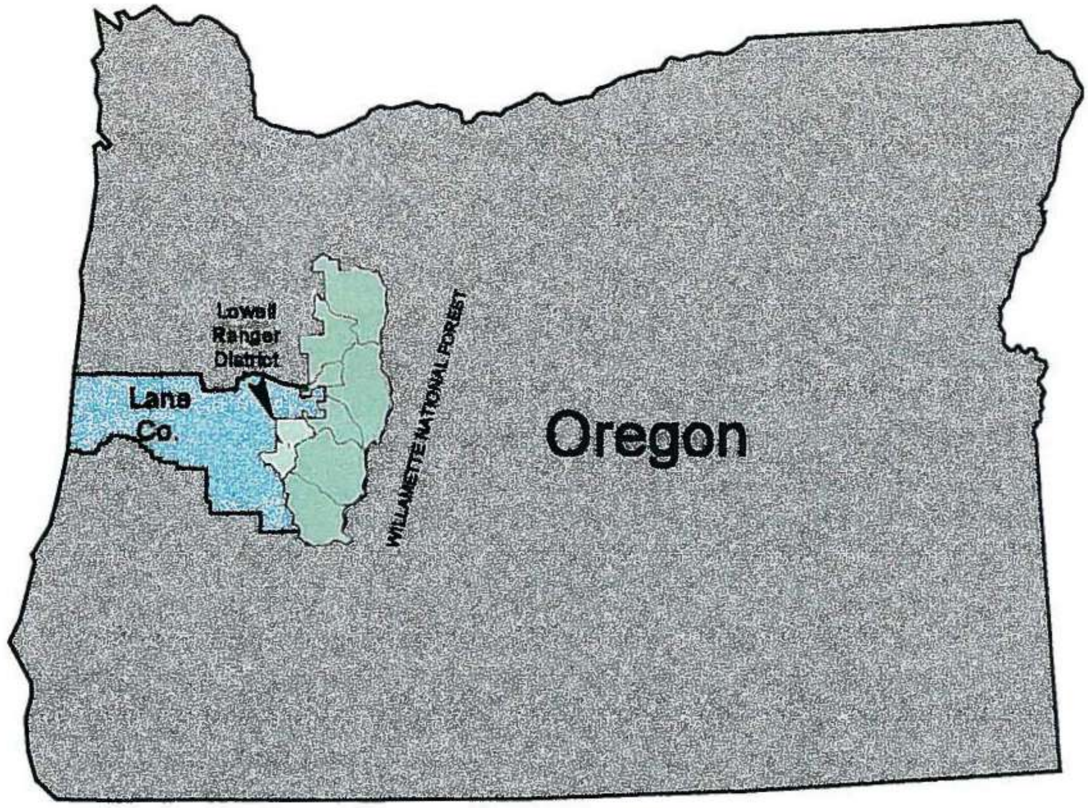
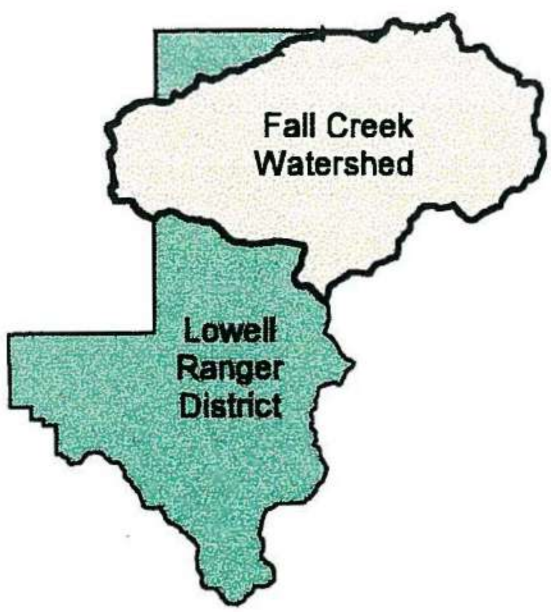
Fall Creek Watershed Analysis

Map 1

State, County and Forest Boundaries





Lowell R. D. and Watershed Boundary

Fall Creek Watershed Analysis

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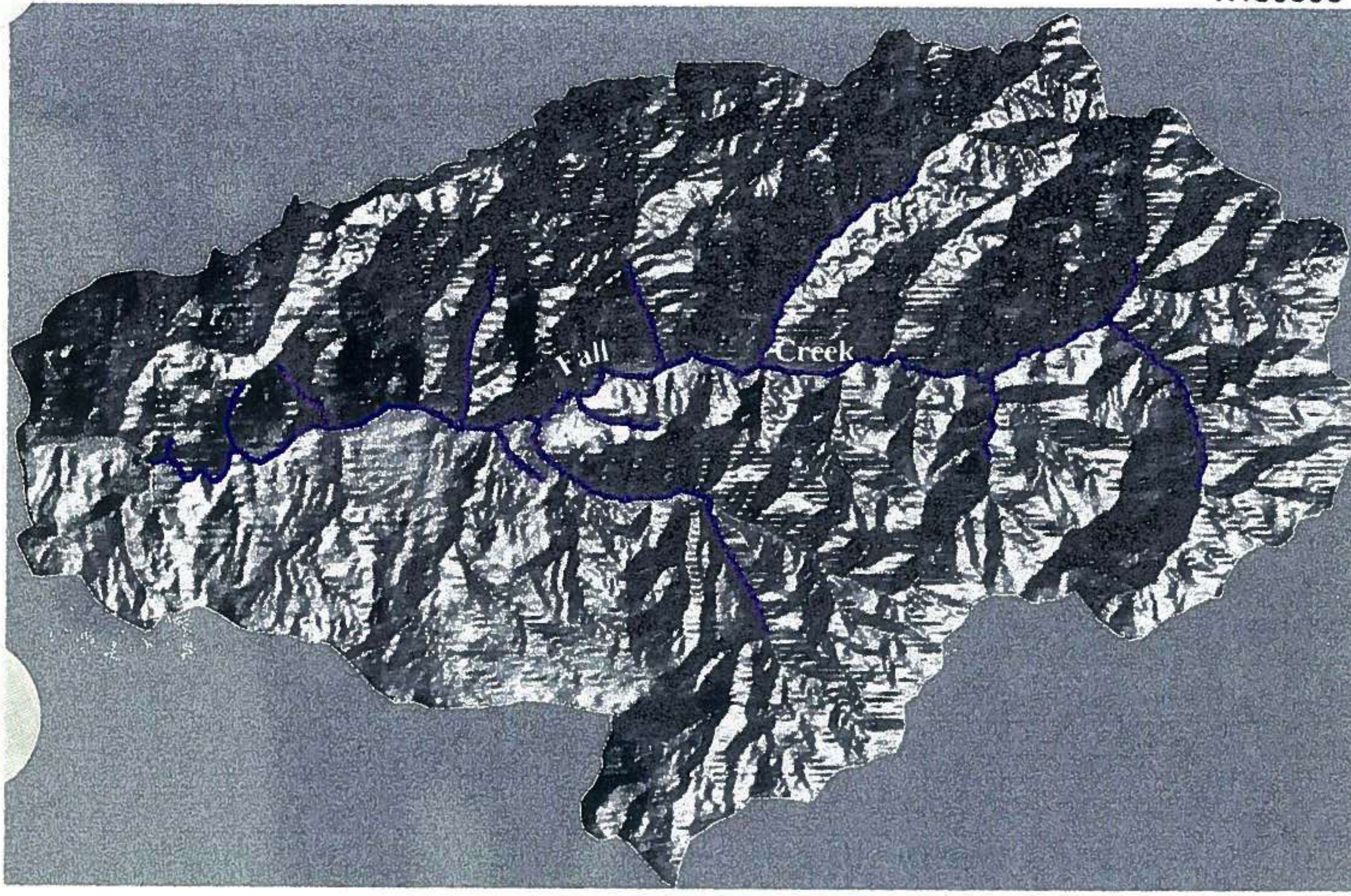

Willamette National Forest
Lowell Ranger District
USFS

September, 1995

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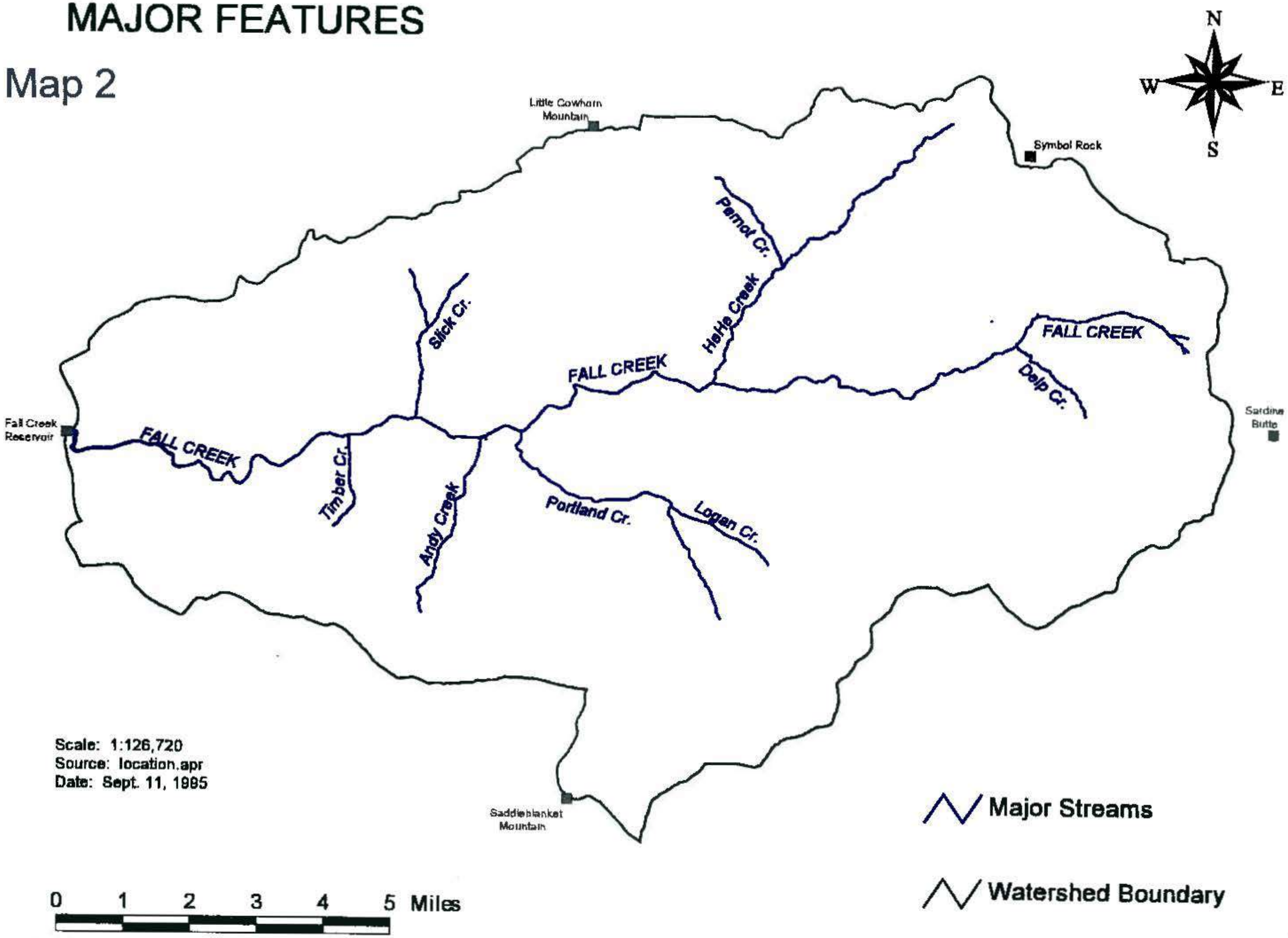
MAJOR FEATURES

Map 2



INTRODUCTION

The Fall Creek watershed provides a wide range of uses and a variety of commodities to local residents. Demands on the watershed range from providing local businesses with forest products to recreational opportunities for local residents. Natural processes and management activities have shaped the landscape into its present form. This analysis will explain the processes which determined landscape changes over time, and recommend watershed management from a holistic (ecosystem) view while providing needed commodities to surrounding communities. Such an approach may make it possible to sustain the diversity and productivity of the watershed. This is not a decision document, but rather a guide for management to assist in sustaining the watershed productivity.

Management direction for the watershed is provided by the Record of Decision (ROD) of April, 1994 and the Final Supplemental Environmental Impact Statement (FSEIS) on Management of Habitat for the Late-Successional and Old Growth Forest Related Species Within the Range of the Northern Spotted Owl. (USDA, USDI, 1994). This FSEIS is popularly known as the Northwest Forest Plan and has amended the Willamette National Forest Land and Resource Management Plan (USDA, 1990). Hereafter, the Northwest Forest Plan and FSEIS will be referred to as the Northwest Forest Plan.

The Northwest Forest Plan requires that a watershed analysis be accomplished prior to any major land management activity within the watershed. This analysis has been completed to comply with this direction and to provide responsible officials with more comprehensive information upon which to base land management decisions.

The analysis area is located approximately 20 air miles east of Eugene in Lane County *(See Map 1).* Its size is approximately 120 square miles which equates to 76,704 acres. Major features of the watershed are delineated in *Map 2.* Specific land allocations outlined in the Northwest Forest Plan can be found in *Table 1* and *Map 3.*

This analysis is a continuation of a district wide assessment completed in June, 1994, for the 1994 Watershed Restoration Program. The Federal Agency Guide for Ecosystem Analysis at the Watershed Scale (Version 2.1) will provide guidance for the process. This analysis will provide:

- A general understanding of the ecological conditions and processes occurring in the watershed,
- A list of restoration projects which will enhance the ecosystem and close the gap between current conditions and the range of natural conditions,
- Support for the Late-successional Reserve Plan,
- Direct future access and travel management decisions,

- Identify recreation uses and trends, and

- Guidelines for further decision making regarding provision of commodities to benefit local communities.

In accordance with direction outlined in the Federal Agency Guide for Ecosystem Analysis, this analysis is comprised of the following components:

- A Characterization section which describes the unique or particularly important characteristics of the watershed *(Chapter 1),*

- An Issues and Key Questions section describing the various concerns and opportunities existing in the management environment, and identifying which need further consideration for best current and future decisions *(Chapter 2),*

- A Reference Condition/Current Condition section discussing the current watershed condition, presented in relationship to historical conditions of the watershed in order to put the various relevant resources in perspective *(Chapter 3),*

- An Interpretation section which explains the differences between historical, current and natural conditions, and how those factors affect the capacity of the watershed to achieve management objectives, presented in relation to the issues and key questions *(Chapter 4: this section provides answers to the Key Questions),* and

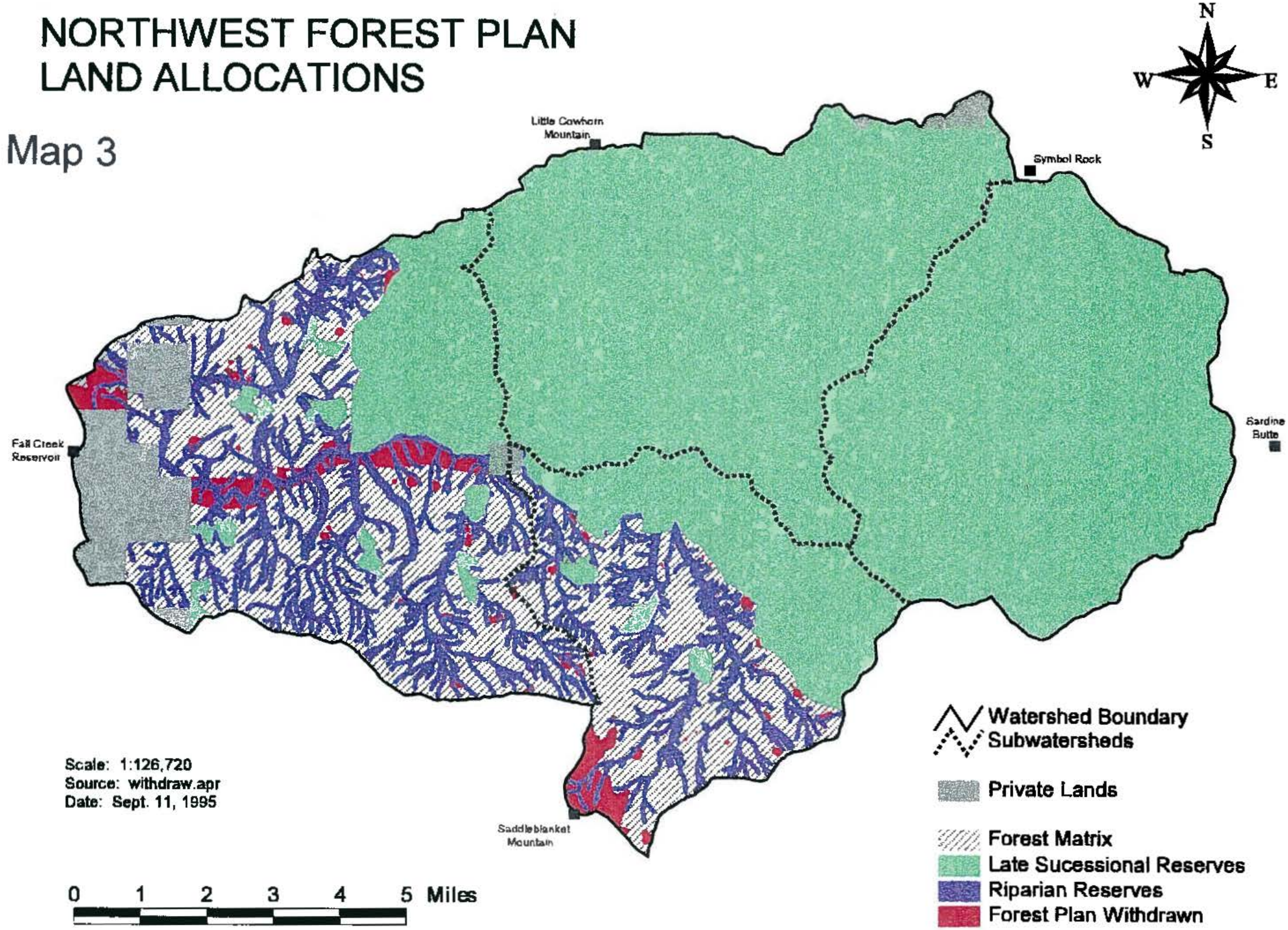
- A Recommendation section which identifies those management activities that could move the system towards the reference conditions or management objectives *(Chpater 5).*

Table 1. Northwest Forest Plan Land Allocations

Land Allocations	Acres	% of Watershed
Late-Successional Reserves	48,590	63%
LSR 100 acres	1,406	2%
Riparian Reserves	9,863	13%
Other Forest Plan Withdrawn	1,087	1%
Matrix	15,758	21%

NORTHWEST FOREST PLAN LAND ALLOCATIONS

Map 3



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Source: withdraw.apr
Date: Sept. 11, 1995

CHAPTER 1

CHARACTERIZATION

The purpose of this section is to place the watershed in context within the river basin and province, and to briefly analyze and describe the dominant physical, biological, and social features, characteristics and uses of the watershed.

PHYSICAL DOMAIN

GEOLOGY

The Upper Fall Creek watershed of the Willamette National Forest is part of the western Cascade subprovince of the Cascade Range. This subprovince is located at the northwest boundary of the Basin and Range Province. It consists of rocks from the Eocene through the Pliocene epochs, spanning a range of approximately 40 million years and ending about four million years ago *(See Map 4)*. The watershed extends from the head of Fall Creek Reservoir on the western margin to the North Fork of the Willamette divide to the east; and from the divide with Little Fall Creek and the McKenzie River on the northern boundary to the divide with Winberry Creek on the south. The elevation ranges from 818 feet at the upper end of the Fall Creek arm of Fall Creek Reservoir to 4,969 feet above Mean Sea Level at the top of Saddleblanket Mountain.

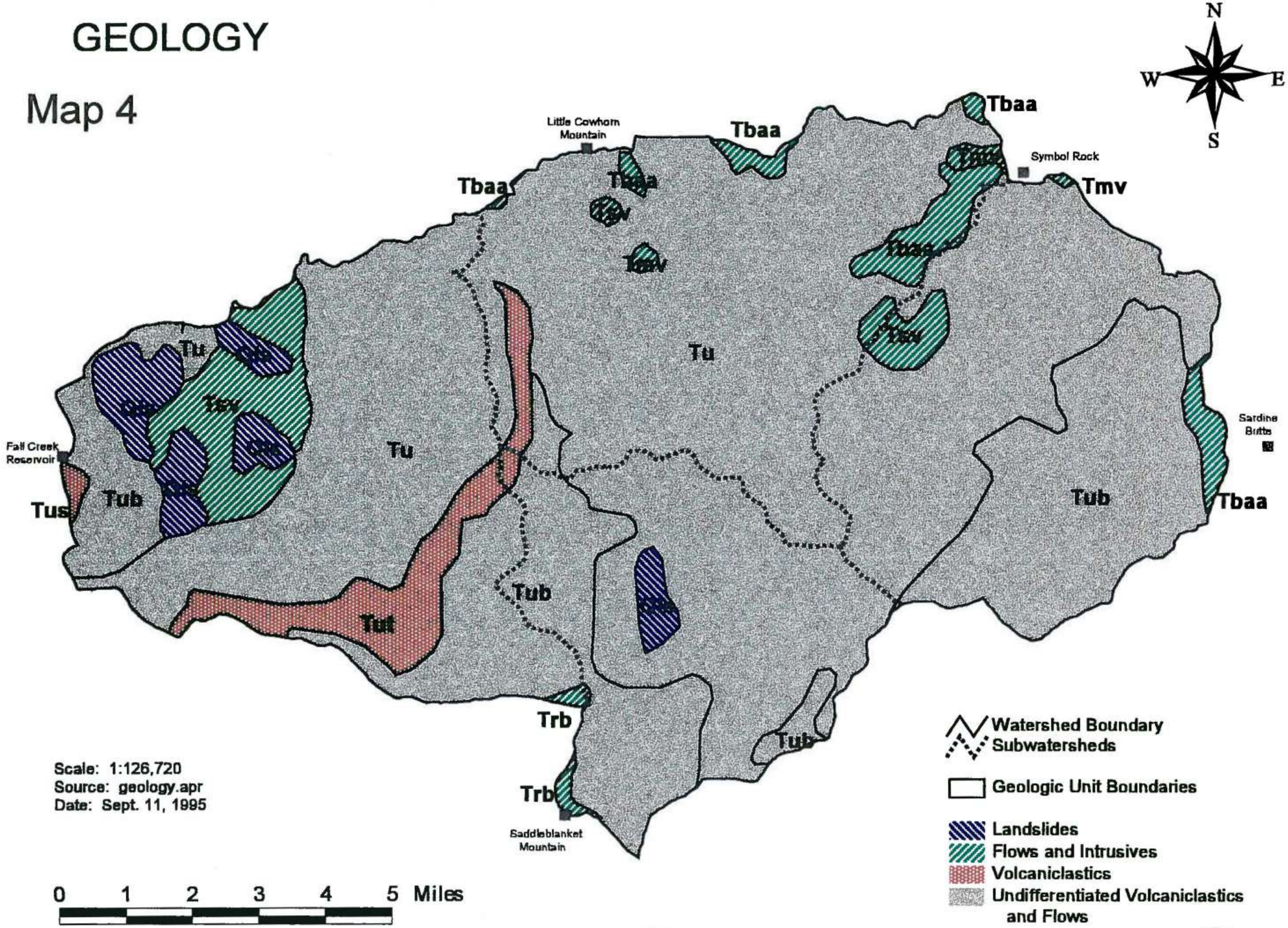
HYDROLOGY

The Fall Creek watershed climate is Pacific-Marine. Precipitation ranges from 40 inches at lower elevations to 70 inches at higher elevations. Most of the precipitation occurs between October and June as rain or snow. Due to the age and nature of the underlying volcanoclastic rocks, the riverine pattern is dendritic with high stream densities. Streams in the watershed originate at the top of ridges and become deeply incised with constrained valley bottoms as they move downslope. Stream gradients are high, ranging from above 20% in the upper portions of the watershed to less than 2% in the main Fall Creek corridor. High stream gradients produce high energy streams which carry large volumes of sediments to Fall Creek, where the stream gradient decreases and deposition occurs upstream of small geologically constrained areas or behind large woody debris. Due to the lack of large woody debris to capture and store sediments and bedrock confined channels, the Fall Creek riverine system is an excellent sediment transport system.

Historically, the Lowell Ranger District emphasized timber management, resulting in a large road system to access timber and other forest resources. Timber sale revenue paid for the majority of past road construction and road maintenance. However, timber harvest has declined with the shift toward ecosystem management. The Regional access and travel management policy dictates that all roads remain open unless some overriding reason for closure exists.

GEOLOGY

Map 4



The District policy reflects this commitment to retain open travel corridors unless otherwise designated. However, the change in forest management has seriously reduced the District's operating budget and its ability to maintain such an extensive system. Therefore, some roads will be removed from the system, others closed until future access is needed, and many kept at the lowest possible maintenance level.

BIOLOGICAL DOMAIN

TERRESTRIAL

The Fall Creek watershed is located along the western boundary of the Forest, adjacent to private industrial forest and the southern Willamette Valley. These lands are managed under intensive forest and agricultural practices contributing very little to late- successional forest habitats. The forest landscape pattern in Fall Creek watershed is typically fragmented, similar to adjacent federal watersheds, but still possessing large tracts of late-successional and old-growth forests. These large blocks provide valuable habitat along the western edge of the Forest and contribute to the connectivity within and adjacent to the watershed. They are located along the Fall Creek corridor, Bedrock/Slick Creeks, Pacific/Marine Creeks and Platt Creek. As a result, the upper two thirds of the watershed have been designated as a Late-Successional Reserve in the Northwest Forest Plan.

Fall Creek watershed vegetation is composed primarily of the Douglas-fir and Western Hemlock forest series. These two forest series are commonly found on the low to mid elevations throughout the Central Oregon Cascades. Along with Douglas-fir and western hemlock, the most common associates are western redcedar, incense cedar, sugar pine, and western white pine. Hardwood species include bigleaf maple, red alder, chinquapin, and madrone.

Some of the most productive forest lands on the Forest are found within the watershed. Conifers can potentially grow to 120 inches in diameter, reaching heights of over 300 feet and living to 800+ years. As a result of the productive capabilities of these forest lands, this watershed has provided large quantities of high quality wood products to local economies during the last five decades.

This watershed is the most botanically diverse watershed on Lowell Ranger District. Seven populations of three sensitive plant species have been documented in rock garden, old-growth riparian, and moist meadow habitats. There is an abundance of habitat for the old-growth and riparian associated survey and manage bryophytes, fungi and vascular plants. Non-forested habitats such as the rock outcrops of Cowhorn Mountain, the large rock garden complex of Gold Point, wet and mesic meadows shrouding Saddleblanket Mountain, and riparian hardwoods associated with creek corridors add to overall biodiversity.

The watershed is host to a number of wildlife species typically found in forest habitats of the Central Cascades. They include Roosevelt elk, black-tailed deer, black bear, mountain lion, bobcat, cougar, flying squirrel, red tree vole, ruffed and blue grouse, mountain quail, waterfowl, Pacific giant salamander, and red-legged frog. Due to its proximity to the Eugene/Springfield metropolitan area, there is substantial hunting, fishing and wildlife viewing pressure in the Fall Creek drainage.

Many threatened, endangered and sensitive (TE&S) species are known or suspected to occur within this watershed. These species are closely associated with late-successional and old-growth forest, diverse special habitats and interior forest habitat. The northern spotted owl is the only TE&S species that has been intensively surveyed and monitored. The entire watershed was designated as Northern Spotted Owl critical habitat by USFWS in 1991 under the Draft Recovery Plan.

AQUATIC

The Willamette River flows into the lower Columbia River downstream from Bonneville and all other dams on the Columbia. Fall Creek is within the Middle Fork Willamette Subwatershed of the Willamette River System.

Spring chinook are the only anadromous fish native to the Middle Fork Willamette River. Summer and winter steelhead were introduced into the system in 1953. Construction of Fall Creek Dam in 1965 limited migration. Currently, downstream passage facilities and an upstream trap are used by migrating salmon and steelhead, although existing runs are low in numbers. The Oregon Department of Fish and Wildlife manages Fall Creek as a recreational fishery and catchable rainbow trout are stocked on a yearly basis. Other fish species native to Fall Creek include rainbow trout, cutthrout trout, mountain whitefish, longnose dace, speckled dace, largescale sucker, and several sculpin species.

SOCIAL DOMAIN

The Fall Creek drainage is a refuge from the Willamette Valley heat during the summer, as it is usually ten degrees cooler than Eugene and is approximately an hour away. Fall Creek's lazy summer flow, combined with deep holes and shallow wading areas, is Springfield's "backyard" water paradise and the forest setting is a year-round attraction. Since it is usually free of snow, winter finds hikers on the trails and boaters in Fall Creek, when flow is high. Its proximity to the Eugene/Springfield metropolitan area also makes the Fall Creek drainage attractive to homeless people as an alternative camping area. Locals enjoy Fall Creek so much, they have formed the Fall Creek Consensus Group to preserve the stands visible from Forest Road 18.

HISTORIC HUMAN IMPACTS

The Fall Creek watershed has attracted people for at least 8,000 years. Archaeological and historic research suggests that a combination of human interaction and natural forces have shaped the landscape in the watershed and changed its character significantly during the last 150 years (Baxter, 1986; Minor, et. al., 1987).

At the time of European exploration at least two tribes, the Kalapuya and Molala, were thought to have inhabited this watershed. In later times, the Klamath were known to have visited the Lowell area on their way to the Willamette Valley.

Epidemic diseases and social dislocation following the arrival of fur trappers, explorers and settlers between 1790 and 1840, resulted in the near extinction of local tribes. Many of the descendents of local tribes are currently part of the Siletz, Grande Ronde, Warm Springs, and Klamath reservations. The earliest Euro-American settlements in Lane County were in nearby Pleasant Hill and Lost Valley in the 1840's. Several settlers made claims in the Fall Creek watershed near Clark Creek in the 1880's and 1890's. Prospectors panned Big Fall Creek, Gold, Portland, and Delp Creeks and gold was actively prospected in the upper reaches of Portland Creek and Sinker Mountain after 1895 (Beckham, et. al., 1981; Briem, 1937).

In 1891, Congress gave the president power to create forest reserves from public domain. In 1897, it passed the Forest Management Act which provided for the administration of the reserves and included forest fire suppression. The Forest Service embarked on a ground patrol system of fire detection in the early 1900's, using rangers on horseback and covering a system of trails and vantage points connected to ranger stations only by telephone lines. In the Fall Creek watershed, lookout sites or stations were established on Clark Butte, Little Cowhorn, Hehe Mountain, Saddleblanket Mountain, and Fawn Rock.

Beginning in 1912, the Forest Service permitted grazing allotments in the Fall Creek watershed for cattle and sheep. Nearby allotments included the Winberry drainage, and Saddleblanket, Sourgrass and Tire Mountains. Trail construction accelerated greatly with the advent of the Civilian Conservation Corps (CCC) from 1933 to 1937. This labor force constructed a system of trails and bridges with shelters, guard stations, lookout towers and associated buildings as well as ranger stations.

In 1933, the Fall Creek CCC Camp was built on Fall Creek Road about five and a half miles northeast of the town of Lowell. Crews from this camp and E.R.A. laborers improved Fall Creek Road and developed campgrounds at Dolly Varden, Big Pool, and Puma Creek. From 1936-37, the CCC constructed the Clark Creek Organization Camp which is eligible to the National Register of Historic Places (Winkler and Lindberg, 1990).

The Fall Creek watershed was first entered for commercial timber production in the 1940's. The earliest harvest units were located in the lower part of Fall Creek. These early units tended to be large 50-150 acre clearcuts with scattered clumps of seed trees. Reforestation was from natural regeneration or supplemented by planting seedlings. During the 1950's, harvest activities centered in Hehe Creek, generally related to salvage from the Hehe fire in 1951. The period of the 1960's through the 1980's was an era of intensive road construction and timber harvest activity. Harvest units averaged 20-30 acres in size and were dispersed across the landscape to provide wildlife habitat and develop road systems. The harvest rate averaged 10% of the watershed area per decade, but has declined in recent years. To date approximately 46% of the watershed has been harvested resulting in two billion board feet of timber.

CHAPTER 2

ISSUES AND KEY QUESTIONS

The purpose of this chapter is to identify the variety of uses and values associated with the watershed and focus this analysis on the key ecosystem elements most relevant to management questions, human values or resource conditions within the watershed. Analysis questions were formulated using indicators most commonly used to measure or interpret these ecosystem elements.

ISSUE 1: THREATENED, ENDANGERED AND SENSITIVE SPECIES

The watershed provides habitat for a number of Threatened, Endangered or Sensitive species (TE&S). Habitat for those species historically found in the watershed should be maintained and/or enhanced. Occurrence of spotted owls is well documented and there are numerous other vertebrate and invertebrate TE&S animal species which occur or may occur. Past management activities may have had an effect on some local populations of TE&S species, their habitats and their ability to migrate and disperse across the landscape.

Three sensitive plant species occur within this watershed: Tall Bugbane, Umpqua Swertia and Thompson's Mistmaiden. Interagency conservation strategies have been or will be written to direct management of these species in a consistent manner across the landscape. Adjacent trails, roads, potential landslide events, and fire suppression may be responsible for loss of some sensitive plant habitats.

Key Questions

1. What and where are the habitat restoration and enhancement opportunities for TE&S species?

2. Have TE&S species habitats been affected by management activities (ex. roads, trails, fire exclusion, timber harvest) in the past?

3. What is the contribution of riparian reserves and other withdrawn land allocations in meeting the dispersal needs of the Northern Spotted Owl and other T&E species?

Data Needs

1. What threatened, endangered, sensitive or rare species are known or have the potential to occur?

2. What is the occurrence and distribution of the Northern Spotted Owl and its habitat in the Fall Creek watershed?

3. How does spotted owl critical habitat compare to the LSR and matrix designation? What is the condition of that habitat?

ISSUE 2A: TERRESTRIAL VEGETATION

The amounts, distribution and configuration of vegetation have been altered by disturbance processes (fire and management activity). These changes have affected biodiversity, distribution of forest plant communities, and historic public use.

Management activities including timber harvest, road building and fire exclusion within this forest may have altered species composition and created vegetation patterns and conditions outside the historic range.

Past activities, especially timber harvest, road building and fire exclusion, have created a somewhat fragmented landscape of various sizes and age classes of vegetation. Typically, managed stands have low levels of snags, coarse woody debris and species richness, which contribute to less-than-desirable conditions for many wildlife species.

A number of special habitats, both forested and non-forested unique sites for plant and wildlife habitat, are found in the watershed. Adjacent trails, roads, timber harvest units, and fire suppression may have changed the biodiversity and character of these sites.

Noxious weeds are those plants which cause harm to the ecosystem. These species are most often found in disturbed areas such as clearcuts, quarries or roadsides and have the potential to outcompete native plant species since their seeds often travel from one place to another on vehicles and Fall Creek is very densely roaded. Non-native seed mixes have been used to stabilize road shoulders throughout the watershed and some of these species migrated from roadsides into the forest interior.

Past management activities have been beneficial to Columbian Black-Tailed deer and Roosevelt Elk populations since the fragmented landscape provides interspersed forage and cover habitat beneficial to big game populations. An emphasis for developing late-successional forest within the watershed could have an effect on big game habitat and current population levels.

Past timber harvest and road building have affected the amount of interior forest habitat. In conjunction, connectivity between patches of existing interior forest habitat may have been disrupted.

Collection of special forest products has been moderate, but demand is expected to increase dramatically in the future. The forestwide Environmental Analysis for Special Forest Products Management does not allow commercial collection in Late-Successional Reserves or riparian areas, which amounts to the greater part of the watershed. Of particular concern are vine maple, moss and lichens in the heavily used Fall Creek corridor.

A few species found in Table C-3 of the FSEIS Record of Decision are located in the watershed including mosses, lichens, invertebrates, and vertebrates. No comprehensive surveys have been completed for these species. Fragmentation of habitat may be a concern for old-growth and riparian-dependent species (loss of interior habitat and corridors limit dispersal and movement), especially in matrix lands.

A number of species found in Table C-3 of the Record of Decision are located in late-successional habitat. Some of these species are known to occur in the watershed and many more species have that potential. Late-successional habitat should be maintained or enhanced for these species.

Key Questions

1. What are the historic and current distributions of seral stage, and what are the processes and disturbances which have led to these patterns and conditions? what are the management

2. What is the risk and role of fire?

3. Can landscape fuel loadings be maintained within the historic range of variability? If so, how?

4. How have past management activities affected wildlife habitat/populations?

5. How and where have past management activities affected special habitats?

6. How and where have road construction and use contributed to non-native species and noxious weed infestations? What type and where are noxious weeds present, and what is the effect on biodiversity?

7. What are the historic and current conditions and trends of big game habitat?

8. Are the big game emphasis areas adequate to meet management objectives for big game with adoption of the Northwest Forest Plan and its associated standards and guidelines?

9. Where does open road density exceed the Forest Plan Standards and Guidelines?

10. What and where are the historic and current conditions of the interior forest habitat? How have management practices contributed to these changes?

11. Are there current or potential connective corridors that need to be enhanced?

12. Has removal of vegetation increased landslides over historic natural conditions?

13. What and where are the conflicts between special forest products collection and current land allocation? (ex., riparian reserves, LSRs, etc.)

14. How and where has habitat for C-3 species been affected by management activities?

15. What habitat or habitat functions need to be identified and restored for these species?

ISSUE 2B: RIPARIAN VEGETATION

Management activities have altered riparian reserves, disrupting the link between terrestrial and aquatic ecosystems. Aquatic species are dependent on healthy riparian ecosystems.

Large conifers are an important component of riparian vegetation in the Fall Creek watershed as they provide shade, nutrients to the soil, channel stability, and future recruitment of instream large woody material. Removal of these trees has negatively impacted aquatic habitat.

Past management activities may have altered the function of riparian areas within the watershed, since altering riparian habitat has affected numerous terrestrial wildlife species requiring intact riparian areas for part of their life history. In assessing conditions, opportunities to restore or enhance riparian vegetation conditions could become evident.

Key Questions

1. How and where have management activities changed terrestrial/aquatic riparian functions within and adjacent to stream channels?

2. What and where are the effects of social uses on riparian reserves?

3. What type and where can management activities, including restoration opportunities, occur in the riparian reserves which would meet objectives in the Aquatic Conservation Strategy?

Data Needs

1. What is the current and historic condition of riparian reserve vegetation?

ISSUE 3: AQUATIC HABITAT

Management activities have altered the complexity of aquatic habitat, reduced water quality and changed flow regimes. These impacts have negatively affected the aquatic ecosystem and species distribution. The density and location of roads and harvest units have also impacted aquatic habitat causing higher peak flows, mass wasting and increases in fine sediment. Instream salvage of large woody material has reduced the channel complexity, and removal of riparian vegetation has resulted in higher stream temperatures, channel erosion, reduced stream and habitat complexity, and reduction in future recruitment of large woody material.

Most recreation facilities and improvements are located in riparian areas with a high number located along the Fall Creek corridor. These facilities could have an effect on water quality.

Key Questions

1. How and where have past activities such as timber harvest, recreation, and road building affected water quality and quantity? (ex., temp, sedimentation, flow)

2. How and where have past management activities affected channel complexity?

3. What are the current and historic conditions of aquatic habitat?

4. What is the current, historic and potential condition of aquatic species and their distribution?

5. What are the restoration opportunities for aquatic habitat?

6. What is the potential effect on aquatic habitat if roads are not maintained?

Data Needs

1. Which culverts at stream crossings cannot accommodate 100-year flood and migration barrier, and risk degradation of aquatic habitat (Class I, II and III)?

ISSUE 4: LATE-SUCCESSIONAL RESERVES

Late-Successional Reserves (LSRs) are designed to protect and enhance late-successional forest, old growth conditions and associated species. The greater part of the Fall Creek watershed is designated as LSR according to the Northwest Forest Plan. The conditions of the Fall Creek watershed LSR have not been assessed and the need for this area to function as a LSR may guide future restoration activities.

Late-successional forest conditions may be lacking within the LSR. This could include lower than desirable levels of multi-species and multi-layered forest, large logs, snags and large decadent trees.

It is important to maintain or enhance habitat and vegetation in the LSR and move it toward late-successional forest conditions. Opportunities to promote stands into attaining desired late-successional forest characteristics could be found.

Key Questions

1. How do current vegetation conditions compare to the objectives for LSRs?

2. How do current vegetation conditions compare to historic range of conditions for the LSRs?

3. What effect would potential management activities in the LSRs have on ecosystem components and processes (restoration opportunities)?

4. What is the current status of spotted owls and levels of suitable habitat within the LSRs?

5. What are conditions of dispersal habitat between these LSRs and adjacent LSRs?

6. Are objectives for the LSRs and are Forest Plan Standards and Guidelines consistent?

Data Needs

1. What is the condition of habitat within the LSRs?

2. What are the effects on air quality if fire is re-introduced as a management tool,?

3. What are the species associated with the LSRs and their locations?

Issue 5: Recreation/Social

Fall Creek is close to the Eugene and Springfield metropolitan area and tends to be at least ten degrees cooler in the summer months, with the result that up to 2,000 people daily can be seen in the drainage on hot summer days. Human occupation of dispersed sites during the fall, winter and spring has also increased during the past four years. Long-time residents have established use patterns in the Fall Creek watershed, and as management direction changes, it will impact how people use the forest, (i.e., camping, fishing and hunting).

The history of human use in the watershed is an important factor in the development of its past environment and current condition, with implications for the future. Patterns of recreation use, expectations for recreation experience, and changing social uses are affected by management direction.

Key Questions

1. What are the effects of land management allocations on recreation and social uses?

2. How will this affect recreation opportunities if roads are not maintained or closed?

3. What are the educational opportunities to inform people of minimum impact use concepts?

4. How have past management activities affected visuals?

Data Needs

1. What are the recreational and social uses and where are they?

CHAPTER 3

REFERENCE, HISTORY AND CURRENT CONDITIONS

The purpose of this section is to document the current range, distribution and conditon of ecosystem elements and explain how these conditions have changed over time as a result of human influenece and natural disturbances. A reference for comparison with current conditions was developed with key plan objectives identified in Chapter Two.

PHYSICAL DOMAIN

GEOLOGY AND SOILS

Fall Creek is the dominant drainage in the watershed. Its main tributaries from west to east are the North Fork of Fall Creek, Boundary, Slick, Bedrock, Andy, Portland, Alder, Hehe, Marine, Gold, Delp, Saturn, Platt, and Briem Creeks. The rocks are primarily Igneous extrusive such as tuffs, lapilli tuffs, tuffaceous sedimentary pyroclastics, and lava flows. There are a few Igneous intrusive rocks, but these account for less than 1% of the the watershed. Distribution estimates of the extrusive rock types range from 75-80% pyroclastic origin and 20-25% lava flows (Peck and others, 1964, Sharrod, 1991). Spatially, the older rocks are predominately tuffs and tuffaceous sedimentary rocks and tend to be at the lower to middle elevations. Lower elevation areas include Upper Hehe Creek and the vicinity of the North Fork of Fall Creek. The younger rocks are predominantly basaltic or andesitic lava flows and tend to be at higher elevations, such as in the areas of Saddleblanket Mountain and Alpine Ridge.

Emplacement of numerous dioritic-dacitic intrusions between ten and three million years ago resulted in thermal and hydrothermal alterations of the inplaced rocks. Emplacement of minor amounts of disseminated metals occurred in areas around Logan and Portland Creeks and the headwaters of Gold and Delp Creeks. None of these have current economical value (Callaghan and Buddington, 1938, Gary and Berri, 1983). This alteration resulted in an increase in the production of clay minerals, which are now found in the soils of many areas.

It was also responsible for hydrothermal weathering of many flow rocks, which resulted in decreased strength and their rapid degradation when used as crushed aggregate. Some of these have been used in the past, resulting in marginal aggregates that degraded quicker than expected and generated more fines than acceptable.

Hydrothermal activities were responsible for the mobilization and subsequent deposition of much of the quartz, agate and jasper found throughout the watershed at lower and middle elevations. Some of these silica deposits were known and utilized by the indigenous people for tools such as projectile points, scrapers, knives, etc. Today this material is frequently found at cultural resource sites and is referred to by archeologists as "cryptocrystaline silica" (CCS).

The volcanoes that produced these rocks have weathered away and created the landscape seen today, which is almost entirely erosional. The older, less altered rocks in the lower portion of the watershed have weathered longer and at a more uniform rate, resulting in flatter ground and thicker soils at lower elevations. These are the areas most prone to landflows and rotational failures. Some of the higher ridges are examples of *"inverted topography"*. These are areas where lava flows filled stream valleys and were left as topographic highs when surrounding pyroclastic rocks eroded more quickly. These areas and steep stream sides are the most prone to debris failures.

The following discussion of soils found in the watershed requires the reader to have a working knowledge of the nomenclature of the Willamette National Forest Soil Resource Inventory (SRI). The SRI was written in 1973 and the maps revised in 1990. The map revision has not been field verified *(See Map5)*.

To simplify analysis of the 1990 SRI soil mapping units within the watershed, they have been grouped into five categories based on similar soil properties and expected behavioral response to management activities *(See Table 2)*.

Category 1 consists of 1990 SRI mapping units 25, 35 and mapping unit complexes which include 100% of Units 25 and 35, i.e., 255. Typically, these soils are on gentle to moderately hummocky sideslopes (5-40%), deep (from 6-12+ feet), clayey and sometimes associated with earthflow geomorphology.

Although this landform includes past large scale earth movements, it is usually stable in its current slope geometry, with the exception of localized areas such as road cuts and stream channels. In-place shear strength can be low to high depending on the moisture content, but the remolded strength (such as in road fills and subgrades) tends to be low. During construction this requires that controlled compaction techniques are used and that the material is not allowed to become saturated. It is often necessary to exclude the surface and subsurface water from these soils to maintain a stable road prism. Due to these soils' low permeability, overland flow of water commonly results in sag ponds and supports hydrophytic vegetation and habitat for aquatic and amphibian animals.

Category 2 consists of SRI complexes which include at least 50% of the mapping units in Soil Category 1. The behavior of this category is similar to that outlined for Category 1, but to a lesser degree and frequency. Landforms tend to be slightly steeper than Category 1 and are often associated with draws and swales on midslopes.

Category 3 is 100% of SRI mapping units and complexes, characterized by steep terrain with shallow rocky soils. This category is more likely to have high surface and subsurface erosion potential and the highest number of road and harvest related failures. The sediments produced are typically coarse grained. The harvest related slope failures tend to be due to the loss of root strength after timber harvest and often occur where water concentrates.

Category 4 consists of SRI complexes which include at least 50% of the mapping units described in Category 3. The behavior of these soil types is similar to those outlined in Category 3, but at a lesser frequency.

Category 5 consists of the rest of the SRI units and complexes. This category represents a wide range of geomorphic settings which tend to be more stable.

The preceding soil categories were first used in the Geology/Soils section of the 1993 Lowell Ranger District Watershed Assessment (pp. 90-99), by Mark Leverton, South Zone Geotechnical Leader. The reader is referred to this document for a more detailed discussion.

Table 2. SRI Mapping Units By Soil Category

Soil Category	Definition of SRI Soil Categories	SRI Mapping Units
Category 1	nearly 100% clayey soils	25, 35 255
Category 2	at least 50% clayey soils	235, 251, 252, 253, 254, 256, 3345, 353, 356
Category 3	nearly 100% steep ground and shallow soils	1, 2, 3, 8, 16, 21, 31, 61, 201, 202, 203, 204, 210, 301, 302, 310, 315, 316, 444, 601, 602, 603 610
Category 4	at least 50% steep ground and shallow soils	161, 168, 212, 213, 214, 215, 216, 304, 305, 313, 332, 441, 517, 604, 605, 606, 607, 608, 614, 515, 616 617
Category 5	all others	all others

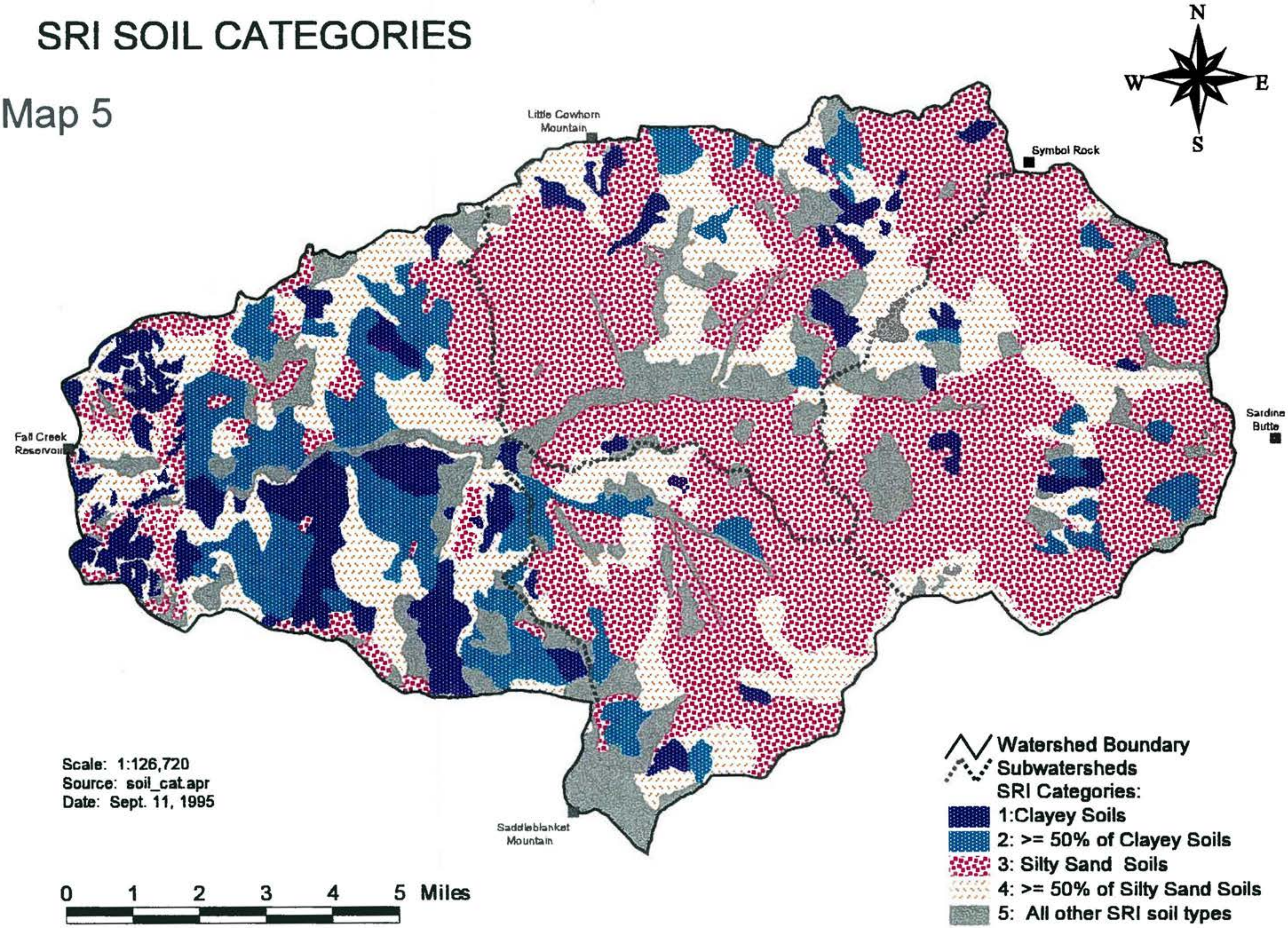
In order to evaluate the assumptions made about the soil behavior categories described above and to evaluate trends, data was collected to determine the following:

1. Slope failure frequency for each subwatershed by failure type *(See Table 3),*
2. Slope failure frequency for each Soil Category by failure type *(See Table 4),* and
3. Miles of road in each Soil Category on sideslopes greater than 50% for each subwatershed *(See Tables 5 and 6).*

The bulk of data relating to the type, frequency, location, aspect, and most likely impacted stream(s) came from the examination of four sets of aerial photos 1949/1955, 1959, 1967, and 1990. The remaining data came from a combination of data from the Lowell Ranger District Watershed Assessment and personal knowledge.

SRI SOIL CATEGORIES

Map 5



Scale: 1:126,720
Source: soil_cat.apr
Date: Sept. 11, 1995

Table 3. Failures Types by Subwatershed

Subwatershed	Road	Harvest	Unmanaged	Total
Lower Fall	17	8	4	29
Portland	30	7	14	51
Hehe	48	16	5	69
Upper Fall	58	28	3	89
Total	153	59	26	238

Table 4: Failure Types by Soil Category

Soil Category	Road	Harvest	Unmanaged	Total
Category 1	12	5	0	17
Category 2	9	0	2	11
Category 3	90	34	14	138
Category 4	30	17	8	55
Category 5	12	3	2	17
Total	153	59	26	238

Using aerial photos as a data source for slope failures has accuracy limitations and gives a biased picture of the actual ground conditions. The easiest failures to recognize were the debris failures associated with newly constructed roads. Cutslope failures were difficult to distinguish from large road cuts and small borrow sources. Small to medium rotational failures were extremely difficult to recognize in the unmanaged areas. It is important to remember that this data is biased toward increasing the percentage of failures attributed to management activities, over those that occur in unmanaged areas. They are difficult or impossible to see in most unmanaged areas due to the forest canopy, the small scale (which limits the size of what can be identified) and examination time constraints. However, even though the percentages may not be absolutely accurate, the trends, conclusions and recommendations based on these data are correct and meaningful. This conclusion is based in part on the author's personal experience, walking through many, many miles of unmanaged ground during the past 24 years. This data is summarized in Table A41, Appendix A.

Prior to logging and road building, slope failures were typically landflows on shallow slopes with deep soils, and debris slides on steep sideslopes with thinner soils. The age of these failures is unknown, but presumably they are hundreds of years old, judged by the age of the trees growing on top of these slope movements. At least some parts of those seen have been active during the life of the trees. There were about 40 failures found on unmanaged ground; twelve are landflows. Of these, five are mapped on the recent update of the Oregon State Geology Map and seven appear on the 1973 SRI map. Seven landflows are found in Lower Fall Creek, two in Hehe and Portland Creeks and one in Upper Fall Creek. No signs of recent movement are seen on aerial photos. The debris slides are found along the steeper stream sides and the higher, steeper mountain sides. There is one debris slide along Bedrock Creek, six along the west side of Portland Creek, four along the west side of Alder Creek, two on the north side of Sinker Mountain, and three on the north side of Saddleblanket Mountain. These debris slides are visible on all four sets of aerial photos examined. The remaining few failures on unmanaged ground are scattered throughout the watershed. Of these, it was not possible to determine if they also occurred on all sets of aerial photos. Still, it is valid to say that the number of failures on unmanaged ground is basically the same, or has only slightly increased during the past 50 years.

After logging began, the new failures identified were associated with road construction and timber harvesting. Of the 238 failures, 153 are road related and 59 are harvest related *(See Tables 3 and 4)*. The majority of these occurred in the fill slopes of roads built when sidecast road construction on full-bench ground was standard practice. Sidecast construction was phased out during the late 1970's and early 1980's. The rate of fill failures typically decreases in the second or third year after an initially higher failure rate, since the most unstable areas fail first. The rate continues to decrease for a few years and then generally levels off, as small failures along the outside edges develop due to the settlement of typically poorly compacted fill edges and incorporated rotting organic debris.

Information available from GIS required that steep ground be defined as greater than 50%, although 55% is usually used as the limit on which typical fills can be constructed. For this watershed analysis, it is thought that the 4% difference does not have a significant effect on the distribution of slope failures.

Expected failures associated with stand replacement fires were not recognized during the examination of aerial photos due to regeneration between the time of the fire and the aerial photo flights. In the case of the Hehe Creek burn, timber was harvested before the subsequent aerial photo flight.

The erosion potential for each Soil Category was determined by averaging the surface and subsurface erosion potential of those SRI soils comprising the Soil Categories. Category 3 had the highest, followed by Categories 4, 1, 2 with 5 having the least erosion potential *(See Table 7)*. Based on the gradation of the SRI soils comprising the Soil Categories, Categories 1 and 2 can be expected to yield the greatest percentage of fine grained sediments; Categories 3 and 4 can be expected to yield the greatest volume of coarse grained sediment, while Category 5 produces a mixture of both at a more moderate rate.

Table 5. Miles and Percentage of Roads on Sideslope by Subwatershed

Subwatershed	Road on Sideslopes				
	Miles < 51%	% < 51%	Miles ≥ 51%	% ≥ 51%	Total Miles
Lower Fall	131.12	92%	11.82	8%	**142.94**
Portland	64.21	81%	14.90	19%	**79.11**
Upper Fall	88.08	71%	36.20	29%	**124.28**
Hehe	97.24	75%	32.2	25%	**129.44**
Total	**380.65**		**95.12**		

Note: Upper Fall Creek, with 29% of its roads or 36.2 miles, has the most miles of road on sideslopes ≥ 51%

Table 6. Miles and Percentage of Roads on Sideslopes by SRI Soil Category.

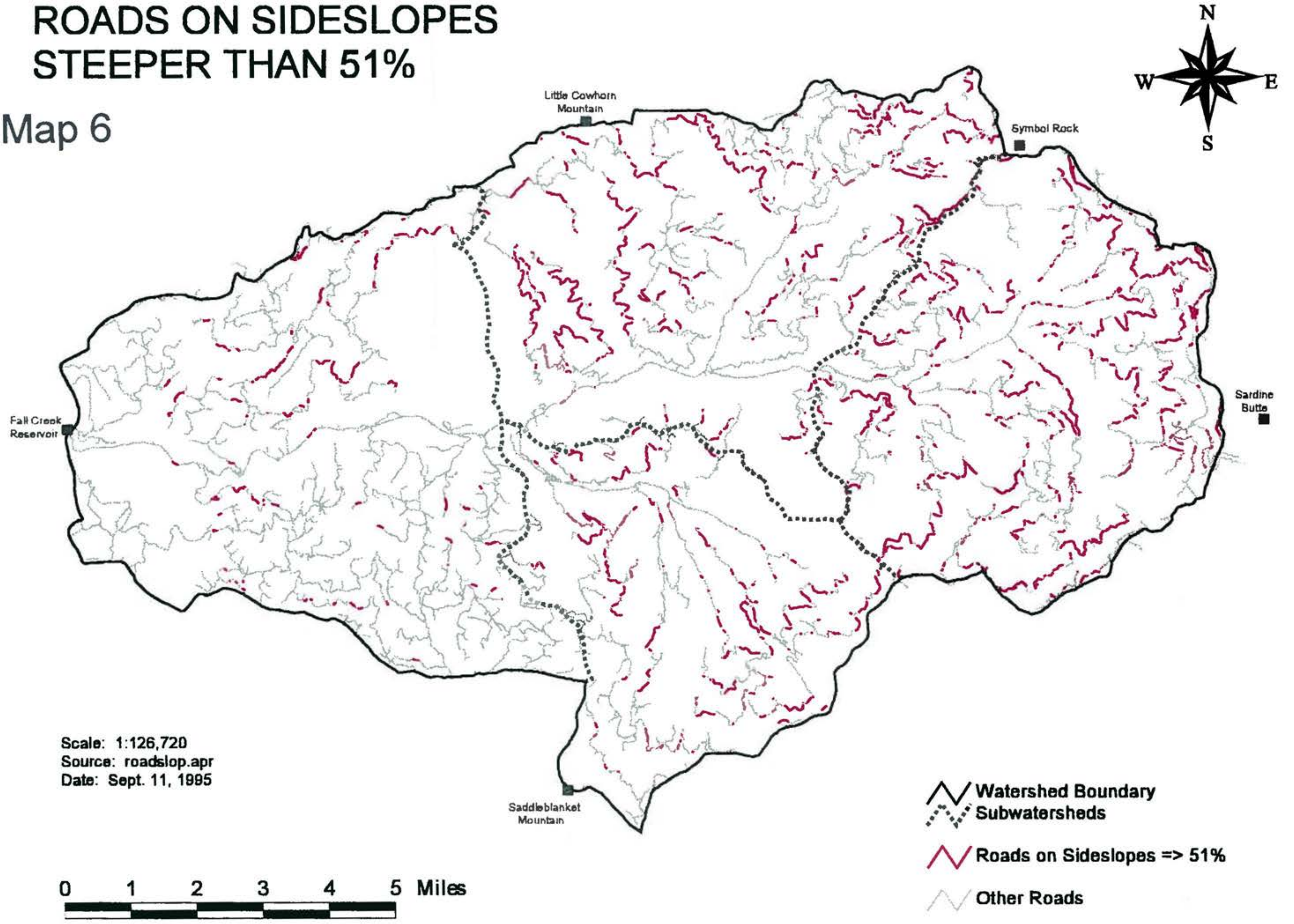
SRI Soil Category	Road on Sideslopes				
	Miles < 51%	% < 51%	Miles ≥ 51%	% ≥ 51%	Total Miles
1	38.10	96%	1.44	4%	**39.54**
2	56.10	96%	2.50	4%	**58.6**
3	105.88	62%	65.55	38%	**171.38**
4	81.71	79%	21.84	21%	**103.55**
5	98.86	96%	3.84	4%	**102.70**
Total	**380.65**		**95.12**		**475.77**

Table 7. Erosion Rating of SRI Soil Categories

Rating	Soil Category	Surface and Subsurface
Least	5	Low to Moderate
Second	1	Moderate
Third	2	Moderate to Moderatel/High
Fourth	4	Moderate/High to Severe
Highest	3	Moderate/High to Very Severe

ROADS ON SIDESLOPES STEEPER THAN 51%

Map 6



Scale: 1:126,720
Source: roadslop.apr
Date: Sept. 11, 1995

In the past, excessive amounts of sediment were identified as being generated from the roads, particularly from the aggregate surfacing. Three primary causes were poor quality aggregate from quarries (with some altered rock), volume and timing of log truck traffic related to amounts of rainfall, and the timing and frequency of road maintenance. Poor quality rock due to thermal and hydrothermal alteration, was often incorporated into surfacing aggregate, where it broke down rapidly and generated excessive fines during hauling traffic especially in wet weather. These conditions were examined during experiments on Lowell Test Road, by Mark Truebe, engineer from the Willamette Supervisor's Office, and Randy Foltz of the Intermountain Research Station, in conjunction with the San Dimas Technology Development Center. This led to the Lowell Ranger District's Wet Weather Haul Policy which identified causes and developed mitigations designed to reduce sediment from aggregate roads. Additional data and information can be found in the following publications: *Reduction of Soil Erosion on Forest Roads* by Edward R. Burroughs, Jr. and John G. King, USDA, USFS, Intermountain Research Station, General Technical Report INT-264, July 1989; *Lowell Surfacing Thickness Design Test Road* in Engineering EM-7170-15, USDA, USFS, Washington, DC September 1994; *Lowell Test Road, Helping to Improve Road surfacing Design* by Gary Evans, Mark Truebe, Willamette National Forest Engineers, and Pete Bolander, Region 6 Engineer, and *Effect of Aggregate Quality on Sediment Production from a Forest Road.* These last two are in the Sixth International Conference on Low Volume Roads.

The watershed has 76,538 acres. Lower Fall Creek is the largest with 23,238 and Portland Creek is the smallest with 13,635. *Tables 9 and 10* show the acre distribution in subwatersheds of each SRI Soil Category. There are 475.77 miles of road in the watershed. Lower Fall Creek, Upper Fall Creek and Hehe Creek have about equal numbers with approximately 125-140 miles; Portland Creek is some 40% less than the others. *Table 7* shows the miles of road in subwatersheds for each SRI Soil Category.

Summary and Background Information:

- Sixty-four percent of the recognized slope failures are road-related; 78% of these occur in Categories 3 and 4, which have steep sideslopes and shallow, coarse-grained soils. These soils represent 65% of the watershed, contain 58% of the roads, and 92% of the roads built on sideslopes greater than 50%.

- 60% of the failures occurred on 50% of the possible aspects: northwest, north, northeast, east and southeast. This is due the increase in moisture and soil depth and the resulting decrease in slope stability.

- 90% of the failures identified are on managed ground.

Table 8. Road Distributions in the Watershed.

Drainage	% of total roads in watershed	% on sideslopes > 50%
Lower Fall Creek	30%	8%
Portland Creek	17%	19%
Upper Fall Creek	26%	29%
Hehe Creek	27%	25%

Table 9. Acres per Soil Category in each Subwatershed

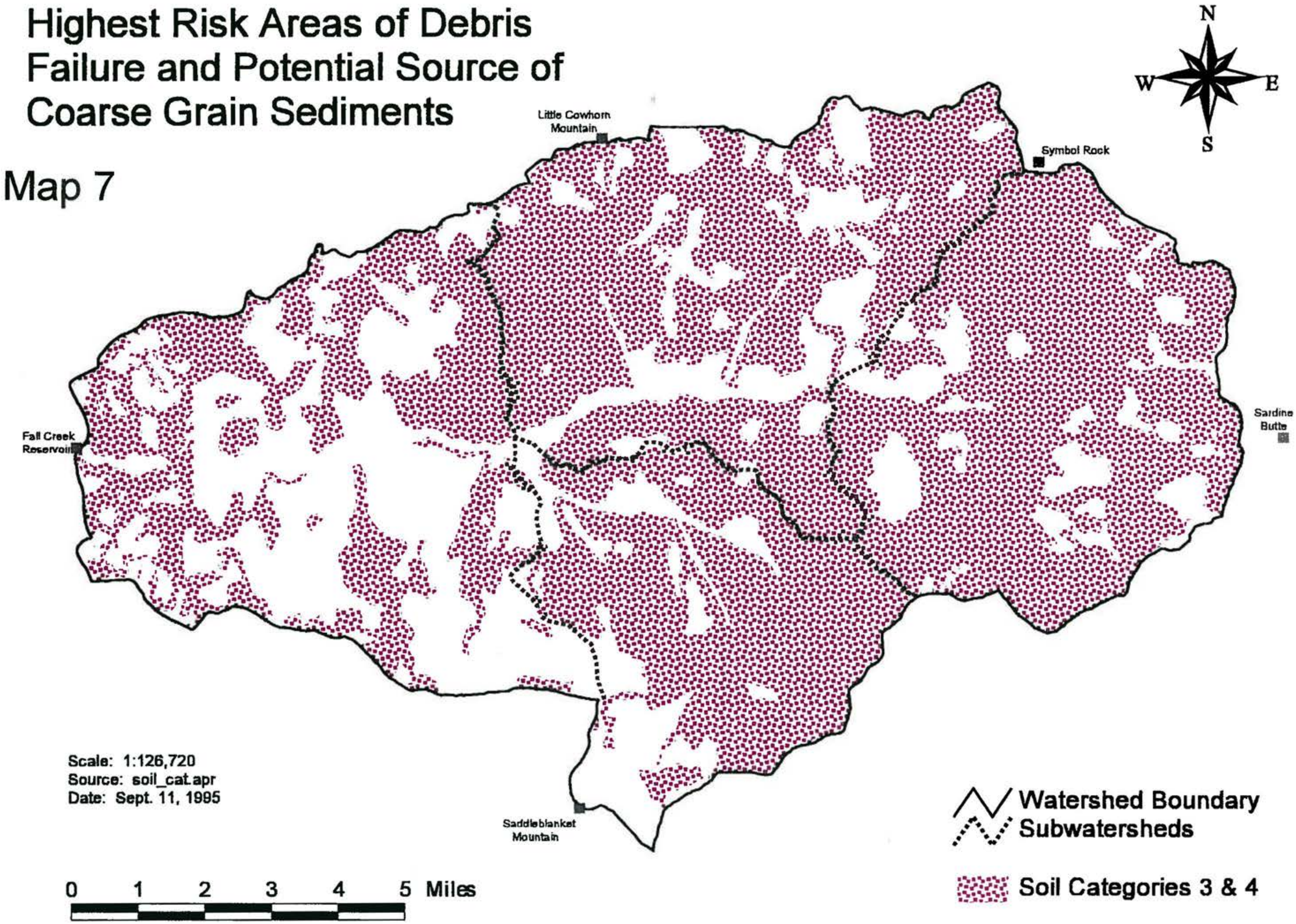
	Soil Category				
Subwatershed	1	2	3	4	5
Lower Fall	5,577	5,374	3,497	5,295	3,487
Portland	262	1,036	6,911	3,088	2,338
Upper Fall	376	975	12,290	3,426	1,981
Hehe	1,006	805	11,590	4,026	3,190

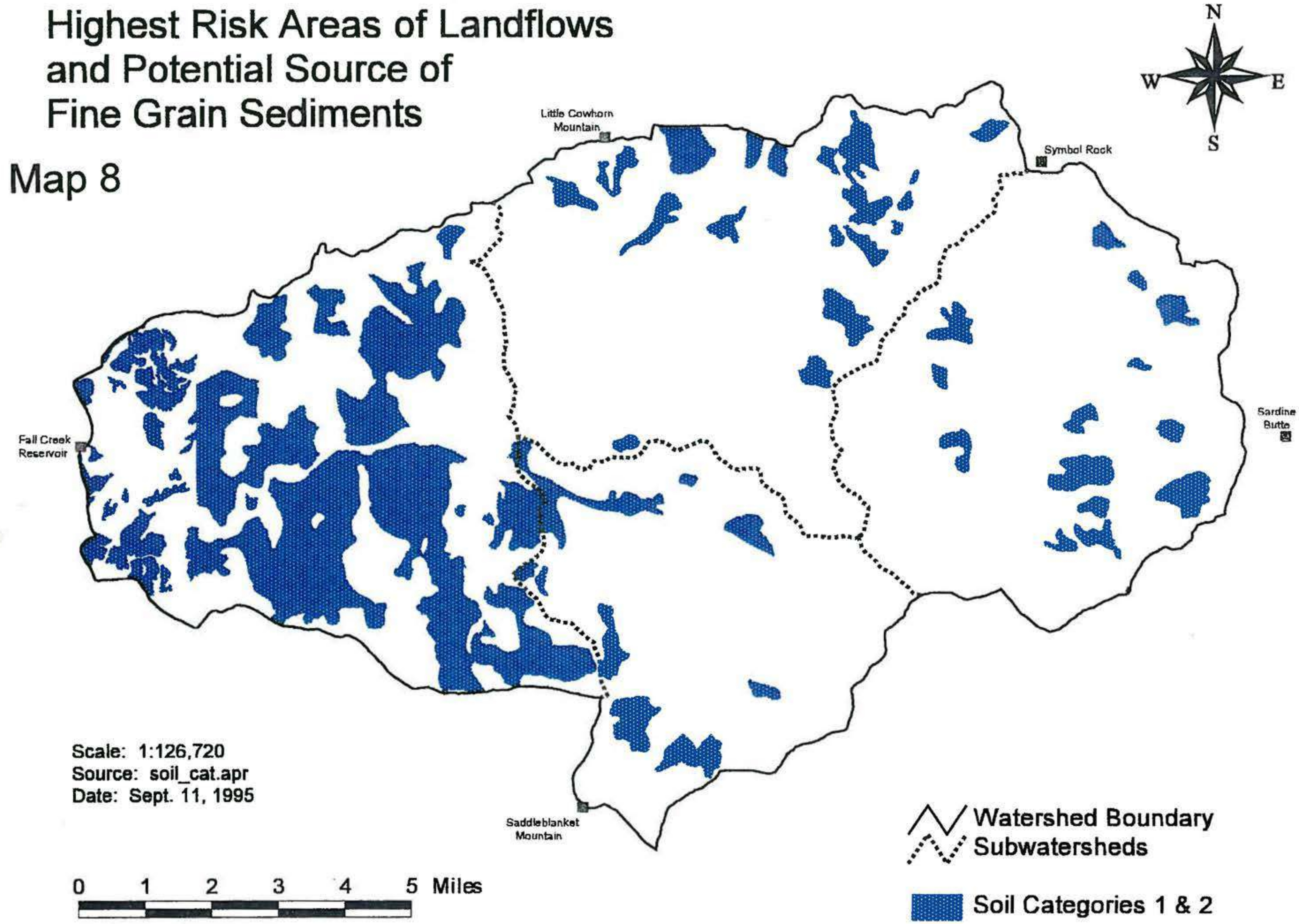
Table 10. Percentage of Subwatershed in each Soil Category.

		Soil Category				
Subwatershed	Total Percent	1	2	3	4	5
Lower Fall	100%	24%	23%	15%	23%	15%
Portland	100%	2%	8%	50%	23%	17%
Upper Fall	100%	2%	5%	65%	18%	10%
Hehe	100%	5%	4%	56%	20%	15%

Highest Risk Areas of Debris Failure and Potential Source of Coarse Grain Sediments

Map 7





Highest Risk Areas of Landflows
and Potential Source of
Fine Grain Sediments
Map 8
N
W
E
S
Little Cowhorn
Mountain
Symbol Rock
Sardine
Butte
Fall Creek
Reservoir
Saddleblanket
Mountain
Scale: 1:126,720
Source: soil_cat.apr
Date: Sept. 11, 1995
0 1 2 3 4 5 Miles
Watershed Boundary
Subwatersheds
Soil Categories 1 & 2

TRANSPORTATION

The Fall Creek Watershed contains four subwatersheds with a total of 483 miles of road in four jurisdictions. Roads are managed by the Forest Service, Bureau of Land Management, Lane County or various private landowners.

Transportation system development of the Fall Creek Watershed began in about 1911 during the horse and buggy era. At that time, the system consisted of user-made trails and unsurfaced buggy roads. Demand for roads in the National Forest led to the implementation of various federal legislative acts beginning about 1906 and continuing through 1921. In the latter year, $4,400,000 was appropriated for construction of forest development roads. At about the same time an "improved road" was constructed on the Middle Fork of the Willamette River. Road building continued at a slow pace until the early 1950's, when a demand for timber and recreation access to public land spurred a dramatic increase. Roads constructed during 1950 to 1980 were characterized by engineering principles of least cost, where little utilized or excess excavation was sidecast below road grade rather than hauled and stored at a waste site. This is also the era where water intercepted by road construction was collected, routed under or along the road and forgotten. This practice, while efficient in road construction and maintenance, was not necessarily good for the land, water or the fisheries resources. This period of rapid road development resulted in the construction of about 85% of the watershed road miles with only short, local roads remaining for later construction.

Approximately 345 miles of existing roads can accommodate use with a passenger car or high clearance vehicle. Eighty miles are closed or can be closed, and 42 miles are decommissioned roads. For the sake of this report, "decommissioned" means that drainage structures have been pulled, the road has been ripped, seeded and fertilized, berms have been added to direct and control water runoff, and the road has been blocked with an earthen berm. Total miles of drivable road, if all closure devices were removed or opened, equals 424 miles. In riparian reserves 123 miles are open, 27 miles closed and 11 miles decommissioned.

Most of the road system was built between 1950 and 1980 when sidecast construction was used to dispose of "excess" excavation. Currently, most of the system is between 14 and 44 years old and is starting to show edge cracking, a result of the sidecasting, and slumping of old fills caused by burying woody material. About 160 miles of these roads are in Riparian Reserves. There are 123 open miles and 27 miles which are closed or could be closed by use of existing gates.

To complicate the situation, the designed life span of corrugated metal pipes (CMPs) is twenty years and much of the system is older than the designed life. In the past, roads proposed to be used for timber haul under the timber sale program were field checked for deteriorated CMPs and failing pipes were replaced using purchaser credit. With the reduction in the timber sale program, this funding source is no longer available and it is expected that a number of the existing pipes will fail, some catastrophically, adding sediment to an already stressed system of streams. A recent field investigation of stream crossings on perennial streams on 18% of the watershed, indicated that nine of 38 crossings surveyed would not pass a 100 year event with the accompanying debris load (SEIS). This amounts to nine failures for 18% of the watershed, so it can be assumed that there would be approximately 50 failures for the entire watershed. While this direct interpolation is probably inaccurate, it can be assumed with some degree of accuracy that failure rate would be in the range of 20-60 culverts. Obviously the rest of the watershed needs to be checked to determine the exact number of culverts that would not pass a 100 year event. This same field inventory showed that of the 38 crossings, only two were armored with riprap to prevent damage from overtopping. The study showed 15 culverts in high risk of overtopping; unfortunately, none of them were armored. Twenty-seven of the 38 culverts had no fish passage. Again, using some interpolation, this data would seem to indicate that there could be as many as 50-70 pipes in Class III and II streams with no fish passage. This data needs to be linked to stream survey data to determine which pipes have a high priority for facilitating fish passage.

Production of Fine Sediments

Due to winter haul, roads on this District are generally surfaced with a sufficient depth of rock to support the haul under adverse weather conditions. However, much of that rock is of poor quality, which adds to sediment problems both during use and when stored in a closed condition. Studies conducted by Burroughs and Foltz, Intermountain Research and Development, show that all roads produce sediment, but roads having traffic produce up to six times the amount of sediment as roads where traffic is eliminated. Those same studies show that sediment can be reduced by 50% when using central tire inflation (CTI) during commercial haul. Further, these studies show that as rutting occurred during use, sediment production increased 2.9-13.3 times. This effect can be reduced by timely maintenance, but maintenance can also produce 1.32 times more sediment. The effect of both use and maintenance on the production of fine sediment can be eliminated by closure of roads when not in use.

The Transportation Management System database shows that there are 19.31 miles of paved road in the watershed. Of those miles, 17.86 or 93%, are in Riparian Reserves, while 1.45 miles or 7% are not. While this data may indicate a good job of roads paved in Riparian Reserves, the author knows of only 3.22 miles paved to reduce sediment. There are 314.86 miles of aggregate roads with 118.80 miles or 38% in Riparian Reserves and 196.06 miles or 61% in Non-Riparian Reserves. The watershed has 52.06 miles of improved or pit run roads of which 13.39 miles or 26% are in Riparian Reserves and 38.67 miles or 72% are in Non-Riparian Reserves. Finally, there are 47.96 miles of natural or native, unsurfaced roads. Of significance, 10.33 miles are in Riparian Reserves while 37.63 miles are in Non-Riparian Reserves. Those miles in the Riparian Reserves should be field checked for possible sedimentation problems and should be of the highest priority for correction. See *Table 11* for a breakdown of road miles in each surfacing category by subwatershed.

Table 11. Surface Type by Sub-Watershed

Paved Surface Type			*Aggregate Surface Type*		
Sub-Watershed	**Riparian**	**Non-Riparian**	**Sub-Watershed**	**Riparian**	**Non-Riparian**
Lower Fall Creek	7.63	0.55	Lower Fall Creek	28.54	65.72
Portland Creek	2.51	0.09	Portland Creek	22.66	41.09
Upper Fall Creek/ Delp Creek	3.53	0.03	Upper Fall Creek/ Delp Creek	33.50	72.96
Hehe Creek	4.19	0.78	Hehe Creek	34.01	65.12
TOTALS	17.86 / 92%	1.45 / 8%	**TOTALS**	118.71 / 33%	244.89 / 67%
GRAND TOTAL	**19.31 Miles**		**GRAND TOTAL**	**363.60 Miles**	

Improved Surface Type			*Native Surface Type*		
Sub-Watershed	**Riparian**	**Non-Riparian**	**Sub-Watershed**	**Riparian**	**Non-Riparian**
Lower Fall Creek	6.59	17.19	Lower Fall Creek	6.51	29.99
Portland Creek	1.46	6.36	Portland Creek	0.47	1.77
Upper Fall Creek/ Delp Creek	2.57	7.26	Upper Fall Creek/ Delp Creek	1.11	2.53
Hehe Creek	2.77	7.86	Hehe Creek	2.77	.51
TOTALS	13.39 / 26%	38.67 / 74%	**TOTALS**	10.86 / 24%	34.80 / 76%
GRAND TOTAL	**52.06 Miles**		**GRAND TOTAL**	**45.66 Miles**	

HYDROLOGY

Aquatic Stream Classification and Distribution

The density of streams varies across the watershed due to site specific characteristics, including soil properties and local variation in precipitation pattern and intensity. *Table 12* displays the number of stream miles by class and the stream density by subwatershed. Miles have been field-verified for Class I, II and III streams; Class IV streams were approximated using orthophotos, but not field-verified. Although overall stream densities are similar to conditions prior to management impacts, the existing road system can be viewed as an extension of the intermittent stream network.

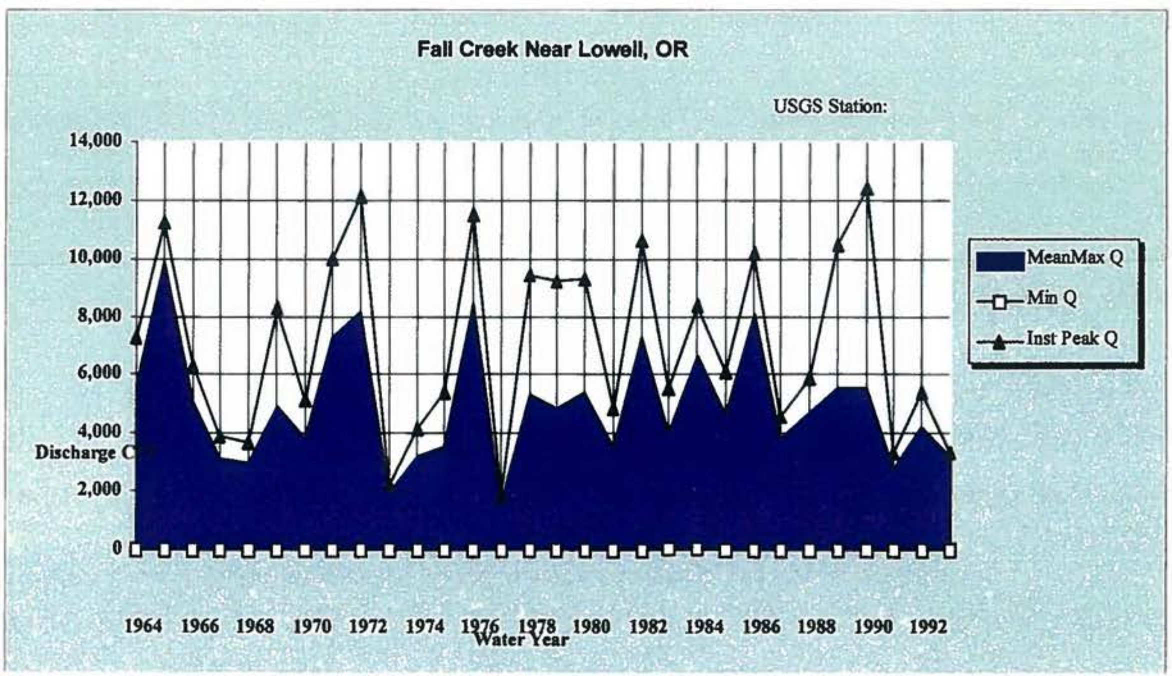
Table 12. Stream Miles by Class and Subwatershed

Stream Class	*Subwatershed*			
	15 1	15 2	15 3	15 4
I	12	4	8	10
II	17	10	10	11
III	25	14	29	18
IV	147	88	145	159
Stream Density (mi/sq mi)	5.72	5.62	6.45	6.48

Streamflow

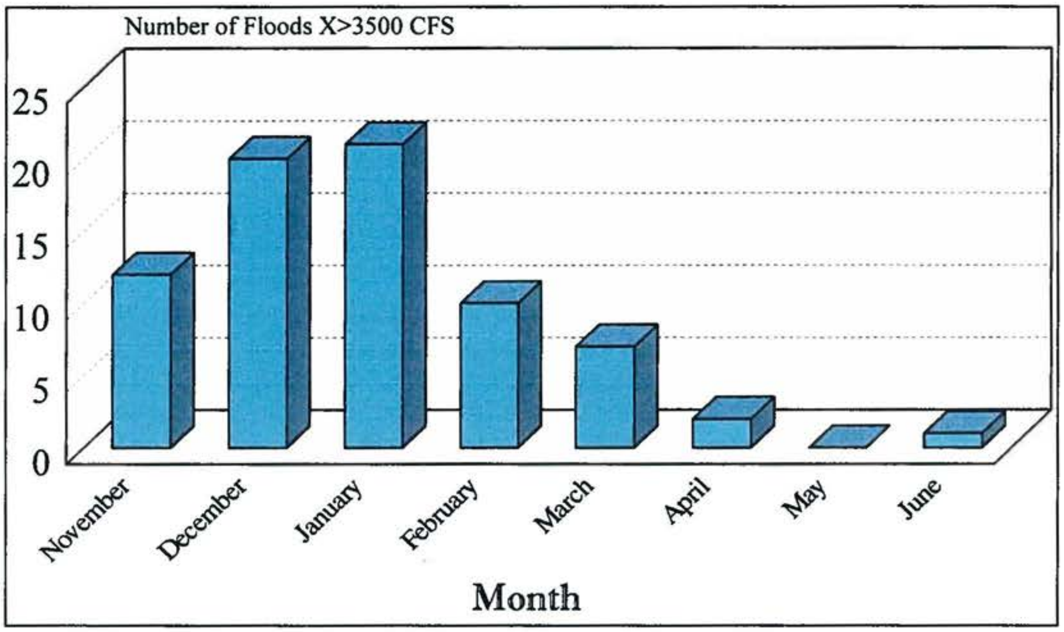
The U.S. Geological Survey (USGS) monitors streamflow on Fall Creek 0.1 miles downstream from the confluence with the North Fork Fall Creek, and roughly one mile upstream from the highwater mark of Fall Creek Reservoir. Station 14150300, named "Fall Creek near Lowell, Oregon," has a drainage area of 118 square miles. The period of record begins in late August of 1963 and continues through the current year, 1995. Data from water years 1964 to 1993 was analyzed and is presented in *Figure 1.*

Figure 1. High Flow Events for Water Years 1964-1993, Station 14150300



Annual high flow events occurring within the Fall Creek watershed for the period of record are presented in *Figure 2*. In this graph the annual instantaneous peak, mean maximum, and minimum daily discharge are displayed. The watershed's largest peak flood events occurred in water years 1965, 1972, 1976 and 1990.

Figure 2. Flood Frequency by Month for Fall Creek Watershed 1964-1993



Notable flood events within the Willamette River Basin prior to the period of record occurred in calendar years 1861 and 1890. Floods of a smaller magnitude took place in 1923, 1945, and 1955 (Waananen, Harris, and Williams, 1971).

A recurrence interval is the probability a certain magnitude flood event will occur over a given period of time. The following summarizes the results of two different methodologies for determining a recurrence interval (RI) and corresponding flood magnitude utilizing Fall Creek flow data. The first is an instantaneous peak flow RI, and the second is a Log-Pearson Type III Duration-Frequency Analysis for mean daily maximum flows.

Instantaneous peak flow recurrence intervals were developed for this gauging station, 14150300, by Harris, et al., 1979, and include values shown in Table 13.

A *Log-Pearson Type III Duration-Frequency Analysis* for 1963 to 1986 was completed based on data collected at the USGS station (Welcher, et al, 1991). This analysis provides a recurrence interval for mean daily maximum flows rather than instantaneous peak flows as seen above. The recurrence intervals are shown in Table 14.

Table 13. Instantaneous Peak Flow Recurrence Intervals, Station 14150300

Recurrence Interval	Discharge (cfs)
2 year	6,140
5 year	9,640
10 year	12,300
25 year	16,100
50 year	19,200
100 year	22,600

Table 14. Mean Daily Maximum Flow Recurrence Intervals, 14150300

Recurrence Interval	Discharge (cfs)
2 year	5,190
5 year	7,184
10 year	8,509
25 year	10,185
50 year	11,436
100 year	12,690

The greatest *flood frequency* occurs over the period of record during December and January as seen in *Figure 3*. Twenty-seven percent of the total number of flood events occurred in December and 29% in January, with November and February trailing at 16% and 14% respectively.

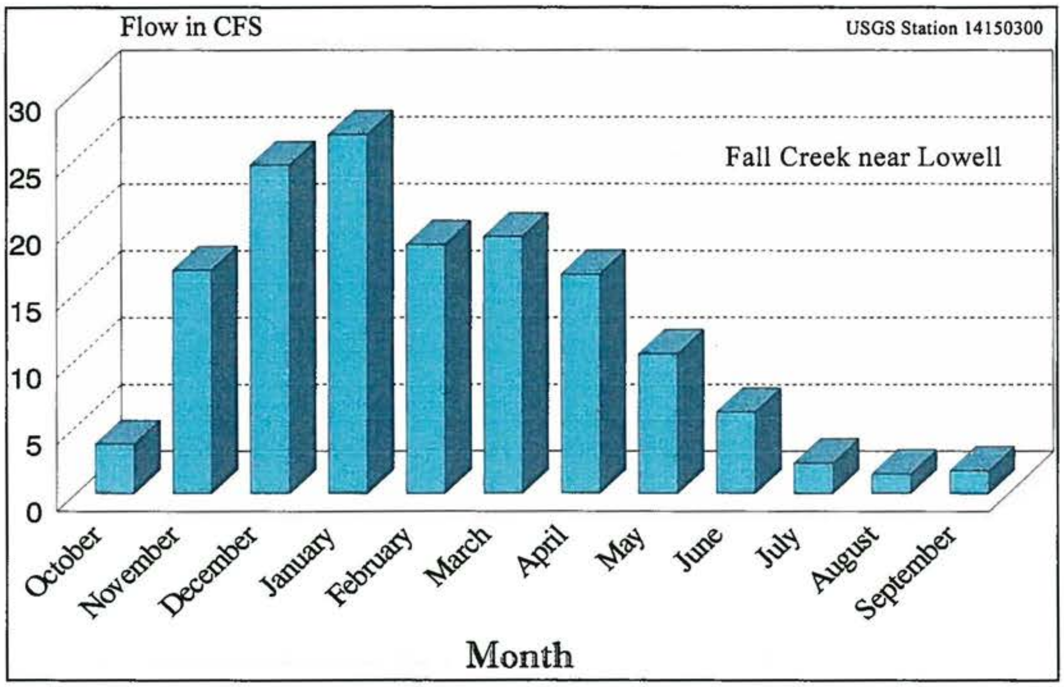
Table 15. Recurrence Intervals for Fall Creek Flood Events

Water Year	Instantaneous Peak RI	Mean Daily	Maximum RI	
1965	11,200 cfs	8.5 year	9,900 cfs	21 year
1972	12,100 cfs	10 year	8,190 cfs	8 year
1976	11,500 cfs	8.5 year	8,490 cfs	10 year
1990	12,400 cfs	10 year	5,570 cfs	2.5 year

Note: the recurrence intervals for Fall Creek flood events were interpolated and are rough ,although close in value.

The average total monthly flow from 1963 to 1993 shows parallel peaks to the flood frequency graph for December and January as being the greatest *quantity of flow* on a monthly basis *(See Figure 2).* These months also have the largest values of monthly mean streamflow data *(See Figure 3).* Although the quantity of flow remains relatively high in the spring from February through March, the frequency of floods above base flow shows a steady decline from February through May. Quantity of stream flow generally follows the pattern of precipitation, most falling as rain. Due to the relatively low elevation of the watershed in most years a significant snowpack contributing to runoff during the spring season does not exist.

Figure 3. Average Total Monthly Flow for Fall Creek 1963-1993

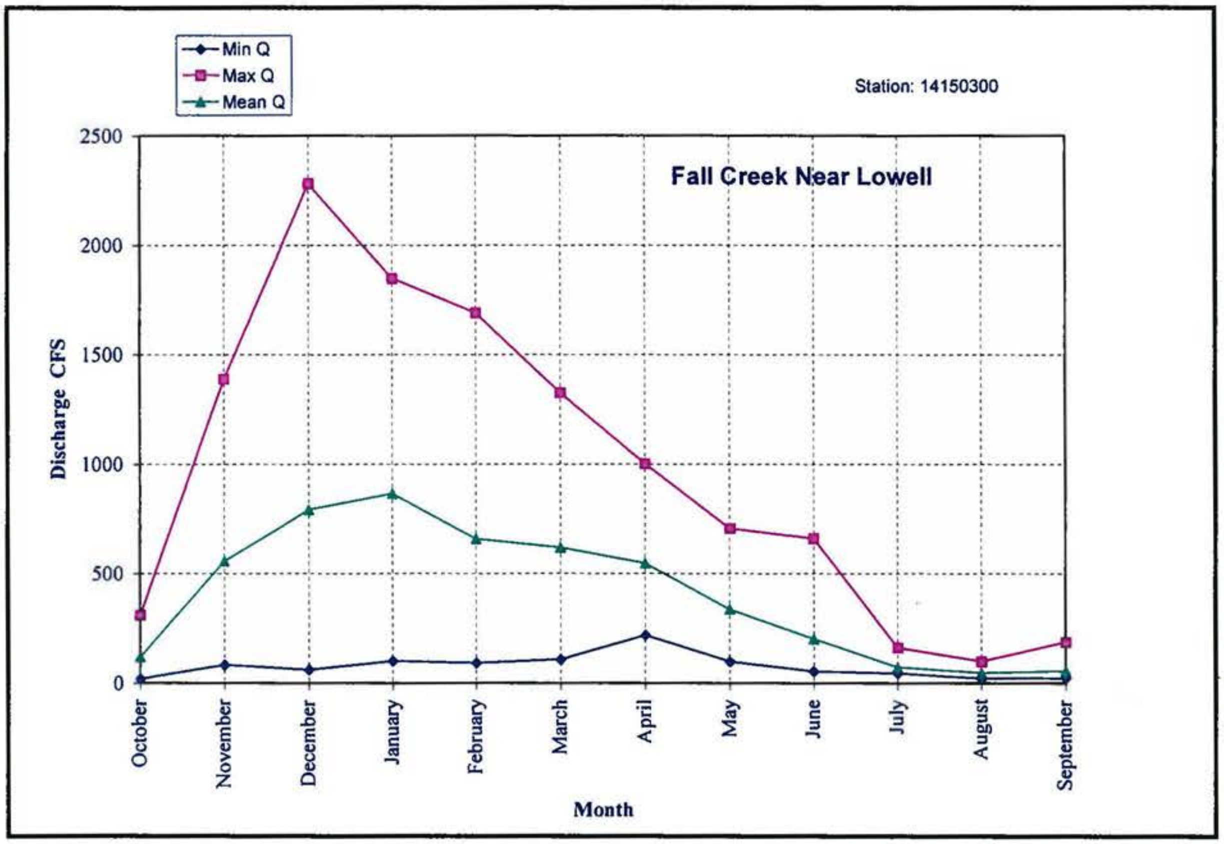


Data Observations for the Period of Record 1963-93:

1. 1977 *mean winter lowest monthly flow* for November through February (with a range of: **61 cfs to 102 cfs**);
2. 1965 *highest monthly mean winter flow* (December, **2,282 cfs**);
3. 1992 *lowest monthly mean summer flow* (August, **21 cfs**);
4. 1990 *highest instantaneous peak* occurred in April (12,400 cfs) although overall, the cumulative discharge for the water year was low (total discharge: 119,811 cfs);
5. 1972 the *second highest instantaneous peak* occurred in **January (12,100 cfs)** with the *highest overall cumulative discharge for the water year* **(235,833 cfs);** note that this peak may have been due to the break-up of a log jam or to a bridge failure that occurred within this drainage;

6. 1977 and 1992 had the *lowest overall cumulative discharges for the water years*, **66,741 cfs and 99,014 cfs;**
7. 1974 has the *second highest cumulative discharge overall for the water year* **(226,355 cfs),** *although* it had four flood events over 3,500 cfs with a maximum *instantaneous peak of only* **4,140 cfs.**

Figure 4. Statistics of Monthly Mean Data for 1963-1993



Hydrologic Recovery

Reference Condition

The vegetative condition of an area, as it relates to snow accumulation and melt, is termed hydrologic recovery. Hydrologic recovery values reflect the potential for an increase in the magnitude of peak flows during rain-on-snow events. Nearly the entire watershed is within the transient snow zone *(See Figure 5),* indicating a potential for high runoff under conditions such as warm wind and rain following a period of snow accumulation. Prior to forest management, hydrologic recovery values probably varied across the watershed as the vegetative condition changed with stand-replacement fires. Increases in peak flows are associated with adverse impacts on stream channel conditions due to an increase in streambed and bank scour.

Current Condition

Hydrologic recovery can be quantified by the Aggregate Recovery Percent (ARP) method. Calculated ARP values were used as a measure of the risk of increased magnitude of peak streamflow related to management activities within each of the subwatersheds. For a further discussion of ARP, see Willamette National Forest LRMP FEIS Chapter IV, Section: Water, and Appendix B.

For planning purposes, the Willamette National Forest Land and Resource Management Plan (Forest Plan) describes the sensitivity of planning subdrainages based on overall slope of the drainage and the percent area within the transient snow zone. Each planning subdrainage was assigned a mid-point ARP value as a reference point for assessment purposes. The mid-point ARP value provides a relative measure of drainage sensitivity. These may be viewed as thresholds of concern below which there would be a higher risk of increased peak flows and potentially adverse effects. *Table 16* lists the current ARP values calculated by subwatershed and a weighted value for the subwatershed based on the Forest Plan mid-point ARP.

Table 16. Current and Weighted Mid-Point ARP Values by Subwatershed

Subwatershed	Current ARP	Weighted Mid-Point ARP
Lower Fall Creek	72	74
Portland Creek	69	80
Upper Fall/Delp Creek	68	78
Hehe Creek	76	79

All Fall Creek subwatersheds are currently below their respective weighted Forest Plan mid-point ARP values. Although values for individual planning subdrainages vary considerably within subwatersheds, overall these values indicate that management activities have increased the potential for magnitude peak flows to be greater during rain-on-snow events on a subwatershed level. This potential would be greatest in the Portland Creek and Upper Fall/Delp Creek subwatersheds.

Roads contribute to an increase in peak flows above the change in vegetative conditions primarily due to the reduced permeability of road surfaces, more rapid water routing to streams in roadside ditches, and interception and conversion of subsurface flow to more rapid surface flow. Although road surface area was factored into the ARP values, an additional factor of road density should be considered when assessing an area's potential contribution to peak flows. All the subwatersheds have relatively high road density values. They range from a high of 4.15 miles of road per square mile in Upper Fall/Delp Creek to a low of 3.59 miles per square mile in Portland Creek.

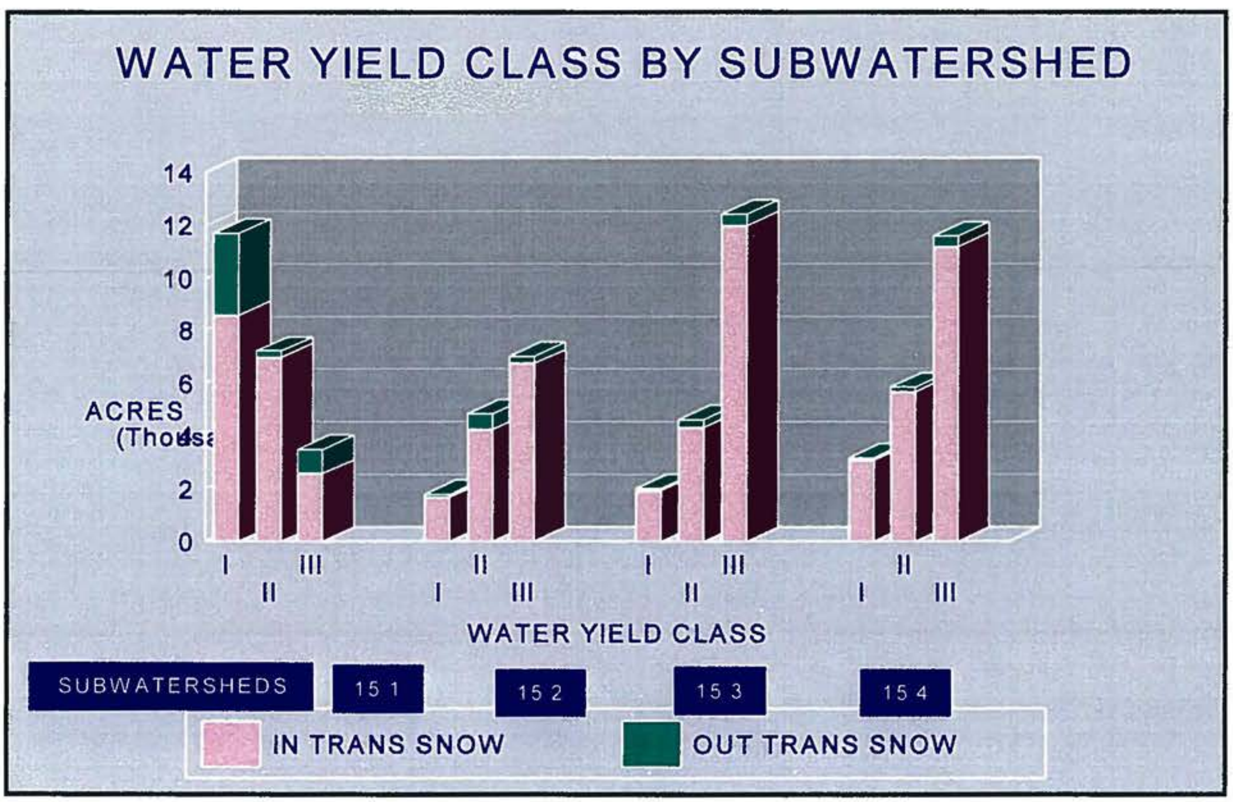
Water Yield

Water yield is a product of the amount of precipitation an area receives combined with its soil and landform properties. The vegetative condition of an area also affects the water yield due to changes in the evapotranspiration rates. Water yield increases have been observed following stand replacement wildfires (Potts, et al., 1989). Management activities including timber harvest have not created significantly more acreage of early successional forest than would have existed at times during a natural fire regime. Therefore, water yields for reference and current conditions are within the range of historic variability, though timber harvest and road construction may have altered the magnitude of peak flow events as previously discussed.

Groundwater storage capacity is directly related to the type of soil and its depth. Relatively shallow soils have a lower ability to store water and have the potential of being the greatest contributors to increased stream flow during high runoff events. Deep soil areas generally have the ability to store water and contribute to the maintenance of base flows. The soil categories listed in *Table 2*, correspond to water yield classes as defined in the Willamette National Forest Soils Resource Inventory (Legard and Meyer 1973). Soil water yield class definitions used in this analysis are as follows:

I. Soils with a low runoff rate and high water detention capacity, given that the soils are not saturated or frozen; important in sustaining high base flows.

Figure 5. Water Yield by Subwatershed



II. Soils with a moderate runoff rate and moderate water detention capacity; water contributions to both peak flows and base flow.

III. Soils with a high runoff rate and low water detention capacity; the storage capacity is low and easily exceeded with most of the water contributing to peak flow; little water yield to sustain base flow.

Subwatershed 151 has a relatively high proportional area in water yield Class I and therefore would have the greatest ability to store water and contribute to baseflow *(See Figure 5)*. The remaining subwatersheds are all dominated by water yield Class III indicating a rapid contribution to streamflow during high runoff events. Overall stream gradients within the watershed are high and there are few surface features capable of storing water during high runoff events. These factors combined with a high percentage of the watershed in the transient snow zone indicate stream discharge would increase rapidly during periods of high soil water input.

Water Quality

Data on water quality within the watershed is limited. Water quality parameters of concern include stream temperatures and turbidity/suspended sediment due to their relationship with beneficial uses as identified by the Oregon Department of Environmental Quality.

Stream Temperatures

The following information is based on stream temperature monitoring data collected by the USGS and personnel from the Lowell Ranger District. Stream temperatures were monitored at various points throughout the watershed during the summer months. Actual monitoring dates vary by year between different sites. Some stream sites were monitored continuously from June through September while others were monitored for a shorter period and/or discontinued during the summer season. The results discussed below provide only a rough approximation of the actual stream temperature conditions in the Fall Creek watershed.

The temperature values summarized in Figures 6-8 represent the average of the daily maximum temperatures recorded during the monitoring period each year.

Spatial Variation

Figures 6, 7 and 8 summarize some of the spatial variation in stream temperatures that occurred in the Fall Creek watershed during the summer months from 1984 through 1986. Data is displayed for each of the three years in which stream temperature monitoring was most extensive. The site location is identified in terms of distance upsteam from the reservoir. Mainstem locations are distinguished from tributary mouth sites and are symbolized by magenta triangles.

Figure 6. 1984 Summer Temperatures

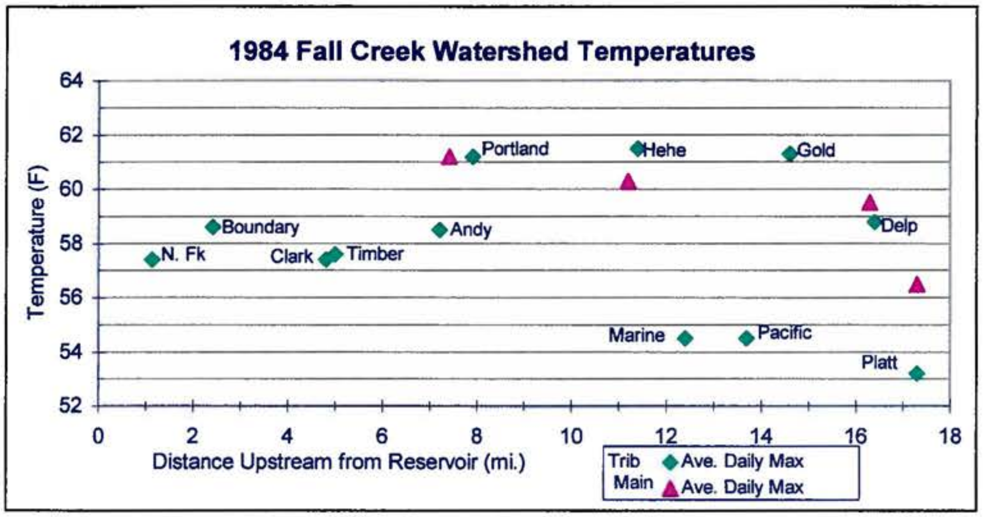


Figure 7. 1985 Summer Temperatures

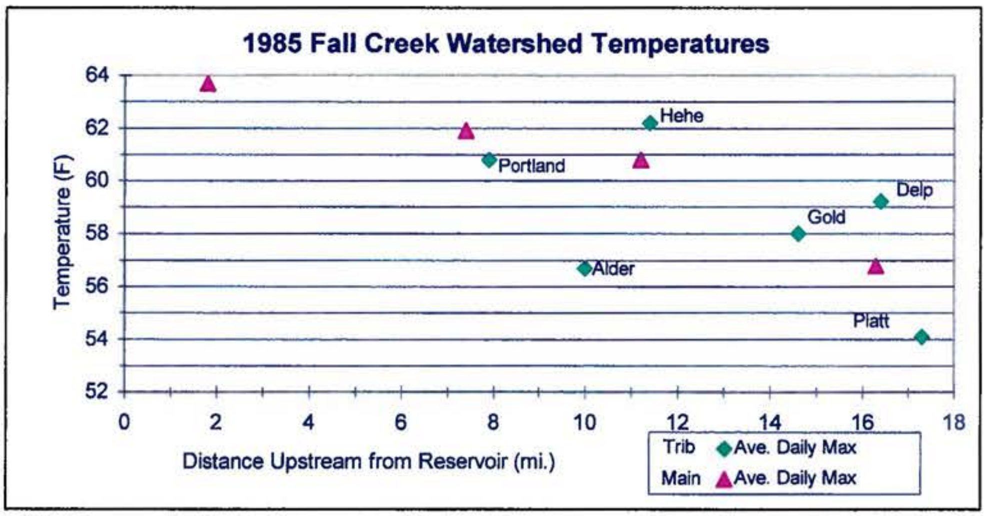
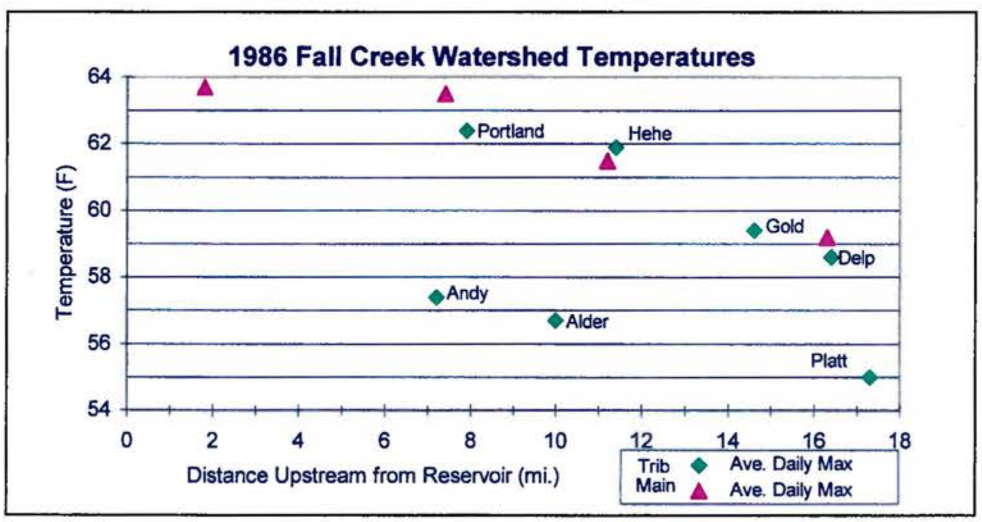


Figure 8. 1986 Summer Temperatures



Stream temperatures are a result of several variables involving energy transfers into and out of the stream (DEQ 1994). In general, water flowing downstream in headwater streams tends to increase in temperature. The pattern of increasing stream temperature moving downstream is evident in the mainstem of Fall Creek for 1984 through 1986. In the tributaries however, the pattern is not consistent. Some tributaries such as Portland and Hehe had higher recorded temperatures than downstream lower elevation tributaries such as Alder and Andy. These differences are possibly due to a combination of natural factors and human impact. Since Portland and Hehe Creeks together contribute approximately 30% of the total summer discharge of Fall Creekm, they also contribute significantly to the summer maximum temperatures. Higher temperatures contributed by these relatively large tributaries are moderated only slightly by cooler temperatures in smaller downstream tributaries and groundwater sources.

A similar contrast can be seen between Delp and Platt Creeks. The mouths of these two headwater tributaries enter the mainstem less than a mile apart, but the larger Delp Creek has considerably higher recorded temperatures in all three *years*. In 1984 and 1986 the temperature in the mainstem just below Delp Creek appears to be closely related to the input temperature from this source.

From this limited data, it appears that temperatures in the three largest tributaries of Fall Creek, Portland, Hehe, and Delp Creeks, may be of concern both in terms of the potential impact to aquatic habitat in those sub-basins, and in terms of the cumulative impact to the mainstem of Fall Creek.

Temporal Variation

Figures 9 and *10* display data from nine locations over a period of eight to ten years. *Figure 9* displays the yearly variation in summer average daily maximum temperatures at four mainstem locations which are listed in order from downstream to upstream. *Figure 10* displays the data for locations at the mouths of five major tributaries also listed in order from downstream to upstream. Some of the variation shown in these graphs is probably due to previously mentioned sampling differences.

The short period and gaps in the record make it difficult to discern trends over time at any one location. Overall, the summer average daily maximum temperature has ranged from a low of 53 degrees at Platt Creek in 1984 to a high of 67 degrees at the mainstem below Boundary Creek in 1992. The direction of change, either up or down, appears to be generally consistent from year to year at different locations. Minor discrepancies, indicated by lines with opposite slopes, occur in a few years but this is probably due to measurement error.

Figure 9. Mainstem Summer Temperatures

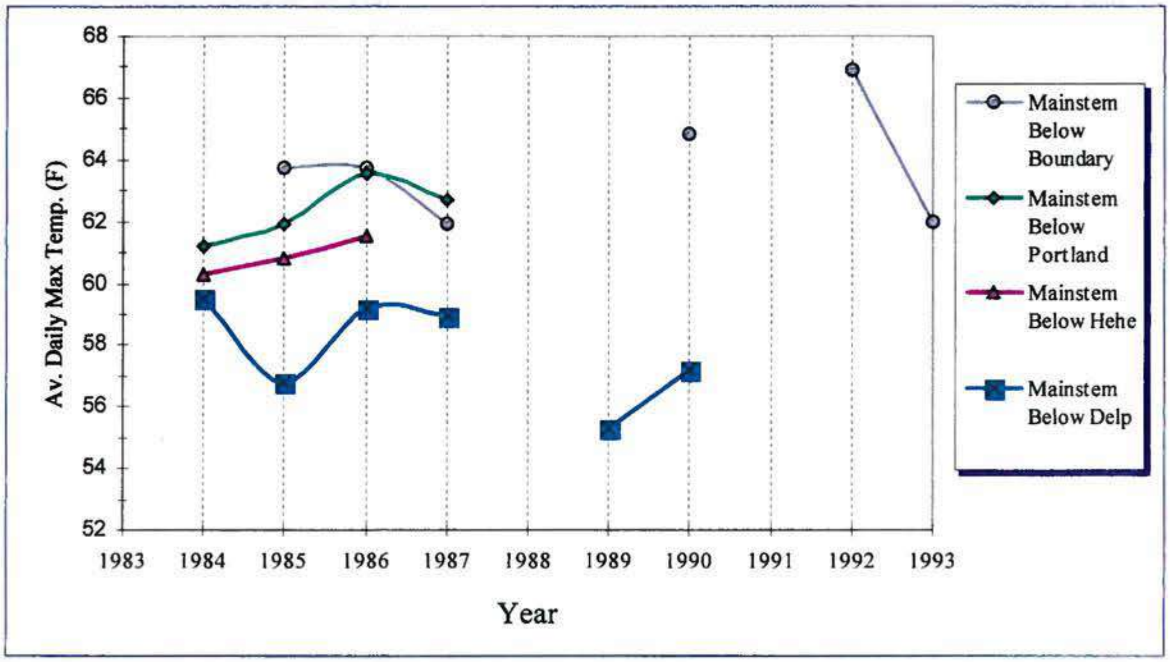
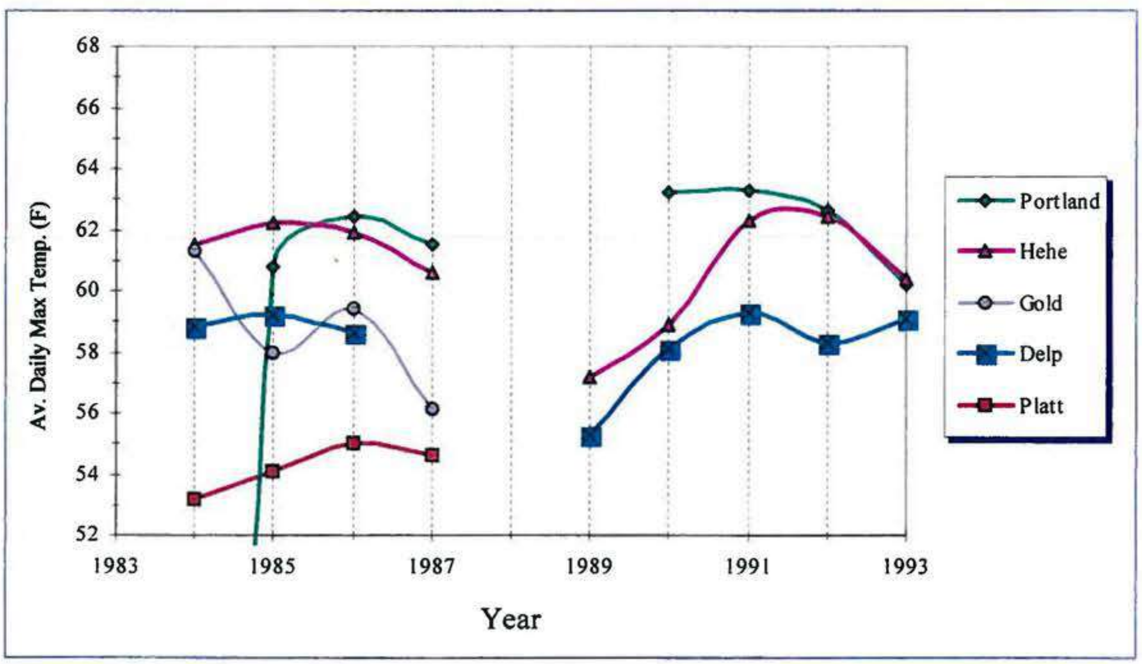


Figure 10. Fall Creek Tributary Summer Temperatures 1984-1993



Suspended Sediment and Turbidity

During high runoff events, streams would have sufficient energy to transport all but extremely large sediment delivered to stream channels. Although some sediment transported in stream channels would be deposited in depositional reaches, the majority would travel to and be deposited in Fall Creek Reservoir. Fine sediment deposited in spawning gravels can cause mortality of salmonid eggs *(See Biological Domain, Fisheries, Reference Condition, this chapter)*. Areas especially sensitive to deposition of fine sediment would be low gradient reaches important for spawning. Turbidity is typically due to suspended particles of silt and clay in the water column, although fine organic material and microorganisms may also have an effect. Increases in turbidity may affect the recreational and aesthetic uses of water as well as increase the difficulty of effective treatment for domestic use. Studies indicate that the ability of salmonids to find and capture food may be impaired at turbidity values in the range of 25-70 NTUs, growth may be reduced and gill tissues damaged after 5-10 days of exposure to turbidity of 25 NTUs, and some species may be displaced at 50 NTUs (MacDonald et. al., 1991).

Reference Condition

Prior to management activities, elevated turbidity levels would have been associated with high runoff events. This would be particularly evident following a large scale wildfire or debris torrent event. Turbidity and suspended sediment values would typically be low during low flow periods.

Current Condition

Visual observations indicate that current turbidity and suspended sediment levels are generally low except during high runoff events. Forest management activities including timber harvest and road construction and use have resulted in increased sediment delivery to streams within the watershed *(See Transportation, Production of Fine Sediment, this chapter)*. Areas of concern include sections where roads and harvest units have impacted unstable soil areas characterized as having the greatest percentage of fine-grained sediment. Potential source areas of fine sediment include the following drainages: Timber Creek, Boundary Creek, South Fall Tributaries, Andy Creek, and Alder Creek. These drainages are located in the Lower Fall Creek subwatershed, with the exception of Andy Creek, located in the Hehe Creek subwatershed.

Several existing road-related landslides have been identified as chronic source areas of sediment; specifically a slide along Road 1832 in the Hehe Creek subwatershed and another associated with Road 1832-343. An unstable landing is also located on Road 1832-341. If corrective action is not taken, this site has the potential to be a significant sediment source area. In addition to the sites listed above, the District Watershed Improvement Needs Inventory contains site-specific project information which could be utilized to locate potential problem areas and assist in project prioritization.

Large Woody Material

Large woody material (LWM) is an important component of most stream reaches within the Fall Creek watershed. It influences the form and structure of stream channels by affecting the stream profile, pool formation, and channel pattern and position. The rate at which sediment and organic matter are transported downstream is controlled in part by the retention of this material behind in-stream structures formed by LWM. The features formed by LWM affect the formation and distribution of instream habitat, provide cover and complexity, and act as a substrate for biological activity Large woody material amounts in stream channels vary across the watershed.

Past management activities such as salvage logging and stream cleaning projects have reduced the current amount of LWM present in stream channels when compared to pre-management conditions. Past flood events in combination with extensive timber salvage within the riparian area of Fall Creek and its tributaries have probably had significant impacts on the stability of gravel and cobble bars, stream banks and riparian vegetation.

Large woody material affecting stream channels originates directly from the adjacent riparian area, tributaries and hillslopes. Past timber management activities have significantly affected this source area of LWM within riparian areas.

BIOLOGICAL DOMAIN

AQUATIC HABITAT

Reference Conditions

Land management activities such as timber harvest and road building have changed aquatic habitat conditions. Prior to these activities, westside cascade streams tended to have intact riparian areas with large conifers. As these trees fell over and provided down woody material, they enhanced channel stability and stream complexity (Sedell et al., 1988), both important factors for providing a healthy aquatic habitat. This wood helps form the stream channel, scours out pools, dissipates flow, retains nutrients, traps substrate (such as spawning gravels and cobbles where macroinvertebrates live), and provides cover habitat. Large wood deposited on floodplains and in off-channel areas is also important, providing protective cover for juvenile fish during winter high flows (Everest et al., 1985). Large wood is an essential component of the stream system, particularly in the western Cascades.

Timber harvest began in Fall Creek during the 1940's. Many of the riparian trees were removed limiting the future input of large woody material to the stream channel. In addition, the 1964 flood removed riparian vegetation, and subsequent salvage of wood within the stream contributed to the reduction in channel complexity.

Other impacts and changes to the stream have been seen in channel widening and a reduction in sinuosity. Such impacts are due to several factors such as building roads within the riparian areas, channelizing the stream, and removing riparian trees and instream large woody material. This large wood normally adds stability (Dose and Roper, 1994), dissipating channel energy and allowing the stream to interact with the floodplain efficiently.

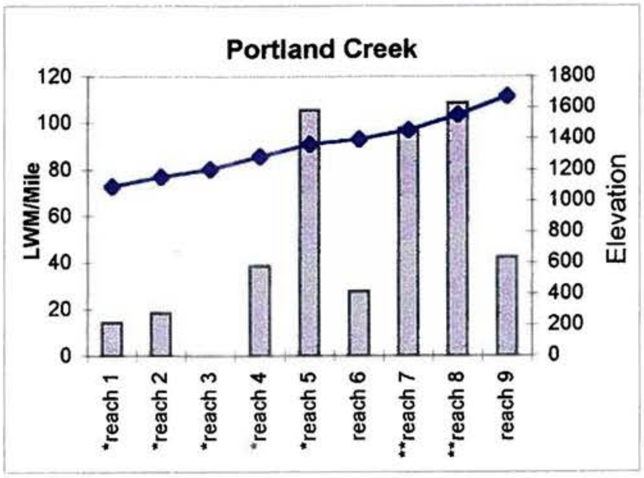
Road ditches directly influence streams by increasing overland flows and depositing fine sediment into the channel *(See Transportation section, Production of Fine Sediment)*. These ditches essentially act as intermittent channels, increasing flow. They can potentially cause bankcutting within the channel, creating even more erosion and fine sediment concerns. The fines fill in between cobbles and gravels embedding the stream channel which ruins spawning and macroinvertebrate habitat. A high concentration of fines within spawning gravels can result in the reduction of available habitat or suffocation of eggs, if fines are embedded within the gravels after spawning. Trout feed on macroinvertebrates; therefore a decrease in available habitat results in limited food availability.

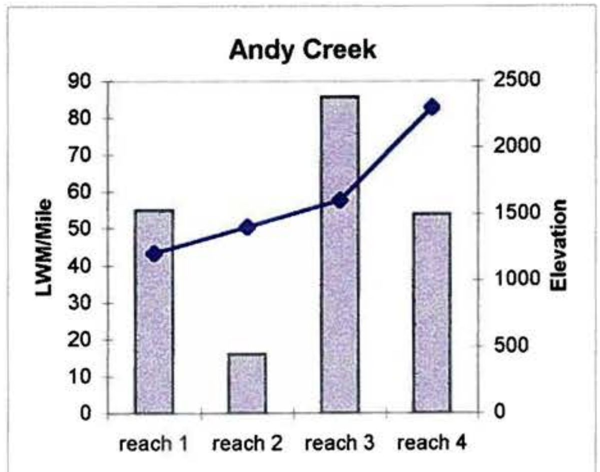
The steep rugged debris flows found in Upper Portland, Upper Hehe and Upper Fall/Delp subwatersheds are prone to landslides. Earth flows found in Timber and Andy Creeks are sources of fine sediment. In the event of slides or failures, an increase in suspended sediment would be a concern.

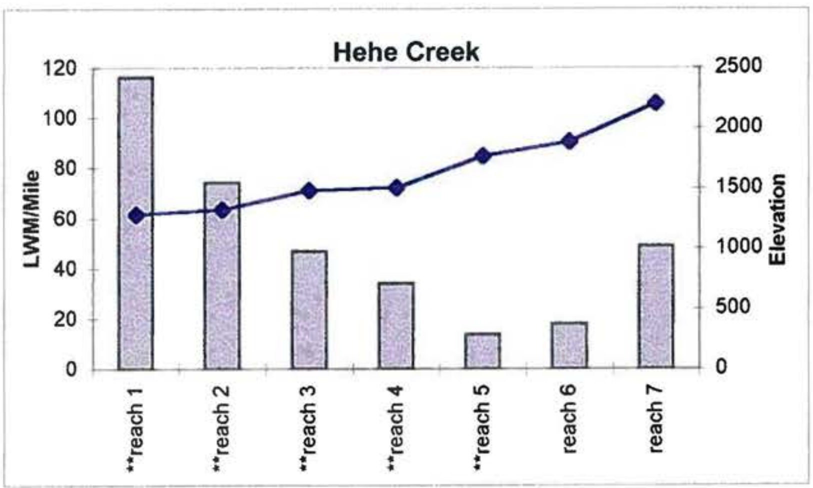
In pristine conditions riparian vegetation would primarily consist of large conifers. The range of natural variability for seral condition throughout the watershed is 3-30% for early seral and 45-75% for late seral. A snapshot-in-time was determined for 1900 in the Fall Creek Watershed which showed 4% early, 17% young, 0% mature and 78% late seral conditions. These benchmark conditions are for upslope sections. Riparian areas are considered to grow trees faster and moister conditions may further protect trees from stand replacement fires. This indicates that an increasing percentage of late successional seral conditions may be found in riparian areas.

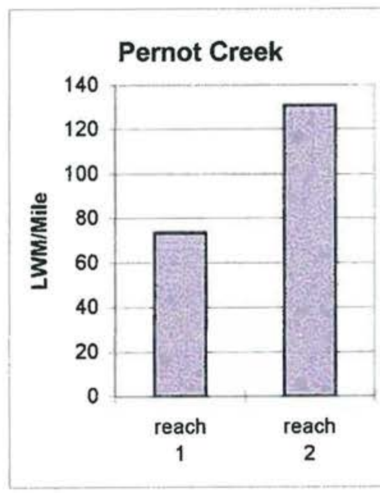
The number of channel-width pools per mile and pieces of instream large woody material per mile are two parameters commonly collected during inventories to assess habitat conditions. The desired condition of these parameters varies depending on channel width, valley and channel geomorphology. Large material such as large wood or boulders enables the channel to scour out pools and provide cover habitat. While a healthy riparian habitat of large conifers supplies the channel with future recruitment of the needed down wood, PACFISH (1995) indicates a desired condition of channel width pools per mile based on channel width, increasing the number of pools desired as channel width decreases. This model works fairly well for low gradient streams. The survey will only recognize pools that are channel-width and longer than they are wide. This eliminates much of the pool habitat in the higher gradient, stairstep habitat, where pools tend to be shorter than their width. Another limitation of using pools per mile is its subjectivity. One surveyor can designate a pool and another may lump the same pool into part of a riffle. Pools cannot be actually counted, as is the case for large wood. The desired condition of instream large woody material in PACFISH is measured at 80 pieces per mile for all streams *(Figures 11, 12 and 13)*.

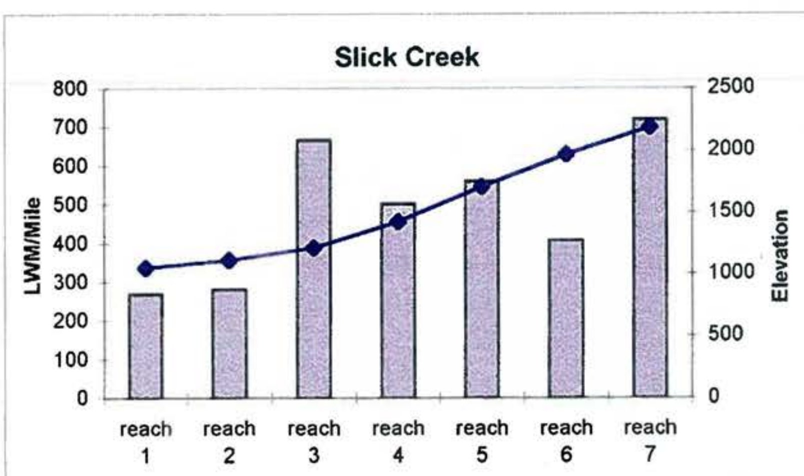
Figure 12. Pieces of Large Woody Material per Mile for Streams Surveyed

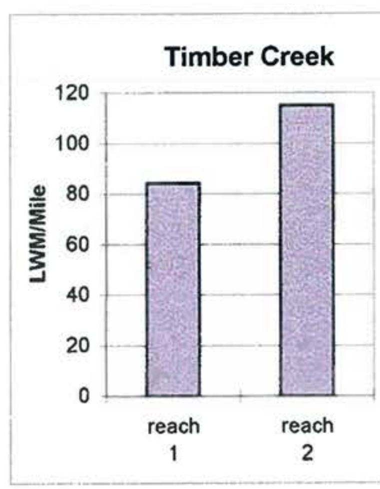








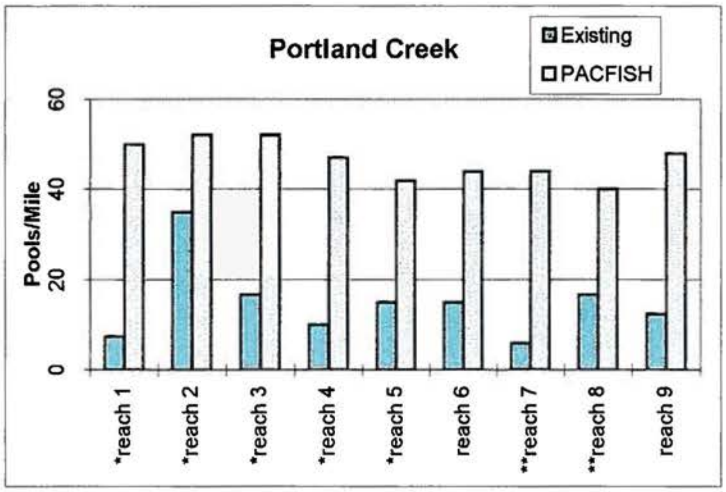


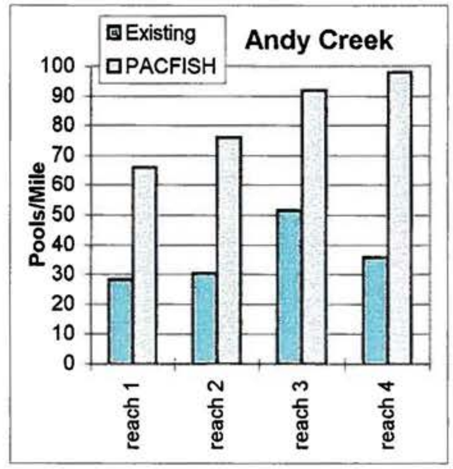


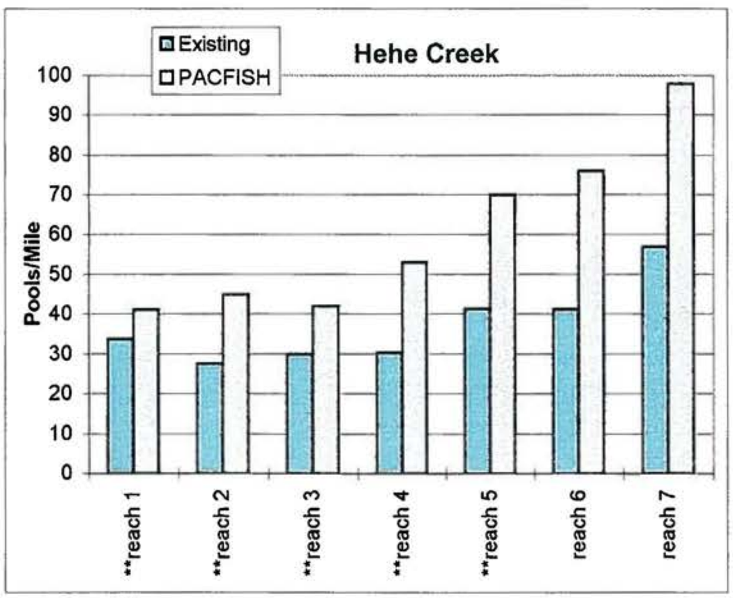
* Data collected prior to instream structure project

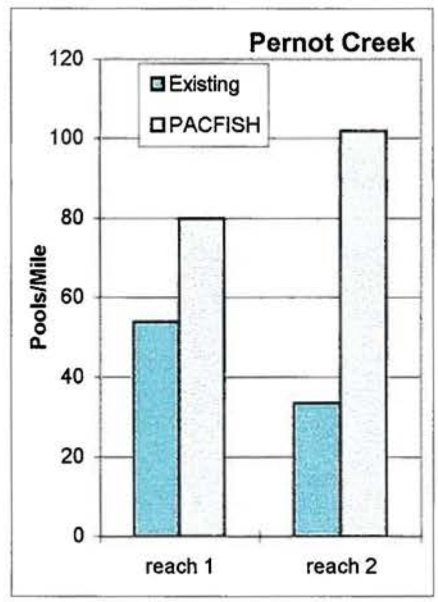
** Data collected post-instream structure project

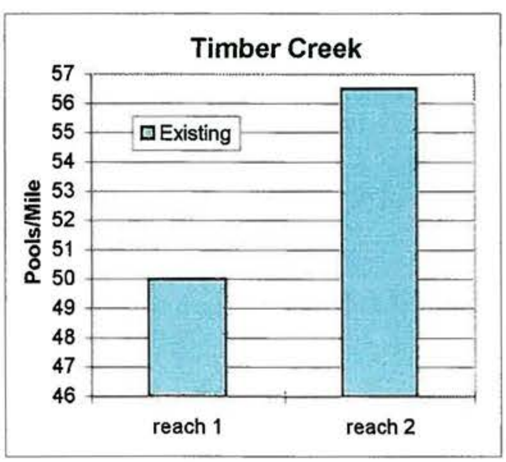
Figure 13. Comparison Between Number of Existing Pools per Mile with PACFISH Reference Condition





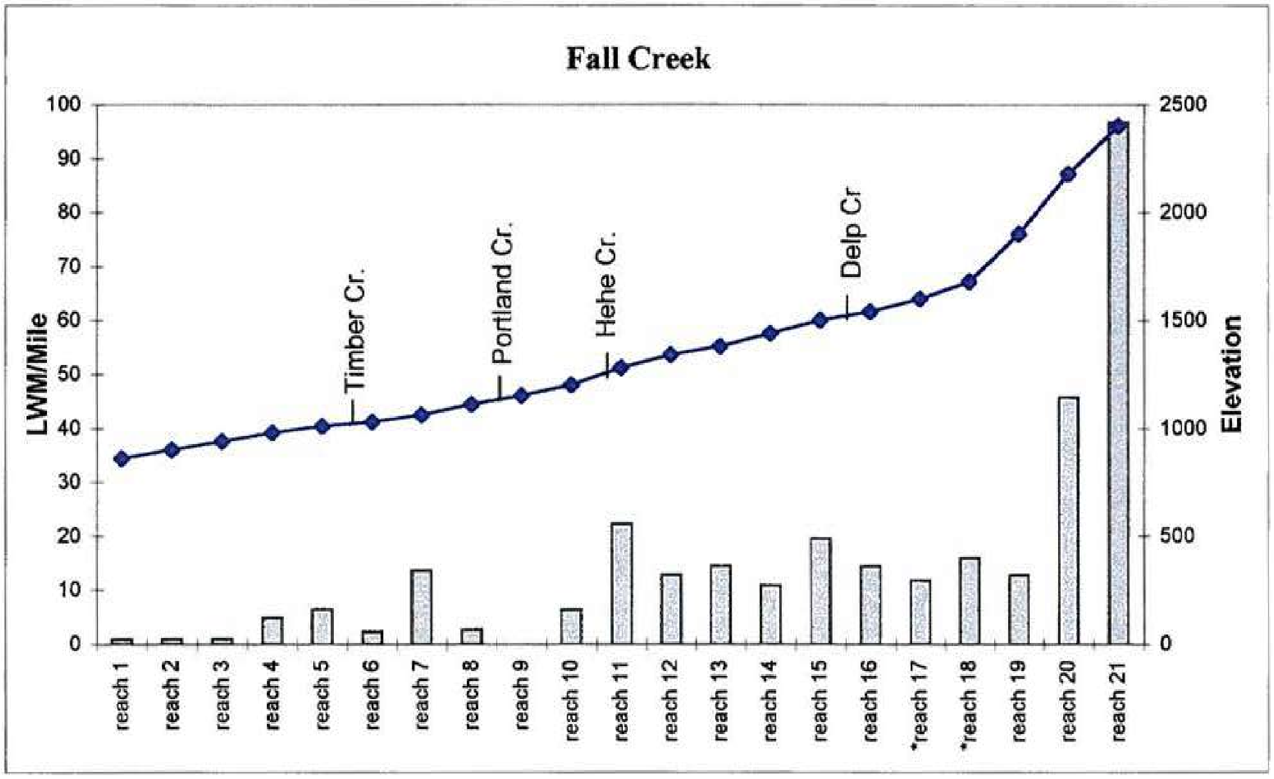


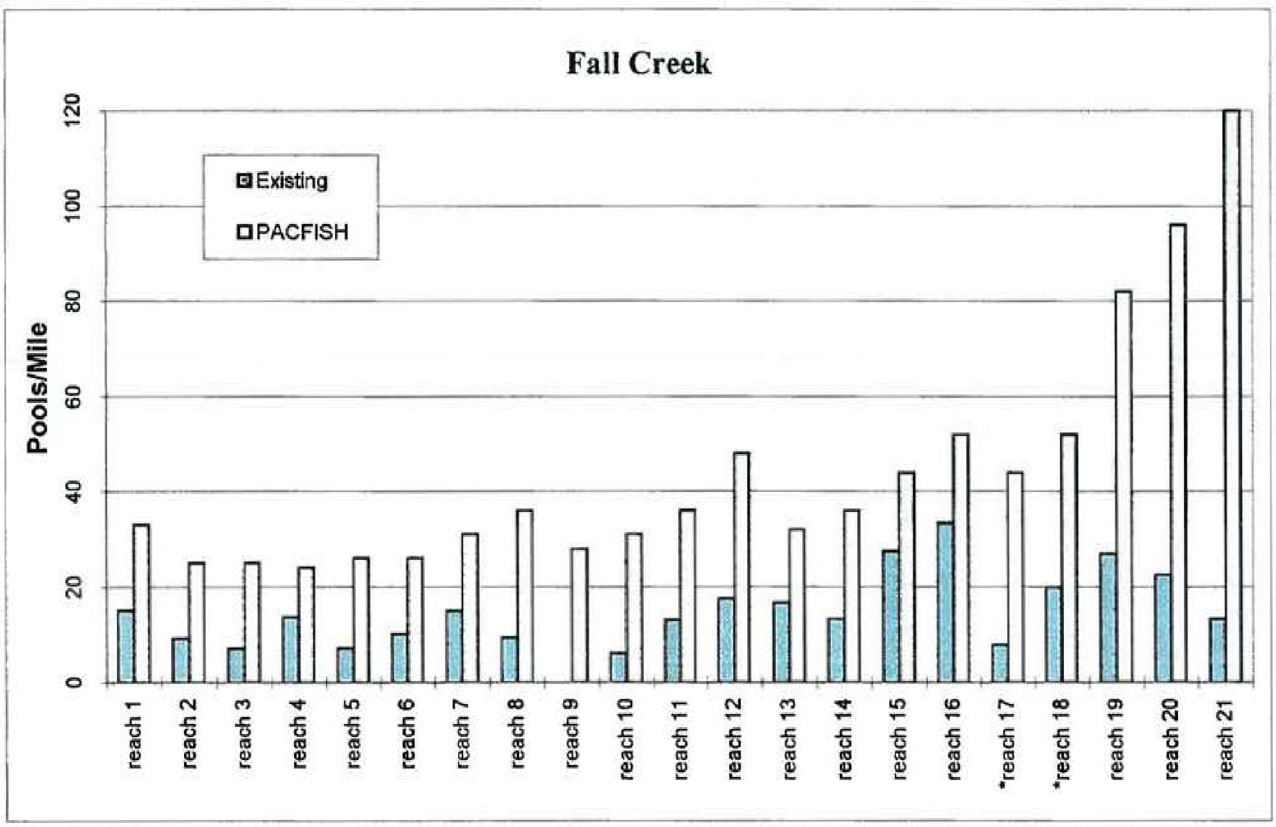




* Data collected prior to instream structure project.
** Data collected post-instream structure project.

Figure 14. Comparison Between PACFISH Reference Condition and Existing Condition at Fall Creek





* Data collected prior to instream structure project.

The Willamette National Forest Plan states guidelines for low and high gradient streams. The low gradient streams should have 105 pieces of large woody material per mile, with a diameter greater than 25 inches and longer than the stream width. High gradient reaches should have at least 50% of the channel influenced by large wood. In streams 0.5 to 2% channel gradient there should be 1 pool per 5-7 channel widths.

The Aquatic Conservation Strategy in the Northwest Forest Plan recognizes that conditions can be site-specific and not similar throughout the region. Several pristine streams within the Willamette Province have been surveyed and are currently being analyzed. This data may lead to a range of natural variability.

Reference conditions for the number of pools and large woody material per mile have not been established. However, impacts from management activities have created a current condition of considerably fewer pools and pieces of large woody material than would be found in a pristine condition.

Fire suppression has also altered historic fire patterns. The increased fuel loading changes the entire watershed from an infrequent moderate-severity to an infrequent high-severity fire regime, creating a higher chance for the occurrence of stand replacement fires. This situation has a higher impact on riparian areas, potentially resulting in the loss of standing and downed trees.

Current Conditions

Fish Species

Historic records indicate that Fall Creek was one of the primary spawning areas for salmon migrating up the Middle Fork Willamette River (Connolly et al. 1992). Spring chinook are the only anadromous fish native to the Middle Fork. Winter steelhead were introduced to the system in 1953 followed by an introduction of summer steelhead in 1981. The system is currently managed by the Oregon Department of Fish and Wildlife for spring chinook and winter steelhead. Other fish species native to Fall Creek include rainbow trout, cutthroat trout, mountain whitefish, longnose dace, speckled dace, largescale sucker lamprey species, and several sculpin species. Bull trout, a sensitive species, was believed to have been native to Fall Creek. However the eradication of fish prior to the flooding of Fall Creek Dam is thought to have removed all the bull trout from the system. Oregon chub, a federally listed endangered species, is indigenous to the Middle Fork Willamette although no known populations exist in Fall Creek. *Map 9* indicates fish bearing streams within the Fall Creek watershed.

Construction of Fall Creek Dam in 1965 limited migration, with fish passage provided by trapping and transporting returning adults to Fall Creek. "Fish Horns" were built into the dam to facilitate the outmigration of the smolts. Migration success has been limited; a recent alteration in discharge, however, has improved outmigration (USDA et al. 1995). The number of adult spring Chinook returning to Fall Creek over the last five years has ranged from a low of 34 fish in 1990 to a high of approximately 220 in 1994. The number of winter steelhead returning over the last five years has been in single digits. *Map 10* displays accessible habitat for anadromous fish.

Aquatic Habitat

For the purpose of this analysis, subwatersheds were used. These include Upper Fall Creek/Delp Creek, Hehe Creek/Middle Fall Creek, Lower Fall Creek, and Portland Creek *(See Map 11)*. In areas where data (such as stream inventory) was available, a more detailed analysis was completed.

Much of the riparian condition has been altered so that large conifers are no longer as dominant. *Figure 14* indicates the existing seral condition of riparian trees separated into 0-30 years old (early seral), 30-80 years old (young seral) and > 80 years old (late successional or mature and late seral) for fishbearing (Class I and II), perennial non-fishbearing (Class III) and intermittent streams (Class IV) for each of the subwatersheds within the Fall Creek watershed. Intermittent streams tend to be impacted most with 54-64% of riparian reserve trees under 80 years old. The percent of trees under 80 years old along fish bearing reaches ranges from 30% in the Lower Fall Creek subwatershed to 85% in the Upper Fall Creek/Delp subwatershed.

Fall Creek has several domestic intakes; some may not be on fish bearing streams but are mapped as Class I. These areas are limited and it is assumed they do not influence the results for this scale analysis.

A valley bottom road runs adjacent to Fall Creek within the Riparian Reserve. Many campgrounds are along the mainstem of Fall Creek and all are heavily used, impacting the riparian area. Several other roads within the watershed are within Riparian Reserves.

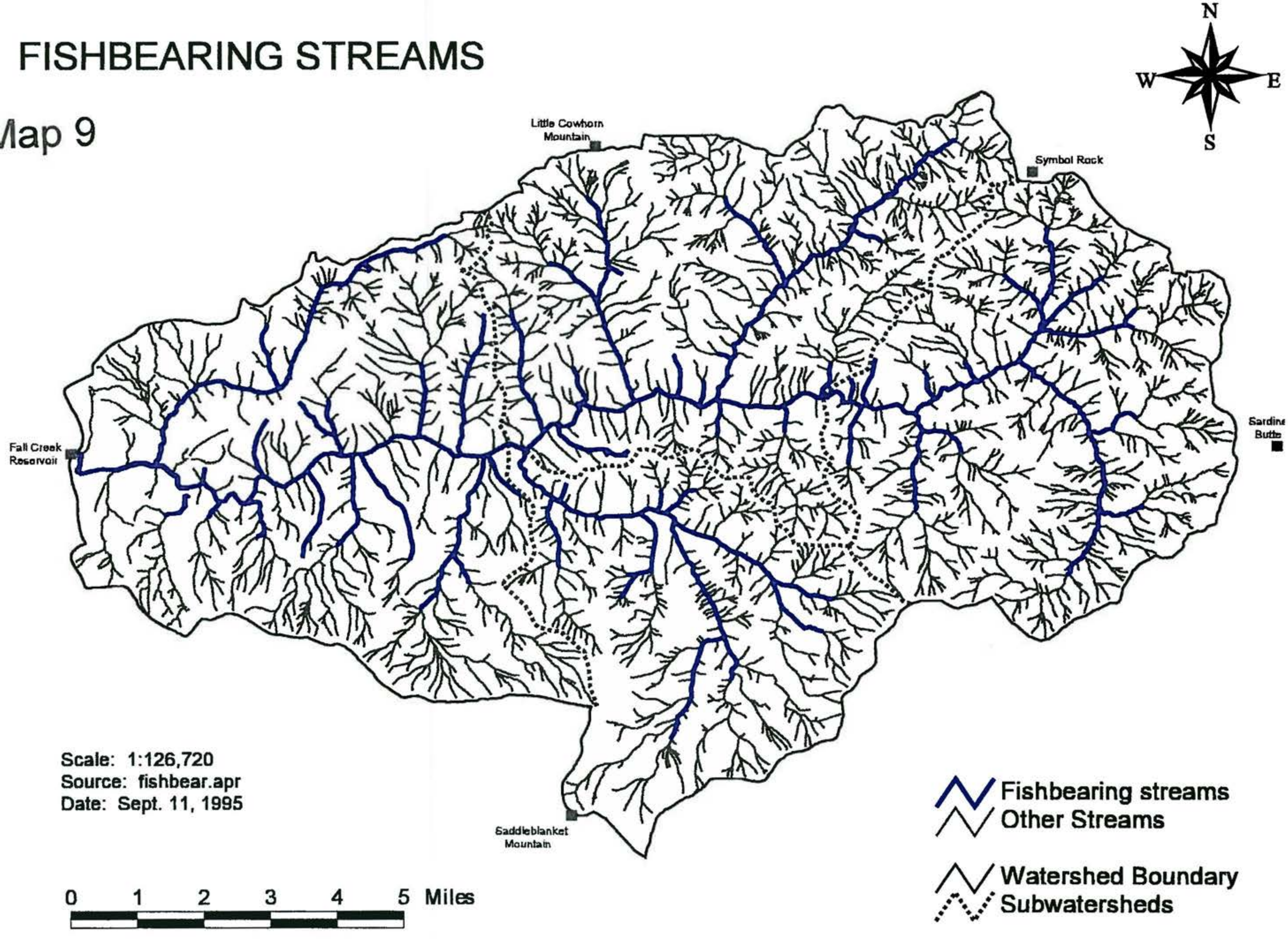
Inventories have shown there is an overall lack of large woody material throughout the watershed. Pool habitat is limited and width-to-depth ratios are high. Many of the streams have been downcut and scoured to bedrock. Some of these conditions have improved due to Instream Aquatic Habitat Improvement Projects. *Map 12* highlights the areas where these projects occurred.

Stream inventories are conducted to assess existing aquatic conditions and inventories were completed on Fall Creek (1992), Timber Creek (1993), Andy Creek (1993), Hehe Creek (1993), Pernot Creek (1993), Portland Creek (1991 and 1992), Logan Creek (1991), Delp Creek (1992), and Slick Creek (1991) *(See Map 13)*.

Map 14 indicates current conditions of LWM per mile and pools per mile for streams surveyed.

FISHBEARING STREAMS

Map 9



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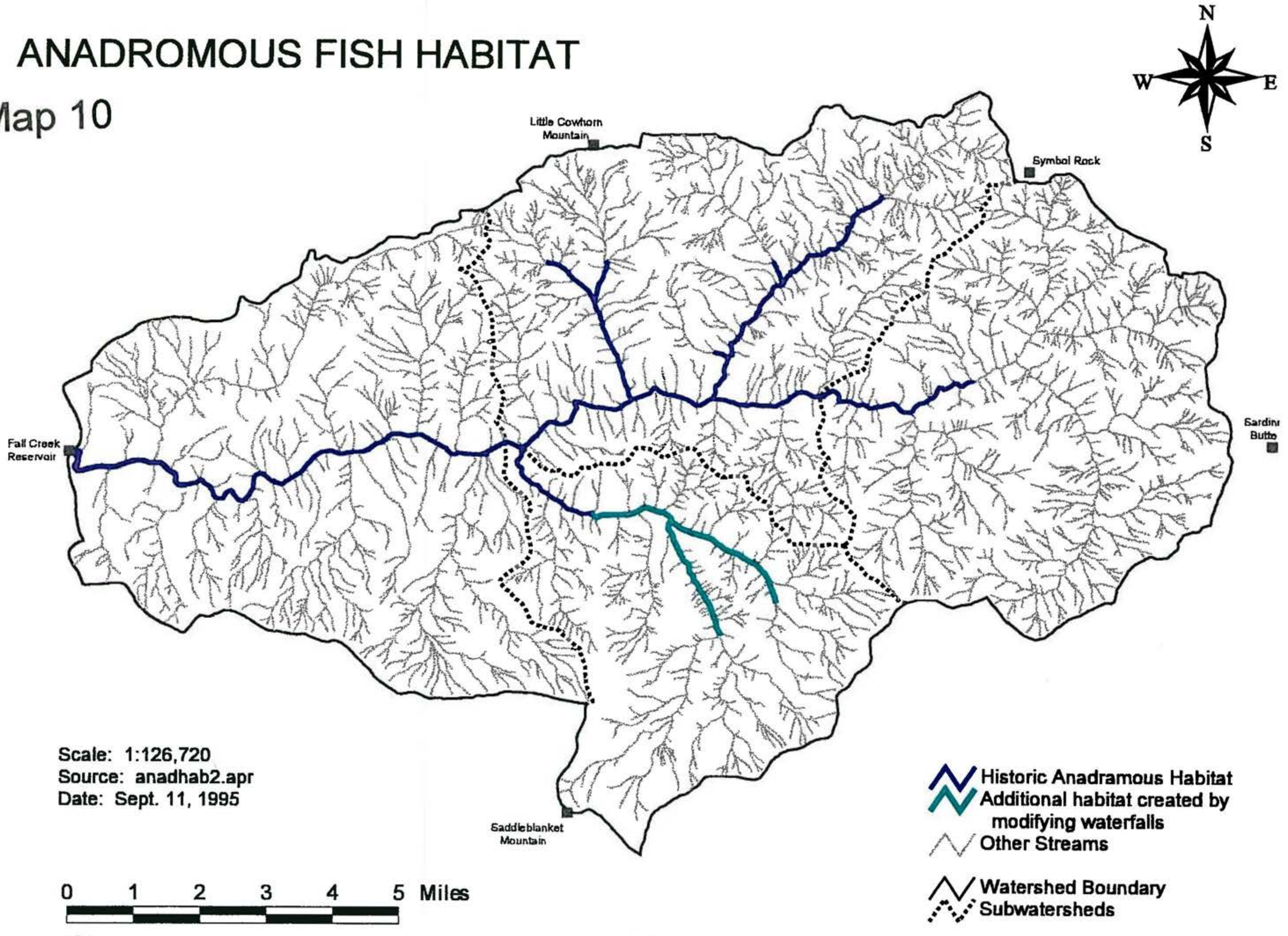
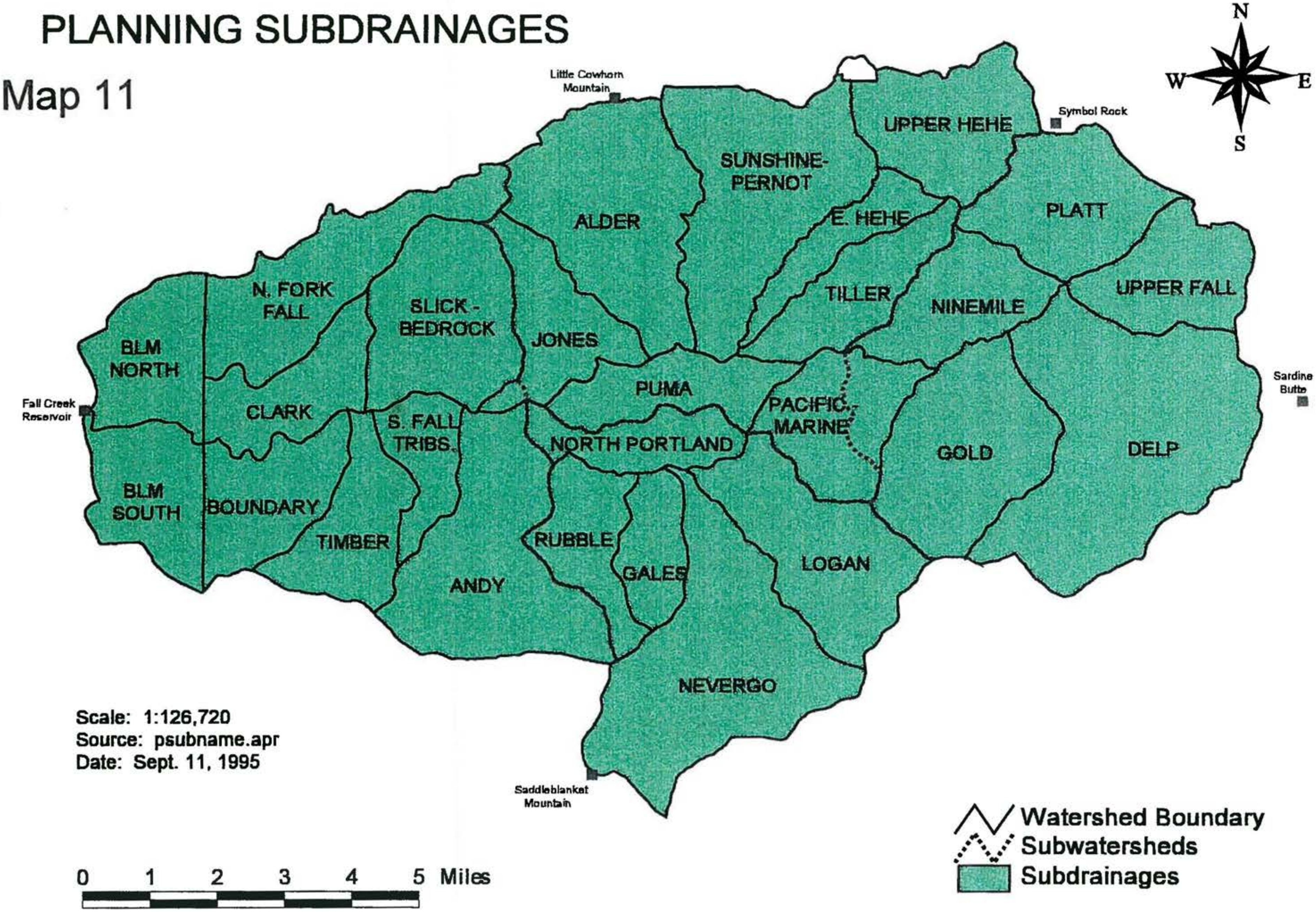
ANADROMOUS FISH HABITAT

Map 10



PLANNING SUBDRAINAGES

Map 11



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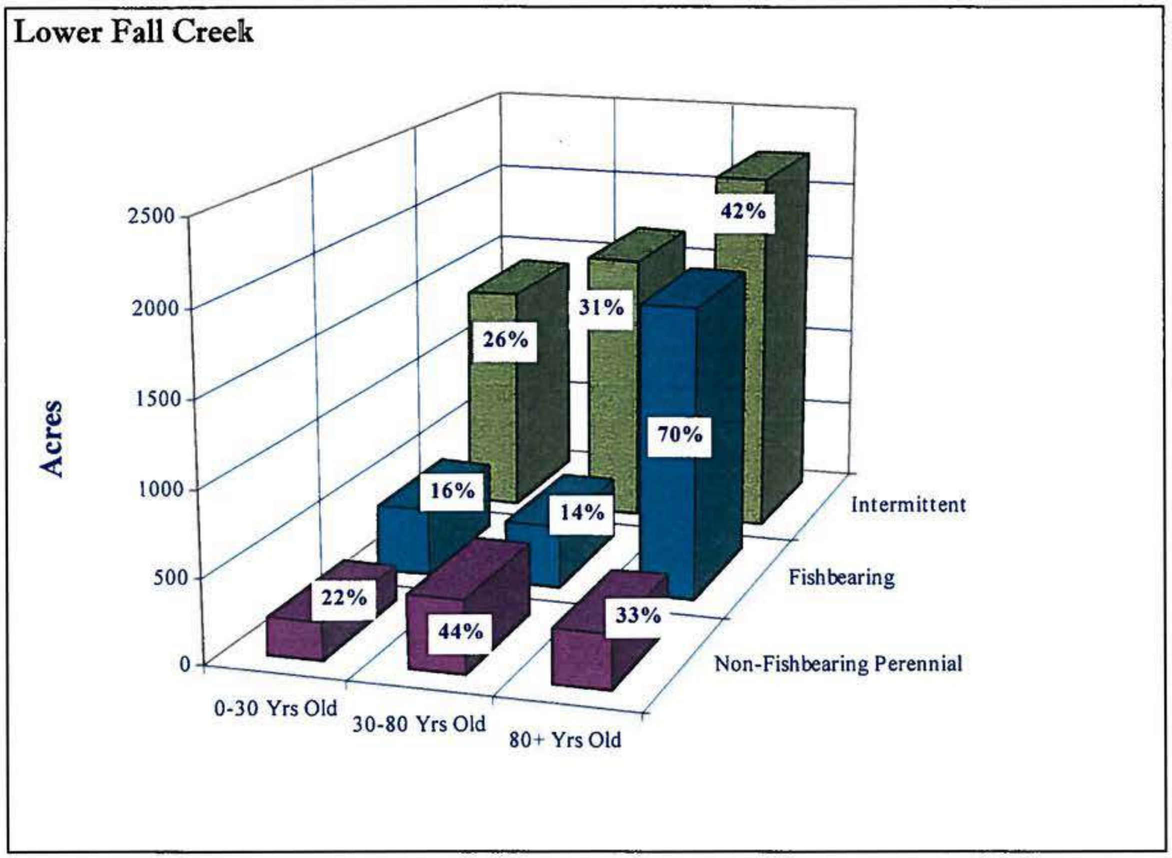
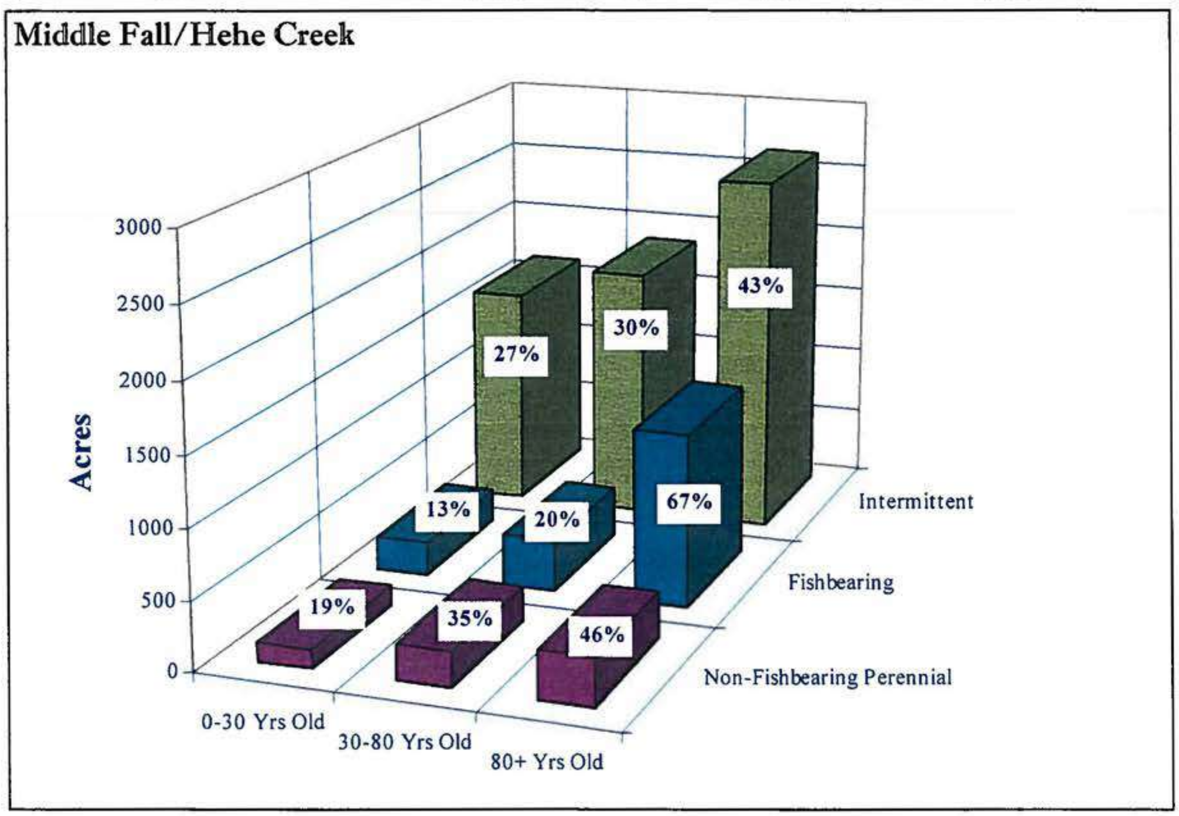
Date: Sept. 11, 1995

Figure 14. **Riparian Seral Condition by Subwatershed**





EXISTING INSTREAM STRUCTURE PROJECT AREAS

Map 12

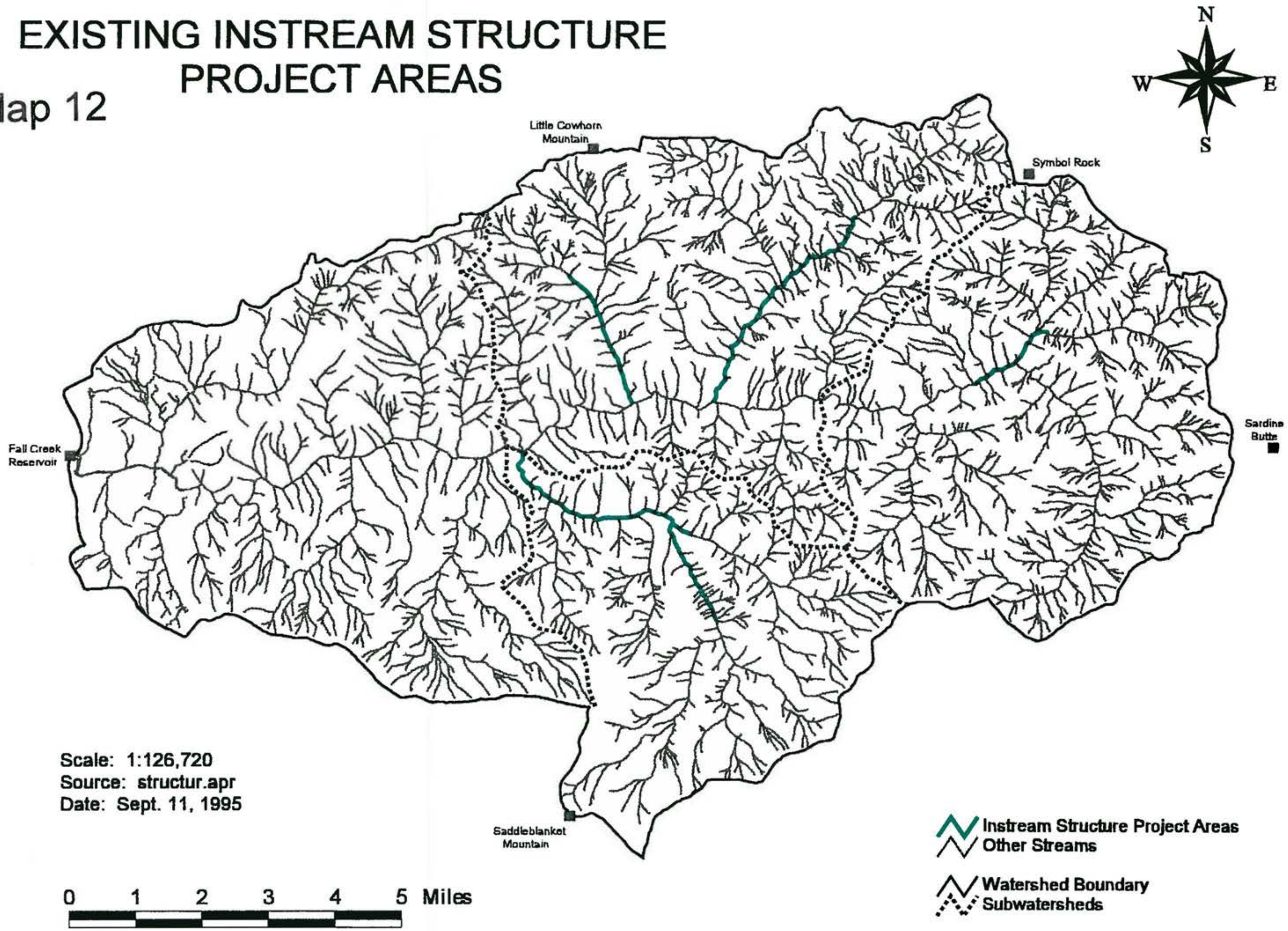


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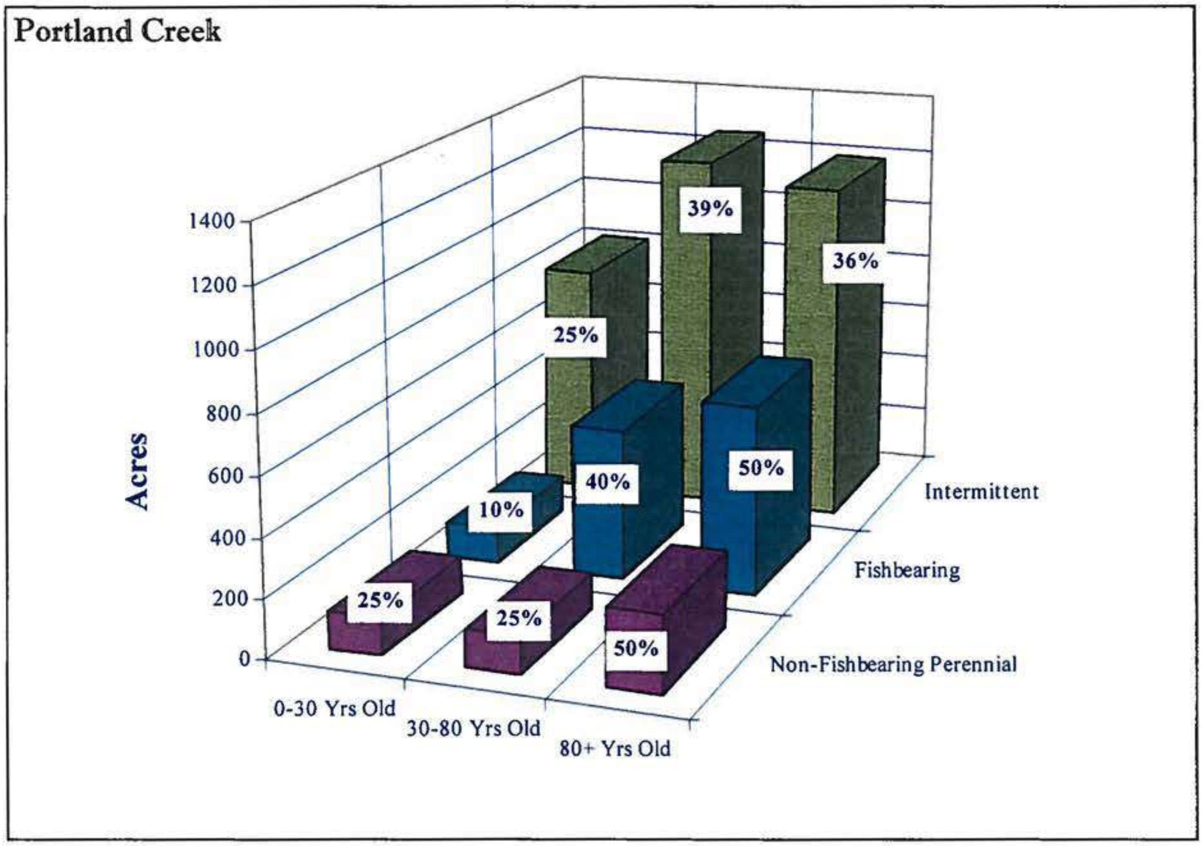
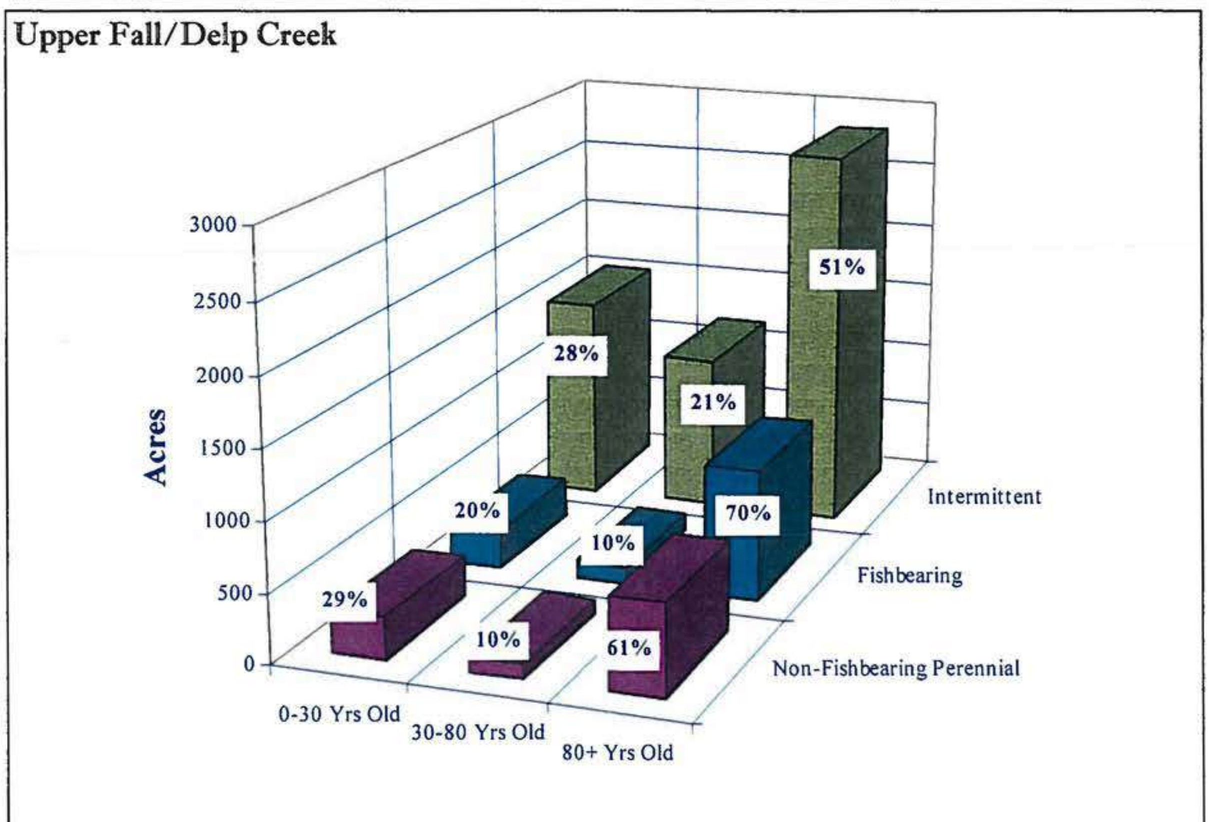
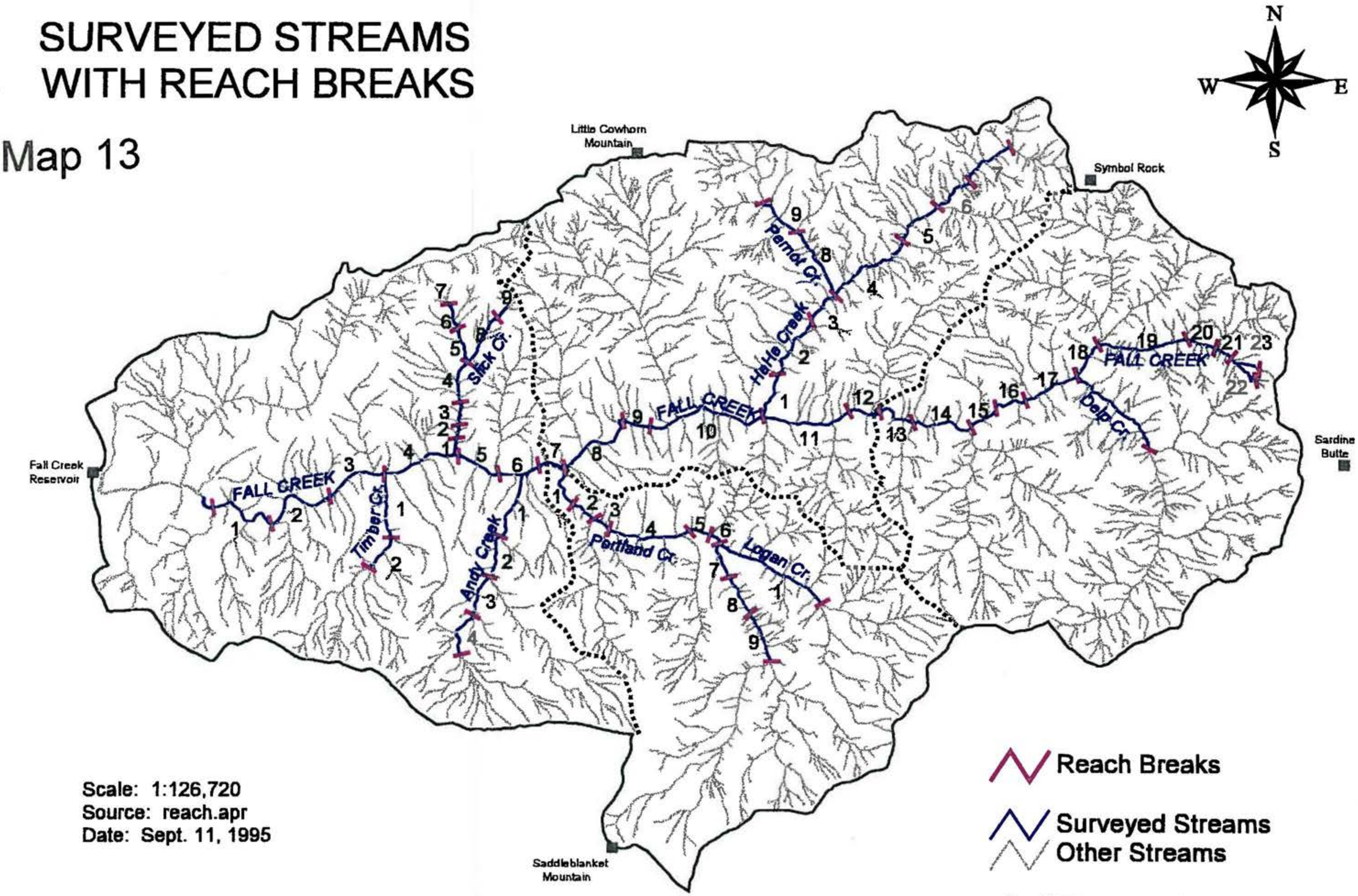
Figure 14 *(continued)*. Riparian Seral Condition by Subwatershed





SURVEYED STREAMS WITH REACH BREAKS

Map 13



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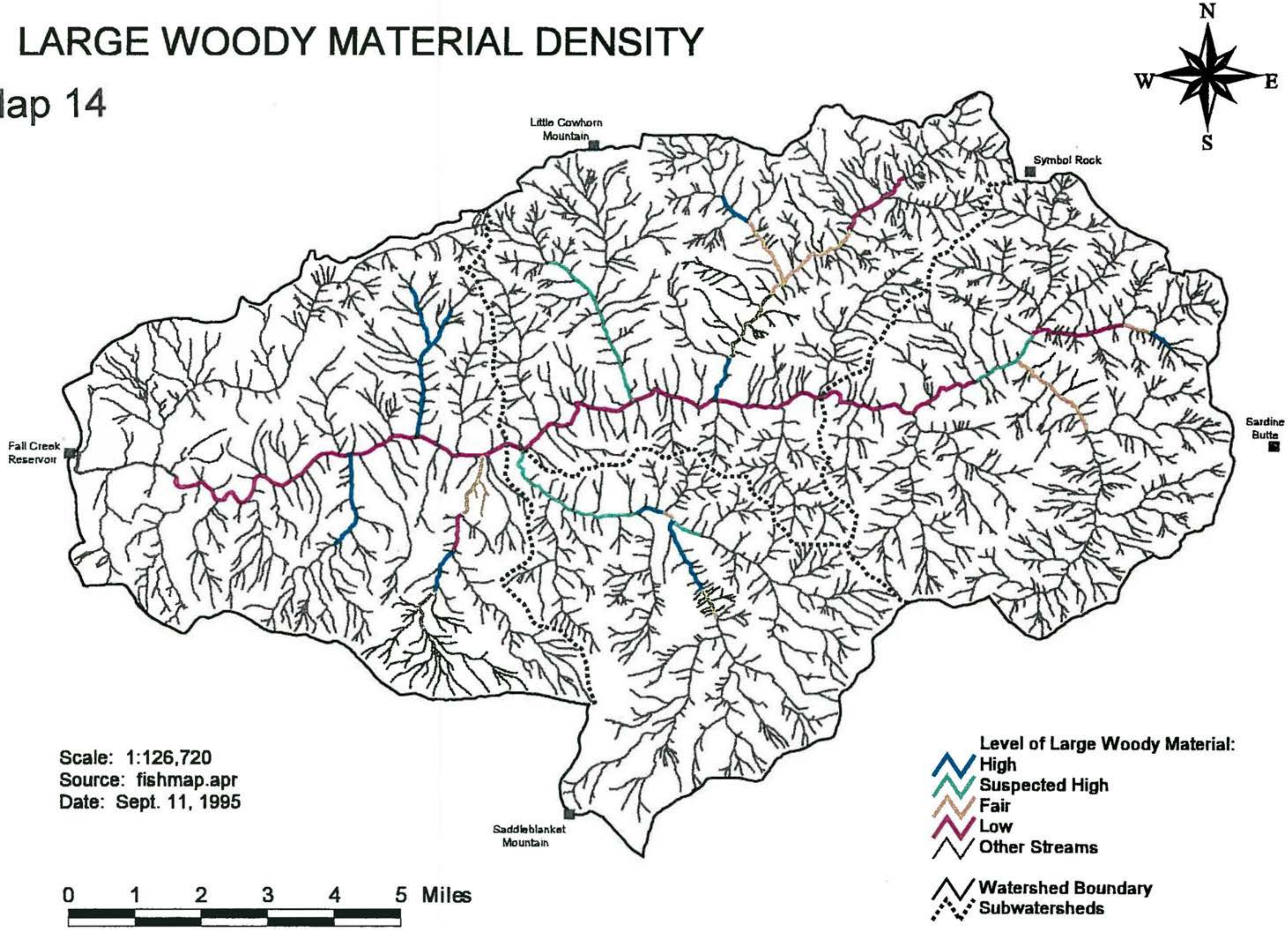
Source: reach.apr
Date: Sept. 11, 1995

0 1 2 3 4 5 Miles

Reach Breaks
Surveyed Streams
Other Streams
Watershed Boundary
Subwatersheds

LARGE WOODY MATERIAL DENSITY

Map 14



Aquatic habitat was analyzed for each of the streams surveyed. Following is a more site-specific look at each of these stream systems.

Fall Creek

The survey began at the boundary of Forest Service land.

Lower Fall Creek

This section of Fall Creek is within a steeply incised valley with a moderate channel gradient and has a high recreation use with heavy angling pressure. Localized alluvial areas are also found within this section.

Lower Fall Creek tends to consist of long stretches of bedrock with deep pool habitat. However, due to survey methodology, Figure 13 does not portray the quality pool habitat actually available. These pools provide good adult trout habitat, but limited cobbles and gravels restrict spawning and macroinvertebrate pNorthwest Forest Planuction. Currently, quantities of LWM are extremely low. Temperatures are high within lower Fall Creek favoring conditions for dace and suckers. Most of the trout consist of rainbows with few cutthroat observed. Many rainbows are probably of hatchery origin.

Middle Fall Creek

The valley becomes more moderately incised scattered with some alluvial reaches. Approximately a half mile of this section is adjacent to private land. It has no large woody material and is in a very poor riparian condition, though the habitat does have some deep pools. Conditions are similar to Lower Fall Creek.

Above the private land upstream from Puma Creek, it appears that a geologic feature is affecting the channel, as it has shifted and consists of riffles with little pool habitat. Bank cutting and mass wasting are common in this area and a source of fine sediment to the system.

Few rainbows are found in the middle section; most of the trout are cutthroats. Many dace are still found along with several sculpin and a few Chinook. Suckers range to the top of this section but are not found upstream. Biological inventories indicate the area on Fall Creek upstream from the confluence of Hehe Creek and in Marine Creek could possibly be primary spawning areas.

Upper Fall Creek

This is a steeply incised valley interspersed with alluvial reaches. The downstream reach may be an important spawning area as the deep pools found in this area provide good habitat, while the pool tailouts have good spawning gravel. The majority of fish here are cutthroat trout and sculpin with very few rainbow trout or dace. A few Chinook were also observed.

A short distance upstream the temperature declines and the fish found are cutthroat with rainbows disappearing near the confluence of Delp Creek. The stream gets smaller and narrower and channel gradient increases. Falls become common, with many creating migration barriers. Downstream from the confluence of Ninemile Creek is a migration barrier for anadromous fish.

A high amount of LWM is found in Reaches 20 and 21 *(See Figure 13)*. However, the wood in Reach 20 is mostly on the upper banks and is not impacting the low flow channel. In Reach 21 the wood appears to have been washed down from an adjacent clearcut. A stream enhancement project added wood to Reach 17 and a small section of Reach 18.

Hehe Creek

Log structures were also added to Reaches 1 through part of 5. Afterwards a high-flow event occurred causing several of the structures to move. Reaches 1 and 2 have a high amount of wood and good habitat. Pools tend to be deep with good spawning gravel in the tailouts. Reach 1 has a healthier riparian zone of large conifers. The biological sampling confirms the more suitable habitat available in Reach 1 by higher numbers. Rainbow trout are dominant with a few juvenile cutthroat. Sculpin and dace were also observed.

Farther upstream the pools become shallower. Cutthroat begin to dominate and dace drop out. Bank cutting becomes more common in the upper reaches, particularly near the Hehe Slide area. The slide is not stable and is continually adding fine sediment into the stream.

Portland Creek

The mouth of the stream borders private land and has been impacted by the lack of riparian vegetation.

Instream habitat enhancement projects were implemented throughout Portland Creek. The upper section was completed in 1991 while the lower section was implemented in 1993. A survey was taken prior to and after implementation of the upper section of the enhancement project. The results did indicate a large increase in LWM and a change in substrate. Prior to implementation the stream had downcut and was scoured to bedrock. The installed structures are now retaining cobbles and gravels creating macroinvertebrate and spawning habitat. Much has been learned about structures since the implementation of the upper section. Some of the logs used as weirs were too large in diameter for the system and may be acting as migration barrier to resident trout during the summer low flows.

Andy Creek

Chichester Falls is a 15 foot drop located at the mouth of Andy Creek. This is a migration barrier genetically isolating the fish in Andy Creek. Amounts of large woody material are ranked as fair in all reaches surveyed except Reach 2 where it is low. Cutthroat trout and sculpin were the only fish species found.

Timber Creek

Many of the large conifers have been harvested. Varied amounts of large woody material are satisfactory in both reaches surveyed. Limiting conditions for this stream seem to be the riparian vegetation. Rainbow trout, cutthroat trout and sculpins were found near the mouth of the stream; however rainbows disappeared farther upstream.

VEGETATION

The dominant forest series found within the Fall Creek watershed is western hemlock. A forest series (or vegetation zone) is the area within which a particular tree species is dominant in the climax plant community. Other forest series can be found within the watershed, but represent only a small proportion of the area. They include the Douglas-fir, grand fir, and Pacific silver fir forest series. Generally, they represent a few scattered pockets of subtle transitions between forest series.

The western hemlock forest series represents warm, moist conditions. This series lies between the lower, drier Douglas-fir series and the higher Pacific silver fir series. The western hemlock series makes up the bulk of the lower to mid-elevations of the Forest. Precipitation varies from 50-80 inches annually, with temperatures slightly below freezing in the winter to 90-100 degrees in summer.

Douglas-fir is the dominant species found with western hemlock and western redcedar. Common associates include incense cedar, sugar pine and western white pine. Hardwood species include bigleaf maple, red alder, vine maple, chinquapin, and madrone. Other plant species also represented in this series include dwarf Oregon grape, salal, rhododendron, swordfern, vanilla leaf, Oregon oxalis, twinflower, and redwoods violet.

Plant associations (or communities) are classified within forest series. Plant associations are defined as generally discrete, recurring collections of plant species which maintain stable populations over a long period of time. Plant association describes the potential, or climax plant communities: the vegetation that would eventually occupy a site in the absence of disturbance.

Fall Creek supports a wide variety of plant associations. Based on the sample of ecoplots within the watershed, 13 of the 18 western hemlock plant associations occur here. Four Pacific silver fir plant associations were also found. The Pacific silver fir series plots occur in the Saddleblanket Mountain area and along the watershed rim. For more information and descriptions of the plant associations, refer to the *Willamette National Forest Plant Association and Management Guide* (Hemstrom, et. al., 1993).

Historic Range of Variability

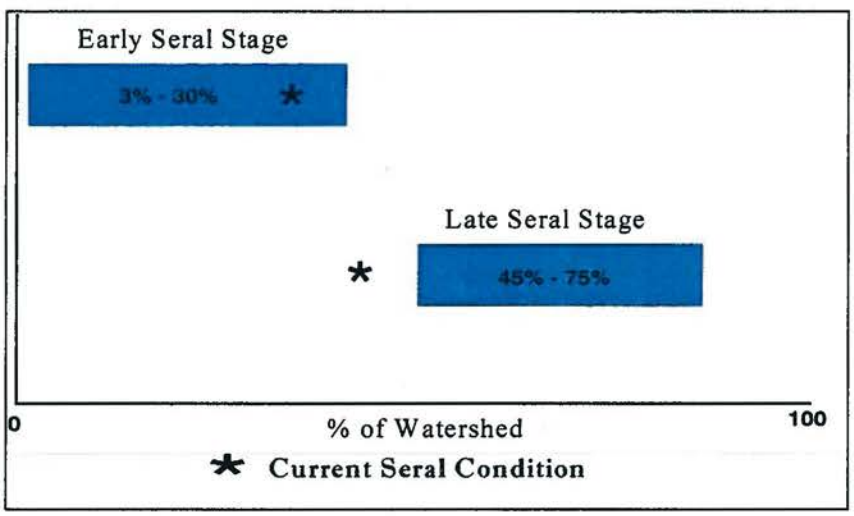
The idea of the "range of historic variability" acknowledges that ecosystems are not static but rather vary over time and space. The dynamic nature of ecosystems exemplifies the need to consider ranges of conditions under natural disturbance regimes, rather than single points in time. A key assumption of this concept is that when system are "pushed" outside the range of historic variability there is a substantial risk that biological diversity and ecological function may not be maintained.

In 1993, the Pacific Northwest Region undertook an assessment of the historic range of variability for a number of key ecosystem elements; elements believed to be crucial to ecosystem health and sustainability. This analysis was completed at the subbasin scale and is referred to as REAP (Regional Ecological Assessment Project, USDA, 1993). The assessment was designed to gain a "first approximation" or "coarse filter" analysis of ecological sustainability of Northwest National Forests. Many assumptions and limitations are inherent in the assessment. However, the apparent patterns and trends are valuable in establishing baseline information to land managers.

The historic range of variability was reconstructed for the time period of 1600-1850 *(See Figure 15)*. The assessment used various fire history studies from the central Oregon Cascades to determine the ranges of seral conditions.

The historic range of variability for the amount of early seral condition was estimated to be 3-30% and the amount of late seral conditions to be 45-75%. Numbers expressed are a percentage of the total subbasin area of the Middle Fork of the Willamette River within the forest series of western hemlock.

Figure 15. Historic Range of Variability **(1600-1850)**



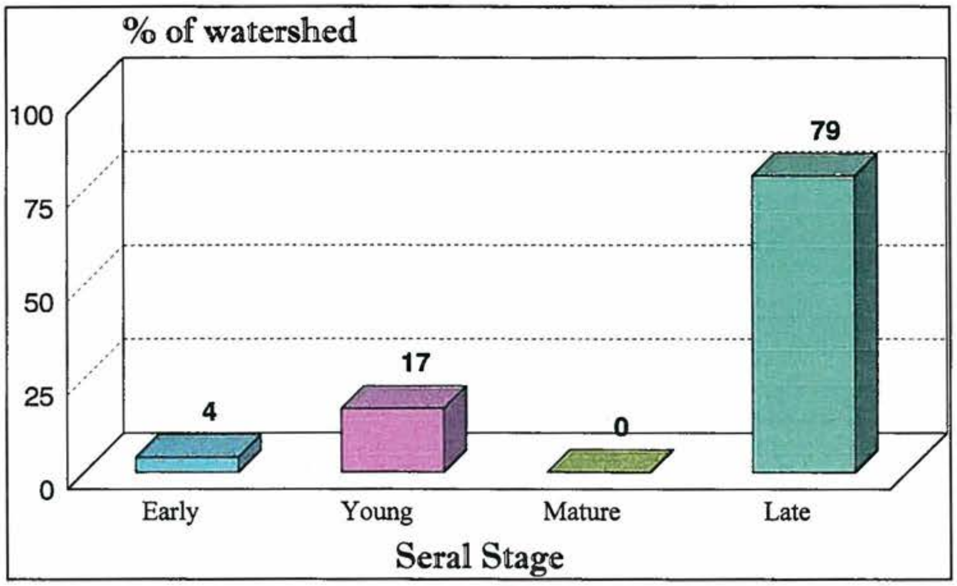
Reference Vegetation Conditions (1900)

The reference vegetation for the Fall Creek watershed was reconstructed for the year 1900 *(See Map 15)*. Nineteen hundred was chosen as the year of comparison because it can be reconstructed from ages of existing stands and it precedes extensive landscape pattern alteration by logging. Prior to 1900, aboriginal burning may have played a significant role in vegetation patterns and fire regimes in the Fall Creek area. Before European settlement in the Willamette Valley, the Kalapuya maintained an oak woodland-savanna vegetation type by annual burning of the prairies and underburning adjacent hillslopes to facilitate hunting and plant gathering and enhancement (Towle, 1979; Boyd, 1988). Disturbances before 1900 are considered to be part of the given "natural" conditions.

The reference vegetation was reconstructed by classifying the current vegetation stands based on their age. For example, a 150 year forest stand in mature seral condition today, would have been a 55 year stand in a young seral condition in 1900.

In 1900, approximately 4% of the watershed was in an early seral condition, 17% in young, 0% in mature, and 79% in a late seral condition *(See Figure 16)*.

Figure 16. Reference Seral Stages **(1900)**



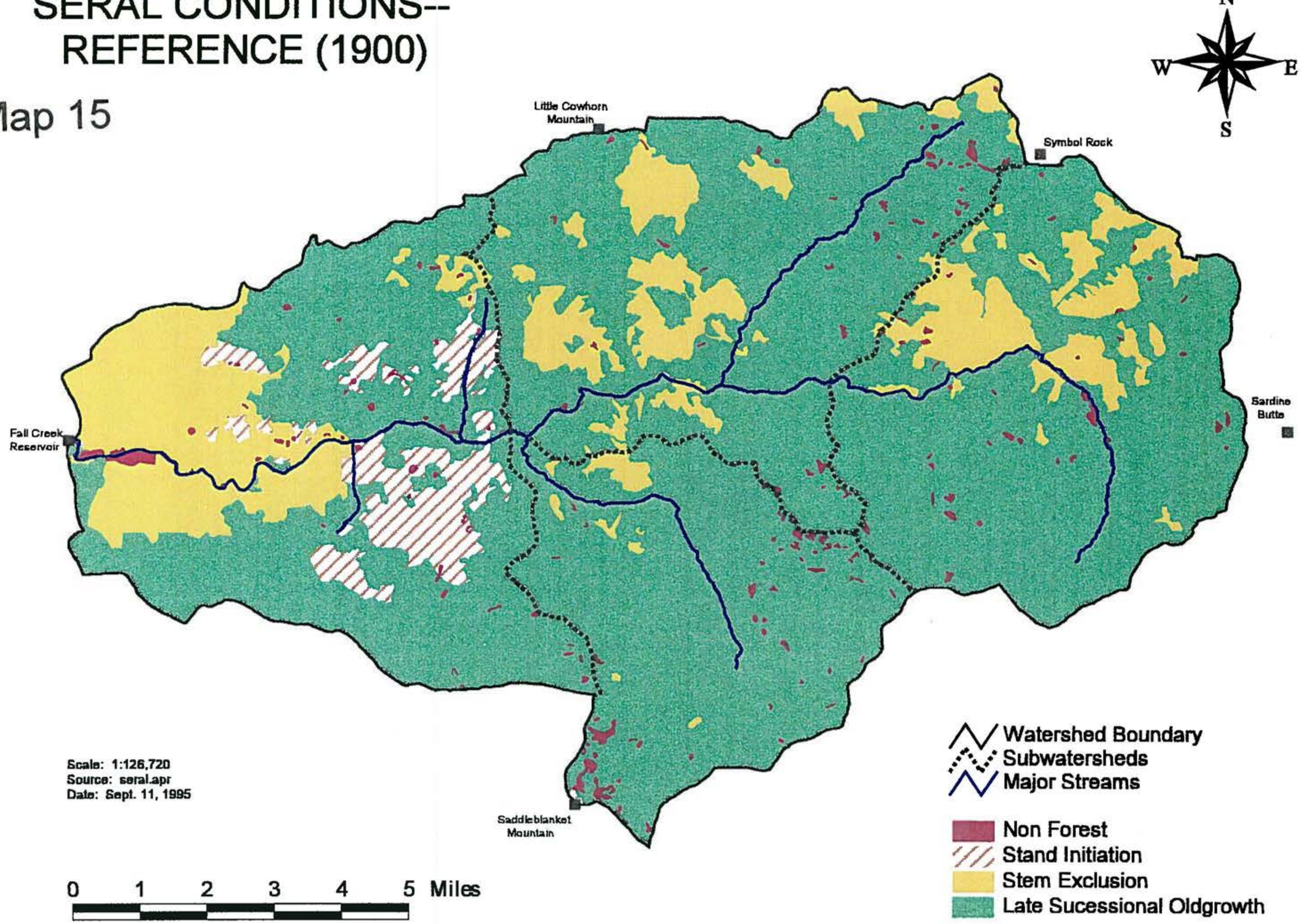
For this analysis, seral stages were defined according to stand ages and relate to stand development stages. The four stand development stages following a disturbance are: stand initiation, stem exclusion, understory reintiation, and old growth (Oliver and Larson). The early, young, mature, and late seral stages are abbreviated names which relate respectively to these four stand development stages. *Table 17* displays the relation and definition of these seral stages.

Table 17. Seral Stage Definitions

Seral Stage	Stand Development	Years
Early	Stand Initiation (SI)	0-30 years
Young	Stem Exclusion (SE)	31-80 years
Mature	Understory Reinitiation (UR)	81-200 years
Late	Old Growth (LSOG)	>200 years

SERAL CONDITIONS-- REFERENCE (1900)

Map 15



All stands were assigned a year of origin. The managed stand year of origin was determined for recorded year of harvest. The year of origin for native stands were determined from a sampling of stump ring counts and stand exam information. When stands did not have year of origin data, the stand was assigned year of origin by extrapolating data through aerial photography. The seral stages were then calculated based on stand ages.

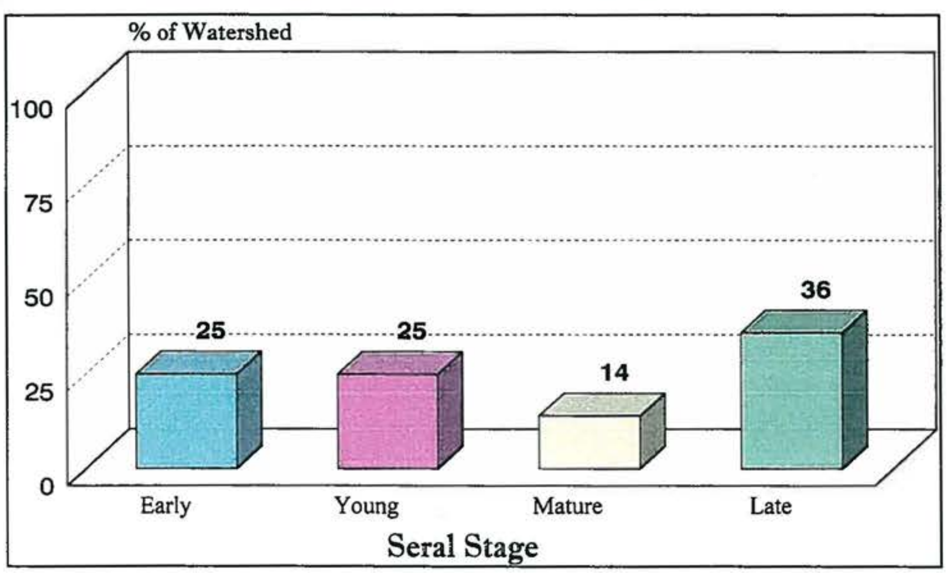
Based on the stand year of origin, the last major fire events in Fall Creek occurred between 1850 and 1900. The early and young seral stages represented on *Map 15* illustrate the size and location of these fires. The fires were predominately mid-sized stand replacement fires. They show varied patterns, ranging from many residual trees remaining to very few left. Most of the mature stands lack structural components of snags and downed logs. A probable scenario is that a stand replacement type fire burned through an area creating snags and over time large amounts of fuel accumulated on the forest floor. Several years or decades later, a second fire came through the area and consumed snags, downed wood and the duff layer more thoroughly than the first fire.

Most of the Fall Creek watershed has a stand year of origin between 1500 and 1700, indicating major stand replacement fire events during this time period. In all probability, low to moderate intensity fires are the major fire occurrences in the watershed. Typically these fires start by lightning on the ridges in early summer, and may have removed undergrowth and perhaps created some canopy gaps as fuel and weather parameters became more extreme. They follow topography, wind patterns and fuel profiles conducive to spread and residence. When conditions became extreme, a stand replacement event occurred.

Current Condition

Currently, 25% of the Fall Creek watershed is in a early seral condition, 25% in a young seral condition, 14% in a mature seral condition, and 36% in a late seral condition *(See Figure 17)*. Approximately 46% of the watershed has been harvested since harvest began in 1943,

Figure 17. Current Seral Stages

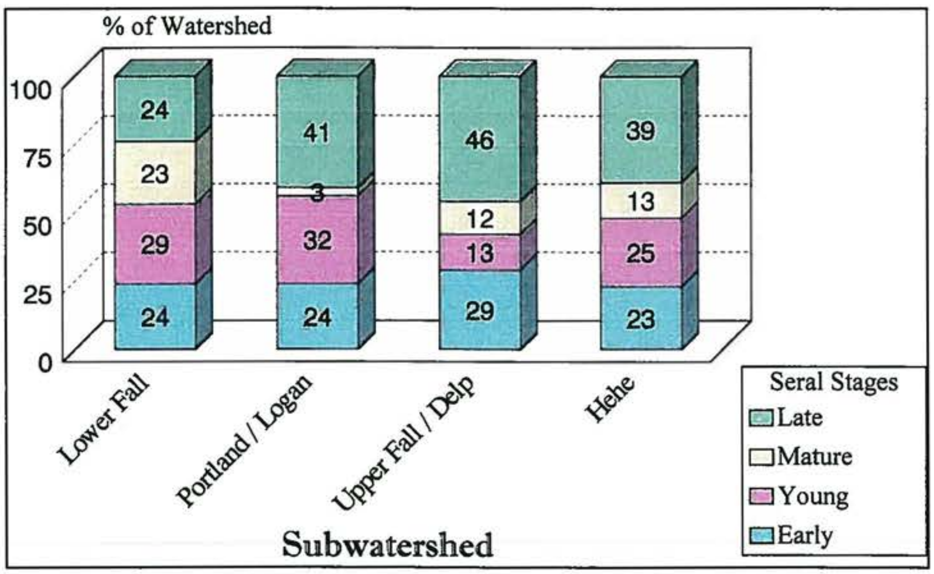


primarily by clearcutting. Salvage harvest along roads has occurred in many of the remaining older stands.

The early seral stands in Fall Creek were created almost entirely by clearcutting. The young seral stands include both older managed stands and some areas where mid-size stand replacement fires occurred in the early 1900's. The mature seral stands were created from a series of stand replacement fires throughout the late 1800's. Most of the late seral conditions originated in the 1500-1700's.

Distribution of the seral stages does not vary much between the four subwatersheds *(See Map 16 and Figure 18)*. Lower Fall Creek has the largest proportion of mature seral stands (23%) and fewest of late seral (23%). This is primarily the result of stand replacement fires in the late 1800's, coupled with early harvest activity. The Upper Fall Delp subwatershed has the largest proportion of late seral stands (46%).

Figure 18. Current Seral Stages by Subwatershed.

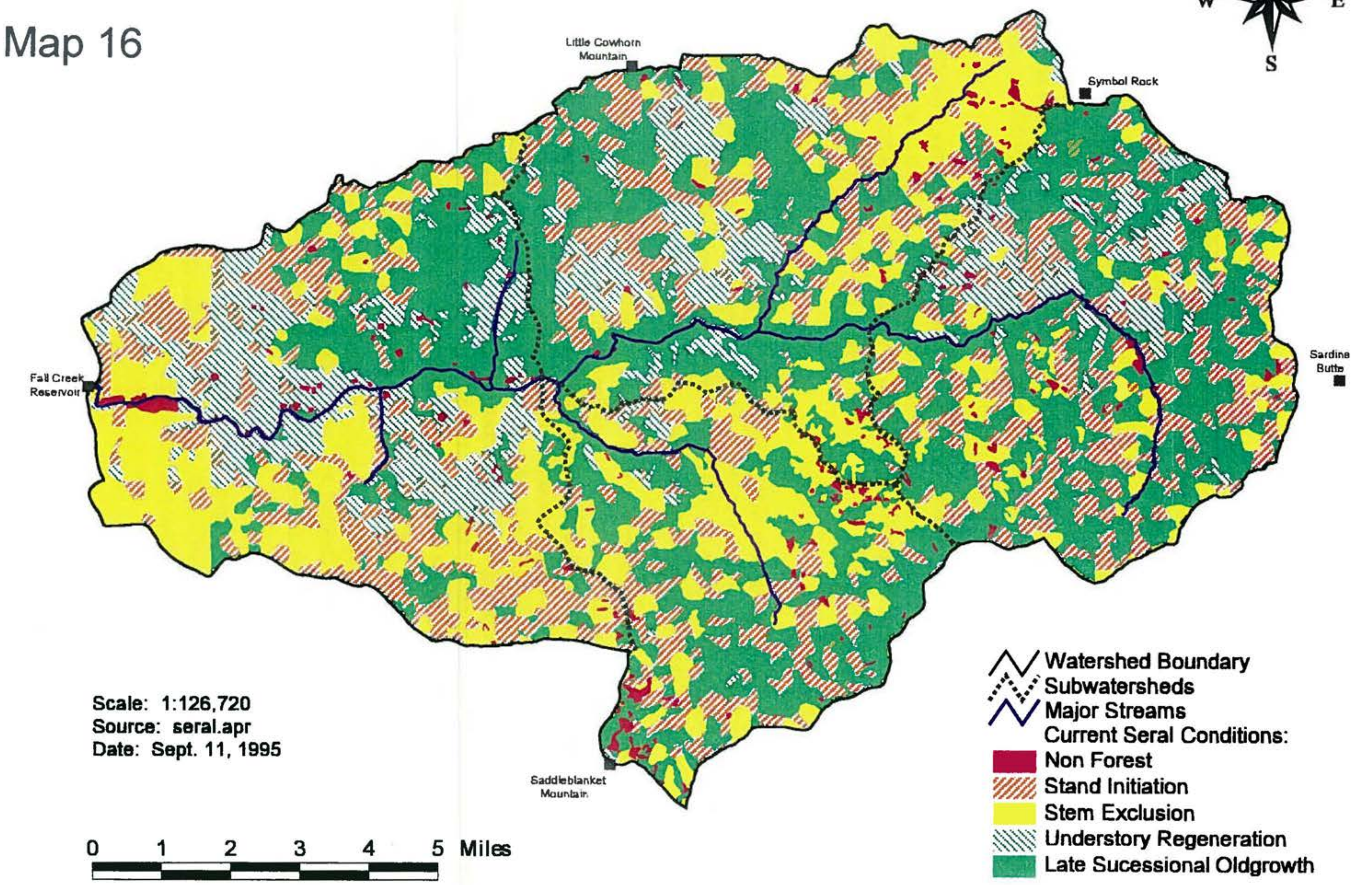


Stand Structure

Early seral conditions in Fall Creek are mainly the result of clearcutting harvest practice, as mentioned above. Clearcutting simplified the structure of these stands. Past logging utilization practices, fuel management, and safety regulations governed the amounts of downed logs and standing snags retained in plantations. Generally, these managed stands have a lower level of downed logs and standing snags than would be present under natural conditions. Clearcuts within the last five to ten years have increasing levels of downed logs and standing snags due to Forest Plan Standards and Guidelines (S&Gs).

SERAL CONDITIONS-- CURRENT

Map 16



Young and mature seral conditions show a varying level of stand structure. Older managed plantations in the young seral conditions have similar levels of structure mentioned above. Native stands represented in the young and mature seral condition were created from stand replacement fires in the late 1800's and early 1900's. The frequency and intensity of these fires determined the existing amounts of downed logs and standing snags in these stands. Stands on northern slopes and along riparian areas generally have higher levels of structure. Many mature stands (120 years old) in Fall Creek exhibit low levels of structure. These conditions may have been a result of a high intensity fire and/or reburns of the area during the late 1800's. Portions of stands which originated after fires in the early 1900's were salvage logged, which reduced the structural components of these stands.

The late seral conditions generally have the associated moderate to high levels of downed logs and standing snags. Fire suppression during this century has contributed to the accumulation of these structures. The timber salvage program has reduced the amounts of downed logs and snags in late seral stands adjacent to road systems.

Landscape Pattern

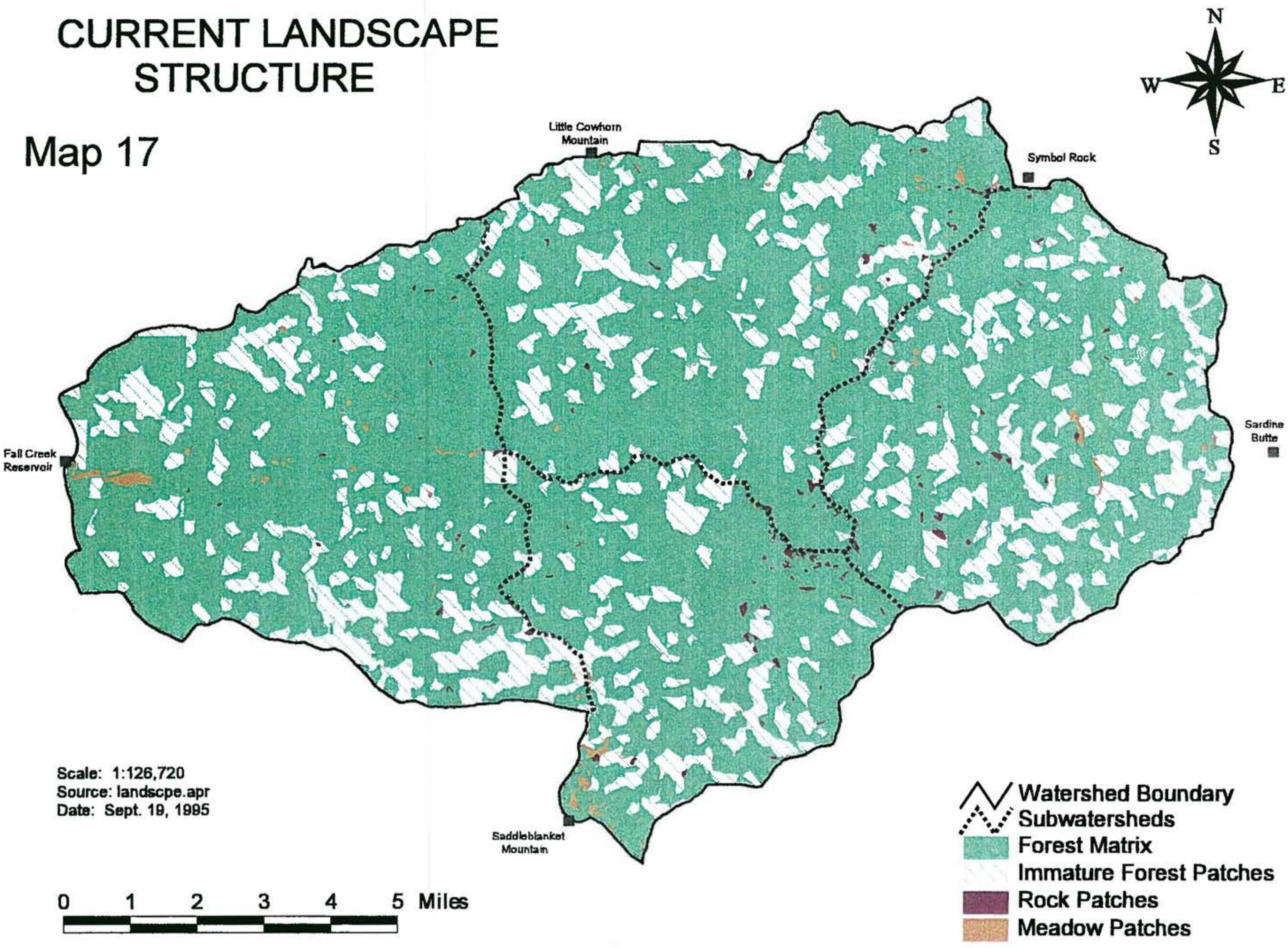
The Fall Creek watershed is highly fragmented. *Map 17* is a landscape structure map displaying the current condition of the Fall Creek watershed. Structural elements of the Fall Creek landscape are divided into four broad categories: forest matrix, immature forest patches, meadow patches, and rock patches.

In landscape ecology terminology, "forest matrix" is defined as the most connected portion of the landscape: the vegetation type exerting the most control over landscape dynamics (Forman and Gordron 1986, Diaz and Apostol 1992). *[Note the difference between the use of the word "matrix" here and in the Northwest Forest Plan.]* Forest matrix within the Fall Creek watershed is defined as a combination of young, mature and late seral stand conditions, representing the small and large sawtimber structural classes. Small sawtimber stands have an average diameter of 11" to 21". Tree height ranges from about 50' to >100' tall. The canopy is generally a single layer with cover ranges from 60-100% closure. It is often open enough to allow some development of an understory, although not usually as rich and diverse as mid and late seral conditions. Large sawtimber stands have an average stand diameter of >21" and trees are usually >100' tall. The canopy frequently has openings allowing development of diverse understory and multi-layers. Varying amounts of snags and downed logs may be present. Although Fall Creek is quite fragmented, forest matrix is still the most connected forest type.

Immature forest patches are composed of early seral conditions and include the following structural classes: grass/forb/shrub, open sapling/pole, and closed sapling/pole. Most of these stands are managed plantations created from a history of clearcut harvesting.

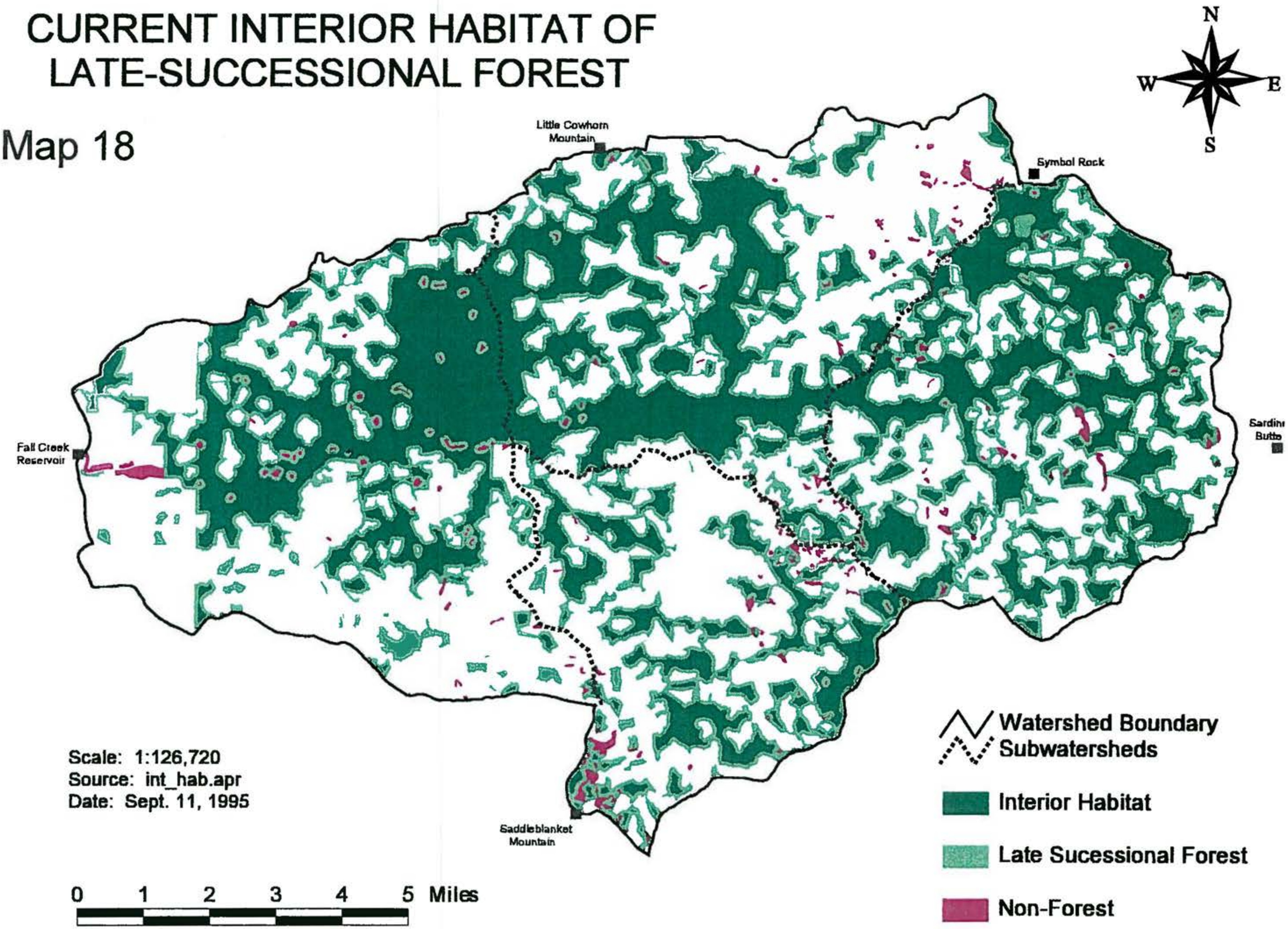
CURRENT LANDSCAPE STRUCTURE

Map 17



CURRENT INTERIOR HABITAT OF LATE-SUCCESSIONAL FOREST

Map 18



Scale: 1:126,720
Source: int_hab.apr
Date: Sept. 11, 1995

Other landscape patch types identified within Fall Creek are meadow and rock patches. Meadow patches consist of dry and mesic meadows and Sitka alder shrub patches. The rock patches are a combination of rock gardens, talus slopes, rock outcrops, and rock quarries.

Late-Successional Forest and Interior Forest

In the Northwest Forest Plan, late-successional forest stands are defined by their mature and old-growth condition. Generally, this refers to any forest stand over 80 years old. This equates to the mature and late seral stages defined in previous sections.

Today late-successional forest habitat comprises 50% of the watershed. In 1900, approximately 78% of the watershed was in the late-successional forest stage.

Although vegetation of the watershed is quite heavily fragmented by timber harvest activities, several relatively large blocks of late successional forest habitat persist today *(See Map 18)*. These current late successional blocks serve as important links in the "functional and interconnected old growth ecosystem" and are important in meeting the objective of ecosystem management in the future.

Late successional blocks often include stands recognized as interior habitat, i.e., the portion of the block least affected by edges and associated edge processes (e.g., wind patterns and temperature). Interior habitat has been dramatically reduced from the time period of 1900; however, some interior habitat still exists *(See Map 18)*.

Current management direction characterizes the Fall Creek watershed as playing an important role in the Late-Successional Reserve (LSR) system in terms of land allocation within the watershed. Two thirds of the upper end of Fall Creek has been designated as a LSR. This LSR is located along the western edge of the Forest and provides valuable late successional forest habitat to the network of LSRs.

Disturbances

Fire

Fire is the dominant landscape pattern forming disturbance in this portion of the Cascades. Fire suppression has been occurring for the last eight decades in the watershed. Given the amount of land affected by fire during the past few centuries, this suppression effort has effectively eliminated wildfire as a major shaper of vegetational landscape patterns and processes. This exclusion has had a number of vegetational effects across the landscape; meadow sizes and abundance may have been altered, forest structure may have become more complex in some areas, and the landscape distribution of natural forest age classes may be less diverse. The Portland Creek fire in 1919 and the Hehe Creek Fire in 1951 are the only two fires which have burned substantial acreage in Fall Creek during this century. Since 1959, an average of five fires per year have been suppressed within the watershed. All these fires remained small and were either human or lightning-caused. Effective fire suppression, coupled with timber harvest patterns, has led to a reduction in the size of early seral patches, as well as a change in the pattern of distribution, compared to conditions expected under the natural disturbance regime.

Fuels Profile

Fuels profiles in the Fall Creek watershed are affected by three elements: silvicultural treatments, catastropic events and time. All three have played a role in the present fuels profile associated with the watershed. Silvicultural treatments (i.e. harvest, thinning and planting) involve about 35,000 acres of the watershed; catastrophic events since 1900 (Portland Creek and Hehe Mountain burns) include about 8,000 acres.

Fuel loading by size class was determined for seral stages from GIS analysis completed for this watershed analysis *(See Table 18). General Technical Report PNW-105 (Photo Series for Quantifying Residues in Common Vegetation Types of the Pacific Northwest)* and field visits using *GTR-PNW-105* and *258 (Stereo Photo Series for Quantifying Forest Residues in the Douglas-Fir -- Hemlock Type of the Willamette National Forest)* were used for assigning a fuels profile for each seral stage.

Table 18. Fuel Loading *(amount of fuel by size expressed in tons per acre)*

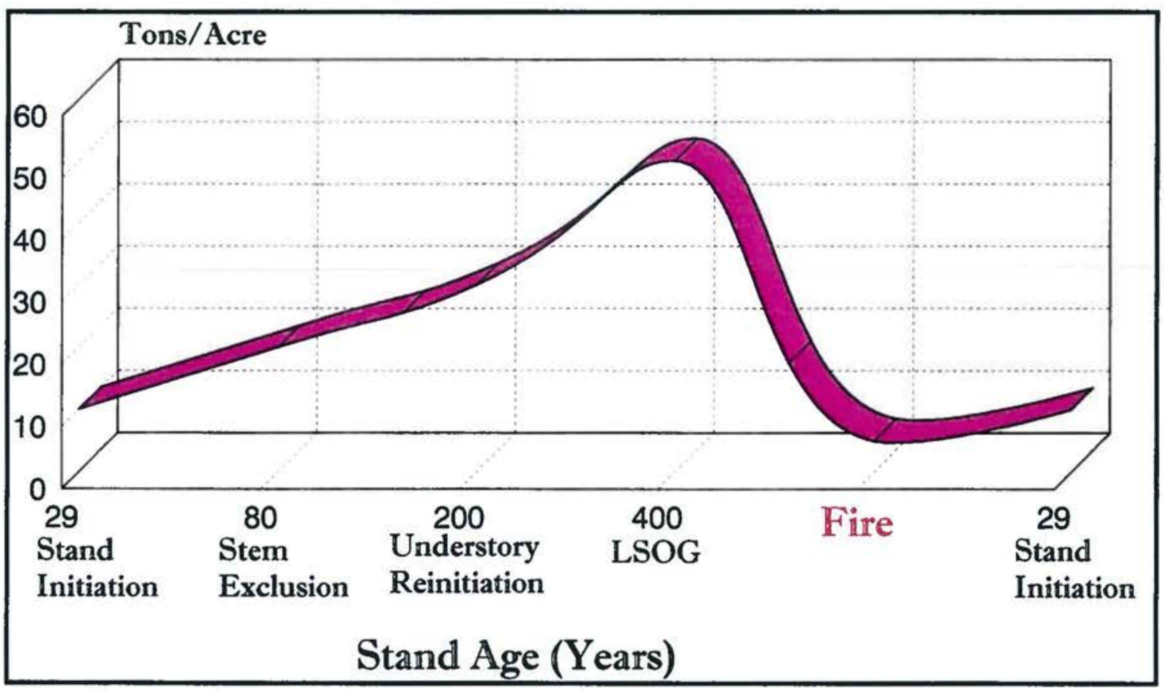
	Size Class			
	0-3 inches Tons/Acre	3-9 inches Tons/Acre	9-20 inches Tons/Acre	Total Tons/Acre
Meadows	2.0			2360 acres 2% of Area
Open Stand: 0-29 yrs	10.1	12.6	11.6	20,103 acres 27% of Area
Stem Exclusion: 30-80 years	6.6	6.7	11.7	17573 acres 25% of Area
Understory Re-initiation: 81-200 yrs	3.8	5.0	18.5	349 acres <1% of Area
Late Successional and Old Growth: 200+ yrs	3.9	4.5	30.0	33193 acres 45% of Area

During the natural cycle of vegetation progression in western forests, accumulation of natural residues often exceeds rate of decay in young stands where normal mortality is high, and low crown heights allow rapid drying of the forest floor. Conversely, stands in the mature stage, with high, dense crowns, may produce a microclimate in which residue decays faster than it accumulates. Heavy fine fuel (0-3") loading is to be expected in open stands where grasses and other forbs, brush and young tree needle-cast combine to form this layer. Late-successional and old-growth areas can be expected to have high fuel loading in the 9 inch and greater sizes as the stand continues to evolve. An equilibrium fuel profile, where fuel accumulated equals fuel decayed, is attained in the younger, vigorous growing stem exclusion and understory re-initiation stages.

Fire patterns, behavior and intensity will be affected by fuel loading. Currently the open stand stages may not mimic the historic range of variability due to management influences such as site preparation (ex. precommercial and commercial thinning and salvage). Fire exclusion for the past eight decades may have affected stand structure and complexity in the prevalence of understory species. Stand density may be greater than prior to suppression activities. Current fragmentation does not mimic the spread patterns fire followed in the pre-suppression, pre-managed watershed.

Fire behavior will be influenced by weather events and fuels. Since the watershed is fragmented, a specific fuel model may not fit a fire event, but multiple models may be used in predicting spread and intensity. The National Forest Fire Laboratory (NFFL) fire behavior fuel models can generalize fire behavior expectations for each seral stage. Fuels have been classified into four groups: grasses, brush, timber, and slash. The differences in fire behavior among these groups are basically related to the fuel loading and its distribution among fuel particle size classes *(See Figure 19)*. Young stands (stand initiation) would exibit fire behavior characteristics of Fuel Models One and Five. Stem exlusion, understory reinitiation and old-growth stands would fall within the characteristics of Fuel Models Eight and Ten *(See NFFL FBO FM guide for FM 1,5,8,10)*.

Figure 19. Fuels Evolution Graph



Risk Assessment

Large fire events occurred in the watershed when a combination of weather and fuel factors were at an optimum for intensity and spread. In all probability, wind, such as those associated with cold fronts, was the major spread event. Relative continuity of the fuel model carrying fire maintained spread and intensity until weather and fuel conditions changed, probably a seasonal change.

Currently the fragmented landscape would support various burning intensities as fuel models change. Significant fire runs may occur in the stand initiation and stem exclusion areas with catastrophic effects (Fuel Models One and Five), while lower intensity fires would occur in the understory reinitiation and old-growth stands (Fuel Models Eight and Ten). The combination of a drought cycle and weather event, such as lightning, would most likely cause an intense burn in all fuel models.

Insects, Disease, and Windthrow

Insects, disease and windthrow play a small role as disturbance agents in the Fall Creek watershed. Douglas-fir beetle *(Dendroctonus pseudotsugae)* is the primary insect attacking Douglas-fir trees. Douglas-fir beetle population increases are strongly associated with areas of fresh blowdown or standing dead timber. Only a few isolated activity centers are located within the watershed.

Root rots, primarily *Phellinus weirii* and *Armillaria mellea*, are endemic to the watershed. Root rots are a site-specific disease. Generally, the fungus is passed from tree to tree through root systems. Thus, if a root rot pocket is initiated, it will continue to grow as long as a host is available. Root rot can be an agent for diversity by creating openings in forest stands. Hardwood re-invade these pockets and are generally resistant to root rots.

Most windthrow in the watershed occurs as small areas immediately adjacent to clearcut units. The high contrast edge between plantations and mature forest stands create an exposed "wall of trees" which can be very susceptible to strong winds.

Timber Harvest

The first clearcut timber harvest within the Fall Creek watershed began in 1943 to provide a source of lumber during World War II. The earliest harvest units were located in the lower part of Fall Creek near the Andy, Rubble and lower Portland Creek drainages. During the 1950's, harvest activities centered in Hehe Creek with most of the harvest related to salvage from the Hehe Fire. Harvest levels continued to provide sustained yields of timber products through 1960-1980 with an average harvest rate of 8% per decade. Changes in forest management policy with the listing of the northern spotted owl and a shift to ecosystem management drastically reduced the harvest levels in the 1990's. Timber harvest, predominately clearcutting, has occurred over 46% of the watershed (35,477 out of 76,704 acres) with over two billion board feet of timber produced from this watershed alone *(See Table 19)*.

Table 19. Timber Harvest by Decade

Decade	Acres	% of Watershed
1940-1949	5,949	8%
1950-1959	5,943	8%
1960-1969	9,206	12%
1970-1979	6,183	8%
1980-1989	7,061	9%
1990-1995	1,135	1%
Total	**35,477**	**46%**

Future Timber Management

As mentioned above, the Fall Creek watershed contains 76,704 acres. After subtracting areas set aside by the Willamette Forest Plan and areas set aside by the Northwest Forest Plan (including riparian reserves), the watershed contains approximately 15,758 acres of suitable lands available for timber management. This area is approximately 21% of the watershed. Of the 15,758 acres of available lands, 10,299 acres (65%) are currently managed plantations and the remaining 5,459 acres (35%) are existing native stands.

WILDLIFE

Reference Conditions

Big Game

An historical perspective for Roosevelt elk population levels in western Oregon (Oregon Department of Fish and Wildlife, 1992) indicates that the species was numerous and widely distributed in western Oregon prior to the arrival of European settlers. During the late 1800's, market hunting for elk and human encroachment on elk range substantially affected elk population levels which was reduced to a few small herds along the coast and in the Cascades by 1900. In 1909, the Oregon State Legislature closed elk hunting in the state. This closure continued until 1938, when hunting was reopened on a limited basis. During the closure period, elk populations recovered substantially due to some transplanting efforts but mainly by virtue of an increase and expansion of remnant elk populations. Population trends continued to rise into the 1960's with a dip in numbers occurring in the 1980's. Overall trends have been on the rise in western Oregon up to the present. Transplanting efforts have occurred within the watershed with approximately 40 elk introduced to the Platt/Briem/Ninemile Creek area between 1987 and 1990.

It is interesting to look at modeling runs executed on historic vegetation using the HEI West Wisdom Model *(Table 26)*. Numbers indicate that habitat conditions were more abundant and of higher quality for big game in 1900 than today. This would suggest that big game was more numerous then, although historical records and information do not support this. The model used has been built and structured around management activities and responses of big game to these activities. The fact that historical vegetation was comprised of large tracts of optimal habitat coupled with no open road densities created high habitat values in the modeling process. This would also suggest future trends toward increased HEI values within the watershed, primarily from increases in optimal thermal conditions in the no-harvest allocations (79% of the watershed). Again, it is anticipated that big game populations will level off or decline slightly as the fragmented landscape matures into contiguous stands of thermal and optimal thermal cover.

Connectivity, Dispersal and Interior Habitat Conditions

At the turn of the century, habitat conditions in the watershed were significantly different than they are today. The vegetation at that time, reconstructed in GIS using stand year of origin information *(See Map 15)*, depicts a watershed composed substantially of late-successional forest habitat. These stands were also contiguous in nature supplying large amounts of interior habitat for species such as the spotted owl, marten, goshawk, Cooper's hawk, pileated woodpecker, fisher, vaux's swift, olive-sided flycatcher, Hammond's flycatcher, Townsend's warbler, band-tailed pigeon, and numerous amphibian species. Not only were these and many other species able to breed and reproduce, but they were also able to move, disperse and migrate without major landscape barriers. This provided for well distributed populations of these late-successional forest dependent species. With the onset of European American influence and habitation, suitable habitats for these species started to decline. This was due to increased forest fragmentation as a result of logging and roadbuilding, loss of good riparian habitat and increased forest fire suppression.

Since only four percent of the watershed was estimated to be in an early seral stage condition (stand initiation), early seral stage dependent or contrast species could be more abundant today than they were in 1900. Species abundance in Fall Creek in 1900 might have been complimented by higher or lower numbers in adjacent watersheds, based on size and location of natural disturbances across the landscape.

The Fall Creek drainage, a major east/west riparian corridor, could have been instrumental in facilitating movement and migration of riparian dependent species (as well as other species) between the Willamette River lowlands and the North Fork of the Middle Fork Willamette and South Fork McKenzie River systems.

Riparian-Associated Species

Riparian associated species were probably much more abundant and widespread historically than they are today. Intact riparian areas with cooler water temperatures and healthy levels of snags and coarse woody debris provided those special habitat components required by aquatic and riparian-associated wildlife species. Amphibians, requiring cool, moist conditions in their life histories, benefited from extensive areas of late-successional forest in the northwest and in the watershed.

Current Conditions

Threatened, Endangered & Sensitive, C-3, Appendix J2 Species

The following are threatened, endangered and sensitive species known or suspected to occur within the watershed. Included in the discussions of each is current information on status and survey history, and future potential occurrence for listed species based on vegetation trends and land allocations in the Northwest Forest Plan. Also included are species of interest or concern, documented or suspected to occur. Refer to *Table B43* in *Appendix B* for those species currently listed under the Endangered Species Act. Also listed are species recently included as Category 2 species (USFWS, Animal Candidate Review, Nov. 1995).

American Peregrine Falcon *(Falcon peregrinus anatum)*

Status: Federal: *Endangered*
State: *Endangered*
Indicator species for endangered species habitat.

Current Status and Survey History: There are no known active peregrine nest sites within the Fall Creek watershed. In the Pacific states, preferred peregrine falcon nesting sites are sheer cliffs 150 feet or greater in height (Willamette National Forest DEIS, 1987). In 1981, the Oregon Department of Fish and Wildlife completed an aerial reconnaissance of cliffs on the Forest and identified those with nest site potential. None were located on the Lowell Ranger District. In 1991, another aerial survey for peregrine nesting sites was conducted by Joel Pagel. Only one site on the district, in the Portland Creek drainage, was identified as having moderate potential for nesting.

The peregrine falcon feeds almost exclusively on birds, many of which are associated with riparian zones and large bodies of water. The Fall Creek watershed itself does not include any large bodies of water except for the very lower end of the analysis area, which is also the upper end of Fall Creek Reservoir. This area could provide potential foraging sources for the bird.

In 1995, ground field reconnaissance was conducted to assess potential sites for peregrines. The district has expanded the list of potential sites within the watershed to five, and monitoring these sites will continue in subsequent years. All sites are within the LSR located in Fall Creek, except for one located on the boundary between LSR and Matrix.

Future trends in habitat and occurrence: The potential exists for peregrines to nest within the watershed. As mentioned, no intensive monitoring of identified potential sites has taken place, although sites will be checked in future years as time and budget allow. Since all potential sites, with one exception, are in the LSR, this could increase chances of birds using the sites, based on reduced disturbance and logging activity in the LSR. The one potential site on the boundary between LSR and Matrix, is most likely to be disturbed based on an open main road almost completely encircling the base of the rock.

Northern Bald Eagle *(Haliaeetus leucocephalus)*

Status: Federal: *Threatened*

State: *Threatened*

Indicator species for endangered species habitat.

Current Status and Survey History: There are no known bald eagle nest sites within the watershed although potential nesting habitat exists at the very low end adjacent to Fall Creek Reservoir. It has been documented that the Eagle Rock pair, nesting above Dexter Reservoir, uses Fall Creek Reservoir as a foraging area. All forested habitat within 1.1 miles of a larger water body should be considered potential nesting habitat. The BLM has designated a 400 acre Bald Eagle Management Area (BEMA) in Section 23 at the extreme west end of the analysis area. Although currently there is no known nesting activity in this area, the potential is high as it includes late-successional habitat and is designated as a connectivity block in their area plan.

Anthony, *et. al.,* (1982), recorded that in the Pacific recovery area, resident bald eagle habitat requirements include a nest site in an uneven-aged (multi-storied) stand with old growth components. Nest trees are usually larger than those trees in the surrounding stands (USFS, 1987) and have thick, stout limbs which can support nests weighing in excess of several hundred pounds and up to ten feet in diameter. These nests are located near bodies of water which support an adequate food supply (USFWS, 1986). The majority of nests in Oregon are located within half a mile of a body of water, while the mean distance of nests in the Cascade Mountains is 470 yards. All forest lands within 1.1 miles of the shoreline of a major body of water can be considered potential bald eagle nesting habitat (USFS, 1987).

Future trends in habitat and occurrence: The lower end of the watershed does contain potential nesting habitat. With the BLM BEMA set-aside, this would provide a source of nesting habitat over the years. Riparian protection, as required in the Northwest Forest Plan, could further provide stands that mature into suitable nesting habitat on federal lands. Stands outside the riparian reserves should be examined for potential development into suitable nesting areas.

Northern Spotted Owl *(Strix occidentalis caurina)*

Status: Federal: *Threatened*
State: *Threatened*
R-6: Sensitive

Current Status: There are 39 known spotted owl activity centers within the watershed. Of these, 25 are located within the LSR (RO219) and 14 are within the matrix portion of the watershed, one of which is on BLM land within a designated connectivity block. USFWS addresses habitat removal adjacent to activity centers using *"Incidental Take"* thresholds, commonly known as *"Take." "Take"* is defined as:

1) Removal of suitable habitat where remaining habitat is below 40% within a 1.2 mile radius of the activity center, *OR*
2) Removal of suitable habitat where remaining habitat is below 500 acres within a 0.7 mile radius of the activity center.

Table 20 displays breakdown of activity centers by land allocation and numbers below *"Take"* thresholds. *"Take"* analysis shows that 31 sites are above the 40% threshold, five are between 30% and 40% and three sites have suitable habitat acres below 30%. Seventy-nine percent of the owl activity centers are above the 40% *"Take"* thresholds. This points to a fairly healthy condition for the watershed in providing habitat for existing activity centers *(refer to Table B42 in Appendix B for complete information on "Take" analysis and reproductive history of these activity centers).* LSR RO219 includes small portions of the Blue River and Oakridge Ranger Districts and includes the Forest Service portion of the Little Fall Creek drainage *(See Map 19).*

Table 20. Number of Spotted Owl Activity Centers Within the Watershed Above or Below *"Take"* Thresholds.

Activity Centers	MATRIX	LSR	TOTAL
Greater than 40%	9	22	31
30% to 40%	3	2	5
Less than 30%	2	1	3
TOTAL	14	25	39

All USFS matrix and BLM activity centers have designated 100 acre cores surrounding them.

Suitable spotted owl habitat is defined as ranging from mature stands with a developing second story and some larger overstory trees, snags and coarse wood to old-growth stands with a component of large diameter trees, snags, downed logs and decadent, decaying trees. These stands would meet the nesting, roosting, foraging, and dispersal requirements of the spotted owl. Currently there are 35,280 acres (46%) of suitable spotted owl habitat within the watershed. This figure is fairly close to the amount of late-successional forest (50%) present in the watershed. The difference is in the map layer used to compute acres. Late-successional forest was computed from the vegetation layer and suitable owl habitat calculated from the district spotted owl habitat layer. Refer to *Table 21* for the breakdown of suitable and capable acres by land allocation.

The figures in *Table 21* are based on suitable habitat typed into the OHAB layer in GIS. This differs slightly from vegetation defined as late-successional forest (80 years or older); thus the four percent difference in the watershed. Seventy-nine percent is in withdrawn allocations; 95% of this land is currently growing or capable of growing suitable spotted owl habitat. Overall, 46% currently exists as suitable habitat.

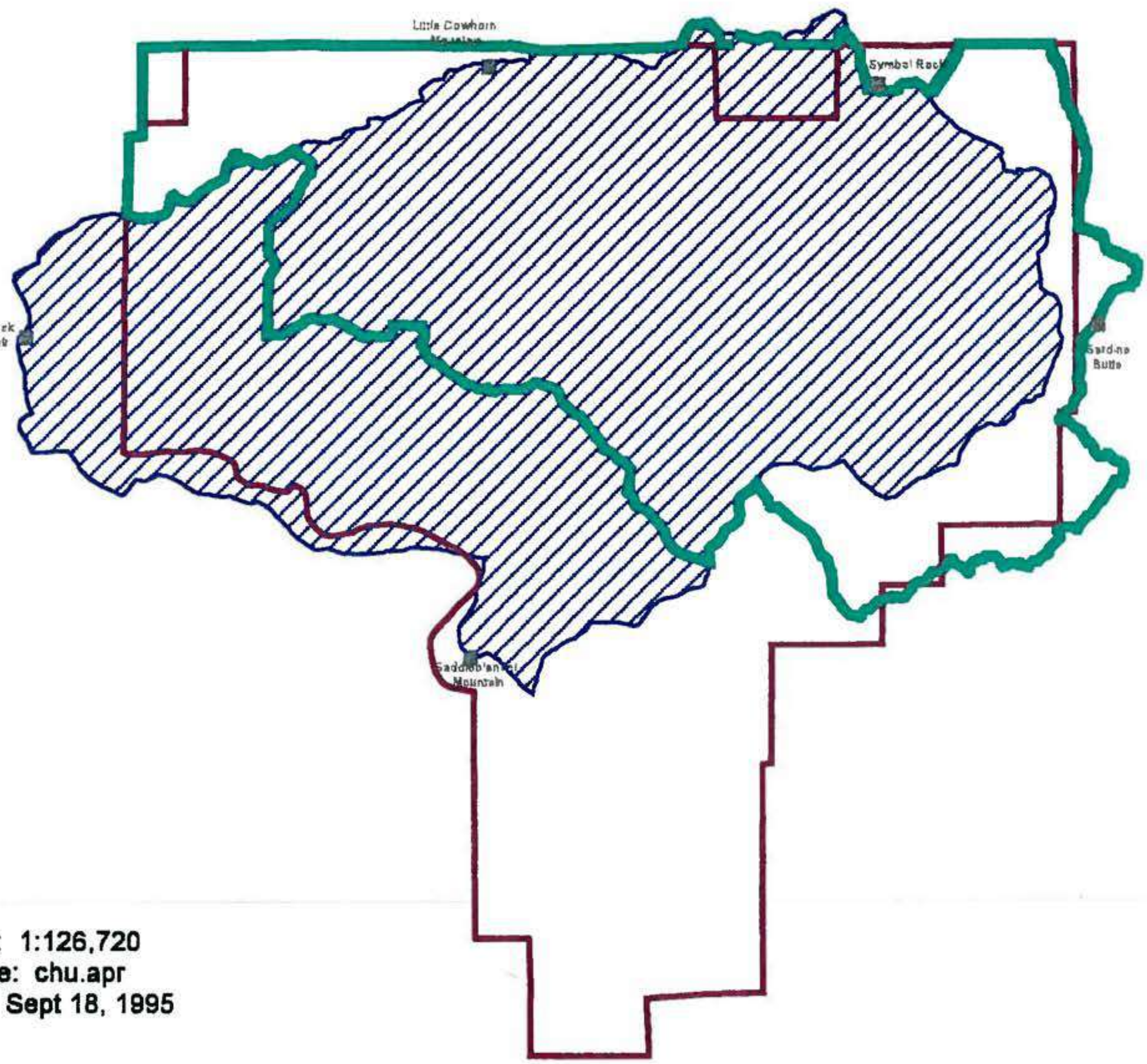
Table 21. Acres of Suitable Owl Habitat by Allocation.

Allocation	Suitable	Capable	Not Capable	% Suitable
LSR RO219	25,292	20,806	2,189	52%
Riparian Reserves	3,392	5,923	617	34%
LSR 100 Cores	1,315	68	24	93%
LMP Withdrawn	675	310	171	58%
SUBTOTAL-Withdrawn Ac.	30,674 (40%)	27,107 (35%)	3,001 (4%)	50%
Matrix	4,607	10,301	939	29%
TOTALS:	35,281	37,408	3,940	46%

Protocol survey status in the watershed: Spotted owl survey history over the years has been somewhat fragmented in the watershed. Most intensive survey work and large calling routes were completed in 1989 and 1990 when direction to survey more intensively was implemented. These calling routes were oriented around proposed timber sale planning areas. Without the current protocol in place at that time, thoroughness in calling an area was somewhat compromised. Only one calling station was placed at the proposed unit and many suitable stands between proposed units were not surveyed. Many of these routes were surveyed later in the summer when results were somewhat less than optimal. Nevertheless, activity centers were located in the watershed and subsequent survey work for non-timber related projects has updated locations and activity center status. The lower portion of the watershed has a more intense survey history while the upper end of the watershed (portions of the LSR) lacks thorough data on spotted owl activity. Since the entire watershed was proposed as an HCA under the ISC strategy, sale planning and related owl calling ceased here in 1990. Other projects since have supported owl survey work (ex. stream enhancement projects, trail projects, active 318 timber sale contracts, etc.).

Map 19

CHU, LSR and Watershed Boundaries



Scale: 1:126,720
Source: chu.apr
Date: Sept 18, 1995

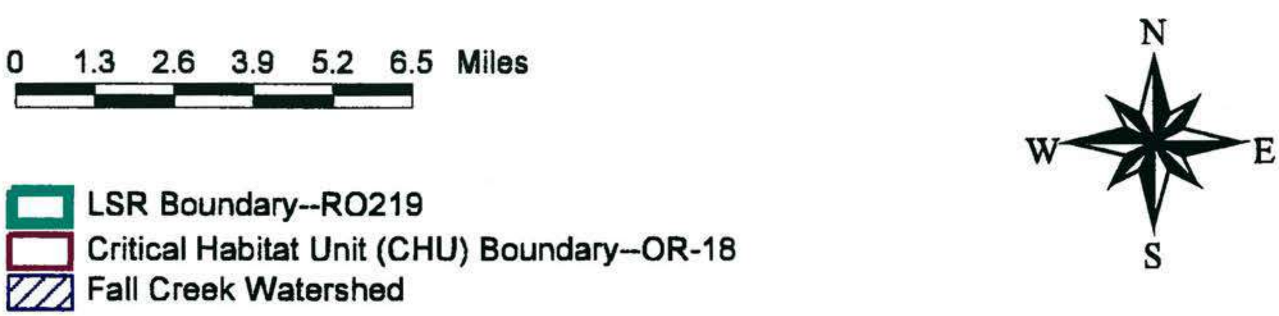


Table 22 depicts an approximation of the percent of the watershed called to protocol by year and number of visits.

Table 22. Spotted Owl Protocol Summary.

Year	Survey Protocol	% Watershed Surveyed	
		3X	6X
Pre 1989	Opportunistic Visits- surveying historic sites and in SOHA's- No area or broadcast protocol work completed.		
1989	Area calling under old protocol done. Work completed late in the season but activity centers found.	30%	
1990	More intensive work done around planning areas and in HCA. Survey work completed just to find AC's in HCA.	10%	30%
1991	Less emphasis on survey in watershed due to HCA status. Some surveys done in Portland Cr. to support stream enhancement.	5%	5%
1992	Survey work completed to support stream enhancement projects along main stem Fall Cr.	45%	0%
1993	Same support work as in 1992.	30%	15%
1994	Timber Cr./Andy Cr. area called to three visit protocol.	20%	0%
1995	No planning areas/Timber support survey work completed. Some activity centers visited to update status.	0%	0%

Dispersal Habitat (11-40) Condition in the Watershed: Table 23 displays acres of habitat meeting the 11-40 definition. The basic assumption underlying the analysis was that all stands of at least 40 years old met 11-40 conditions. The acres are broken out by sub-watershed. Map 1 displays current 11-40 conditions in this watershed.

Table 23. Current spotted owl dispersal (11-40) conditions within the watershed.

	Lower Fall	Portland/Logan	Upper Fall/Delp	Hehe
% (Acres)	67.1 (15625)	59.9 (8174)	59.5 (11336)	67.5 (13996)
Total for the Watershed:		64.0% (49131 Acres)		

Dispersal conditions adjacent to the watershed and between LSRs: Table 24 depicts dispersal distances between the Fall Creek LSR RO219 and the four adjacent LSRs. Dispersal conditions overall are in fair condition. Areas of concern are:

1. The dispersal corridor to the north (from RO219 to RO217) moves through fairly large areas of extensively harvested private lands
2. Dispersal conditions in the three quarter townships at the eastern edge of the LSR are currently below the 50% level. This area of federal land has been well fragmented from past timber harvest and could be a priority area for dispersal habitat enhancement. A comprehensive LSR Assessment for LSR RO219 is planned for FY '96.

Table 24. LSR Dispersal Distances

LSR	LSR	Straight Line	Possible Dispersal Route
		Distance (miles)	Distance (miles)
RO219	RO217	7	7 - 8.5
RO219	RO218	6.5	10 +
RO219	RO220	6.5	7
RO219	RO222	10.5	12

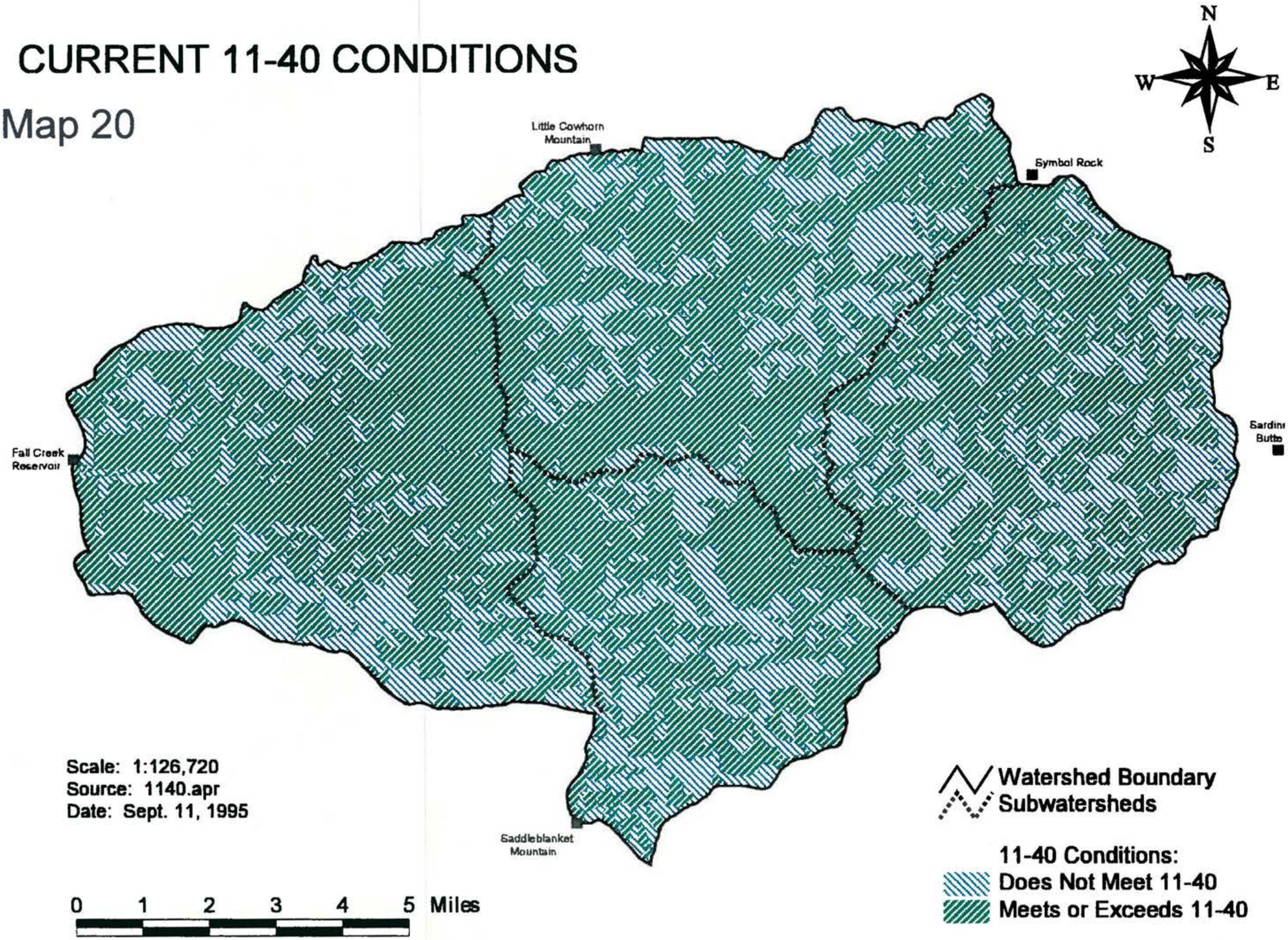
Critical Habitat: Critical Habitat Unit OR-18 currently overlaps the watershed and LSR RO219 (Figure YY). Approximately 95% of the watershed is also designated within this critical habitat unit. Table 23 depicts habitat conditions and percent overlap between CHU OR-18 and LSR RO219. This information was extracted from Table G-11 (Vol. II, App. G, FSEIS).

Table 25. CHU OR-18 Condition and Overlap with LSR RO219

Total CHU Acres	LSR Overlap Acres	CHU/LSR Overlap Acres	Suitable STOC acres w/in CHU	Suitable STOC Acres w/in LSR
107,557	66,031	61,307 (57%)	54,233 (50.4%)	31,228 (48%)

CURRENT 11-40 CONDITIONS

Map 20



Cooper's and Sharp-shinned hawks), is a very aggressive hunter that generally forages within the canopy for small mammals and birds. There is growing concern that timber harvest and related activities are causing the decline of goshawk populations, although there is little research and monitoring information that adequately addresses this issue in the Northwest. Mature and old-growth forests with closed canopies are often selected for nesting, although one nest site on the Lowell District has been located in a 35 year-old managed stand in the Winberry drainage.

Limited surveying and monitoring for the goshawk have been accomplished. There are two fairly reliable sightings of goshawks in the lower portion of the watershed, but nest locations have not been verified.

Future habitat trends: There is high potential for goshawks to exist within the watershed with almost two-thirds of it currently considered suitable habitat. Potential habitat should increase over time as stands currently in no-harvest allocations develop into late-successional forest. Dispersal conditions for juveniles should be adequate although, as mentioned previously for the spotted owl, there are dispersal concerns to the north where private industrial lands are abundant.

Pacific Western Big-eared Bat *(Plecotus townsendii townsendii)*

(also known as Townsend's Big-Eared Bat *(Plecotus townsendii)*

Status:	Federal:	Candidate Category 2
	State:	Sensitive
	R-6:	Sensitive

Current Status and Survey History: Although Pacific Western Big-eared Bats are the most characteristic bat in caves of the western U.S., the small amount of historical population data indicates a decline in numbers. Caves and cave-like structures are critical habitat for these bats as hibernacula in winter and as roosts for summer nursery colonies (Perkins, 1987). Pacific Western Big-eared Bats are also known to roost in the bark crevices of large snags.

Historical evidence indicates the presence of isolated populations of Pacific Western Big-eared Bats in Lane County and on private land adjacent to the Willamette N.F. (Perkins, 1987). A general survey of Lane County and the Willamette N.F. was conducted by Perkins during the summer and winter of 1983-84. In Lane County, hibernacula of this bat were found on private land adjacent to the Willamette N.F. and near Bohemia Mines on and adjacent to the Umpqua N.F. (Perkins, 1987). Three recent Pacific Western Big-eared Bat sites have been recorded on the Lowell Ranger District; one of these within the watershed.

California Wolverine *(Gulo gulo luteus)*

Status:	Federal:	Candidate Category 2
	State:	Sensitive

R-6: Sensitive

Current Status and Survey History: At the present time, no wolverine studies have been conducted in the Cascades. The most recent and comprehensive wolverine study was in northwestern Montana, conducted by Hornocker and Hash (1981) during 1972-1977. Wolverines appear to be extremely wide-ranging, and unaffected by geographic barriers such as mountain ranges, rivers, reservoirs, highways or valleys. For these reasons, Hornocker and Hash (1981) conclude that wolverine populations should be treated as regional rather than local.

Wilderness or remote country where human activity is limited appears essential to the maintenance of viable wolverine populations. High elevation wilderness areas appear to be preferred in summer, which tends to effectively separate wolverines and humans. The greatest impacts on the potential of land to support wolverines in the Pacific Northwest are largely due to forest fragmentation, settlement and access (Banci, 1994). Wolverine populations on the edge of extirpation usually have been reduced to areas of habitat which have not been developed, extensively modified or accessed by humans through roads and trails. The perception of the wolverine as a high elevation species usually coincides with areas of increased human disturbance and loss of habitat, restricting them to wilderness and inaccessible areas. In winter, wolverines move to lower elevation areas which are snowbound with very limited human activity. Wolverines make little use of young, thick timber and clear-cuts (Hornocker and Hash, 1981).

Lowell Ranger District is relatively low in elevation with few areas unimpacted by human activities. Most of the area has been fragmented and large blocks of intact mature timber stands are rare. There are no known sightings of wolverine on the district correlating with known habitat requirements described above.

Future habitat trends: The withdrawal of approximately 63% of the watershed for contiguous late-successional forest habitat (along with portions of Blue River and Oakridge Ranger Districts) should aid in providing potential habitat for the wolverine. There is a concern that the high densities of roads and trails remaining in the LSR could still prove to be a disturbance barrier, minimizing the potential for wolverines to re-establish themselves in the watershed.

White-footed Vole *(Phenacomys albipes / Arborimus albipes)*

Status: Federal: Candidate Category 2
State: Sensitive
R-6: Sensitive

Current Status and Survey History: Very little is known about the natural history of the White-footed Vole. *Phenacomys* is thought to be one of the most primitive of living Microtines and unable to withstand much competition. Preferred habitat seems to be moist areas near small streams in mature timber or pole-sized regeneration stands (Maser, 1966).

Specific studies of the White-footed Vole have not been accomplished, and all trappings of this vole have been accidental. It is suspected if such studies were undertaken, this vole might be more prevalent than is currently believed (Verts, personal communication).

Two specimen of the White-footed Vole have been collected on or near the Willamette N.F. One was found near Vida; the other on the Blue River District. It is thought that this is the easternmost extent of their range (Maser, 1966). Most of the known specimen of *P. albipes* in Oregon are west and north, primarily near the Pacific Coast.

Surveys for the White-footed Vole have not been conducted on the District or within the watershed. Voles are known to favor riparian associated habitat, although they have also been found in a variety of other forest conditions including logged areas. It is likely that the vole would have extensive areas of suitable habitat available for its use in the future with the provisions of late-successional and riparian reserves.

Pacific fisher *(Martes pennanti pacifica)* (J2).

Status: Federal: Candidate- Category 2

Current Status and Survey History: The fisher has the potential to occur within the watershed although no survey work has been completed to document its presence at this time. They prefer a closed canopy environment with diverse stand structure including large diameter snags and trees with cavities for use as denning sites. Highly diverse stands with adequate amounts of coarse woody material are important in providing foraging habitat for the fisher. They are associated with low and mid-elevation forests of the western hemlock zone. It has been affected by past logging and forest fragmentation, along with increased human access and disturbance patterns in western forests.

Future habitat trends: The fisher has the potential to occur in the watershed. With the potential for development and maintenance of late-successional forest in almost 80% of it, habitat for this species should increase over time as stands develop.

American marten (*Martes americana)* (J2).

Current Status and Survey History: The marten is another carnivore with the potential to occur within the watershed. The species shows a strong preference for large patches of late-successional forest which include adequate amounts of larger coarse woody debris in various decay classes. No survey work has been completed for the species but suitable habitat does exist.

Future habitat trends: Same as for the fisher.

Oregon red tree vole (*Phenacomys longicaudus*) (C-3 & J2)

Current Status and Survey History: The red tree vole is the smallest and least studied of the arboreal rodents of Douglas-fir forests in the Pacific Northwest. They feed exclusively on conifer needles. They are strictly arboreal and may spend their entire life in tree tops. Logging and loss of late-successional habitat has had an effect on vole populations in the northwest due to fragmentation and loss of old-growth habitat. The vole's main predator is the spotted owl. Spotted owl pellet analysis in the H.J. Andrews Experimental Forest indicates that the vole comprises 13% of the spotted owl diet.

Future habitat trends: The red tree vole shows an affinity for late-successional old-growth forests. Human-caused or natural disturbances (ex., fire, wind, disease) would tend to greatly reduce local populations of this species. With the no-harvest allocations within the watershed, this species should show an increasing trend in numbers. There is concern of potentially isolating populations between reserves due to the fragmentation of matrix lands. The vole is a survey and manage species and surveys will be required for all ground disturbing activities implemented in 1997 or later, when survey protocols should be implemented.

Other mammals:

There are five species of bats listed as species of concern and identified in Appendix J2 of the FSEIS. These species are listed in *Appendix B, Table B43.* All are suspected to occur within the watershed and habitat requirements vary among the species. The hoary and silver-haired bats are migratory species that could be present during the summer months. They are both associated with late-successional old-growth forests when roosting and foraging. The fringed, long-eared and long-legged myotis species tend to use large trees and snags for roosting habitat. These three species also use caves, old mines and rock crevices as winter hibernacula sites.

Future habitat trends: The no-harvest allocation lands along with mitigation measures established as S&Gs in the Northwest Forest Plan will help provide suitable roosting and foraging areas for these species. There are no known mines or caves within the watershed, but bridges along the mainstem of Fall Creek provide potential roost sites for some bat species. Survey work will be completed in the watershed to identify potential sites before ground disturbing activities are implemented.

Red-legged Frog *(Rana aurora)*

Status:	Federal:	Candidate Category 2
	State:	Sensitive
	R-6:	Sensitive

Current Status and Survey History: The red-legged frog is a pond frog which inhabits reservoirs, lakes and the slow-moving water of streams, most commonly in wooded areas.

Breeding waters utilized by these frogs vary considerably, but generally have certain requirements. These include permanent or temporary waters with little or no flow, which must last long enough for metamorphosis to occur and must contain sturdy underwater stems for egg attachment (Nussbaum, *et. al.*, 1983). During the non-breeding season, red-legged frogs have been found in moist forest situations 600-900 feet or more from any standing water (Nussbaum, *et. al.*, 1983).

Red-legged frogs are usually found below 2700 feet in elevation. While they are more common in the Coast Range, they may be found in the western Cascades. One breeding site has been documented in the Nine Mile Creek drainage and other sites probably occur. This pond, about 1/2 acre in size, is located at 2600 feet in elevation. It is impacted by increased windthrow on the south side as it is adjacent to a recently logged stand. This could have an effect on its ability to function as a breeding site. With LSR and riparian reserve protection, this species should maintain itself. Further monitoring will be completed to assess any trends.

Northwestern Pond Turtle *(Clemmys marmorata marmorata)*

Status:	Federal:	Candidate Category 2
	State:	Sensitive
	R-6:	Sensitive

Current Status and Survey History: The northwestern pond turtle inhabits marshes, sloughs, moderately deep ponds, and slow-moving portions of creeks and rivers, and prefers rocky or muddy bottoms with aquatic vegetation (watercress, cattails, etc.). Survey work in Fall Creek Reservoir (Hardin, 1993) indicated the presence of turtles in the upper end of the reservoir adjacent to the US Army Corps of Engineer's campground at Cascara, located just inside the lower end of the analysis area. Age distribution findings in the reservoir indicated a heavy bias toward adults; only one juvenile was found in the entire reservoir. This would suggest that successful recruitment of young turtles is not occurring in the system, possibly due to predation of young by both native and non-native species in the reservoir and reduction in amount of and access to suitable nesting habitat. Farther upstream in the Fall Creek watershed no known turtle habitat exists.

Future habitat trends: Since turtles were found in upper portions of the reservoir, it would be desirable to complete further survey work to assess impacts of recreational/boating use on the reservoir and to determine reasons for poor juvenile recruitment into the system. Also, any information concerning potential nesting locations in the extreme lower end of the watershed will prove beneficial in providing for the maintenance of turtle numbers in the reservoir.

Tailed Frog *(Ascaphus truei)* (J2).

Status:	Federal:	Candidate Category 2
	State:	Protected, Sensitive\vulnerable

Current Status and Survey History: The Tailed Frog is a riparian associated late seral species normally found in permanent, fast-flowing, rocky, cold-water streams and headwaters in coniferous forests. Although tailed frogs are normally found in or near streams during rainy weather, they have been known to forage 25 or more meters away from water (Nussbaum, *et. al.,* 1983). Average clutch size is 50 to 60 eggs and in some Cascade populations females breed only in alternating years (Leonard, *et. al.,* 1993). In the Oregon Western Cascades, tailed frogs have a one to three year larval period, possibly longer depending on climatic conditions, thus contributing to their relatively low reproductive ability.

Recent surveys have located small isolated populations among the upper reaches of two Class III streams (Alder and Delp Creek). Estimates of population densities have not been attempted. These populations have been located in lightly impacted watersheds with cool water temperatures. Few surveys for riparian associated amphibians have been completed inside the watershed and additional populations are likely to exist. Surveys will continue to identify other sites and distribution.

Future habitat trends: With LSR and riparian reserve protection, this species is likely to maintain its population. Tailed frogs, a riparian associated species, should show stable trends within the watershed as impacted riparian areas develop into late successional forests. This will provide increased protection from siltation and higher stream temperatures and also provide corridors for immigration to streams with more favorable conditions in the future. The major concern for the tailed frog is a degrading road system and the increasing potential for road failures with the accompanying degradation of associated aquatic habitat.

Clouded Salamander *(Aneides ferreus)* (J2).

Status: State: Sensitive/undetermined status

Current Status and Survey History: Clouded salamanders are normally found in large woody material (LWM), preferably Douglas-fir, and stumps of varying decay previously inhabited by ants, termites, and other invertebrates (Leonard, *et. al.,* 1993). They require permanent dampness, rotten logs necessary for specific invertebrates, and rocky or woody debris, such as large Class III and IV Douglas-fir logs with sloughing bark, for cover. Once a large log or woody debris has decayed to the point of moisture loss, the salamander must abandon its habitat. Clouded salamanders are dependent upon a continuous supply of suitable large, rotten logs or snags.

This species has been documented only once near the headwaters of Alder Creek. Although this represents only one sitting, very little upland survey work for terrestrial amphibians has been accomplished to date. Clouded salamanders are likely to occur elsewhere in the watershed.

Future habitat trends: With a large percentage of the watershed residing in the LSR, riparian reserves network, and reduced extraction of LWM this species is likely to maintain itself.

Oregon Slender Salamander *(Batrachoseps wrighti)* (J2).

Status: State Sensitive/undetermined status

Current Status and Survey History: Oregon slender salamanders are most commonly found in mature Douglas-fir forests on the western slopes of the Oregon Cascades (Nussbaum, *et. al.,* 1983). An endemic species to Oregon, this salamander dwells in moss-covered logs, rotting stumps and under rocks or pieces of bark near spring seeps. In late spring and early summer they retreat vertically for a subterranean existence to maintain suitable moisture regimes. The watershed is south of the southern edge of its range and no documented sightings exist. This salamander, living a primarily subterranean existence, is not extremely effective in terrestrial movement and some natural barriers may prevent access. However, some questions remain concerning this species' existence within the Fall Creek watershed.

Future Habitat Trends: Although this species has not been known to occur, its habitat exists. Historical harvesting activities have removed some of the components necessary for Oregon slender salamander habitat, primarily LWM and cover for sufficient moisture regimes. However, with the provisions of late-successional and riparian reserves, suitable habitat should increase in availability for any residents or immigrants from the north.

Cascade torrent salamander *(Rhyacotriton cascade)* (J2).

Status: State Protected, Sensitive/vulnerable

See: "Southern torrent salamander"

Southern torrent salamander *(Rhyacotriton variegatus)* (J2).

Status: Federal: Candidate Category 2

State: Protected, Sensitive/vulnerable

Current Status and Survey History: The recent revision by Good and Wake of the family and genus of Torrent Salamanders in 1992, split the "Olympic Salamander" into four distinct species not fully accepted by all authorities (Leonard, *et. al.,* 1993). Two of the species which may occur in this watershed are the Southern and Cascade torrent (seep) salamanders. The two species can be separated by range, subtle morphological characteristics, and slight differences in life history. *Rhyacotriton* spp. normally occur in or near permanent, cold streams and seeps in association with talus, small rocks, and gravel, often in streams with moss capped rock rubble in late seral forests. Torrent salamanders are mostly aquatic and their habitat appears to be restricted to riparian zones. These species are sensitive to activities impacting headwater areas and seeps, such as logging and road building activities, which increase sedimentation and/or temperatures of water in their coarse substrate habitat areas.

There are no documented sightings within the watershed confirming *R. variegatus* or *R. cascadae*. Recent surveys among the upper reaches of Alder Creek have confirmed the presence of torrent salamanders in the drainage. This population of salamanders has some peculiar morphological characteristics. Currently the species has not been identified. Specimens from this species have characteristics of both the Southern and Cascade torrent salamanders, and voucher specimens have been submitted for genetic testing and identification. This population is located between the current range of both the Southern and Cascade torrent salamander and identification may provide support or oppose the current taxonomy of this genus.

Future habitat trends: Most perennial streams within the Alder Creek subwatershed are likely to contain this variety of torrent salamander, as well as other perennials. Other areas will be surveyed, including Nevergo Creek (in Fall Creek), Winberry and the Middle Fork Willamette watersheds, to further knowledge of the species and its distribution. As riparian-associated salamanders, the Southern and/or Cascade torrent salamanders are likely to have extensive habitat in the future with the provisions of late-successional and riparian reserves. As with the tailed frogs, there is considerable concern regarding road failures due to less road maintenance and decreased accessibility. For example, a plugged culvert with associated road failure could deplete a large reach of prime aquatic and associated riparian habitat.

Arthropods

No arthropods, as listed on Table C-3 of the Northwest Forest Plan, are suspected to occur.

Mollusks

Current Status and Survey History: Of the mollusks listed in Table C-3 of the Northwest Forest Plan and Appendix J2, only two species may occur. *Prophysaon coeruleum* is a land slug which could occur in coniferous forests from low to mid-elevations. The southern Willamette valley is at the southern end of its range and all historic locations have been absorbed by urban development. There are no known sightings on the Willamette National Forest. *Prophysaon dubium* is another land slug associated with riparian areas and rock slides. Rock source development could have an effect on this species. Both are survey and manage species requiring surveys prior to implemention of ground disturbing activities in 1999 or thereafter.

Future Habitat Trends: With 79% no-harvest allocations, there should be adequate habitat available for these species in the future. Surveys will be labor intensive and should provide information to protect discovered sites. Anticipated impacts to matrix lands between the reserves suggest that the potential for populations to maintain themselves exists only within designated reserves.

Species Of Interest

Osprey *(Pandion haliaetus)*

Current Status and Survey History: There are three known osprey nests. One is located at the lower end of the watershed on BLM land and two are farther up the mainstem of Fall Creek. All three sites have been documented as active at some point in time during the past several years. With the put-and-take fishery, enough forage seems to be available to support three nest sites along Fall Creek. It also appears that the high recreational use of the creek during summer months has not had a significant detrimental effect on ospreys using the drainage.

Future Habitat Trends: The Fall Creek corridor will be monitored in future years to update activity and presence of osprey, especially at known nesting sites.

Band-tailed pigeon *(Columba fasciata monilis)*

Current Status and Survey History: The Pacific coast population of the band-tailed pigeon has a distribution farther north and west than any other race of this species (Pacific Coast Band-tailed Subcommittee, 1994). Various state and federal surveys, although lacking somewhat in uniform monitoring techniques, suggest a significant decline between 1972 and 1993. Habitats for the pigeon have been affected by past management activities, especially logging.

In the watershed, one site has been documented as a potential nesting/roosting area. This is located along Fall Creek just below the mouth of Slick Creek. On more than one occasion, a number of pigeons have been observed in the area from Fall Creek Road. Here the concentrated sightings are thought to be associated with a mineral spring/lick along the mainstem of Fall Creek. The mineral source could be an important source of calcium, reported as significant to pigeons during nesting and rearing of young. In the past two years, two pigeons, rehabilitated through the local Willamette Wildlife Rehabilitation Center, have been released in this area.

Future Population and Habitat Trends: With this important site documented, there is concern that continued recreation/disturbance in the area could be affecting its use by the pigeons. Further monitoring should be completed to assess the importance of this site and others.

Big Game Habitat

The watershed, as described in Chapter One, *Characterization*, is a front country; a relatively low elevation watershed, most lying within big game winter range. Currently, 26% (19,947 acres) lies within summer range and 74% (56,759 acres) lies within winter range. The summer/winter range line was delineated using the 3000 feet elevation line as a base and then adjusting this line based on aspect, slope, topography, and general knowledge of big game use *(See Map 21)*. The Lowell District, in cooperation with ODFW, transplanted approximately forty elk in the Upper Fall Creek area between 1987 and 1989. This area indicates high use during the summer months, with a herd becoming well established and using the upper end.

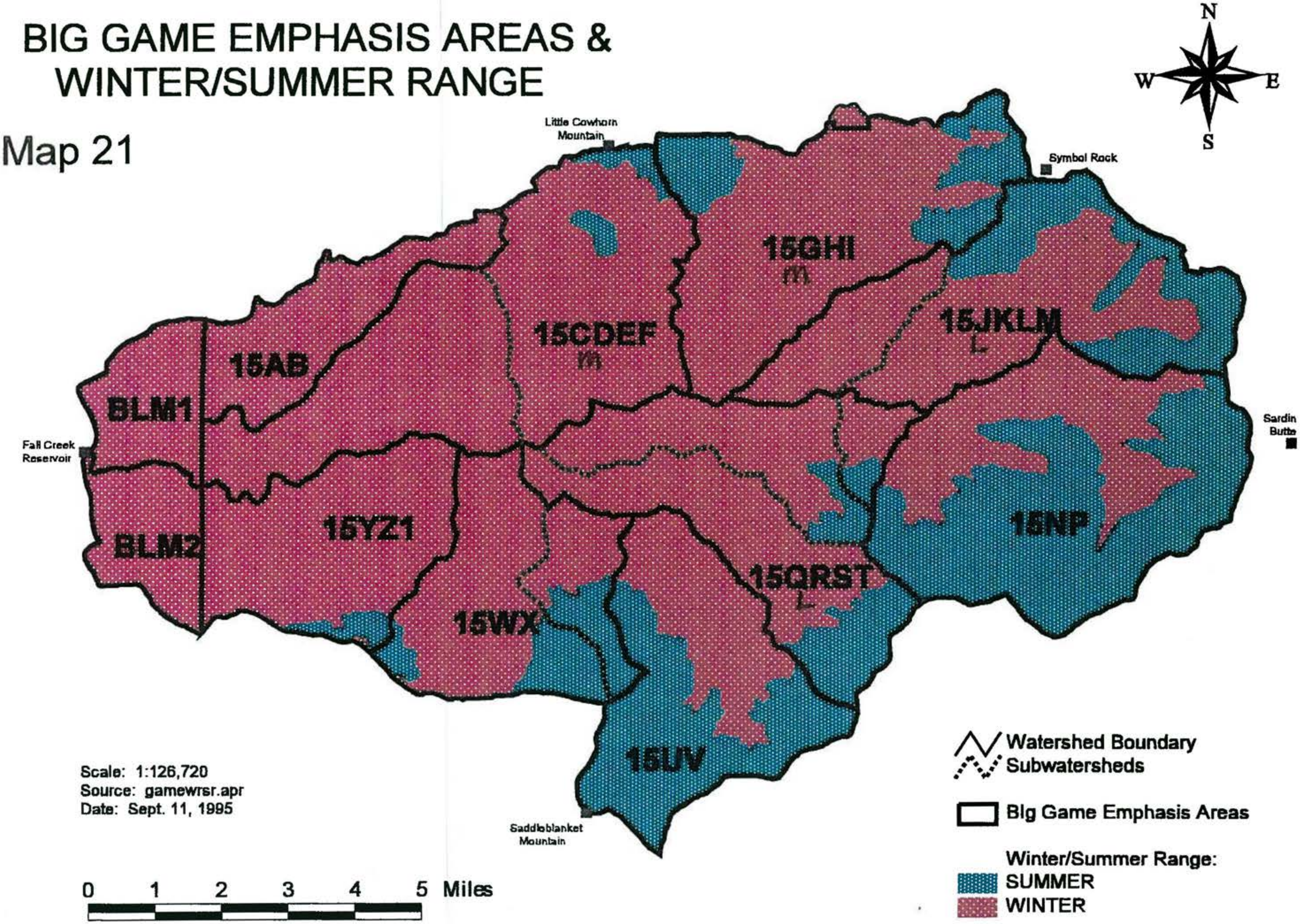
The Willamette National Forest Land and Resource Management Plan spells out direction in its standards and guidelines for management of big game habitat. It requires habitat analysis using four habitat components: forage quality, cover quality, road densities, and the location of forage and cover areas relative to each other. This is evaluated using the *Model to Evaluate Elk Habitat in Western Oregon* (Wisdom, 1987). Modeling is done on previously designated Big Game Emphasis Areas (BGEAs). There are 11 BGEAs varying from low to high emphasis, based mainly on elk use and habitat condition of the area. BLM and private lands do not have the same emphasis designations as the Forest; therefore the watershed portion outside the forest boundary was assigned a rating based on adjacent emphasis ratings within the District boundary *(Refer to Table 26 for a breakdown of BGEAs, their size and emphasis ranking)*. Modeling was completed using the current vegetation layer in GIS in conjunction with Paradox and HEI West programs.

Table 26 exhibits current conditions of the BGEAs in the watershed. As shown, there are only two areas with high emphasis. These are the North Fork of Fall Creek area and the Andy/Rubble Creek area. There are some high use areas within BGEAs with an overall rating of moderate or low. These include the upper end of Nevergo Creek adjacent to Saddleblanket Mountain, which is high use summer range; the upper end of Briem/Platt/Nine Mile Creeks and Hehe Mountain, also summer range; and portions of the Hehe Creek area, which are mainly within winter range.

Seasonal migration and movement of elk occurs between summer and winter ranges inside and between watersheds. It is suspected that elk using the Saddleblanket Mountain area in the summer move downslope to the northwest and use lower Portland, Rubble, Andy, and Timber Creeks, or move down into the North Fork of the Middle Fork Willamette River drainage. The Hehe Mountain herd is thought to either move down into lower Hehe Creek or to the north into the Deer Creek area in the McKenzie watershed. More information is needed to determine seasonal migration routes of elk utilizing habitat in the watershed at some point during the year.

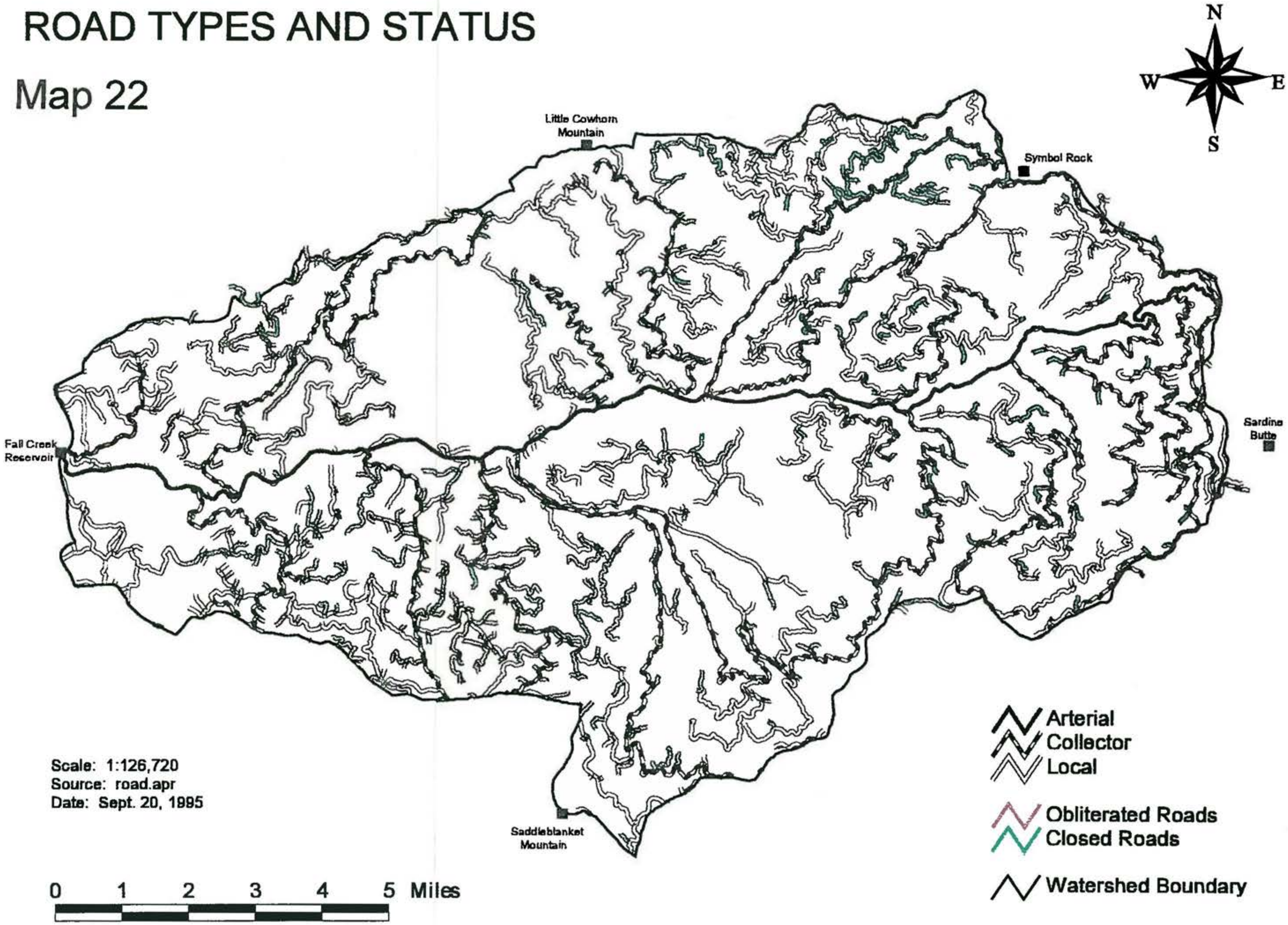
BIG GAME EMPHASIS AREAS & WINTER/SUMMER RANGE

Map 21



ROAD TYPES AND STATUS

Map 22



Scale: 1:126,720
Source: road.apr
Date: Sept. 20, 1995

TABLE 26. Big Game Habitat Effectiveness Values for Current and Reference Vegetation Conditions in the Watershed

	HABITAT CONDITION	Forage Quality		Cover Quality		Road Density		Size and Spacing		HEI		Forest S&G's HEI	Comments
		Cur.	Ref.	Cur.	Ref.	Cur.	Ref.	Cur.	Ref.	Cur.	Ref.		
	North Fork Fall Creek 15AB 9688 Total Ac. (H)	.49	.54	.59	.95	.42	1.00	.72	.33	.54	.64	.6	High road densities Open Road Density (ORD)= 2.64 - miles/sq. mile
-	Clark\Slick\Jones\Alder 15CDEF 11701 Total Ac. (M)	.51	.59	.69	.81	.37	1.00	.57	.45	.52	.68	.5	ORD = 3.12 mi./sq. mi.
-	Sunshine\E. & U. Hehe 15GHI 8713 Total Ac. (M)	.46	.75	.59	.93	.41	1.00	.68	.42	.53	.73	.5	
-	Tiller\Ninemile\Platt\U. Fall 15JKLM 9040 Total Ac. (L)	.47	.75	.69	.85	.27	1.00	.80	.41	.52	.72	↑	High summer use - High road densities
	Delp\Gold 15NP 10825 Total Ac. (L)	.48	.75	.69	.97	.33	1.00	.83	.38	.55	.73	↑	
-	Pacific\Marine\Puma\N.Portl-and\Logan 15QRST 8840 Total Ac. (L)	.37	.75	.73	.97	.37	1.00	.63	.44	.50	.75	↑	
	Gales\Nevergo 15UV 6898 Total Ac. (M)	.45	.72	.68	1.00	.39	1.00	.81	.39	.56	.73	.5	
	Andy Creek 15WX 6208 Total Ac. (H)	.34	.75	.55	.88	.44	1.00	.87	.43	.52	.73	.6	Low forage - open road densities above S & G's ORD = 2.47 mi./sq. mi.
	Timber Creek 15YZ 5496 Total Ac. (M)	.29	.72	.52	.68	.35	1.00	.81	.31	.46	.62	.5	Low forage - open road densities above S & G's ORD = 3.26 mi./sq. mi.
	BLM 1 2134 Total Ac. (M)	.28	.75	.45	.50	.25	1.00	.72	.30	.39	.58	.5	
	BLM 2 2126 Total Ac. (M)	.36	.75	.49	.77	.48	1.00	.73.	.31	.50	. 5	.5	

- ↑ -- should show increasing trends over time

Late Successional Forest Connectivity And Wildlife Dispersal Habitat

The Northwest Forest Plan has allowed for wildlife dispersal by the designation of no-harvest riparian reserves adjacent to Class I-IV streams. These areas serve the need to maintain healthy riparian systems and provide areas of refuge, movement and dispersal for many riparian-associated species as well as terrestrial-associated species. In addition to riparian reserves, other lands set aside within the matrix portion of the watershed would complement riparian reserves by providing additional dispersal habitat. These include 100 acre spotted owl core areas within the matrix portion, designated no-harvest LRMP allocations and unsuited lands currently providing dispersal opportunities.

With adoption of the Northwest Forest Plan, the 50-11-40 strategy delineated in the FSEIS (1992) was no longer required. This strategy required every quarter township to maintain at least 50% of the area in stands averaging 11 inches DBH and 40% canopy closure. The USFWS remains concerned with dispersal conditions, not only within the LSRs but also between LSRs. *(Refer to Wildlife, TE&S section, this chapter, for a discussion on dispersal conditions for the spotted owl.)* *Table 27* depicts current seral conditions of those lands set aside in the watershed. In this table, dispersal acres were defined as meeting the stem exclusion definition, which is 31+ years. Many wildlife species would use these stands for dispersal, even though they may fall short of meeting 11-40 conditions. *(Refer to the spotted owl section in this chapter for 11-40 analysis.)*

In summary, 76.5% of withdrawn allocations currently meet stem exclusion seral conditions.

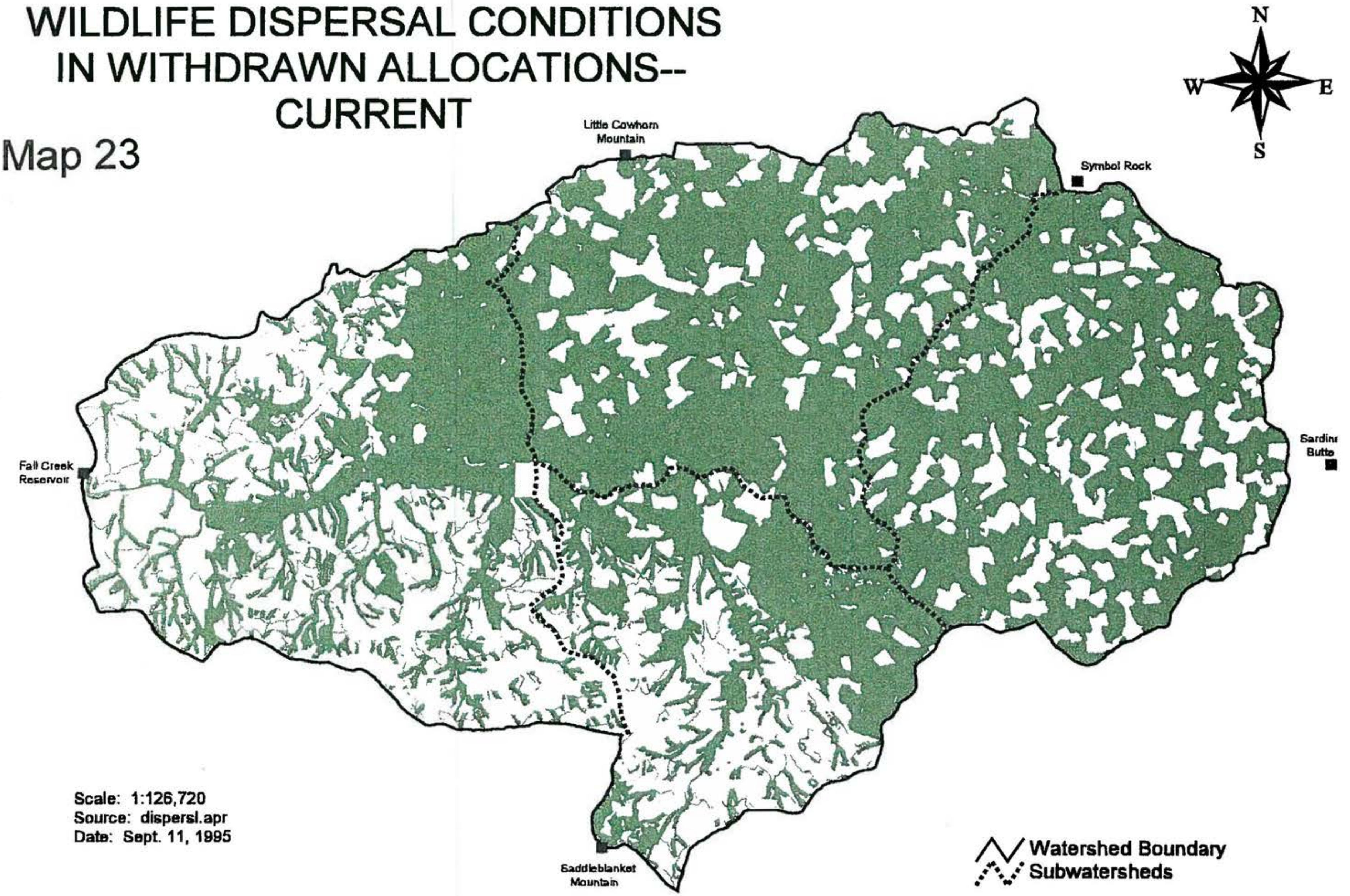
The data in *Table 27* shows current conditions of no-harvest allocations. Data depicts the percentage of these allocations meeting dispersal conditions along with percentages meeting late-successional forest conditions. Refer to *Map 23* which displays this information spatially. *Maps 24* and *25* show the projected change in these conditions over the next 40 years and identify areas of concern.

Table 27. Percent of "No-Harvest" Allocations within each Subwatershed Meeting Dispersal and Late-Successional Forest Conditions.

	Lower Fall	Portland/Logo	Upper Fall/Delp	Hehe
Wildlife Dispersal Habitat (31-80 Years)	22%	35%	13%	25%
Late Successional Forest Habitat (> 80 Year)	60%	45%	58%	52%
TOTALS	82%	80%	71%	77%

WILDLIFE DISPERSAL CONDITIONS IN WITHDRAWN ALLOCATIONS--CURRENT

Map 23

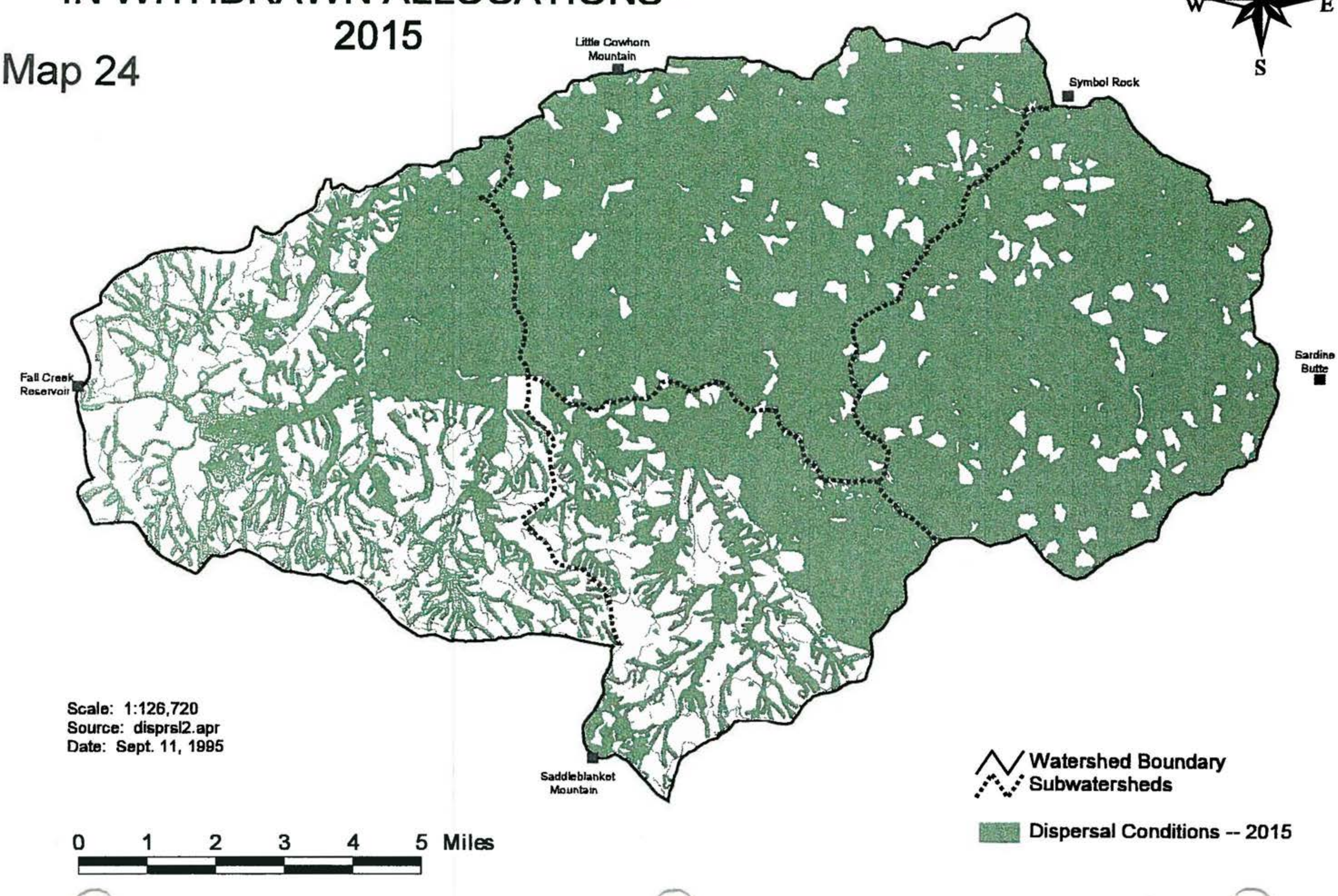


Scale: 1:126,720
Source: dispersl.apr
Date: Sept. 11, 1995

0 1 2 3 4 5 Miles

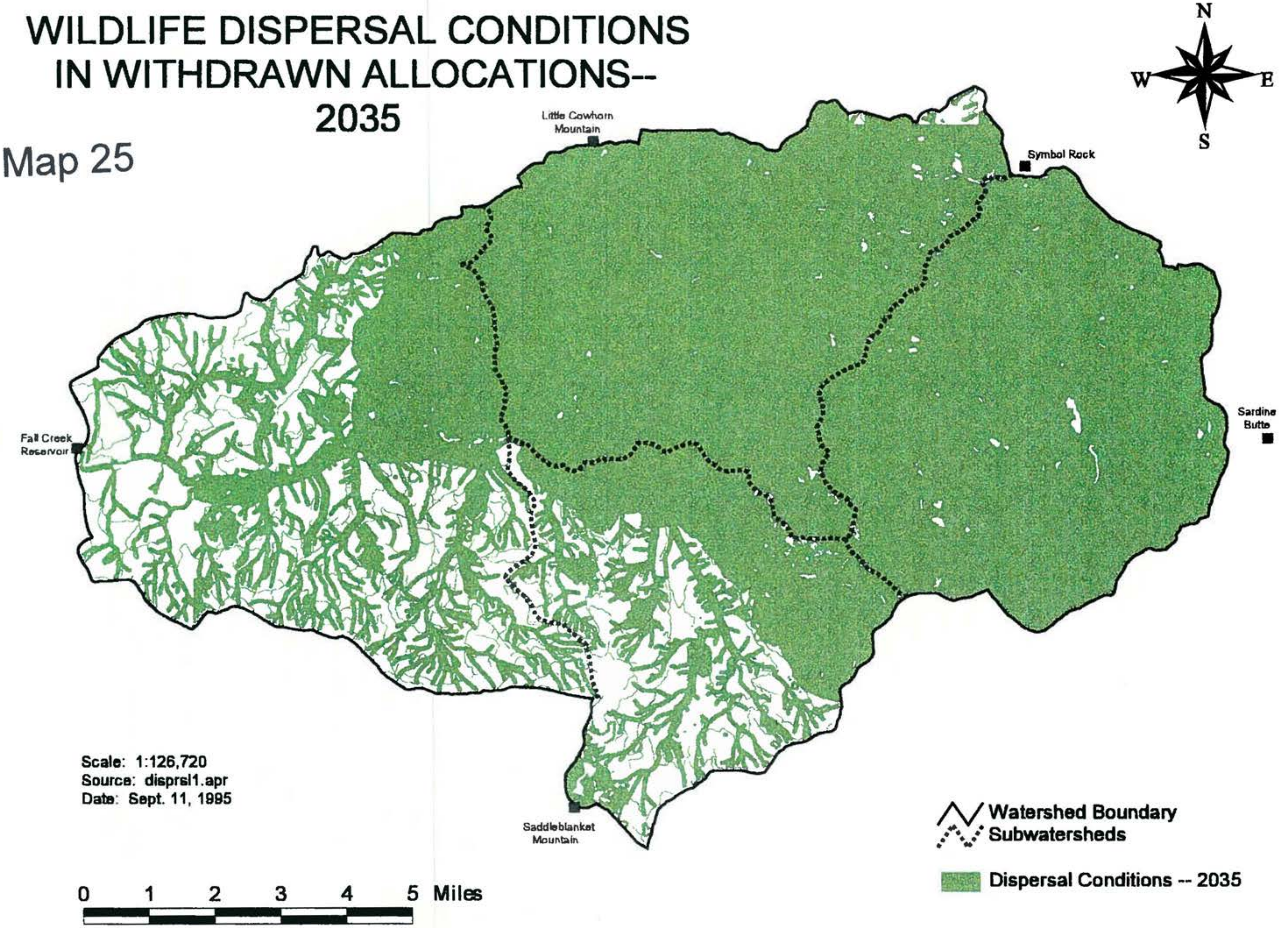
WILDLIFE DISPERSAL CONDITIONS IN WITHDRAWN ALLOCATIONS-- 2015

Map 24



WILDLIFE DISPERSAL CONDITIONS IN WITHDRAWN ALLOCATIONS-- 2035

Map 25



Marten/Pileated Woodpecker Areas

On Page C-3 of the Northwest Forest Plan for Amendments to the Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl, Item Two states: "Administratively withdrawn areas that are specified in current plans and draft plan preferred alternatives to benefit American marten, pileated woodpecker, and other late-successional species are returned to the matrix unless local knowledge indicates that other allocations and these standards and guidelines will not meet the objectives for these species."

Presently, there are four areas (757 acres) designated for martens within the matrix portion of the watershed and one area (417 acres) designated for the pileated woodpecker. Current habitat conditions, in conjunction with Northwest Forest Plan land allocations, depict it to be in a fairly good condition as far as meeting dispersal requirements. These are:

- 79% in a withdrawn allocation,
- 63.2% currently meeting 11-40 conditions, and
- 50% currently meeting late-successional forest conditions.

Over time, habitat conditions will improve and almost 80% will meet late-successional forest conditions. There is a concern that the riparian reserve default network, as specified in the Northwest Forest Plan, would not provide blocks of habitat as specified in the Willamette Land Resource Management Plan (LRMP) for the marten. In many cases, no-harvest lands are in the form of reserve strips resulting in high amounts of edge habitat and less interior habitat. Nevertheless, with the above conditions and set-aside lands, marten and pileated woodpecker needs should be met.

Snag And Coarse Woody Debris Levels

Snag and coarse woody debris levels vary substantially within the watershed.

Modeling was completed using a spreadsheet program developed by Matt Hunter (1990) designed to determine snag densities based on current snag levels in both managed and natural stands. This information was developed using local knowledge of stands in the watershed, past harvest history of managed stands, and recent wildlife tree retention requirements in harvested stands. The analysis was completed in each of the four subwatersheds of Fall Creek. This gives a general view of the current condition of snag levels. More site-specific project planning and analysis might reveal some minor differences in these figures due to more refined analysis.

Table 28 depicts these current snag levels (notice assumptions used to develop snag percent levels in natural stands). Current direction in the LRMP provides snags to support 40% potential populations of primary cavity excavators on managed lands. These snags should be at least 18 inches in diameter and 40 feet tall. Monitoring of snag levels should be completed at the subwatershed level.

Table 28. Current snag levels in the watershed.

	Lower Fall	Portland/Logo	Upper Fall/Delp	Hehe
% Level	33.6%	41.7%	48.9%	44.3%

Assumptions: Stands were assigned a current snag level based primarily on year of origin. Managed stands harvested between 1940 and 1986 were assigned a value of 0, between 1986 and 1991, a value of 20, and recent harvest units with better wildlife tree retention, a value of 40%. Older natural stands were assigned percent values between 10 and 90 based on year of origin.

Current Condition of LSR RO219

"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 designated to maintain a functional, interacting, late-successional and old-growth forest ecosystem" (Northwest Forest Plan, 1994).

A major portion (63%) of the watershed is allocated as a Late-Successional Reserve (RO219). [Refer to Table 21 for total amounts of suitable spotted owl habitat within the LSR (including the Blue River and Oakridge R.D. sections of the LSR)]. *Table B42* in *Appendix B* shows owl activity centers located within the LSR and their reproductive history. Currently 31 known owl activity centers exist within the LSR; 27 of which have been pair locations within the last five years. Nesting has been documented at 15 of these sites within the last 5 years. Total number of activity centers meets the goal that large LSRs contain 15-20 pairs.

Wildlife/Habitat Relationships

Approximately 250 vertebrate species (excluding fish) occur or may potentially occur. All forest-dependent species are associated with western hemlock plant associations, since the entire watershed consists of these plant communities.

A wildlife guilding process has been used to model current habitat conditions. This process, developed by Mellen, *et al.,* (1994), maps habitat conditions at a landscape scale for species guilds. These guilds are groups of vertebrate species (excluding fish) generally requiring similar habitat seral stages for all or portions of their life histories. Currently, an estimated 250 species use the watershed for a portion or all of the year. *Table 29* depicts habitat conditions for a number of these species guilds. Guilds are described by home range (H.R.), size, seral stage requirements (open, small tree, large tree), and whether the species use single habitat patches, aggregate-like patches (mosaic), contrasting habitat patches (edge species), or are generalists using all seral conditions in combination.

Table 29. Suitable Habitat Acres Available by Habitat Guild

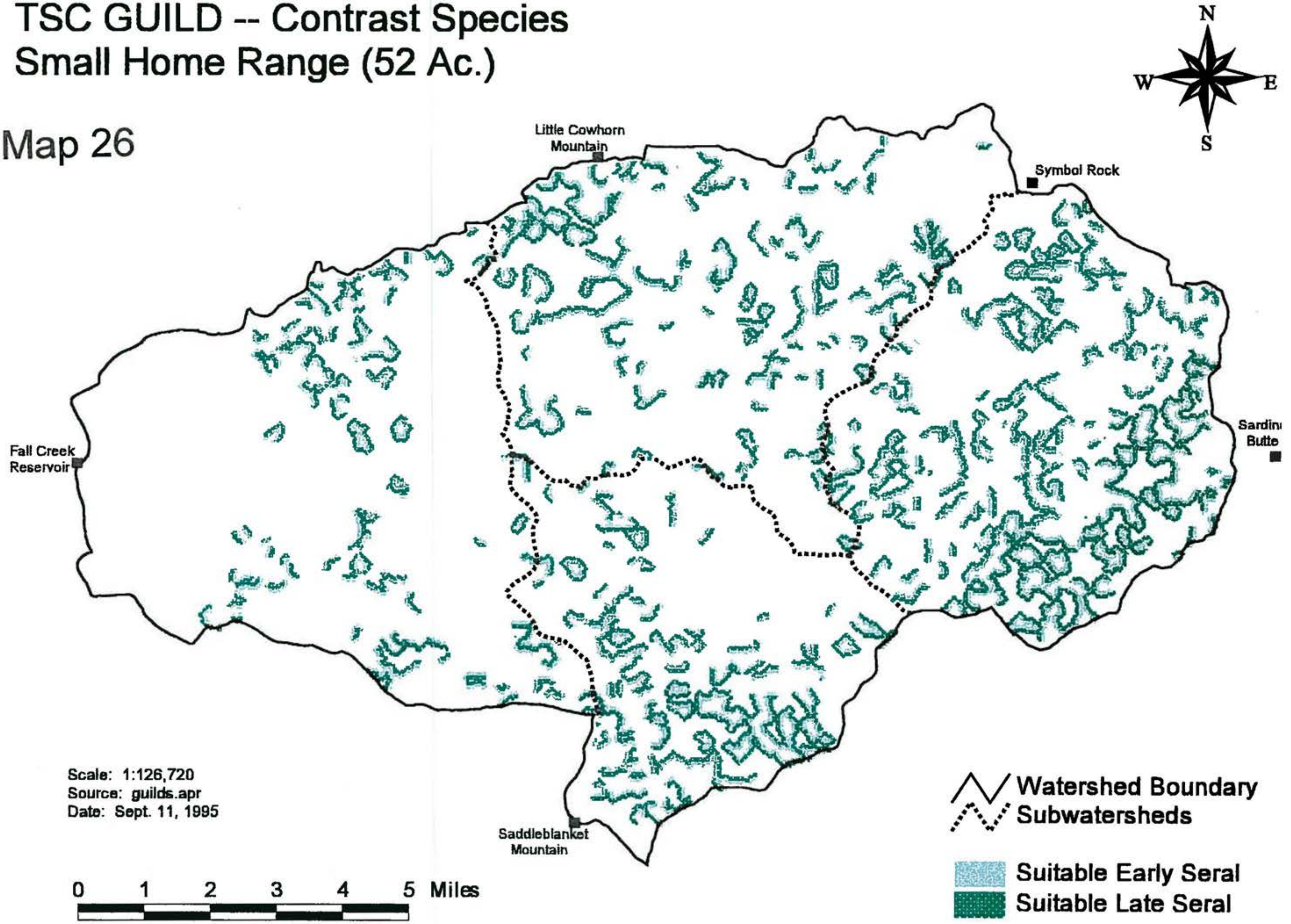
Guild	Sample Species Present	High	Med.	Low	Non-Suit.	Trends
I. Early seral species						
A. TSPE Small H.R. Open Patch Species	Wrentit Dusky Flycatcher Savannah Sparrow Western Bluebird Cal. Ground Squirrel	17283 (23%)	-- --	-- --	59422 (77%)	↓
B. TLME Large H.R. Open Mosaic Spp.	Red Fox Rough-legged Hawk	1563 (2%)	-- --	7389 (10%)	67753 (88%)	↓
C. TMME Medium H.R. Open Mosaic Spp.	Merlin	2706 (4%)	54 (≅0%)	10194 (13%)	63751 (83%)	↓
D. TSME Small H.R. Open Mosaic Spp.	Scrub Jay Mountain Quail American Goldfinch Calliope Hummingbird	17989 (23%)	85 (≅0%)	619 (1%)	58012 (76%)	↓
II. Late Seral Species						
A. TLML Large H.R. Large Tree Mosaic Spp.	Northern Goshawk Pileated Woodpecker Marten Fisher Northern Spotted Owl Barred Owl	13229 (17%)	125 (≅0%)	10291 (13%)	52060 (70%)	↑
B. TSPL Small H.R. Large Tree Patch Spp.	Red Tree Vole Brown Creeper Shrew-mole Trowbridges's Shrew	26531 (35%)	-- --	-- --	50174 (65%)	↑

Guild	Sample Species Present	Suitable	Non-Suitable	Trends
III. Contrast Species				
A. TLC Large H.R. Contrast Spp.	Red-tailed Hawk Great Horned Owl Elk Great Gay Owl	25428 (33%)	5127 (67%)	↓
B. TMC Medium H.R. Contrast Spp.	Big Brown Bat American Kestrel Little Brown Myotis	25350 (33%)	51355 (67%)	↓
C. TSC Small H.R, Contrast Spp.	Olive Sided Flycatcher Lewis' Woodpecker Cassins' Finch	14057 (18%)	62648 (82%)	↓

↓ = declining conditions ↑ = improving conditions

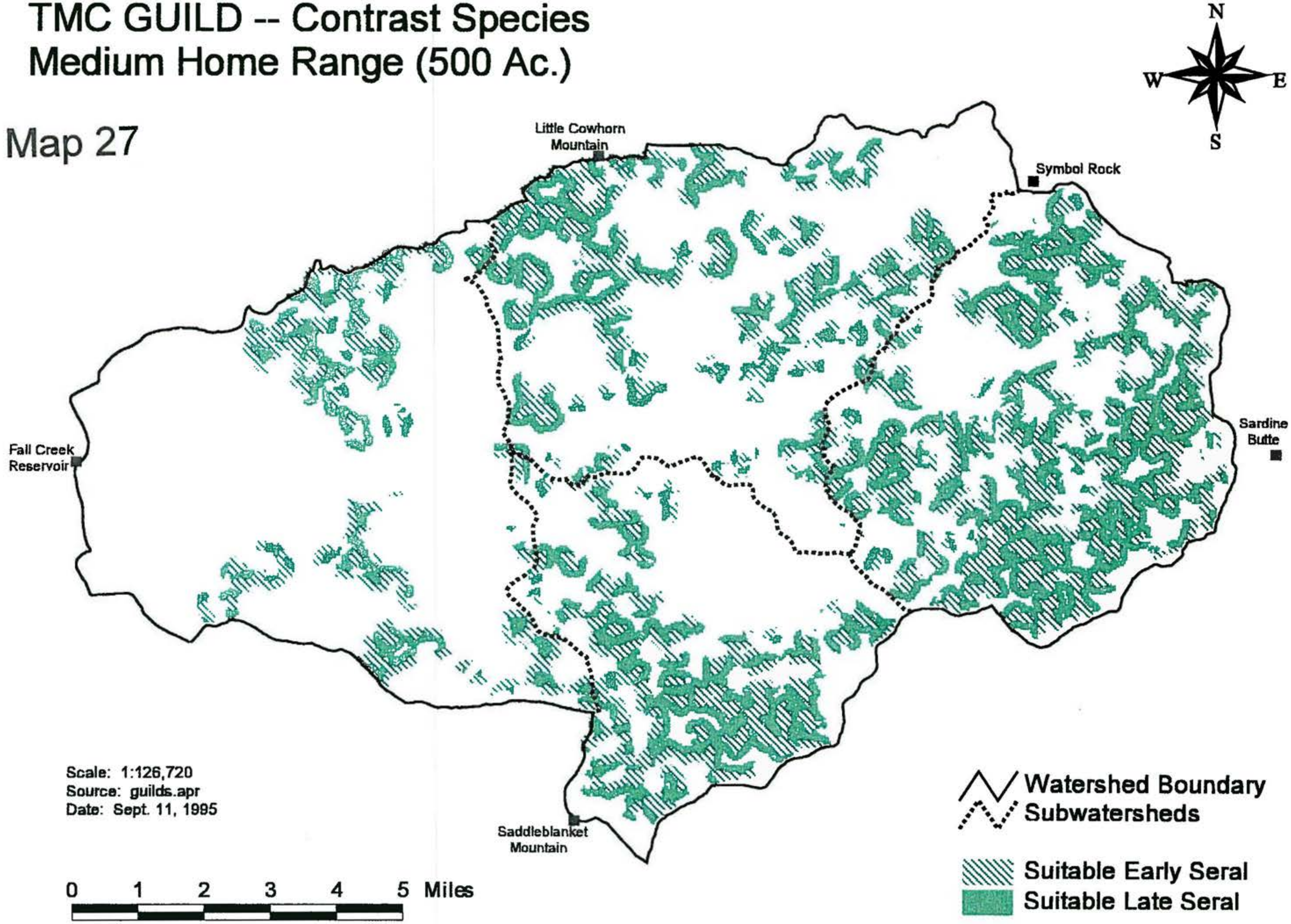
TSC GUILD -- Contrast Species
Small Home Range (52 Ac.)

Map 26



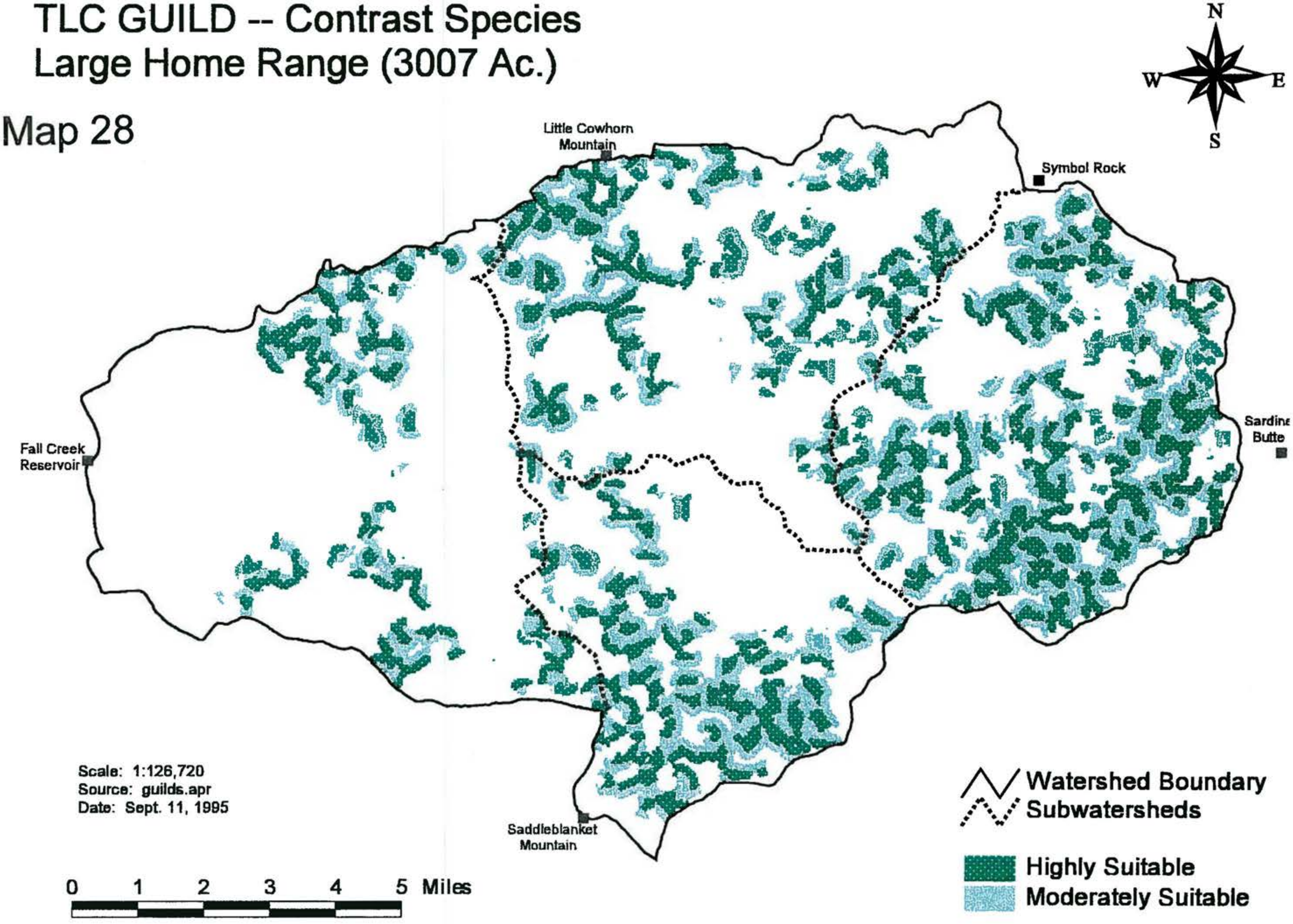
TMC GUILD -- Contrast Species
Medium Home Range (500 Ac.)

Map 27



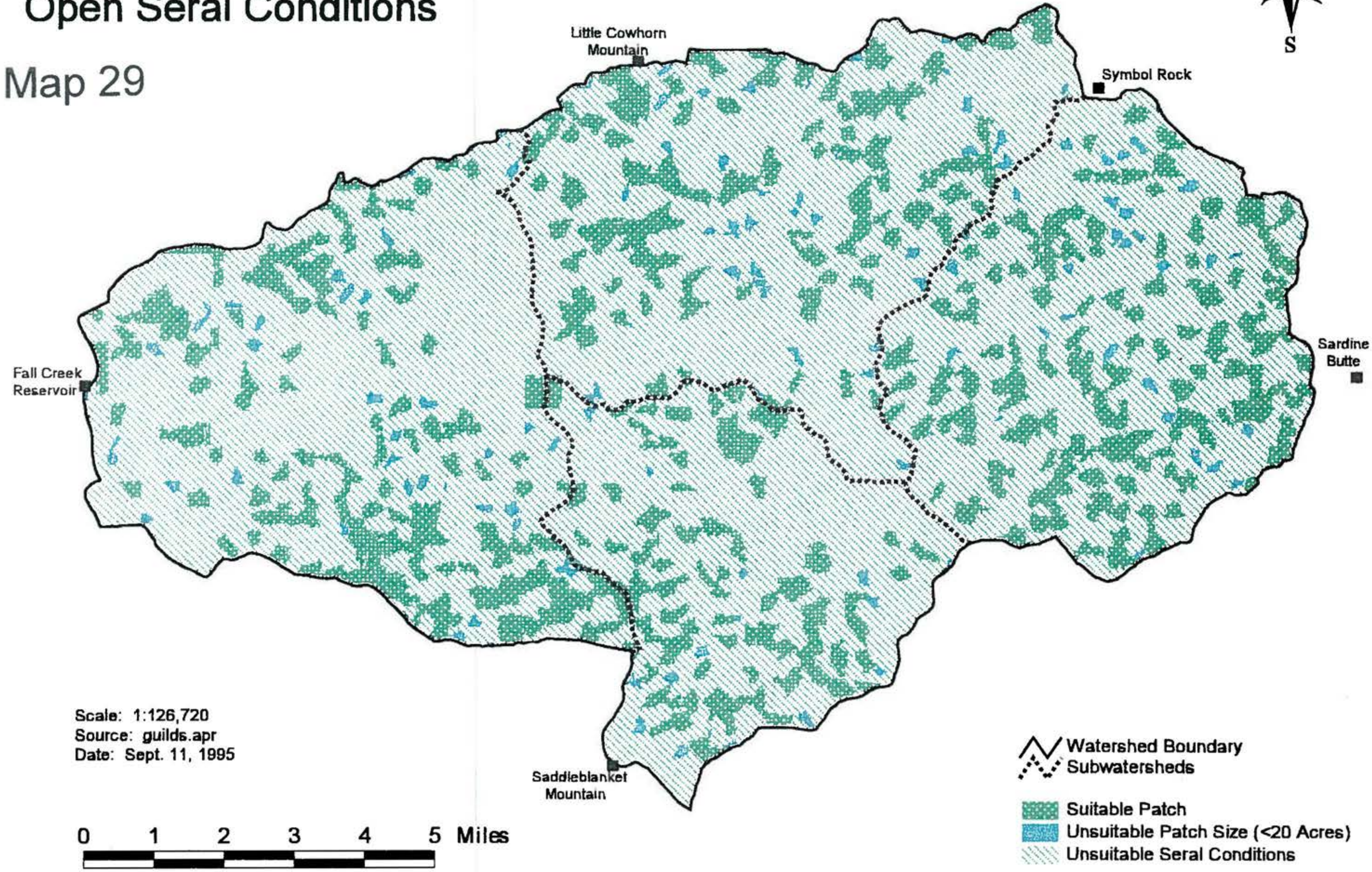
TLC GUILD -- Contrast Species
Large Home Range (3007 Ac.)

Map 28



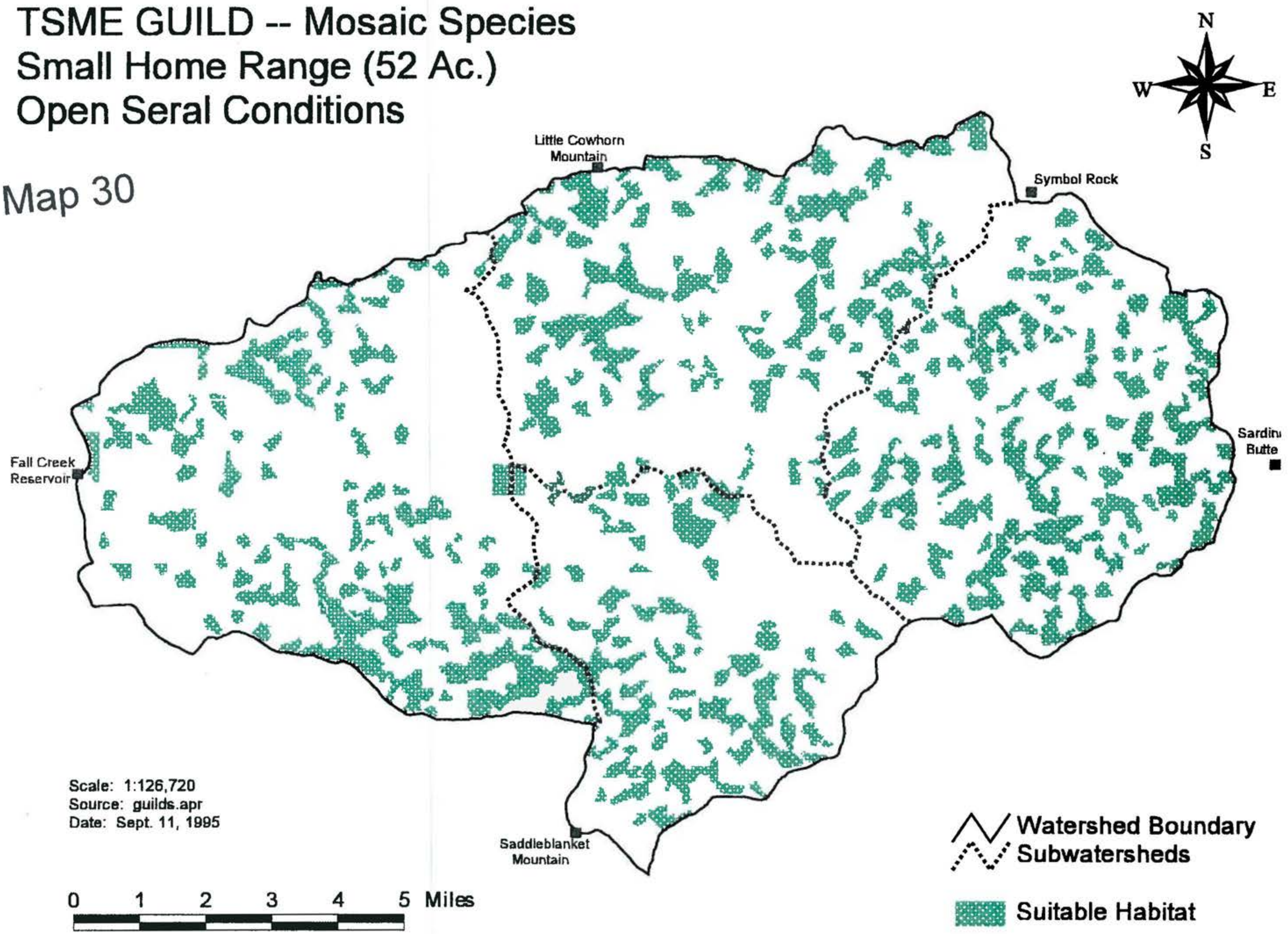
TSPE GUILD -- Patch Species
Small Home Range (52 Ac.)
Open Seral Conditions

Map 29



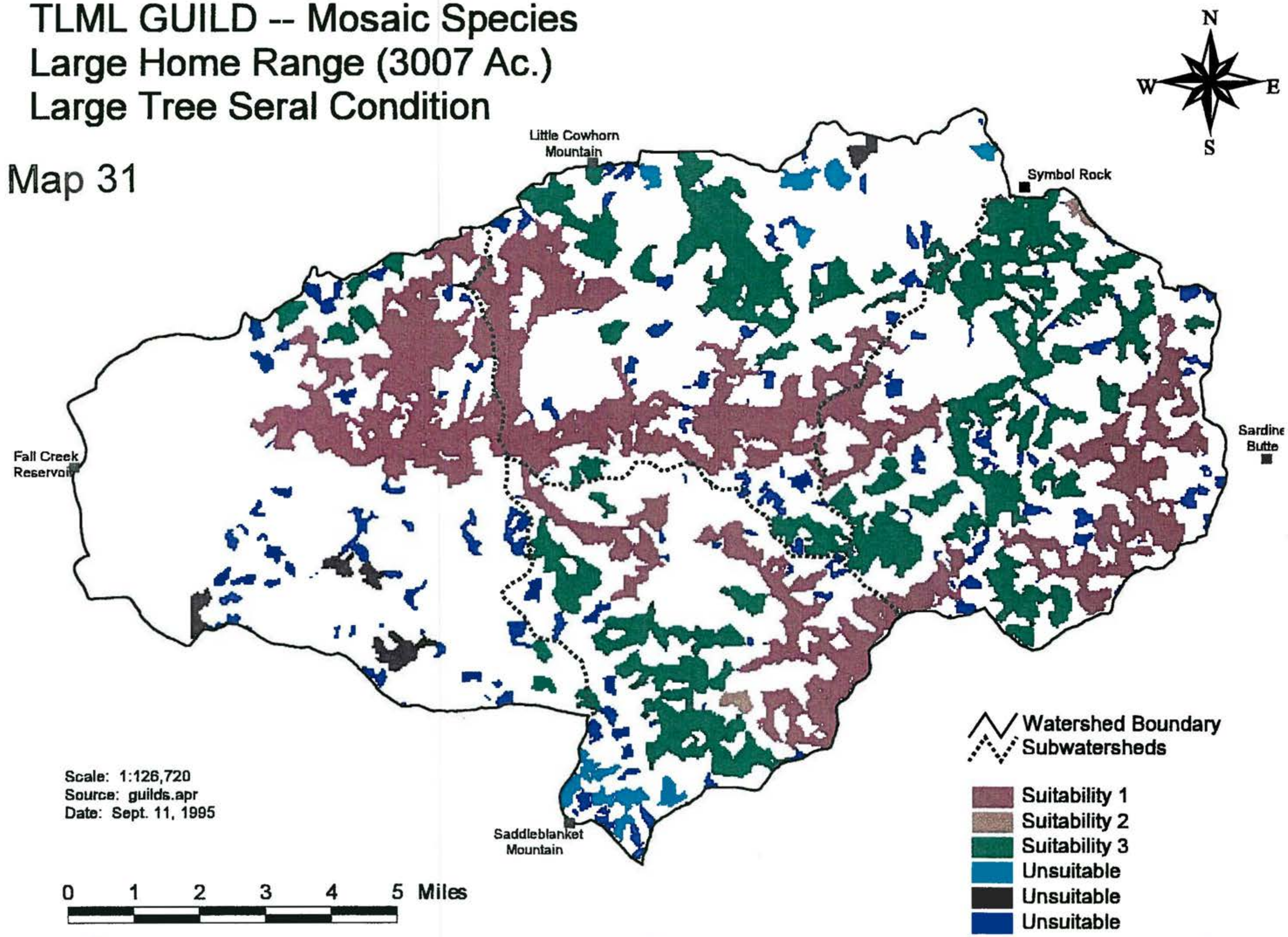
TSME GUILD -- Mosaic Species
Small Home Range (52 Ac.)
Open Seral Conditions

Map 30



TLML GUILD -- Mosaic Species
Large Home Range (3007 Ac.)
Large Tree Seral Condition

Map 31



For example, approximately 23% of the watershed currently contains suitable early seral conditions and minimum patch size of 20 acres to support species of the TSPE (terrestrial, small home range, patch, open seral conditions) guild. This figure could be skewed because many of these species are dependent on the standing and dead wood structural components lacking in many early seral, managed stands. Approximately 35% is considered suitable habitat for the TSPL species guild, which requires large tree structure and a minimum home range of 52 acres. Refer to Maps 26 through 31 for spatial distribution of suitable habitat for specific habitat guilds.

Assumptions/Concerns from this analysis:

1. These results are generalizations for species combined into guilds. Species in these guilds might have differences in certain specific habitat requirements or home range sizes.

2. The model assesses the watershed condition in providing habitat for certain species guilds. It also addresses the condition and its contribution in providing habitat for a certain species, but it does not address species viability.

3. One of the assumptions of the model is that habitat outside the analysis boundary mirrors habitat patterns inside the boundary. The option to buffer lands outside the area is available, but was not used for this analysis. Since the watershed borders private harvested lands, the results are biased, based on the mirror assumption. This would create bias in both directions, where less suitable early seral habitat appears than actually exists and less large tree habitat exists than is represented. Again, although more early seral habitat might be present than the model shows, it lacks adequate levels of snags and coarse woody debris.

For generalist species, all polygons were considered habitat; therefore the results for these species were not included in *Table 29*. One of the main concerns is the lack of certain structural components based on past harvest and associated activities. This includes reduced levels of snags and coarse woody debris due to harvest and salvage operations.

Botany

Sensitive and Rare Plants

Reference Condition

Human use in the watershed was concentrated in the lowland riparian Fall Creek corridor and along the ridgeline trail systems used by seasonally nomadic tribes. All three of the sensitive plants found in the Fall Creek watershed may have been encountered by Native Americans or early settlers, but there are no accounts of their use as either medicinal or food plants or as grazing forage.

Current Condition

No plant species listed as Threatened or Endangered by the USFWS occur on the Willamette N.F., but two candidates for the Endangered Species Act List 2 occur in Fall Creek Watershed.

The Willamette National Forest has a list of sensitive plant species designated by the Regional Forester. The Region's Sensitive Species Program is designed to manage rare species and their habitats to prevent a need for federal listing at a future date. Sensitive species are vulnerable due to low population levels or significant threats to habitat (USFS, R-6 FSM). *Table 30* lists sensitive plants by subwatershed.

Table 30. Sensitive Plants of the Fall Creek Watershed

Species	Subwatershed	Populations	Impacts
Romanzoffia thompsonii	Hehe Creek	1	None
Romanzoffia thompsonii	Portland Creek	2	Adjacent Trail
Cimicifuga elata	Lower Fall Cr.	1	Adjacent Trail
		1	Adjacent Road
	Upper Fall Creek	1	Historic, unrelocated
Frasera umpquaensis	Upper Fall Creek	1	Adjacent Road and Adjacent Clearcut

Three populations of *Romanzoffia thompsonii* are located within Fall Creek Watershed. This species is an annual mistmaiden, residing in rock garden and rock outcrop habitats. Sites always have an abundance of water in the springtime; Thompson's mistmaiden is only found associated with seeps, blooming while they still run (April through June, depending on the elevation). Soil development is minimal and is usually composed of gravel or scree with soil in small pockets in the rocky crevices. The substrate on which the plant survives is often a moss mat, most commonly *Bryum miniatum*, with monkeyflowers, plectritis, and blue-eyed marys in a plant association called a rock garden.

One population of *Romanzoffia* is located in the Hehe Creek subwatershed and two are found in the Portland Creek subwatershed. The Hehe Creek population is in Forest Plan Allocation 10e (Dispersed Recreation-Semiprimitive Non-motorized) and the other two are in General Forest. The Hehe Creek population is in Late-Successional Reserve; the others in Matrix.

This species is greatly dependent on the hydrologic regime; populations would be devastated if these habitats were to undergo a loss of or change in the water flow pattern. The two populations in the Portland Creek drainage are accessible by the Gold Point Trail, but not immediately adjacent to it. One population occurs on a natural viewpoint below the trail. This population was visited in both 1994 and 1995; impacts by recreationists seems minimal.

Tall bugbane, *Cimicifuga elata*, is a regional northwest endemic which is a candidate for listing by the State of Oregon and the USFWS. An interagency challenge cost-share project was initiated in 1992 to determine this plant's habitat preferences and responses to management. In the western Cascade mountains, this species grows in mixed Douglas fir/western hemlock/bigleaf maple forest. At all sites, common swordfern is a dominant in the understory. Sites are usually steep and somewhat rocky and always mesic throughout the summer. Plants grow in all stand ages, although most reported populations are in mid to late seral stands. Plants growing under an open canopy have much higher rates of reproduction (Kaye and Kirkland, 1994). Response to management has been mixed. Survival is not high in clearcut units on the Willamette NF but populations in thinned units and adjacent to clearcuts seem to survive, if not directly impacted.

Three populations of this plant reside in the watershed; two in the Lower Fall Creek and one in the Hehe Creek subwatershed. Both of the Lower Fall Creek populations are in Matrix allocations, although one is found within the Fall Creek Special Interest Area (SIA) designated in the Willamette Forest Plan. One population is found along a trail and the other along a road. The latter is an historic, unrelocated site from an early 1900's herbarium collection. This Hehe Creek population is also found within the Fall Creek SIA.

One of the Lower Fall Creek populations has been monitored for the past four years. The population (WILFALL) is found in a riparian old-growth setting. Individuals are stable in number (individuals have been tagged and are being followed through their life cycles) but reproductive levels and population size are very low. No recruitment has been observed. The slope on which the population is located is steep and unstable. Neither of the other populations have been relocated during the 1994 or 1995 field seasons.

The third sensitive plant in this watershed is Umpqua swertia, *Frasera umpquaensis*. This plant is considered a Candidate List 2 by USFWS. Swertia is a tall member of the gentian family associated with high elevation mesic meadows. Common associates are coneflower, bracken fern, cow parsnip, and false hellebore. Like most *Frasera* populations on the Willamette N.F., it is found in meadow edges adjacent to timber, thereby gaining a measure of canopy coverage.

The only population, found in the Delp Creek Subwatershed, is in both General Forest and Matrix land allocations. The population is located throughout a meadow which has been dissected by a road. Timber adjacent to part of the population was harvested in 1963.

An interagency Conservation Strategy for this plant (Cripps, 1993) designated this population as one of three for monitoring on the Forest to determine population stability. Individual plants have been followed for three years. Reproduction at this site is low compared to others on the Forest. No recruitment of seedlings has been documented. Unlike other populations, bracken fern and bigleaf huckleberry seem to dominate the site during the middle and latter part of the growing season. These species overtop the *Frasera* and could cause shading and/or competition for scarce water resources late in the season.

The Willamette NF also tracks rare and unique species which have the potential of being listed as Sensitive. These species may be associated with disappearing habitats or they may be common elsewhere and at the edges of their range on the Willamette. They make a major contribution to the overall biodiversity on the Forest. The Willamette Forest Plan directs the Botany Program to create a Forest Watch List for such species (USDA, 1990) *(See Table 31).*

Table 31. Rare and Unique Plants from Fall Creek Watershed

Populations Species	Sitename	Status List	Total on Willamette
Botrychium virginianum	Lower Fall Cr.	C[1]	6
Scoliopus hallii	All subwatersheds	C[1]	9
Sidalcea cusickii	Upper Fall Cr.	W[2]	15

- [1] Concern List, Willamette NF. Directed by the Willamette Forest Plan Monitoring. Its purpose is to avoid the need to list species by tracking them prior to their loss.
- [2] Watch List, Oregon Natural Heritage Program, taxa of concern, but not currently threatened or endangered

A number of these species are found in the Fall Creek Watershed. Two species prefer forested habitats: Virginia grapefern in moist woods and fetid adder's tongue adjacent to streams. The other species, Cusick's checkermallow, prefers mesic meadow habitats (Hitchcock and Cronquist, 1973).

Survey and Manage Species

Reference Condition

Most of the species designated as survey and manage are associated with old-growth and riparian habitat. An assumption is made that the number of populations of a given species located in the Fall Creek Watershed was higher historically due to recent fragmentation of old-growth habitat by managed stands. This has resulted in a loss of interior habitat necessary for the maintenance of some of these species *(compare Map 15, Reference Seral Conditions to Map 18, Current Interior Habitat of Late-Successional Forest).* It also created changes in microclimate and composition of riparian habitat due to removal of timber in managed stands adjacent to streams.

Current Condition

The Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl (USDA, 1994b) contains a list of species, called survey and manage species, that must be considered when planning projects. A large list of old-growthdependent species was created and effects of alternatives on each species were analyzed by experts during the EIS process (results appear in Table C3 in the Northwest Forest Plan).

Botanical survey and manage elements include lichens, bryophytes (mosses and liverworts), fungi, and vascular plants. No forestwide or regionwide surveys of these species have been initiated; information is incomplete. The biological importance of these species is just being discovered. Fungi provide food for flying squirrels, the prey base of spotted owls, as well as voles, squirrels, mice, and other small mammals (Maser, *et al.,* 1978). Lichens provide a food source for deer and elk during winter when grass and shrubs are unpalatable or buried by snow (Thomas and Toweill, 1982). They are also used by flying squirrels, red-backed voles and woodrats (Maser, *et al.,* 1985). Lichens, which contain cyanobacteria as their "algal" symbiont, make nitrogen available in forests where it is a limiting nutrient (USDA et al., 1993). Bryophytes are important reservoirs of water and nutrients (USDA et al., 1993) and account for approximately 20% of the total biomass and 95% of the photosynthetic biomass in the forest understory (Binkley and Graham, 1981). Bryophytes are important food sources for invertebrates and are used as nesting materials for mammals (USDA et al., 1993).

Lichens are organisms composed of both a fungus and an alga or a cyanobacterium. A number of nitrogen-fixing lichens are found throughout the Forest and are old-growth dependent (Pike, *et al.,* 1975; Lesica, *et al.,* 1991). Although exact locations are not known, they have been recorded and collected by Dr. David Wagner, bryologist and former curator of the University of Oregon Herbarium, on field trips along Fall Creek Trail. Examples are *Lobaria oregana*, *Lobaria pulmonaria*, *Peltigera* spp. and *Pseudocyphellaria* spp. Other botanists have documented *Usnea longissima* along the Fall Creek Trail. These species are epiphytes, so they require retention of aggregates of standing trees to maintain a suitable microclimate and to provide for dispersal (USDA, 1994a). Their dispersal capability is extremely limited (USDA, 1993). Dr. Wagner also identified *Antitrichia curtipendula*, a moss on the C3 List.

No known survey and manage fungi occur in the watershed and only one vascular plant has been documented from an ecology plot. *Allotropa virgata*, the candystick, is a mycotrophic species, a plant with no chlorophyll, which requires an association with another plant for food. The plant grows in the Douglas-fir series, and may be associated with hemlock, fir and lodgepole pine elsewhere. This species is not restricted to old-growth, but the largest populations occur there. It does not tolerate competition and is never abundant. The plant prefers dry, well-drained soils and abundant coarse woody debris (UDSA, 1994a).

Special Habitats

Reference Condition

Based on seral stage conditions in 1900, it is fair to assume that special habitats occurred in at least the same, but probably greater amounts than exist today. Dry meadow complexes, mesic meadows, rock cliffs, outcrops, and talus slopes all appear in varying amounts. With the onset of management activities, some of these habitats have been impacted. Reoccurring fire maintained dry open meadows and prevented conifer encroachment. The hydrologic regime was probably such that ponds, sumps, wet and mesic meadows developed over time and remained as sources of unique native vegetation and habitats for some special habitat species obligates. The Fall Creek drainage, a major east/west riparian corridor, could have been instrumental in facilitating movement and migration of riparian-dependent species between the Willamette River lowlands and the North Fork of the Middle Fork Willamette and South Fork McKenzie River systems.

Stands in the 1900's were more structurally complex than today. Without human-caused influence in the watershed, natural disturbance was the controlling force of stand structure and diversity. North slope and riparian areas, where intense fire disturbance was not as common as on south slopes, theoretically had higher levels of dead and downed wood than those stands with recurring fire and disturbance patterns. Less intense, yet more commonly reoccurring fires in uplands and south slopes might have maintained coarse wood at lower than current levels, especially with the onset of fire suppression in the early 1900s.

Special habitats were used by Native Americans for food resources (ex., Camas bulbs from mesic meadows and wild onion from dry rock gardens). Selective harvest allowed a continual supply. Using fire as a hunting tool, the Native Americans in the western Cascades manipulated special habitats. As these areas burned along with forested areas, drier habitats burned more intensely then wetter ones. Fires may have been started purposely in meadows to lure deer and elk in to forage.

Current Condition

Special habitats contribute to the overall biodiversity across the landscape and are important for plants and wildlife. For the most part, these areas are non-forested including meadows, rock outcrops, ponds and talus slopes. Some special habitats (ex., swamps and mineral deposits) are forested.

The Willamette NF has recognized the significance of these sites (comprising approximately three percent of the Fall Creek Watershed) in its standard and guideline FW-211 (USDA, 1990). This S&G states that these sites will be maintained or enhanced (repaired) and areas surrounding the sites will be deleted from their management allocation and treated as non-mapped special wildlife habitats (Management area 9D) or riparian reserves.

Special habitats were mapped and given general habitat types using aerial photo interpretation. The most prevalent special habitat in Fall Creek is by far the rock garden. Many of the smaller gardens are randomly distributed throughout the watershed; two major complexes (Hehe Creek and Gold Point) account for over half of the habitats. Mesic meadows, Sitka alder and rock outcrops are also fairly common. Dry and wet meadows are somewhat less common. Mesic and wet meadows and alder are concentrated around the Saddleblanket Mountain area. Hardwoods occur along the Fall Creek riparian corridor.

Table 32 depicts location and acreage of special habitats currently existing. Maintaining or "reclaiming" special habitats is crucial to maintaining biodiversity across the landscape in the Pacific Northwest. Various wildlife species have evolved over time to be either partially or totally dependent on these habitat types for a portion or all of their life histories. Some land slugs are suspected to be dependent on rock slides or talus slopes for a major portion of their life histories. Perennial or intermittent ponds are crucial to the reproduction and larval development of many frogs and salamanders. These ponds also provide a source of insect forage for many species of bats and passerine birds. Dry meadow complexes are important foraging areas for kestrels and great gray owls because they support small mammal prey species such as gophers and voles. Snags and coarse woody debris are important for a long list of wildlife species. They serve as homes for many primary and secondary cavity-nesting birds.

Table 32. Special Habitats of Fall Creek Watershed

Habitat Type	Acreage	Number in Watershed
Rock Garden	1133	253
Mesic Meadow	343	34
Sitka Alder	265	19
Rock Outcrop	219	22
Dry Meadow	148	27
Wet Meadow	147	21
Hardwoods	71	24
Shrub Talus	34	2
Pond	6	1

Insects and fungi are decomposers of dead wood which eventually contributes to long-term site productivity. Marten use dead and downed wood for foraging, denning and resting.

It is evident that past management activities have affected special habitats. Until the early 1900s, fire played an active role in maintaining the rock garden meadow complexes, such as the one west of Gold Point in the Logan Creek drainage. Although the geology of the area indicates shallow soils and low potential for establishment of conifers in these areas, it is possible that since the advent of fire suppression, these meadows have started to experience ingrowth and encroachment of conifers, thus affecting habitat availability for certain wildlife species.

Past pond surveys indicate impacts due to harvest activity. One perennial pond in the Ninemile Creek drainage, surveyed in 1994 for amphibian occurrence, was found to contain a substantial number of red-legged frog egg masses. A timber sale unit has recently been harvested within 50 feet of the pond, thus opening the canopy and inducing windthrow into the pond, thereby potentially altering its habitat structure. A recent survey of the pond revealed that it has almost dried up, a first-time observation for this pond, regardless of the season. Altered hydrologic regimes in the area along with increased evaporation, may be affecting the pond's ability to function as it has historically.

The only cliff in the watershed identified as having moderate nesting potential for peregrine falcons, is adjacent to a main road. Travel along this road during critical nesting periods could deter the falcon from using this potential nest site.

Functions of each type of special habitat delineated previously, and the wildlife species which use them, are outlined in the Special Habitat Management Guide (Dimling and McCain, 1992).

Roads and managed stands have affected all types of special habitat. Two to eight percent of the habitat types in the watershed are adjacent to or contain roads and 10-56% of habitats are found within managed stands *(See Table 33)*.

Table 33. Acres of Roads and Managed Stands Intersecting Special Habitats

	Acreage Affected	
Habitat Type	**Roads**	**Managed Stands**
Rock Garden	29.1 *(3%)*	285.0 *(25%)*
Mesic Meadow	10.7 *(3%)*	183.5 *(53%)*
Sitka Alder	5.0 *(2%)*	46.8 *(18%)*
Rock Outcrop	11.4 *(5%)*	90.4 *(41%)*
Dry Meadow	9.1 *(6%)*	41.5 *(28%)*
Wet Meadow	11.1 *(8%)*	82.0 *(56%)*
Hardwoods	1.5 *(2%)*	7.4 *(10%)*
Shrub Talus	0.4 *(1%)*	11.5 *(34%)*
Pond	0.5 *(8%)*	1.1 *(18%)*

The 1990 Willamette NF LRMP directs the Forest to "maintain or enhance" special habitats. The management guide outlines a methodology for analysis of the environmental factors necessary for maintenance of each habitat and aids in formulating site-specific prescriptions for these areas (Dimling and McCain, 1992).

Noxious Weeds

Historic Conditions

Noxious weeds have increased in abundance since the turn of the century. Established weed species have been present in the watershed for years. Scotch broom was introduced as an ornamental shrub and an erosion control agent in the 1920s (Miller, 1995). St. John's-wort has been a medicinal herb for many years; it was probably a garden escapee. Thistles traveled west as contaminants in alfalfa and other crop seedbags and came into Portland in the ballast of sea-faring vessels (Forcella and Harvey, 1988). Most of these species would have been considered newly invading species in the 1930s. Knapweed, toadflax and giant knotweed were probably not found anywhere on the forest.

Current Conditions

The Willamette NF initiated an Integrated Weed Management Program in 1993. The Forest Plan S&G directs that sites be identified and analyzed for the most effective control methods based on site-specific analysis of weed populations (USDA, 1993a).

The highest priority species for treatment are new invaders: those weeds in early stages of invasion which have not naturalized to the point of resource damage. No new invaders are found in the Fall Creek watershed. Other weeds found on the Forest are termed "established infestations." These weeds have spread to the point where eradication is impossible and resource damage is unacceptable. Established weeds include Canada thistle, bull thistle, tansy ragwort, Scotch broom, and common St. John's-wort.

The most common established weed is Scotch broom, which may be found in any disturbed site but is most commonly associated with clearcut logging units, landings and logging roads. Scotch broom competes with young conifers in plantations. This species is found throughout; no area has escaped. Other weed species associated with plantations include Canada thistle, bull thistle and tansy. All are generally outcompeted, due to lack of sunlight, in moderately young (40 year) forest plantations. St. John's-wort can be found in these sites, but is also common in meadow habitats which often harbor natural soil disturbers such as groundhogs and mountain beavers. St. John's-wort, once established, has the ability to outcompete native species, causing a severe reduction in the biological diversity of the site.

Due to the sheer amount of acreage these infestations cover, treatment methods are limited primarily to biological control. This type of control involves the use of insects which naturally feed on the plant or its seeds, eventually causing an equilibrium in population numbers. A section of the Federal Department of Agriculture, APHIS, is responsible for the testing and release of biological control agents. Testing must be conducted because insects are imported from the weed's place of origin (usually Europe or Asia) and effects on native flora must be examined.

Records of biological control releases indicate that insects have been released in Fall Creek since 1993 *(See Table 34)*. Seed weevils and flea beetles have been released for Scotch broom and tansy respectively.

Table 34. Biological Control Releases on Lower Middle Fork

Noxious Weed Populations

Target Weed	Insect	Year	Location
Scotch broom	*Apion fuscirostre*	1993	18S 2E Sec 16
		1993	18S 2E Sec 21
		1993	18S 2E Sec 29
		1993	18S 3E Sec 20
Tansy	*Longitarsus jacobaea*	1994	19S 3E Sec 2
	(root-eating flea beetle)	1994	19S 3E Sec 11

Special Forest Products

Historic Condition

As previously mentioned, Native Americans spent summers foraging in the Fall Creek area. Use was limited to what they could eat or carry; presumably no one area was over-exploited.

Current Condition

There has been an increasing realization by the Forest Service that timber, firewood and Christmas trees are not the only products the forest may provide to help sustain local communities. In response to this, forest specialists wrote an Environmental Assessment and amendment to the Forest Plan which outlined standards and guidelines for collection levels, and established in which management allocations collection could occur (USDA, 1993b).

Moss harvest is of the greatest concern in the Fall Creek Watershed. Since Fall Creek is close to the Eugene/Springfield metropolitan area and because the riparian area is so extensive, a great deal of unregulated harvest has occurred. Although permits are legally required for harvest, only thirty-seven permits were issued in 1993 and two in 1994 (S. Weber, personal communication).

According to forestwideS&Gs, one may take 30% of the plants in a given area for commercial harvest. However, collection is not allowed in riparian reserves, special interest areas, special wildlife habitats, or Late-Successional Reserves. These allocations comprise the majority of harvestable sites in the watershed. District-specific guidelines state that harvesters must stay 200 feet or more away from Little Fall Creek, Fall Creek and Hehe Creek and no harvest is allowed in Portland Creek. Price for moss is $0.33 per bushel, with a $10 minimum per permit.

Poaching has not been identified in any areas, but no monitoring of this resource occurs due to lack of funding. Preliminary work from PNW indicates that it may take 15-30 years to grow a moss pelt in the Coast Range, where growing conditions are optimal year-round (Dr. Nan Vance, personal communication).

SOCIAL DOMAIN

REFERENCE CONDITIONS

Native Americans

Historic and archaeological research suggests that people adapted to changing conditions and influenced the development of their environment. At the time of European exploration, at least two tribes are thought to have used the Fall Creek watershed. Kalapuya reportedly had winter villages in the nearby Pleasant Hill area and the Molala and possibly the Klamath seasonally visited the area for hunting and plant collecting.

Over 30 archaeological sites representing seasonal base camps and more temporary campsites have been found in the Fall Creek Watershed to date. The majority of these sites are located in lower elevation terraces or along ridge systems which served as travel routes. Several sites near local outcroppings of jasper appear to have been quarried for toolstone. Early descriptions of the area vegetation and tribal oral history suggest that fire was used as a tool to maintain an open landscape. Early pioneers claim that the forest floor was so open that people could easily ride or drive stock throughout the valley (Briem, 1937). Both prairie fires and underburning were techniques used in the Willamette Valley to hunt game and ensure the return of berries, roots, and other important plants (Boyd, 1988).

Despite the impact of epidemic diseases and the movement of survivors onto reservations, native people continued to visit the area. Charlie Tufti and Indian Charlie from the Warm Springs Reservation reportedly hunted in the Fall Creek valley (Briem, 1937). In the 1890's and 1900's, Native Americans from the Warm Springs Reservation were employed in the Lowell area hop yards.

The Homestead Era

After the earliest homesteaders settled most of the open prairie in the Lowell and Dexter areas in the 1840s, a few settlers claimed the remaining smaller forest openings. In 1889, William Winkle settled where Fall Creek Guard Station would be built in 1915. Mr. Eli Davis settled directly above his claim, and when Mr. Winkle died in 1891, Mr. Davis absorbed his claim. In 1896, he accepted script for the claims and left the valley. Austin Clark staked his claim in 1891 in an open prairie where the Clark Creek Organization Camp was later built. Mr. Allison W. Jones arrived in 1890 and remained until 1895 when he sold out to P. S. Hills of Jasper. This claim was logged in 1936-37 by log truck and the area planted with grass for stock grazing (currently the inholding of Cedric Hayden). Beginning in 1912, the Forest Service permitted grazing allotments for cattle and sheep in the Fall Creek Watershed. Nearby allotments included Winberry, Saddleblanket/Sourgrass Mountains and Tire Mountain.

Recreation

American 19th century ideology stressed the work ethic and leisure activities were discouraged. This was a deeply imbedded part of social values and beliefs (Dulles, 1965). The "frontier" was considered a barbarous place where idleness more often than not produced drunkards (Crevecoeur). It is no surprise that recreational use was not common in the national forests before the turn of the century.

The forest was still viewed as being a bit wild: a place to be conquered and subdued. Some of the earliest recreational pursuits of "conquering" mountain peaks, and hunting for wild "trophy" animals (for wall mounting rather than food) echoed these thoughts.

Most of the campgrounds along Fall Creek were built in the 1930's by the Civilian Conservation Corps (CCC). Campground use was generally low and concentrated during the summer months. Fall Creek Road 18 was paved in the late 1960s providing better access for passenger vehicles. The last campground constructed, in 1965, was Broken Bowl. During this time recreational use was high and most people used campgrounds rather than dispersed sites. Estimates of over 5,000 people in the drainage during hot summer weekends were common. A checkpoint at the lower end of the drainage was set up during high fire danger to inform people about fire restrictions. "Checkpoint Charlie," as it was known, stopped up to 900 cars a day (Bill Pratt, personal communication).

Economic Activity

European settlers depended on bountiful natural resources for a living. Early timber sales in Fall Creek were small, and used log drives in river beds to remove logs (Rakestraw, 1993). Rangers prepared smaller sales at Lowell for local industry, small saw mills and settlers (Rakestraw, 1993). Products other than timber included cascara bark, cedar trees, berries, and minerals.

As roads were built improving access, timber harvest activities began to dominate the uplands. This provided Lane County residents with a steady source of jobs and unique job-related lifestyles that inspired pride and a sense of identity.

CURRENT CONDITIONS

Unique Areas in the Watershed

In order to maintain old-growth characteristics in the areas with heaviest recreational use, the Forest Plan designated a Special Interest Area, SIA (5a) from T19S, R2E, Section 31 up Fall Creek to T19S, R4E, Section 19. Surrounding that area is the Fall Creek viewshed (11a).

The three designated old growth groves in the watershed lay either in the SIA or the viewshed. The Bedrock-Slick Creek Semi-Primitive, Non-Motorized area occupies the largest unroaded portion of the watershed.

The small portion of BLM land (T18S, R1E, SE corner of Section 25) has no current recreation facilities. A day-use area is mentioned in their long-range plan, depending on available funding. Portions visible from Fall Creek Reservoir are identified in their long-range plan as "scenic".

Summer Recreation

All six developed and twenty known dispersed sites, with the exception of Cowhorn Lookout, are within riparian reserves. On hot weekends, over 2,000 people can be found in the drainage. Many do not camp, but return home at night. No official use counts are gathered outside developed campgrounds which collect fees, so only estimates are available for dispersed use. Past use counts are not kept at the District. The Forest Plan holds the Persons At One Time (PAOT) capacity of developed sites to 412 (the combined total PAOTs of existing developed sites). No sites which would increase the official PAOTs may be constructed, so when developed sites can't hold all who desire to camp, displaced people move into existing dispersed sites enlarging them or creating new sites. As the population of Eugene and neighboring towns continues to grow, recreation in Fall Creek is expected to increase.

The five developed campgrounds and Clark Creek Organizational Camp were placed in concessionaire hands beginning in the 1995 season.. Management of campgrounds by private entities rather than the Forest Service is expected to continue. Due to the interrupted coverage of the concessionaire during the 1995 season, use counts are not expected to reflect actual use.

Fisherman's Point, administered by the Army Corps of Engineers, is also a popular campground. Before the gate was installed in 1991, it received year-round use averaging 4,550 persons per year. In 1991, the operating season was changed to Memorial Day weekend through Labor Day weekend, and use was changed "for camping only." From 1991 through 1994 the yearly average was 1,650 persons per summer season. Although it is a perfect spot for boat access to upper Fall Creek Reservoir, no boats are allowed in order to protect Northwest pond turtles. In the near future, the Army Corps plans to make Fisherman's Point a "reservation-only" site.

Cowhorn Lookout continues to have loyal return visitors as well as a few people who vandalize the historic structure. By including it in the rental program, vandalism is expected to decrease with the increase of responsible visitors.

Most dispersed sites are occupied longer by fewer people. Occupation continues into winter months at the more popular sites. Garbage collected from dispersed sites was approximately 13 cubic yards in 1994, and increased to 15+ cubic yards in 1995 (the season was not over at the time of this report) (personal conversation, Larry Lassiter 1995). Human feces, moldy urine spots and used toilet paper can be found on bare ground and scattered in the bushes at some sites. A handful of sites have had vegetation cut down as well as hack marks through the bark, and bark removal from larger trees.

Of the 28.4 miles of existing trails, approximately 50% are within riparian reserves. If the planned 21.2 miles of trails are constructed, 30% would be within the riparian reserves. Mountain bike use has also skyrocketed in recent years. In 1980, 10% of local bike sales were mountain bikes; in 1994, sales rose to 80% (Dave Ruter, personel communication). With the increasing interest in old-growth and books highlighting old-growth trails, recreation hiking, and mountain biking, trail use is expected to increase.

Winter Recreation

When the cold, damp air of winter settles in over the drainage, land based recreational use plummets. In the past, all but two campgrounds were closed due to saturated soils and winter storms that can send branches crashing down and trees toppling. Given the incidence and kind of root rot in Fall Creek, trees and branches will continue to fall when exposed to extremes of nature.

During winter flows, kayaks, an occasional open canoe or cat-a-raft and the rare raft, (if the water is high enough) are found on Fall Creek (Bruce Mason, personal communication). It is considered an intermediate run with most people putting in at Bedrock Campground and taking out at the pump chance on private land (Jim Reed, personal communication).

CHAPTER 4

INTERPRETATIONS

The purpose of this chapter is to compare existing, historical and reference conditions of specific ecosytstem elements; explain significant differences, similarities or trends and their causes; and identify the system capability to achieve key management objectives identified in Chapter Two.

ISSUE 1: THREATENED, ENDANGERED AND SENSITIVE SPECIES

1. What are the habitat restoration and enhancement opportunities for TES species and where are they located?

See Chapter 5, Recommendations.

2. Have TE&S species habitats been affected by management activities in the past?

The majority of sensitive plant species have been located while surveying for project-level analysis. Thus, only a portion of the watershed has been adequately surveyed for plants on the Regional Forester's current sensitive species list.

Romanzoffia thompsonii: Populations are stable. Two of the populations are near trails but do not seem to have been adversely impacted by recreational traffic. This plant's habitat is considered 9D (Special Wildlife Habitat) under FW211 so there should be no impact to populations in Matrix land allocations.

Cimicifuga elata: Existing Fall Creek populations are stable but not reproducing. A section of the Fall Creek Trail, which receives a great deal of use, is adjacent to the population and could have dissected the original population (the original population occurred on both sides of the trail). Currently, trail impact is minimal as hikers remain on the trail.

Frasera umpquaensis: This population is also stable but not reproducing. It is hypothesized that the hydrologic regime of the habitat is changing due to road building and/or timber harvest adjacent to the population. It is theorized that the water table has dropped and that the area where *Frasera* occurs is becoming drier than in the past. New, more drought-tolerant bracken fern and bigleaf huckleberry are dominating the site competing with *Frasera* for both light and water.

Peregrine Falcon: Main concern for the falcon is continued disturbance from public and Forest Service travel during critical nesting periods. One site in the Portland Creek area identified as having moderate nesting potential, has been impacted by the proximity of a main arterial road.

Wolverine: Due to no-harvest allocations in 79% of the watershed and the LSR allocation, habitat conditions conducive to wolverines will improve over time. The concern here is disturbance due to recreation activities and road travel, and its effect on potential wolverine occupation.

Pond turtle: The upper end of Fall Creek Reservoir is used by the pond turtle. Potential disturbance from swimmers and anglers could have an effect on the turtle's ability to use the area without undue stress and avoidance behavior. Potential nesting habitat could be impacted by high use of the upper end, above Angler's Point. In addition, there is concern that turtles are used for target practice, causing increased turtle mortality. Predation of juvenile turtles by non-native species also affects population levels.

Red-legged frog: Surveys are not adequate for this species. The one pond located in the Nine Mile Creek drainage identified as a red-legged breeding site has been heavily impacted by adjacent harvest activity. The hydrologic regime of this pond has potentially been altered by harvest and road construction adjacent to this site.

Clouded Salamander: Past harvest activity, especially salvage, has removed an important component of large, coarse, woody debris on a substantial number of acres. Decay Class III, IV and V logs are very important for breeding and have considerable impact on the life history of this species. Coarse wood is also important in providing moist microenvironments for a number of other terrestrial salamanders suspected to occur, such as the Oregon slender salamander, ensatina, western red-backed salamander, and Dunn's salamander.

Bald Eagle: Potential nesting habitat exists at the lower end of the watershed within 1.1 miles of the reservoir. The Bald Eagle Management Area set aside on BLM land should provide adequate nesting habitat for eagles to establish along the reservoir.

3. What is the contribution of riparian reserves and other withdrawn land allocations in meeting dispersal needs of the Northern spotted owl and other TES species?

Spotted Owl: Overall, habitat quality and quantity is good. With approximately 80% designated as no-harvest allocations, habitat for the owl will improve over time. Approximately 60% of the no-harvest allocations currently meet 11-40 conditions which is more than adequate in fulfilling current dispersal needs. There is a potential barrier to dispersal of young north of the watershed and the LSR due to large tracts of private industrial forest lands between LSR RO219 and LSR RO217. The extreme upper end of the watershed and portions of Oakridge and Blue River Ranger Districts to the east are also areas of small concern.

White-footed vole: This species, although not documented in the watershed, is suspected to occur. Because of its preference for riparian-associated habitat the reserve network will provide adequate and suitable habitat over time.

For an expanded discussion regarding contributions of riparian reserves and other withdrawn land allocations to other TE&S species, see *Chapter Three, TE &S.*

ISSUE 2A: TERRESTRIAL VEGETATION

1. What are the historic and current distributions of seral stage vegetation? What are the processes and disturbances which have led to these patterns and conditions?

Table 35 shows the relationship between historic range of variability, reference seral conditions in 1900, and current seral conditions in 1995 as determined during REAP for early and late seral conditions *(for a discussion of REAP, see Chapter Three, Vegetation, Historic Range of Variability)*. A comparison shows the amount of early seral vegetation in 1900 and 1995 to be within the historic range of conditions. REAP estimates the historic range of variability for early seral to range between 3-30%. Reference conditions in 1900 are at the low end of the range and current conditions in 1995 are at the high end. Although current early seral conditions lie within the historic range of variability, most stands are managed plantations lacking the structural component of snags and downed logs present under naturally occurring conditions.

A comparison of late seral vegetation amounts shows the 1900 reference conditions to be above the historic range of variability. Currently, the late seral condition is 36% which is below estimated ranges. This is largely due to timber harvest within the last six decades but is also influenced by fires occurring in the late 1800's and two fires in Portland and Hehe Creeks this century.

Table 35. Comparison of seral conditions

Seral Stage	REAP (1600-1850)	Reference (1900)	Current (1995)
Early	3-30%	4%	25%
Young	-	17%	25%
Mature	-	0	14%
Late	45-75%	78%	36%

It is important to note that timber management activities have not only altered the overall percentage of various seral stages, but also greatly affected vegetation patterns *(see Landscape Patterns, this Chapter)*.

Changes in the quantity, quality and distribution of these seral conditions are primarily the result of replacement stands following natural fires and timber management. Timber management activities and fire suppression have interrupted the natural fire cycle. This interruption of a naturally occurring disturbance agent combined with future forest management, will probably have the following trends under current management direction:

♦ *Disturbance*

The reference conditions had infrequent medium to large stand replacement fires. Small scale within-stand disturbances probably occurred in pockets from insects, disease and windthrow.

Current conditions are a result of dispersed, clearcut and salvage timber harvest and fire suppression. Extensive road systems have been constructed to access timber, increasing windthrow along clearcut edge, which in turn increases fire risk.

Future conditions will be the result of continued fire suppression and timber harvest, which will retain higher levels of green trees. Road systems will reach an equilibrium and then gradually decline. Old roads will be closed with some new roads constructed to access available timber. Windthrow will continue along edges of riparian reserves and throughout retention areas in harvest units. There will be an increased risk of fire with accumulation of fuels and development of understories or fuel ladders in untreated stands.

♦ *Stand Structure*

Reference conditions had a greater diversity of stand structure with more snags, coarse downed wood and remnant green trees. Early and young seral conditions lasted longer as natural reforestation required more time.

Currently, there is less diversity of snags, coarse downed wood and remnant green trees as a result of total utilization of wood biomass during harvest activities. This trend is changing in plantations younger than five years. Early and young seral conditions are shorter in duration due to intensive reforestation.

Future conditions will show an increased level of snags, coarse downed wood and retention of remnant green trees in plantation openings as directed by the Northwest Forest Plan.

♦ *Landscape Pattern*

Reference conditions had connectivity of mature stands throughout the watershed, most of which was interior habitat.

Current conditions show fragmentation of the mature forest matrix, loss of connectivity and isolation of mature forest blocks in addition to increased patchiness. Patches are smaller and more uniformly sized than expected under the natural disturbance regime. Increased edge habitat means less interior habitat and more risk of windthrow. Edge contrast is high with abrupt transitions between early and late successional vegetation. Open patches are more evenly distributed throughout the landscape and are beginning to coalesce.

Future conditions will exhibit connectivity of forest matrix in riparian reserves and no-harvest allocations, with younger forest interspersed among late seral networks. There will be large openings on upper slopes as units undergo minimum fragmentation and continued creation of high contrast edges along riparian reserves.

2. What is the risk and role of fire in the watershed?

Large fire events occurred in the watershed when a combination of weather and fuel factors created optimum conditions for fire intensity and spread. The watershed hosted moderate to high intensity fires from 1800 to the present, resulting in present stands with light ground fuels and vigorous second growth. Fragmentation due to management activity futher reduces the risk of catastrophic fire.

The current, fragmented landscape would support various fire intensities as fuel models change. Significant fire runs may occur in stand initiation areas (Fuel Models 1 and 5), while lower intensity fires would occur in stem exclusion and LSOG stands (Fuel Models 8 and 10). These fires would likely not approach the size of historical fires.

Areas where fire or mechanical treatments would reduce fire risk could be identified. Unfragmented blocks of LSOG may be protected from catastrophic fire by underburning. Further risk reduction should look at stands with a high fuel loading in the 0-3" diameter class, which includes the stem exclusion and stand re-initiation stages.

Fire may also have desirable effects in meadows, such as grass mosaic diversification and encroachment arrest.

Overall, the watershed presents a low risk for a catastrophic fire event, due primarily to fragmentation and vigorous second growth resulting from fires in the 1800s.

3. Can landscape fuel loadings be maintained within the historic range of variability? If so, how?

Landscape fuel loading can be maintained within the historic range of variability by management activities. Young stands removed from management due to current land allocations, may exhibit an increased fuel loading as these stands approach stem exclusion as a result of overstocking. If a precommercial thinning regime is maintained, and commercial entries for thinning and salvage are planned, fuel loading will not accumulate as rapidly, thus decreasing excessive fuels buildup.

Landscape fuel loading in an unmanaged area is most likely diverse ranging from relatively light, continuous fuelbeds to scattered, large-diameter fuelbeds. Fire intensity and spread varies as these characteristics change. For example, in stem exclusion/ understory re-initiation stands, more fine fuels allow greater rates-of-spread but with lower burn intensities. In understory re-initiation/late successional old growth stands, the greater quantity of large downed material may support higher intensity fires with more variability in rate of spread.

Where fuel loading exceeds Forest S&Gs, machine piling of slash or underburning can reduce the fuel profile. When an area accumulates fuel loading in excess of S&Gs, it should be identified as an understory burning priority, since an unsuppressed fire may be a stand replacing event. Fire breaks created along ridges of subdrainages would decrease the risk of stand replacement events entering other areas. Periodic underburning will maintain a fuel profile favoring controllable fire behavior.

4. How have past management activities affected wildlife habitat/populations?

From results of the guilding process used to model habitat conditions for species guilds, it is evident that habitat conditions are currently marginal for those species requiring large areas of open or early seral conditions. Although only a few species requiring these conditions could occur in the watershed, some have evolved with fire occurrences in the Pacific Northwest. These species historically benefited from large fire areas containing abundant forage and nesting habitat such as cavities in trees and snags. Fragmentation of habitat with removal of important components such as snags and coarse woody debris (CWD) may affect these species. There is also concern regarding the abundance of contrast species in the watershed. These favor edge habitats and are currently considered to be at healthy levels. Future trends, however, indicate a decrease in habitat for these contrast species based on current no-harvest allocations. Such species would include the red-tailed hawk, Roosevelt elk, Great-horned owl, olive-sided flycatcher, and Lewis' woodpecker.

As stands develop and reduced future harvest occurs, early seral and open conditions will decline. This could have an effect on distribution and abundance of certain species such as the mountain quail, western bluebird, American goldfinch, dusky flycatcher, and California ground squirrel. Although distribution and abundance of open seral-dependent species could be reduced in the future, overall species effects would be minimal. Conversely, as late-successional conditions develop and are maintained, more late-successional forest and interior habitat dependent species benefit. These include the goshawk, pileated woodpecker, fisher, marten, Northern Spotted Owl, red tree vole, brown creeper, and winter wren.

Snag levels are adequate except in lower Fall Creek where they are below 40% as identified in the Forest LRMP. Generally, CWD levels coincide with snag levels in the sub-watersheds. The Northwest Forest Plan defines CWD as logs equal to or greater than 20 inches in diameter (small end), at least 20 feet in length, and in Decay Classes I or II. Reduced snag and CWD levels are due to past management activities or historic fire occurences. Amounts in some natural stands are low due to fires and salvage logging, resulting in low quantities of dead wood components. Extensive measurements are needed to determine how snag and CWD levels correlate with fire history, intensity and pattern. This would present a more comprehensive picture of natural amounts of dead wood occurring in the area before European arrival and settlement. With no-harvest allocations and matrix S&Gs, snag and CWD levels should be maintained or increased in the future..

5. How and where have past management activities affected special habitats?

As discussed in Chapter Three, special habitats were identified using aerial photo interpretation. This categorization of habitats is very general; field visits are necessary to determine exact compositions of habitat and management effects. Prescriptions for habitat restoration should be written during project-level planning and analysis.

Various types of vegetation manipulation and associated road building have affected special habitats. The most influential effect has been of managed stands and roads on both mesic and wet meadows. Results of harvesting to habitat edges is reduction of hiding and thermal cover for wildlife, reduction of shade for species intolerant of direct sunlight, a general change in the microclimate, and potential changes in hydrology upon which plant species distribution and compositions depend. Building roads adjacent to or through these habitats results in filling of meadow habitat, causing a reduction in overall size, addition of habitat for noxious weeds favoring road-fill areas, alteration of hydrology if culverts are incorrectly placed or plugged, and dissection of contiguous habitat potentially disallowing migration and dispersal of plant and/or animal species. Other dry habitats such as rock outcrops, shrub talus, dry meadows, and rock gardens have not been altered as seriously. Fire suppression and exclusion could affect these dry meadow areas by reducing productivity, general health and allowing conifer encroachment. The future trend for special habitats is stable, with WNF LRMP Standard and Guideline FW211 protecting dry sites as 9D and wet sites as riparian reserves.

6. How and where has road construction and use contributed to non-native species and noxious weed infestations? What noxious weeds are present, where are they located and what is their effect on biodiversity?

Road construction and maintenance have been the most important factors contributing to the spread of noxious weeds, since road maintenance acts as a constant disturbance agent disallowing succession and maintaining early seral, pioneer conditions conducive to weedy species. Thus, roadsides act as corridors where weeds may travel from one disturbed site to another such as in managed stands and quarries.

Established infestations of Scotch broom, tansy, Klamath weed, Canada thistle and bull thistle are found throughout the watershed. These species are restricted to roadsides and managed stands, but some species such as Klamath weed and thistles are actively moving into dry meadow habitat as in dry rock gardens of the Gold Point complex. Weed species in natural habitats have the effect of lowering overall biodiversity of a site as they outcompete natural vegetation. This can adversely affect wildlife populations which depend on native plant species for survival.

No new invaders appear in the watershed, which is unique to the Willamette NF, and if at all possible, they should be kept out. However, established weeds such as Scotch broom, tansy, thistles and St. John's wort will continue to spread wherever soil disturbance occurs such as managed stands, roadsides and quarries.

7. What are historic, current conditions and trends of big game habitat in the watershed?

See below.

8. Are current big game emphasis areas adequate to meet management objectives with adoption of the Northwest Forest Plan and associated standards and guidelines?

See below.

9. Where do open road densities exceed Forest Plan Standards and Guidelines?

Modeling of big game habitat conditions indicates areas of concern within the watershed and with the modeling process itself. According to the Forest Plan and Northwest Forest Plan land allocations, 21% of the watershed will be available for management activities including harvest. This represents a very small portion of the watershed where timber harvest can be used to create early seral forage conditions for big game. All matrix lands are in winter range habitat. This means that adequate forage and thermal cover need to be provided and maintained in appropriate amounts, especially in the lower Fall Creek area. This is based on modeling using the HEIWEST Wisdom Model which assigns values to different seral conditions and their position on the landscape in relation to each other. The model assumes that providing a well dispersed network of forage and cover stands in an area will benefit and maintain desired big game populations. This is not the case when looking at HEI values generated from modeling the reference 1900 vegetation layer. Numbers display better habitat conditions in 1900 than in the present, although all accounts indicate big game populations are currently higher. This indicates inadequacies of the model since the input parameters are not reflective of future management direction. It will be increasingly difficult to maintain young seral or forage conditions; therefore other options should be considered.

Some concerns and trends that have become obvious based on the model are:

A. *Open road densities:* The District has had a very progressive program of road decommissioning during the past several years. These closures were prioritized in high Big Game Emphasis Areas (BGEAs) in conjunction with no-harvest allocations. Decommissioning has been emphasized in the Little Fall Creek, North Fork Fall Creek, Andy Creek, and Rubble Creek areas *(See Map 22, Chapter 3)*. Nevertheless, road densities in these areas and in the watershed as a whole are generally high. Any further road closures in the Lower Fall Creek area will affect the main arterials. Gates should be considered as a possible closure option. Lower Fall Creek, which includes high emphasis winter range, should remain a priority for road closure utilizing either berms or gates. Big game is especially vulnerable to harassment during winter months when conserving energy is vital to overwinter survival. Roads should be considered for closure throughout the watershed, especially those which are sediment producers and impact the function of the LSR or are high maintenance/low use roads. Final road closure proposals should be addressed in the District Access and Travel Management Plan.

B. *Forage:* Overall, forage levels are acceptable except in winter range areas. This is especially true in Andy Creek and Timber Creek in addition to a portion of BLM and private land. These areas should be considered during project-level planning to determine options for forage creation and maintenance of permanent foraging areas.

C. *Big Game Habitat Trends:* With early seral stands developing into stem exclusion conditions and beyond, open forage areas will decline over time. This will be most pronounced in the upper end of the watershed within the LSR boundaries leading to reduced big game population levels. Black-tailed deer, more dependent on browse availability than elk, could be more affected by the change in management direction. Open road density conditions should improve overall with implementation of a District Access and Travel Management Plan.

10. What and where are the historic and current conditions of interior forest habitat? How have management practices contributed to these changes?

See Chapter 3, Current Conditions.

Trends: Interior forest habitat conditions will improve over time. Some species benefiting from increased interior habitat are the spotted owl, marten, fisher, pileated woodpecker, Barred owl, northern goshawk, red tree vole, northern flying squirrel, white-footed vole, and brown creeper. One concern is that a major portion of the riparian reserve network outside the LSR will not function as interior habitat, which could affect security for movement, migration or dispersal of interior forest-associated species in linear strips of dispersal habitat.

11. Are there current or potential connective corridors in the watershed that need to be identified and/or enhanced?

The main Fall Creek corridor is unique with late-successional habitat historically important in facilitating movement of wildlife species in an east/west direction. The habitat is fragmented but some contiguous stands along the corridor remain. The major concern in the corridor is recreational development and its accompanying land use. The main Fall Creek road, developed and dispersed campsite networks, and the high use of Fall Creek itself during spring and summer months contribute to the reduced effectiveness of this major riparian corridor. It provides an area for foraging, breeding, movement, and dispersal for many wildlife species such as the Harlequin duck, osprey, foothill yellow-legged frog, spotted owl, common merganser, white-footed vole, marten, and band tailed pigeon.

Private property in the center of the watershed at the confluence of Portland and Fall Creeks could be another barrier to wildlife movement through the corridor. The property, 160 acres straddling main Fall Creek, has recently been harvested and is being developed as a Christmas tree farm.

The abundance of young seral conditions within the watershed, especially in upper Andy and Timber Creeks, has created a barrier to the north/south movement of wildlife from Fall Creek into the Winberry Creek drainage. Currently, the Slick Creek/Bedrock area provides an intact connection between Little Fall Creek and Fall Creek. Enhancing dispersal conditions within the Andy Creek drainage would continue this corridor link to the south from Fall Creek to the Fall Creek/Winberry Divide. This would provide connectivity in a north/south direction between watersheds and should provide both ridgetop and riparian habitat in the corridor.

Riparian reserve protection of Class IV streams should provide for needs of small stream and seep-related wildlife species such as the torrent salamander. Specimens taken from the Alder Creek drainage indicate some overlapping morphological characteristics between the cascade and southern torrent salamanders. The watershed could prove to be unique as the ranges of these two distinct torrent species merge in the area. When creating riparian reserve protection buffers, it is important to assess the habitat requirements of these amphibians in the upper reaches of Class IV streams and to maintain water quality and temperature of seep areas.

Effectiveness of the riparian reserve network in serving as dispersal habitat for more terrestrial species:

With harvest of matrix lands between riparian reserves, fragmentation patterns in the lower end of the watershed will continue over time. The marten, a species which riparian reserve widths were intended to benefit, will have adequate acres of suitable habitat with the reserve network in place at the lower end, although acres will be linear in alignment rather than intact blocks of quality interior habitat. As this edge is created, these reserves become very susceptible to windthrow further reducing effectiveness of the reserve "strip". With greater blockage of late-successional habitat in certain areas, creating "stepping stones" of higher quality habitat could prove more effective in providing secure refugia for dispersing spotted owls, marten, *P.dubium* and other species. This would not preclude the need to protect integrity, quality and temperature of all streams and associated riparian areas.

Other areas of importance which should be high priority for maintenance or enhancement activities are: the main divide area between Fall Creek watershed and adjacent Quartz Creek, South Fork McKenzie, North Fork of the Middle Fork of the Willamette, and Winberry Creek drainages. These ridgetop areas are important for vascular and non-vascular plant species and wildlife.

12. Has removal of vegetation increased landslides over historic natural conditions?

The frequency of slope failures has increased considerably since the beginning of road construction and clearcut timber harvesting with the highest number of failures occurring on steep sideslopes.

The majority of slope failures identified for analysis are debris failures occurring in the fill-slopes of roads built utilizing sidecase construction and clearcut harvest units. The predominant sediment produced from these failures was coarse grained and typically less than 100 or 200 cubic yards. Most of the sediment from these types of failures occur during initial slope collapse. Small amounts continue to dribble downslope but volume diminishes as the slope revegetates and the material prone to failure stabilizes. These types of failures are also the easiest to identify on aerial photos and appear to have produced a significant volume of sediment. Amount and size of sediment reaching fish-bearing streams is unknown as is the amount and size of material from unmanaged ground.

Failures occuring in clayey soils on shallow sideslopes are generally rotational failures associated with road cutslopes and landflows and occasionally clear-cut harvest units. Sediment produced from these soils is fine-grained and thought to produce significant amounts of silt, clay and suspended colloidal sediment. These types of failures can be chronic sediment producers.

The general trend of road-related failures during historic times is fluctuation with the amount of new road construction. It is important to realize that the frequency of failures will be substantially less presently than during the sidecast construction era. Harvest-related failures increase with the increase in number of harvest units. Therefore, these types of failures are likely to decrease over time due to changes in harvest practices.

13. What and where are the conflicts between special forest products collection and current land allocations?

Willamette NF LRMP amendments include those pertaining to allowable levels of harvest for different species and allocations where commercial collection will or will not be permissible. Collection is not permissible in LSRs, Riparian Reserves, Special Wildlife Habitats, Special Interest Areas, and Old-Growth Groves. Thus, approximately 14% of the watershed is available for special forest product collection. An increasing demand for moss is predicted as stocks on the coast decrease. Latest regeneration rates are in the region of 2.7 kg/ha/yr or 0.6% annual increase in biomass. (Peck, 1995)

14. How and where has habitat for C-3 species been affected by management activities?

15. What habitat or habitat functions need to be identified and restored for these species?

Most C-3 species are dependent upon interior old-growth and/or unfragmented riparian habitat. Timber harvest has occurred throughout the watershed in randomly dispersed patterns. This resulted in highly fragmented landscapes containing little interior habitat, with the exception of large blocks in the Slick/Bedrock Creek areas and the upper Fall Creek/Delp Creek subwatershed. Even though 50% is in late seral condition, a very small percentage of this acreage is suitable habitat for species needing interior habitat microclimates. Chen, et.al.,(1991) note that changes in light, air and soil temperatures, wind, humidity, and tree mortality may be moderated from <200 feet to >790 feet of the stand edge.

The Fall Creek corridor is the main riparian corridor of the watershed. It has been dissected by a road and in some areas there are gaps in overstory vegetation adjacent to the private tree farm and timber management units. A significant amount of upland riparian vegetation has also been altered by timber harvest; 50% of the original riparian habitat is late-successional and much of this is fragmented.

There is a definite need for comprehensive surveys to determine trends, but with 79% of the drainage in an LSR designation restored old growth and riparian habitat should increase each decade. In Matrix, the amount of these types of habitat will continue to decrease and with it the structural complexity necessary for epiphytic members on the list. A concerted effort should be made to conserve these species given the overall management standards and guidelines. For example, mitigation measures outlined in FEMAT, (USDA, et al., 1993) and Appendix J of the SEIS (USDA, 1994a) which could be used include:

- Maintaining "leave" trees in patches of four acres to become a source of genetic material and function as refuges; prescriptions should include considerations for wind-firmness to avoid blowdown,
- Maintaining the same "leave" trees over several rotations due to slow growth, poor dispersal and slow colonization of many organisms,
- Selecting diverse "leave" tree species and structure in clumps to maintain microhabitats and microclimates, and selecting trees with a large variety of bryophytes and lichens,
- Insuring large downed woody debris is left on-site,
- Retaining riparian buffers,
- Maintaining patches throughout the watershed using the existing pattern of pileated and pine marten and other non-harvest allocations to provide larger blocks of habitat; connecting them as dispersal corridors if there are no riparian corridors in the area, and
- Scattering leave trees around rock outcrops and along ridgelines.

Mitigation measures for the candystick found in Appendix J of the Northwest Forest Plan (USDA, 1994a) include:

- Developing a map of the populations,
- Analysis of ecoplot data to further refine potential habitat,
- Surveys for *Allotropa* during watershed analysis occurring at the project level on the Willamette NF,
- Revisiting historic sites,
- Surveying areas slated for prescribed burning, and
- Restricting salvage of down logs in high probability habitat.

ISSUE 2B: RIPARIAN VEGETATION

1. How and where have management activities changed terrestrial/aquatic riparian functions within and adjacent to stream channels?

The ROD outlines the purpose of riparian reserve strategy in:

a) Maintaining and restoring riparian structures and functions of intermittent streams,

b) Conferring benefits to riparian-dependent and associated species other than fish,

c) Enhancing habitat conservation for organisms dependent upon the transition zone between upslope and riparian areas,

d) Improving travel and dispersal corridors for many terrestrial animals and plants,

e) Providing greater connectivity of the watershed, and

f) Serving as connective corridors among LSRs.

Many of the riparian reserve area tributaries of mainstem Fall Creek have been heavily impacted by timber harvest, roads and fire. These impacts have resulted in stands of relatively early seral stages. The mainstem Fall Creek Riparian Reserve, however, consists predominantly of late seral stage stands. The exception is private land downstream from Portland Creek and the lowest section of Fall Creek above the reservoir where riparian reserve condition is in early to mid-seral stage. Private land will be managed differently than that of national forests and is expected to remain in an earlier seral stage.

Riparian Reserve Condition by Subwatershed

Lower Fall Creek

Management impacts in Slick Creek and Bedrock Creek drainages have been relatively small. Generally, parameters affecting riparian and aquatic habitat conditions can be characterized as good. Riparian reserves associated with remaining tributaries have been impacted by timber harvest and road construction.

Portland Creek

Current conditions within riparian reserves are the result of a wildfire in 1919, timber harvest and subsequent road construction. Many parameters affecting riparian and aquatic habitat conditions are below desired values.

Hehe/Middle Fall Creeks

Riparian reserves in the upper portion of Hehe Creek drainage were impacted by fire in 1951. Following this, further impacts were due to timber harvest including salvage logging of stands affected by the fire and resultant road construction.

Delp/Upper Fall Creeks

These are in the best overall riparian condition although half the area associated with intermittent streams has been impacted.

The riparian reserve network will develop into late-successional forest over time. There are opportunities for riparian habitat enhancement to facilitate development of late-successional forest within riparian reserves. The Watershed Team has developed a set of recommendations for appropriate activities and mitigation measures *(See* Table 40, *Riparian Recommendations). Table B44* in Appendix B is an "effects matrix" drafted by forest biologists addressing potential impacts of wildlife species activities within riparian reserves of concern identified in FSEIS ROD. These are draft effects and provide basic guidance for proposals in riparian reserves. Reference will be made to this draft "effects matrix" when recommendations are developed for activities within the reserves.

Table 36. Relative Riparian Condition by Drainage Within Subwatersheds

Subwatershed	Best Condition	Worst Condition
Lower Fall Creek	Clark Slick/Bedrock	Timber, Andy, Boundary, Upper North Fork
Middle Fall/Hehe Creek	Jones Middle Fall	Upper Hehe (15I) Lower Hehe (15H)
Portland Creek	Rubble/Lower Portland Gales	Logan, Lower Portland North, Upper Portland /Nevergo
Upper Fall/Delp Creek	Saturn/Platt/Briem	

2. What type and where can management activities including restoration opportunities occur in riparian reserves which would meet objectives in the Aquatic Conservation Strategy?

See Chapter 5, Recommendations.

ISSUE 3: AQUATIC HABITAT

1. How and where have past management activities such as timber harvest, recreation and road building affected water quality and quantity, (i.e., temperature, sedimentation and flow)?

All subwatersheds have an increased risk of larger peak flows as a result of management activities due primarily to timber harvest and road construction. Hydrologic recovery varies considerably between planning subdrainages within each of the subwatersheds. Current ARP values indicate the greatest potential for increased magnitude of peak flows is in Portland and Upper Fall/Delp subwatersheds. Due to stable characteristics of most stream channels, the majority of stream reaches would not be adversely impacted by the small increases of peak flows. An exception to this could be those depositional reaches displayed in *Map 32,* which are potentially important spawning areas.

Of considerable impact to the mainstem Fall Creek riparian reserve are high recreation and road use since the road impacts approximately 75 feet of riparian reserve for approximately 20 miles *(See Table 37).*

Table 37. Riparian Reserves impacted by Roads.

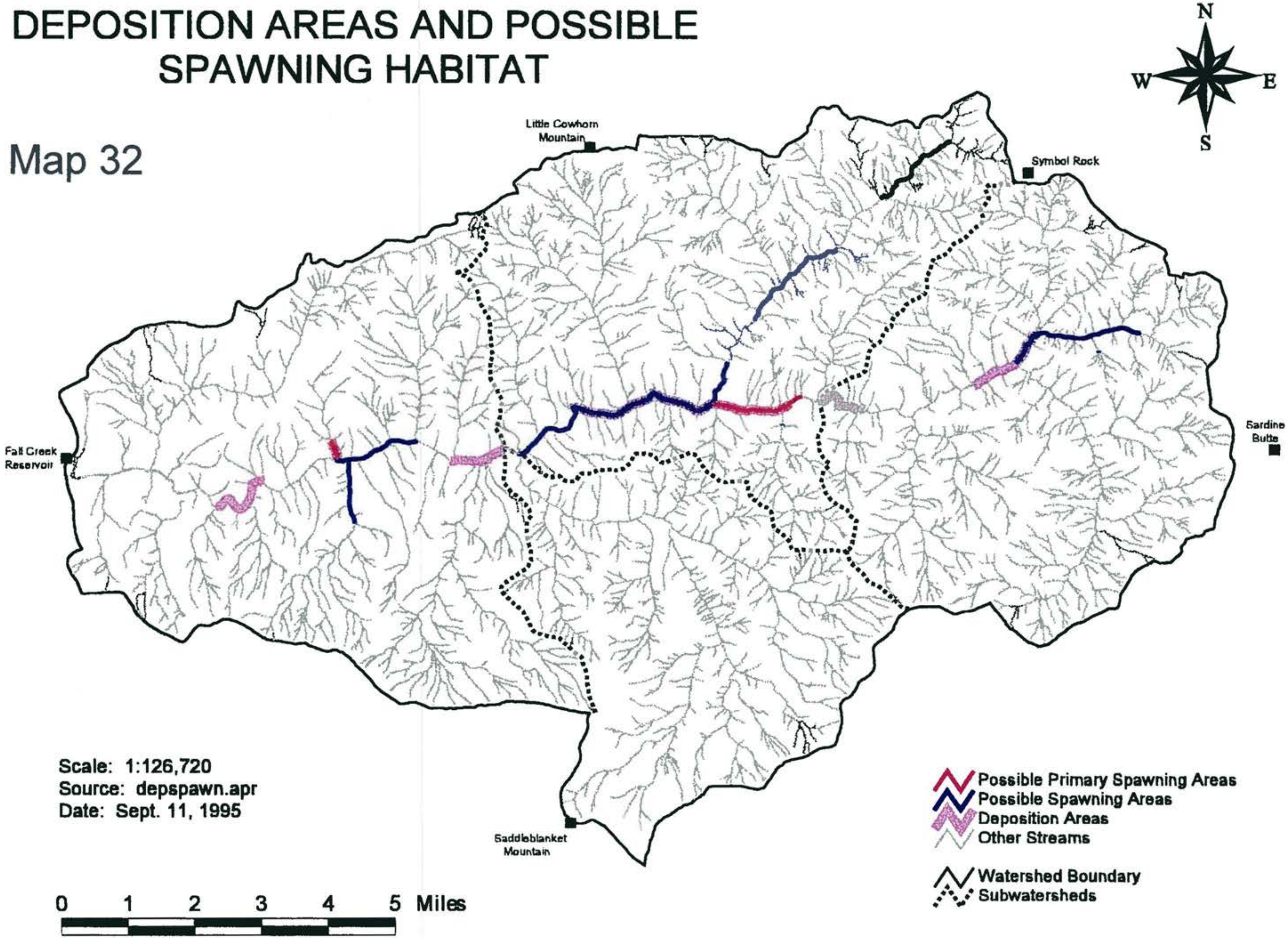
	Lower Fall	Portland	Middle Fall/Hehe	Upper Fall/Delp
% Riparian Reserve affected by Roads	3.7%	3.4%	3.0%	3.4%
% Riparian Reserve affected by Roads along Fish-bearing Streams	5.1%	5.9%	3.8%	5.3%

Although debris torrents, large deep-seated mass movements and streambank erosion have naturally supplied sediment to stream channels in the past, management activities have increased the rate of sediment delivery to stream channels. Timber harvest and roads have had the greatest influence on sediment production. The largest source of management-related sediment is associated with roads, and areas of particular concern are near steep debris flow terrain in upper Hehe, Delp, Portland, Nevergo, Alder and Jones Creeks.

Sediment sources associated with roads include mass wasting from road fills and cutbanks as well as surface erosion from ditches, cutbanks and road surface. Heavy use of roads during wet weather has increased the supply of sediment considerably and both aggregate surfaced as well as native surfaced roads are of concern. Options available to reduce amounts of sediment generated include seasonal restrictions of use and road decommissioning or obliteration.

DEPOSITION AREAS AND POSSIBLE SPAWNING HABITAT

Map 32



Significant degradation of aquatic habitat could result from lack of road maintenance. Erosion of road surfaces, fill slopes and cutbanks combined with large quantities of sediment from road-fill failures due to culvert blockage could have severe adverse effects on in-stream habitat. Additional sediment could degrade habitats of macroinvertebrates, amphibians, fish spawning habitat, and impact young fish.

Map 33 indicates alluvial depositional areas in mainstem Fall Creek and possible spawning areas. Deposition of fine sediment generated from management activities could adversely affect the quality of these reaches for spawning. Highlighted areas are thought to be heavily used for spawning.

Developed campgrounds and many dispersed recreation sites are located within riparian reserves especially on the mainstem of Fall Creek and its larger tributaries. These sites are often within 100 feet of the stream channel. At some sites streambank erosion contributes additional sediment to the channel due to disturbance of vegetation. In addition, small diameter down wood is frequently utilized as firewood; however, very large woody debris is generally not removed by campers.

2. How and where have past management activities affected channel complexity?

Instream large woody material is very low in mainstem Fall Creek. Much of this is thought to be due to past salvage activities particularly after the 1964 flood event. Map 14 indicates the amount of LWM found in creeks surveyed throughout the watershed. Suspected high amounts of large woody material in Portland and Fall Creeks are areas where surveys occurred prior to log and boulder stream enhancement projects. Logs and boulders have been added to Alder Creek; however, no stream surveys have been completed.

The amount of large woody material has been increased in areas where instream structures were installed. However, this wood is cabled to the stream channel and is relatively stationary. In pristine conditions, this would be more dynamic, rising and falling with the flow and redistributing spatially through time. Potential for failure of artificially placed, woody material anchoring systems exists during high flow events which could contribute to concentrations of debris damaging or destroying downstream culverts and bridges. Despite the risk this artificially place woody material has created, cabling structures to stationary objects seems to have improved habitat while protecting existing facilities in flashy stream systems. Long-term impacts from cabled, stationary logs are unknown and need to be monitored..

The Aquatic Conservation Strategy in the 1994 Northwest Forest Plan establishes riparian reserves which will slowly improve conditions creating a trend toward larger conifers and a recruitment source of large woody material.

3. What are the current and historic conditions of aquatic habitat?

See Chapter 3, Aquatic Habitat.

Pools per mile are low throughout the watershed. However, many of the tributaries are steep stairstep habitat where channel-width pools, longer rather than wider, are not commonly found. The mainstem of Fall Creek is low in pools per mile, but the quality of pools in lower reaches is high due to length and depth. The number of pools in Hehe Creek appear to have increased due to habitat enhancement work. Portland Creek is expected to improve as structures retain more coarse sediment. Although Map 14 indicates a low amount of LWM for Lower and Middle Fall Creek, instream habitat enhancement projects would be a low priority die to overall habitat conditions.

Riparian condition data correlates well with temperature data collected throughout the watershed. Hehe and Portland Creeks are generally the warmest of Fall Creek tributaries during critical summer periods while Platt Creek is one of the coolest.

Streams flowing through riparian reserves with a relatively small percentage impacted by fire or timber harvest may be a source of cold water refugia. These areas are Slick Creek, Bedrock Creek, Clark Creek, Platt Creek, Briem Creek, and Saturn.

4. What is the current, historic and potential condition of aquatic species and their distribution?

Refer to Chapter 3 and Map 9 and 10.

Anadromous runs are decreasing within the Willamette River. However, the current drawdown at Fall Creek Dam during smolt migration has resulted in an increase of adult chinook returning to Fall Creek.

Rainbow trout are found lower in the Fall Creek system and will continue to be stocked by ODFW. Cutthroat are found higher in the drainage. Temperatures are improving over time and this trend is expected to continue with the current riparian reserve. As temperatures decrease conditions will favor salmonids and dace populations may decline.

Many aquatic associated wildlife species occur within the watershed. These include torrent salamander, Dunn's salamander, Pacific giant salamander, tailed frog, red-legged frog and roughskin newt. Over time, the abundance of these species should improve with the riparian reserve protection guidelines. There is concern about impending road failures due to lack of maintenance and accessibility that could substantially impact breeding habitat for the more stream-dependent species such as Pacific giant salamander, tailed frog and torrent salamander.

5. What are the restoration opportunities for aquatic habitat?

See Chapter 5, Aquatic Habitat Recommendations.

6. What is the potential effect on aquatic habitat if roads are not maintained?

Roads through riparian areas constructed using sidecast practices have led to sediment-producing failures in the past. With decreased road accessibility and maintenance activities older roads are more likely to fail. This could prove detrimental to riparian associated species such as torrent salamanders, Dunn's salamander, Pacific giant salamander, tailed frog and two molluscs possibly occurring in the watershed.

An increase in road and culvert failures can be expected if funding for road maintenance continues to decrease. Effects to the aquatic system have been previously discussed. Areas of most concern include debris-flow areas of Hehe, Portland, Nevergo, Delp, Alder and Jones Creeks. These are steep areas prone to road failures. However, land flow areas of Andy and Timber Creeks consist of fine, clay materials. If these areas were to fail, the sediment source would be more detrimental due to increased suspended sediments. Aquatic animals most affected by road failures are also mentioned above.

An Access and Travel Management Plan can help determine which roads could be decommissioned or obliterated. Other efforts to prevent possible failures include cross ditching and/or outsloping roads so they are more self-maintaining and weatherized.

ISSUE 4: LATE-SUCCESSIONAL RESERVES

1. How do current vegetation conditions compare to objectives for Late-Successional Reserves?

The objective of LSRs is to protect and enhance conditions of late-successional old-growth forest ecosystems. They should maintain a functional, interacting, late-successional forest ecosystem.

Almost one-half of the LSR is composed of managed stands, many of which are characterized as having relatively simple stand structures due to management activities. This would include inadequate retention of standing dead and downed coarse woody debris during the harvest phase, pre-commercial thinning, conifer release and commercial thinning tailored to a single species preference, i.e., Douglas-fir. These activities, as well as salvage, have created less diverse stands within the LSR.

Although current conditions are not the best within the LSR as approximately half the area currently exists in low diversity managed stands, allowing stands to develop with some application of silvicultural methods should increase diversity over time. More in-depth silvicultural prescriptions will be addressed in the LSR RO219 Assessment

2. How do current vegetation conditions compare to historic range of conditions for the LSR?

See Chapter 3, Vegetation Current Conditions.

3. What effect would potential management activities in the LSR have on ecosystem components and processes or restoration opportunities?

A more in-depth LSR assessment should identify areas of concern and methods in which activities can be implemented while maintaining consistency with objectives of the Late Successional Reserve.

There is definite need to continue enhancing or improving habitat. Past practices have simplified diversity and reduced interior habitat conditions historically occurring in the LSR. Generally, managed stands are single-storied stands managed to a single species preference, primarily Douglas-fir. Some intervention and stand manipulation will be necessary to fix the direction in which these managed stands are developing. There is need to develop a strategy for increasing diversity and late-successional forest conditions within the LSR. By using low-impact implementation methods, projects should be used which would speed the process in developing late-successional forest conditions, thus increasing stand diversity and improving riparian areas.

4. What is the current status of spotted owls and what are levels of suitable habitat within the LSR?

See Chapter 3, Wildlife Current Conditions.

5. What are conditions of dispersal habitat between this LRS and adjacent LSRs?

See Chapter 3, Wildlife Current Conditions.

6. Are objectives for the LSR and Forest Plan Standards and Guidelines consistent?

Recreation in the watershed, in addition to the current existing road system, conflicts with "maintaining a functional interacting, late-successional forest ecosystem". Roads could be main dispersal barriers for a number of late-successional associated species having small home ranges such as many of the land snails and slugs.

Fire exclusion in the reserve due to fire suppression policy might affect its ability to function and maintain a heathy condition previously maintained through periodic maintenance fires. Fuel buildup could increase the chance of a catastrophic fire event. With stringent air quality standards in the local area, it will be difficult to implement prescribed burning for fuel reduction in high-risk areas. Burning "windows" would be short to meet air quality guidelines. A specific fire management plan delineating prescribed fire activity for fuels reduction and species diversification would be prepared prior to any habitat manipulation. In riparian and late-successional reserves, the goal of wildfire suppression is limiting the size of wildfires. Natural fires burning under prescribed conditions may be allowed to continue burning upon completion of a LSR assessment.

Recreational activities in the LSR could alter movements and behavior of species that would not otherwise be affected. In the past, big game emphasis in the watershed provided habitat by fragmenting the landscape. This provided edge habitat beneficial to contrast species such as elk and deer in meeting foraging and cover requirements. Due to the absence of program harvest in LSRs, its objectives conflict with Forest Plan S & G's in maintaining habitat conditions supporting big game population levels.

ISSUE 5: RECREATIONAL/SOCIAL

Issue 1: How has management direction affected patterns of recreational use and what are expectations for recreational experience and changing social uses?

For the most part, people learn how to act in the forest from their parents or grandparents. "People define the values associated with forest settings (where they may live, work, or play) and their attitudes, behaviors and knowledge of forest systems affect it directly and indirectly. So programs that alter the biological system processes will alter the human system that interacts with it...." and the way in which people perceive forests will affect how that biological system will be altered (Stankey and Clark, 1992).

1. What are effects of land management allocations on recreation and social uses?

What attracted people to forests in the past, continues to draw them today. Tall, majestic trees, abundant green vegetation, easily accessible swimming holes and trails are still found along Fall Creek. Those desiring a social experience tend to have more people at their campsites while those seeking solitude may prefer dispersed sites.

People are often not aware that their actions may conflict with other management strategies; for example, boaters expect Fall Creek to be navigable; anglers expect to catch fish; but fish habitat improvement projects may impede boat use. Without education, people in the forest will continue to engage in conflicting and unacceptable behavior.

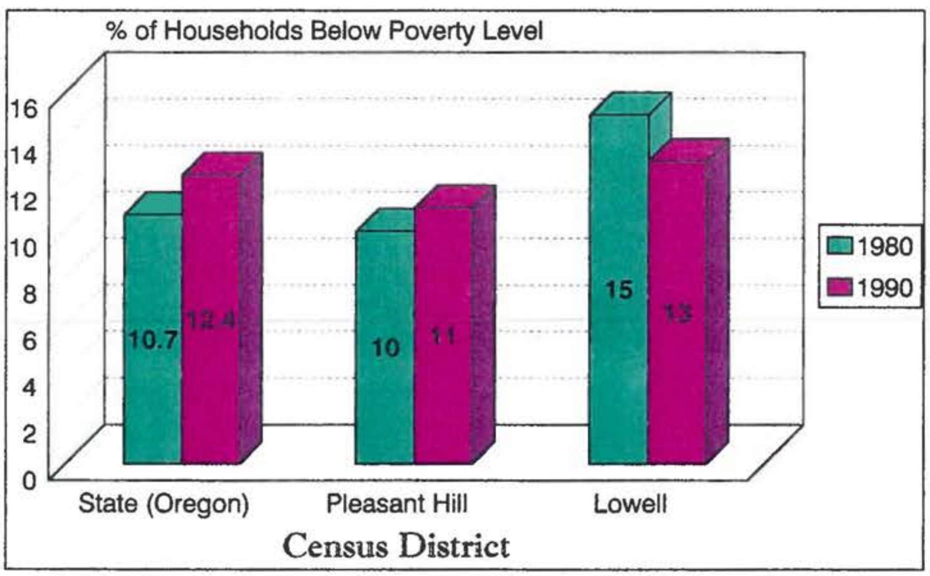
At the turn of the century, the forest was viewed as a workplace, not a place to recreate. When roads expanded providing easy access to the watershed, more people were able to interact with the forest. Today, more people view the forest as a place to recreate, rather than a place to work. which is reflected in the growth of metropolitan areas and the corresponding decline in rural populations. Studies show that "Through the 1980's, Oregon's population grew 8%...(and) all of this growth occurred in metropolitan areas; rural population declined." (SCOPR II-1,1994). A growing number of people appreciate forests more for scenic value rather than for employment or raw materials. For example, the Fall Creek Consensus Group worked with the Forest Service to maintain a no-harvest corridor along Fall Creek.

Creek Consensus Group worked with the Forest Service to maintain a no-harvest corridor along Fall Creek.

There is an increased focus on Special Forest Products (SFP). Long-time gatherers tend to apply for permits and follow regulations (Sonja Weber and John Poet, personal communication). Currently, some "poaching" or illegal harvest of SFP occurs in the watershed. If the number of households below the poverty line continues to grow *(See Figure 20),* SFP poaching as a means of support may increase, given the low levels of Forest Service presence in the watershed. Driven by economics, a growing trend of counties is to gain management of federal lands. To the south, Douglas county voted to control these lands in their area. Continued poor economic conditions may generate more local attempts to manage federal lands.

From 1972-1992, there was a 24% loss of timber and wood product jobs in Lane County (Lowell Oregon Community Assessment, 1995). Soon after the "318" sales in 1990, which provided timber while many timber sales were in litigation, the Lowell Ranger District workforce reflected the decline in timber sector jobs with a dramatic decrease from 115 employees in 1989 to 30 in 1995. A 74% workforce reduction reflects the broader societal demand that the Forest Service reduce its level of timber harvest. Increased interest in SFP is expected, as the Forest Service continues to diversify its resource utilization.

Figure 20. Percentage of Households Below Poverty Level



2. How will this affect recreation opportunities if roads are not maintained or closed?

The effect of road closure on recreational opportunities is currently unknown. Existing upland trailheads would be inaccessible by most older, younger or physically limited people and the cost of trail maintenance would increase. Currently, plans to include Little Cowhorn Lookout in the lookout rental plan are in process, but if roads are not maintained, its access

Road closures would increase the amount of semi-primitive motorized or non-motorized landbase, thus benefiting people seeking solitude or a more primitive experience. Converting roads to trails would provide extended trail opportunities for hikers, equestrians, mountain bikers and off-road vehicles. However, hunters would be impacted by the reduced number of roads available.

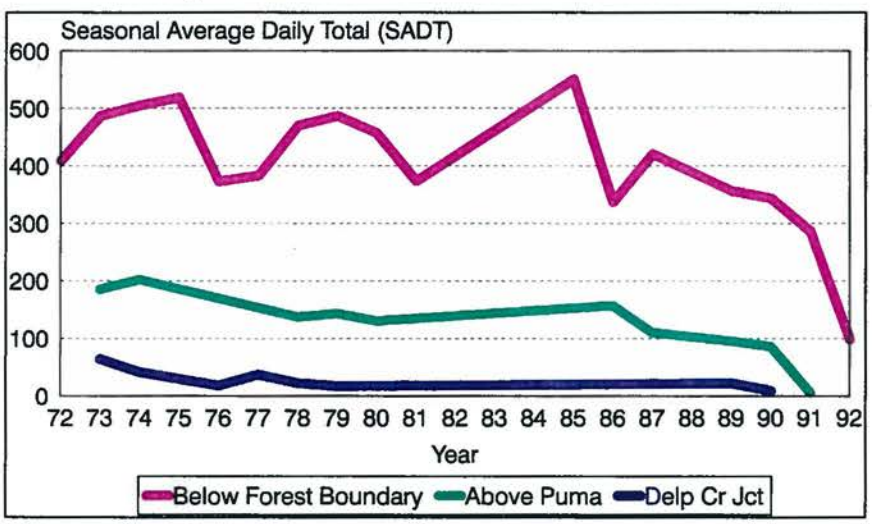
3. What are the educational opportunities to inform people of minimum impact use concepts?

Some opportunities to educate people in "minimum impact" use of the forest are direct contact by recreation technicians in the field and by campground concessionaires Signs can be posted in developed and dispersed sites. Presentations can be made at campfire programs, in classrooms (K-12), youth organizations, outdoor clubs and at District and Supervisor's Office meetings. Brochures can be distributed at the Lane County Fair, U of O outdoor programs office, Lane County Parks and Recreation sites, I-5 rest areas north and south of Eugene, tourist information bureaus, local RV shops and the Eugene RV shows. Public service announcements on local radio and television stations are another effective educational tool.

6. What are the recreational and social uses in the watershed and where are they?

Road use surveys from early 1970's through the early 1990's show much higher traffic levels on the lower portion of Road 18. Even though data is missing for some years, the overall trend is a reduction in traffic over time *(See Figure 21).* In the early 1930's major road construction was related to timber harvest. The new roads increased recreation and hunting access to the watershed, but it is thought that paving Road 18 in the late 1960's increased use of passenger vehicles in the drainage. The 1994 Oregon State Comprehensive Outdoor

Figure 21. Traffic Trends on FS Road 18.



Recreation Plan (SCORP) states "the number one current dispersed recreation activity is sightseeing/driving for pleasure," with non-pool swimming as second.

During the late 1960's, most people used developed campgrounds rather than dispersed sites (Bill Pratt, personal communication). In 1975, dispersed sites were still used primarily for day use (Code-A-Site data, 1975 & '76). Since then, there has been a shift in location and seasonal use patterns. More people, including families with school aged children, are camping in dispersed sites, staying longer and remaining during the off-season (Larry Lassiter, personal communication). From 1975 to 1995, percent of ground cover in dispersed sites has decreased, frequency and impacts of site use have increased, and more sites are used year around *(See Figures 22-24).*

Kayak use did not begin until the late 1970's, when technology replaced home-made fiberglass boats with "plastic" boats. Bruce Mason, who pioneered runs on Fall Creek, mentioned that most people run Fall Creek in the winter when the water is high, although some will boat in late spring as well (as low as 200 CFS), when it's more a "scenic trip than a white water experience". The SCORP states that non-motor boating is the number one desired activity respondents would like to try.

Mountain bike use has exploded since 1990. The Fall Creek National Recreation Trail was not designed nor recommended fo bikes, although bike use is increasing. Most trails in the watershed are steep attracting more advanced riders. Off-road biking is ranked 16th in the current SCORP's recreation participation study, but moves up to 11th in desired activities to try. Trail hiking also moves up from 7th in participating activities to 4th in desired activities to try. Between the SCORP findings and the trend of increasing local populations, trail use is expected to increase.

Homeless people search for a free place to stay, as trying to exist in the city becomes increasingly difficult Most people expect the city and its troubles to stay behind when they enter the forest. Although some people see the forest as an extension of the city and treat it as such, the current trends of late-night parties, drug use, domestic violence, and thefts are not expected or appreciated by most who come to camp. Most people expect to relax, enjoy a slower pace and experience nature. SCORP found that "nature study" is fourth on the list of both current and desired activities.

Figure 22. Impact of Previous Site Use

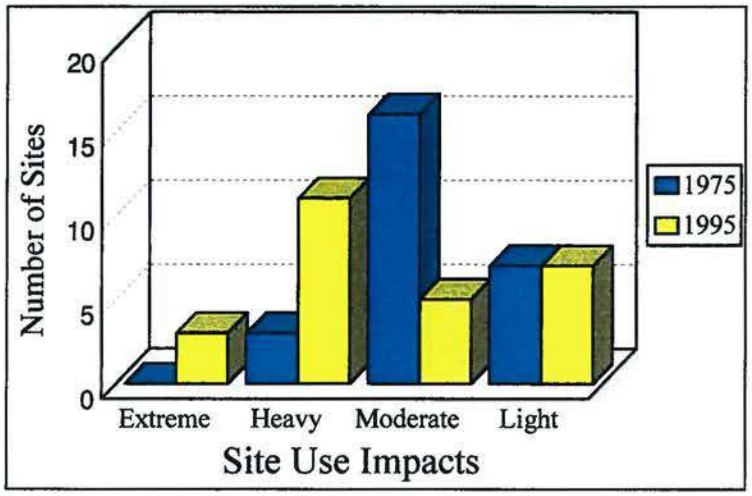


Figure 23. Percent Ground Cover in Dispersed Sites

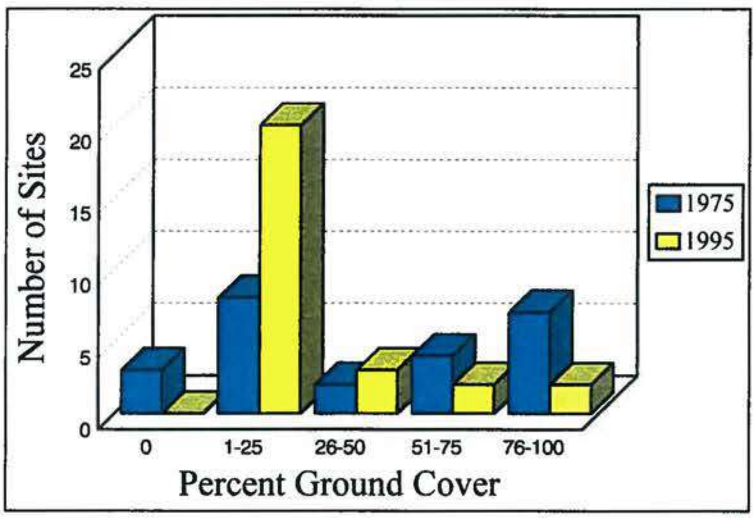
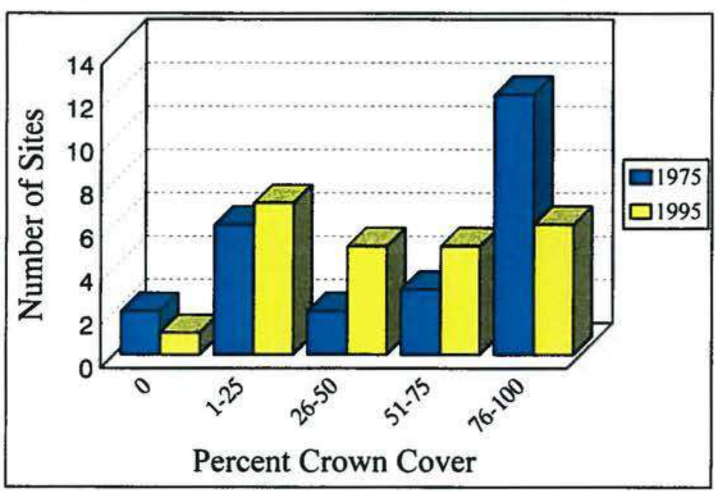


Figure 24. Percent Crown Cover in Dispersed Sites



CHAPTER 5

RECOMMENDATIONS

The purpose of this section is to identify those management activities that could move the system towards reference conditions or management objectives, as appropriate. Following the narrative, Table 40 summarizes recommendations by Issue identified in Chapter Two.

ISSUE 1: THREATENED, ENDANGERED AND SENSITIVE SPECIES

1. ***Unknown Occurrence:*** Continue surveying for sensitive and rare plants and animals to identify their distribution throughout the watershed and determine stability of populations. If management actions might impact populations, recommend mitigation measures follow recommendations in conservation strategies.

2. ***Frasera:*** Analyze the effect of roads on the meadow inhabited by the *Frasera* population. If changes are caused by hydrological events, identify any possible mitigation measures that would restore the hydrologic regime.

3. ***Cimicifuga:*** Analyze the possibility of treatment in the form of complete removal, topping or pruning a few overstory trees to open the canopy and let more sunlight into the population of tall bugbane. This will enhance reproduction and recruitment of the *Cimicifuga* population along Fall Creek.

4. ***Northern Spotted Owls:*** Continue to monitor spotted owls and update status of activity centers within the matrix portion of the watershed. Avoid incidental *"Take"* where possible, based on the latest USFWS Biological Opinion.

5. ***Peregrine Falcon:*** Monitor potential nest sites, assessing the possibility of disturbance detrimental to peregrine occupation. Recommend permanent or seasonal closure of specific roads in the watershed which may influence habitat use through the District Access and Travel Management Plan (ATM). If activity is documented at specific sites, consider improving foraging habitat for prey species adjacent to the site.

6. ***Harlequin Duck:*** Monitor to increase understanding of breeding behavior and habitat selection for nesting and rearing. Assess impacts of recreational use on the Harlequin duck in the highest recreational use areas: mainstem Fall Creek, lower Hehe and Portland Creeks.

7. ***Torrent Salamander and Tailed Frog:*** Survey to expand information about distribution of the two torrent species that can potentially occur within the watershed. Protect or enhance riparian areas to benefit this species, especially at seep areas in the headwater of the watershed. Consider road rehabilitation/decommissioning, especially of those roads becoming inaccessible due to low maintenance priorities, which could pose a threat to riparian or water quality.

8. ***Red Legged Frog:*** Survey to determine location and breeding sites within the watershed. Monitor the Ninemile Creek pond and determine the effects of adjacent harvest activity on this site, including increased windthrow into the pond itself. Plant shade species for cover adjacent to the harvest unit.

9. ***Band-tailed Pigeon:*** Survey and monitor the known mineral lick site for occurrence and impacts from human use.

10. ***Northwest Pond Turtle:*** Current conditions indicate that turtles occur in the upper end of Fall Creek Reservoir. Concern is regarding lack of recruitment of young into the lake system. This could be due to predation from native and non-native species and lack of amount and access to suitable nesting habitat. Continue to monitor turtle activity in the upper end of the reservoir using radio telemetry and other observation methods to determine human impacts on turtle nesting and reservoir use.

11. ***Townsend's Big-eared bat and other bat species:*** Protect known cave in the watershed from disturbance and impacts. Survey bridge sites to determine use by all bat species and impacts from human activity.

12. ***Bald Eagle:*** Continue to monitor use patterns of the reservoir and work with USACE and BLM to enhance or maintain nesting habitat adjacent to the reservoir.

Issue 2A: Terrestrial Vegetation

1. Disturbance

Fire: Although fire suppression will continue to protect valuable forest resources and interrupt the natural fire cycle, management techniques which mimic natural fire disturbance should be applied. Use of prescribed fire, given the right circumstances, may be appropriate to manage forest structure and diversity, create fuelbreaks and reduce the risk of catastrophic fire. Use of different harvest treatments should attempt to mimic natural fire disturbances. Keep different levels of retention in regeneration harvests and use various thinning regimes to mimic conditions left after natural fires. These treatments would provide control over stocking levels and fuel loading by manipulating the forest composition and structure.

Underburning or prescribed fire is still in its infancy. More information and research is needed to better understand its applicability and role in the forest ecosystem.

Successional process change: The amount of late-successional forest is below the historic range of variability as a result of timber harvest. Timber harvest has converted stands from late seral to early seral at a faster rate than under natural succession. In matrix land allocation, given the objective of producing commercial forest products, the amount of late-successional forest will continue to decline. Remaining late-successional stands in matrix should be evaluated for their contribution to landscape dynamics and scheduled over time to allow recovery of other stands into late-successional habitat. The decline of late-successional forest in the matrix will be offset by late-successional forest recovery in the no-harvest allocations of the Forest Plan, riparian reserves, and LSRs. Recovery of these stands will take time but is important in bringing the level of late-successional forest within historic ranges. Focus for treatments should be on managed plantations in riparian reserves and LSRs. Priorities would include stands that could acquire late-successional characteristics more rapidly with treatment, or are prone to fire, diseases, winds, or other disturbances. Depending on stand conditions, treatments in riparian reserves would include:

- Stand density management (thinning) to create patches and produce larger diameter trees,
- Creation of gaps to promote multi-storied canopies,
- Development of snags, malformed trees, and coarse woody debris,
- Reforestation for establishment, stocking level maintenance, and species diversity,
- Underplanting to expedite development of stand layering,
- Release advanced regeneration of conifers, hardwoods or other plants,
- Treatments to reduce the risk to insects and diseases, and/or
- Use of prescribed fire to reduce fuel loading and/or risk of catastrophic wildfire.

Thinning prescriptions should encourage development of diverse stands with large trees and a variety of species in the overstory and understory. Prescriptions should vary within and among stands.

Early Seral Conditions over Time: Some general conclusions/recommendations can be drawn from the guilding process used in the watershed. Results indicate that long-term habitat trends for species dependent on early seral conditions are declining in the watershed. The matrix portion would maintain a certain amount of habitat for these species due to continued harvest activity, yet the watershed as a whole would not have the habitat currently available. It is recommended that population trends within the entire range of these species be evaluated to identify any species that could become at-risk.

Windthrow: Although windthrow is not a major problem within the watershed, it will continue to occur along the "high contrast" edges of harvest units. Forest susceptibility to windthrow will remain high given riparian reserve requirements, green tree retention, wildlife trees, and large woody debris. Careful planning and implementation will be needed in the placement of dispersed trees and green tree retention areas. Retention trees should be feathered along riparian reserve edges, and located to minimize exposure to prevailing winds. Topping portions of the live tree crown may be necessary to reduce the risk of windthrow.

2. Altered Landscape Patterns

Fragmentation: The late-successional forest in the watershed is highly fragmented from the cutting patterns of previous timber harvest and it will take decades to change the landscape. Any future timber harvest should attempt to mimic natural fire patterns by creating larger patch sizes and openings on upper slopes and ridges with high snag intensities. This can be accomplished by increasing the size of patches and aggregating new harvest units adjacent to existing plantations, better known as the "minimum fragmentation" approach. Dispersal corridors should also be maintained by using various management techniques such as scheduling stands for treatment over time, using different retention levels in regeneration harvest systems, and accelerating the development of dispersal and late-successional habitat in managed plantations. Areas of highest priority would be Fall Creek, Winberry Divide, main Fall Creek corridor to Wagon Wheel Pass, and along Alpine Ridge.

Loss of connectivity:

- Consider increasing the effectiveness of the mainstem Fall Creek corridor for wildlife dispersal/movement/migration. This might include silvicultural activity in managed stands within riparian reserve boundaries along the creek. The upper end of the drainage would be a priority due to higher fragmentation. If further monitoring indicates a serious conflict between human and wildlife use, such as impacts to the Harlequin duck, consider restricting recreational activities in these critical areas.

- Consider decommissioning roads which potentially disrupt wildlife movement by use of the District ATM. Priority areas for such closure should be roads in the LSR, riparian reserves and those located in saddles which serve as natural "funnels" for wildlife migration and dispersal. Examples include:

  1) Wagon Wheel Pass
  2) 1912/1839 Juntion, at the upper end of Delp Creek
  3) 1821/1821-199 Junction

- Maintain an intact connective corridor between the Fall Creek watershed and adjacent Winberry Creek watershed. The Andy Creek drainage provides good access through the low divide between Timber Butte and Saddleblanket Mountain, and should be considered a priority. This would provide an intact north/south corridor connecting the Little Fall Creek, Big Fall Creek and Winberry drainages through Slick/Bedrock/Andy Creek. These areas offer an opportunity to enhance potential dispersal habitat in managed stands through standard silvicultural practices of stand density management. Late-successional stands in this area could also be designated as a lower harvest priority until adjacent stands develop into dispersal habitat. As managed stands develop adequate dispersal conditions, current late-successional stands could be considered for harvest, perhaps with higher green tree retention requirements or other alternative prescriptions. As specific project planning is implemented in this area, more site-specific recommendations could be based on stand harvest priorities.

3. Stand Structure

All managed plantations within the watershed were established under management regimes guided by the goal to produce an optimum and sustainable yield of timber. These intensive management regimes consisted of a series of treatments to guarantee reforestation, species composition, stocking levels, and stand growth and development. The goals and objectives for the majority of these plantations have now changed under the Northwest Forest Plan. Approximately 53% (18,896 acres) of the plantations are in the LSR, 17% (5,912 acres) in riparian reserves, and 29% (10,299 acres) are in matrix. Treatment objectives for the LSR and riparian reserves focus on development of late-successional forest characteristics and prevention of large scale disturbances by fire, wind, insects, and disease, which would destroy or limit their ability to sustain viable populations. Treatments in riparian reserves are further guided by objectives established in the Aquatic Conservation Strategy. Treatments should focus on:

- developing multi-species and multi-layered assemblages of trees,
- moderate to high accumulations of snags and large downed logs,
- moderate to high canopy closure,
- moderate to high numbers of trees with physical imperfections such as cavities, broken tops, and large, deformed limbs, and
- moderate to high accumulation of fungi, lichens and bryophytes.

The appropriate types of treatments for development of late-successional forest characteristics have been discussed in the previous section, under this Issue.

Objectives for the matrix are very similar to those of the original plantations. These objectives include commercial wood production; maintenance of old-growth components such as snags, downed logs, and relatively large green "leave" trees at moderate levels; and increasing diversity by providing early seral habitat. The full "tool box" of silvicultural treatments is available to meet these objectives and the appropriate treatments are discussed in the Forest Plan and Northwest Forest Plan.

4 & 5. Changes in Habitat Diversity and Noxious Weeds

- Attempt to restore species composition and reduce fragmentation of special habitats. Continue noxious weed surveys to identify sites in meadows and other areas where weeds may be outcompeting natives, in order to prioritize introduction of biological control agents. Emphasize prevention to keep new invaders from spreading into the watershed. Include blackberries and reed canary grass in riparian surveys to determine the extent to which they have taken over.

- Use prescribed fire, girdling and selective harvest methods to restore mesic and dry meadows to their natural size and species composition. Analyze the effectiveness of this technique in controlling noxious weeds at these sites. Sites should be analyzed at the project level and prescriptions written in SIA or Special Wildlife Habitat Management Plans.

- Consider closing and/or decommissioning roads which affect the hydrologic regime of mesic and wet meadow habitats and act as main travel routes for weeds through ATM and/or SIA Management planning. Continue collecting and propogating native species (both grasses and herbs) for use on decommissioned roads.

- Continue to classify and determine management effects on special habitats during project level planning. Prescriptions for those habitats affected by timber management or roads should aim for restoration of said habitat.

6. Big Game Habitat

With the changes in management emphasis, there is concern that the current modeling/habitat effectiveness indices used are not representative of habitat trends.

- Re-evaluate big game emphasis areas in the watershed. At the Forest level, work with ODFW to determine future concerns and trends in big game population levels.

Modeling results point out a few areas of concern, especially in the Lower Fall Creek area. Open road densities are still above the Willamette N.F. S&Gs by varying amounts.

- Recommend considering further closures (temporary and permanent) in Andy, Rubble, Timber, and Boundary Creeks using the District ATM.

- Maintain or increase forage in these drainages either by regeneration harvest or maintenance of permanent foraging areas.

- Maintain special open habitat areas throughout the watershed for forage, especially in the Upper Nevergo Creek and Upper Fall/Briem Creek areas.

7. Marten/Pileated Network

As addressed in *Chapter Three, Current Conditions*, the marten/pileated woodpecker network includes approximately 1174 acres within the matrix portion of the watershed. A screening process established that it is not essential to maintain the current network in this watershed due to lands currently set aside. The dendritic stream nature of the watershed provides marginal but adequate habitat for marten and pileated woodpecker utilization and dispersal within the matrix. The concern with this strategy is that the riparian reserve network, as depicted from GIS mapping, is an elaborate system of narrow, linear "polygons". In many instances this network might not provide quality interior habitat for the safe movement and dispersal of larger terrestrial organisms. The quantity of habitat is adequate but the quality and arrangement might not meet the needs of these species. The exposure of abrupt riparian reserve edges by regeneration harvest practices, could alter their effectiveness as dispersal habitat due to increased windthrow along these edges and overall lack of optimal interior forest. As interim riparian width strategy is implemented, monitoring should be geared toward evaluating the effectiveness of this strategy. Retention of large intact blocks of late-successional forest habitat is important in combination with a major portion of the riparian reserve network. Some adjustments to Class IV and intermittent riparian reserve boundaries could be made, supplimenting retention of more intact interior blocks of matrix habitat to better serve the dispersal and refugia needs of many wildlife species. Also, larger openings of early seral conditions could be created through silvicultural prescriptions, mimicing more natural disturbance patterns.

8. *Special Forest Products*

- Balance customer service with avoidance of adverse impacts to any C-3 species (mosses, liverworts or lichens) in LSR or riparian reserves.

- In matrix, offer commercial harvest permits in timber sale areas.

- Monitor compliance with permit requirements in the LSR and riparian reserves to determine whether illegal harvest continues in Fall Creek. If so, consider an educational program explaining the effects of harvest on the resource.

9. *Northwest Forest Plan Table C-3 Species*

- Conduct surveys to determine which C-3 species occur in the watershed and manage for these species even though their distribution is not documented.
- Use mitigation measures outlined in *Chapter Three, Current Conditions,* to ensure survival of C-3 species, especially in matrix and riparian areas not providing adequate dispersal corridors and interior habitat.
- Consider survey and manage species when working in riparian areas. Consider retention of a diversity of tree species and maintenance of the diverse structural components (snags, downed woody material).
- Evaluate the use of prescribed burning in maintenance and/or enhancement of *Allotropa* habitat.
- If a "hot spot" for any group of survey and manage species is locted within the watersed, consider special land use designations such as mycological or bryological SIA.

ISSUE 2B: RIPARIAN VEGETATION

1. *Riparian seral condition outside HRV*

Since a substantial amount of the riparian reserve network has been impacted by past management activities, additional vegetation manipulation could promote development of desirable characteristics in managed stands within riparian reserves. These projects could increase the rate of development of late-successional forest conditions and assist in attainment of Aquatic Conservation Strategy (ACS) objectives. High priority riparian reserves for overall aquatic maintenance and enhancement consist of those areas with the best riparian condition *(See Chapter 4, Table 36)*. However, since these areas are thought to have healthy riparian stands, second priority areas (those in poor condition) would benefit most from riparian silviculture projects. The latter include the following drainages: Timber, Andy, Boundary, North Fork Fall, Hehe, Logan, Portland, and Nevergo Creeks. *Table 38* lists activities which could occur in riparian reserves and would be consistent with attainment of ACS objectives. Included in this list are projects that would have a beneficial effect on aquatic and riparian resources by promoting the development of desired conditions at a faster rate than if left untreated.

It is recommended that interim widths for riparian reserves be maintained as stated in the Northwest Forest Plan. Riparian reserves provide dispersal and connective habitat for terrestrial animals and plants as well as protection of aquatic resoruces. The Northwest Forest Plan states that post-watershed analysis riparian reserve boundaries for permanently flowing streams should approximate the boundaries prescribed in the associated standards and guidelines (page B-13). The Northwest Forest Plan indicates that post-watershed analysis riparian reserve boundaries for intermittent streams may be different than the interim widths prescribed in the S&Gs. Adjustments to interim riparian reserve boundary widths, while ensuring attainment of ACS objectives and providing terrestrial habitat connectivity, were considered; however information supporting such adjustments was inadequate.

Due to the scope of this analysis, it is recognized that site-specific project analysis could reveal circumstances requiring consideration for modifications to the interim riparian reserve widths. If site-specific project analysis determines a necessity for deviation from the interim riparian reserve widths, the rationale for these deviations must be documented and demonstrate that ACS objectives and terrestrial habitat connectivity would not be adversely affected.

*2. **Roads adversely affect riparian dispersal by creating barriers***

There are high road densities throughout the watershed (483 total miles). A substantial portion of these roads (150 miles or 31%) occur within riparian reserves. Associated with these roads are numerous creek and channel crossings with culverts providing continual water flow. This could have major impacts on wildlife movement and dispersal. For example, culverts create barriers to dispersal of aquatic salamanders requiring water for movement/dispersal. Road surfaces could present barriers to some smaller organisms reluctant to move across a dry, non-forested environment.

It is recommended that roads in riparian reserves be evaluated to determine which are necessary for continued access to the district. Non-access roads should be assessed to determine impacts on wildlife movement/dispersal. Subsequent decommissioning or culvert replacement (for improved passage of aquatic animals) should be implemented where indicated.

ISSUE 3: AQUATIC HABITAT

The Aquatic Conservation Strategy in the Northwest Forest Plan explains that watersheds in the best condition should receive the highest priority for increased protection and for restoration projects (pg. B-9). This analysis has determined that drainages tributary to Fall Creek in the best condition include: Slick, Bedrock, Saturn, Platt, Briem, and Clark Creeks. Riparian vegetative condition and stream temperatures are generally good within these drainages. Therefore projects enhancing other aquatic parameters in these areas should receive a higher priority (e.g. potential sediment source areas associated with roads).

Areas of second priority for restoration would be those in the worst condition. These areas are delineated in *Issue 2B: Riparian Vegetation*, this Chapter, indicating highest priorities for silviculture restoration projects. Instream structure projects and road/culvert upgrade or obliteration projects are prioritized below.

1. LWM Low within Stream Channels

Install stream structures in areas devoid of large woody material; however, this material should be placed with little or no tie-down. Many log and boulder structures were tied down within the watershed; additional untied structures with rootwads should be added to the watershed in limited amounts. Andy Creek is an area identified as a lower gradient stream in need of large woody material. The low gradient would be conducive to placing structures without tying them down. Continue monitoring instream structure projects.

2. Tiedown LWM Conflicts in Fall Creek

Reassess instream projects in Fall Creek. This watershed analysis has shown that habitat in Lower and Middle Fall Creek is in good condition due to deep pools and bedrock shelves. Habitat limitations in this part of Fall Creek are primarily due to high water temperatures. Therefore instream structure placement would not improve aquatic conditions. Instream projects may also conflict with other users such as kayakers and swimmers. Structures of obvious human construction may conflict with the scenic views some recreationists expect in Fall Creek. In addition, if logs were tied down with cable, maintanence of the structures would be mandatory, since failure may expose cable to boaters and other recreationists and create safety hazards.

3. Sedimentation

Slope failures due to timber harvest and road building are found throughout the watershed. Debris flow areas tend to be more prone to these events. Such failures need identification and restoration where possible. Areas are prioritized below:

1) *Hehe Creek drainage:* This area has many existing failures and the creek has been impacted by fine sedimentation due to road failures and fires. Limiting fines entering the system would enhance the instream structures installed in Hehe Creek.
2) *Delp Creek:* This tributary also has many existing slides; however, the instream large wood component and riparian condition is relatively healthy.
3) *Nevergo, Upper Portland and Alder Creeks:* Portland and Alder have had many instream structures installed. Limiting fines from slides due to road or harvest units would enhance the restoration work already completed.
4) *Jones Creek:* Upper Jones has several road-related slides that would benefit from some type of restoration.

Roads known to be sediment sources or without funding for maintenance should be decommissioned, obliterated or weatherized so they are self maintaining. Bin walls can also be installed where specified. Roads of particular concern are 1832 in Hehe Creek and 1832-343 in Blowout Creek. The landing on 1832-341 should also be obliterated. When conducting an Access and Travel Management Plan objectives from the Northwest Forest Plan and the Aquatic Conservation Strategy should be included.

Culvert failure may occur if culverts are not sized correctly or if maintenance is reduced. Culverts in danger of failing should be replaced so they can accomodate a 100-year event. Culverts surveyed in Portland and Hehe Creeks A survey was completed in Portland and Hehe Creeks and culverts needing replacement are listed in *Table 39* at the end of this Chapter.

The remainder of the watershed requires survey. Priority areas are similar to Items 1-4 listed above.

Types of road surfacing and amount of use can influence the quantity of fine sediment entering streams. Poor aggregate road surfacing should be identified throughout the watershed. Enhancement includes restricting use, resurfacing, reconstructing, decommissioning or stabilizing the aggregate. Again, priority areas would be similar to the ones stated above.

4. Maintain or Enhance Possible Cold Water Tributaries

The Northwest Forest Plan indicates the need to identify possible cold water refugia areas and to further enhance and protect those areas from habitat degradation. Possible cold water refugia locations were based on the riparian condition. These have been broken into three levels: the primary and best condition includes Slick, Bedrock, Clark, Platte, Briem and Saturn Creeks; secondary are Jones, Rubble and Gales Creeks; and Upper Alder and Delp Creeks are tertiary. These drainages should be surveyed to identify potential upslope enhancement projects that would further enhance aquatic habitat. Such projects may consist of riparian silviculture, road decommissioning or upgrading and culvert replacement. Riparian reserves should be maintained to their fullest widths.

5. High Stream Temperature

High stream temperature has been a concern in the Fall Creek drainage; however, it has improved over time. Riparian reserve width should be maintained throughout the watershed to assist this trend.

6. Unnatural Migration Barriers

Opportunities exist to increase connectivity in the aquatic system by eliminating upstream migration barriers to fish. Many culverts within the watershed do not allow upstream fish passage. This condition has created isolated resident populations of fish and eliminated fish from some reaches containing suitable habitat. Restoration projects allowing fish passage should be prioritized by the amount, quality and significance of habitat available to migrating fish.

Replace the identified culverts in Portland and Hehe Creeks from the survey *(See Table 39).* Inventory the remainder of the watershed.

7. Anadromous Fish

Numbers of salmon and steelhead returning to the entire Willamette River system are dropping. However, the anadromous fishery in Fall Creek appears to be improving due to changes in drawdown during smolt outmigration. Cooperation with Oregon Department of Fish and Wildlife and Army Corps of Engineers should continue.

8. Facilities Located in Riparian Reserves

Assess recreation areas for erosion concerns within the riparian reserves. These areas should be stabilized to reduce fine sediment input to streams. Bedrock Campground is a known site in need of such enhancement.

ISSUE 4: LATE-SUCCESSIONAL RESERVES

The main intent of the Late Successional Reserve is to maintain a functional, interacting, late-successional forest ecosystem. There is a concern about conflicts with other uses in the LSR, such as recreation and road use/maintenance. Realizing that roads, trails and associated activities will continue in the future, the following recommendations are mitigation measures for this presence:

1. ***Road Density:*** Consider road closures throughout the LSR, while meeting multi-resource demands. These would be dead-end roads with low maintenance priority and potentially high resource impacts, if left open. A high priority closure to benefit wildlife would be the Briem/Platt Creek area (Road 18-365). Recommendations for road closures should be addressed in the District Access and Travel Management Plan.

2. ***Young Managed Plantations:*** Recommend silvicultural prescriptions that would enhance late-successional forest habitat within the LSR. Prescriptions would address:

    - Development of old-growth forest characteristics including snags, logs on the forest floor, large trees, and canopy gaps enabling establishment of multiple tree layers and diverse species composition, and

    - Prevention of large-scale disturbances by fire, wind, insects, and diseases that would destroy or limit the ability of reserves to sustain viable forest species populations.

    Priority stands would be identified in a more detailed Late-Successional Reserve Assessment.

3. ***Public Awareness:*** Provide interpretive signs along main Fall Creek addressing the current allocations within the watershed, with emphasis on the Late-Successional Reserve. Use a variety of methods to educate people before and during their visit to the watershed.

4. ***High Fuel Loading:*** Develop a Fire/Fuels Management Plan for the LSR. This should be incorporated into the Late-Successional Reserve Assessment.

ISSUE 5: RECREATION/SOCIAL

As the state population continues to increase and more people are expected to recreate outdoors (SCORP), it is recommended that the Lowell District continue to be proactive in managing the recreation resource. With monitoring information, the District can focus on areas requiring attention. Developing different methods to reach and educate forest users should reduce on-site infractions and increase user satisfaction and pride in their National Forest. Like all resources, forests are a function of socio-cultural appraisal; their apparent usefulness a reflection of societal perception. Hence the meaning and value of forests change over time and space (Stankey and Clark, 92).

1. ***Unsanitary site conditions***

- Monitor levels and location of occurance.
- Contact people at dispersed sites and demonstrate proper waste disposal methods; leave brochure if site is occupied, but no one is present.
- Analyze and implement corrective actions at heavily impacted sites. This could include closing the site temporarily or permanently; installing a temporary or permanent toilet; ticketing the offenders and charging them for clean up; or other management actions.

2. ***Increased recreation traffic***

- Monitor impacts to dispersed sites and trails.
- Rip and replant compacted areas of heavily impacted sites and repair trail sections identified in monitoring program.
- Contact users before they enter the watershed about minimum impact actions they can use to reduce damage.
- Analyze and implement actions to correct loss of vegetation, site compaction or erosion. These could include ripping and revegetating heavily impacted sites; temporary (during the wet season) or permanent closure; day use only; limitation on the length of site visits; signs or other methods of outreach on minimum impact camping techniques; site hardening or other management actions.

3. ***Restriction of access (road closure)***

- Analyze impacts to public and involve them during the ATM process.
- Write management guides for the Fall Creek viewshed, and Special Interest Area.
- Locate partners to help maintain roads, for example selling roadside alder blocking roads to purchasers for use in commercial mushroom production.
- Closed roads may be converted to trails for hikers, equestrians, mountain bikers and off road vehicles.

4. *Harvest Cycles*

Rehabilitation projects can utilize appropriated funds to accomplish management objectives. To better understand the complex relationship between the forest, the watershed, the Lowell Ranger District, local communities (Lowell, Pleasant Hill, Dexter, Eugene and Springfield) and their economic interdependence, a social assessment should be completed. This is best accomplished in a broad-scale analysis, at the Providence level.

5. *Adjacent land owners*

Initiating dialogue with adjacent and inholding land owners is good business. Trust can go a long way towards building partners in improving and maintaining the watershed.

The following table summarizes activities which may occur in Riparian Reserves. All projects must be consistent with the "Aquatic Conservation Strategy" (ACS) developed in the Northwest Forest Plan. The most important criteria for activities is maintaining or enhancing and not retarding or preventing attainment of the ACS. Activities listed below are based on the Northwest Forest Plan (FSEIS) or are recommendations from the watershed team (REC).

Table 38. Acceptable Management Activities in the Fall Creek Watershed

ACTIVITY	FSEIS	REC	COMMENTS
SALVAGE	☑		When catastrophic events degrade riparian conditions; If site-specific CWD requirements are met; Apply silvicultural practices needed to attain ACS; *Site specific NEPA is required.*
LOGGING SKYLINE CORRIDORS		☑	No closer than 200 feet; No wider than 20 feet; Trees cut must be left; *Site specific NEPA required.*
CABLE YARDING TAILHOLDS/ GUIDELINES		☑	No closer than 25 feet of the stream channel or above the break in slope; *Site specific NEPA required.*
CREATING/MAINTENANCE OF WATERSOURCES, (PUMP CHANCE)		☑	Allow for upstream mitigation and fish; Remove temporary structures at end of season; *Site specific NEPA required.*
FUEL TREATMENT		☑	Prescribe burning in native stands; Fuel reductions in managed stands(i.e., handpiles); Meadow maintenance; *Site specific NEPA required.*
NOXIOUS WEED TREATMENT		☑	
ROAD CLOSURES OR RECONSTRUCTION	☑		*Site specific NEPA required,* and/or ATM Plan.
ROCK QUARRY CONSTRUCTION		☑	Cannot occur in the riparian reserves.
ROCK QUARRY REHAB/CLOSURE		☑	*Site specific NEPA required.*
EROSION CONTROL-SEED AND FERTILIZATION		☑	Use native species, wherever practical.
ROADSIDE WASTING	☑		Restrict sidecasting as necessary to prevent the introduction of sediments into stream.
COMMERCIAL THINNING	☑		♦ Apply silvicultural practices for desired vegetation characteristics needed to attain ACS objectives (FSEIS, TM-1, C, pg.C-32). ♦ 25-50' no-thin buffer; Variable density 50-300"; Target areas with low CWD and overstocking; Maintain tree species diversity. ♦ Consider fire/landscape effects when planning no-thin areas; Retain all existing snags and down logs; Leave at least 2 trees per acre for CWD of the DBH class thinned; Minimum canopy closure should be approx. 50% of post-thin; *Site specific NEPA required.*

Table 38 *(continued)*. Acceptable Management Activities in the Fall Creek Watershed

ACTIVITY	FSEIS	REC	COMMENTS
PCT/YOUNG STAND DENSITY MANAGEMENT AND RELEASE		☑	Retain streambank trees; 25' no-thin on at least 20% of Class IV stream miles w/in a project area or w/in each watershed to provide heterogeneity of the landscape; Retain all hardwoods and yew; *Site specific NEPA required.*
PLANTING AND UNDERPLANTING		☑	Maintain diversity of tree and plants species for nonvascular epiphytes; *Site specific NEPA required.*
COLLECTION OF RESTORATION MATERIALS.		☑	Native species.
COLLECTION OF SPECIAL FOREST PRODUCTS			Cannot occur in the riparian reserves.
ROADSIDE MAINTENANCE	☑		See FSEIS, RF-2, a-g, pg.c-32
ROADSIDE BRUSHING		☑	*Site specific NEPA required.*
WILDLIFE TREE CREATION		☑	Retain tops on site; *Site specific NEPA required.*
IN-STREAM ENHANCEMENT PROJECTS	☑		Improve stream habitat and channel condition; Evaluate short-term impacts vs. long term benefits; *Site specific NEPA required.*
BROWSE CUTBACK/RELEASE OF TREES		☑	Maintain diversity of species and enhance structure for epiphytic nonvascular species; *Site specific NEPA required.*
FERTILIZATION-AERIAL		☑	Timing of application; rehabilitation purposes; keep out of open water; *Site specific NEPA required.*
FERTILIZATION-GROUND		☑	Timing of application; rehabilitation purposes; keep out of open water; *Site specific NEPA required.*
ANIMAL DAMAGE CONTROL		☑	*Site specific NEPA required.*
PRUNING		☑	No pruning w/in 50' of water and reduce prune stocking; *Site specific NEPA required.*
TRAIL / CAMPGROUND MAINTENANCE	☑		*Site specific NEPA required.*
TRAIL CONSTRUCTION/ RECONSTRUCTION	☑		*Site specific NEPA required.*

ATM and General Transportation Recommendations

Currently there are approximately 481 miles of road in the Fall Creek Watershed. At one time the Lowell Ranger District constructed about 12 miles of road per year, of which 60% were in the watershed. At present, no roads are being built and there are no plans to construct any within the next three to four years. Historically, the major use pattern has been one of 70% industrial (logging) and 30% public use (primarily recreation). These patterns are now reversed, with a public use of about 70%. Most of this is within two miles of the watershed edge, with a flurry of activity in the higher elevations during hunting season. Commercial use is expected to increase as logging resumes, but commercial use will never reach previous levels, while recreation use should grow reflecting the growth of nearby communities.

Road Management Objectives are currently in place for most roads owned by the Forest Service within the watershed, but these are outdated due to reallocation of land in the current Forest Plan (as amended by the Northwest Forest Plan). The RMOs address repeated access for the critical vehicle, currently listed as large yarders. This is no longer true, especially of land contained within the Late-Successional Reserves. Today the critical vehicle is a small self-propelled mobile yarder.

The Transportation Management System (TMS) database was field verified for the watershed analysis area and matches well with the GIS "Tran" layer. Much of the data within TMS is not geographic, however, and requires verification with current use trends and anticipated future requirements.

In the early 80's, an inventory of all-wheel track roads within the watershed was conducted under the direction of Emergency Directive Ten. At that time the District proactively identified roads required for future management, and they were added to the system. Other roads were closed or decommissioned. Few wheel track roads are left unmanaged within the watershed, but roads previously converted to system roads may no longer be required.

Road maintenance has decreased directly with the reduction in commercial use. Though maintenance records on specific roads were not kept, road maintenance budgets in general have been reduced to approximately 20% of historic levels. This cutback in funding resulted in a corresponding reduction in road maintenance. Previously, roads were maintained each year; some above their required maintenance level. Currently no roads are maintained above their assigned level, and it is thought that few, if any, are maintained at the level specified in the TMS. This is reflected in the current increase in slough material filling ditches and reduction in road width due to encroaching brush. As brush continues to encroach, these roads will become ever more difficult to access with heavy equipment to perform maintenance, resulting in more plugged drainage structures causing failed culverts and an increase in the amount of sediment delivery to an already stressed stream system. This makes the identification of unnecessary roads more critical and the need for decommissioning more obvious.

Roads requiring immediate attention due to their history of chronic maintenance problems include all or portions of the following:

- Road 1832 above the Hehe Burn (portions of this road continually migrate downslope into the Hehe Drainage.
- 1832-342 and 1832-341
- 1830-405, 1830-407 and 1830-409 roads constructed under the Starlite and Moonshine Sales
- Roads with tendencies toward or currently active landmovements: 1800-365, 1844, 1845, 1839, 1825, and portions of 1835.

Most of these roads are in Late-Successional Reserves and funding for corrective maintenance is not available through the timber sale program. These problem areas should be investigated for repair or decommissioning and submitted to the "Jobs in the Woods" program.

No existing data shows which roads are a concern for continuous delivery of sediment except those in danger of catastrophic failure, listed above. It is known, however, that all roads deliver sediment, and those driven deliver more sediment, especially if constructed from marginal quality rock. An investigation to identify roads contributing to fine sediment problems in streams is recommended.

All areas of the watershed are highly roaded and do not meet the open road density requirements as specified in the Wisdom Model for Big Game. This is true regardless of the area designation (High, Medium or Low Elk emphasis area). Clearly, if we are to meet these requirements, roads need to be decommissioned or closed for a portion of the year.

1. ***Road crossings at fish bearing streams:***

- Identify and improve those stream crossings where fish passage has been eliminated or where crossing is determined to pose a substantial risk to riparian conditions
- Improve the structure so that it will accommodate the 100 year flood including associated bedload and debris.
- Perform a risk analysis on all Class I, II and III stream crossings to determine which crossings pose the highest risk of overtopping and schedule for repair as money becomes available.

2. ***Road surfacing:***

- Identify locations, in riparian reserves, where poor quality aggregate contributes to sediment.

- Where possible, close those roads to use by motorized vehicles. Where vehicle restriction is not practicable, stabilize the rock by surface treatment, or blanket with a layer of high quality rock to provide a non sediment pNorthwest Forest Planucing wearing course. Where roads will be needed for commercial haul, encourage the use of CTI, by financial contributions, to reduce sediment pNorthwest Forest Planuction through rutting and maintenance.

3. ***Drainage structures in non fish bearing streams and ditch relief:***

- Identify where confined drainage is causing unacceptable erosion and correct through the addition of drainage structures, or, where possible, remove the drainage structure and outslope the road to restore natural drainage. If road is to be used for timber haul, identify and repair those places where confined drainages have caused excessive erosion and repair with purchaser credit.

4. ***Road fills and sidecast material:***

- Identify locations through field inventory.

- Where failures are identified, pull back unstable sidecast and fill material.

- Where the road facility is needed for continued access, stabilize through the use of geotextiles and remove the unstable buried woody debris. Where the road is not needed for future management, decommission road after doing material pull-back.

5. ***Stable but unvegetated fill and cut slopes:***

- Identify locations where fill and cut slopes are unvegetated and surface erosion is causing sedimentation problems, particularly in Riparian Reserves. Stabilize the slopes through the use of geotextiles and/or vegetative materials,.

6. ***Wet areas where road construction and the installation of CMP's has consolidated water causing changes in the micro-watershed:***

- Identify locations where this has occurred. Where roads must remain open for public or administrative needs, install additional structures to minimize disruption of natural hydrologic flow patterns, including diversion of streamflow and interception of surface and subsurface flow. Where roads are no longer needed, remove the structure and fill to allow the natural system to recover.

7. ***General Recommendation:***

- Complete an Access and Travel Management Plan for the Watershed to determine which roads are needed for continued access for our public and for administrative uses.

- Store roads with intermittent use in a closed condition. Decommission roads no longer needed to administer the Watershed. Where decommissioning is not feasible, reconstruct the roads so they do not contribute sediment to the watershed.

Table 39: Summary of culvert analysis for Portland and Hehe Drainages.

Road No.	Location	100 Year Storm Overtop Fill	Risk of Overtopping	Fish Passage	Fill Armored	Inside LSR	Priority for Repair
1825	MP 6.71 NEVERGO FK.	YES	HIGH	NO	NO	NO	HIGH
1825	MP 7.08 NEVERGO FK.	NO	HIGH	YES	YES	NO	LOW
1825	MP 7.83 NEVERGO CR.	NO	HIGH	NO	NO	NO	MEDIUM
1824210	MP0.41 NEVERGO FK.	NO	HIGH	NO	NO	NO	MEDIUM
1835	MP 11.93 PORTLAND FK	NO	HIGH	YES	NO	NO	MEDIUM
1835	MP 14.65 PORTLAND FK.	YES	HIGH	YES	NO	NO	HIGH
1835	MP 15.73 PORTLAND FK.	YES	MEDIUM	YES	NO	NO	HIGH
1835230	MP 0.33 PORTLAND FK.	YES	HIGH	YES	NO	NO	HIGH
1835240	MP 2.69 PORTLAND FK.	YES	MEDIUM	NO	NO	NO	MEDIUM
1835241	MP 0.95 PORTLAND FK.	NO	HIGH	NO	NO	NO	MEDIUM
1831	MP 0.63 SUNSHINE CR.	YES	LOW	NO	NO	YES	MEDIUM
1831	MP 0.84 HEHE TRIB.	NO	HIGH	NO	NO	YES	MEDIUM
1831	MP 1.62 HEHE TRIB.	YES	HIGH	NO	NO	YES	HIGH
1831	MP 3.17 HEHE TRIB.	NO	HIGH	NO	NO	YES	MEDIUM
1831	MP 3.93 HEHE TRIB.	NO	HIGH	YES	NO	YES	MEDIUM
1831	MP 4.12 HEHE TRIB.	YES	HIGH	NO	NO	YES	HIGH
1831	MP 6.80 HEHE CR.	NO	HIGH	NO	NO	YES	MEDIUM
1831382	MP 1.14 HEHE TRIB.	YES	MEDIUM	NO	NO	YES	HIGH
1831383	MP 1.35 HEHE TRIB.	NO	HIGH	NO	NO	YES	MEDIUM

TABLE 40: RECOMMENDATIONS

Issue 1: Threatened, Endangered and Sensitive Species

↑= Improving conditions	→= Continuing/No Change
↓= Declining conditions	? = Unknown; Further Data Needed

Findings	Causal Activity	Location	Trend Matrix	LSR	Recommendation
1. Unknown Occurence		Throughout Watershed	?	?	♦ *Data Need:* Maintain or increase survey and monitoring effort
2. *Frasera* habitat	Harvest, Roads	Portland Creek	↓	↓	♦ Restore Hydro Regime/ habitat
3. *Cimifuga* habitat	Succession	Fall Creek	↓	↓	♦ Restore by over-story treatment of three to five trees in each occurrence area
4. Spotted Owl distribution in the Watersheds	Timber harvest, road building and interior forest habitat fragmentation	Throughout Watershed	↓	↑	♦ Enhance LS Forest Components, maintain interior habitat integrity ♦ Maintain and create CWD and snags where site specific analysis determines low levels
5. Impacts to potential Peregrine Falcon habitat	Timber harvest, road building and accompanying disturbance	Identified sites within the Watershed	?	?	♦ Enhance Forage ♦ Reduce disturbance by seasonal road closures ♦ *Data Need:* Increase survey and monitoring effort for this species
6. Harlequin Duck	Timber harvest, roads human use in riparian areas	Fall Cr, Lower Portland Cr, Lower Hehe Cr	?	?	♦ *Data Need:* Monitor to determine effects on breeding and nesting behavior during critical spring months ♦ Recommend mitigation if sensitive areas are found
7. Torrent Salamander. Tailed Frog	Timber harvest and roads	Upper Fall Cr, Nevergo Cr, Delp Cr, Alder Cr	↓	?	♦ *Data Need:* Monitor for presence and disturbance ♦ If found, assess risk of roads to sensitive sites ♦ Mitigate to reduce potential for road failures adjacent to riparian areas
8. Red Legged Frog	Timber harvest	Ninemile pond and other unknown locations	?	?	♦ *Data Need:* Survey other potential sites; monitor the Ninemile pond to determine changes in hydrology regime from timber harvest/road building ♦ Rehabilitate Ninemile pond by planting shade species

↑= Improving conditions	→= Continuing/No Change
↓= Declining conditions	? = Unknown; Further Data Needed

Findings	Causal Activity	Location	Trend Matrix	Trend LSR	Recommendation
9. Band-tailed Pigeon	Human use in riparian areas	Fall Cr	?	?	♦ *Data Need*: Monitor known site to determine human use impact in the area and survey for other sites
10. Northwestern Pond Turtle	Human use in riparian areas & predation by exotic species	Full pool -Fall Cr Reservoir	↓	?	♦ *Data Need:* Work with ACE to determine nest location/use by radio telemetry and monitor impacts from recreational activities in the reservoir ♦ *Data Need:* Determine impacts of exotic species on juvenile turtle recruitment into the reservoir population
11. Townsend's Big-eared Bat and other bat species	Timber harvest and roads	Throughout Watershed	?	?	♦ *Data Need:* Continue to survey and monitor for suitable sites and use of bridges in the watershed. Assess impacts of human use on known roosting/hibernacula sites ♦ Protect and monitor the known cave site
12. Bald Eagle	Human use in riparian areas	Junction of Fall Creek and Fall Creek Reservoir			♦ Monitor BLM BEMA to determine use ♦ Continue to monitor use of the reservoir and implement projects to enhance perch, roost and nest areas.

Issue 2A: Terrestrial Vegetation

Findings	Causal Activity	Location	Trend Matrix	Trend LSR	Recommendation
1. Disturbance					
♦ Interrupted Natural Fire Cycle	Fire Suppression	Throughout Watershed	↓	↓	♦ *Data Need:* Research underburn regimes ♦ Thinning ♦ Prescribe burns ♦ Mimic stand structure with variable density thinning or different retention levels in regeneration harvest units
♦ Successional process change, Late-Successional forest below Natural Range of Variability	Timber harvest	Throughout Watershed	↓	↑	♦ Accelerate late-Successional forest development

↑= Improving conditions	→= Continuing/No Change
↓= Declining conditions	? = Unknown; Further Data Needed

Findings	Causal Activity	Location	Trend Matrix	Trend LSR	Recommendation
Disturbance (cont).					
♦ Loss of early seral conditions over time*	Fire suppression and reduced timber harvest	LSR		↓	♦ *Data Need:* Assess contribution of the watershed to overall viability of early seral associated species
♦ Increased windthrow on edges	Timber harvest, roads	Throughout Watershed	→	→	♦ Feather edges ♦ Minimize exposure ♦ Windproof trees by topping to reduce crown
2. Altered landscape patterns					
♦ Fragmentation of mature stands	Timber harvest, roads and fire suppression	Throughout Watershed	↓	↑	♦ Minimize fragmentation
♦ Loss of connectivity			?	↑	♦ Maintain and enhance dispersal corridors ♦ *Note:* Priority enhancement for dispersal/LS-Forest habitat would be along Alpine Ridge and Fall Creek/Winberry Divide. Maintain or improve late-Successional forest conditions where possible in the Andy Creek drainage. Harvest of late-Successional forest should be a low priority in this area. ♦ Use different management techniques in these corridor areas (vary retention levels and harvest methods)
♦ Smaller Patches			→	↑	♦ Increase patch size by aggregating harvest units with existing plantations
♦ Increased Edge			→	→	♦ Feather edges
♦ Reduced Interior Habitat			↓	↑	♦
♦ Reduced Late-Successional Forest Connectivity to Adjacent Watersheds			↓	↑	♦ Maintain an intact connective corridor between the Fall Creek watershed and adjacent Winberry Creek through the Andy Creek subwatershed; LS harvest should be low priority in this area

* Long-term trend (30-50 years from present)

↑= Improving conditions	➔= Continuing/No Change
↓= Declining conditions	? = Unknown; Further Data Needed

Findings	Causal Activity	Location	Trend Matrix	Trend LSR	Recommendation
3. Less Diverse Stand Composition and Structure	Timber harvest, roads and fire suppression	Throughout Watershed	↑	↑	♦ *Data Need:* Snag and CWD inventories in matrix lands ♦ Lower Fall Creek snag creation in natural stands. ♦ Thinning to create diversity and patchiness ♦ Snag/CWD retention and creation ♦ Underplanting to promote multi-storied stands
4. Changes in habitat diversity					
♦ Species composition	Timber harvest, roads and fire suppression	Throughout Watershed	↑	↑	♦ *Data Need:* Inventory SHAB's to determine effects of management and write restoration prescriptions ♦ Prescribed burning in dry meadow habitats ♦ Closing roads through the ATM process
♦ Habitat Fragmentation			↓	↑	♦
5. Noxious Weed Invasion	Roads, timber harvest	Throughout Watershed	➔	➔	♦ *Data Need:* Inventory roadless areas and meadows for invasion ♦ *Data Need:* Inventory noxious weeds and prioritize intNorthwest Forest Planuction of bio. control agents ♦ Develop non-invasive erosion control seed mix ♦ Prevention measures for invaders (Education)
6. Big game habitat quality					
♦ High open road density		Lower Fall Creek	➔	➔	♦ Identify roads to permanently or seasonally close through the ATM process
♦ Reduced early seral habitat over time, due to reduced regeneration harvest		LSR		↓	♦ Maintain or enhance Special Habitats (natural openings) ♦ Forage enhancement opportunities
♦ Conflict in Management direction for habitat effectiveness analysis/S&G's			➔	➔	♦ Conflict in management direction - Change and update big game modeling parameters to better represent management activities and habitat conditions

↑= Improving conditions	→= Continuing/No Change
↓= Declining conditions	? = Unknown; Further Data Needed

Findings	Causal Activity	Location	Trend Matrix	Trend LSR	Recommendation
7. Current Martin/Pileated network	N/A	Matrix	?		♦ Conflict in management direction - With approximately 79% of the watershed in no harvest allocations and interim riparian widths, current martin/pileated areas should be returned to matrix
8. Special Forest PNorthwest Forest Planucts (SFP's) harvest levels	Harvest activity conflicts with Willamette's Forest Plan Direction	Matrix LSR	→	?	♦ *Data Need:* Monitor compliance with permit requirements ♦ Offer SFP's in association with timber harvest units
9. Northwest Forest Plan Table C-3 Species	Timber harvest, roads and fire suppression	Throughout Watershed	↓	↑	♦ *Data Need:* Survey for C-3 species at the project level ♦ Consider special land designations if "hot spots" are found ♦ Evaluate role of prescribed burning in maintenance of *Allotrope* (Candystick)

Issue 2B: Riparian Vegetation

Findings	Causal Activity	Location	Trend Matrix	Trend LSR	Recommendation
1. Riparian seral condition outside HRV % early seral is high % late seral is low	Timber harvest	Throughout Watershed	↑	↑	♦ Maintain Northwest Forest Plan riparian reserves ♦ Accelerate Late -Successional conditions in riparian areas using various silviculture methods ♦ Tributaries with the poorest riparian seral condition: Timber, Andy, Boundary, North Fork Fall, Hehe, Logan, Portland and Nevergo Creeks. Riparian silviculture projects may enhance conditions. ♦ Recommend evakuation of private land in the watershed. ♦ Work with private landowners to maintain or enhance habitat.
2. Roads adversely affect riparian dispersal- create barriers **See Table XX Chapter 3*	High road density especially in riparian areas	Throughout Watershed	→	?	♦ *Data Need:* Research and monitor roads and their impacts on wildlife movement and dispersal ♦ Reduce road densities through decommissioning consistent with ATM and Northwest Forest Plan objectives

↑= Improving conditions	→= Continuing/No Change
↓= Declining conditions	? = Unknown; Further Data Needed

Issue 3: Aquatic Habitat

Findings	Causal Activity	Location	Trend Matrix	Trend LSR	Recommendation
1. LWM low within stream channels	Timber harvest and salvage	Throughout Watershed	↑	↑	♦ Continue to monitor previous enhancement projects for effectiveness ♦ Restore streams by placement of in stream structures. Recommend no tiedowns for a few structures per mile. ♦ Priority - Andy Creek
2. Tiedown - LWM conflicts with recreation ♦ Unknown impacts to a dynamic system from placement of static structures ♦ Impacts of structures on aesthetics and safety	N/A	Throughout Watershed	↑	↑	♦ Reassess the need for new projects in Fall Creek
3. Sedimentation					
♦ Slope failures	Roads and timber harvest	Throughout the watershed, and specifically: Landing pullback 1832/341; Hehe 1832; Blowout Creek 1832/343	→	→	♦ High priority areas for inventory and restoration work are 1) Hehe Creek 2) Delp/Nevergo/Upper Portland Creeks 3) Alder/Jones Creeks ♦ Specifically decommission/obliterate/install bin walls ♦ Utilize slope failure and culvert inventory information to assess failure impacts to resources
♦ Culvert failure	Size of culvert/reduced maintenance	Throughout Watershed	↓	↓	♦ *Data Need:* Survey watershed for potential culvert replacement. Prioritize based on risk to the resource. ♦ Replace specified culverts identified from Portland/Hehe Creeks inventory that do not meet 100 year event specifications.

♦

↑ = Improving conditions	→ = Continuing/No Change
↓ = Declining conditions	? = Unknown; Further Data Needed

Findings	Causal Activity	Location	Trend Matrix	Trend LSR	Recommendation
• Impacts from roads • See Transprotation Section in Chapter 3 for specific sites	N/A	Throughout Watershed	→	→	• Need to identify where road surfacing is poor quality aggregate • Restrict use or resurface with high quality rock • Decommission • Reconstruct • Resurface • Stabilize the aggregate or immobilize the fines in the aggregate
4. Maintain and enhance possible cold water tributaries	N/A	Listed in order of priority: Slick, Bedrock, Clark, Platt, Briem, Saturn, Jones, Rubble, Gales, Upper Alder, Delp	↑	↑	• *Data Need:* Survey and identify potential upslope enhancement projects
5. High stream temperature	Timber harvest, roads, salvage	Mainstem Fall, Hehe, and Portland Creeks	↑	↑	• Maintain Riparian Reserves
6. Unnatural migration barriers	Roads/culverts	Throughout Watershed	→	→	• *Data Need:* Inventory the watershed to determine barriers • Replace culverts in Portland/Hehe Creeks that have previously been identified as barriers *(Refer to Transportation report at the end of this Chapter)*
7. Anadromous Fish	Fall Creek Dam	Fall Creek	→	→	• Continue cooperation with ODFW and ACE
8. Facilities are located in riparian reserves	Human use in riparian areas	Mainstem Fall Creek	→	→	• Mitigate sedimentation from recreation sites

↑= Improving conditions	→= Continuing/No Change
↓= Declining conditions	? = Unknown; Further Data Needed

Issue 4: Late-Successional Reserves

Findings	Causal Activity	Location	Trend Matrix	Trend LSR	Recommendation
1. High road density within LSR	Roads	Throughout LSR		→	♦ Prioritize closure and/or decommission/obliterating during LSR assessment/ATM process
2. High percent of early seral stands that lack structure and diversity	Timber harvest and fire suppression	Throughout LSR		↑	♦ Prescriptions for young managed stands to move toward Late Successional forest
3. Need for public awareness/interpretati on	N/A	Throughout LSR		↑	♦ Interpretive techniques explaining the purpose of the various land allocations within the watershed. Should be focused along main Fall Creek in high use areas.
4. High Fuel Loading	Fire Suppression	Throughout LSR		↓	♦ Identify and prioritize stands for fuels treatment to reduce fuel loadings above natural conditions

Issue 5: Recreation/Social

Findings	Causal Activity	Location	Trend Matrix	Trend LSR	Recommendation
Human Activity					
1. Unsanitary site conditions (potentially health related)	Human use	Riparian Reserves	↓	↓	♦ *Data Need:* Monitor use ♦ Education in proper human waste disposal ♦ Mitigate the heavily impacted dispersed sites ♦ Ticket and require clean up

↑= Improving conditions	→= Continuing/No Change
↓= Declining conditions	? = Unknown; Further Data Needed

Findings	Causal Activity	Location	Trend Matrix	LSR	Recommendation
2. Increased recreational traffic (especially during wet season in dispersed sites)	Human use	Riparian Reserves	↓	↓	♦ Rehabilitate vegetation/compaction on heavy use sites ♦ Monitor use/impacts ♦ Educate for minimum impact camping/trail use ♦ Harden sites for use to decrease sedimentation /site degradation ♦ Close sites/trails ♦ Limit number of days/length of stay ♦ Day use only
3. Restriction of access	Road Closure	Throughout Watershed	↓	↓	♦ Address in ATM (Public involvement) ♦ Prepare management plan for Fall Creek Special Interest Area ♦ Find partners for maintenance ♦ Convert roads to multi-purpose trails
4. Harvest Cycles	Change in management direction	Throughout Watershed	→	→	♦ Appropriated funds directed towards rehabilitation projects ♦ Conduct social assessment ♦ Continue use of LA's in Harvesting/treating hazard trees
5. Adjacent landowner	N/A	Downstream and inholdings	N/A	N/A	♦ Create partnerships ♦ Consider inholding acquisition or exchange

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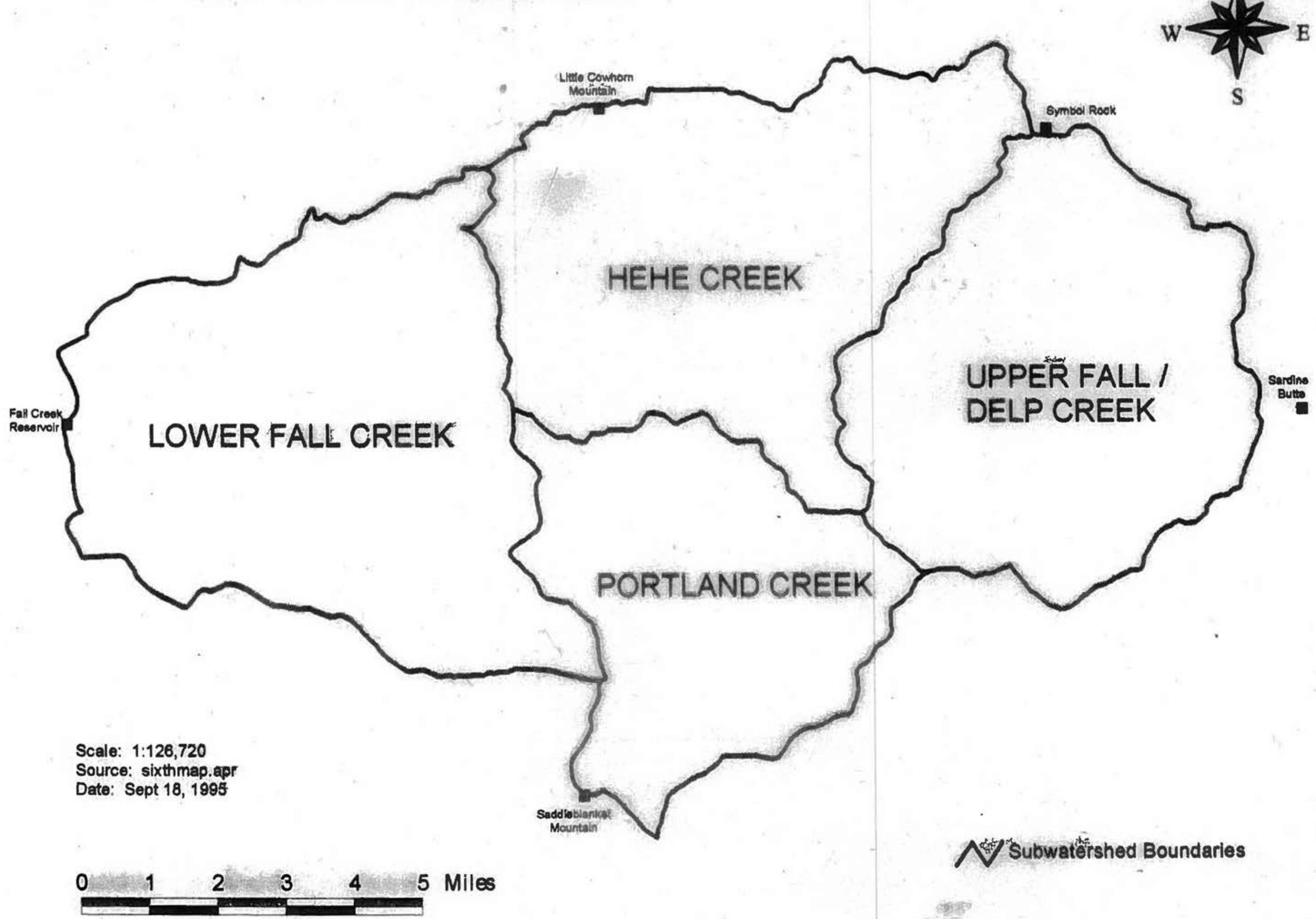
FALL CREEK SUBWATERSHEDS



APPENDIX A: GEOLOGY

Table A41. Summary of Inventoried Landslides

Slope Failure Number	WA #	Failures Previously Identified	WA Failure	Photo year of Failure	U of O Airphoto Number	Debris Failure	Rotational Failure	Road Fill Related	Road Cut Related	Harvest Related	Road and Harvest Related	Unmanaged Ground	Managed Ground	Aspect
1	77	-	Y	-	-	Y	N	N	N	Y	N	-	Y	-
2	38	-	Y	-	-	Y	N	Y	N	?	Y	-	Y	-
3	37	-	Y	-	-	Y	N	Y	N	?	Y	-	Y	-
4	39	-	Y	-	-	Y	N	Y	N	?	?	-	Y	-
5	72	-	Y	-	-	Y	N	?	?	?	?	-	Y	-
6	56	-	Y	-	-	?	?	?	?	?	?	-	Y	-
7	66	-	Y	-	-	Y	N	N	N	Y	N	-	Y	-
8	67	-	Y	-	-	Y	N	N	N	Y	N	-	Y	-
9	-	-	Y	-	-	Y	N	Y	N	?	Y	-	Y	-
10	68	-	Y	-	-	Y	N	N	N	N	N	Y	-	-
11	65	-	Y	-	-	Y	N	N	N	Y	N	-	Y	-
12	40	-	Y	-	-	Y	N	N	N	Y	N	-	Y	-
13	42	-	Y	-	-	Y	N	Y	N	Y	?	-	Y	-
14	-	-	Y	-	-	Y	N	N	N	Y	N	-	Y	-
15	43	-	Y	-	-	?	?	Y	N	?	?	-	Y	-
16	41	-	Y	-	-	Y	N	Y	N	?	?	-	Y	-
17	64	-	Y	-	-	Y	N	N	N	Y	N	-	Y	-
18	31	-	Y	-	-	N	Y	N	Y	N	?	-	Y	-
19	71	-	Y	-	-	?	?	?	?	?	?	-	Y	-
20	56	-	Y	-	-	Y	N	Y	N	?	?	-	Y	-
21	57	-	Y	-	-	N	Y	N	Y	?	?	-	Y	-
22	33	-	Y	-	-	Y	N	N	Y	Y	Y	-	Y	-
23	63	-	Y	-	-	Y	N	N	N	Y	N	-	Y	-
24	29	-	Y	-	-	Y	N	N	Y	?	?	-	Y	-
25	34	-	Y	-	-	?	?	Y	N	N	N	Y	-	-
26	30	-	Y	-	-	Y	N	Y	N	?	?	-	Y	-
27	32	-	Y	-	-	?	?	Y	N	?	?	-	Y	-
28	55	-	Y	-	-	?	?	N	N	Y	?	-	Y	-
29	35	-	Y	-	-	?	?	N	N	Y	?	-	Y	-
30	54	-	Y	-	-	Y	N	N	Y	?	?	-	Y	-
31	53	-	Y	-	-	?	?	?	?	?	?	-	Y	-
32	69	-	Y	-	-	?	?	N	N	Y	?	-	Y	-
33	52	-	Y	-	-	Y	N	Y	N	?	?	-	Y	-
34	51	-	Y	-	-	Y	N	Y	N	N	N	-	Y	-

Table A41. Summary of Inventoried Landslides

Slope Failure Number	Subwatershed	Road Number	Mile Post	Township	Range	Section	1/4 section	Soil Category	SRI Mapping Unit	Affected Drainage	Harvest Unit Name	Comments
1	1	1816	-	19	2	6	SW	5	23	Boundary	-	Occurred in 89 storm. 86 ERFO.
2	1	-	-	19	2	6	SE	4	212	-	-	
3	1	1816 174	0.9	19	2	6	SE	4	212	-	-	Comp 30 SSI.
4	1	1816	1.7	18	2	31	SE	1	25	-	-	Chain Link Retainiing Wall. 86 ERFO.
5	1	-	-	19	2	5	SE	1	235	Timber	-	Occurred in 89 storm.
6	1	1830 405	-	18	3	8	SE	5	162	N. Fall	-	Total road width gone, some into N. Fork Fall Ck.
7	1	-	-	19	2	9	NW	3	602	Timber	30 Weight # 6	
8	1	-	-	19	2	9	NW	3	602	Timber	Gondor #6	
9	1	-	-	19	2	4	SW	4	212	Timber	-	
10	1	-	-	18	2	28	NE	2	235	Fall	-	Along Fall Ck. Trail
11	1	-	-	19	2	11	NW	4	212	Andy	Scarsdale # 6	
12	1	-	-	19	2	2	NE	1	25	Andy trib.		Rub Andy SSI.
13	2	-	-	18	2	36	NW	4	212	Portland		Welded Wire Retaining Wall.
14	4	-	-	18	2	1	SE	4	313	Alder		Took out CMP below on road 1817 406 M.P. 2.0.
15	4	1800	17.8	18	2	25	NE	5	15	PUMA		Puma SSI.
16	2	-	-	18	2	36	NE	4	212	Portland		Pumarine SSI.
17	2	-	-	19	2	12	NE	3	201	Rubble	Gambler # 3	
18	2	1825	6	19	3	18	SE	2	235	Nevergo		Mica High SSI.
19	4	1830	5.3	18	3	5	SW	4	212	Pernot		
20	4	1830 405	-	18	3	8	SE	4	212	Hehe		Moonshine SSI.
21	4	1830	2.6	18	3	17	SW	4	212	Sunshine		Sunshine SSI.
22	2	1825	5.1	19	3	8	SW	3	201	Gales		Mica Low SSI. Buttress.
23	2	-	-	19	3	20	NW	1	25	Nevergo	Nevergo # 6	Goes all the way down into Nevergo Ck.
24	2	1825	-	19	3	20	SW	1	25	Nevergo		Look SSI.
25	2	-	-	19	3	16	NW	3	201	Portland		Alpine SSI. GPS # 050921A. Went across Portland Ck.
26	2	-	-	19	3	21	NW	4	212	Portland		89 Storm
27	2	1835	11.5	19	3	9	SE	3	201	Portland		GPS # 042521B.
28	4	-	-	18	3	10	SW	3	21	Hehe		Occurred in 89 storm.
29	2	-	-	19	3	10	NE	3	201	Logan		Occurred in 89 storm.
30	4	1831 342	4.9	18	3	2	SW	3	301	Hehe		86 ERFO
31	4	1832 342	0.1	18	3	11	SE	3	201	Tiller		Blowout Ck. SSI. 86 FO.
32	3	-	-	18	3	12	SE	3	201	Saturn	Quartz # 6	
33	4	1832 395	3.3	18	3	13	NW	4	212	Fall		Nugget SSI.
34	4	1834	3.7	18	3	13	NE	3	201	Nine Mile		86 ERFO.

Table A41. Summary of Inventoried Landslides

Slope Failure Number	WA #	Failures Previously Identified	WA Failure	Photo year of Failure	U of O Airphoto Number	Debris Failure	Rotational Failure	Road Fill Related	Road Cut Related	Harvest Related	Road and Harvest Related	Unmanaged Ground	Managed Ground	Aspect
35	50	-	Y	-	-	Y	N	N	N	Y	N	-	Y	-
36	44	-	Y	-	-	Y	N	Y	N	?	?	-	Y	-
37	45	-	Y	-	-	Y	N	Y	N	?	?	-	Y	-
38	49	-	Y	-	-	?	?	?	?	?	?	-	Y	-
39	47	-	Y	-	-	?	?	?	?	?	?	-	Y	-
40	-	-	Y	-	-	Y	N	N	N	Y	N	-	Y	-
41	-	-	Y	-	-	Y	N	N	N	Y	N	-	Y	-
42	-	-	Y	-	-	Y	N	N	N	Y	N	-	Y	-
43	-	-	Y	-	-	Y	N	Y	N	?	?	-	Y	-
44	-	-	Y	-	-	Y	N	Y	N	?	?	-	Y	-
45	-	-	Y	-	-	Y	N	Y	N	?	?	-	Y	-
46	-	-	Y	-	-	?	?	N	Y	?	?	-	Y	-
47	-	-	Y	-	-	?	?	N	Y	?	?	-	Y	-
48	-	-	y	-	-	?	?	Y	N	?	?	-	Y	-
49	-	-	Y	-	-	Y	N	Y	N	?	?	-	Y	-
50	-	-	Y	-	-	?	?	N	Y	?	?	-	Y	-
51	-	-	Y	-	-	Y	N	Y	N	?	?	-	Y	-
52	-	-	Y	-	-	Y	N	Y	N	?	?	-	Y	-
53	-	-	Y	-	-	Y	N	Y	N	?	?	-	Y	-
54	-	-	Y	-	-	Y	N	Y	N	?	?	-	Y	-
55	-	-	Y	-	-	Y	N	Y	N	?	?	-	Y	-
56	-	-	Y	-	-	Y	N	Y	N	?	?	-	Y	-
57	-	-	Y	-	-	Y	N	Y	N	?	?	-	Y	-
58	-	-	Y	-	-	Y	N	Y	N	?	?	-	Y	-
59	-	-	Y	-	-	Y	N	Y	N	?	?	-	Y	-

Table A41. Summary of Inventoried Landslides

Slope Failure Number	Subwatershed	Road Number	Mile Post	Township	Range	Section	1/4 section	Soil Category	SRI Mapping Unit	Affected Drainage	Harvest Unit Name	Comments
35	4	-	-	18	3	13	SE	4	212	Nine Mile		89 Flood.
36	3	1835	0.3	18	4	19	NE	3	201	Gold		Falling Gold SSI.
37	3	1800	25.4	18	4	19	NE	3	8	Fall		
38	4	1832	-	18	4	9	SW	3	201	Breim		86 ERFO. Blocked 1832 365.
39	4	1800	0.1	18	4	16	SW	2	335	Buzzard		Buzzard SSI.
40	3	-	-	18	4	21	NE	3	201	Fall		Caused pipe to plug and fill to fail below on road 1844.
41	4	-	-	18	4	16	NE	3	201	Fall		Washed out the fill on 1800, MP 29.4. 86 flood.
42	4	-	-	18	2	12	NE	3	201	Alder trib		occured during 86 flood.
43	4	1817	-	18	3	6	SE	3	61	Alder trib		Whole road width gone.
44	4	1831 386	-	18	3	4	NW	3	201	Pernot		Whole road width gone.
45	3	1839 553	-	19	4	5	NE	3	21	Delp		
46	4	1830 407	-	18	3	9	SE	4	212	Hehe trib		Part of larger earthflow.
47	2	1835	-	19	3	10	SW	4	212	Logan trib		Possibly part of larger earthfall.
48	2	1835	11.64	19	3	16	SW	3	212	?		Road surface downdropped about 12 inches.
49	2	1835 240	-	19	3	16	NE	4	212	Portland trib		150' wide, 10' of road width left.
50	2	1835	-	19	3	16	SW	3	201	Nevergo		GPS # 051100A and 0510233A. 2 slides about 50' apart.
51	4	1839	1.17	18	4	20	SE	3	212	Delp		On Retaining Wall Inventory. Sheet-pile .
52	4	1839	1.18	18	4	20	SE	3	212	Delp		On Retaining Wall Inventory. Sheet-pile .
53	4	1839	1.19	18	4	20	SE	3	212	Delp		On Retaining Wall Inventory. Sheet-pile .
54	4	1839	1.21	18	4	29	NW	3	201	Delp		On Retaining Wall Inventory. Sheet-pile .
55	4	1839	1.23	18	4	29	NW	2	235	Delp		On Retaining Wall Inventory. Sheet-pile .
56	4	1839	1.26	18	4	29	NW	2	235	Delp		On Retaining Wall Inventory. Sheet-pile .
57	4	1839	1.49	18	4	29	NW	3	212	Delp		On Retaining Wall Inventory. Sheet-pile .
58	4	1839	1.83	18	4	29	NW	3	212	Delp		On Retaining Wall Inventory. H-pile.
59	3	1839 381	-	18	3	24	SW	4	212	Fall		On Retaining Wall Inventory. Concrete, 600 square feet.

Slope Failure Number	WA #	Failures Previously Identified	WA Failure	Photo year of Failure	U of O Airphoto Number	Debris Failure	Rotational Failure	Road Fill Related	Road Cut Related	Harvest Related	Road and Harvest Related	Unmanaged Ground	Managed Ground	Aspect
60	-	-	Y	-	-	Y	N	Y	N	?	?	-	Y	-
61	-	-	Y	-	-	Y	N	Y	N	?	?	-	Y	-
62	-	-	Y	-	-	Y	N	Y	N	?	?	-	Y	-
301	-	-	-	1949/55	-	Y	N	N	N	N	N	Y	-	N
301a	-	-	-	1949/55	-	Y	N	N	N	N	N	Y	-	N
301b	-	-	-	1949/55	-	Y	N	N	N	N	N	Y	-	N
302	-	-	-	1949/55	-	Y	N	N	N	N	N	Y	-	N
303	-	-	-	1949/55	-	Y	N	Y	N	N	Y	-	Y	E
304	-	-	-	1949/55	-	Y	N	N	N	N	N	Y	-	NW
305	-	-	-	1949/55	-	Y	N	N	N	Y	N	-	Y	E
306	-	-	-	1949/55	RE 21-10	N	Y	N	Y	Y	N	-	Y	SE
307	-	-	-	1949/55	-	Y	N	N	N	N	N	Y	-	S
308	-	-	-	1949/55	LC3 RE 21-	N	Y	N	N	N	N	Y	-	S
309	-	-	-	1949/55	LC3 36-3	Y	N	Y	N	N	Y	-	Y	S
310	-	-	-	1949/55	LC3 36-4	Y	N	Y	N	N	Y	-	Y	SE
310a	-	-	-	1949/55	-	Y	N	N	N	N	N	Y	-	E
310b	-	-	-	1949/55	-	Y	N	N	N	N	N	Y	-	E
310c	-	-	-	1949/55	-	Y	N	N	N	N	N	Y	-	E
310d	-	-	-	1949/55	-	Y	N	N	N	N	N	Y	-	E
310e	-	-	-	1949/55	-	Y	N	N	N	N	N	Y	-	E
310f	-	-	-	1949/55	-	Y	N	N	N	N	N	Y	-	E
310g	-	-	-	1949/55	-	Y	N	N	N	Y	N	-	Y	N
310h	-	-	-	1949/55	-	Y	N	N	N	Y	N	-	Y	N
310i	-	-	-	1949/55	-	Y	N	N	N	Y	N	-	Y	N
384	-	Y	-	1959	EG1 26-13	Y	N	Y	N	N	Y	-	Y	SE
385	-	-	-	1959	EG1 26-10	Y	N	Y	N	N	Y	-	Y	SE
386	-	-	-	1959	-	Y	N	Y	N	N	Y	-	Y	E
387	-	-	-	1959	-	Y	Y	N	Y	N	N	Y	-	S
388	-	-	-	1959	EG1 26-10	Y	N	Y	N	N	Y	-	Y	S
389	-	-	-	1959	EG1 25-17	Y	N	N	N	N	N	Y	-	SE

Table A41. Summary of Inventoried Landslides

Slope Failure Number	Subwatershed	Road Number	Mile Post	Township	Range	Section	1/4 section	Soil Category	SRI Mapping Unit	Affected Drainage	Harvest Unit Name	Comments
60	3	1839 381	-	18	3	24	SE	4	212	Fall		On Retaining Wall Inventory. H-pile.
61	3	1839 381	-	18	3	24	SE	4	212	Fall		On Retaining Wall Inventory. Sheet-pile.
62	4	1839 381	-	18	3	2	NW	3	301	Hehe trib		
301	2	-	-	19	3	28	-	4	444	Nevergo		One of 3 on N. side of Saddle Blanket Mtn., 400' to 1,000' long.
301a	2	-	-	19	3	28	-	4	444	Nevergo		One of 3 on N. side of Saddle Blanket Mtn., 400' to 1,000' long.
301b	2	-	-	19	3	28	-	4	444	Nevergo		One of 3 on N. side of Saddle Blanket Mtn., 400' to 1,000' long.
302	2	-	-	19	2	4	-	3	8	Logan		Scoured drainage into Logan Ck., about 2,000' to 2,500' long.
303	2	1824	-	19	2	1	NW	3	201	Portland		Possibly from a landing. Sluiced down Rubble Ck. all the way to Portland Ck.
304	3	-	-	19	3	1	SW	5	441	Gold		
305	4	-	-	19	2	25	NE	3	8	-		
306	1	-	-	18	2	29	NW	4	212	Fall Trib		
307	4	-	-	18	3	19	SW	3	201	Fall		
308	1	-	-	18	2	23	NW	3	8	Bedrock		
309	1	-	-	19	1	12	NE	5	-	-		
310	1	-	-	18	1	36	SW	5	-	Little Gold		
310a	2	-	-	19	3	5	SE	3	21	Portland		
310b	2	-	-	19	3	5	SE	3	21	Portland		
310c	2	-	-	19	3	5	SE	3	8	Portland		
310d	2	-	-	19	3	5	SE	3	8	Portland		
310e	2	-	-	19	3	8	NE	3	8	Portland		
310f	2	-	-	19	3	8	NE	3	201	Portland		
310g	4	-	-	18	2	13	NE	3	201	Nevergo		
310h	4	-	-	18	2	13	NE	3	201	Nevergo		
310j	4	-	-	18	2	12	NW	3	201	Nevergo		
384	3	1800	-	18	4	15	SW	2	335	Fall Trib		
385	3	1800	-	18	4	15	SW	2	335	Fall Trib		50' X 200', starts on upper road.
386	3	1839	-	18	4	29	NW	2	235	Delp		200' to 300' section where retaining walls were built.
387	3	1800	-	18	4	17	SE	3	201	Fall		Possibly an old borrow site.
388	3	1800	-	18	4	8	NE	3	201	Briem		
389	3	1832	-	18	4	7	NW	3	201	Platt		

Table A41. Summary of Inventoried Landslides

Slope Failure Number	WA #	Failures Previously Identified	WA Failure	Photo year of Failure	U of O Airphoto Number	Debris Failure	Rotational Failure	Road Fill Related	Road Cut Related	Harvest Related	Road and Harvest Related	Unmanaged Ground	Managed Ground	Aspect
390	-	-	-	1959	EG1 25-14	Y	N	N	Y	N	Y	-	Y	SW
391	-	-	-	1959	EG1 25-15	N	Y	N	N	N	N	Y	-	W
392	-	-	-	1959	-	Y	N	Y	N	N	Y	-	Y	N
393	-	-	-	1959	-	Y	N	Y	N	N	Y	-	Y	N
394	-	-	-	1959	-	Y	N	Y	N	N	Y	-	Y	N
395	-	-	-	1959	-	Y	N	Y	N	N	Y	-	Y	SE
396	-	-	-	1959	EG1 25-15	Y	N	Y	N	N	Y	-	Y	SE
397	-	-	-	1959	-	Y	N	Y	N	N	Y	-	Y	N
398	-	-	-	1959	-	Y	N	Y	N	N	Y	-	Y	N
399	-	-	-	1959	-	Y	N	Y	N	N	Y	-	Y	N
400	-	-	-	1959	EG1 25-15	Y	N	Y	N	N	Y	-	Y	N
401	-	-	-	1959	-	N	Y	N	Y	N	Y	-	Y	W
402	-	-	-	1959	-	N	Y	N	Y	N	Y	-	Y	W
403	-	-	-	1959	EG1 25-15	Y	N	Y	N	N	Y	-	Y	S
404	-	Y	-	1959	-	Y	N	N	N	N	N	Y	-	N
405	-	Y	-	1959	-	Y	N	N	N	N	N	Y	-	N
406	-	-	-	1959	-	Y	N	Y	N	N	Y	-	Y	E
407	-	-	-	1959	EG1 25-13	Y	N	Y	N	N	Y	-	Y	N
408	-	-	-	1959	EG1 25-13	N	Y	N	Y	N	Y	-	Y	S
409	-	-	-	1959	EG1 25-12	Y	N	Y	N	N	Y	-	Y	N
410	-	-	-	1959	-	N	Y	N	Y	N	Y	-	Y	N
411	-	-	-	1959	-	Y	N	Y	N	N	Y	-	Y	N
412	-	-	-	1959	EG1 25-11	Y	N	N	N	Y	N	-	Y	SE
413	-	-	-	1959	-	Y	N	N	N	Y	N	-	Y	E
414	-	-	-	1959	EG1 14-47	N	Y	N	Y	N	Y	-	Y	SE
415	-	-	-	1959	-	Y	N	N	N	Y	N	-	Y	SW
416	-	-	-	1959	EG1 15-16	Y	N	Y	N	N	N	-	Y	E
417	-	-	-	1959	EG1 15-16	Y	N	Y	N	N	N	-	Y	E
418	-	-	-	1959	EG1 15-16	Y	N	Y	N	N	N	-	Y	E
419	-	-	-	1959	EG1 54-15	Y	N	N	N	N	Y	-	Y	N
420	-	-	-	1959	-	Y	N	Y	N	N	N	-	Y	N
421	-	-	-	1959	EG1 57-7	Y	N	N	N	Y	N	-	Y	NE
422	-	-	-	1959	-	Y	N	Y	N	N	Y	-	Y	SE
423	-	-	-	1959	EG1 12-12	Y	N	Y	N	N	Y	-	Y	NW
424	-	-	-	1959	-	Y	N	N	Y	N	Y	-	Y	N
425	-	-	-	1959	EG1 10-11	Y	N	Y	N	N	Y	-	Y	NE
426	-	-	-	1959	-	N	Y	N	N	N	N	Y	-	SE
427	-	-	-	1959	-	N	Y	N	Y	N	N	-	Y	S
428	-	-	-	1959	EG1 1-116	Y	N	N	N	Y	N	-	Y	SE

Table A41. Summary of Inventoried Landslides

Slope Failure Number	Subwatershed	Road Number	Mile Post	Township	Range	Section	1/4 section	Soil Category	SRI Mapping Unit	Affected Drainage	Harvest Unit Name	Comments
390	3	1835	-	18	3	36	SW	3	201	Gold		
391	4	-	-	19	3	1	SE	3	8	Hehe Trib		
392	4	1832	-	18	3	12	NE	3	8	Hehe Trib		
393	4	1832	-	18	3	12	NE	3	8	Hehe Trib		
394	4	1832	-	18	3	12	NE	3	8	Hehe Trib		
395	3	1832	-	18	4	6	SW	3	201	Platt		
396	4	1831	-	18	3	1	SW	5	185	Fall Trib		
397	4	1831	-	18	3	1	NE	3	8	Hehe		
398	4	1831	-	18	3	1	NE	3	8	Hehe		
399	4	1831	-	18	3	1	NE	3	8	Hehe		
400	4	1831	-	18	3	1	NE	3	8	Hehe		
401	4	-	-	18	3	1	NW	3	310	Hehe Trib		
402	4	1831	-	18	3	1	SW	3	310	Hehe Trib		
403	4	1831	-	18	3	1	NE	3	8	Hehe		
404	3	-	-	19	3	1	SW	4	441	Gold		
405	3	-	-	19	3	1	SW	4	441	Gold		
406	3	1834	-	18	3	26	SW	1	25	Fall		
407	4	1832	-	18	3	11	SW	4	212	Hehe Trib		
408	4	1832	-	18	3	11	SW	1	35	Hehe Trib		
409	4	-	-	18	3	11	NW	4	212	Hehe		
410	4	-	-	18	3	11	NW	1	25	Hehe		
411	4	1831	-	18	3	2	SE	1	25	Hehe		
412	4	-	-	18	3	2	NE	3	301	Hehe		
413	4	-	-	18	3	2	NE	3	301	Hehe Trib		
414	4	1831	-	18	3	10	NE	5	23	Hehe		
415	2	-	-	19	3	3	SW	3	201	Logan		
416	2	1825	-	19	3	8	SW	3	201	Nevergo		
417	2	1825	-	19	3	8	SW	3	201	Nevergo		
418	2	1825	-	19	3	8	SW	3	201	Nevergo		
419	2	-	-	19	3	4	NW	3	201	Logan		
420	4	1835 250	-	18	3	31	SE	3	8	Fall		
421	4	1830	-	18	3	5	SW	4	212	Hehe		
422	2	1825	-	19	3	20	NW	5	23	Nevergo		
423	2	1825	-	19	3	20	NW	1	25	Nevergo		
424	2	1825 214	-	19	3	6	NW	5	23	Portland trib		
425	2	1825 214	-	18	2	36	SE	5	23	Portland trib		
426	1	-	-	18	2	23	NW	3	201	Bedrock		
427	1	1817 367	-	18	2	16	SE	2	235	Slick trib		
428	1	1817	-	18	2	29	NE	2	235	Fall		

Slope Failure Number	WA #	Failures Previously Identified	WA Failure	Photo year of Failure	U of O Airphoto Number	Debris Failure	Rotational Failure	Road Fill Related	Road Cut Related	Harvest Related	Road and Harvest Related	Unmanaged Ground	Managed Ground	Aspect
429	-	-	-	1959	EG1 1-116	Y	N	Y	N	N	Y	-	Y	SE
430	-	-	-	1959	-	Y	N	Y	N	N	Y	-	Y	SW
431	-	-	-	1959	EG1 1-54	Y	N	Y	N	N	Y	-	Y	W
432	-	Y	-	1959	EG1 1-54	Y	N	Y	N	N	Y	-	Y	W
433	-	-	-	1959	EG1 1-54	Y	N	Y	N	N	Y	-	Y	W
434	-	-	-	1959	-	Y	N	N	N	Y	N	-	Y	W
435	-	-	-	1959	EG1 1-28	Y	N	N	N	Y	N	-	Y	W
436	-	Y	-	1959	-	Y	N	N	N	N	N	Y	-	N
437	-	Y	-	1959	-	Y	N	N	N	N	N	Y	-	N
438	-	Y	-	1959	-	Y	N	N	N	N	N	Y	-	N
439	-	Y	-	1959	-	Y	N	N	N	N	N	Y	-	E
440	-	Y	-	1959	-	Y	N	N	N	N	N	Y	-	E
441	-	Y	-	1959	-	Y	N	N	N	N	N	Y	-	E
442	-	Y	-	1959	-	Y	N	N	N	N	N	Y	-	E
443	-	Y	-	1959	-	Y	N	N	N	N	N	Y	-	E
444	-	Y	-	1959	-	Y	N	N	N	N	N	Y	-	E
445	-	Y	-	1959	-	Y	N	N	N	Y	N	-	Y	N
446	-	Y	-	1959	-	Y	N	N	N	Y	N	-	Y	N
447	-	Y	-	1959	-	Y	N	N	N	Y	N	-	Y	N
311	-	-	-	1967	ESF 5-199	Y	N	N	N	Y	N	-	Y	SW
312	-	-	-	1967	ESF 5-201	Y	N	Y	N	N	Y	-	Y	S
313	-	-	-	1967	ESF 5-201	Y	N	Y	N	N	Y	-	Y	N
314	-	-	-	1967	ESF 5-200	Y	N	Y	N	N	Y	-	Y	N
315	-	-	-	1967	ESF 6-63	Y	N	Y	N	N	Y	-	Y	N
316	-	-	-	1967	ESF 6-63	Y	N	Y	N	N	Y	-	Y	N
317	-	-	-	1967	ESF 6-62	Y	N	Y	N	N	Y	-	Y	E
318	-	-	-	1967	ESF 6-61	Y	N	N	N	N	N	Y	-	E
319	-	-	-	1967	ESF 6-61	Y	N	Y	N	N	Y	-	Y	E
320	-	-	-	1967	ESF 6-61	Y	N	N	N	N	N	Y	-	W
321	-	-	-	1967	-	Y	N	Y	N	N	Y	-	Y	N
322	-	-	-	1967	-	Y	N	Y	N	N	Y	-	Y	NE
323	-	Y	-	1967	-	Y	N	Y	N	N	N	-	Y	E
324	-	-	-	1967	ESF 6-59	Y	N	Y	N	N	N	-	Y	N
325	-	-	-	1967	-	Y	N	Y	N	N	Y	-	Y	N
326	-	-	-	1967	-	Y	N	Y	N	N	Y	-	Y	N
327	-	-	-	1967	-	Y	N	Y	N	N	Y	-	Y	N
328	-	-	-	1967	-	Y	N	Y	N	N	N	-	Y	N
328a	-	Y	-	1967	-	Y	N	Y	N	N	Y	-	Y	SW
329	-	-	-	1967	-	Y	N	Y	N	N	N	-	Y	S

Table A41. Summary of Inventoried Landslides

Slope Failure Number	Subwater-shed	Road Number	Mile Post	Town-ship	Range	Section	1/4 section	Soil Category	SRI Mapping Unit	Affected Drainage	Harvest Unit Name	Comments
429	1	1817 412	-	18	2	29	NE	2	235	Fall trib		
430	1	1817	-	18	2	16	SW	2	235	N. Fall		
431	1	1817	-	18	2	20	NE	3	21	N. Fall		
432	1	1816	-	18	2	20	NE	5	162	N. Fall		
433	1	1817	-	18	2	20	NE	5	162	N. Fall		
434	1	-	-	18	2	20	NE	3	21	N. Fall		
435	1	-	-	18	1	36	SE	5	-	Little Gold		
436	2	-	-	19	3	30	NW	3	21	Nevergo		
437	2	-	-	19	3	30	NW	3	21	Nevergo		
438	2	-	-	19	3	30	NW	3	21	Nevergo		
439	2	-	-	19	3	5	SE	3	21	Portland		
440	2	-	-	19	3	5	SE	3	21	Portland		
441	2	-	-	19	3	5	SE	3	8	Portland		
442	2	-	-	19	3	5	SE	3	8	Portland		
443	2	-	-	19	3	8	NE	3	8	Portland		
444	2	-	-	19	3	8	NE	3	201	Portland		
445	4	-	-	19	3	13	NE	3	201	Nevergo		
446	4	-	-	19	3	13	NE	3	201	Nevergo		
447	4	-	-	19	3	12	NE	3	201	Nevergo		
311	3	-	-	18	4	27	NW	3	201	-		
312	3	1845	-	18	4	15	NW	3	8	-		
313	3	1844	-	18	4	21	NW	3	201	-		
314	3	1844	-	18	4	21	NW	3	201	-		
315	3	1839	-	19	4	5	SW	3	201	Delp		
316	3	1839	-	19	4	5	NW	3	201	Delp		
317	3	1839	-	18	4	32	NW	4	212	Delp		
318	3	-	-	18	4	32	NW	2	235	-		
319	3	1839	-	18	4	32	NW	1	25	Delp		
320	3	-	-	18	4	32	NE	3	201	Delp		
321	3	1839	-	18	4	29	NW	5	235	Delp		
322	3	1839	-	18	4	29	NW	3	201	Delp		
323	3	1839	-	18	4	29	SW	4	212	Delp		
324	3	1844	-	18	4	19	NW	3	8	Fall		
325	3	1844	-	18	4	20	NE	4	212	Fall		
326	3	1844	-	18	4	20	NW	3	8	Fall		
327	3	1844	-	18	4	20	NW	3	8	Fall		
328	3	1832	-	18	4	9	SW	3	201	Briem		
328a	3	1832	-	18	4	9	SW	3	201	Briem		
329	3	1832	-	18	4	5	SE	3	201	Platt		

Table A41. Summary of Inventoried Landslides

Slope Failure Number	WA #	Failures Previously Identified	WA Failure	Photo year of Failure	U of O Airphoto Number	Debris Failure	Rotational Failure	Road Fill Related	Road Cut Related	Harvest Related	Road and Harvest Related	Unmanaged Ground	Managed Ground	Aspect
330	-	-	-	1967	-	Y	N	Y	N	N	N	-	Y	SW
331	-	-	-	1967	-	Y	N	Y	N	N	N	-	Y	SW
332	-	-	-	1967	-	Y	N	Y	N	N	N	-	Y	S
333	-	-	-	1967	ESF 6-78	Y	N	N	Y	N	N	-	Y	NW
334	-	Y	-	1967	-	Y	N	Y	N	N	Y	-	Y	E
335	-	-	-	1967	ESF 6-79	Y	N	Y	N	N	Y	-	Y	E
336	-	-	-	1967	-	Y	N	N	N	N	Y	-	Y	N
337	-	Y	-	1967	-	Y	N	N	N	N	Y	-	Y	NW
338	-	Y	-	1967	-	Y	N	Y	N	Y	Y	-	Y	NW
339	-	Y	-	1967	-	Y	N	Y	N	N	Y	-	Y	NW
340	-	-	-	1967	-	Y	N	Y	N	N	Y	-	Y	SW
341	-	-	-	1967	-	Y	N	Y	N	N	Y	-	Y	N
342	-	Y	-	1967	-	Y	N	Y	N	N	Y	-	Y	N
343	-	Y	-	1967	-	Y	N	Y	N	N	Y	-	Y	N
344	-	Y	-	1967	-	Y	N	Y	N	N	Y	-	Y	N
345	-	Y	-	1967	-	Y	N	Y	N	N	Y	-	Y	S
346	-	Y	-	1967	-	Y	N	N	N	N	N	Y	-	N
347	-	Y	-	1967	-	Y	N	N	N	N	N	Y	-	N
348	-	-	-	1967	-	Y	N	Y	N	N	N	-	Y	N
349	-	Y	-	1967	-	N	Y	N	N	N	N	Y	-	E
350	-	-	-	1967	ESF 17-21	Y	N	N	Y	N	Y	-	Y	E
351	-	-	-	1967	-	Y	N	Y	N	N	Y	-	Y	E
352	-	-	-	1967	ESF 17-21	Y	N	Y	N	N	Y	-	Y	N
353	-	-	-	1967	-	Y	N	N	N	Y	N	-	Y	NW
354	-	-	-	1967	-	Y	N	N	N	Y	N	-	Y	NW
355	-	-	-	1967	-	Y	N	N	N	Y	N	-	Y	NW
356	-	-	-	1967	-	Y	N	N	N	Y	N	-	Y	NW
357	-	-	-	1967	-	Y	N	N	N	Y	N	-	Y	NW
358	-	-	-	1967	-	Y	N	N	N	Y	N	-	Y	NW
359	-	-	-	1967	ESF 31-14	Y	N	N	N	Y	N	-	Y	NW
360	-	-	-	1967	ESF 31-14	Y	N	Y	N	N	Y	-	Y	N
361	-	-	-	1967	ESF 31-14	Y	N	Y	N	N	Y	-	Y	N
362	-	-	-	1967	ESF 31-14	Y	N	Y	N	N	Y	-	Y	NE
363	-	-	-	1967	ESF 31-14	Y	N	Y	N	N	Y	-	Y	W
364	-	-	-	1967	ESF 31-14	Y	N	Y	N	N	Y	-	Y	N
365	-	-	-	1967	ESF 31-14	Y	N	Y	N	N	Y	-	Y	S
366	-	-	-	1967	ESF 31-143	Y	N	N	N	Y	N	-	Y	W
367	-	Y	-	1967	ESF 7-67	Y	N	Y	N	N	Y	-	Y	W
368	-	-	-	1967	ESF 7-67	Y	N	Y	N	N	Y	-	Y	E

Table A41. Summary of Inventoried Landslides

Slope Failure Number	Subwatershed	Road Number	Mile Post	Township	Range	Section	1/4 section	Soil Category	SRI Mapping Unit	Affected Drainage	Harvest Unit Name	Comments
330	3	1832	-	18	4	5	SE	3	201	Platt		
331	3	1832	-	18	4	5	SE	3	201	Platt		
332	3	1832	-	18	4	6	SE	3	201	Platt		
333	3	1839	-	18	3	24	SW	3	201	Fall		
334	3	1834	-	18	3	24	SW	1	25	Fall		
335	3	1834	-	18	3	24	NE	4	212	Nine Mile		
336	4	-	-	18	3	12	SE	4	212	-		
337	4	1832	-	18	3	12	NE	3	310	Hehe		
338	4	1832	-	18	3	12	NE	3	310	Hehe		
339	4	1832	-	18	3	12	NE	3	310	Hehe		
340	3	1832	-	18	4	6	SW	3	201	Platt		
341	4	1831	-	18	3	1	NE	3	8	Hehe		
342	4	1831 397	-	18	3	1	NE	3	8	Hehe		
343	4	1831 397	-	18	3	1	NE	3	8	Hehe		
344	4	1831 397	-	18	3	1	NE	3	8	Hehe		
345	4	-	-	18	3	2	NE	3	301	Hehe		
346	3	-	-	19	3	1	SW	4	441	Gold		
347	3	-	-	19	3	1	SW	4	441	Gold		
348	3	1833 254	-	18	3	26	SW	3	8	Pacific		
349	4	-	-	18	3	10	NE	5	23	Hehe		
350	4	1831 383	-	18	3	10	NE	5	23	Hehe		
351	4	1831 383	-	18	3	3	SE	5	23	Hehe		
352	4	-	-	18	3	2	SE	1	25	-		
353	4	-	-	18	3	2	NW	3	8	Hehe		
354	4	-	-	18	3	2	NW	3	8	Hehe		
355	4	-	-	18	3	2	NW	3	8	Hehe		
356	4	-	-	18	3	2	NW	3	8	Hehe		
357	4	-	-	18	3	2	SW	3	310	Hehe		
358	4	-	-	18	3	2	SE	3	8	Hehe		
359	2	-	-	19	3	21	NE	3	201	Portland		
360	2	1835	-	19	3	16	NW	3	201	Portland		
361	2	1835	-	19	3	16	NW	3	201	Portland		
362	2	1835	-	19	3	9	NE	4	212	Logan		
363	2	1835	-	19	3	10	NE	3	201	Logan		
364	2	1835	-	19	3	10	NW	3	201	Logan		
365	2	1835	-	19	3	10	NW	3	201	Logan		
366	2	-	-	19	3	3	SE	3	201	Logan		
367	4	1835	-	18	3	31	SE	3	8	Fall		
368	3	1833	-	18	3	27	NE	4	212	Pacific		

Table A41. Summary of Inventoried Landslides

Slope Failure Number	WA #	Failures Previously Identified	WA Failure	Photo year of Failure	U of O Airphoto Number	Debris Failure	Rotational Failure	Road Fill Related	Road Cut Related	Harvest Related	Road and Harvest Related	Unmanaged Ground	Managed Ground	Aspect
369	-	-	-	1967	ESF 7-68	Y	N	N	N	N	Y	-	Y	N
370	-	-	-	1967	ESF 7-70	Y	N	Y	N	N	N	Y	-	S
371	-	-	-	1967	ESF 7-70	Y	N	N	Y	N	Y	-	Y	S
372	-	-	-	1967	ESF 31-12	Y	N	Y	N	N	Y	-	Y	W
373	-	-	-	1967	ESF 31-13	Y	N	N	N	N	N	Y	-	E
374	-	-	-	1967	ESF 31-13	Y	N	N	N	N	N	Y	-	E
375	-	-	-	1967	ESF 31-13	Y	N	Y	N	N	Y	-	Y	E
376	-	-	-	1967	-	Y	N	Y	N	N	Y	-	Y	NE
377	-	-	-	1967	-	Y	N	Y	N	N	Y	-	Y	NE
378	-	-	-	1967	-	Y	N	Y	N	N	Y	-	Y	NE
379	-	-	-	1967	-	Y	N	N	N	Y	N	-	Y	SE
380	-	-	-	1967	-	Y	N	Y	N	N	Y	-	Y	NE
381	-	-	-	1967	ESF 14-11	Y	N	N	N	N	Y	-	Y	W
382	-	-	-	1967	ESF 14-11	Y	N	Y	N	N	Y	-	Y	NE
383	-	-	-	1967	ESF 17-17	Y	N	Y	N	N	Y	-	Y	S
383a	-	Y	-	1967	-	N	Y	N	N	N	N	Y	-	SE
383b	-	Y	-	1967	-	Y	N	N	N	N	N	Y	-	-
383c	-	Y	-	1967	-	Y	N	N	N	N	N	Y	-	-
383d	-	Y	-	1967	-	Y	N	N	N	N	N	Y	-	-
383e	-	Y	-	1967	-	Y	N	N	N	N	N	Y	-	E
383f	-	Y	-	1967	-	Y	N	N	N	N	N	Y	-	E
383g	-	Y	-	1967	-	Y	N	N	N	N	N	Y	-	E
383h	-	Y	-	1967	-	Y	N	N	N	N	N	Y	-	E
383j	-	Y	-	1967	-	Y	N	N	N	N	N	Y	-	E
383k	-	Y	-	1967	-	Y	N	N	N	N	N	Y	-	E
383l	-	Y	-	1967	-	Y	N	N	N	N	N	Y	-	N
383m	-	Y	-	1967	-	Y	N	N	N	N	N	Y	-	N
383n	-	Y	-	1967	-	Y	N	N	N	N	N	Y	-	N
500	-	-	-	1990	-	Y	N	N	N	Y	N	-	Y	S
501	-	-	-	1990	-	Y	N	N	N	Y	N	-	Y	NE
502	-	-		1990	-	Y	N	Y	N	N	Y	-	Y	E
503	-	-	-	1990	-	Y	N	N	N	Y	N	-	Y	W
504	-	-	-	1990	-	Y	N	Y	N	N	Y	-	Y	E
505	-	Y	-	1990	-	Y	N	Y	N	N	Y	-	Y	E
506	-	-	-	1990	-	Y	N	Y	N	N	Y	-	Y	E
507	-	-	-	1990	-	Y	N	Y	N	N	Y	-	Y	E
508	-	-	-	1990	-	Y	N	N	N	Y	N	-	Y	SW
509	-	-	-	1990	-	Y	N	Y	N	N	Y	-	Y	E
510	-	Y	-	1990	-	Y	N	Y	N	N	N	-	Y	S

Table A41. Summary of Inventoried Landslides

Slope Failure Number	Subwatershed	Road Number	Mile Post	Township	Range	Section	1/4 section	Soil Category	SRI Mapping Unit	Affected Drainage	Harvest Unit Name	Comments
369	3	1833	-	18	3	26	NW	3	201	Pacific		
370	4	1831	-	18	3	10	NW	3	201	Hehe		
371	4	1831	-	18	3	10	SW	3	201	Hehe		
372	2	1825	-	19	3	8	SE	2	235	Nevergo		
373	2	1824	-	19	3	6	NW	4	212	Gales		
374	2	1824	-	19	3	6	NE	4	212	Gales		
375	2	1825	-	18	3	30	SE	4	212	Portland		
376	4	1828	-	18	3	18	SW	3	201	Alder		
377	4	1828	-	18	3	18	SW	3	201	Alder		
378	4	1828	-	18	3	18	SW	3	201	Alder		
379	4	-	-	18	3	19	SW	4	212	Sunshine		
380	2	1824	-	19	2	1	SE	3	201	Rubble		
381	4	-	-	18	3	25	NE	3	201	Puma		
382	4	1828	-	18	2	12	SW	3	201	Zog		
383	4	1828	-	18	2	24	SW	3	201	Jones		
383a	1	-	-	18	2	14	NE	3	201	Bedrock		
383b	2	-	-	19	3	30	NW	2	21	-		
383c	2	-	-	19	3	30	NW	2	21	-		
383d	2	-	-	19	3	30	NW	2	21	-		
383e	2	-	-	19	3	5	SE	3	-	Portland		
383f	2	-	-	19	3	5	SE	3	-	Portland		
383g	2	-	-	19	3	5	SE	3	-	Portland		
383h	2	-	-	19	3	5	SE	3	-	Portland		
383j	2	-	-	19	3	8	NE	3	-	Portland		
383k	2	-	-	19	3	8	NE	3	-	Portland		
383l	2	-	-	18	2	13	NE	3	201	Zog trib		
383m	2	-	-	18	2	13	NE	3	201	Zog trib		
383n	2	-	-	18	2	13	NW	3	201	Zog trib		
500	3	-	-	18	4	10	NE	3	201	Buzzard		
501	3	1839	-	19	4	4	SW	3	201	Delp		
502	3	1839	-	18	4	32	SW	3	21	Delp		
503	3	1839	-	18	4	32	SE	3	201	Delp		
504	3	1839	-	18	4	29	SW	1	25	Delp		
505	3	1839	-	18	4	32	NW	1	25	Delp		
506	3	1839	-	18	4	32	NW	1	25	Delp		
507	3	1839	-	18	4	29	SW	4	212	Delp		
508	3	-	-	18	4	28	NW	5	23	Delp Trib		
509	3	1800	-	18	4	6	SW	3	201	Briem		
510	3	1800	-	18	4	8	NE	4	212	Briem Trib		

Table A41. Summary of Inventoried Landslides

Slope Failure Number	WA #	Failures Previously Identified	WA Failure	Photo year of Failure	U of O Airphoto Number	Debris Failure	Rotational Failure	Road Fill Related	Road Cut Related	Harvest Related	Road and Harvest Related	Unmanaged Ground	Managed Ground	Aspect
511	-	-	-	1990	-	Y	N	Y	N	N	Y	-	Y	NW
512	-	-	-	1990	-	Y	N	Y	N	N	Y	-	Y	SE
513	-	-	-	1990	-	Y	N	N	N	N	Y	-	Y	W
514	-	-	-	1990	-	Y	N	Y	N	N	Y	-	Y	N
515	-	-	-	1990	-	Y	N	Y	N	N	N	-	Y	W
516	-	-	-	1990	-	Y	N	Y	N	N	N	-	Y	S
517	-	-	-	1990	-	Y	N	N	N	Y	N	-	Y	E
518	-	-	-	1990	-	Y	N	N	N	Y	N	-	Y	N
519	-	-	-	1990	-	Y	N	N	N	Y	N	-	Y	N
520	-	-	-	1990	-	Y	N	N	N	N	N	Y	-	NW
521	-	-	-	1990	-	Y	N	N	N	Y	N	-	Y	NE
522	-	-	-	1990	-	Y	N	N	N	Y	N	-	Y	NE
523	-	-	-	1990	-	Y	N	N	N	Y	N	-	Y	W
524	-	-	-	1990	-	Y	N	N	N	Y	N	-	Y	N
525	-	Y	-	1990	-	Y	N	Y	N	N	N	-	Y	N
525a	-	Y	-	1990	-	Y	N	Y	N	N	N	-	Y	N
525b	-	Y	-	1990	-	Y	N	Y	N	N	N	-	Y	N
526	-	-	-	1990	-	Y	N	Y	N	N	N	-	Y	NW
527	-	-	-	1990	-	Y	N	Y	N	N	N	-	Y	NW
528	-	Y	-	1990	-	Y	N	Y	N	N	N	-	Y	N
529	-	Y	-	1990	-	Y	N	Y	N	N	N	-	Y	N
530	-	Y	-	1990	-	Y	N	Y	N	N	N	-	Y	N
531	-	-	-	1990	-	Y	N	Y	N	N	N	-	Y	N
532	-	-	-	1990	-	N	Y	N	Y	N	N	-	Y	W
533	-	Y	-	1990	-	Y	N	N	N	N	N	Y	-	N
534	-	Y	-	1990	-	Y	N	N	N	N	N	Y	-	N
535	-	-	-	1990	-	Y	N	Y	N	N	N	-	Y	NW
536	-	-	-	1990	-	N	Y	N	N	Y	N	-	Y	N
537	-	-	-	1990	-	Y	N	N	N	Y	N	-	Y	SW
538	-	-	-	1990	-	Y	N	N	N	Y	N	-	Y	SW
539	-	-	-	1990	-	Y	N	Y	N	N	Y	-	Y	W
540	-	-	-	1990	-	Y	N	Y	N	N	Y	-	Y	W
541	-	-	-	1990	-	Y	N	Y	N	N	Y	-	Y	S
542	-	-	-	1990	-	N	Y	N	Y	N	Y	-	Y	E
543	-	-	-	1990	1390-134	N	Y	N	Y	N	Y	-	Y	NW
544	-	-	-	1990	-	Y	N	N	N	Y	N	-	Y	NE
545	-	-	-	1990	-	Y	N	N	N	Y	N	-	Y	NE
546	-	-	-	1990	-	Y	N	Y	N	N	Y	-	Y	N
547	-	-	-	1990	-	Y	N	Y	N	N	Y	-	Y	NW

Table A41. Summary of Inventoried Landslides

Slope Failure Number	Subwatershed	Road Number	Mile Post	Township	Range	Section	1/4 Section	Soil Category	SRI Mapping Unit	Affected Drainage	Harvest Unit Name	Comments
511	3	1846	-	19	4	5	SW	3	201	Delp		
512	3	1839	-	18	4	31	SW	3	201	Delp		
513	3	1844	-	18	4	32	NE	3	201	Delp		
514	3	1839	-	18	4	30	SW	3	201	Delp Trib		
515	3	1839	-	18	4	20	SW	4	212	Delp		
516	3	1832	-	18	4	6	SW	3	201	Platt		
517	3	-	-	19	4	6	NW	3	201	Delp		
518	3	-	-	18	3	36	SE	3	201	Gold		
519	3	-	-	18	4	30	SW	3	201	Gold		
520	3	1839	-	18	4	24	SW	5	23	Fall		
521	3	-	-	18	3	12	SW	3	201	Saturn		
522	3	-	-	18	4	8	NW	3	201	Saturn		
523	4	-	-	18	3	12	NW	3	8	Hehe Trib		
524	4	-	-	18	3	12	NW	3	8	Hehe Trib		
525	4	1832	-	18	3	12	NE	3	310	Hehe Trib		
525a	4	1832	-	18	3	12	NE	3	310	Hehe Trib		
525b	4	1832	-	18	3	12	NE	3	310	Hehe Trib		
526	4	1832	-	18	3	1	SE	3	8	Hehe Trib		
527	4	1832	-	18	3	12	NE	3	8	Hehe Trib		
528	4	1831	-	18	3	1	NE	3	8	Hehe		
529	4	1831	-	18	3	1	NE	3	8	Hehe		
530	4	1831	-	18	3	1	NE	3	8	Hehe		
531	4	1831	-	18	3	1	NE	3	8	Hehe		
532	4	1831	-	18	3	1	NE	3	301	Hehe		
533	3	-	-	19	3	1	SW	3	441	Gold		
534	3	-	-	19	3	1	SW	3	441	Gold		
535	4	1835	-	18	3	36	NW	3	201	Gold		
536	3	-	-	18	3	14	NW	4	212	Tiller		
537	4	-	-	18	3	11	SE	4	212	Hehe Trib		
538	4	-	-	18	3	11	SE	1	25	Hehe Trib		
539	4	-	-	18	3	11	SE	4	212	Hehe		
540	4	-	-	18	3	12	NW	4	212	Hehe Trib		
541	4	-	-	18	3	2	NE	3	301	Hehe Trib		
542	4	-	-	18	3	2	NW	3	301	Hehe Trib		
543	3	1833	-	18	3	27	NE	4	212	Pacific Trib		
544	4	1832	-	18	3	15	NW	3	21	Hehe Trib		
545	4	1832	-	18	3	15	NW	3	21	Hehe Trib		
546	4	1832	-	18	3	15	NE	3	21	Hehe		
547	2	1835	-	19	3	15	SW	3	201	Portland		

Table A41. Summary of Inventoried Landslides

Slope Failure Number	WA #	Failures Previously Identified	WA Failure	Photo year of Failure	U of O Airphoto Number	Debris Failure	Rotational Failure	Road Fill Related	Road Cut Related	Harvest Related	Road and Harvest Related	Unmanaged Ground	Managed Ground	Aspect
548	-	-	-	1990	-	Y	N	Y	N	N	Y	-	Y	SW
549	-	-	-	1990	1590-66	Y	N	Y	N	N	Y	-	Y	W
550	-	Y	-	1990	-	Y	N	N	N	N	N	Y	-	E
551	-	Y	-	1990	-	Y	N	N	N	N	N	Y	-	E
552	-	Y	-	1990	1590-65	Y	N	N	N	N	N	Y	-	E
553	-	Y	-	1990	-	Y	N	N	N	N	N	Y	-	E
554	-	Y	-	1990	-	Y	N	N	N	N	N	Y	-	E
555	-	Y	-	1990	-	Y	N	N	N	N	N	Y	-	E
556	-	-	-	1990	-	Y	N	N	N	Y	N	-	Y	SW
557	-	Y	-	1990	-	Y	N	N	N	Y	N	-	Y	E
558	-	-	-	1990	-	Y	N	N	N	Y	N	-	Y	W
559	-	-	-	1990	-	Y	N	N	N	Y	N	-	Y	W
560	-	Y	-	1990	-	Y	N	N	N	Y	N	-	Y	W
561	-	-	-	1990	-	Y	N	N	N	Y	N	-	Y	E
562	-	-	-	1990	-	N	Y	N	N	N	N	Y	-	W
563	-	-	-	1990	-	N	Y	N	N	N	N	Y	-	N
564	-	-	-	1990	-	Y	N	Y	N	N	Y	-	Y	NE
565	-	Y	-	1990	-	Y	N	Y	N	N	Y	-	Y	N
566	-	Y	-	1990	-	Y	N	N	N	N	N	Y	-	N
567	-	Y	-	1990	-	Y	N	N	N	N	N	Y	-	N
568	-	Y	-	1990	-	Y	N	N	N	N	N	Y	-	N
569	-	-	-	1990	-	Y	N	Y	N	N	Y	-	Y	SE
570	-	-	-	1990	-	Y	N	Y	N	N	Y	-	Y	SE
571	-	-	-	1990	-	Y	N	Y	N	N	Y	-	Y	NW
572	-	Y	-	1990	-	N	Y	N	N	N	N	Y	-	NW
573	-	-	-	1990	-	Y	N	Y	N	N	Y	-	Y	W
574	-	-	-	1990	-	Y	N	N	N	Y	N	-	Y	E
575	-	Y	-	1990	-	Y	N	N	N	N	N	Y	-	N
576	-	Y	-	1990	-	Y	N	N	N	N	N	Y	-	N
577	-	Y	-	1990	-	Y	N	N	N	N	N	Y	-	N

Table A41. Summary of Inventoried Landslides

Slope Failure Number	Subwatershed	Road Number	Mile Post	Township	Range	Section	1/4 section	Soil Category	SRI Mapping Unit	Affected Drainage	Harvest Unit Name	Comments
548	2	1835	-	19	3	9	NE	3	201	-		
549	2	-	-					3	201	Nevergo		
550	2	-	-	19	3	5	SE	3	21	Portland		
551	2	-	-	19	3	5	SE	3	8	Portland		
552	2	-	-	19	3	5	SE	3	8	Portland		
553	2	-	-	25	3	5	SE	3	8	Portland		
554	2	-	-	19	3	8	NE	3	8	Portland		
555	2	-	-	19	3	8	NE	3	201	Portland		
556	4	-	-	18	3	4	SE	3	201	Pernot		
557	2	-	-					1	25	Nevergo		
558	2	1825	-	19	3	20	NW	1	25	Nevergo		
559	2	1825	-	19	3	20	NW	1	25	Nevergo		
560	2	1825	-	19	3	20	NW	1	25	Nevergo		
561	2	1824	-	19	3	8	NW	3	201	Gales		
562	1	-	-	19	2	12	NW	4	212	Andy Trib		
563	4	-	-	18	2	13	SE	3	201	Alder Trib		
564	4	1828	-	18	2	13	SW	3	201	Zog Trib		
565	4	1828	-	18	2	12	SW	3	201	Zog Trib		
566	4	-	-	18	2	13	NE	3	201	Zog Trib		
567	4	-	-	18	2	13	NE	3	201	Zog Trib		
568	4	-	-	18	2	12	NW	3	201	Zog Trib		
569	4	1817	-	18	2	12	NW	3	201	Zog Trib		
570	4	1817	-	18	2	12	NW	3	201	Zog Trib		
571	1	1821	-	19	2	3	SE	1	255	Andy		
572	1	-	-	18	2	23	NW	3	201	Bedrock		
573	4	-	-	18	2	13	NW	3	201	Jones		
574	1	1816	-	18	2	33	NW	4	212	Timber		
575	2	-	-	19	3	30	NW	3	21	Nevergo		
576	2	-	-	19	3	30	NW	3	21	Nevergo		
577	2	-	-	19	3	30	NW	3	21	Nevergo		

APPENDIX B: WILDLIFE

APPENDIX B: WILDLIFE

Table B42. Northern Spotted Owl Reproductive History and Home Range Acres.

		MSNO	0084 (Matrix)	0528 (Matrix)	1008 (Matrix)	1015 (Matrix)	2860 (Matrix)	2862 (Matrix)	2866 (Matrix)	2868 (Matrix)	2883 (Matrix)
		Geographic Name	Nevergo Creek	BLM Site	Andy Creek 1	Slick Creek	Portland-Gales Creek	North Fork Fall CR.	Rubble Creek	Andy Creek	North Fk Fall Cr S.
REPRODUCTIVE HISTORY	YEARS	1970									
		1971									
		1972									
		1973			S						
		1974	S								
		1975									
		1976									
		1977									
		1978									
		1979									
		1980				S					
		1981				PU					
		1982				S					
		1983									
		1984									
		1985				PU					
		1986									
		1987				S (night resp.)					
		1988									
		1989			S	S	S	S	PU	PN1	S
		1990	PU		S	PU		PX	PX		PX
		1991	S			PN2	PU	S (night resp.)	PN2		PU
		1992			PX	S	S		PZ	PN2	PN1
		1993			PN1	S			PN2		
		1994			PN1	PU		S		PU	PU
		1995	PX		S (non-nesting)						
TAKE STATUS	.7 Mile Radius	<30%									
		30 - 40					X (392.85)	X (389.84)			
		40 - 50		X (438)					X (419.68)	X (406.09)	
		>50%	X (581.01)		X (616.47)	X (674.36)					X (661.94)
	1.2 Mile Radius	<30%		X (783)							
		30 - 40			X (1,146.78)		X (885.05)			X (993.45)	
		40 - 50	X (1,418.85)					X (1,434.42)	X (1,177.76)		
		>50%				X (1,755.44)					X (1,966.97)

Table B42. Northern Spotted Owl Reproductive History and Home Range Acres.

		MSNO	2887 (Matrix)	2890 (Matrix)	2892 (Matrix)	2894 (Matrix)	3548 (Matrix)	1012 (LSR)	1013 (LSR)	1016 (LSR)	1017 (LSR)
		Geographic Name	Gales Creek	Lower Rubble Creek	Boundary Creek	North Boundary	Lower Rubble	Zog Creek	Jones Creek	Marine Creek	Tiller-Ninemile Creek
REPRODUCTIVE HISTORY	YEARS	1970									
		1971									
		1972									
		1973									
		1974									
		1975									
		1976									
		1977									
		1978									
		1979									
		1980							S	PN1	PU
		1981						PU	PU	PU	PN1
		1982						PN1	PU		
		1983									
		1984									
		1985									
		1986							S		
		1987						PN2	PU		
		1988							S		
		1989						S	PN1		
		1990	PU	PX	PN1			PN2	S	S	PU
		1991		PX	PU	S	S		S		PU
		1992		PN2		PN2	PNU			PN1	S
		1993		PU	S	PX					
		1994			S	S		PN1			
		1995						S (night resp)			
TAKE STATUS	.7 Mile Radius	<30%									
		30 - 40			X (302.42)						
		40 - 50	X (434.21)	X (416.83)			X (443.97)				
		>50%				X (634.12)		X (728.21)	X (669.39)	X (654.90)	X (626.84)
	1.2 Mile Radius	<30%			X (653.57)						
		30 - 40									
		40 - 50	X (1,439.93)	X (1,439.01)		X (1,391.91)	X (1,394.16)				
		>50%						X (1,836.22)	X (1,906.67)	X (1,611.28)	X (1,766.82)

Table B42. Northern Spotted Owl Reproductive History and Home Range Acres.

		MSNO	1019 (LSR)	1020 (LSR)	1021 (LSR)	1022 (LSR)	1028 (LSR)	1029 (LSR)	1031 (LSR)	2858 (LSR)	2863 (LSR)
REPRODUCTIVE HISTORY	YEARS	Geographic Name	Gold Creek East	West Delp Creek	East Delp Creek	Buzzard Creek	Lower Logan Creek	Upper Logan Creek	Saturn/Briem Creeks	L.Logan Creek	Sunshine Creek
		1970									
		1971									
		1972									
		1973									
		1974									
		1975									
		1976									
		1977									
		1978									
		1979									
		1980	PU	PN2	PU	PU		PU			
		1981	PN1		PU	PU		PU	S	PU	
		1982			S	S		PU			
		1983									
		1984									
		1985									
		1986	S				PU				
		1987	PX		PU				S		
		1988					S				S
		1989	PX		PX		S	PN1	S	S	S
		1990	PN1	S	PN2	PU		PN1	S		PX
		1991		S	S	S	S	PX		PU	S
		1992		PN2	PN1	S	S		PN2		PN2
		1993			PU						PX
		1994									
		1995									
TAKE STATUS	.7 Mile Radius	<30%									
		30 - 40					X (338.57)			X (344.27)	
		40 - 50						X (467.43)			
		>50%	X (507.50)	X (664.88)	X (673.89)	X (613.84)			X (729.04)		X (555.66)
	1.2 Mile Radius	<30%									
		30 - 40								X (1,105.41)	
		40 - 50	X (1,409.94)				X (1447.17)				
		>50%		X (1,531.21)	X (1,639.08)	X (1,680.38)		X (1,449.56)	X (1,941.47)		X (1,771.97)

Table B42. Northern Spotted Owl Reproductive History and Home Range Acres.

		MSNO	2864 (LSR)	2865 (LSR)	2888 (LSR)	2891 (LSR)	2895 (LSR)	2897 (LSR)	2899 (LSR)	2900 (LSR)	3550 (LSR)
		Geographic Name	Lower Tiller Creek	Tiller Creek	Upper Pernot Creek	Upper Hehe Creek	North Delp Creek	Delp-Nehi Creek	Logan	Lower Ninemile Creek	Middle Delp Creek
REPRODUCTIVE HISTORY	YEARS	1970									
		1971									
		1972									
		1973									
		1974									
		1975									
		1976									
		1977									
		1978									
		1979									
		1980					PN1				
		1981									
		1982									
		1983									
		1984									
		1985									
		1986									
		1987									
		1988									
		1989	S	S							
		1990		PU	PX	PN1		PN1			
		1991						S	S	PX	
		1992	PNU				S			S	S
		1993	S				PX	PU		PU	
		1994					PNU			PU	
		1995									
TAKE STATUS	.7 Mile Radius	<30%									
		30 - 40									
		40 - 50				X (416.83)	X (484.21)		X (440.66)		X (483.54)
		>50%	X (588.96)	X (518.41)	X (724.07)			X (521.95)		X (679.44)	
	1.2 Mile Radius	<30%									
		30 - 40							X (961.82)		
		40 - 50				X (1,439.01)					
		>50%	X (1,543.22)	X (1,471.15)	X (1,758.40)		X (1,628.95)	X (1,449.25)		X (1,771.55)	X (1,645.75)

Table B42. Northern Spotted Owl Reproductive History and Home Range Acres.

		MSNO	4082 (LSR)	4084 (LSR)	7002
REPRODUCTIVE HISTORY	YEARS	Geographic Name	Pumarine	Saturn/Platt	West Nimrod Butte
		1970			
		1971			
		1972			
		1973			
		1974			
		1975			
		1976			
		1977			
		1978			
		1979			
		1980		S	
		1981			
		1982			
		1983			
		1984			
		1985			
		1986			
		1987			
		1988			
		1989			
		1990			
		1991			
		1992			
		1993	PN1	S	
		1994			
		1995			
TAKE STATUS	.7 Mile Radius	<30%			X (257.20)
		30 - 40			
		40 - 50			
		>50%	X (567.88)	X (681.81)	
	1.2 Mile Radius	<30%			X (723.18)
		30 - 40			
		40 - 50			
		>50%	X (1,531.63)	X (1,976.05)	

<u>DEFINITIONS FOR REPRODUCTIVE HISTORY AND TAKE STATUS</u>:

Reproductive History

Site Status P = Pair, S = Single, "blank" = unknown or not surveyed

Nesting Status N = Nesting, X = Non-nesting, U = Unknown nesting (either surveyed with unknown results or not surveyed), Z = Failed

Reproductive Status # = Number of young produced, U = Unknown

Take Status

Take is defined by USFWS as either 1) Less than 50% (500 ac.) suitable spotted owl habitat remaining within >7 mile home range radius of the activity center or 2) Less than 40% (1182 ac.) suitable spotted owl habitat remaining within 1.2 mile home range radius of the activity center

Table B43. USFWS Threatened, Endangered, Sensitive and Category 1 and 2 species.
ROD Survey and Manage (C-3) Species. Appendix J2 Species and Other Species of Concern.

Species (*scientific name*)	Status: Regional Foresters Sensitive Species List	Status: Federal Register Notice of Review	Status: ROD Table C-3 Survey and Manage Species (√)	Status: Appendix J2 Species of Concern (√√)
Amphibians and Reptiles				
Northern red legged frog (*Rana aurora aurora*)	S	C2		
Northwestern pond turtle (*Clemmys marmorata marmorata*)	S	C2		
Spotted frog (Western pop.) (*Rana pretiosa*)		C1		
Tailed frog (*Ascaphus truei*)		C2		√√
Foothill yellow-legged frog (*Rana boylii*)		C2		
Cascades frog (*Rana cascadae*)		C2		
Southern torrent (seep) salamander (*Rhycotriton variegatus*)		C2		√√
Cascade torrent (seep) salamander (*Rhycotriton cascadae*)				√√
Clouded salamander (*Aneides ferreus*)				√√
Oregon slender salamander (*Batrachoseps wrighti*)				√√
Birds				
American peregrine falcon (*Falco peregrinus anatum*)	S	E		
Northern bald eagle (*Haliaeetus leucocephalus*)	S	T		
Northern spotted owl (*Strix occidentalis caurina*)	S	T		
Ferruginous hawk (*Buteo regalis*)	S	C2		
Harlequin duck (*Histrionicus histrionicus*)	S	C2		
Northern goshawk (*Accipiter gentilus*)		C2		
Greater sandhill crane (*Grus canadensis*)	S			
Common merganser (*Mergus merganser*)				√√
Great gray owl (*Strix nebulosa nebulosa*) ROD **species of concern w/ protect. buffer**				
Mammals				
California wolverine (*Gulo gulo luteus*)	S	C2		
White footed vole (*Arborimus alpies*)	S	C2		
American marten (*Martes americana*)				√√

Table B43 *(cont.)*. USFWS Threatened, Endangered, Sensitive and Category 1 and 2 species. ROD Survey and Manage (C-3) Species. Appendix J2 Species and Other Species of Concern.

Species *(scientific name)*	Status: Regional Foresters Sensitive Species List	Federal Register Notice of Review	ROD Table C-3 Survey and Manage Species (√)	Appendix J2 Species of Concern (√√)
Pacific fisher *(Martes pennanti pacifica)*		C2		√√
Oregon red tree vole *(Phenacomys longicaudus)*			√	√√
Pacific western big-eared bat *(Plecotus townsendii townsendii)*	S	C2		
Long eared myotis *(Myotis evotis)*		C2		√√
Yuma bat *(Myotis yumanensis)*		C2		
Fringed myotis *(Myotis thysanodes)*		C2		√√
Long legged myotis *(Myotis volans)*		C2		√√
Hoary bat *(Lasiurus cinerus)*				√√
Silver haired bat *(Lasionycteris noctivagens)*				√√
Invertebrates				
Arthropods				
Beer's false water penny beetle *(Acneus beeri)*	S	C2		
Mt. Hood primitive brachycentrid caddisfly *(Eobrachycentrus gelidae)*	S	C2		
Tombstone prairie faralan caddisfly *(Farula reaperi)*	S	C2		
Fort Dick limnephilus caddisfly *(Limnephilus atercus)*	S	C2		
Tombstone Prairie oligophlebodes caddisfly *(Oligophlebodes mostbento)*	S	C2		
One-spot rhyacophilan caddisfly *(Rhyacophila unipunctata)*	S	C2		
Molluscs				
Prophysaon coeruleum			√	√√
Prophysaon dubium			√	√√

Total = 40 species

(S) = Species identified on the Regional Forester Sensitive species list
(√) = Survey and manage species identified in the ROD under table C-3
(√√) = Species of concern recognized in Appendix J2 of the ROD
Federal Register Notice of review classifications:
(E) = Endangered(T) = Threatened
(C1) = Category 1: Taxa for which the Fish and Wildlife Service has sufficient biological information to support a proposal to list as endangered or threatened.
(C2) = Category 2: Taxa for which existing information indicates may warrant listing, but for which substantial biological information to support a proposed rule is lacking.

IMPACTS OF A..IVITIES WITHIN RIPARIAN RESERVES TO WILDLIFE SPEC... OF CONCERN, AS IDENTIFIED IN THE FSEIS ROD, 1994. C...MON MITIGATION TO ALL ACTIVITIES INCLUDES THE REQUIRED SURVEY AND MANAGE STRATEGY AS DESCRIBED IN THE ROD. THESE IMPACTS MAY VARY WITH SITE-SPECIFIC CONDITIONS. ALL WNF S&G'S APPLY.

This information is the result of a meeting between biologists and ecologists on the Willamette National Forest. The basis for the information is professional judgment. New information obtained on impacts may alter this table in the future.

KEY

D/N = SHORT TERM DELETERIOUS/LONG TERM NEUTRAL
U/N = SHORT TERM UNKNOWN/LONG TERM NEUTRAL
N/N/ = SHORT TERM NEUTRAL/LONG TERM NEUTRAL
D/B = SHORT TERM DELETERIOUS/LONG TERM BENEFICIAL
(-RLF) = ALL AMPHIBS EXCEPT RED LEGGED FROM
(-FM) = ALL BATS EXCEPT FRINGED MYOTIS

ACTIVITY	AFFECTS	MITIGATION	MITIGATION	ASSUMPTIONS /comm
SPECIAL FOREST PRODUCT COLLECTION	NEUTRAL - ALL	May need to reassess if any impacts id'd by botanists to mosses and lichens		1
SPRING FERTILIZATION (1/1-6/30)	U/N - MOLLUSKS D/N - AMPHIBS N/N - REST	no spray w/in 20' of open water		2,3,5,6,7,8,9 detrimental affect due to contact of preadults amphibs w/chemical
FALL FERTILIZATION (stands <20yrs) (10/1-12/31)	U/N- MOLLUSKS D/N - AMPHIBS (-RLF) N/N - REST	no spray w/in 20' of open water		2,3,6,7,8,9,10 detrimental affect due to contact of adults w/chemical
FALL FERTILIZATION (stands >20yrs) (10/1-12/31)	U/N - MOLLUSKS D/N - AMPHIBS N/N - REST	no spray w/in 20' of open water		2,3,5,6,7,8,9,10
PRE-COMMERCIAL THIN (<20yrs)	N/B MOLLUSKS AND RLF D/N AMPHIBS (-RLF) N/B STOC,GOSH,RTV, FM N/N BATS,MARTEN FISHER	25' no thin on >20% of stream miles w/in an individual project area or w/in each watershed for heterogeneity w./ stand (class 4) Also 25' no thin on all class 3. No heavy equipment w/in 25'		2,7,9,11,12,13, These forest stands is not primary habitat for frogs in the fall months
COMMERCIAL THIN (>20yrs)	N/B MOLLUSKS, RLF,RTV D/N AMPHIBS (-RLF) N/N BATS, MARTEN, FISHER	25' no thin on >20% of stream miles w/in an individual project area or w/in each watershed for heterogeneity w/in stand Also 25' no thin on all class 3. In RR, min conifer canopy closure of 50% (overhead)	Retain all existing snags and down logs in RR No heavy equipment w/in 25' Leave at least 2 trees per acre for LWD of the DBH class thinned.	3,9,11,12,13,14, CT can affect the number of small snags available for several decades after treatment

Table B44.

PRUNING (stands <25'ht)	D/N AMPHIBS (-RLF) NEUTRAL - REST	No heavy equipment w/in 20' No pruning w/in 25' of water. Beyond this 25' strip, no more than 30% of eligible trees to be pruned to outside edge of RR		3,15,16,
PRUNING (stands >25'ht)	NEUT - BATS (-FM) U/N - REST	same as above		3,15,16,
HIKING TRAIL CONSTRUCTION	D/N - AMPHIBS (-RLF) NEUTRAL - REST	minimize construction of trails w/in 25' of streams and minimize total miles and construction parallel to stream w/in RR		1,17,20,
HORSE/MTN BIKE TRAILS	SEE ABOVE	same as above		1,18,20,
SNOWMOBILE TRAILS, GROOMED XC SKI TRAILS	NEUTRAL - BATS (-FM) D/D MOLLUSKS, RLF, STOC, GOSH, RTV, FM, MARTEN, FISHER D/N - AMPHIBS (-RLF)	same as above Leave all trees felled during construction on site		1,19,20,
FIREWOOD OR BLOWDOWN REMOVAL	D/N - AMPHIBS (-RLF) NEUTRAL - REST	leave 500 lineal feet/acre; >20"dbh, <20' minimum piece length; or largest available		21
REGENERATION HARVEST	D/N AMPHIBS (-RLF) B/B - FM, MARTEN, FISHER NEUTRAL - REST	Done only for the purpose of maintaining meadows		2,9,22
UNDERSTORY BURNING (spring, ie before May)	N/B MOLLUSKS, RLF, STOC, GOSH, RTV, MARTEN, FISHER D/N - AMHIBS (-RLF) N/N - BATS (-FM) D/B - FM	Burn early		23
HAZARD TREE REMOVAL	N/N - RTV, MARTEN, FISHER, MOLLUSCS, TF, STOC, GOSH D/N - BATS B/B - AMPHIBS (-TF)	Leave felled hazard trees on site except within road prism and areas where trees impede normal function of admin site	Leave at least 240 lineal feet/acre; >20" dbh, >20' minimum piece length or largest available in forested areas with potential to provide habitat	24
MINING CLAIMS (Commercial)	D/D - ALL			
RIPARIAN PLANTING	N/B - ALL			
SNAG CREATION	N/B - ALL			26

BROWSE CUTBACK	N/N - ALL			27
LWD PLACEMENT AND ENHANCEMENT	B/B	If falling trees or topping to create/obtain material, no overhead reduction in conifer canopy closure will occur		
INSTREAM PLACEMENT OF ROCK	D/B - RLF, CSS, TF N/B - MARTEN, FISHER N/N - REST			
ROAD CONSTRUCTION/RE-CONSTRUCTION	D/D - ALL			
ROAD DECOMMISSIONING	N/B			
ROADSIDE BRUSHING	N/N			24
BIG GAME FORAGE SEEDING (Non-native seed)	D/D - MARTEN, FISHER, STOC, GOSH N/N -REST	Reassess if botanists id potential impacts to lichens and bryophytes		28
PUMP CHANCE CREATION	N/N			29

SPECIES: MOLLUSKS = P.COERULEON & P.DUBIUM
RLF = RED LEGGED FROG
OSS = OREGON SLENDER SALAMANDER
TF = TAILED FROG
CS = CLOUDED SALAMANDER
STOC = SPOTTED OWL
GOSH = GOSHAWK
RTV = RED TREE VOLE
FM = FRINGED MYOTIS
HB = HOARY BAT
LEM = LONG EARED MYOTIS
LLM = LONG LEGGED MYOTIS
SHB = SILVER HAIRED BAT
PB = PALLID BAT
MARTEN
FISHER

ASSUMPTIONS:

1. Assumed all stand conditions/ages included, including LSOG forest habitat.
2. Assumed stand condition/age to which activity is applied is <20 years (open canopy).
3. Assumed stand condition/age to which activity is applied is >20 (closed canopy) and <80 years (not yet mature forest structure).
4. No special forest product harvest within any LSR or protection buffer.
5. Impacts to eggs and larvae are a primary concern during this season.
6. Fertilizer as applied normally can have a detrimental effect on adults when they directly contact the chemical.
7. These species are not commonly found in stands <20 years (open canopy stands)
8. Fertilizer as applied normally does not have a detrimental effect on prey species (insects, rodents, etc.)
9. Forested stands <80 years old (not yet mature forest structure) is not optimal habitat for activities during the breeding season.
10. Impacts to eggs and larvae are not a concern during this season.
11. During PCT operations, most of the shrubs will remain intact.
12. During PCT operations, leave shear banks unthinned.
13. The intent of the management activity is to promote old growth forest structure.
14. In forest stands regenerated by fire, PCT may not have occurred.
15. Pruning is limited to 25-30% of total trees occurring in a 30' radius.
16. Pruning in stands with trees <25' height will decrease canopy closure; otherwise not.
17. Hiking trials minimize removal of trees and understory vegetation; they also create narrow corridors through forests.
18. Horse and mountain bike trails are wider than hiking trails and narrow than snowmobile trails.
19. Snowmobile trails remove more trees and understory vegetation and create road-width corridors through forests.
20. Effects of trail construction considers only effects on wildlife habitat and not wildlife disturbance potential.
21. Assume LSR guidelines for salvage apply to riparian reserves (C-14-16); canopy closure must be <40% for salvage to occur, therefore salvage will not reduce existing canopy closure.
22. Purpose is to maintain special habitats such as meadows (generally <5 acres)
23. Light, spring burn which leaves duff and reduces fuels.
24. Areas such as road sides, campsites, admin sites are not optimal habitat.
25. Commercial mining claims remove patches of forest, create ponds, and affect subsurface water quality.
26. Most snag creation will occur in open stand conditions (plantations) that will not be habitat for most species considered.
27. Some understory vegetation removed in local areas.
28. Non-native grass seed is not as high quality food to granivores and herbivores as are native grasses and forbs that they replace (indirect effect to predators)
29. Localized impacts expected but not expected to affect many individuals or to last for more than a day or two.

APPENDIX C: RECREATION

Appendix C: Recreation

Figure C25. Tent Sites per Dispersed Site

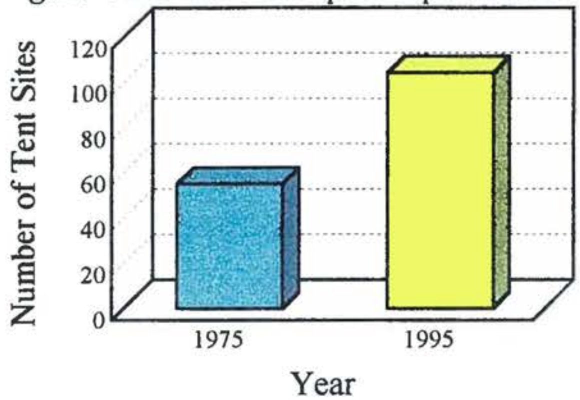


Figure C26. Number of Vehicles per Site

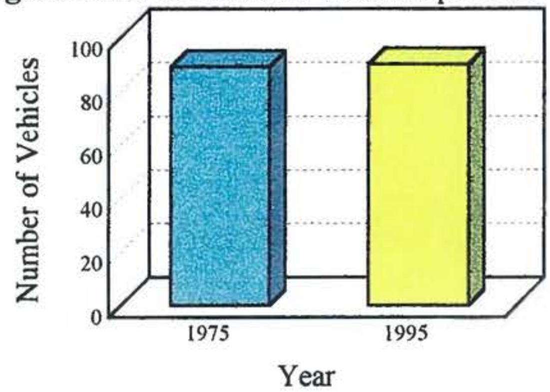


Figure C27. Number of Sites Occupied

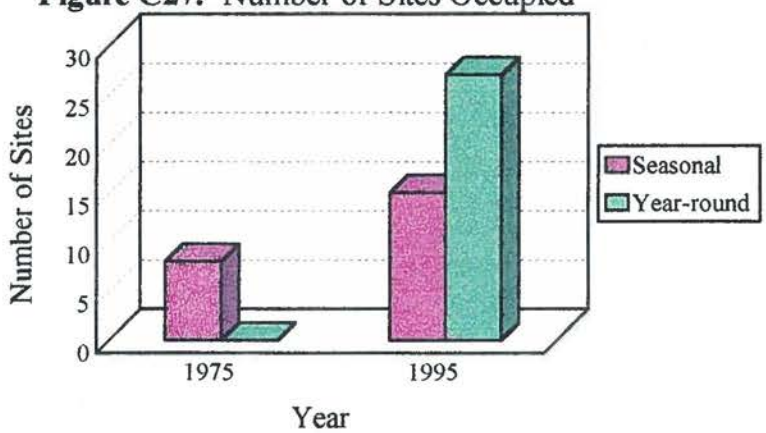


Figure C28. Site Capacity (PAOTs)

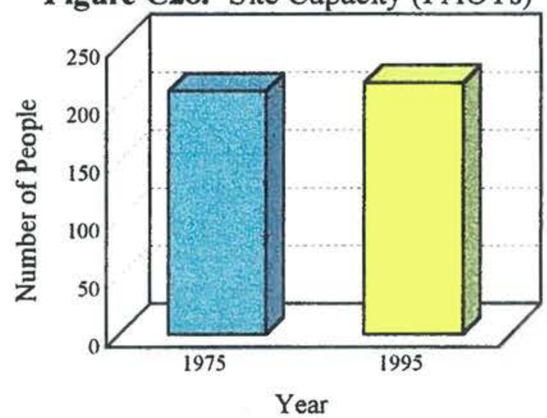


Figure C29. Use Level per Dispersed Site

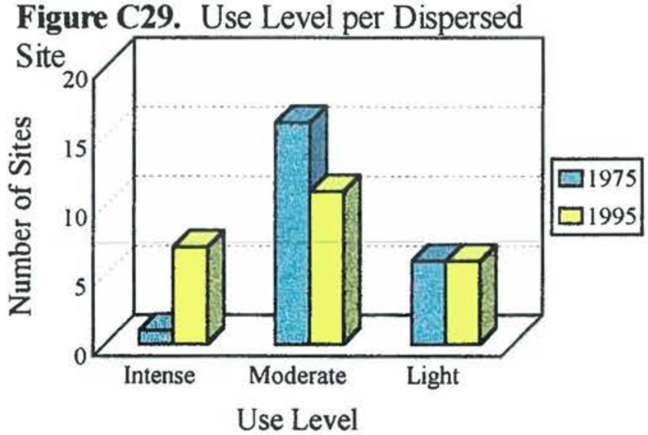


Figure C30. Frequency of Use

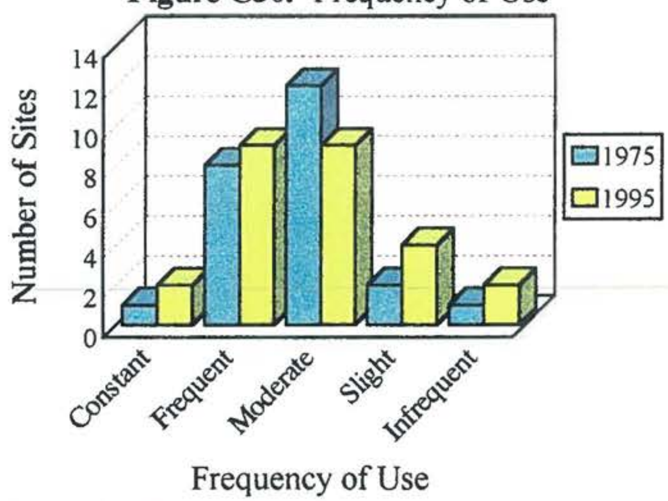


Figure C31. Firewood Availability