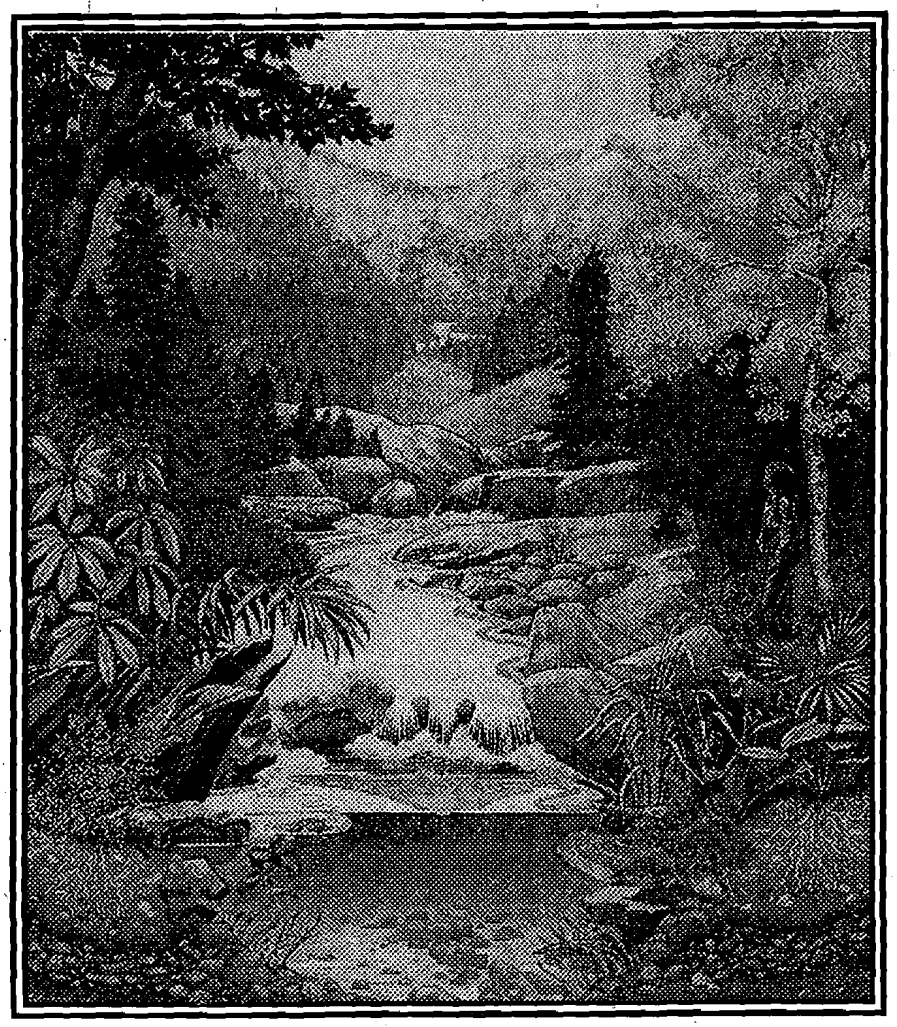
SALMON CREEK



WATERSHED ANALYSIS

* * * * *

WILLAMETTE NATIONAL FOREST
OAKRIDGE RANGER DISTRICT
WESTFIR, OREGON
SEPTEMBER 1996

TABLE OF CONTENTS

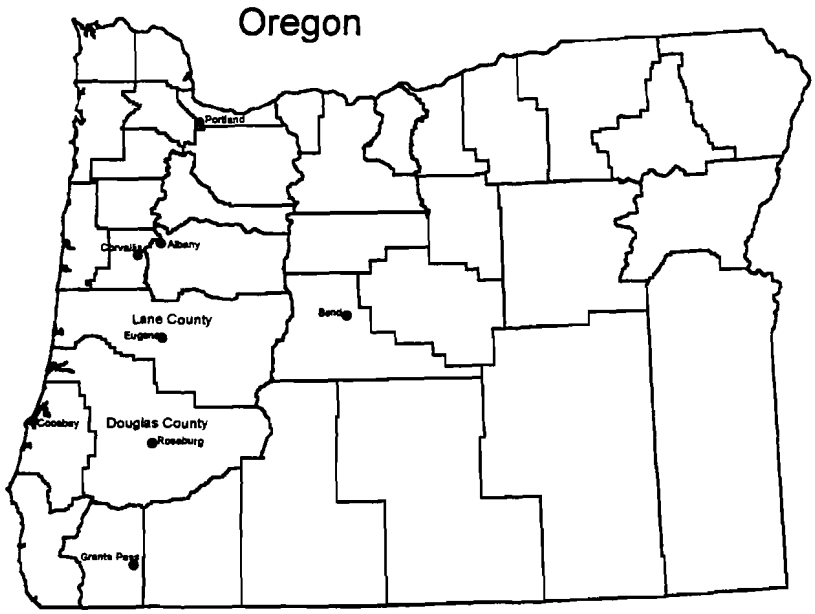
LIST OF FIGURES

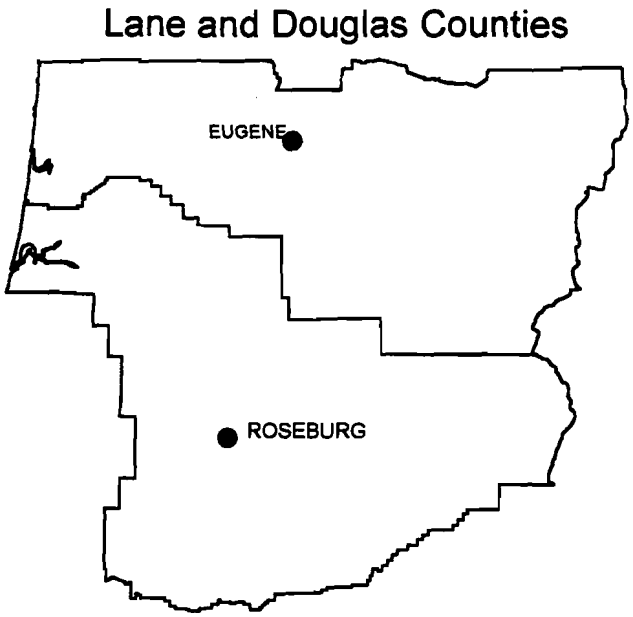
CHAPTER III
REFERENCE / CURRENT CONDITIONS

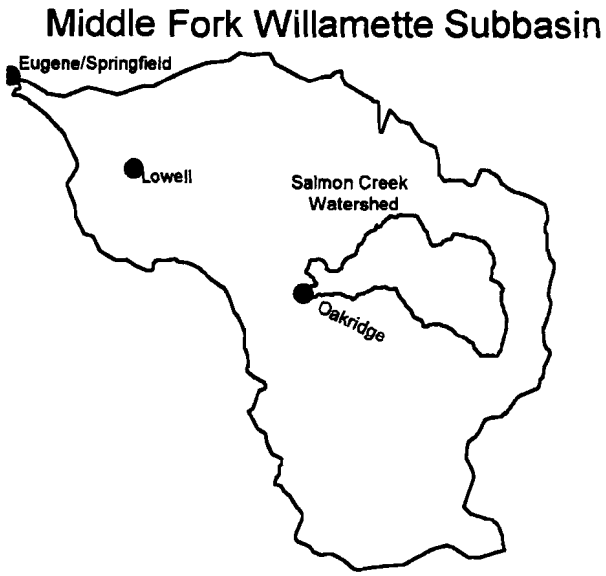
LIST OF TABLES

INTRODUCTION

Figure 1:
Vicinity Map







INTRODUCTION

LOCATION AND LAND OWNERSHIP

The Salmon Creek watershed is located within the Oakridge Ranger District of the Willamette National Forest, approximately 38 air miles (or 44 river miles) from the Eugene/Springfield metropolitan area. It lies immediately upstream from and to the northeast of the City of Oakridge. The watershed consists of one fifth field watershed (Salmon Creek, #18) and three sixth field watersheds (Lower Salmon Creek, 18 1; Black Creek, 18 2; Upper Salmon Creek, 18 3). The Salmon Creek watershed totals 82,432 acres. Approximately 2,049 acres (two percent of the watershed) is privately owned, most of which is used for residential, agricultural, or forestry purposes. The remainder of the watershed is National Forest land.

MANAGEMENT DIRECTION

The Record of Decision for the Final Supplemental Environmental Impact Statement (FEIS) on Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl (USDA, USDI, et. al. 1994a) requires that a watershed analysis be completed for all watersheds on federal lands. The SEIS has become popularly known as the Northwest Forest Plan, and has resulted in the amendment of the Willamette National Forest Land and Resource Management Plan (USDA, 1990). This watershed analysis has been done to comply with this direction and in a larger sense to provide decision-makers with a more comprehensive body of information upon which to base their land management decisions.

DOCUMENT FORMAT

This analysis tells how this watershed came to have the characteristics it has, of the particularly important processes occurring within it, and how management activities have affected landscape processes and patterns in the watershed. The document is comprised of the following components:

- A Characterization chapter that describes the unique or particularly important characteristics of the watershed.
- An Issues and Key Questions chapter that describes the various concerns and opportunities that exist in the management environment. This chapter identifies the questions that need to be answered to better make the many decisions that need to be made now, and in the future.
- A Reference Conditions/Current Conditions chapter that discusses the historical conditions of the watershed and how those conditions have changed over time. This chapter puts into perspective the current condition existing in the watershed, presented in relation to the various relevant resources.
- An Interpretation chapter that explains the differences between historical, current and natural conditions and how those factors affect the our ability to achieve management objectives in this watershed, presented in relation to Issues and Key Questions. This chapter provides answers to the Key Questions.
- A Recommendations chapter that identifies those management activities that could move the system towards reference conditions or management objectives.

This format is based on that presented in "Ecosystem Analysis at the Watershed Scale, (USDA, USDI, revised, August 1995). The presentation of this analysis is essentially linear; one page follows another. The processes and features of this watershed are complex, interact with one-another, and can be generally conceived of as a multi-dimensional entity. Describing such a complex phenomenon as a watershed in a linear format invariably will result in a substantial amount of overlap and/or generalization. For example, water quality can be influenced by a number of very different activities, processes, and underlying structures. While water quality can be considered a physical condition (as opposed to biological), biological processes may have profound influences on the quality of water. We beg the readers' indulgence for the unavoidable repetition of some key concepts and conditions as we attempt to illustrate the three-dimensional nature of this watershed and the complex processes occurring within it.

CHARACTERIZATION

CHAPTER I

CHARACTERIZATION

This section describes the dominant characteristics of the physical, biological, and human aspects of the watershed that are useful in understanding how the processes occurring within the watershed affect its conditions and functions. This chapter describes the unique and particularly important characteristics of the physical, biological, and social aspects of the watershed.

PHYSICAL ENVIRONMENT

GEOLOGICAL FEATURES

The Salmon Creek Watershed Analysis area is 82,432 acres in size. It is located in the transition from the Western Cascades to the High Cascades physiographic subprovince of the Cascade Range. The downstream area from the confluence of Salmon Creek and the Middle Fork Willamette River to the confluence of Salmon and Black Creeks are within the older Western Cascades. From the confluence of Salmon and Black Creeks, bedrock transitions from younger Western Cascades to High Cascades in the uplands.

The bedrock of the older Western Cascades is predominantly pyroclastic (tuffs and breccias) and altered flows and intrusions. Soils range from clay to sand dominated, depending upon whether derived from pyroclastics or flows / intrusions respectively. Several large earthflow landforms exist, most notably on the north side of Salmon Creek from Wall Creek to Mule Creek, the Polallie Creek area and the Warble Creek area. These earthflow features are currently stable on the large scale, but have localized areas of active or potential slope instability, especially in areas where water is concentrated (creeks, draws and swales).

The bedrock of the younger Western Cascades and High Cascades are predominantly unaltered flows and minor intrusions. Soils tend to be sand and cobble dominated. The geomorphology of this area (from the confluence of Black and Salmon Creeks to the uplands) is best characterized as alpine glacial with U-shaped valleys and an abundance of glacial till. Valley sidewalls are steep and prone to debris slides.

HYDROLOGY

Salmon Creek is a major tributary of the Middle Fork of the Willamette River. Surface hydrologic features within the Salmon Creek watershed are composed of an extensive intermittent and perennial stream network, many small seeps and wetlands, and numerous ponds and lakes located primarily in the upper portion of the watershed. The elevation ranges from 1,300 feet near the mouth to 7,200 feet in the upper watershed. Figure 1 of this chapter shows the location of the Subwatersheds within the Salmon Creek watershed.

Structures

The only dam located within the boundaries of the watershed is a relatively small diversion dam utilized to channel water to an Oregon Department of Fish and Wildlife salmon and trout hatchery located near the mouth of Salmon Creek. This dam is currently a barrier to resident salmonids.

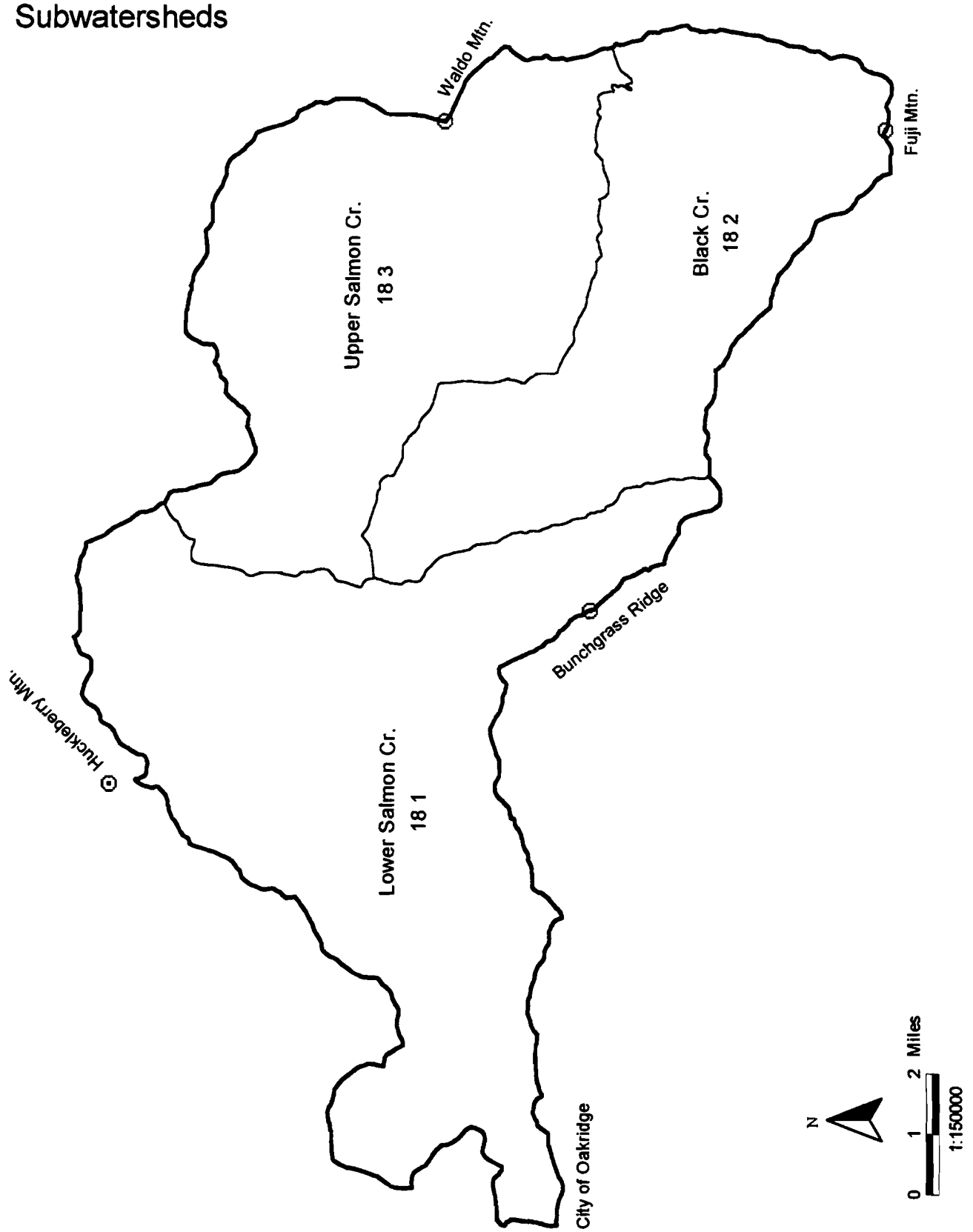
At this time the Salmon Creek watershed has approximately 259 miles of developed roads with 9 major culvert installations and 12 bridge installations. Of the 259 miles of roads, 29 miles are of maintenance level 5 which is assigned to roads that provide a high degree of user comfort and convenience. Normally, these roads are double-lane and paved or single-lane paved with turnouts. 57 miles of this system is of maintenance level 3 which is assigned to roads open and maintained for travel by a prudent driver in a standard passenger car. User comfort and convenience are not considered priorities on level 3 roads. The remaining 173 miles of the system is of maintenance level 2 which is assigned to roads open for use by high clearance vehicles. Passenger car traffic is not a consideration in maintenance of level 2 roads.

Climatic Factors

The watershed has a temperate climate with generally wet cool winters and dry warm summers. Average annual precipitation ranges from about 40 inches in the lower portion of the watershed to approximately 80 inches in the higher elevations. Above 4,000 feet in elevation, the majority of the winter precipitation falls

Figure 1:

Salmon Creek
Subwatersheds



as snow. Between 1,300 and 4,000 feet in elevation, fluctuating weather patterns result in a transient snow pack. Approximately 61 percent of the watershed is considered to be within the transient snow zone.

Streamflow
The lowest flow period during the year is typically August and September. The majority of the runoff occurs between November and May. High flow events generally occur between November and May and usually occur during periods of high rainfall associated with rapid snowmelt (Harr 1981). During the summer months, melting of the seasonal snowpack at high elevations contributes to summer base flows. Timber harvesting and road construction have likely increased the magnitude and frequency of peak stream flows.

Stream Channel Variation
Considerable variation exists in the valley characteristics of the mainstem of Salmon Creek. At the mouth of the watershed, the channel is constrained by levies installed in approximately 1958 to provide flood protection for the City of Oakridge. Lower mainstem stream reaches of Salmon Creek and Black Creek tend to have relatively low gradients except where the channel is highly constrained by valley walls and controlled to a large extent by bedrock (e.g., Salmon Creek Falls). Depositional areas, occurring in the relatively low gradient areas are typically less constrained by valley walls, and the channel displays a higher degree of sinuosity.

Water Quality and Use
The Oregon Department of Environmental Quality (DEQ) has identified beneficial uses for Willamette River tributaries (OAR 340-41-442). Relevant beneficial uses for Salmon Creek include: public domestic water supply, resident fish and aquatic life, fishing, boating, water contact recreation and aesthetic quality.

The primary sources of water pollution along the length of Salmon Creek are considered nonpoint sources. These pollutants originate from diffuse sources rather than a discharge at a single location. The primary nonpoint source problems of concern include elevated levels of sediment and increased stream temperatures. Elevated levels of sediment are often associated with soil erosion from road surfaces and hill slopes where vegetation has been disturbed. Elevated stream temperatures can be attributed to reduced amounts of streamside vegetation, generally from past harvesting prior to establishment of policies requiring retention of riparian vegetation and natural disturbance.

The City of Oakridge relies on wells located near the mouth of Salmon Creek as its primary municipal water supply. A study conducted in 1993 found that there is a potential for surface water from Salmon Creek to influence the City's well field. The estimated surface water contribution to the Oakridge well field within a six month period was estimated to be 60 percent. Surface water withdrawn from Salmon Creek provides a secondary municipal water supply for the City of Oakridge.

The operation of the Oregon Department of Fish and Wildlife hatchery relies on the diversion of high quality water from Salmon Creek. One water quality parameter of particular concern affecting hatchery operations is elevated stream temperatures in Salmon Creek during the summer months. Another is sedimentation.

BIOLOGICAL ENVIRONMENT

VEGETATION
Plant communities in the watershed are diverse and reflect landscape influences, varied soils and landforms, and a wide elevation gradient. Most of the plant associations described by Hemstrom et al. (1987) are represented within this watershed. Forest age classes and structure reflect the influences of wildfire and timber harvesting.

Plant Communities
Approximately 94 percent of the watershed is occupied by coniferous forests ranging in age from several to over 600 years. Other plant community types that are found within the watershed include: herbaceous wetlands (bogs, marshes, and meadows dominated by sedges, rushes, and grasses); hardwood and shrubby wetlands (hardwood marshes and swamps); coniferous wetlands (cottonwood and western red cedar swamps); red alder stands acres (wet and dry types); coniferous-hardwood forests; temperate and high temperate coniferous forests (with lodgepole pine); subalpine forest parks; rock outcrops, talus and talus/shrub communities; Oregon white oak woodland inclusions; and grass and forb dry hillsides. None of

these communities are unique to the province except as mentioned in the following remnant populations section.

Stand Age and Structure
The harvesting which has occurred over the last 55 years has created most of the younger forest age classes but wildfire has had the largest influence of any natural process upon the structure and distribution of vegetation age classes within this watershed.

Approximately 19,641 acres have been regeneration harvested in the last 55 years, leaving approximately 62,783 acres (76%) of the watershed unharvested. Approximately 68,460 acres is vegetated with forests at least 40 years of age. These totals include land allocations available and unavailable for timber management. Very little harvest has occurred in the upper, eastern area of the watershed; which is occupied by the Waldo Lake Wilderness and the Waldo Lake Recreation Area. If the amount of past harvest is applied only to areas outside of non-harvest allocations, about 65 percent of the land available for timber harvest has already been harvested.

Remnant Populations
Though the non-forested areas represent a small portion of this watershed, these areas provide habitat for some relatively uncommon plant communities. Some south-facing rock outcrops support populations of rabbit brush, a shrub that typically grows only on the east side of the Cascades. Some of the rocky meadows on south facing slopes contain stands of Oregon white oak, a species typically found at lower elevations and is quite abundant in the Willamette valley.

Alaska yellow cedar and sub-alpine fir, trees more typically found at much higher latitudes, can occasionally be found on high ridges and north-facing cirque basins. Whitebark pine, typically a sub-alpine and alpine tree, occurs in limited areas within the watershed, generally on the two percent of the watershed above 6500 feet in elevation.

Fire History
Aside from the general climate that provides for the forest growth in this watershed, wildfire is the most dominant natural force shaping the structure and age class distribution of the forest. Over the past two centuries, about 44,000 acres, or 53 percent of the watershed, has been subject to stand replacing, or catastrophic, wildfire. Some of these areas have burned twice in this period. The Waldo fire that burned around 1900 in the Salmon Creek drainage is an example of such an area. Approximately 13 percent of the acreage affected by fire over the last 200 years burned with less severity, retaining small to moderate numbers of trees from the pre-fire stand. Many stands in the watershed also have experienced ground fire with little overstory mortality. It appears that these areas of underburning were extensive and underburning is possibly more frequent than stand replacing fire.

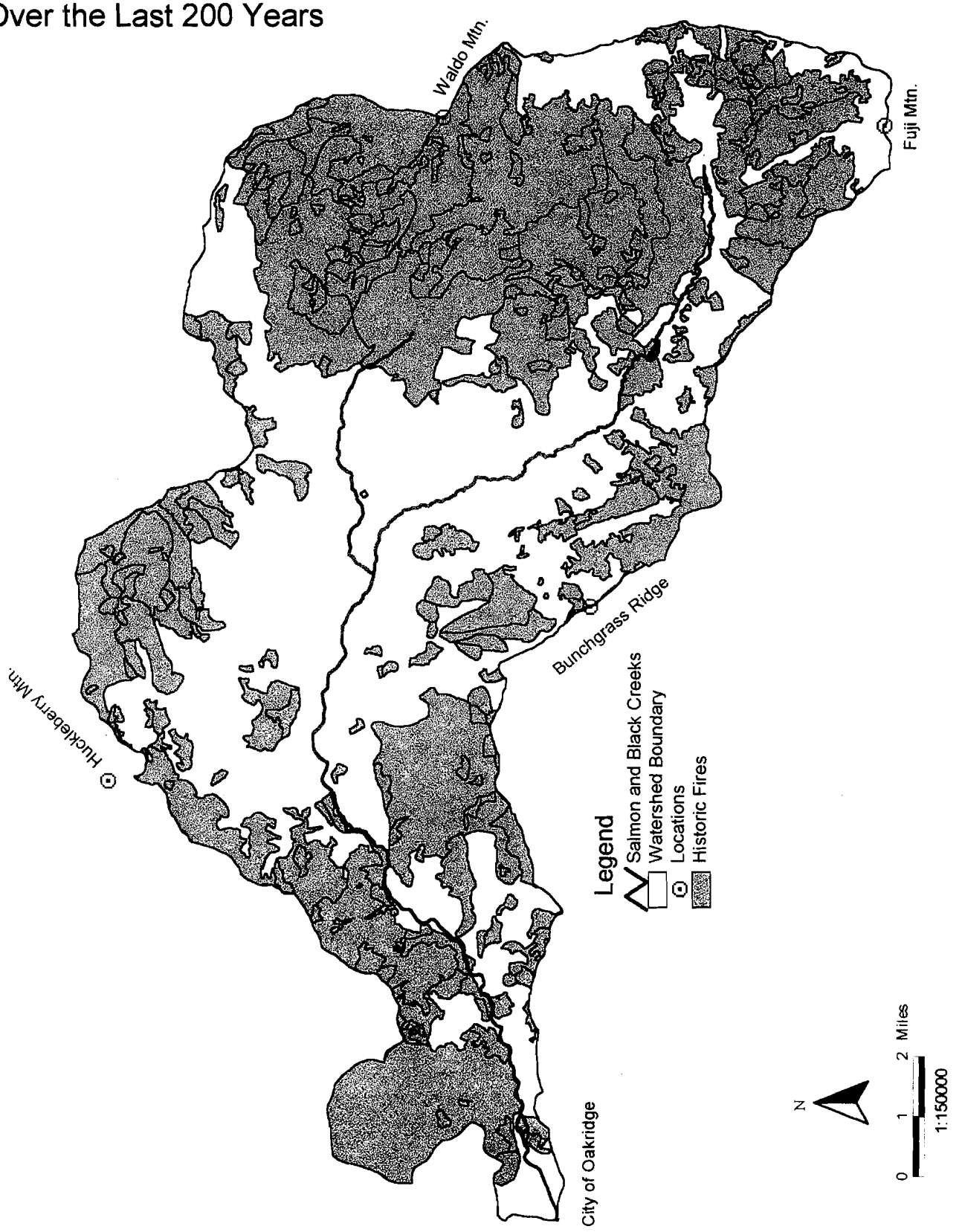
As shown by Figure 2 of this chapter, the wildfire occurrence has not been uniform over the watershed. More than 75 percent of all acres above 5,000 feet in elevation have burned. The center of the watershed has had very little fire activity in the last 200 years. The eastern third of the watershed and the northern third from Salmon Creek to the northern watershed boundary have a fire return interval of 40 to 50 years while the remaining southern one-third from Salmon Creek south to the watershed boundary has an 80 to 100 year fire return interval. Dividing the last 200 years into four 50 year periods shows that during the first 50 year period approximately 21,000 acres burned. During each of the next two periods, at least 12,000 acres burned per period, while during the last 50 year period only a little over 4,000 acres burned, of which more than half can be attributed to the 1991 Warner Creek Fire. Average tree ages in undisturbed areas of Salmon Creek watershed indicate that this area probably experienced very large fires that may have affected most of the watershed at intervals in excess of 370 years.

WILDLIFE SPECIES AND HABITAT

General Terrestrial (Including Spotted Owls and Other Late-Successional Species)
The range of elevation, aspect, slope, and soil types described previously contribute to a wide ranging diversity of wildlife habitat types within this watershed. As described in the Vegetation section, timber harvest and wildfire have contributed greatly to the diversity of stand conditions and stand ages present within the watershed.

Figure 2:
Occurrence of Wildfire
Over the Last 200 Years

Salmon Creek Watershed Analysis



Habitat for northern spotted owls and other late seral dependent species such as northern goshawk, brown creeper, American marten, and red tree vole is found in a variety of stand sizes and configurations throughout the watershed.

Higher elevation areas within the watershed provide habitat for high-elevation associates such as fisher and great gray owls. Mule Mountain and Bunchgrass Ridge provide western extensions of high elevation habitat and link these areas to the High Cascade Plateau in the eastern portion of the watershed. Lower and mid elevation habitat predominates in the remainder of this watershed, and provides important wintering ground for numerous altitudinally migratory wildlife species such as Roosevelt elk.

Appendix A contains a list of species expected to occur within the watershed along with their guild identification. Many of the vertebrate species expected to occur on the Willamette National Forest (327 species of birds, mammals, reptiles and amphibians combined; USDA, 1995) have suitable habitat, and are expected to occur within this watershed. The distribution of these species and their aggregation into communities vary with the distribution of plant communities, vegetational condition, and climatic conditions across the landscape.

Federally listed threatened or endangered species known to occupy habitat within this watershed include northern bald eagle, American peregrine falcon, and northern spotted owl. In addition, notable terrestrial species listed as sensitive by Oregon Department of Fish and Wildlife, candidates for Federal listing, or ROD and J2 wildlife species of concern (USDA, USDI, 1994b) that have been documented (indicated by a "D" after the species in the following species list) or that have potentially suitable habitat within this watershed include: great gray owl (D), flammulated owl, northern goshawk (D), harlequin duck (D), common merganser (D), black-backed and three-toed (D) woodpeckers, American marten, fisher (D), California wolverine, Pacific western big-eared bat (D), and red tree vole.

Aquatic Habitat

Reports made during 1938 stream surveys indicate that Salmon Creek had some of the best spawning habitat in the Middle Fork of the Willamette and its tributaries at that time. Those native to this area claim that Salmon Creek Falls (located approximately 5 miles above the confluence with the Middle Fork of the Willamette) was passable to salmon during the high flows of late spring, but was impassable during the low flows of summer.

In many Salmon Creek tributaries, however, waterfalls do create year-round upstream migration barriers for fish. In addition to these natural barriers, numerous road/stream crossing culverts were installed in a manner that creates additional barriers to the upstream migration of fish and have resulted in isolated resident populations of fish in some of these tributaries.

Habitat complexity in streams and localized stream bank stability has in many areas been reduced below natural levels due to removal of in-channel large woody material in the past.

Significant diversity exists in the numerous lakes and ponds that are mostly located in or adjacent to wilderness areas. The majority of the lakes within the watershed can be categorized as being either oligotrophic or ultraoligotrophic. These classifications mean the lakes have low to very low concentrations of nutrients in the water and low organic production.

Fish

Salmon Creek historically supported runs of spring chinook salmon. Migration was blocked in the 1950's with the construction of Lookout and Dexter dams on the Middle Fork of the Willamette, downstream from Oakridge. Bull trout are believed to have inhabited the watershed but there have been no official sightings in recent years (although an angler reported catching a bull trout in the summer of 1995). Bull trout numbers are thought to have declined in this watershed due to a lack of an anadromous fish prey base, dam construction, and habitat decline.

The Salmon Creek watershed contains a variety of aquatic species. Wild populations of cutthroat and rainbow trout exist throughout the watershed. Although brook trout have been stocked in many of the high lakes in this watershed, none have been observed in the main stem of Salmon Creek or Black Creek. Brook trout were, however, observed in the upper reaches of Mule Creek and Wall Creek.

The Salmon Creek watershed contains several lakes, located primarily in wilderness areas. Many of these lakes were originally fishless. Most of the larger wilderness lakes have been stocked with fish species such as Rainbow trout, cutthroat trout, and brook trout and many have naturally reproducing populations. The introduction of fish to naturally fishless lakes in the North Cascades in Washington has been shown to affect amphibian, macroinvertebrate, and zooplankton populations (Liss, 1991). It is possible that similar results have occurred in the Salmon Creek watershed. These effects may be due to competition for food or due to the fact that these organisms are often prey for introduced fish species.

The lower reaches of the mainstem of Salmon Creek between the Fish Hatchery Road bridge and the confluence with Black Creek are stocked with rainbow trout.

There is potential for the reintroduction of spring chinook and bull trout into this watershed if a method can be developed to capture and transport migrating juveniles downstream where they could be released below Lookout and Dexter dams. The low summer water temperatures of the upper Salmon Creek watershed would be suitable for the reintroduction of bull trout.

Amphibians
There are several sensitive amphibian species located in the Salmon Creek watershed, including the tailed frog, the red-legged frog, the cascade frog, the Oregon slender salamander, and the western toad.

Macroinvertebrates
There is not much information available on the macroinvertebrate species occurring in much of the watershed, however, several sensitive species of aquatic insects are known to occur on the Willamette National Forest.

SOCIAL ASPECTS

MANAGEMENT HISTORY
The Salmon Creek watershed has been visited by people for perhaps 10,000 years. Historic, archaeological and paleoclimatic research in the watershed suggests that people adapted to changing conditions and influenced the development of their environment, especially over the last 150 years.

Native Americans
At the time of European exploration, at least three tribes are thought to have used the Salmon Creek watershed. The Molala are believed to have had winter villages in the Oakridge/High Prairie area and, with the Kalapuya of the Willamette Valley, to have seasonally visited the higher elevations of the watershed. In later times, possibly after the arrival of the horse, the Klamath made trips into the area on their way to the Willamette Valley to trade.

Over 40 archaeological sites representing seasonal base camps and campsites of a more temporary nature have been found in the Salmon Creek watershed to date. The majority of these sites are located in lower elevation terraces or meadows and prairies which were much more extensive before Euro-American settlement.

There is good evidence from General Land Office survey plats, explorer's journals and tribal oral history that fire was used as a tool to maintain a more open landscape. Both prairie fires and underburning were techniques used to hunt game and to ensure the return of berries, roots, and other important plants.

The local tribes were nearly decimated by the epidemic diseases and social dislocation that followed the arrival of fur trappers, explorers, and settlers between 1790 and 1840. A few well-known Molala, especially Charlie Tufti and Jim Chuck Chuck, remained in the Oakridge area and shared their skills with the new settlers. Many of the descendants of local tribes are currently part of the Siletz, Grande Ronde, Warm Springs, and Klamath reservations.

The Homestead Era
The majority of early settlement in the Oakridge area was along the main stem of the Middle Fork Willamette River. A few homesteads were claimed on the lower portions of Salmon Creek near Oakridge. No mining claims were made in the watershed.

Beginning in 1914, the Forest Service permitted grazing allotments in the Salmon Creek watershed for cattle and sheep. Animals were trailed up Salmon Creek to allotments at Blair Lake and the prairies leading into the Waldo Wilderness.

Administrative History
In 1891, Congress gave the President the power to create forest reserves from public domain. In 1897, Congress passed the Organic Administration Act which provided for the administration of the reserves, including controlling forest fires. The early Forest Service embarked on a ground patrol system of fire detection in the early 1900's, using rangers on horseback covering a system of trails and vantage points connected to ranger stations by telephone lines. In the Salmon Creek watershed, lookout sites or stations were established on Mule Mountain, Waldo Mountain and Fuji Mountain.

In 1908, the Flat Creek administrative site was withdrawn and a ranger station constructed between 1910 and 1918. The complex was expanded from 1924 to 1936 to include a warehouse, barn, residences, and a gas and oil house. The complex has since been modernized.

A system of trails was constructed which accelerated greatly with the advent of the Civilian Conservation Corps, from 1933 to 1942. This labor force made possible the construction of a system of trails and bridges with shelters, guard stations, lookout towers and associated buildings, as well as ranger stations. The Oakridge CCC Camp was located to the south of Salmon Creek and west of the Fish Hatchery. Their projects included development of the Salmon Creek Falls Campground and construction of the Salmon Creek Ranger Station at the junction of the present day Fish Hatchery Road and Forest Road 24.

Forest Management
Commercial logging within the watershed began with the construction of the Davis-Weber sawmill in 1920. From 1920 through 1924, about 328 acres were logged in the lower portion of the watershed.

CURRENT MANAGEMENT DIRECTION

The Willamette National Forest Land and Resource Management Plan (USDA, 1990) prescribes land uses by assigning various Management Area designations to land within the Forest. The Salmon Creek watershed contains 23 management areas (Table 1 and Figure 3 of this chapter). Late-Successional Reserve RO220 Assessment also provides specific management direction for portions of this watershed.

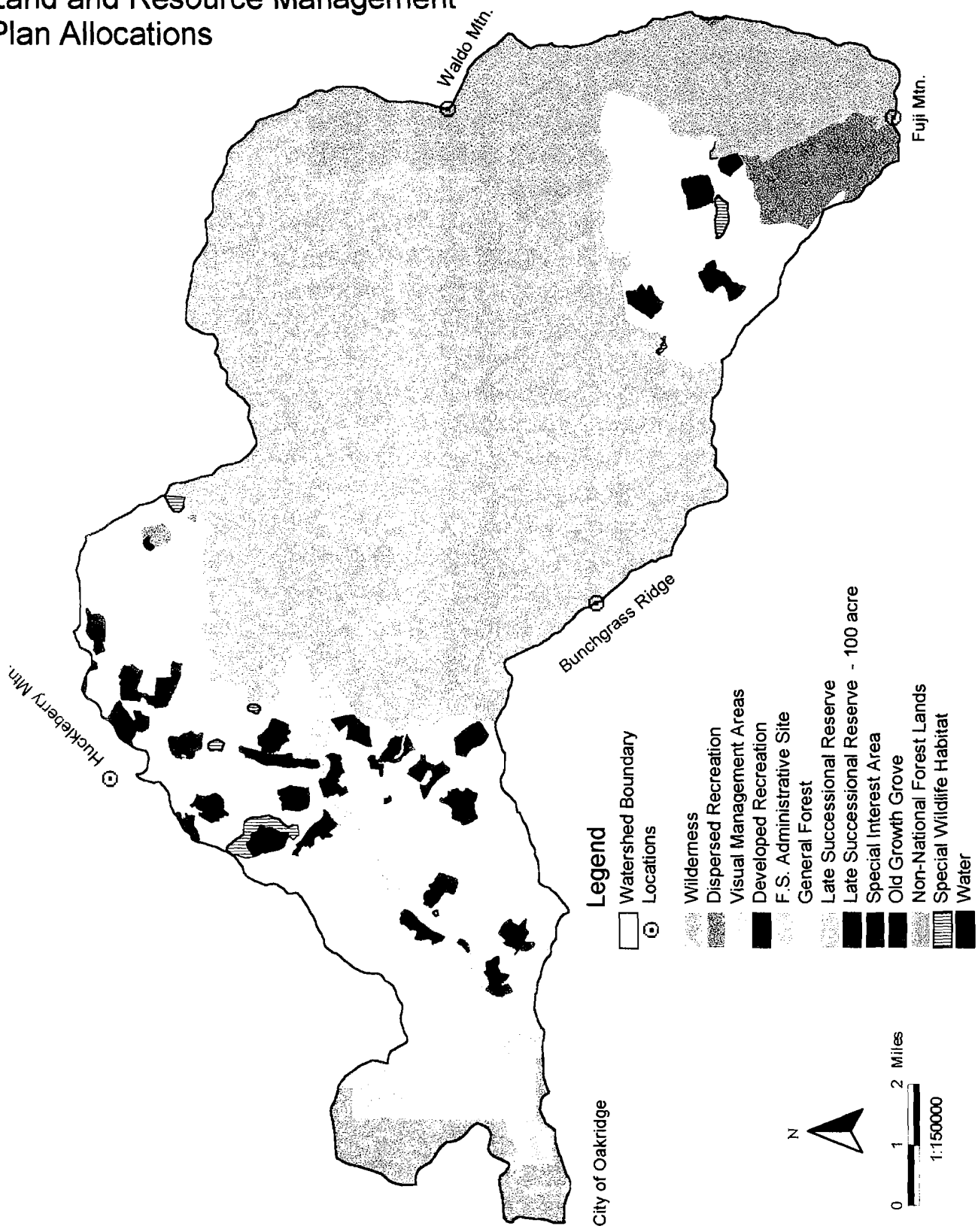
Table 1: Ownership Pattern and Willamette National Forest Plan Management Areas as Amended

Management Area	Description	Acres	Percentage
1	Wilderness	11,051	13
5a	Special Interest Area	9	<1
7	Old-Growth Grove	149	<1
9d	Special Wildlife Habitat Area	366	<1
10e	Dispersed Recreation - Semi primitive	1,839	2
10f	Dispersed Recreation - Lakeside setting	102	<1
11c	Scenic, Partial Retention Middleground	309	<1
11d	Scenic, Partial Retention Foreground	754	1
11e	Scenic, Retention Middleground	979	1
12a	Developed Recreation - Forest Service Site	32	<1
13a	Special Use Permit Areas	89	<1
13b	Forest Service Administrative Use Areas	6	<1
14a	General Forest - Intensive Forest Management	15,027	18
15-1	Class I Riparian Reserve	1,394	2
15-2	Class II Riparian Reserve	1,730	2
15-3	Class III Riparian Reserve	1,367	2
15-4	Class IV Riparian Reserve	3,201	4
15-L	Lake Riparian Reserve	396	<1
15-WSH	Wet Special Habitat Riparian Reserve	100	<1
16a	Late-Successional Reserve	38,884	47
16b	Late-Successional Reserve - 100 acre	3,052	4
8000	Private Land not in Riparian Reserve	1,592	2
WA	Major Water Bodies	4	<1

Total Acres in watershed = 82,432

Figure 3: Salmon Creek Watershed Analysis

1990 Willamette National Forest
Land and Resource Management
Plan Allocations



RECREATION EXPERIENCES

Scenic Values

The scenic resources of the Salmon Creek valley are shaped by ongoing geological and biological processes. The lower elevations are characterized by relatively steep, densely forested canyon walls, a diversity of managed and old-growth Douglas-fir stands, and riparian and wetland vegetation. As the visitor ascends by forest roads, the vista opens onto a flat, glaciated valley where dispersed camping is popular. Continuing up Furnish and Black Creeks, one climbs from the old Western Cascades geologic province to the High Cascades landscape of rolling terrain, mantled by pumice and ash. Punctuated by views of volcanic features, this landscape is generally forested with Pacific silver fir and mountain hemlock stands.

The Willamette Forest Plan Visual Quality Objective for the lower portions of the watershed adjacent to Salmon Creek is Partial Retention foreground.

Among the special places of scenic interest in the watershed are the gorge and falls through the area of the Salmon Creek Falls Campground, the Wall Creek Warm Springs, and Joe Goddard's Grove, a group of exceptionally large trees in the Black Creek drainage. The upper Salmon Creek watershed contains several trailheads accessing the Waldo Lake basin. Expansive scenic views of the Waldo Wilderness area exist from Waldo Mountain lookout and Fuji Mountain.

Developed Recreation

Only two campgrounds have been developed within the watershed. Salmon Creek Falls and Blair Lake campgrounds are both popular with local people, especially anglers. Salmon Creek Falls is also a popular day use destination, and use is predicted to increase as the Salmon Creek trail system becomes more well-known. Light motor vehicle traffic on the fourteen miles of paved road along Salmon Creek encourages moderate bicycle use.

The Trail System

Located adjacent to the Oakridge community, the Warrior (fitness) trail and Salmon Creek trail system is heavily used by walkers, joggers, and mountain bikers. Accessible from the rest stop area on Highway 58, this trail system is being cooperatively developed by the Forest Service, State of Oregon, and City of Oakridge.

The most popular trails for hiking, mountain biking and horseback riding are the Eugene to Crest trail and the Black Creek trail. About 75% of the equestrian users access the wilderness trails via Skookum Campground and Harrelson Horse Camps. The Blair Lake trail system is located along a series of prairies which provide excellent elk habitat. This trail receives the most use during the hunting season, as does the upper Black Creek trail system, especially in the area of Deer Camp. The Salmon Lakes trail, which accesses the Waldo Lake Wilderness, is very popular with hikers and anglers.

Dispersed Camping

The majority of the dispersed camp sites are located along Salmon and Black Creek because they offer easy road access and proximity to the river. The use is most concentrated in the lower portion of Salmon Creek, especially during hunting season.

The Waldo Lake Wilderness area provides numerous primitive camp sites, concentrated mainly at Salmon, Gander, and Swan Lakes.

Swimming and Boating

Swimming holes in lower Salmon Creek and the higher elevation lakes are used for swimming. There is currently some kayak and small raft use on lower Salmon Creek in the Spring.

Hunting and Fishing

The watershed is very popular with both elk and deer hunters, and the majority of use at dispersed sites takes place during the hunting season. Salmon Creek receives use mainly by local anglers, who take mainly hatchery-stocked rainbow trout.

COMMUNITY-BASED RECREATION AND RELATED ECONOMIC BENEFITS

Surrounded by forest lands, the community of Oakridge is heavily reliant on recreation and extractive resources for its economic base. Since World War II, the Forest Service has played an increasingly important role in community planning and development.

Community-Based Recreation

People in Oakridge use the forest for recreation, especially hunting and fishing. Hunting still retains the character of a subsistence activity for many people in this community.

The Salmon Creek watershed has the potential to provide the setting for increased recreation use. The Warrior/Salmon Creek trail system ties directly into the community and visitor use through the Highway 58 rest area. The area has been used since 1991 by the Fat Tire Festival, a mountain biking event which drew 500 participants in 1995.

Firewood

Firewood was the major source of heating fuel in local communities prior to rural electrification. It persisted as a major source in timber dependent communities such as Oakridge until the 1970's, when air pollution became an issue. A booming timber industry allowed for an ample supply of log decks where firewood could easily be obtained for very small fees.

Since the 1970's, more efficient wood stoves and pellet stoves, as well as the increasing availability of natural gas in the Eugene-Springfield area have reduced the demand for firewood. With reduced timber harvests in the 1990's, suitable log decks have become scarce, and any sizable area of timber blowdown is reserved for commercial salvage sales. Areas that have been administratively or Congressionally withdrawn place additional constraints on the availability of firewood. In the current year, two thirds of the permits issued by the Oakridge Ranger District were for the Deschutes National Forest, where firewood is more plentiful. Only portions of the lower Salmon Creek watershed are available for firewood collection. Permits for single logs, found by the permittee, comprise the majority of the wood permits issued. In the past year, only 34 of the 103 firewood permits issued on the Oakridge Ranger District were for the Salmon Creek watershed area. The majority are issued for the North Fork of the Middle Fork of the Willamette watershed, to the north. Over 80 percent of these permittees are residents of the Oakridge/Westfir community.

Special Forest Products

Special forest products such as ferns, boughs, beargrass, salal, and other plants are commercially extracted from the watershed. Huckleberries have the potential to become a more important product in the future.

Source of Raw Materials and Jobs

Traditionally, local people have worked in the woods as loggers and truck drivers, and in the sawmills and related businesses. Timber harvesting in this watershed helped supply the Pope and Talbot Mill that existed in Oakridge from the 1940's until it closed in 1989. The Pope and Talbot mill site is currently owned by the City of Oakridge. The industrial site has received some environmental clean up and is now the site of several secondary wood products businesses, with more development planned.

An average of 28 million board feet of timber has been harvested per year since logging began in this watershed, about 55 years ago. A grand total of about 1.6 billion board feet has been harvested to produce lumber and plywood products from this watershed. This timber harvesting and associated mill processing created many jobs over the years, as further discussed in the FEIS for the Willamette National Forest Plan on pages III-213 to 235.

As the supply of timber from National Forest lands declined in the 1990's, tourism and special forest products have played a more important role in the local economy. However, Oakridge is still home to a number of people who make their living cutting, yarding or hauling trees, or working for the Forest Service.

ISSUES/

KEY QUESTIONS

CHAPTER II

ISSUES AND KEY QUESTIONS

INTRODUCTION

The main purpose of this Watershed Analysis is to facilitate, direct, and support management activities and decisions by providing decision makers with current resource information and a priority listing of various potential management activities. Therefore, the issues identified in this Watershed Analysis are focused on past, current, and expected future management activities and how they affect the current and reference conditions. Individuals using this analysis during project development should find it to be user-friendly. They will be able to find direct references to the activities they are contemplating rather than having to sort through a number of resource discussions to find references to the activities in question.

Key questions have been developed for each issue. These are questions that need to be answered in order to understand how human activities may affect the processes occurring in the watershed. They are also those questions which most need to be answered in order for decision-makers to make fully informed decisions about current and proposed management and social activities in this watershed.

Key questions are answered in the last two chapters of this analysis: Interpretation and Recommendations. These conclusions are a synthesis, by issue, of the Reference/Current Conditions (Chapter III.) and the answers to the Key Questions.

ISSUE #1* - *INTENSITY AND PATTERN OF VEGETATION MANIPULATION RELATED ACTIVITIES

Timber harvest and associated activities such as slash disposal, reforestation, and precommercial thinning have played a significant role in shaping the vegetation patterns within this watershed, since fire suppression began near the beginning of this century (see Issue 2). Timber harvest for lumber production has been occurring in this watershed for about 55 years on federal land and for over 100 years on private land. This has resulted in a substantial economic benefit to local communities and the nation as a whole. Wildlife forage enhancement activities, such as brush cut-back, seeding, and fertilizing have also played a role, but to a lesser extent.

The intensity of vegetation manipulation activities, especially timber harvest, may be considerably outside the historic range of conditions which would have resulted from wildfires. The amount of stand replacement due to regeneration harvest over the past 55 years has been 29,843 acres, or 36 percent. This amount has ranged from 465 acres to 10,000 acres per decade. The amount of stand replacement due to wildfire in the last 200 years has been 53 percent, ranging from 5 acres to 13,000 acres per decade (the 5 acre decade occurred after fire suppression became standard practice). Continuation of past harvest intensities could ultimately result in low amounts of late-successional (80 years and older) forest at any given time in certain areas within the watershed and could result in eliminating late-successional forests on all but those acres reserved from harvest (such as wilderness and other non-harvest allocations and reserves).

The intensity of application of vegetation management activities (again, especially timber harvest) may have also had an effect on hydrological processes. Such effects may include increases in surface erosion, mass movement rates, peak stream flows, water quality, and water yield. Another effect has been the deterioration of stream channel conditions.

The pattern of vegetation manipulation activities across the landscape, especially harvest of timber, has resulted in fragmentation of late-successional forests, isolation and/or removal of riparian forests, a reduction in connectivity, and a net reduction of late-successional forest due to edge effects. These changes may have had a profound effect on the amount and quality of interior habitat and the dispersal of native and non-native plants and animals across the landscape. They have also created a pattern that is not natural, except on acres reserved from harvest.

Timber harvesting and associated activities have also reduced the bio-diversity and site productivity of the replacement stands and riparian areas of some harvest units. Most or all the large woody debris has been removed from some harvested stands. Regenerated stands were often planted densely to avoid reforestation failure. They were also typically planted with fewer species than occurred on the sites prior to

harvest. Precommercial and commercial thinning have tended to homogenize stands by making the tree spacing, diameter, and species distribution more uniform. Where late-successional forests still exist, some have been salvaged leaving few snags and down logs on the ground or in streams. Certain species, such as Pacific yew, were removed, resulting in replacement stands with less vertical structure and species diversity than natural stands tend to have.

ISSUE #1 KEY QUESTIONS

1) Given current land allocations in the Willamette Forest Plan, as amended by the Northwest Forest Plan, what is the location and acreage of areas that are available for regeneration harvest for the next two decades and for commercial thinning, by decade, for the next 50 years?

2) How has the intensity and pattern of vegetation manipulation affected native and non-native plant and animal habitat diversity, species composition, guild viability, amount of interior habitat, and habitat connectivity?

3) How has the intensity and pattern of vegetation manipulation affected trails, recreation, aesthetics, special forest products, and firewood availability?

4) Where and to what extent has the change in spatial and temporal distribution of vegetation influenced the potential for water yield, water quality (especially water temperature), and peak flow changes?

5) What are the most important delivery mechanisms for sediment generated by vegetative manipulation in this watershed? What are relative amounts of sediment delivery to streams by these mechanisms? Where are the high risk areas?

6) Where and to what extent has removal of existing and future sources of large wood material in stream channels affected in-stream habitat condition? Where and to what extent has vegetation manipulation affected channel function and riparian habitat condition and its contiguity?

7) How have our vegetation management practices affected the Salmon Creek Fish Hatchery and the City of Oakridge emergency and secondary water supplies?

8) How will we protect small wetlands, seeps, and springs from management activities?

ISSUE #2 - THE EXCLUSION OF NATURAL FIRE FROM THE ECOSYSTEM HAS ALTERED THE NATURAL PROCESSES

Fire suppression, over the last seven decades, has reduced the impact of wildfire as a major shaper of vegetational landscape patterns and processes.

Given the amount of land affected by fire over the last few centuries (see the fire frequency discussion under Issue #1), this suppression effort may have had a number of vegetational effects across the landscape. For example, meadow sizes and abundance have been shrinking as trees encroach upon them; forest structure may have become more complex in some areas; the landscape distribution of natural forest age classes may have become less diverse in some areas; populations of some fire dependent species may have declined (such as lodgepole pine, *Montia diffusa*, and *Astragalus spp.*); and fuel loading across the landscape may have increased in some areas. However, as described in Issue #1, other areas have been treated to reduce fuel loading.

Continued fire exclusion in this watershed could have several negative consequences on long-term landscape processes. Increasing fuel accumulations may ultimately result in fires that are more frequent, more severe, larger, and less suppressible. Continued fire exclusion may result in an increase in insect and/or disease outbreaks on harsher sites where dense stands may develop in the absence of fire. It could also result in positive changes in long-term site productivity as more organic material accumulates, and negative changes as fires burn more intensely.

Fire exclusion may have increased the habitat available for threatened, endangered, and sensitive (TE&S) species such as spotted owls as forests become more structurally complex in terms of understory layers and snag and down wood accumulation. However, increasing fuel accumulations may be of special concern

within the Late-successional Reserve (LSR), where there is much less opportunity for vegetation management activities to modify fuel accumulations and where there are or will be more contiguous fuel beds accumulating, which could lead to larger and more severe wildfires in the LSR.

ISSUE #2 KEY QUESTIONS

1) Fire pattern, fire behavior, and burn intensity are affected by fuel loading conditions. How do current conditions compare to fuel loading conditions before the advent of fire suppression? What areas are at high risk?

2) If we utilize prescribed fire within established forest stands (as opposed to post-harvest site preparation) in order to reduce high fuel loading and bring the landscape back to the reference condition, under what conditions could we control the fire? How many acres (per period of time and allocation) and under what conditions could we prescribed burn and still remain within air quality limits, and where are the high priority areas?

3) Under a reference condition fire regime, what would the habitat diversity look like? Where could prescribed fire help us to re-establish or maintain the reference condition?

4) How would prescribed fire affect TE&S and ROD species habitat, fire dependent plant species, big game habitat, and aquatic species habitat?

ISSUE #3 - THE DENSITY, CONDITION, USE, AND LOCATION OF ROAD AND TRAILS HAS ALTERED THE LANDSCAPE PROCESSES AND INFLUENCED WILDLIFE HABITATS

This watershed currently contains 270 miles of system and non-system roads and approximately 55 miles of maintained trails. About 35 miles of these roads are seasonally closed for a variety of reasons, most commonly to avoid traffic related wildlife disturbance, although some of these roads are used occasionally for administrative use, e.g., fire suppression. Approximately 4 additional miles of road are closed year around. This extensive road system is for the most part a direct result of past timber harvest as discussed in Issue #1. The system also provides access for recreational activities as well as administrative uses such as fire suppression. The roads in this system were generally designed for a 20 year service life. Roads that have reached their 20 year service life and have not been reconstructed are beginning to deteriorate. There are about 11 miles of non-system road that do not meet current standards for management.

Roads can result in increased peak flows as a result of vegetation removal, as with timber harvest (see Issue #1). Roads also increase peak flow by providing for more efficient slope drainage. Roads may increase the amount of mass movement and magnitude of peak stream flow because they often intercept and re-direct the surface and sub-surface flow of water.

Effects on wildlife and plants include elimination or creation of wetlands or a change in the hydrologic character of special habitats (for example the drainage of a moist meadow). Roads can also affect the connectivity of habitats. They fragment habitat for organisms that find it difficult to cross small bare openings and for organisms that find stream culverts impassable. Road and trail use has the potential to disturb wildlife and affect species viability. Roads and trails can be a vector for the spread of non-native plants.

An extensive road system can have beneficial impacts by providing access to large areas for various recreational activities such as hunting, fishing, dispersed camping, hiking, mountain biking, and driving for pleasure. Road closures can limit these opportunities and concentrate use in areas with more open roads, which could create resource problems. Local economies can be positively or negatively affected by changing the amount and ease of access, changing traffic patterns, recreational uses, and the availability of firewood and special forest products.

A portion of the road system is deteriorating and funds are no longer available for proper maintenance of the entire road system. Roads that are not properly maintained can cause sediment delivery to streams as a result of ditch and roadbed erosion. Maintenance needs, including culvert upgrading, need to be prioritized to most effectively make use of the limited maintenance funds. The Northwest Forest Plan standards and guidelines require existing culverts, bridges, and other stream crossing structures which pose a substantial risk to riparian conditions to be improved to accommodate at least a 100 year flood event. Many stream

crossing structures do not meet this design criteria and correcting this situation would entail a substantial cost that is not now funded.

Recovery and growth of riparian vegetation immediately upstream from bridges and large culverts could result in the accumulation of large amounts of woody debris. This could ultimately threaten the stream crossing structure as well as down-stream resources.

ISSUE #3 KEY QUESTIONS

(ROADS - system and non-system)

1) Where has the density, condition, location, and use of roads influenced natural and management induced disturbance (i.e. landslides, surface erosion, slope movement)?

2) Where and to what extent have the presence, patterns, and use of roads and trails affected native and non-native plant and animal habitat diversity, species composition, guild viability, amount of interior habitat, habitat connectivity, and riparian reserves?

3) Where has the density and location of roads affected hydrological function (i.e. wetlands, expansion of the drainage network, and streamflows)?

4) What are the potential resource effects of not maintaining all the roads in this road system due to lack of funding?

5) Where are the high risk or high priority road/stream crossings which do not have drainage structures designed to withstand 100 year events?

(ACCESS)

6) How does changed access influence the potential for human caused fire ignitions, suppression response time, and the amount of acres burned?

7) How does changed access, including abandoned trails and historic sites, affect public and administrative use of the forest?

ISSUE #4 - AQUATIC COMMUNITIES MAY HAVE BEEN CHANGED FROM REFERENCE CONDITIONS DUE TO THE INTRODUCTION OF NON-NATIVE SPECIES

The introduction of fish to naturally fishless lakes may have effects on naturally occurring populations of amphibians and aquatic insects through competition and predation. Introductions of other non-native species such as bull frogs have also had effects on the native aquatic species.

Restoration of salmon, steelhead trout, and bull trout runs could also create some negative effects such as increased recreational impact in riparian areas and conflict between river users (specifically kayak and raft users) and in-channel structures.

ISSUE #4 KEY QUESTION

1) What are the effects of introduction of non-native species on native aquatic communities?

ISSUE #5 - THE DIVERSION DAM FOR THE WILLAMETTE FISH HATCHERY HAS THE POTENTIAL TO FAIL, WHICH IN TURN, COULD DISRUPT OPERATIONS AT THE FISH HATCHERY

The Fish Hatchery diversion dam is being undercut by Salmon Creek. Construction of a new diversion dam is scheduled to begin in the summer of 1996. The existing diversion is a barrier to resident fish populations.

ISSUE #5 KEY QUESTION

1) Should the new diversion dam be equipped with a fish passage structure?

ISSUE #6 - THERE IS A CONCERN FOR PROTECTION OF WATER QUALITY FOR THE OAKRIDGE MUNICIPAL WATER SUPPLIES AND THE WILLAMETTE FISH HATCHERY

Salmon Creek and its associated ground water areas are important sources of water for the City of Oakridge and the Willamette Fish Hatchery. Administrative facilities, recreational facilities, and management activities in the Salmon Creek watershed that could decrease surface and ground water quality are of a concern.

ISSUE #6 KEY QUESTIONS

1) What facilities and management activities could potentially contaminate the Oakridge Municipal wells, the emergency municipal water source (Salmon Creek) and Willamette Fish Hatchery water sources?

2) Do administrative and recreational facilities affect water quality?