second order streams within high and extreme landslide potential areas.
3. Map of roads within high and extreme landslide potential areas.
4. Map of surface ravel potential.
5. Map of stream bank erosion potential.
6. Forest Service road inventory map and forms (available at Hebo Ranger District office only).
7. Map of inventoried streams and fish enhancement projects (available at Tillamook Resource Area office only).

Appendix E

References Cited

Baker, C., V. Crispin, B. House and C. Kunkel. 1986. Nestucca River Basin Anadromous Salmonid Habitat Overview. Interagency Report.

Benda, L. and T. Dunne. 1987. Sediment Routing by Debris Flow. Erosion and Sedimentation in the Pacific Rim (Proceedings of the Corvallis Symposium, August, 1987). AHS Publ. No. 165.

Bennett, K.A. 1982. Report to the Siuslaw National Forest. Effects of Slash Burning on Surface Erosion Rates in the Oregon Coast Range. Corvallis, Oregon.

Boehne, P.L. and R.A. House. 1983. Stream ordering: a tool for land managers to classify western Oregon streams. Tech. Note OR-3. USDI, Bureau of Land Management. Portland, Oregon.

Booth, D. 1991. Estimating Prelogging Old-Growth in the Pacific Northwest. Journal of Forestry, Volume 89.

Brown, E. Reade. 1985. Management of Wildlife and Fish Habitats in Forests of Western Oregon and Washington. USDA, Forest Service. Portland, Oregon. 2 vols. 635 pp.

Burroughs and King. 1989. Reduction of Soil Erosion on Forest Roads. USDA, Forest Service, Intermountain Research Station, General Technical Report INT-264.

Cooper, R. 1994. Detailed Report of Water Availability on Nestucca River. Oregon Water Resources Department. Unpublished Modelling Results.

Crispin, V., R. House and D. Roberts. 1993. Changes in instream habitat, large woody debris, and salmon habit after restructuring of a coastal Oregon stream. North American Journal of Fisheries Management. 13:96-102.

Dale, V., M. Hemstrom, and J. Franklin. 1983. The Effect of Disturbance Frequency on Forest Succession in the Pacific Northwest. Proceedings of Society of American Foresters' Annual Meeting, October, 1983. Portland, Oregon.

Espy, M. and B. Babbitt. 1994. Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl. USDA, Forest Service and USDI, Bureau of Land Management.

Everest, F.H., et al. 1985. Salmonids. In Management of Wildlife and Fish Habitats in Forests of Western Oregon and Washington. E.R. Brown, ed. USDA, Forest Service, Pacific Northwest Region, Portland, Oregon.

FEMAT. 1993. Forest Ecosystem Management: An ecological, economic, and social assessment. USDA, USDI, EPA and USDC.

Franklin, J. and C. Dyrness. 1973. Natural Vegetation of Oregon and Washington. USDA, Forest Service. General Technical Report PNW-8.

Franklin, J.F. and C.T. Dyrness. 1988. Natural Vegetation of Oregon and Washington. Oregon State University Press. 452 pp.

Friedman, Rachel. 1981. An exploratory study of the environmental factors relating to the distribution of *Pleuricospora fimbriolata*. Unpublished manuscript on file with Forestry Sciences Lab, Corvallis, Oregon.

Fugi, W. 1994. Personal Communication Concerning Streamflow Data (State Scenic Waterway Flows) for the Nestucca River.

Grenier, J.J. and S.K. Nelson. In Press. Marbled Murrelet Habitat Associations in Oregon. In Ralph, C.J., G. Hunt, J. Piatt, and M.G. Raphael. Conservation Assessment for the Marbled Murrelet. USDA, Forest Service General Technical Report PSW-XXX.

Hammond, Paul and Kenton Chambers. 1985. A new species of *Erythronium* (Liliaceae) from the Coast Range of Oregon. Madrono 32(1):49-56.

Harr, D., Krieger. 1972. Clearcut Logging and Low Flows in Oregon Coastal Watersheds. Oregon State University, School of Forestry, Forest Research Lab, Research Note 54.

Hemstrom, M. and S. Logan. 1986. Plant Association and Management Guide, Siuslaw National Forest. USDA, Forest Service. Pacific Northwest Region Publication No. R6-ECOL 220-1986a.

House, R., V. Crispin, and J.M. Suther. 1991. Habitat and channel changes after rehabilitation of two coastal streams in Oregon. In Fisheries Bioengineering Symposium, American Fisheries Society Symposium 10. Bethesda, Maryland.

Huff, Mark H., Richard S. Holthausen, and Keith B. Aubry. 1992. Habitat Management for Red Tree Voles in Douglas-Fir Forests. USDA, Forest Service General Technical Report PNW-GTR-302, 16pp. Pacific Northwest Research Station, Corvallis, Oregon.

Isaackson, Dennis. 1994. Personal Communication. Oregon Department of Agriculture. Salem, Oregon.

Kentta, R. 1994. Confederated Tribes of Siletz Indians of Oregon. Personal Communication.

Lauman, J., A. Smith and K. Thompson. 1972. Supplement to the Fish and Wildlife Resources of the North Coast Basin, Oregon, and their Water Requirements. April, 1968. A report with recommendations to the Oregon Water Resource Department.

Luoma, Dan. 1982. A description of a plant community supporting abundant *Pleuricospora fimbriolata*. Proceedings of the Oregon Academy of Science, Volume XVIII, Corvallis, Oregon.

Maser, Chris, Bruce R. Mate, Jerry F. Franklin and C.T. Dyrness. 1981. Natural History of Oregon Coast Mammals. USDA, Forest Service General Technical Report PNW-133, 49Y 6pp. Pacific Northwest Forest and Range Experiment Station. Portland, Oregon.

McDonald, C. and S. Schneider. 1992. Nestucca River Basin Water Quality Study - Tillamook and Yamhill Counties, Oregon. USDA, Soil Conservation Service and Forest Service. Manuscript prepared for Tillamook Soil and Water Conservation District.

Miller, Amy and Katie Grenier. 1994. Revegetation Recommendations for FY94. Internal document, Siuslaw National Forest, Corvallis, Oregon.

Moffatt, R., R. Wellman, and J. Gordon. 1990. Statistical Summaries of Streamflow Data in Oregon: Volume 1 -- Monthly and Annual Streamflow, and Flow Duration Values. U.S. Geological Survey Open File Report 90-11B, Portland, Oregon. Prepared in Cooperation with the Oregon Water Resources Board.

Muhn, James and Stuart R. Hanson, September 1988: Opportunity and Challenge, The Story of BLM. USDI, Bureau of Land Management.

Munger, T. 1944. Out of the Ashes of Nestucca - Two Sequels to Oregon's Great Nestucca Fire of a Century Ago. American Forests, Volume 40.

.elson, T.E., et al. 1992. Status of Anadromous Salmonids in Oregon Coastal Basins. Oregon Department of Fish and Wildlife

Nicholas, J.W. and D.G. Hankin. 1988. Chinook Salmon populations in Oregon coastal river basins: descriptions of life histories and assessment of recent trends in run strengths. Oregon Department of Fish and Wildlife. Information Report 88-1.

Nicholls, Jack. 1994. McMinnville Water and Light Department. Personal communication concerning streamflow data and unpublished storage and diversion data from McGuire Reservoir.

Oregon Department of Agriculture. 1994. Noxious Weed Policy and Classification System. Salem, Oregon.

Oregon Department of Environmental Quality. 1988. Oregon Statewide Assessment of Nonpoint Sources of Water Pollution.

Oregon Department of Fish and Wildlife, July 1992 and 1994. Oregon's Elk Management Plan.

Oregon Records Survey Project, Portland Oregon; No.65-1-94-25 April 1940: Inventory of Oregon Tillamook County #29; Federal Works Agency; Works Projects Administration.

Oregon State Parks and Recreation Division. December 1988. Oregon Outdoor Recreation Plan.

Oregon Water Resource Department. 1992. Request for approval of North Umpqua and Nestucca River scenic waterway flows for Diack findings, for Water Resources Commission Approval. Memorandum dated June 5, 1992.

Ralph, C.J., S.K. Nelson, M.M. Shaughnessy, S.L. Miller and T.E. Hamer. 1994. Methods for surveying marbled murrelets on forests: A protocol for land management and research. Pacific Seabird Group Marbled Murrelet Technical Committee.

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

Reiter, M. and R. Beschta. 1994. Patterns of Large Wood and Stream Temperature in Forested Coastal Streams. COPE Report, Volume 7, Number 2 & 3.

Roberts, Kitty. 1990. Pilot Study on Relationships between coarse woody debris and *Pleuricospora fimbriolata* at Grassy Overlook. Unpublished paper, Salem District BLM, Oregon.

Rock, Alexandria. 1949: History of Little Nestucca County.

Runyan, Dean, Associates, Dick Conway & Associates. The Economic Impacts of Travel in Oregon, 17 January 1989. Prepared for the Tourism Division, Oregon Department Development Department.

Spies, T.A., J.F. Franklin and T.B. Thomas. 1988. Coarse Woody Debris in Douglas-fir Forests of Western Oregon and Washington. Ecology. 69:1689-1702.

Spies, T.A. and S.P. Cline 1988. Coarse woody debris in forests and plantations of coastal Oregon. Pages 5-23 in: Maser, C., R.F. Tarrant, J.M.Trappe and J.F. Franklin, eds. From the forest to the sea: A story of fallen trees. General Technical Report PNW-GTR-229. USDA, Forest Service, Pacific Northwest Forest and Range Experiment Station. Portland, Oregon.

State of Oregon. 1963. Chapter 564, Wildflowers. Oregon Revised Statutes. Salem, Oregon.

Swanston, D.N. 1971. Principle Mass Movement Processes Influenced by Logging, Road Building and Fire. In Forest Land Uses and Stream Environment, October 19-21. J.T. Kreiger and J. Hall, Directors, Oregon State University. Corvallis, Oregon.

Swanston, D.N. and F.J. Swanson. 1976. Timber Harvest, Mass Erosion, and Steepland Forest Geomorphology in the Pacific Northwest. In Geomorphology and Engineering. p. 199-221. Donald R. Coates, ed. Dowden, Hutchinson & Ross, Inc. Stroudsberg, Pennsylvania.

ensma, P., J. Rienstra, and M. Yeiter. 1991. Preliminary Reconstruction and Analysis of Change in Forest Stand Age Classes of the Oregon Coast Range From 1850 to 1940. USDI, Bureau of Land Management. Technical Note T/N OR-9.

Teran, Bob. 1994. Personal Communication. Oregon Department of Forestry, Tillamook, Oregon.

Thomas, D.W. 1988. The distribution of bats in different ages of Douglas-fir forests. Journal of Wildlife Management. 52(4):619-626.

Thomson, K., and J. Fortune. 1968. Oregon State Game Commission - Basin Investigations Section. The Fish and Wildlife Resources of the North Coast Basin, Oregon, and their Water Requirements. A report with recommendations to the Oregon State Water Resources Board.

Tillamook Pioneer Association. 1972. Tillamook Memories. 218 pp.

USDA, Forest Service. 1993. Conservation Strategy for *Poa laxiflora*. Siuslaw National Forest. Corvallis, Oregon.

USDA, Forest Service. 1994. The Use of Native and Nonnative Plants on National Forests and Grasslands. Internal memo, Region 6 Policy, Portland, Oregon.

USDA, Forest Service, and USDI, Bureau of Land Management. 1994. Environmental Assessment for the Implementation of Interim Strategies for Managing Anadromous Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, and Portions of California. Washington, D.C.

)I, Bureau of Land Management. 1984. Management Plan for the Nestucca River Area of Critical Environmental Concern. Salem District BLM, Oregon.

USDI, Bureau of Land Management; Oregon State Office. Information Bulletin No. OR-94-410.

U.S. Fish and Wildlife Service, 1986. Recovery Plan for the Pacific Bald Eagle. U.S. Fish and Wildlife Service, Portland, Oregon. 160 pp.

Wald, A.R. 1975. The Impact of Truck Traffic and Road Maintenance on Suspended Sediment Yield from a 14-foot Standard Forest Road. MS thesis, University of Washington, Seattle, Washington. 38 pp.

Washington Forest Practices Board. 1993. Standard Methodology for Conducting Watershed Analysis, Ver. 2.0. Olympia, Washington.

Wellman, R., J. Gordon and R. Moffatt. 1993. Statistical Summaries of Streamflow Data in Oregon: Volume 2 -- Annual Low and High Flow, and Instantaneous Peak Flow. U.S. Geological Survey Open-File Report 90-118. Portland, Oregon. Prepared in cooperation with the Oregon Water Resource Department.

Wemple, B.C. 1994. Assessing the Hydrologic Role of Logging-access Roads in Two Large Forested Basins in the Western Cascades of Oregon. PhD dissertation. Oregon State University, Corvallis, Oregon.

Appendix F

Maps Included With Analysis

Following is a list of the maps for the watershed analysis (11 inch by 17 inch format) which were mailed under separate cover. Larger maps like these and all other maps are maintained in the field offices.

Map #1	Watershed Blocks and Subwatersheds
Map #2	Forest Plan Land Allocations
Map #3	Critical Habitats
Map #4	Owl and Murrelet Reserve Areas
Map #5	Current Seral Stages
Map #6	Major Wildlife Habitat Zones
Map #7	Water Monitoring Sites
Map #8	Perennial and Intermittent Streams
Map #9	Productive Flats and Landslide Areas
Map #10	Interim Riparian Reserves
Map #11	Anadromous Fish Distribution
Map #12	Land Ownership
Map #13	Roads
Map #14	Historic Seral Stage Distribution
Map #15	Projected Seral Stage Distribution

Appendix G

Set of Key Questions to be Answered or Addressed

These are the most important questions that the watershed analysis will attempt to answer. They are intended to focus and drive the analysis.

Soils / Hydro / Water Quality

- What and where are the beneficial uses in the watershed and which of these are sensitive to activities occurring in the watershed?
- How are water quality and beneficial uses being impacted by forest management activities and what steps should be taken to reduce the impacts?
- Are stream temperatures within the range of natural variability and within state water quality standards, and what are the effects on beneficial uses?
- What and where are the impacts producing high levels of fecal coliforms in the lower river?
- What is the range of natural variability for streamflow, sediment levels, and water temperature?
- What and where are the impacts producing fine sediments and what are the effects of this on beneficial uses?
- What impacts are roads having on suspended sediment, streamflow, channel and bank configuration?
- Are channel-altering flows within the range of natural variability and what are the effects on sensitive channel segments?
- What historic disturbance regimes are affecting stream channels?
- Where are the riparian areas that need vegetative treatments to restore them to proper functioning condition?

Wildlife

- What and where are the beneficial uses of wildlife in the watershed?
- What are the species native to the analysis area and what are their population trends and specific threats to population viability, if any?
- What is the range of natural variability for wildlife populations and habitat?
- Are current populations within the range of natural variability?
- How have forest, agricultural and wildlife management activities affected wildlife populations and habitat?
- What impacts are roads having on wildlife and wildlife habitat?
- What historic natural disturbances impacted populations and habitat?
- What habitat conditions are required by the species with declining populations? Within the range of natural variability, how can we best maintain and provide the habitat conditions needed by these species in the short and long term?
  - What are the critical habitats involved?
  - Where are the known sites?
  - What is the current level of habitat fragmentation?
  - What is the current level of interior forest habitat?
  - What is the current level of down woody debris?
  - What is the current snag density and distribution?
  - What is the current stand age/type distribution?

- Where and what are the unique habitat types (i.e., bogs, meadows, talus); what are their benefits; are there any current threats, and how can they best be protected?
- How wide should Riparian Reserves be to protect basic wildlife habitat processes, species/guilds. What functions will they serve?
- What specific areas (stands or subwatersheds) are a priority to consider for active management?
- What types of treatments will be proposed? How much treatment is planned?
- How much should the short-term habitat condition of a stand be compromised for the benefit of meeting long-term habitat objectives?

Fisheries

- What species of fish inhabit the watershed? What is the current status of the important anadromous and resident fish species?
- What are the current condition of the habitats of anadromous and resident fish species relative to the desired future conditions? Where are the important productive flats (low gradient, unconfined stream reaches)?
- Is there evidence that fish habitat conditions have changed from historic conditions?
- Where have management activities and natural processes reduced the large wood supply below natural levels?
- What is the current condition of the riparian zones relative to the desired future conditions?
- Where are fish habitats sensitive to increased stream water temperatures?
- What can be done to adequately protect and restore riparian areas?
- What can be done to restore degraded/declining habitats of anadromous and resident fish species?

Ecology

- What is the relationship of the Nestucca Watershed ecosystem to the surrounding ecosystems?
- What general ecosystem processes, (i.e., climatological factors, nutrient cycling, hydrologic processes) including those outside of the watershed, affect ecological functions in the Nestucca Watershed?
- What is man's past and future influence on the ecosystem?
- How can federal lands be managed to balance ecosystem needs considering current and expected private land management?

Silviculture

- What traditional or new silvicultural prescriptions can be used to achieve wildlife, fisheries, riparian and other desired future conditions in the Nestucca Watershed?
- Where are opportunities for stand manipulation within the next decade?
- What areas are high risk for windthrow?

Recreation

- What are the effects of current and proposed recreation development/use on ecosystem resources?
- Are current recreation-related restrictions adequate to protect ecosystem resources?
- How do various state and federal designations on the Nestucca River affect ecosystem management opportunities in the watershed?
- What management opportunities are there to protect ecosystem resources from unacceptable human impact from recreation?

Roads

- What are the beneficial values of roads in the ecosystem?
- What are the effects of roads on ecosystem processes?
- What are the criteria used in determining whether roads should be built/closed/obliterated on federal lands?
- What road construction/maintenance standards would adequately protect ecosystem values?