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United States
Department of
Agriculture

Forest Service

Pacific
Northwest
Region

Upper East Fork Lewis River Watershed Analysis

Gifford Pinchot National Forest

EXECUTIVE SUMMARY

The 36,946-acre Upper East Fork of the Lewis River Watershed is comprised of National Forest (29,831 acres) and State and private (7,115 acres) ownership. The area has been divided into 23 sub-basins for analysis by an interdisciplinary team.

In this first iteration of analysis, the following 15 issues are analyzed: Surface Erosion from Roads; Soil Productivity; Beneficial Uses of Water; Hydrologic Changes; Stand Structure and Composition; Riparian Reserve Fragmentation; Threatened, Endangered and Sensitive (TES) Plants; Special Forest Products; Special Habitats -Plants; Deer and Elk Winter Range; Riparian Reserve Fragmentation (aquatic habitat changes); Habitat Condition for TES Animal Species; Quantity and Quality of Key Habitat Attributes for Resident Salmonids; Impacts on Natural Resources by Recreation Use; Impacts to Recreation Associated With Human Activity.

Characterization

Formed by volcanic and glacial processes, the topography is rough with multiple ridge crests separated by steep, deeply dissected valleys. In the western portion, however, the terrain is more gently sloping. Elevations are highest (4,200 feet) in the eastern portions of the watershed with the lower elevations primarily located in the western portions with elevations down to 1,200 feet. Drained by the East Fork of the Lewis River and its tributaries, the watershed is vegetated by coniferous forest plant associations which provide habitat for 227 terrestrial species.

Fire history for this area has dramatically altered the landscape to what is seen today. Large scale stand replacement fires such as the Yacolt Fire of 1902, estimated to have covered 238,900 acres, left one of the largest continuous areas of fire killed snags in the State of Washington. Many reburns of the area followed the 1902 fire. Intense fire prevention tactics involving snag felling from the 1930's to the 1960's removed many of the large snags across the landscape.

Current Conditions

Roading has been a major contributor of sediment to streams since road construction began in the 1940's. Road density across the watershed is 1.76 miles per square mile but six of the 23 sub-basins have densities greater than 3.0 miles per square mile.

Several "beneficial use" stream reaches are used as spawning, rearing, and holding habitat by winter steelhead. Downstream habitat for other salmonid species such as chinook salmon and coho salmon are influenced by water quality from this watershed. These uses are vulnerable to changes from sediment, stream temperature, large woody debris (LWD), and peak flows.

The vegetation of the Upper East Fork Watershed has been categorized into six zones (or ecoclasses) based on plant species present, their proportions and potential vegetation. Vegetation

is further classified by structure stages. Large stand replacing fires from the turn of the century have contributed to the high amount of young forest stands (64%). Timber harvest activities have been limited to mostly commercial thinning due to the young stand ages. The large stand replacing fires have also altered Riparian Reserve stand structure. Four percent of Riparian Reserves are in Late Successional structure stages. One State listed threatened and one State listed Sensitive listed plant species have been found within the Upper East Fork watershed.

Fish currently occupy about 49 miles of the 286 total miles of stream within the watershed. Winter steelhead spawn in the Upper East Fork watershed while other salmonids are present downstream below Sunset Falls. Of the 25 miles of stream surveys completed so far, 92 percent are rated as poor condition for LWD per mile and 52 percent are rated in poor condition for pools per mile.

Analysis of stream shading indicates large segments of the East Fork Lewis River and Copper Creek lack canopies that cover more than 50 percent of the stream channel. These open canopies could be the main factor leading to the high number of stream temperature samples taken between 1978 and 1993 that exceeded State Water Quality Standards for maximum water temperatures.

Riparian Reserves are recovering from the past fires but still lack the large wood component. Only two sub-basins have potential for ongoing recruitment of large wood into streams. The other 21 sub-basins have young conifer stands that will take many years to begin providing large diameter wood into the aquatic system.

The watershed contains habitat for the following TES species: bald eagle, northern spotted owl, gray wolf, grizzly bear, harlequin duck, northern goshawk, pileated woodpecker, American marten, larch Mountain salamander, red-legged frog, and Cascade frog. To evaluate habitat conditions the species are placed in guilds (groups). There are nearly 8,000 acres of suitable spotted owl habitat on National Forest lands (27%) in the watershed. Nesting habitat makes up more than 1,200 acres of those 8,000 acres. Nesting habitat is equivalent to optimum habitat for other species requiring large tree character and multi canopy stand structure.

Two habitat elements of old-growth stands are large diameter snags and down woody material. Most of the snags created by fire were felled in the 1960's as a fire prevention measure. Snags that still persist from the fires are soft and generally less than 20 feet tall. Stands that were regenerated following the fires do not yet contain large trees that could become snags in the near future. Old-growth stands in sub-basins 6 and 7 do contain abundant snags.

The 8,131 acres of deer and elk biological winter range within the watershed are located along the mainstem of the East Fork and along Copper Creek. Optimal thermal cover on National Forest lands is currently two percent of the total biological winter range habitat. Forest plan goals are to maintain 44 percent of biological winter range in optimal thermal cover.

Human use is widespread through the watershed, with concentrated numbers and activities near access roads, trails, and developed sites. Commercial use includes harvest of timber, mineral

development, and special forest products. A variety of recreational activities are pursued over the landscape without benefit of a comprehensive recreation development plan. A relatively high number of dispersed camping sites have sprung up over time, and high use is causing adverse effects within the watershed.

Reference Conditions

Reference conditions explain how the existing conditions have changed over time as a result of human influence and natural disturbances. They describe the known or inferred history of the landscape so we may know what was sustainable in the past and what changes have occurred to affect sustainability.

Volcanic and glacial activity have created the landscape we see today. Folding and faulting of this material has also influenced the landscape.

Stream temperature increases probably coincide with large fires in the basin. Vegetative canopies that provide shading are lacking, although the trend is changing as forest stands grow and mature.

Because the Upper East Fork watershed has recently experienced large scale stand replacement fires compared to other parts of the Lewis River Basin, late-successional habitat may have been nearer to the lower end of the 45 to 70 percent natural range.

Distribution of resident and anadromous fish within the watershed has been altered by road construction. Although no reference information is available, it is assumed that the number of large woody pieces per mile of stream was higher than it is now due primarily to snag removal and stream cleanout practices.

The extent and magnitude of human uses in the watershed has grown exponentially from the mid-1800's until present time intensified by population growth and technological advancements accompanying the industrial era.

Interpretation

For each of the 15 issues, existing, historical, and reference conditions are compared by explaining significant differences, similarities, or trends and their causes. The comparisons, explanations, and discussions are presented in a similar series of tables and paragraphs that enable the reader to follow the logic of the analysis.

Using the above tables and paragraphs the team integrated the information spatially, i.e. showing which sub-basins were of concern in comparitive format. Table 24, Synthesis Table, uses a matrix of rows and columns to display ratings of 27 different factors of ecological concern for each sub-basin. These compilations of data, information, and interpretations form the basis for

recommendations.

Recommendations

The ID Team recommends activities that could move the system toward management objectives or reference conditions, as appropriate.

Restoration Activities	Priority	Number of Sub-basins
Road Decommissioning	High	4
Road Weatherization	Low	4
Development - Upland Young Tree Stands	Medium	18
Development - Riparian Young Tree Stands	High	9
Rehabilitate Rock Quarries	Low	2
Stream Enhancement	High	2
Snag Creation	High	4
Erosion Control/Slope Stabilization	Low	6
Roads to Trails	Medium	6
Recreation Site Rehabilitation	High	9

Monitoring Activities	Priorities	Number of Sub-basins
Recreation Use	High	7
Mineral Development	High	6
Recreation Use in Silver Star Area	High	7
Stream Temperature	High	8
Stream Surveys	Medium	8
Fish Surveys	Medium	9
Amphibians	Medium	7
Riparian Reserve Rehabilitation	High	9
Monitor Cliff Nest Sites for Raptors	High	2
Verification of Ecological Inventory	High	23

Commodities and Development	Number of Sub-basins
Old-growth Fragment Retention	10
Potential for Recreation Develop.	11
Opportunities for Timber Harvest	19

In Appendix D, each team member discusses the limitations of the analysis, confidence in the analysis, data gaps, and implications of these limitations for management.

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of the
LEWIS RIVER
WATERSHED ANALYSIS

Gifford Pinchot National Forest
Mount St. Helens National Volcanic Monument

December, 1995

INTRODUCTION

Management direction for the National Forest lands comprising the Upper East Fork of the Lewis River watershed (Figure 1, Vicinity Map) is set forth in the Gifford Pinchot National Forest Land and Resource Management Plan, 1990 as amended (through amendment 11 Update No. 2, June 26, 1995), hereafter referred to as the 1990 GPNF Forest Plan. On April 13, 1994, the 1990 GPNF Forest Plan was amended by the Secretary of Agriculture as documented in the Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl, hereafter referred to as the ROD (Figure 2, Land Allocations). This Record of Decision is the culmination of a public land management effort initiated by President Clinton in April, 1993, and along with the accompanying Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl is frequently called the Northwest Forest Plan. The Northwest Forest Plan (NFP) provides extensive management direction, including land allocations, see Figure 3 Northwest Forest Plan Allocations Map, that comprise a comprehensive ecosystem management strategy. A major part of this strategy is the Aquatic Conservation Strategy (NFP, page B-9) which has four components (NFP, Page B-12)

- 1. Riparian Reserves
- 2. Key Watersheds
- 3. Watershed Analysis, and
- 4. Watershed Restoration

The Upper East Fork of the Lewis River Watershed was selected for analysis at this time because:

1. most of the area is a Key Watershed (ROD, page B-18).
2. it is known to contain high priority watershed restoration needs.
3. a watershed-scale analysis is needed to support proposed timber sales, timber stand improvement, road reconstruction and trail reconstruction work.

The **purpose** of this watershed analysis is to: 1) develop and document an understanding of the ecological structures, functions, processes and interactions occurring within the Upper East Fork of the Lewis River watershed; and 2) identify desired conditions, trends, and restoration and management opportunities.

The responsible official who will make decisions about site-specific project proposals will use this landscape scale analysis to help decide whether or not a particular proposal or management action meets the Aquatic Conservation Strategy objectives (NFP, page B-11).

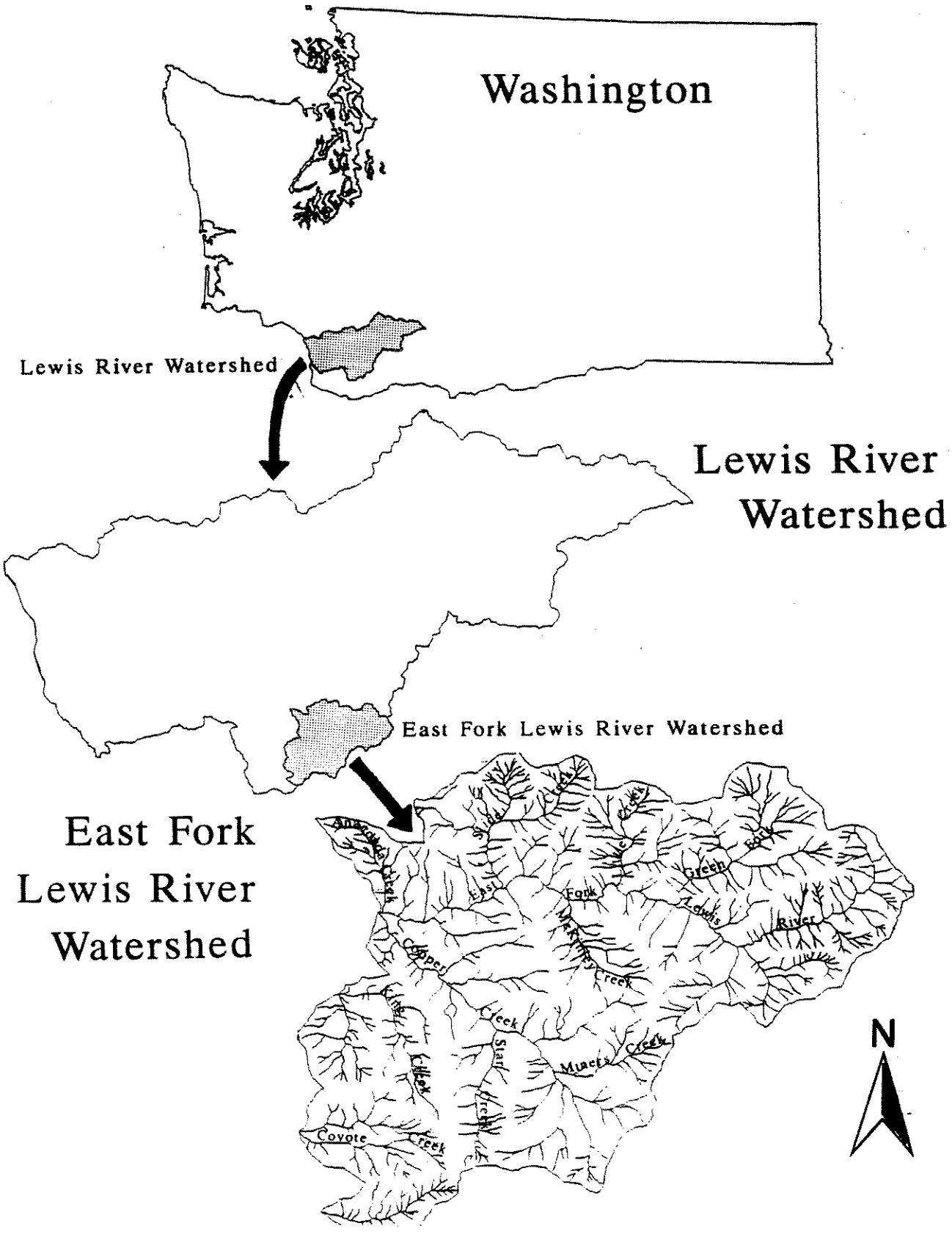


Figure 1 Vicinity Map

Land Allocations

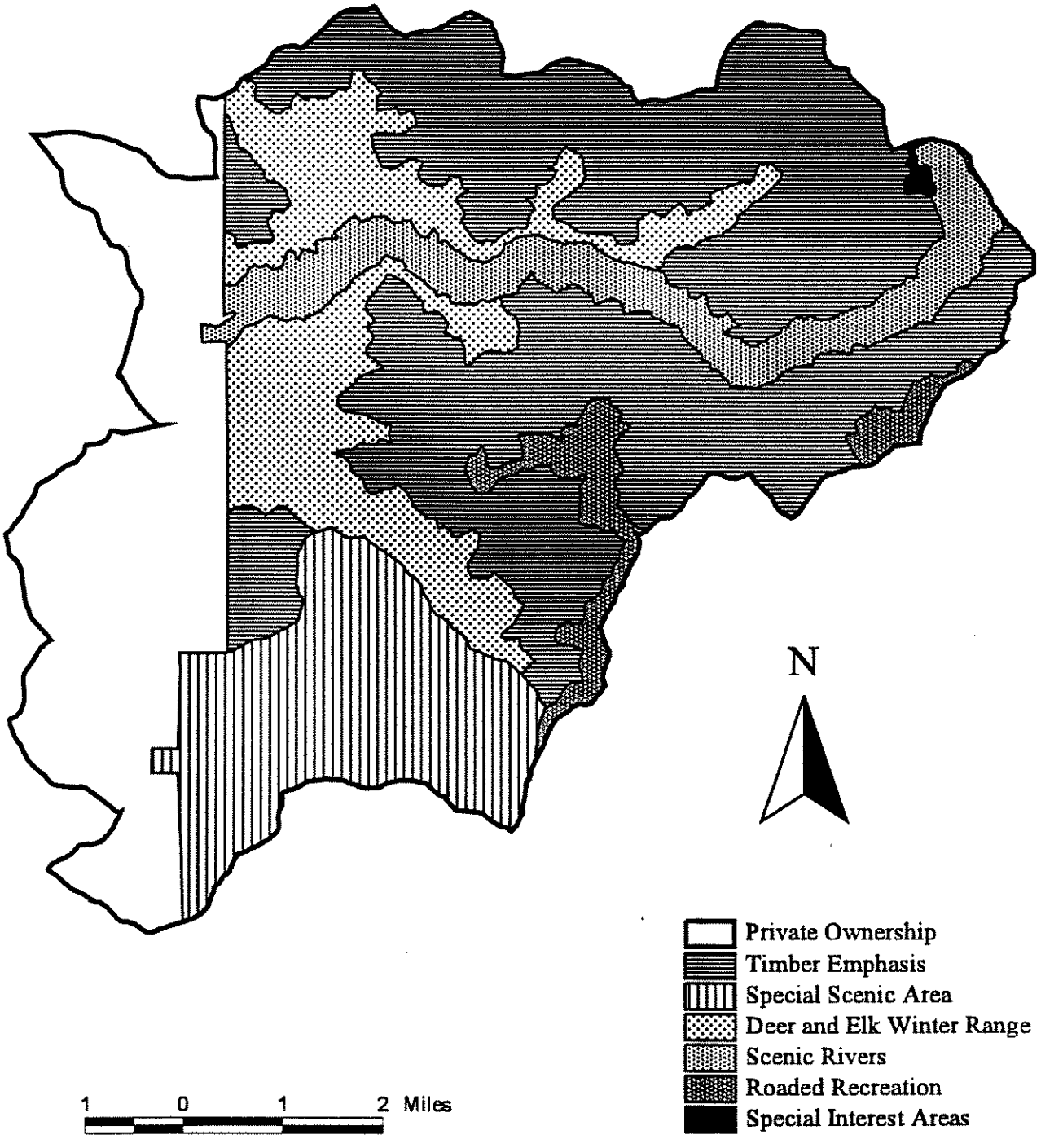
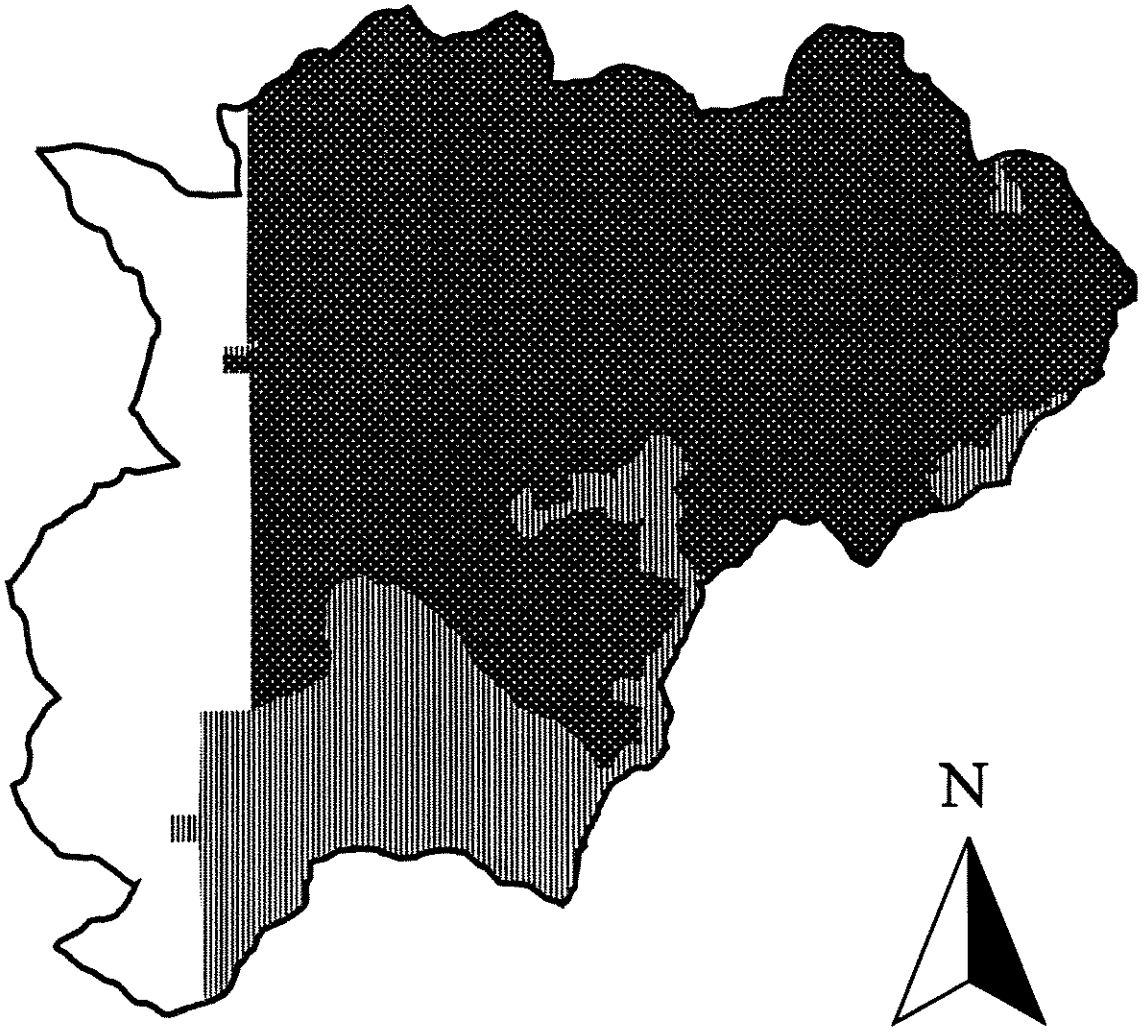


Figure 2 Gifford Pinchot National Forest Land Allocations

Northwest Forest Plan Allocations



1 0 1 2 3 Miles

Adiministratively Withdrawn Areas
Matrix Lands
Private Ownership

Figure 3 Northwest Forest Plan Allocations

The analysis was conducted by an interdisciplinary (ID) team of specialists trained in the fields of geology, soils, hydrology, botany, fisheries, and wildlife biology, recreation management, forest fuels, and silviculture (see List of Preparers).

The ID team used the Ecosystem Analysis at the Watershed Scale (The Revised Federal Guide for Watershed Analysis) Version 2.1, March 24, 1995, hereafter referred to as the 6-Step Guide, to structure the analysis of the Upper East Fork Lewis River Watershed.

This report is organized to help readers understand the six-step process followed by the ID team, and to provide an understanding of the processes and interactions occurring in the watershed.

Chapter I - **Characterization of the Watershed** - (a) places the watershed in context within a broader geographic area and (b) briefly describes the dominant physical, biological, and human dimension features, characteristics, and uses of the watershed.

Chapter II - **Issues and Key Questions** - identifies the variety of uses and values associated with the watershed in order to focus the analysis on the **key elements** that are most relevant to the Management questions, Human values, and Resource conditions within the watershed.

These elements formulate analysis questions using the indicators most commonly used to measure or interpret these ecosystem elements.

Chapter III - **Current Conditions** - documents the range of the ecosystem elements' current conditions and how they are distributed.

Chapter IV - **Reference Conditions** - explains how the existing conditions from Chapter III have changed over time as the result of human influence and natural disturbances. It's purpose is to describe the known or inferred history of the landscape to better understand what was sustainable in the past and what changes have occurred to affect sustainability.

Chapter V - **Interpretation** - compares the existing historical, and reference conditions of specific ecosystem elements by explaining significant differences, similarities, or trends and their causes. The capability of the system to achieve key management objectives is also explored.

Chapter VI - **Recommendations** - identifies those management activities that could move the system toward reference conditions or management objectives, as appropriate.

Material is presented in the same general order in each chapter to follow a logical and parallel pattern as follows:

1. Geology, physical processes, soils
2. Water-related features, hydrologic processes
3. Vegetation Composition, Structure, TES plant species, C-3 lichens, Bryophytes and Fungi
4. Aquatic animals and habitat
5. Terrestrial animals and habitats, TES animal species
6. Human dimension
7. Integration and ecology

CHAPTER I CHARACTERIZATION

A large portion of the Pacific Northwest lies within the Columbia River Basin, which can be divided into smaller river basins such as the Lewis River. The East Fork of the Lewis River is a small watershed that occupies a portion of the Lewis River basin. See Figure 1, Vicinity Map page 2.

The Upper East Fork of the Lewis River Watershed Analysis Area (hereafter referred to as the Upper East Fork) encompasses an area of National Forest lands and other ownership lands within the Lewis River drainage and its tributaries. The Upper East Fork of the Lewis analysis area includes Green Fork, Little Creek, Slide Creek, Poison Creek, McKinley Creek, and most of Copper Creek and associated smaller creeks within National Forest lands. To the west, the analysis area includes mixed-ownership lands that include Anaconda Creek and portions of Rock Creek and King Creek. (See Figure 3, Gifford Pinchot National Forest Land Allocations.)

The analysis area is divided into 23 sub-basins (Figure 4, Sub-basins Map).

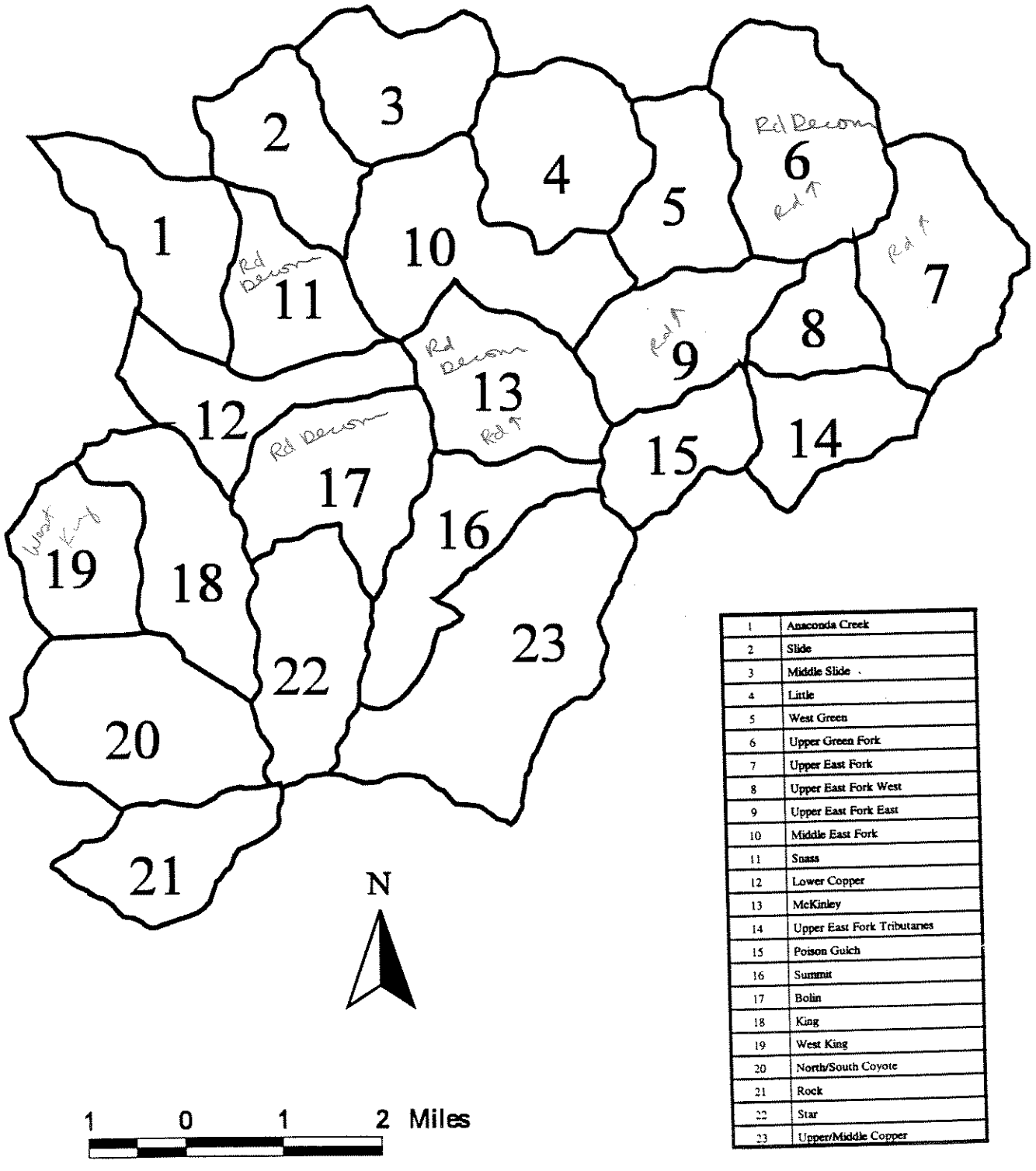
The Upper East Fork covers 36,946 acres (29,831 under Forest Service management and 7,115 of other ownership), and ranges in elevation from 1,000 feet in the western downstream part of the watershed to 4,442 feet at the summit of Green Mountain. All the land, water, plants, animals, and people within this area make up the watershed ecosystem.

Geology, Physical Processes, Soils

The Upper East Fork of the Lewis River is a unique area of the Forest, due to the amount of mineralization that has occurred in the Silver Star area. Geologically this area has been intruded by a pluton (an igneous intrusion that solidified slowly, causing minerals to form separately). This pluton dates back about 20 million years. The volcanism in this area also formed numerous pipes, or vertical conduits beneath volcanoes. These pipes are usually filled with volcanic breccia and fragments of older rock. As a zone of high permeability, it is commonly mineralized. The numerous mining claim holders in this area (over 300 valid claims) are primarily interested in copper, silver, zinc, lead, and molybdenum. Mining in the area can be traced back to the late 1800's.

Volcanism in the rest of the basin has formed numerous flows of andesite and pyroclastics, as it has in other areas of the forest. This material is more than 24 million years old. The pyroclastic material shows some weathering but has not produced the stability problems noted in other watersheds. Mass wasting potential for the Upper East Fork is low to moderate. Folding and faulting of this material has helped create the landform as we see it today.

Upper East Fork Sub-basins



1	Anaconda Creek
2	Slide
3	Middle Slide
4	Little
5	West Green
6	Upper Green Fork
7	Upper East Fork
8	Upper East Fork West
9	Upper East Fork East
10	Middle East Fork
11	Snass
12	Lower Copper
13	McKinley
14	Upper East Fork Tributaries
15	Poison Gulch
16	Summit
17	Bolin
18	King
19	West King
20	North/South Coyote
21	Rock
22	Star
23	Upper/Middle Copper

Figure 4 Sub-basins Map

Glacial activity in the basin (in the form of cirques along the ridge tops) is also evident in the higher elevations. A cirque is a deep steep-walled half bowl like recess located at the head of a glacial valley. Evidence of the extent of glaciation from the last ice period of 8,000 to 15,000 years ago is limited.

Soils in the area are thin and not very productive. This is probably due to the numerous fires that occurred in the drainage during the first half of this century.

Water Quality

The East Fork of the Lewis River Watershed is a Tier 1 key watershed extending to the National Forest boundary. Surface water in the analysis area is dominated by streamflow with very few lakes. No Washington State Department of Ecology 303 (d) "water quality limited" segments occur in the analysis area, but two sites downstream of the area are water quality limited, due to high stream temperature and fecal coliform counts. Water quality monitoring at the National Forest boundary indicates that between 1978 and 1993 the East Fork of the Lewis equaled or exceeded the state water quality standards for stream temperature 220 times. Copper Creek equaled or exceeded the stream temperature standard 52 times.

Vegetation

The Upper East Fork Lewis River Watershed lies within the Southern Washington Cascades Province of the Pacific Northwest (Franklin & Dyrness 1973). On a broad scale, the vegetation is temperate coniferous rainforest. Most of the watershed is within the Western Hemlock Zone (49 percent) and Pacific Silver Fir Zone (38 percent). Five percent is comprised of deciduous hardwoods (alder), seven percent is non-forest, and less than two percent is either wetlands or water. Nineteen percent of the watershed is in non-National Forest land ownership (Figure 5 Vegetation Zones).

The vegetation patterns have been shaped significantly by fire. A series of large, hot stand-replacement fires in the early 1900's resulted in the formation of large, fairly homogenous stands over most of the watershed. Portions of the higher peaks and ridges burned so hot that shrub/forb seral stages still predominate. Fire prevention activities such as snag felling, off-site stocking and single-species planting have also contributed to the lack of vegetative diversity. Timber harvest within the watershed has primarily been commercial thinning. A small amount of clearcut harvest has occurred in the northeastern portion where large trees survived the fires.

One State Threatened and one State Sensitive plant species are found within the watershed.

Vegetation Zones (Ecoclasses)

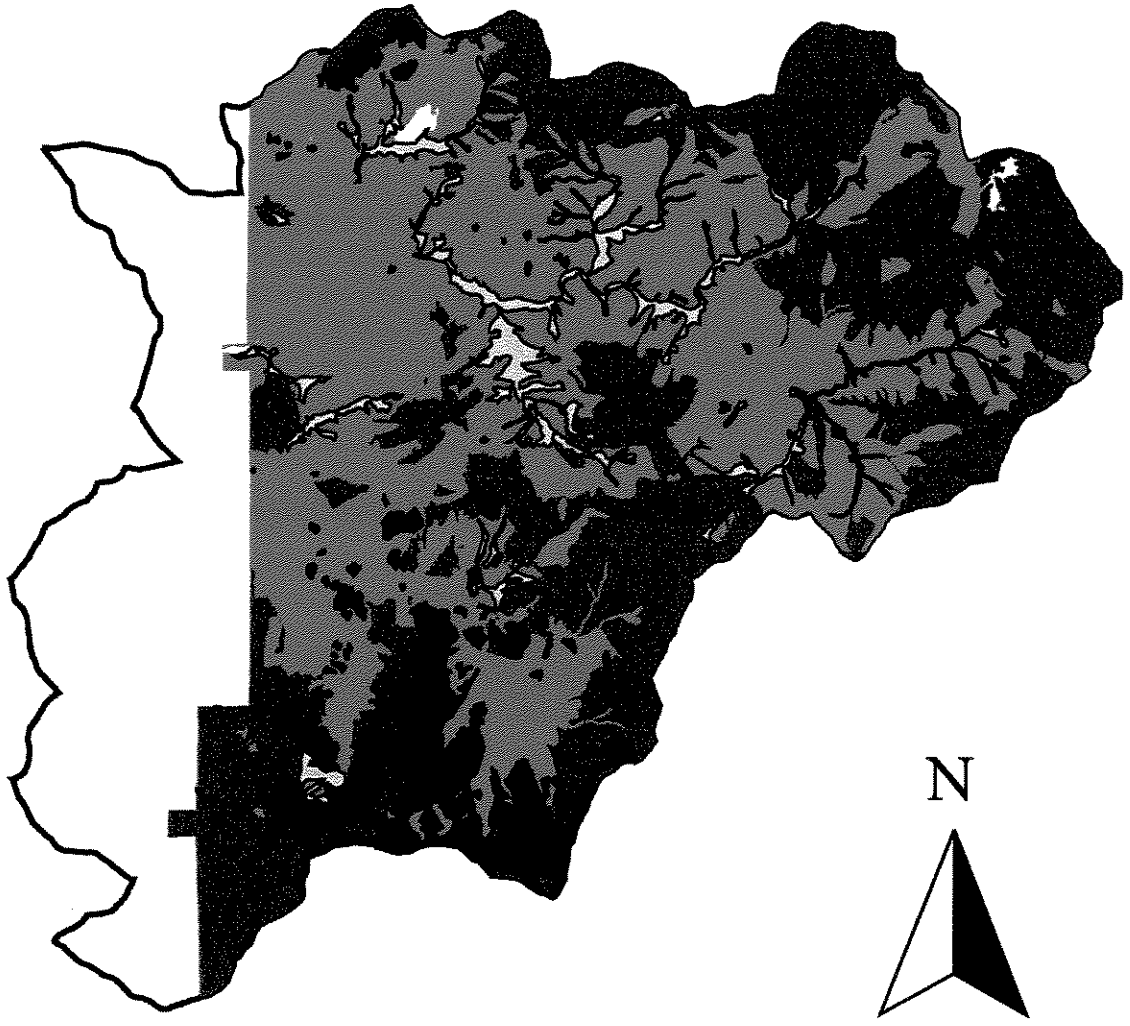


Figure 5 Vegetation Zones Map

Fire

Wildfire has been the principal forest disturbance in the Pacific Northwest. Natural fires west of the Cascades are usually described as infrequent and catastrophic, consisting of severe surface and crown fires which usually kill a higer proportion of the trees in the stand. The marine influence on weather, with mild temperatures and abundant moisture, leads to both a high accumulation of flammable biomass and infrequent periods of hot and dry weather making large fires possible. The fire history of this area includes large scale stand replacement fires such as the Yacolt Burn of 1902, estimated at 238,900 acres of state, private and federal lands. The Yacolt Burn was at one time considered the largest continuous area of fire-killed snags in the State of Washington. Located in Clark and Skamania Counties, it extends from the foothills of the Cascades eastward to the Wind River, and from the Columbia River northward to Chelatchie Prairie. The original fire of 1902 killed approximately 12 billion board feet of timber. Following the 1902 fire came many reburns, the largest of these being the Rock Creek Fire of 1927 which burned 48,000 acres and the Dole Fire of 1929 which cover 227,500 acres, some of them burned beyond the boundaries of the 1902 burn. Some parts of the area have been burned over five times.

These large fires were generally human caused and associated with debris burning. Like most large fires in the Pacific Northwest, they were driven by strong, dry east winds in either September or October, after periods of prolonged drought. This condition is largely brought about by the area's proximity to the Columbia River Gorge, which acts as a funnel for the air masses moving westward over the Cascades. Lookout Mountain, located on the southeast edge of the watershed, in August, September and October, periodically records east winds of 30 to 40 miles per hour. On occasion Three-Cornered Rock and Larch Mountain lookouts on state protected lands report east winds of 50 miles per hour. These are drying winds which even after a heavy rain will dry forest fuels to the ignition point in a matter of hours. Dry east winds were responsible for the fast spread of the 1902 fire. At that time most of the area was burned in only 48 hours. The 1918, 1927 and 1952 fires were spread by the east wind.

Large recorded fires that occurred within the Upper East Fork Watershed during the period 1902 to 1952 are displayed in Table 1.

Table 1 Large Recorded Fires

Name of Fire	Year	Total Acreage	Acreage Within National Forest Boundary
Yacolt	1902	238,900	63,000
Camp 5	1910	2,800	2,800
East Fork	1910	6,500	0
Nichols Creek	1911	1,000	0
Jack Mountain	1917	12,000	0
Sunset	1919	26,900	5,000
Clark Timber Co.	1922	15,000	600
Rock Creek	1927	48,000	24,000
Dole	1929	227,500	46,000
Gumboot	1945	1,500	1,500

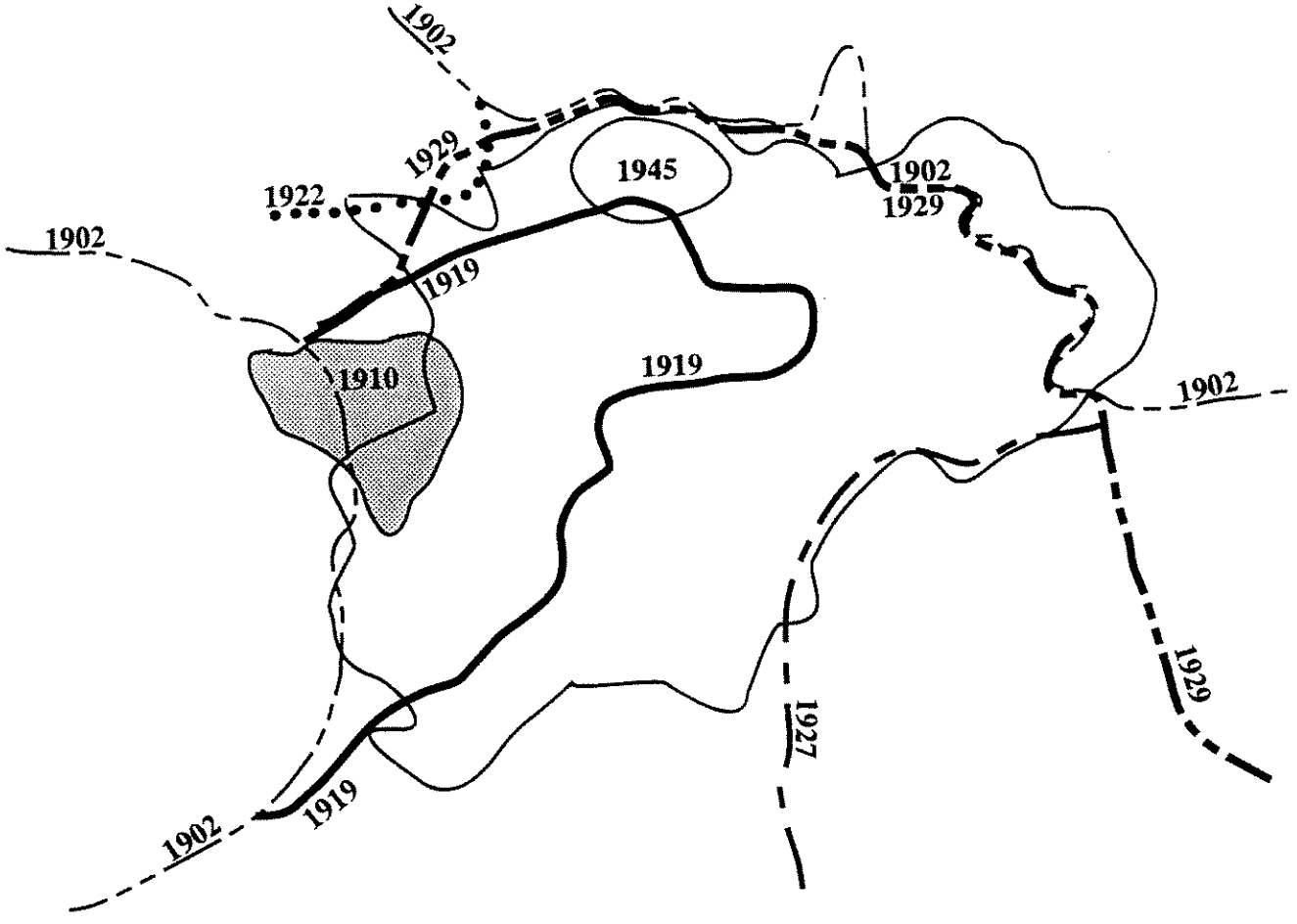
During this same period of time, numerous other large fires burned within what is called the Yacolt Burn for an approximate total of 81,000 additional acres. The last of these fires occurred in 1952 (see Figure 6 Large Historic Fires).

The tremendous loss of private, state and federal timber volume by the original 1902 fire and the reburns was a devastating loss to the economy of southwestern Washington. Had there been only the original burn, with little or no reburn, the loss would not have been so catastrophic. The ensuing reburns destroyed untold millions of young trees that were reforesting the 1902 burn area. The National Forest portion of the Siouxon Burn can be cited as an example of what the Yacolt Burn might have been like without the reburns. This Siouxon area presently supports a good stand of 70-75 year old reproduction.

Following the great reburns of 1927 and 1929, a program of fire break construction was undertaken by the Forest Service. Between 1930 and 1935, 75.5 miles of fire breaks were built, with about one-third located on state-protected areas. These fire breaks were designed to cut the Yacolt Burn into large blocks, which for fire suppression purposes, were to serve as the first line of defense. This fire break operation called for "clearcutting" all snags within 200 feet of the top of all the major ridges. All other snags above the level of the ridge for an additional distance of 300 feet were to be felled. Thus the width of the break varied depending on the steepness of the sides of the ridge from a minimum of 400 feet to a maximum of 1000 feet. This construction of fire breaks continued until the early 1960's.

Large Historical Fires

1902 - 1945



1902 - Yacolt

1910 - Camp 5

1919 - Sunset

1922 - Clark County Timber Co.

1927 - Rock Creek

1929 - Dole

1945 - Gumboot

Upper East Fork Watershed

N

1.1 0 1.1 2.2

Figure 6 Large Historic Fires

Because of this fire break construction, the number, intensity and size of fire starts within the Yacolt Burn were greatly reduced. Additionally, to help reduce risk, a fire closure policy for the area was instituted to be in affect from approximately July 15 to October 10, depending on weather conditions. This closure effectively removed the ignition source for human caused fires during the periods of highest fire danger in the area.

The Upper East Fork falls within the area that has been classified as Warm Moist Western Hemlock and Pacific Silver Fir Fire Group 8 in the Fire Ecology of the Mid-Columbia published in 1994. This fire group generally lacks fine fuels through most of the stand history. Sites containing devil's club and skunk cabbage may have very heavy fuel buildups, but the presence of water keeps these fuels too moist to burn readily and facilitates relatively rapid decay. Classic old-growth stand conditions are common in the undisturbed areas, indicating infrequent disturbance.

Under current stand conditions, stand replacement will only occur during large, intense fires. Most of the active burning occurs during one burning period, although it can occur over several burning periods. Low rates-of-spread and fire line intensities dominate; prolonged smoldering can create a high severity burn. High intensity fires depend on extreme winds, prolonged drought, or both. The highest fire danger occurs from mid-September through October.

Aquatic Animals and Habitat

The Upper East Fork includes 286 miles of streams. Of those, 11 miles are Class I, 38 miles are Class II, 18 miles are Class III and approximately 219 are Class IV. Classes I and II support anadromous and resident fish populations, Class III are perennial and provide water quality and Class IV streams are intermittent (Figure 7 Stream Classes).

Winter steelhead are the only anadromous fish species that spawn in the Upper East Fork Watershed. All other anadromous species (spring/fall chinook, early/late coho, and summer steelhead) are present in the basin below Sunset Falls. Washington Department of Fish and Wildlife has used several tributries above Sunset Falls as rearing areas for hatchery coho, and spring chinook in the recent past; however, this practice is no longer in effect (H.Fiscus Personal Communication, 1995). Resident fish species in the watershed include: rainbow, cutthroat, and eastern brook trout, whitefish, and sculpin. The primary objective for fish in the watershed is to increase populations, protect habitat and restore their distribution. The winter steelhead populations have been classified as depressed due to chronically low returns (WDFW 1993).

Specific goals in the East Fork Lewis Watershed include: restoring/protecting key habitat attributes necessary for resident and anadromous fish survival; reducing stream temperatures to meet state water quality standards; reducing aquatic habitat fragmentation; and reducing the quantity of management related sediment that reaches the stream channels. Objectives will be set at the project level to meet these goals.

Stream Classes

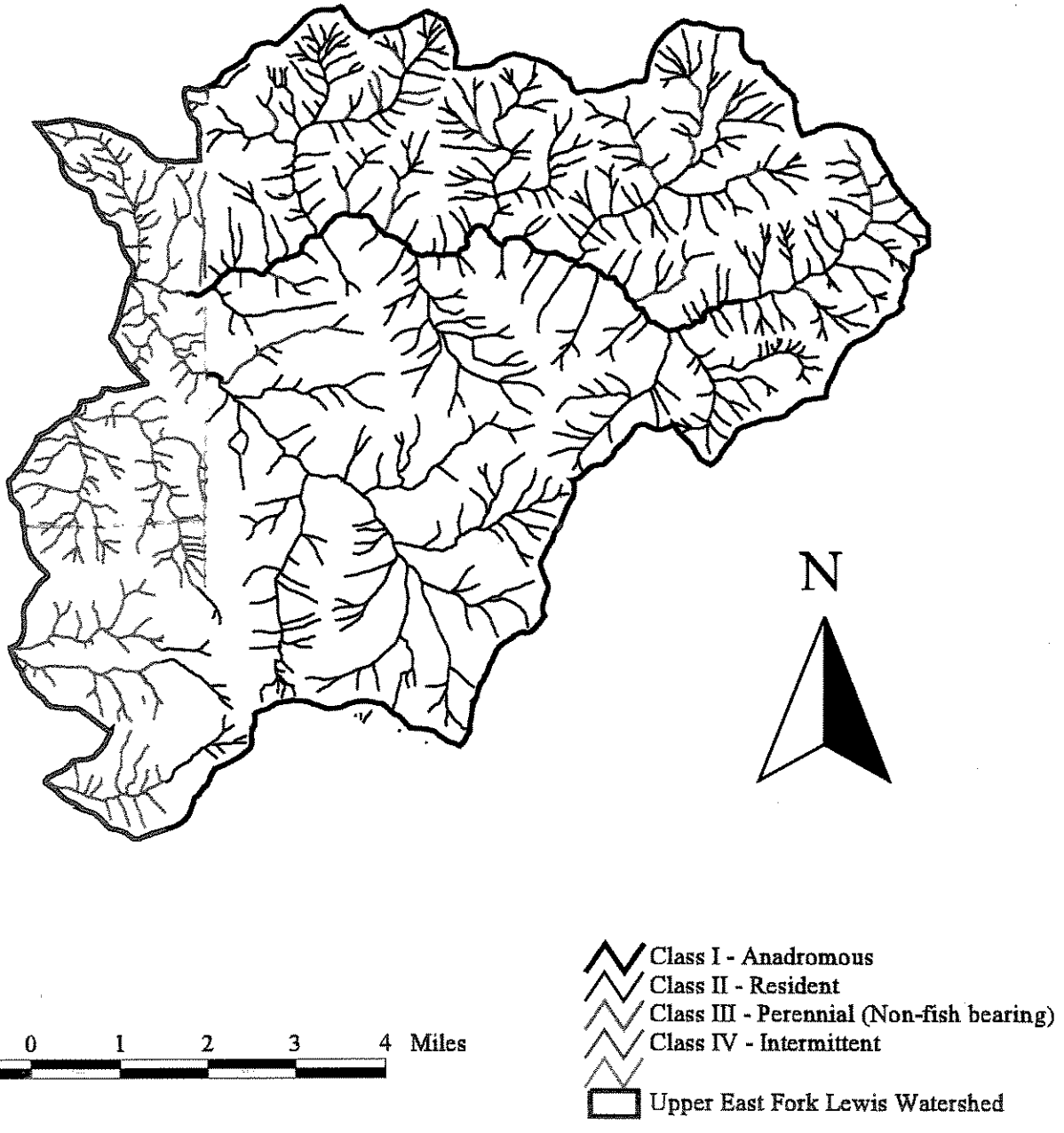


Figure 7 Stream Class

As part of the Aquatic Conservation Strategy (See Northwest Forest Plan, page B-12), "Riparian Reserves" are a land allocation where special standards and guidelines direct land use. The allocation includes reserves, i.e. lands alongside (1) all water bodies (lakes, ponds, wetlands, and streams) and (2) unstable and potentially unstable areas (Figure 8 Riparian Reserves).

Terrestrial Animals and Habitats, TES Animal Species

Fires that occurred in the early 1900's have resulted in large fairly homogenous stands of young timber, and very little old growth. For this reason habitat for spotted owls, and other species that require the same type of habitat is very limited. Old growth habitat in the watershed currently exists in relatively small, or highly fragmented larger blocks that are primarily in the northeast part of the watershed (sub-basins 6 and 7). The only spotted owl activity center is in sub-basin 6.

The watershed contains a significant amount of elk and deer winter range located along the East Fork of the Lewis River and along Copper Creek. Young single story stands that originated following the large catastrophic fires do not currently provide optimal thermal cover which are multi-storied conifer stands.

There are cliffs in the watershed that may be suitable golden eagle and peregrine falcon nest sites. There is one reported golden eagle nest in the watershed that was first documented in 1985, but it is not known if the nest is still active. An immature golden eagle was seen in the watershed in August 1995, indicating that nesting may be occurring there.

Two gray wolves were reportedly seen in the southern portion of the watershed in July of 1992.

The density of large snags within the watershed appears to be low. Snags that were created by the fires were felled in the 1930's - 1960's in an effort to prevent spread of future fires, and the stands that were established after the fires have not yet produced large diameter trees.

The Human Dimension

The upper portion of the East Fork of the Lewis (Catapoola) River Watershed contains a variety of resources that are known to have been used by the native populations. The Silver Star area borders several differing ecological zones that figured prominently in native usage. This area was most likely used for hunting and berry gathering. It is possible that this area played an important part in the quest for spiritual power. Access to this area was from an ancient Indian trail that ran through Yacolt from east of the mountains.

By the turn of the century, precious metals were discovered in the Copper Creek drainage. This area has never become a major producer of metals in the State of Washington. The Yacolt Burn in 1902 destroyed large quantities of virgin timber which were needed to construct mining facilities. Mining activity was brought to a halt following tose large fires. While no large scale operations are underway, there are smaller active claims on record today.

Riparian Reserves

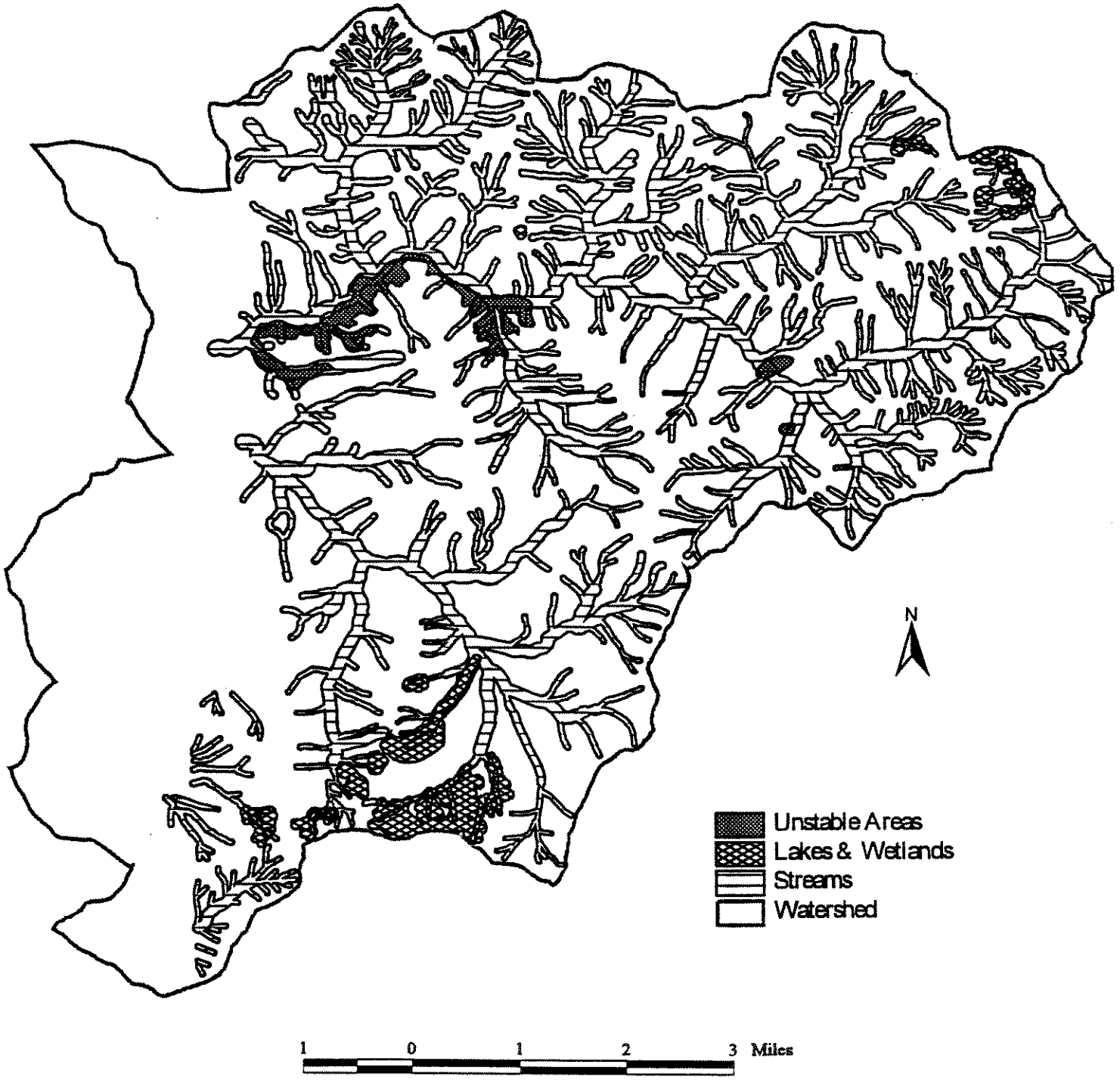


Figure 8 Riparian Reserves

Land within the analysis area provides both Roaded and Unroaded recreation opportunities. The Silver Star Roadless Area, Silver Star Special Interest Area and East Fork Lewis River (eligible for "Scenic River" designation) are located here. The area contains Semi-Primitive, Non-Motorized recreation..

Most people visit this watershed to work or to recreate. Camping, picnicking, berry picking, rock climbing, mining, sightseeing, hunting, fishing, backpacking, hiking, horseback riding, boating, rafting, kayaking, mountain bike riding and motorcycle riding are the primary recreational pursuits.

CHAPTER II ISSUES AND KEY QUESTIONS

Having characterized the watershed, the ID team began assembling a list of issues. For this watershed analysis, "Issues" are topics of concern about key elements of the ecosystem that are related to:

management goals and objectives,

human values, or

resource conditions within the East Fork of the Lewis River Watershed.

Each issue generates Key Questions to be investigated. These questions are:

1. address the issues by focusing on the elements that influence and are influenced by humans, and which can be measured at the watershed scale, and

2. are expected to be answered by the analysis.

A general announcement letter was mailed to 84 addresses which including private landowners living within the watershed analysis area, individuals interested in watershed analysis in general, and other agencies. Some of the "Other agency" representatives who have provided input in recent watershed analysis efforts are:

John Barnett, Cowlitz Tribe
Lee Carlson, Yakima Indian Nation
Neal Darby and Tod Williams, US Fish and Wildlife Service
Rollie Geppert, Washington Dept. of Fish and Wildlife
Nora Jewett, Washington Dept. of Ecology
Ron Lee, Environmental Protection Agency
Matt Longenbaugh, National Marine Fisheries Service

The ID team shared the characterization (Chapter I of this report) and presented and discussed the list of Issues and Key Questions as it stood at the time. Verbal and written input was received. From this, an updated list of Issues and Key Questions was compiled. See Appendix C, List of Issues and Key Questions.

In order to proceed, the total list was prioritized to focus the team specialists' limited time and resources so that they would be working on those issues of greatest importance.

Being prepared to answer watershed-scale questions about anticipated future land management decisions is the driving force behind this iteration of the Upper East Fork of the Lewis River Watershed Analysis. Accordingly, the types of future decisions are of varying urgency and, therefore, can be used as criteria for prioritizing the issues.

The following criteria were used to prioritize issues:

1. Mining activities (Copper Creek, Bolen Creek, and Miners Creek areas)
2. Special Forest Products (and associated activities)
3. Restoration (possible fish structures, road projects, erosion control, recreation sites,)
4. Timber Stand Improvement (TSI), such as fertilization, and precommercial thinning
5. Divot Timber Sale
6. Commercial thinning timber harvest in the next 3-5 years
7. Dispersed recreation planning
8. Silver Star trail construction
9. Road 4107 mine access improvement

Criteria 2, 3, 5 and 7 were given the greatest weight.

A total of 15 issues were rated as "High" priority and will be addressed in the Upper East Fork of the Lewis River Watershed Analysis. These issues are:

- **Surface Erosion - Roads**: Surface erosion from newly constructed roads has been a major contributor to sedimentation to streams in the past. Most sediment is transported during new construction and in the first two to three years thereafter. After this time, growth on the fill slopes and cut slopes help alleviate this problem, however, in areas near stream crossings the problem can continue to influence stream habitat for many years. Poor construction practices in the past have recently created numerous problems from fill slope failures that directly and indirectly move sediment into many streams.

  Soil Productivity: Fire has played a major role in this sub-basin in characterizing soil productivity. Very hot fires, as indicated by some of the past burns, have destroyed soil nutrients and sterilized what soil remained.

  Beneficial Uses of Water: The Upper East Fork Lewis River Watershed Analysis Area contains many beneficial uses that are influenced either directly or indirectly by the aquatic system. The state water quality standards regulations are in place to protect the existing and designated uses of water. These include water supply, recreation, and growth and propagation of fish and other aquatic life. A complete list of these beneficial uses, their vulnerability, and future trends are not known at this time. For this iteration, due to time constraints, the analysis will focus on fish spawning and rearing beneficial uses.

No Change from last time

Hydrologic Changes: Past disturbances such as wildfire in the analysis area may have influenced basin hydrology by increasing peak flows during fall and winter storms and by decreasing summer low flows. Human activities such as timber harvest and road building have occurred throughout the watershed, and may influence the timing and quantity of runoff as well.

Stand Structure and Composition / Soil Productivity

Fire history and subsequent fire prevention activities have altered stand structure, composition, and age class distribution of forested plant communities, and plant, lichen, fungi, and bryophyte biodiversity. All sub-basins are substantially below the estimated historic ranges of late-successional vegetation.

Riparian Reserve Fragmentation

Some critical components of terrestrial habitat within Riparian Reserves have been altered by fragmentation, influencing the capacity of these ecosystems to provide effective habitat for riparian dependent species. Disruption of connectivity between these areas can potentially result in species isolation. This can lead to undesirable changes in species composition, use, and ecosystem functions within Riparian Reserves and the watershed.

TES and C-3 Species

The Endangered Species Act and the Northwest Forest Plan mandate that we monitor for threatened, endangered, and sensitive (TES), and late successional dependent (C-3) species respectively. Less than 5 percent of the watershed has been surveyed for TES species, and none of the watershed has been surveyed for C-3 species.

Special Forest Products

Recently, a number of special forest products have been promoted for utilization by the public for personal, recreational, and commercial ventures. Many different plant, lichen, fungi, and bryophyte species are currently being utilized, and more species will undoubtedly be used in the future.

Special Habitats-Plants

Special habitats such as non-forested sites, wetlands, rock outcrops, caves, and talus slopes

are important for biodiversity. Many sensitive plant species and plants with narrow ecological niches are associated with these habitats. Forest-wide standard and guideline FW-211 directs these habitats and their ecotones are to be protected. The designated Silver Star Botanical Special Interest Area supports several populations of the Clackamas corydalis, a State Threatened and C-3 species. Meadows with highly diverse plant communities are also present. Edible berries and mushrooms are abundant.

Deer and Elk Winter Range: The watershed contains a significant amount of big game winter range. The winter range area was burned by fires in the early 1900's and is characterized by even-age conifer stands.

Riparian Reserve Fragmentation: Some critical components of terrestrial habitat within the riparian reserves have been altered. This influences the capability of these ecosystems to provide effective habitat for riparian dependant species.

Habitat Condition for Threatened, Endangered, and Sensitive Species: The watershed contains suitable or potentially suitable habitat for Threatened, Endangered, and Sensitive species including northern spotted owl, bald eagle, peregrine falcon, gray wolf, grizzly bear, and amphibians. Golden eagles, a non-listed but protected species may nest in the watershed.

Quantity and Quality of Key Habitat Attributes for Resident and Anadromous Salmonids:. Current aquatic habitat conditions are a result of past natural and human induced processes that have occurred in the watershed. Fire regimes, and road construction, combined with increased human populations in the watershed have, through time, altered stream habitats and aquatic communities.

Impacts on Natural Resources by Recreation Use: Forest users have been able to take advantage of the many varied recreation opportunities as a result of better accessibility. The Silver Star Special Interest Area, the Silver Star Roadless Area and the East Fork Lewis River (pending addition to the National Wild and Scenic River System) and numerous cultural and historic sites are located within this watershed.

Impacts to Recreation Associated With All Human Activity: The Upper East Fork Lewis River watershed analysis area contains a variety of recreation settings and opportunities. Access to this area has brought about an increase in both recreational and non-recreational activities. This increase in human activity threatens the recreation resource and user expectations. The end product of recreation management is determined by the resulting experience people have.

CHAPTER III CURRENT CONDITIONS

Chapter III consists of brief presentations (illustrated by maps, tables, and charts) which describe current conditions and trends of relevant ecosystems and processes within the watershed.

Geology, Physical Processes, Soils

Surface Erosion

Surface erosion in the watershed is a concern for various reasons. Fires during the past 100 years have heavily impacted the area. These fires were hot enough to burn all the duff and change the character of the soil. Left bare, slopes became very susceptible to erosion. As vegetative growth resumed, surface erosion decreased but is still a concern in some areas. Roading in the area has also increased the amount of sedimentation to streams. Estimates of sediment yield from roads in this watershed are around 400 tons/square mile/year with large variations based on the road type, slope and proximity to any streams.

Soil Productivity

The soil characteristics of this watershed have been greatly influenced by the intensity of fires that have taken place over the last century. These fires have removed the organic layer on the surface and destroyed some of the nutrients in the soil. This, along with other factors, has contributed to the slow growth of vegetation in the watershed.

Water-Related Features, Hydrologic Processes

Beneficial Uses

Initial scoping for beneficial uses in the Upper East Fork Lewis Watershed Analysis Area indicates the primary uses to be anadromous (steelhead) spawning and rearing and resident salmonid spawning, rearing, and adult holding. Other uses identified include water related recreation along the East Fork and its tributaries, Sunset Campground, and possible domestic water use downstream from the National Forest boundary. Analysis for this iteration will focus on anadromous spawning and rearing. The areas having high use for anadromous spawning and rearing are shown on Figure 11 - Aquatic Beneficial Uses. These areas have been identified, using stream survey information, other fish surveys, and aerial photo interpretation. All potentially critical beneficial use areas are not represented, only those known or suspected at this time. A discussion of optimum habitat conditions for these beneficial uses is included in the Aquatic Animals and Habitat section of this document.

Following is a vulnerability assessment for each beneficial use area, identifying potential for changes from sediment, stream temperature, Large Woody Debris (LWD), and peak flows. The vulnerability assessment uses conditions such as stream channel characteristics or existing monitoring data to help determine whether this area has the potential to degrade when input variable rates such as sediment, solar radiation, wood, or water change.

Sediment

Increased levels of sediment can adversely affect fish habitat and riparian ecosystems. Spawning gravels can be filled in by fine sediment, reducing survival of eggs and developing small salmonids (Everest et al. 1987); food availability can be reduced (Cordone and Kelley 1961), and an important habitat such as pools may be filled in by excess sediment (Megahan 1982).

The majority of stream channels in the analysis area are characterized as "erosion" and "transport" reaches, with moderate to high gradients and confined channels that tend to move input variables such as wood, water, and sediment through quickly (see Figure 10, Erosion-Transport-Response Reaches). Changes to the amounts of these input variables are most noticeable in low gradient, less confined sections (called "response" reaches) in the Upper East Fork Lewis Watershed.

The following observations of reaches were made from 1958-59, 1979, and 1989-90 aerial photos:

- Response reaches #B006 (Green Fork) and #B010 (East Fork Lewis) in the Upper East Fork Lewis River Analysis Area are currently in some phase of recovery and adjustment to sediment pulses from past fires and flood events in the 1920's and 1930's (See Figure 11, Stream Segments). These reaches decreased in width 40% and 28% respectively, in the period 1959-1979. They are adjusting primarily by channel narrowing, riparian vegetation encroachment, and/or down cutting.

- The other reaches that contain high quality beneficial use areas (See Figure 12, Aquatic Beneficial Uses) have shown slight decreases in channel width (0-14 percent) during the air photo record. This is probably an indication of the lack of vulnerability to sediment input, as a number of debris avalanches and debris torrents were noted in the 1959 aerial photos. This could also be due to a lack of large woody debris in the channel that would tend to store sediment in

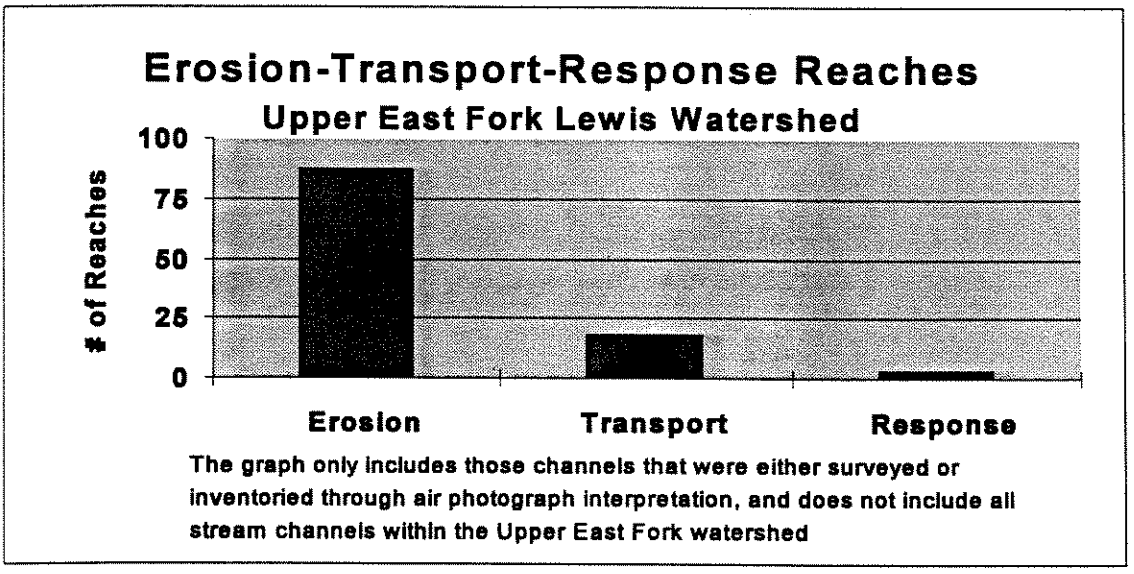


Figure 9 - Number of Erosion-Transport-Response Reaches in the Upper East Fork Watershed

sections of the channel.

Refer to the write-up discussing geologic processes for potential sources of sediment input in the analysis area.

Stream Segments

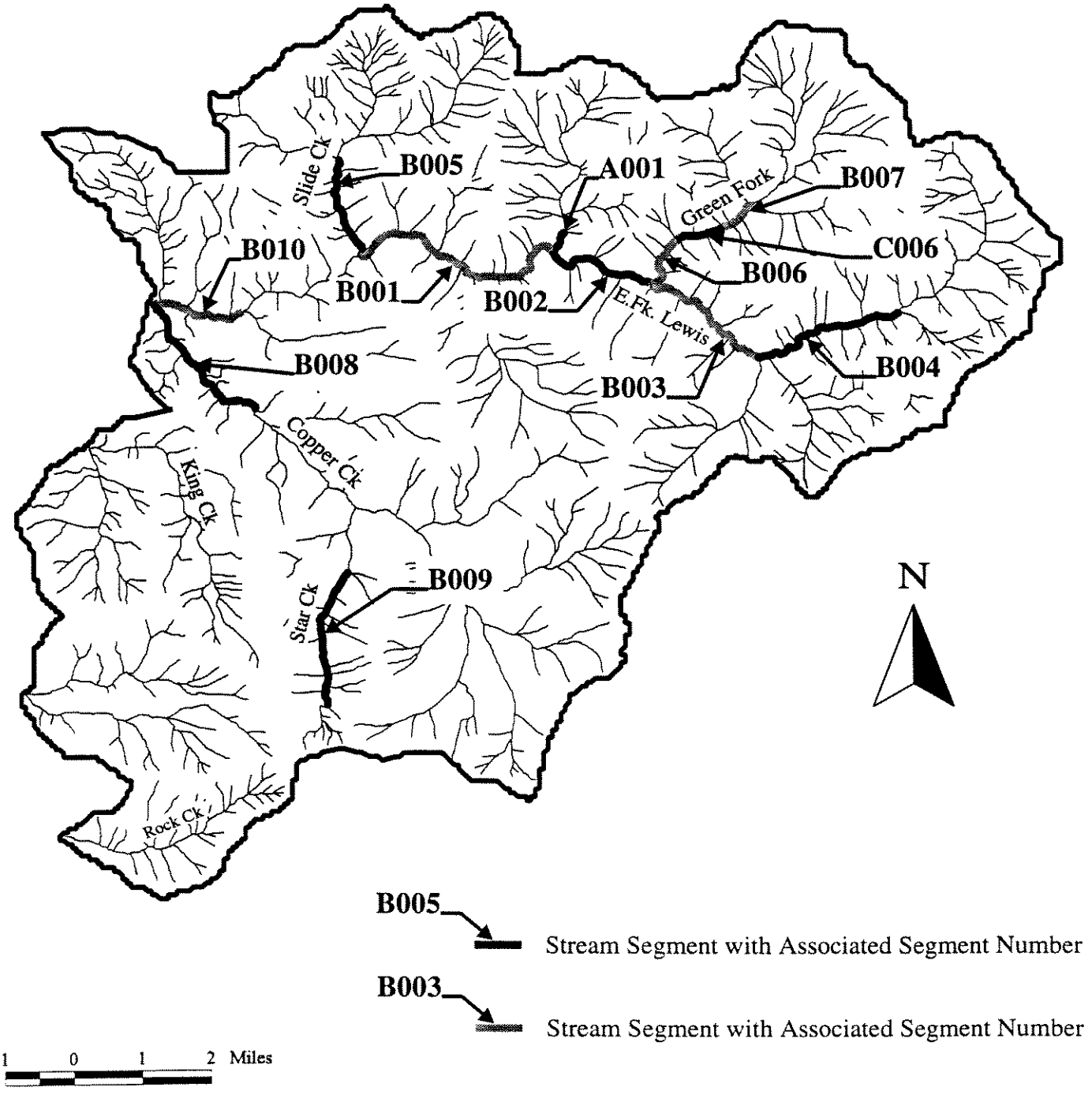


Figure 10 - Stream segments that were analyzed using historic air photographs.

Aquatic Beneficial Uses

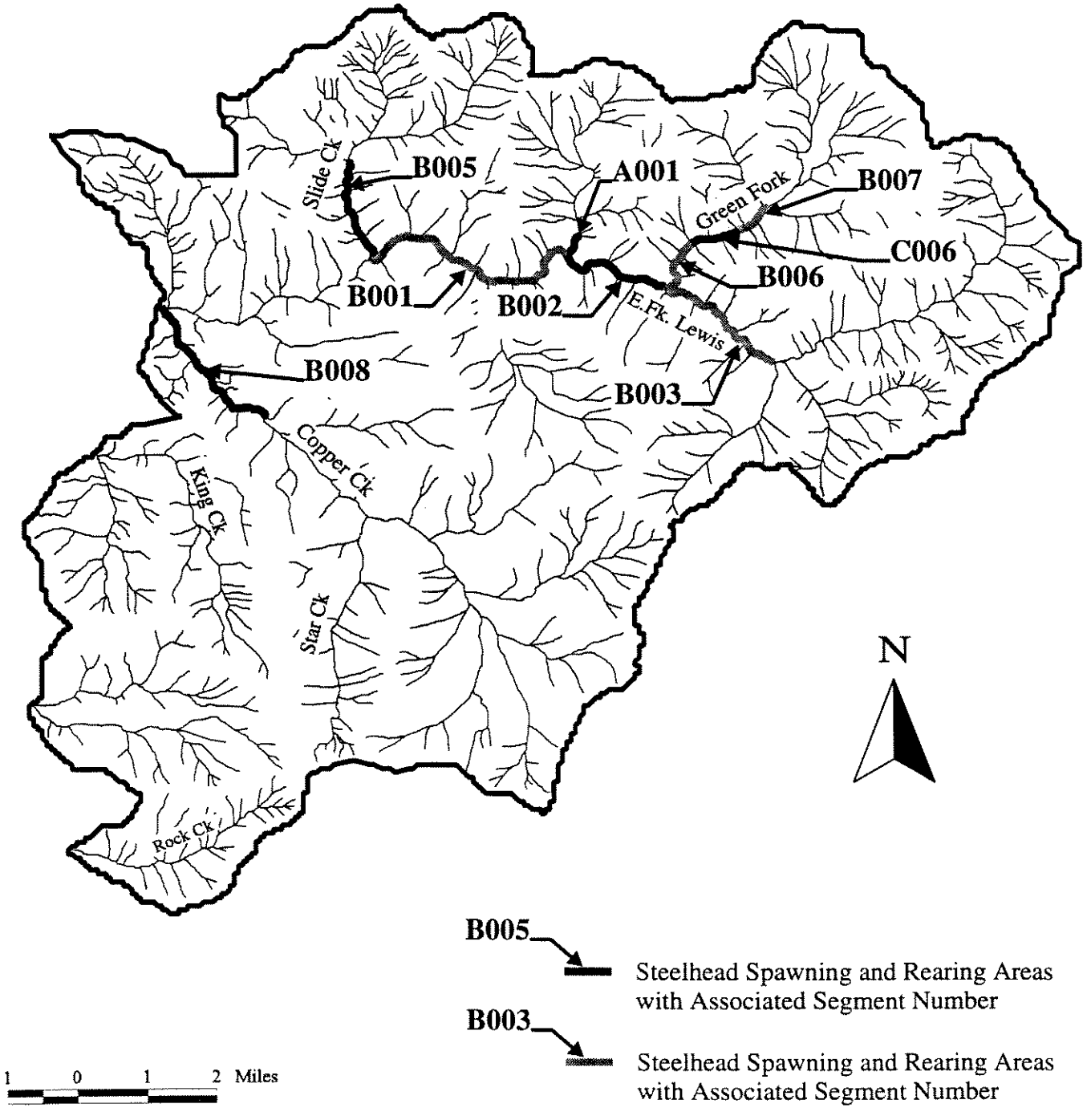


Figure 11 - Stream segments that contain steelhead spawning and rearing areas.

Stream Temperature

Stream water temperature is a major factor influencing the composition and productivity of aquatic ecosystems.

Two monitoring stations have collected surface water temperature data in the Upper East Fork Lewis River Analysis Area. One station is located at Sunset Campground on the East Fork and collected data from 1978 to 1993. Stream temperatures at this station have equaled or exceeded State water quality standards of 16° Celsius 220 times, with a maximum of 19.5 degrees Celsius during this time period (See figure 13). The other station is located on Copper Creek near Bolin Creek and collected samples from 1977 to 1981. State standards were equaled or exceeded 52 times during this period, with a maximum temperature of 18.3 degrees Celsius recorded in 1977 (See figure 13).

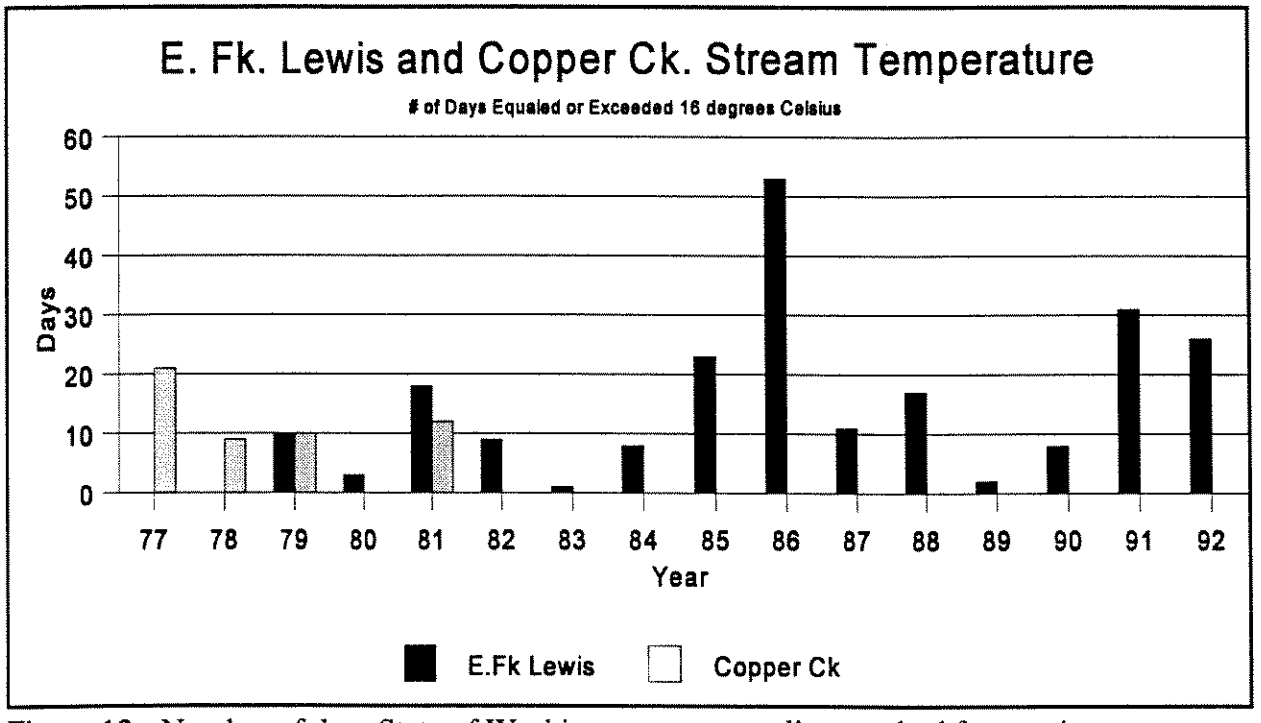


Figure 12 - Number of days State of Washington water quality standard for maximum stream temperature was equaled or exceeded.

An analysis of stream shading indicates large segments of the East Fork Lewis River and Copper Creek lack canopies that cover more than 50 percent of the stream channel (See Figure 14, Openings in Riparian Canopy). These open canopies are probably a major factor in stream

Openings in Riparian Canopy

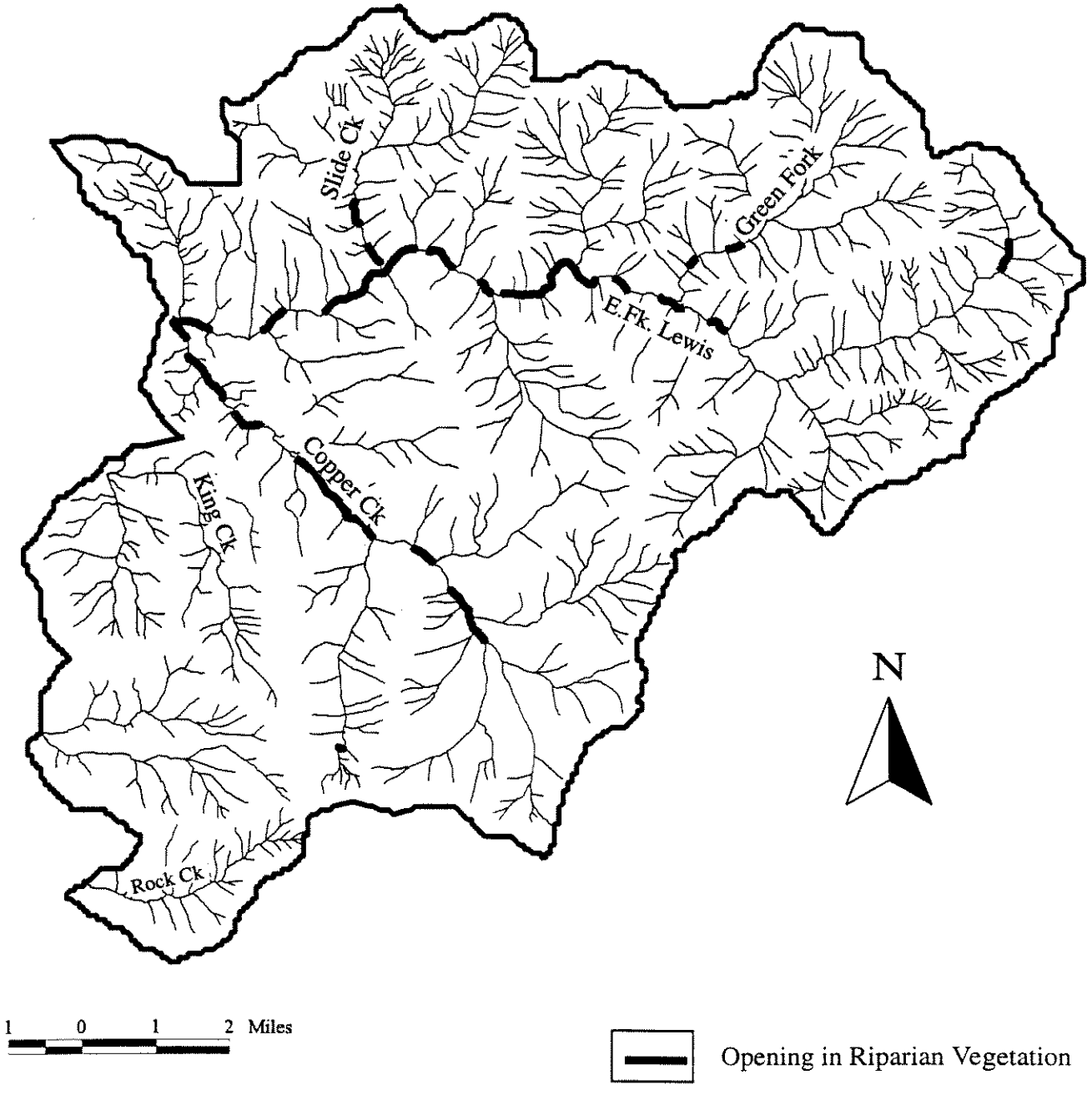


Figure 13 - Map showing segments where more than 50% of the stream channel is open to exposure to direct sunlight due to openings in the riparian canopy.

warming and ultimately the high stream temperatures noted in the paragraph above. Beneficial use segments included in these sections of open canopy are #B001 (East Fork Lewis), #B002 (East Fork Lewis), and #B008 (Copper Creek) (See Figure 11 Aquatic Beneficial Uses, page III-5).

Large Woody Debris

Large woody debris is an important component in stream channels, influencing them by affecting bed profiles, channel patterns, and channel geometry (Bisson et al. 1987). Large wood also provides habitat for aquatic organisms by increasing channel complexity, formation of pools and providing hiding cover.

The following observations were made from 1959, 1979-80, and 1989-90 aerial photos:

- In general, beneficial use reaches lack large woody debris. Only two reaches, #B005 (Slide Creek) and #B006 (Green Fork) had moderate amounts of large wood noted in the 1989 photos. This wood was mostly contained in log jams.

- Riparian areas are recovering from past fires, but still lack a large coniferous component. Most of the large wood component is composed of hardwoods (maple, alders, cottonwood).

Refer to the write-up discussing Aquatic Animals and Habitat, for areas that are low in large woody debris recruitment potential.

Peak Flow

Peak flow increases may affect a channel by augmenting bank erosion and channel bed scour. This has the potential to introduce more sediment to streams through additional bank erosion, causing effects similar to those described in the sediment section. Channel bed scour may reduce fish spawning and rearing capabilities by creating a channel bed that is unstable and moves frequently, due to increased peak flows. This vulnerability analysis will only address bank erosion since stream substrate data is not available to evaluate increased channel bed scour frequency and magnitude.

- A moderate amount of bank erosion is present in reach #B006 (See Figure 11, Aquatic Beneficial Uses, page III-5) of the Green Fork. LWD added

- In general, other reaches don't appear to be susceptible to bank erosion due mostly to bedrock or boulder bank composition. This tends to protect channel banks from high rates of erosion.

Refer to the write-up discussing Hydrologic Changes that follows, for areas that may be contributing to increased peak flow.

Summary

The table below displays reaches that contain beneficial uses and the potential of those reaches to degrade when the amount of input variables such as sediment, solar radiation, or water change. A rating of "LOW" indicates that a reach is not likely to degrade when the quantity of each input variable changes, while a rating of "HIGH" indicates that a reach will likely degrade. This rating is based on information derived from a variety of sources including: 1) Aerial photo interpretation; 2) Stream survey information; 3) Water quality monitoring data; 4) Channel classification literature (Rosgen 1993) and is a summary of the information displayed above.

Table 2 Beneficial Uses Summary

Segment #	Stream Name	Sediment	Stream Temp	Peak Flow
B001	E.Fk. Lewis	Low	High	Low
B002	E.Fk. Lewis	Med	High	Low
B003	E.Fk. Lewis	Low	Low-Med	Low-Med
B005	Slide Creek	Med	Med	Low
B006	Green Fork	High	Unknown	Med
B007	Green Fork	Low	Unknown	Low
B008	Copper Creek	Med	High	Med
C006	Green Fork	Low	Unknown	Low
A001	Little Creek	Low	Unknown	Low

The large woody debris rating below simply displays whether a particular reach has the potential to allow large woody debris to accumulate due to physical factors such as stream gradient or channel constriction points.

Table 3 Large Woody Debris Rating

Segment #	Stream Name	LWD
B001	E.Fk. Lewis	Low
B002	E.Fk. Lewis	Low
B003	E.Fk. Lewis	Low
B005	Slide Creek	High
B006	Green Fork	Med-High
B007	Green Fork	Med
B008	Copper Creek	Med
C006	Green Fork	Med
A001	Little Creek	Low

Hydrologic Changes

A peak flow analysis was conducted using the State of Washington "Standard Methodology for Conducting Watershed Analysis" procedure. The analysis models changes in discharge resulting from vegetation removal. As recommended in the procedure, a two-year storm was modeled for the analysis.

The table below displays sub-basins that currently have increased peak flows more than 5% when compared to a fully forested condition (see Figure 14, Peak Flow).

Table 4 Peak Flow Increases

Sub-basin	Peak Flow Increase
2	10%*-19 %**
7	6%*-11%**
10	5%*-10%**
11	7%*-13%**
12	7%*-14%**
20	8%*-15%**
21	13%*-25%**
22	5%*-10%**
23	9%*-16%**

* - peak flow increase for an average two year storm
** - peak flow increase for an unusually strong two year storm

Another component of the peak flow analysis is the extension of the stream channel network by roads and ditch lines in roads. These factors may increase peak flows through road cut slope interception of subsurface flow and routing of surface waters through road ditch lines as "pseudo channels." The following increases in the channel network were calculated (see Figure 14, Peak Flow).

Sub-basin 1 had a 16-40% increase in length of the stream channel network due to roads.
Sub-basin 2 had a 14-34% increase in length of the stream channel network due to roads.
Sub-basin 10 had a 14-34% increase in length of the stream channel network due to roads.
Sub-basin 11 had a 15-38% increase in length of the stream channel network due to roads.
Sub-basin 13 had a 13-34% increase in length of the stream channel network due to roads.
Sub-basin 17 had a 15-38% increase in length of the stream channel network due to roads.
Sub-basin 19 had a 16-41% increase in length of the stream channel network due to roads.

Peak Flow Changes

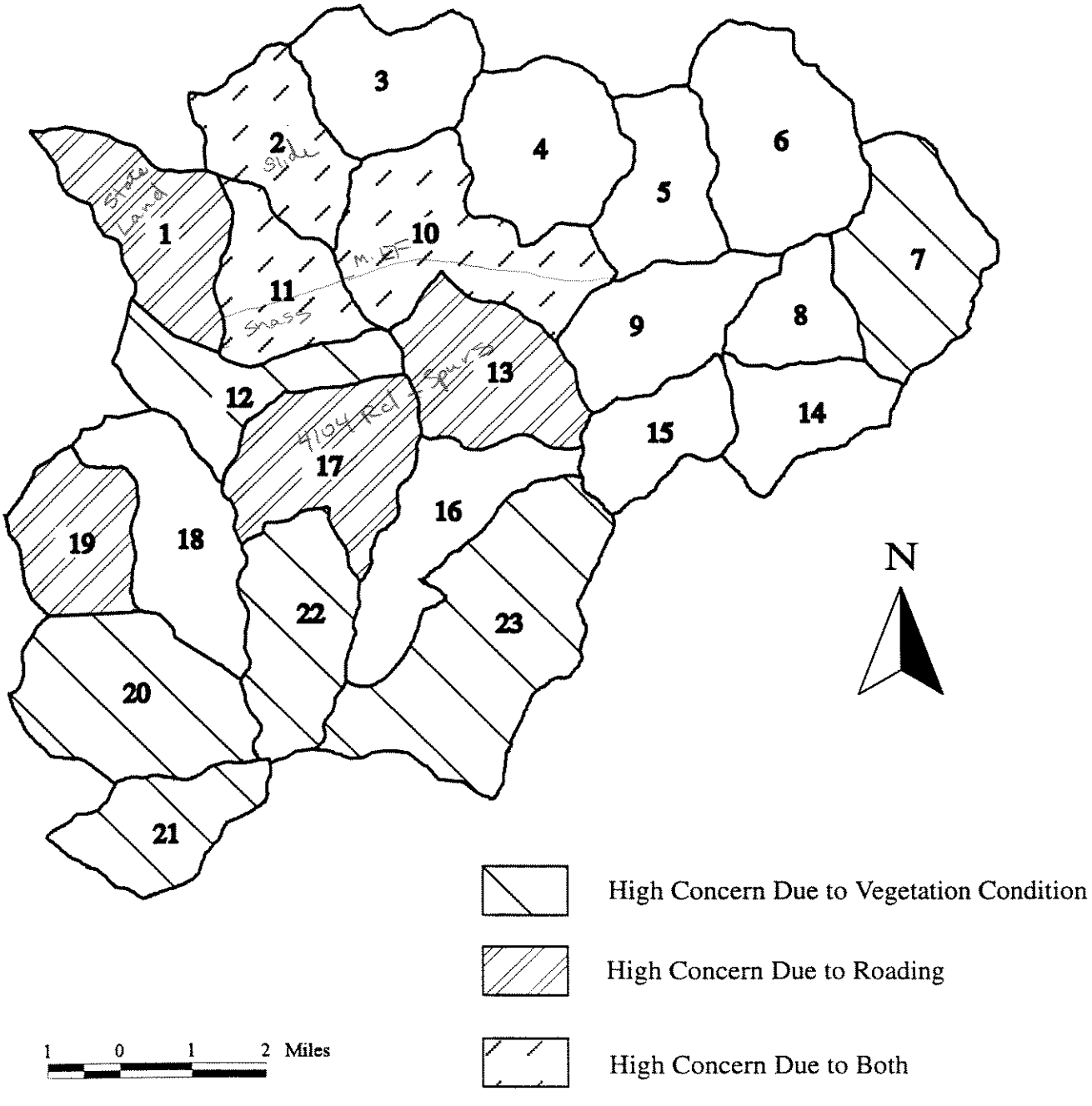


Figure 14 - Areas that may have increased peak flow due to vegetative conditions or roading.

Vegetation Composition, Structure, TES Plant Species, C-3 Bryophytes and Fungi

Stand Composition

The vegetation of the Upper East Fork Lewis River Watershed has been categorized into six vegetation zones (or ecoclasses) based on potential plant associations (Brockway et al. 1983; Topic et al. 1986; Topic 1989). Alder has been included as a vegetation zone because it occurs in unstable areas where disturbance interrupts vegetation development. Table 5 shows the amounts of each vegetation zone in the watershed, and Table 6 shows the breakdown of zones by sub-basins. Data for vegetation zones on non-National Forest lands are unavailable, and are not included in the tables.

Table 5 Vegetation Zones (Ecoclasses)

VEGETATION ZONE	PERCENT	ACRES	ELEVATIONS
Western Hemlock	49%	14,601	< 3000 ft
Pacific Silver Fir	38%	11,405	3000-4000 ft
Alder	5%	1,382	< 4000 ft
Wetlands	1%	417	All
Non-Forest	7%	1,992	All
Water	<1%	4	All

Table 6. Vegetation Zones by Sub-basin

Sub-Basin		Western Hemlock		Pacific Silver Fir		Alder		Wetlands		Water		Non-Forest	
	Acres	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
1*	153	129	84%	5	3%	7	5%	-	-	-	-	-	-
2*	1251	1171	94%	20	2%	24	2%	1	-	-	-	36	3%
3	1471	833	57%	405	28%	116	8%	-	-	-	-	119	8%
4	1727	896	52%	650	38%	173	10%	-	-	-	-	7	<1%
5	1236	667	54%	496	40%	72	6%	-	-	-	-	2	<1%
6	2108	550	26%	1508	72%	29	1%	12	1%	-	-	10	<1%
7	1893	360	19%	1336	71%	44	2%	67	4%	4	<1%	83	4%
8	827	428	52%	364	44%	33	4%	-	-	-	-	1	<1%
9	1425	1029	72%	352	25%	31	2%	-	-	-	-	14	1%
10	2234	1828	82%	171	8%	224	10%	1	-	-	-	9	<1%
11	1244	1102	89%	99	8%	43	3%	-	-	-	-	-	-
12*	699	408	58%	226	32%	64	9%	-	-	-	-	1	<1%
13	1643	796	48%	573	35%	270	16%	-	-	-	-	3	<1%
14	1077	492	46%	531	49%	28	3%	-	-	-	-	4	<1%
15	1001	362	36%	531	53%	89	9%	-	-	-	-	18	2%
16	1592	550	35%	569	36%	75	5%	82	5%	-	-	317	20%
17	1784	1377	77%	324	18%	-	-	-	-	-	-	82	5%
18*	379	74	20%	290	77%	-	-	-	-	-	-	19	5%
19*	0	-	-	-	-	-	-	-	-	-	-	-	-
20*	683	5	1%	622	91%	-	-	20	3%	-	-	37	5%
21*	498	-	-	465	93%	-	-	-	-	-	-	32	6%
22	1624	630	39%	463	29%	60	4%	39	2%	-	-	432	27%
23	3282	914	28%	1405	43%	-	-	195	6%	-	-	766	23%
Totals		14601	49%	11405	38%	1382	5%	417	1%	4	<1%	1992	7%

*Sub-basins with non-National Forest ownership. Analyses on National Forest Lands only.

Stand Structure

From an ecological/functional perspective, stand structure is often more informative than stand age or seral (successional) stage. Stand structure definitions have been developed based on a number of different criteria (Hall et al. 1985), and were recently expanded to include a total of 16 categories (see Appendix E for definitions). Table 7 shows structure stages present for the whole watershed. For ease of interpretation, structure stages are also combined into seven groups based on ecological functions at a more coarse scale; Table 8 lists these 7 groups by sub-basin. Figure 15 shows the grouped conifer vegetation structure stages and Figure 16 shows distribution of grouped other vegetation structure stages.

Table 7. Vegetation Structure Stages

Structure Stage	%	Grouped Structure Stages	%
Grass/Forb	2	Grass/Forb/Seedling	16
Shrub/Seedling	14		
Remnant Forest	0		
Open Sapling/Pole	5	Open/Sapling/Pole/Small Tree	21
Open Small Tree	16		
Closed Sapling/Pole	11	Closed Sapling/Pole/Small Tree	41
Closed Small Tree	30		
Large Tree Single-Layer	2	Large Tree Single-Layer	2
Large Tree Multi-Layer	2	Large Tree Multi-Layer	2
Hardwood Sapling/Pole	<1	Hardwoods	10
Hardwood Shrub/Seedling	<1		
Hardwood Trees	9		
Wetlands	1	Non-Forest	8
Water	<1		
Rock	7		
Dry Meadow/Shrubland	<1		

Table 8. Grouped Vegetation Structure Stages for Sub-basins

Sub-Basin	Acres National Forest	Grass/ Forb/ Seedling	Open Sap/Pole/ Sm Tree	Closed Sap/Pole/ Sm Tree	Lg Tree Single Layer	Lg Tree Multi layer	Hardwoods	Non-Forest
1*	153	13%	43%	26%	-	-	18%	-
2*	1251	4%	23%	58%	-	-	12%	3%
3	1471	30%	19%	33%	-	-	9%	8%
4	1727	16%	6%	68%	-	-	10%	<1%
5	1236	9%	4%	78%	3%	-	6%	<1%
6	2108	9%	18%	47%	6%	13%	1%	8%
7	1893	21%	10%	36%	16%	8%	2%	8%
8	827	22%	12%	63%	-	-	4%	<1%
9	1425	21%	21%	46%	-	-	11%	1%
10	2234	9%	28%	47%	-	-	16%	<1%
11	1244	2%	29%	48%	-	-	21%	-
12*	699	2%	47%	31%	-	<1%	19%	<1%
13	1643	17%	21%	45%	-	-	17%	<1%
14	1077	30%	16%	48%	-	-	3%	3%
15	1001	19%	27%	43%	-	-	9%	2%
16	1592	21%	22%	20%	<1%	-	12%	25%
17	1784	7%	22%	53%	1%	3%	10%	5%
18*	379	43%	42%	4%	-	6%	2%	5%
19*	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A
20*	683	45%	14%	15%	5%	12%	-	8%
21*	498	4%	78%	10%	1%	1%	-	7%
22	1624	16%	22%	19%	2%	-	12%	29%
23	3282	18%	17%	30%	<1%	-	6%	29%
Totals	**29,831**	**16%**	**21%**	**41%**	**2%**	**2%**	**10%**	**8%**

* Sub-basins with non-National Forest ownership. Analyses are of National Forest lands only.

Grouped Coniferous Vegetation Structure Stages

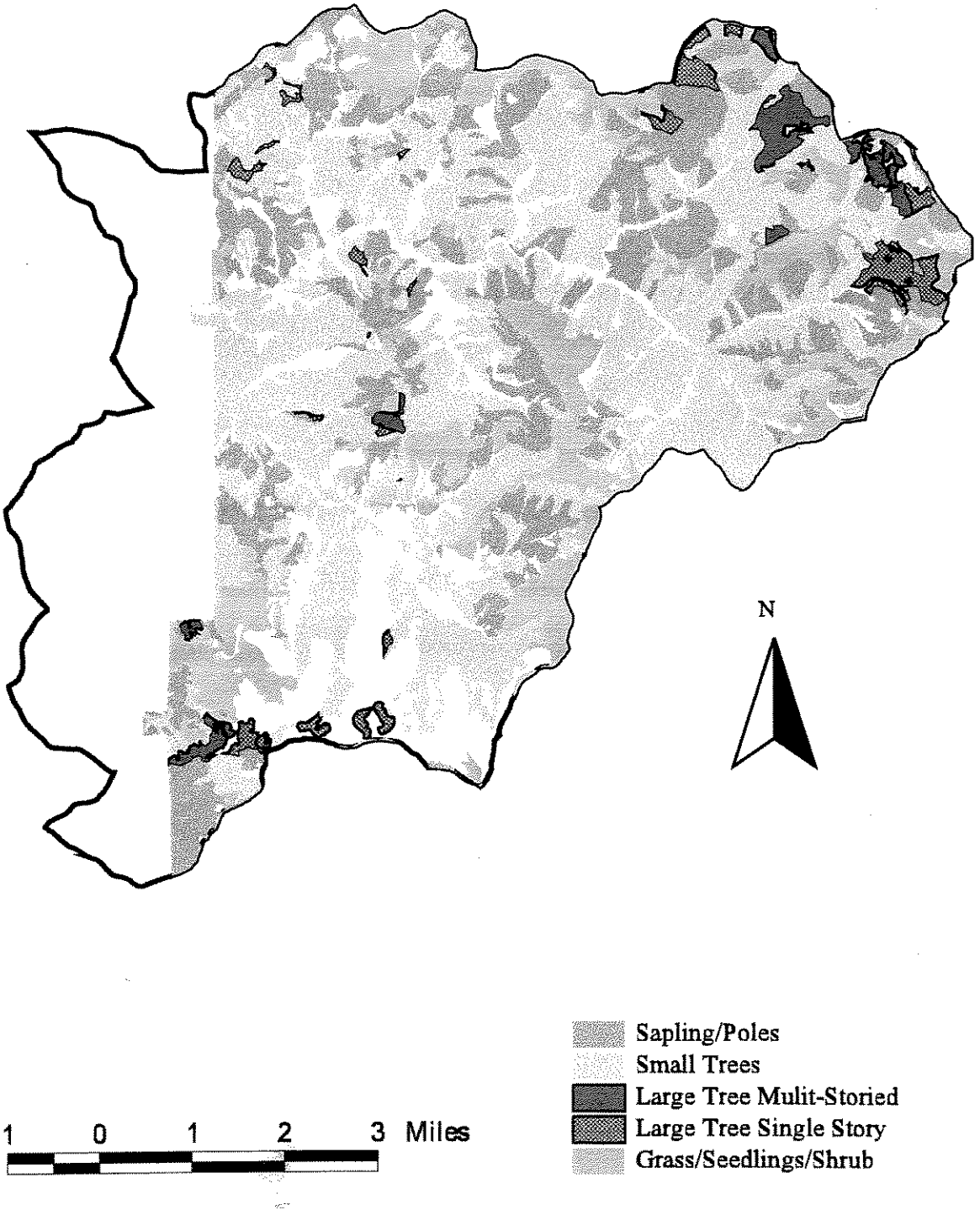


Figure 15 Grouped Coniferous Vegetation Structure Stages

Grouped Other Vegetation Structure Stages

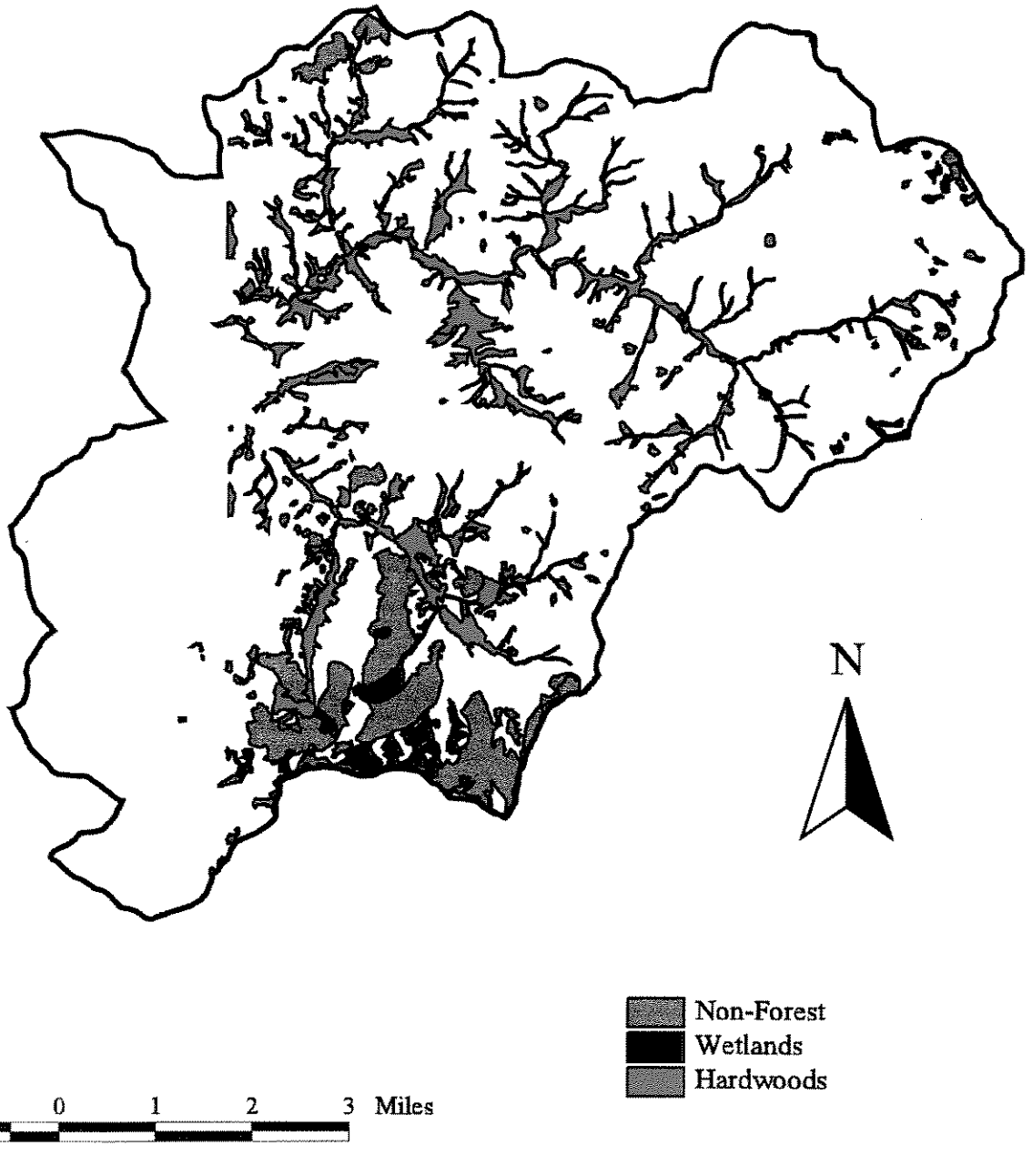


Figure 16 Grouped Other Vegetation Structure Stages

Since about 1939, three percent of the National Forest lands within the watershed have been clearcut harvested, two percent have been commercial thinned, and <one percent have been salvage logged. An unknown amount of the 19 percent of non-National Forest ownership has also been harvested. Table 9 summarizes harvesting activity on National Forest land by sub-basins.

Table 9. Harvested Area on National Forest Lands

Sub-Basin	Acres National Forest	% Clearcut Harvested	% Commercial Thinned	% Salvaged
1*	153	-	1%	-
2*	1251	-	13%	-
3	1471	-	-	-
4	1727	-	3%	-
5	1236	5%	-	trace
6	2108	22%	-	5%
7	1893	17%	1%	-
8	827	-	-	-
9	1425	-	-	-
10	2234	-	<1%	-
11	1244	-	8%	-
12*	699	-	26%	-
13	1643	-	4%	-
14	1077	-	-	-
15	1001	-	-	-
16	1592	-	trace	-
17	1784	2%	8%	-
18*	379	-	-	-
19*	0	-	-	-
20*	683	-	-	-
21*	498	-	-	-
22	1624	-	-	-
23	3282	-	-	-
Watershed Totals	**29,831**	**3%**	**2%**	**<1%**

* Sub-basins with non-National Forest ownership. Analyses are based on National Forest acreage.

Riparian Reserves

Stand structure and composition within Riparian Reserves have been altered by fire history within the watershed. Four percent of the Riparian Reserves are in late-successional structure stages, 23 percent are in hardwoods, and 64 percent are in early to mid-successional structure stages. Table 10 lists grouped structure stages within Riparian Reserves, and Table 11 shows structure stages by sub-basin.

Table 10. Grouped Riparian Reserve Vegetation Structure Stages

Riparian Reserve Grouped Structure Stages	Acres	Percent
Grass/Forbes/Seedling	746	8%
Open Sapling/Pole/Small Tree	1,445	16%
Closed Sapling/Pole/Small Tree	3,586	40%
Large Tree Single Layer	161	2%
Large Tree Multi-Layer	190	2%
Hardwoods	2,086	23%
Non-Forest	832	9%
Riparian Reserve Totals:	**9,046**	**100%**

Table 11. Grouped Riparian Reserve Vegetation Structure Stages, by Sub-basins.
Percentages are based upon the amount of Riparian Reserve within each sub-basin.

Sub-Basin	Acres Riparian Reserve	Percent Riparian Reserve	Grass/ Forb/ Seedling	Open Sap/Pole /Sm Tree	Closed Sap/Pole /Sm Tree	Lg Tree Single Layer	Lg Tree Multi Layer	Hard-wood	Non-Forest
1 *	27	18%	3%	44%	28%	-	-	24%	-
2 *	420	34%	1%	21%	48%	-	-	27%	3%
3	546	37%	21%	14%	35%	-	-	23%	7%
4	642	37%	5%	5%	66%	-	-	25%	-
5	366	30%	2%	-	76%	2%	-	19%	-
6	581	28%	12%	16%	46%	5%	14%	5%	-
7	586	31%	19%	7%	30%	14%	11%	6%	13%
8	276	33%	12%	11%	65%	-	-	12%	-
9	376	26%	11%	22%	33%	-	-	34%	-
10	688	31%	3%	18%	37%	-	-	42%	1%
11	548	44%	-	15%	45%	-	-	39%	-
12 *	150	21%	41%	24%	-	-	-	35%	-
13	488	30%	3%	17%	37%	-	-	43%	-
14	340	32%	23%	17%	50%	-	-	9%	2%
15	260	26%	9%	23%	41%	-	-	26%	1%
16	494	31%	11%	12%	17%	-	-	26%	34%
17	427	24%	1%	14%	49%	3%	1%	32%	-
18 *	28	7%	32%	24%	6%	-	26%	-	13%
19 *	NA	NA	NA	NA	NA	NA	NA	NA	NA
20 *	183	27%	23%	24%	15%	6%	18%	-	13%
21 *	148	30%	3%	84%	-	1%	2	11%	-
22	478	29%	2%	17%	18%	2%	-	27%	34%
23	991	30%	7%	17%	32%	-	-	12%	32%

* Indicates sub-basins with non-National Forest ownership

TES Plants

Of the 35 TES vascular plant species either documented or suspected to occur in the Mount St. Helens Administrative Unit, one State listed Threatened and one State listed Sensitive species have been found within the Upper East Fork Lewis River Watershed (Table 12).

Table 12. Documented and Suspected TES Plant Species

SPECIES	FEDERAL STATUS	STATE STATUS	C-3 STATUS	UEFL	MSH UNIT
Agoseris elata	-	S	-	S	S
Botrychium lanceolatum	-	S	-	S	D
B. lunaria	-	S	-	S	D
B. minganense	-	S	-	S	S
B. montanum	-	S	-	S	S
B. pinnatum	-	S	-	S	D
Carex atrata var. erecta	-	S	-	S	D
C. densa	-	S	-	S	S
C. interrupta	-	S	3	S	D
C. scopulorum v prionophylla	-	S	-	S	S
Chrysolepis chrysophylla	-	S	-	S	S
Cicuta bulbifera	-	S	-	S	S
Cimicifuga elata	-	T	2	S	S
Corydalis aquae-gelidae	-	**T**	**2**	**D**	D
Cypripedium fasciculatum	-	T	2	S	S
Epipactus gigantea	-	S	-	S	S
Githopsis specularioides	-	S	-	S	S
Liparis loeselii	-	E	-	S	S
Luzula arcuata	-	S	-	S	S
Microseris borealis	-	S	-	S	S
Mimulus suksdorfii	-	S	-	S	S
Montia diffusa	-	S	-	S	D
Ophioglossum vulgatum	-	T	-	S	S
Orobanche pinorum	-	S	-	S	S
Parnassia fimbriata v hoodlana	-	S	-	S	S
Pedicularis rainierensis	-	S	-	S	S
Platanthera sparsiflora	-	S	-	S	S
Pleuricospora fimbriolata	-	**S**	-	**D**	D
Poa nervosa v nervosa	-	S	-	S	S

SPECIES	FEDERAL STATUS	STATE STATUS	C-3 STATUS	UEFL	MSH UNIT
Polemonium carneum	-	T	-	S	S
Polystichum californicum	-	S	-	S	S
Saxifraga debilis	-	S	-	S	S
Sisyrinchium sarmentosum	-	T	2	S	D
Utricularia intermedia	-	S	-	S	D
Veratrium insolitum	-	S	-	S	S

State/Federal Status: T = Threatened E = Endangered S = Sensitive
Siting Status: D=documented, S=suspected
C-3 Status: 1 = Manage known sites
2 = Survey prior to activities & manage sites
3 = Conduct extensive surveys and manage sites
4 = Conduct general regional surveys

Corydalis aquae-gelidae (Clackamas corydalis/cold-water corydalis) - found beside and growing in cold rocky streams, springs, and seeps in the western hemlock and Pacific silver fir zones. This species is a regional endemic to SW Washington and NW Oregon. Streams inhabited by this plant are usually perennial but not necessarily fish bearing. Substrate is typically coarse gravels free of other understory competitors. Riparian Reserves are especially important to this species.

Pleuricospora fimbriolata (fringed pinesap) - found in the duff and humus layer in shaded coniferous forests from southern Washington to California typically in late-successional stands.

C-3 Species

Table 13 lists data on vascular C-3 species either suspected to be in, or documented in the Upper East Fork Lewis River Watershed. Data on C-3 lichens, bryophytes, and fungi are almost non-existent for the Upper East Fork Lewis River watershed, as no formal surveys have been conducted. Table 14 lists C-3 lichens documented in the Upper East Fork Lewis River Watershed area, the Mount. St. Helens Administrative Unit, and the Gifford Pinchot National Forest. Table 15 lists documented C-3 fungi in the Watershed.

Table 13. C-3 Vascular Plants suspected or documented in the Upper East Fork Lewis River Watershed

Species	Federal Status	State Status	C-3 Status	UEFL	MSH Unit
Allotropa virgata	-	-	1,2	S	D
Arceuthobium tsugense	**-**	**-**	**1,2**	**D**	**D**
Botrychium minganense	-	S	1,2	S	D
B. montanum	-	S	1,2	S	D
Coptis asplenifolia	-	S	1,2	?	?
C. trifolia	-	-	1,2	?	?
Corydalis aquae-gelidae	**-**	**T**	**1,2**	**D**	**D**
Cypripedium fasciculatum	-	T	1,2	S	S
C. montanum	-	M3	1,2	S	S
Galium kamtschaticum	-	S	1,2	S	S
Habenaria orbiculata	**-**	**M3**	**1,2**	**D**	**S**

Table 14. C-3 Survey and Manage lichens documented in the Upper East Fork Lewis River Watershed, Mount. St. Helens Administrative Unit, or Gifford Pinchot National Forest

SPECIES	Survey & Manage Strategy	GPNF	UEFL	MSH NVM
Rare Leafy (arboreal) Lichens				
Tholurna dissimilis	1, 3	X		
Rare Nitrogen-fixing Lichens				
Dendriscocaulon intraculatum	1,3	X		X
Lobaria hallii	1, 3	X		
Lobaria linita	1,2,3	X		
Nephroma occultum	1, 3	X		X
Pseudocyphellaria rainierensis	1, 2, 3	X		X
Nitrogen-fixing Lichens				
Lobaria oregana	4	X		X
Lobaria pulmonaria	4	X		X
Lobaria scrobiculata	4	X		X
Nephroma bellum	4	X		X
Nephroma helveticum	4	X		X
Nephroma laevigatum	4	X		X
Nephroma parile	4	X		X
Nephroma resupinatum	4	X		X
Peltigera collina	4	X		X
Pseudocyphellaria anomala	4	X		X
Pseudocyphellaria anthraspis	4	X		X
Pseudocyphellaria crocata	4	X		X
Sticta fuliginosa	4	X		X
Sticta limbata	4	X		
Pin Lichens				
Calicium viride	4	X		
Riparian Lichens				
Cetrelia cetrarioides	4	X		

Collema nigrescens	4	X		
Leptogium saturninum	4	X		
Usnea longissima	4	X		X
Rare Rock Lichens				
Pilophorous nicricaulis	2,4	X		
Aquatic Lichens				
Hydrotheria venosa	1, 3	X	X	X

Table 15. C-3 Survey and Manage fungi documented in the Upper East Fork Lewis River Watershed

Species	C-3 Survey & Manage Strategy*
Cantharellus cibarius	3,4
Hydnotrya subnix	1,3

* 1=manage known sites
  2=survey prior to activities and manage sites
  3=conduct extensive surveys and manage sites
  4=conduct general regional surveys

Special Habitats: Plants

Stream riparian areas, wetlands, rock outcrops, caves, talus slopes, and old-growth stands provide the majority of special plant habitat. Due to fire history, many stream riparian areas have been altered from their natural conditions, possibly reducing their capacity to provide special habitat. Although mature hardwood species are present, up slope conifers are lacking. Many of the stream riparian areas no longer provide epiphytic or understory habitat, shade, or nutrients to the riparian areas.

The Silver Star designated Botanical Special Interest Area has several meadows with highly diverse plant communities. The area also supports several populations of the Clackamas corydalis (*Corydalis aquae-gelidae*). Although edible berries and mushrooms are abundant, this area is closed to harvest because of its importance as a special area and because of the high pressure it has received due to its accessibility to urban centers.

Fire

This issue is rated at a moderate level and will not be directly analyzed by the ID team during the development of the Upper East Fork Lewis River Watershed Analysis.

Fire Management - The number of people visiting the Upper East Fork is expected to increase, due to the proximity of the area to a large population center and the growing demand for recreation. The risk of human caused fires associated with recreation use is likely to increase but is still considered to be low.

Aquatic Animals and Habitat

Information on aquatic organism populations is lacking. This discussion will focus on the limited aquatic information that is available, which is primarily fish habitat and distribution data. Existing habitat conditions were evaluated using the following aquatic habitat attributes: pieces of in- channel LWD per mile, potential recruitment of LWD, primary pools per mile, water temperature, and aquatic habitat fragmentation.

Stream habitat surveys have been completed on approximately 25 miles of stream in 11 sub-basins (2, 3, 7, 8, 9, 10, 11, 12, 13, 17, and 23). Fish currently occupy approximately 50 miles of stream in the watershed. Fish and other aquatic organisms are sensitive to a variety of disturbance factors and have specific habitat requirements for their life stages. The optimum habitat factors for the species that are present in this watershed are displayed in Table 16.

In-Channel Large Woody Debris per mile

Large woody debris is a critical component of aquatic habitats for a variety of organisms. It influences channel morphology, the storage and routing of sediment, and the amount and complexity of habitat for aquatic organisms (Hicks et. al 1991). Wood is delivered to the stream channel through a variety of mechanisms (i.e., landslides, transport from upstream areas, and direct entry from adjacent side slopes). Management activities and natural processes alter the effectiveness of these natural delivery mechanisms and the longevity of wood in the system. For example harvest within the riparian zone reduces the available wood supply for direct entry from adjacent slopes.

The Columbia River Basin Policy Implementation Guidelines (PIG) identified standards for quantities of LWD in western Cascade streams to provide quality salmonid habitat. The existing condition identified in stream surveys is evaluated against this standard to determine a rating of good, fair or poor. Streams in good condition meet or exceed the standard of 80 pieces per mile. Streams in fair

Table 16 Optimum Habitat Condition Factors for Aquatic Organisms, by life stage.

Organism/ Life Stage	Cutthroat Trout	Rainbow Trout	Brook Trout	Winter Steelhead	Sculpin	Whitefish
Distribution	Throughout basin	Throughout basin	Pemi and Moon Lakes	Mainstem and Tribs up to RM 42.	Throughout basin	Throughout basin
Spawn Season	Spring (Feb.-Mar)	Spring (Feb.-Mar)	Fall (Sept. - Oct.)	Nov-May Enter, Spawn Mar-June	Late Spring Sex. Mature 2 yrs old	Fall (Oct.-Dec.) Sex. Mature 3-4 yrs old
Temp	6.1-17.2 C	2.2-20 C	4.5-10 C		Not Available	Not Available
Habitat Factors	cover, coldwater, substrate 1.3-10 cm. quantity pools, volume pools	cover, coldwater, substrate 1.3-10 cm	Tied to springs/upwelling		Under stones in swift water	Gravel in riffle reaches or shoals of lakes
Rear Season	April - January	April - January	Nov. - Aug.	Year Round - April-July Emerge. Emigrate Spring 2 years later.	Not Available	Nov. - Jan.
Habitat Factors	Enter substrate in winter for hiding cover, fine sediment deposits decrease populations.	Slow velocities, cover, densities higher in pools, enter substrate in winter for hiding cover. Avg. Max. Weekly Temp 19 C. 25-50 NTU's for 2.5-4.5 days = reduced growth and emigration.	Enter substrate in winter for hiding cover, Avg. Max. Weekly Temp 19 C. 25-50 NTU's for 2.5-4.5 days = reduced growth and emigration		Not Available	Not Available
Adult	Year Round	Year Round	Year Round	See Spawn Season	Year Round	48-52 °C
Habitat Factors	associated with cover, use upper reaches of streams when other spp. present, cold water.	cover, cold water substrate used as cover	LWD cover, cold water, substrate used as cover	See Above	Streams and Lakes with stable bottoms. Feed primarily on aquatic insects, can eat salmon fry	Streams/lakes in summer, large pools in winter. Food is primarily aquatic insects.

condition contain 40-79 pieces of LWD/mile, and streams in poor condition contain less than 40 pieces of LWD per stream mile. Stream survey data indicate, approximately 92 percent of the surveyed streams are rated as poor, approximately 6 percent are rated as fair, and 2 percent are rated as good (Figure 16, Large Woody Debris per Mile).

Potential Recruitment of Large Woody Debris

The current recruitment potential of LWD from the riparian areas into the stream systems is a concern due to past fires. Results of an aerial photo analysis by sub-basin show that 19 percent of the riparian areas have a "low" potential for current LWD recruitment, 68 percent have a "moderate" potential for current LWD recruitment, and 13 percent have a "high" potential for current LWD recruitment. High recruitment potential is defined as riparian areas with old, dense, conifer stands. Low recruitment potential is defined as riparian areas with young, sparse, hardwood stands. The majority of this watershed rates as moderate because the riparian areas were burned in the early part of the century and the stands are now composed of mature, dense hardwoods. This analysis followed the Washington State Department of Natural Resources Riparian Watershed Analysis module. Changes in the module methods are noted in the assumptions section of this document. These numbers indicate that there is currently a very limited supply of LWD adjacent to stream channels that is currently available. The areas with the highest recruitment potential are located in sub-basins 6, 7, 12, and 22. Through time the potential for LWD recruitment sources will increase in other sub-basins as the conifer trees along the streams mature and grow more dense.

Large Woody Debris Per Mile

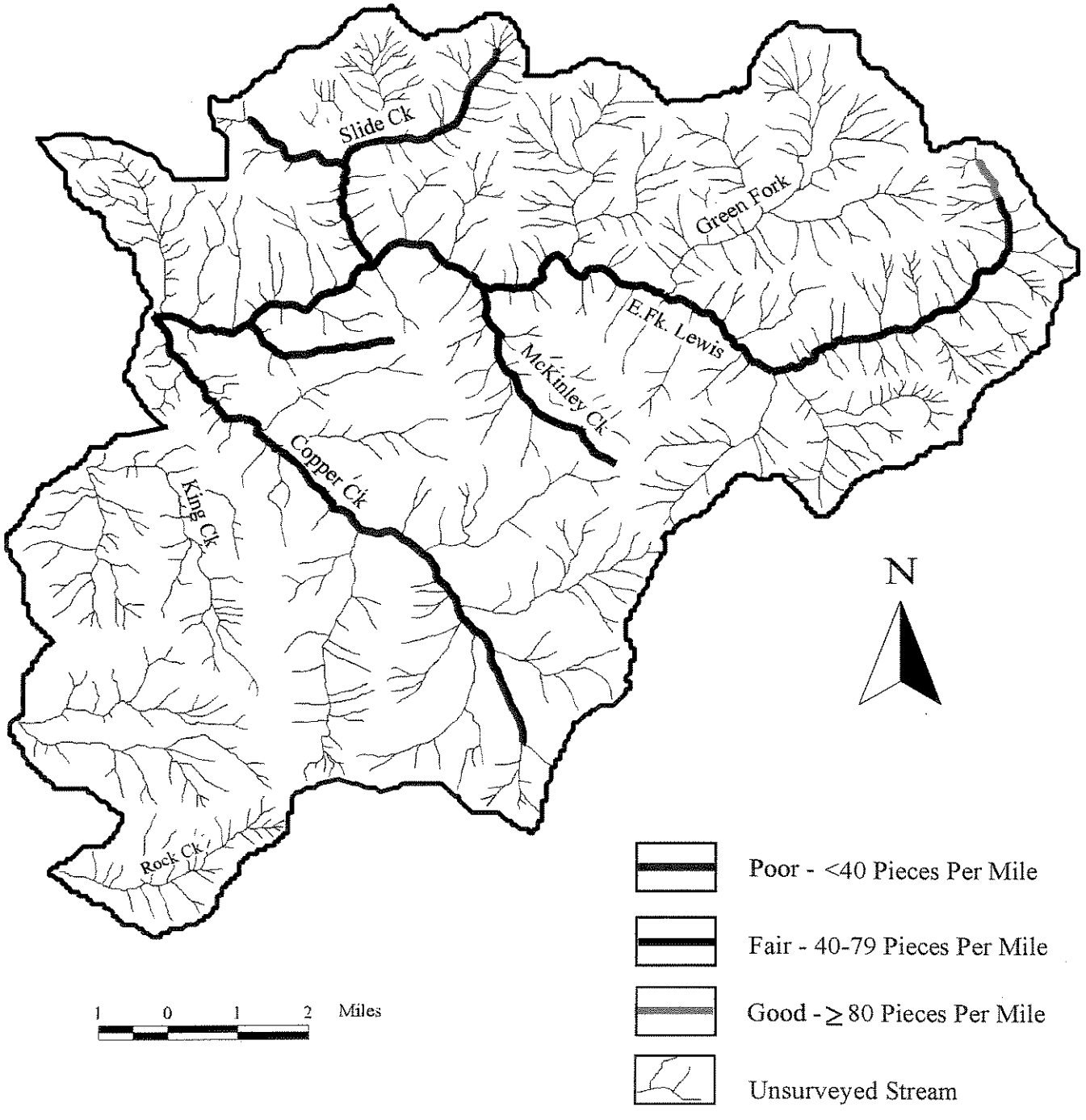


Figure 17 - Large woody debris ratings per mile for surveyed streams in the Upper East Fork Watershed.

Primary Pools per Mile

Pools provide thermal refuge for aquatic organisms dependent on cool stream temperatures; protective cover for rearing; and act as holding areas for LWD flowing through the stream system. The quality of habitat formed by pools is based on several factors including: pool depth, stream width, amount of LWD in place, and the complexity of sub-habitats within the pool. The number of pools increases as the stream size decreases. Channel morphology influences where pools are formed in the stream channel, and determines the hydraulic controls that create the pools.

The PIG identified standards for quantities of pools/mile in streams based on stream width to provide quality salmonid habitat (Table 17). This standard is what the existing condition identified in stream surveys is evaluated against to determine a rating of good, fair or poor. Streams in good condition meet or exceed the quantity of pools based on width; streams in fair condition contain 50-99 percent of the desired number of pools, and streams in poor condition contain fewer than 50 percent of the desired pools per mile. Stream survey data indicate approximately 52 percent of the surveyed streams are rated as poor, approximately 6 percent are rated as fair, and approximately 42 percent are rated good. (Figure 17, Primary Pools per Mile)

Table 17 Desired Pool Frequency Based on Stream Width (PIG Standards)

Wetted width in feet	5	10	15	20	25	50	75	100	125	150	200
Number Of Pools/Mi.	184	96	70	56	47	26	23	18	14	12	9

Primary Pools Per Mile

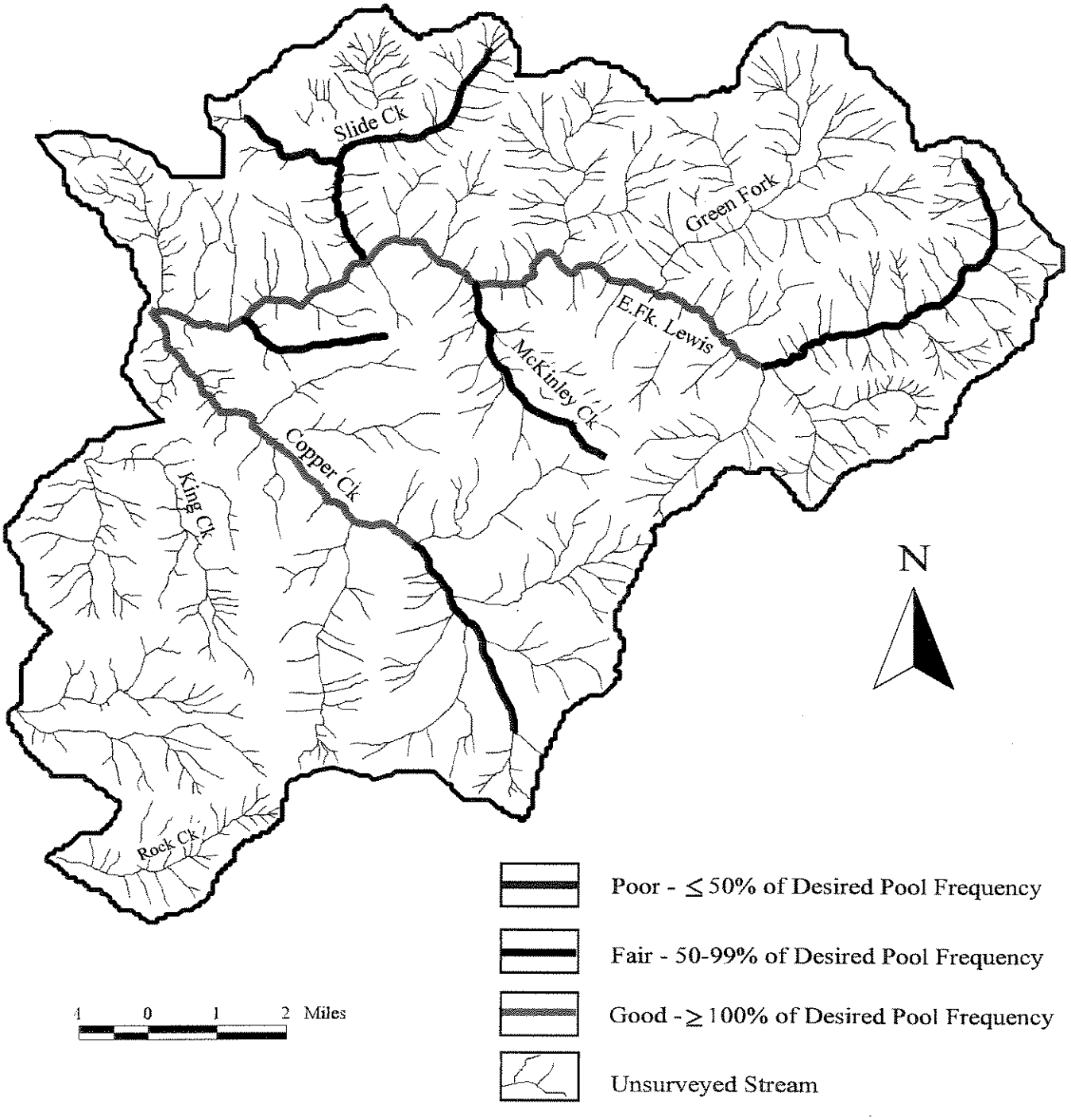


Figure 18 - Primary pool ratings per mile for surveyed streams in the Upper East Fork Watershed.

Stream Temperature

Stream water temperature is a major factor influencing the composition and productivity of aquatic ecosystems. Fish, aquatic macro invertebrates, and other aquatic organisms are affected directly and indirectly by changes in water temperatures. For salmonids specifically, stream temperature influences the timing of migration, spawning, incubation rates, growth, distribution, resistance to parasites, food supply and quality, and tolerances to diseases and pollutants (Bjornn and Reiser 1991). Aquatic organisms are often able to withstand short term increases in stream temperature and adjust by locating optimum habitat within the channel. Long term changes or peaks in water temperature may directly alter the established patterns of the salmonid populations.

Stream temperature monitoring was initiated in 1977 at the Sunset Falls and the Copper Creek gaging stations and continued until 1992, when funding was discontinued. The data that was collected has numerous gaps, the analysis having been done with the most complete data sets available for the low flow period of July - October. Months with no data were excluded. Maximum seven day averages were calculated on data from both stations, with results displayed below. At each station, the maximum state water quality standard continued to be exceeded, even after averaging was completed.

A discussion of how stream temperatures affect aquatic beneficial uses is presented in the water related features, hydrologic processes section of this document.

Figure 19 Maximum 7-day average stream temperatures at the Copper Creek gaging station.

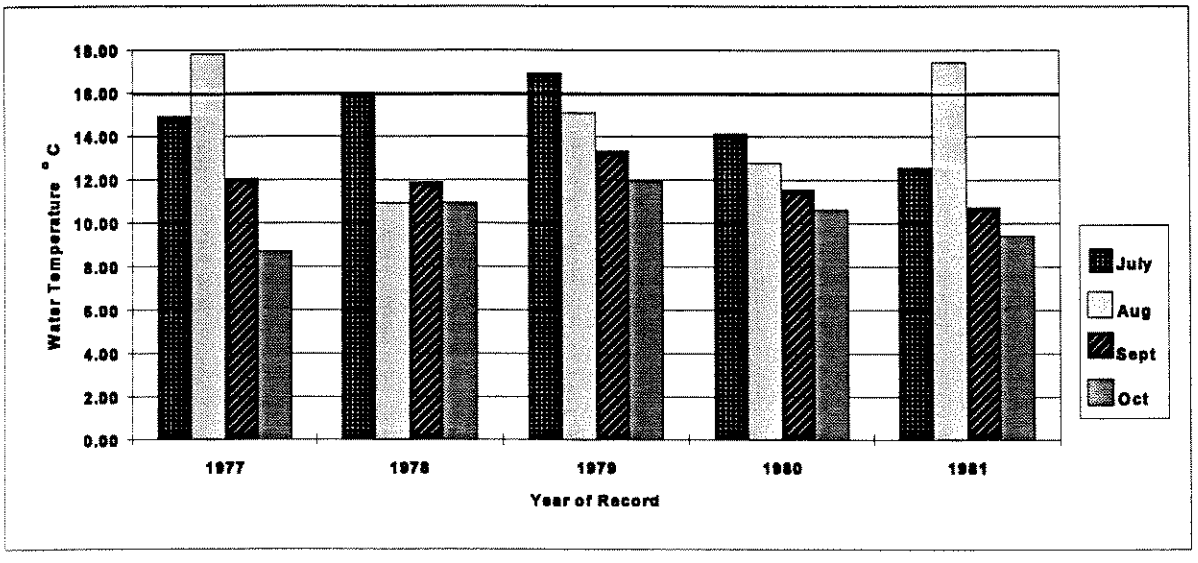
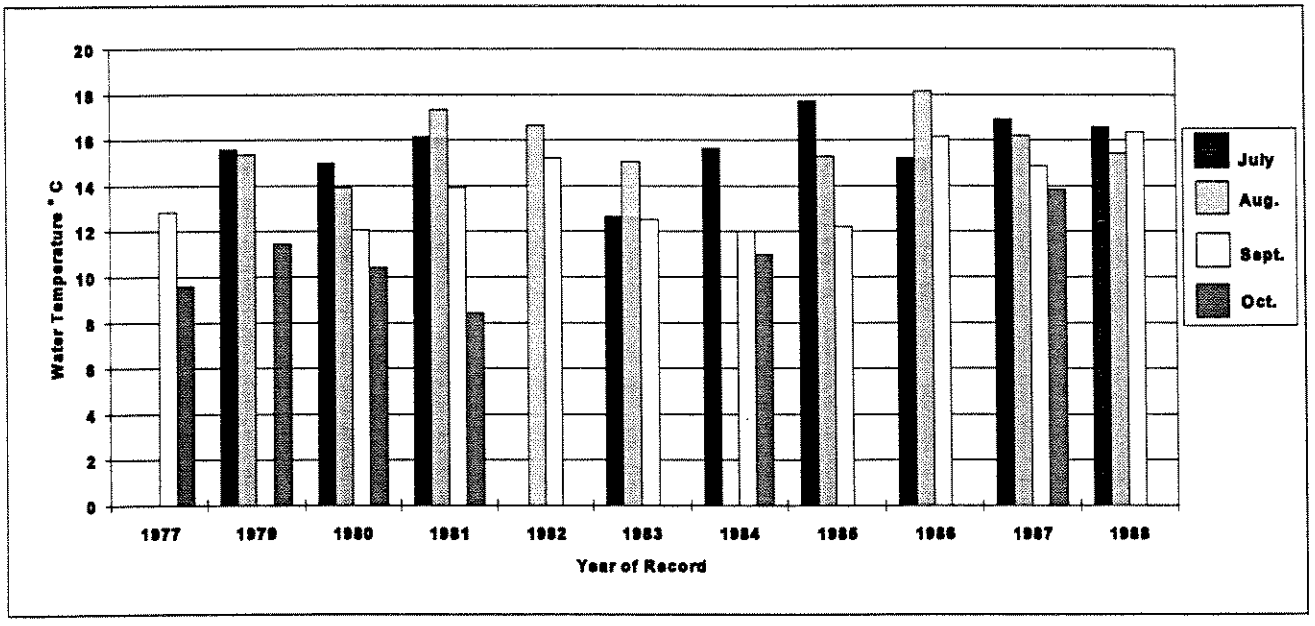


Figure 20 Maximum 7-day average stream temperatures at the Sunset Falls gaging station.



Aquatic Habitat Fragmentation

Roads aregenerally an important factor in the decline of fish populations and often fragment the aquatic system. Roads and culverts can not only block upstream migration of resident fish, but can also alter the flow pattern of LWD through the system and can increase sediment input (Furniss et. al. 1991).

Currently the road density in the watershed is 1.79 miles per square mile, with 321 stream crossings. Individual sub-basins, however, have road densities that exceed 4.6 miles per square mile (Figure 21 Road Densities), with as many as 30 road/stream crossings in a single sub-basin.

The riparian reserve aquatic habitat fragmentation index which is based upon the number of road crossings over streams was normalized by stream length in each sub-basin. This value is a surrogate for the impact that the aquatic system has received due to increased road building. It is not an established method but only an attempt to display the information we have at this time. Sub-basins 19, 1, 17, 11, 10, 2 and 13 were within the highest one-third of the values (Figure 22 Aquatic Habitat Index). This indicates they have received the most intense degree of habitat fragmentation caused by the presence of roads. Sub-basin 19 had the highest value of 2.1 crossings/mile of stream. This small watershed (1200 acres), with only 9.8 miles of stream had 21 stream crossings. The aquatic habitat fragmentation index value is 1.12 crossings/mile of stream over the entire watershed, indicating an average of just over one crossing per mile of stream.

Figure 21 Road Densities in the Upper East Fork Lewis Watershed by Sub-basin.

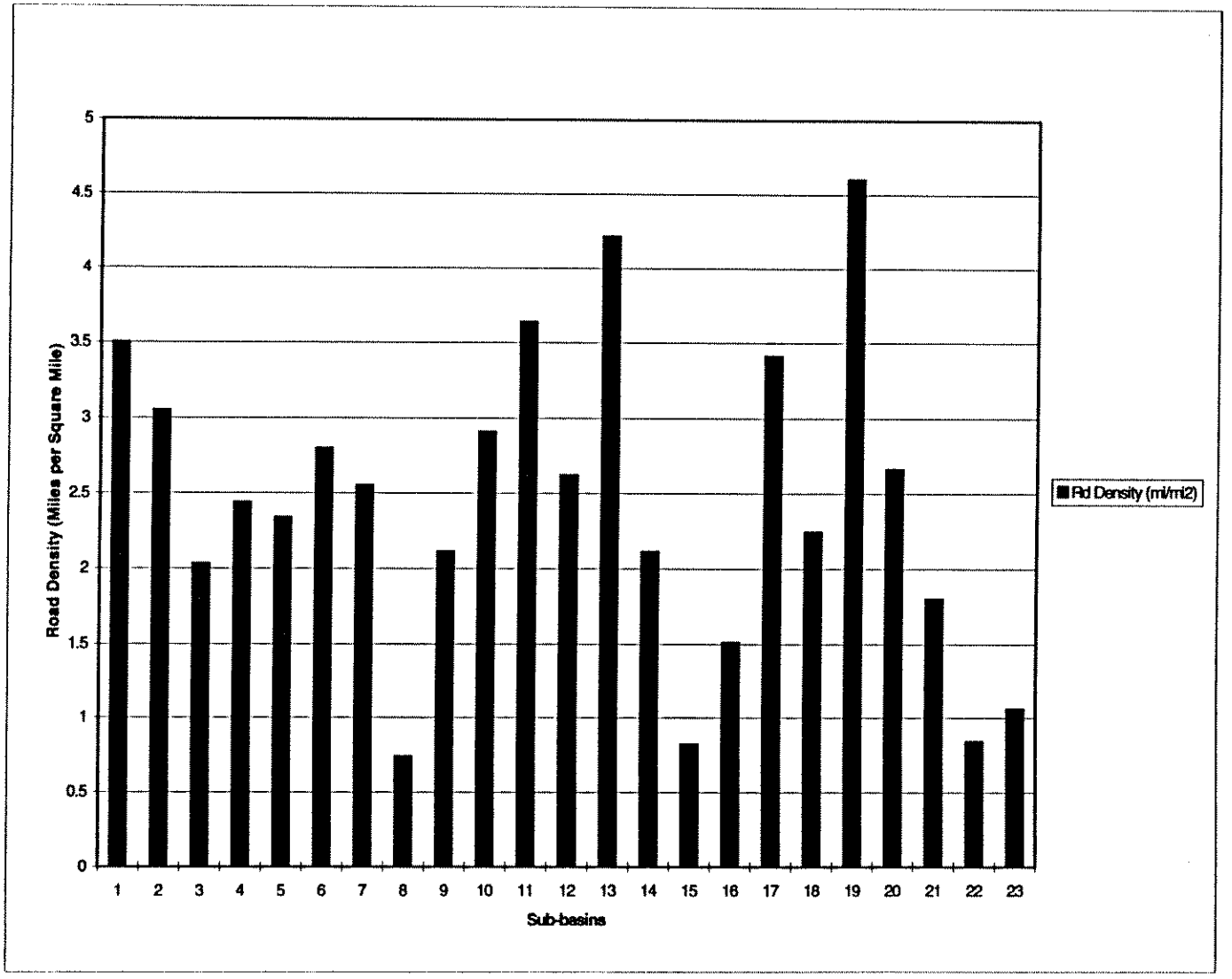
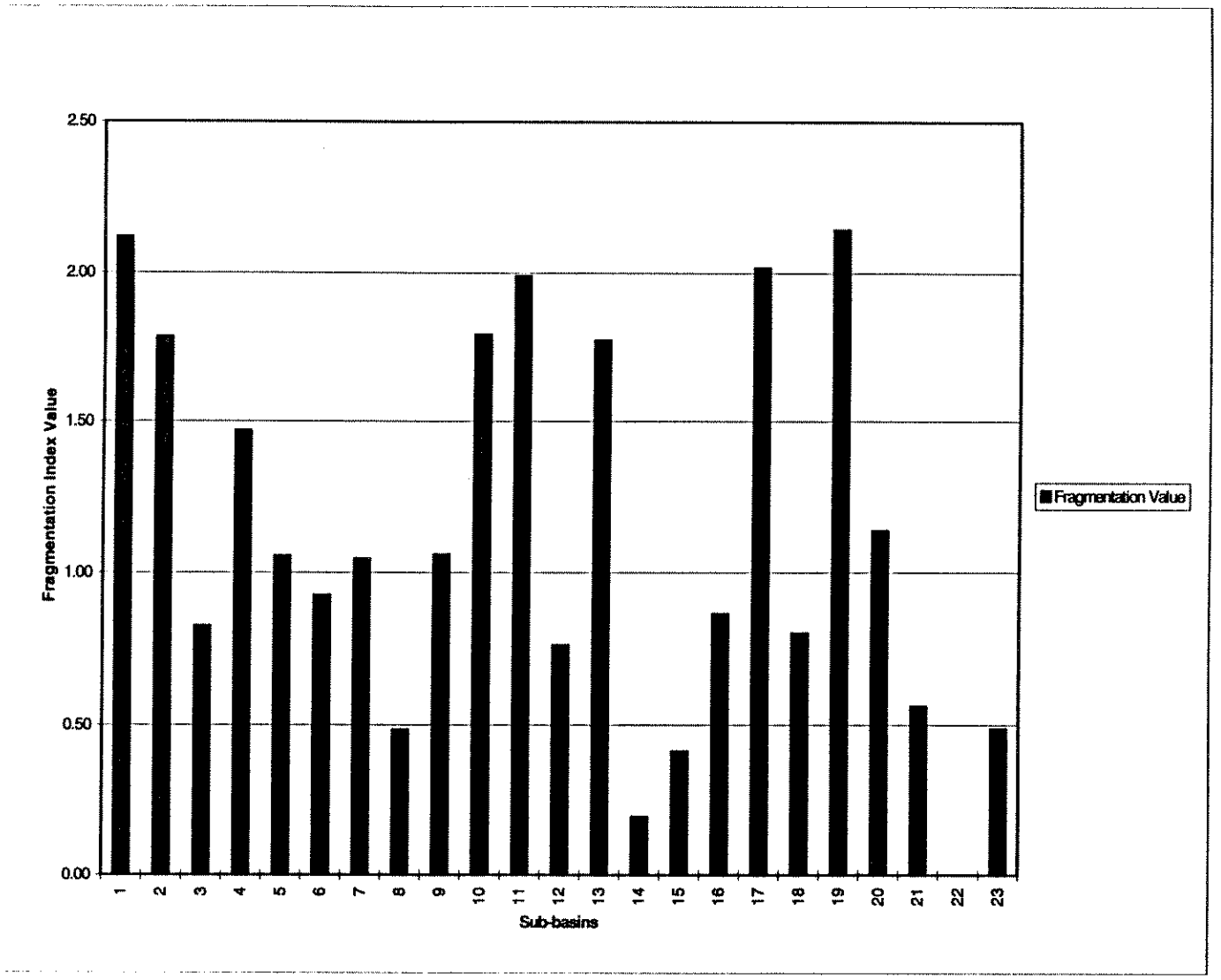


Figure 22 Aquatic Habitat Fragmentation Index by Sub-basin in the Watershed.



Terrestrial Animals and Habitat, TES Species

Terrestrial Animals and Habitat

National Forest lands in the watershed contain habitat for 227 terrestrial species. Of these, 45 species are dependant on snags, and 62 are dependant on down logs. There are 13 species that are Federally listed as threatened or endangered, or as a candidate for federal listing (C2).

The high priority issues that relate to wildlife habitat in the Upper East Fork of the Lewis River Watershed are 1) Habitat for threatened, endangered, and sensitive (TES) species, 2) Elk and deer winter range, and 3) Riparian Reserve fragmentation. Riparian Reserve fragmentation will be addressed in the discussion of habitat for listed late-successional wildlife species.

Habitat for Threatened, Endangered, and Sensitive Species

The watershed contains habitat for the following TES species (* indicates species has been reported in the watershed):

Cope's giant salamander (Dicamptodon copei) Forest Service sensitive

Larch Mountain salamander (Plethodon larselli) Candidate for federal listing (C2) *

Red-legged frog (Rana aurora aurora) Candidate for federal listing (C2)

Cascades frog (Rana cascadae) Candidate for federal listing (C2)

Spotted frog (Rana pretiosa) Candidate for federal listing (C2)

Northern goshawk (Accipiter gentillis) Candidate for federal listing (C2)

Pileated woodpecker (Dryocopus pileatus) Forest Service sensitive

Peregrine falcon (Falco peregrinus) Federally listed (endangered)

Bald eagle(Haliaeetus leucocephalus) Federally listed

Harlequin duck (Histrionicus histrionicus) Candidate for federal listing (C2)

Mountain quail (Oreortyx picta) Candidate for federal listing (C2)

Northern spotted owl (Strix occidentalis) Federally listed (threatened) *

Gray wolf (Canus lupus) Federally listed (endangered) *

Fisher (Martes pennanti) Candidate for federal listing (C2)

American marten (Martes americana) Forest Service sensitive

Townsend's big-eared bat (Plecotus townsendii) Candidate

for federal listing (C2)

In addition to these federally listed and candidate species, golden eagles (Aquila chrysaetos) have been known to nest in the watershed. The golden eagle is on Washington State's candidate species list, and is protected by federal law.

Wildlife species on the Gifford Pinchot National Forest have been categorized into life-history guilds, based on the type and arrangement of habitat used, home range size, and whether special habitat features need to be present.

The species listed above were placed in the following guilds:

Terrestrial Group

Guild Code	Patch Configuration	Home Range	Structure Stage	Species	Acres of Habitat Available
TLMLT	Mosaic	Large	Large Tree	Northern goshawk Pileated woodpecker Spotted owl Fisher American Marten	1,136
TLGG	Generalist	Large	All	Gray wolf Grizzly bear	27,908
TSGG	Generalist	Small	All	Red-legged frog Cascade frog	27,908
TSMO	Mosaic	Small	Open	Mountain quail	8,536
TLC	Contrast	Large	Contrast	Golden eagle	2,248

Riparian Group

Guild Code	Water Body	Aquatic Association	Structure Stage	Species	Acres of Habitat Available
LKRVARG	Lakes/Rivers	Aquatic and Riparian	All	Bald eagle	8,284
LKRVA	Lakes/Rivers	Aquatic		Cope's giant salamander	7,968
RIVARG	Riverine	Riparian	Forested	Harlequin duck	6,072
LAKEARO	Lakes	Aquatic and Riparian	Open	Spotted frog	4

Special Habitat Group

Guild Code	Special Habitat	Species
SPCL	Lava/Talus	Larch Mountain salamander
SPCL	Abandoned buildings, wooden bridges, mines, and caves	Townsend's big-eared bat
SPCL	Cliffs	Peregrine falcon

Habitat for Guilds TLMLT and TSGG (Spotted owl, northern goshawk, pileated woodpecker, fisher, marten, red-legged frog, and Cascades frog)

Since the northern spotted owl, northern goshawk, pileated woodpecker, fisher, and marten are members of the same guild, suitable habitat for these species would be similar.

There are about 7,988 acres of suitable spotted owl habitat on National Forest land in the watershed. This represents about 27% of the National Forest land in the watershed. Of this, about 1,248 acres are nesting habitat, 1,468 acres are foraging habitat, and 5,272 acres are dispersal habitat. Nesting habitat is equivalent to optimum habitat for the other species in this guild.

See Figure 23 for a map of spotted owl habitat in the watershed.

Table 18 Suitable spotted owl habitat by sub-basin (National Forest land only)

Sub-Basin	Nesting Habitat Acres	Percent	Foraging Habitat Acres	Percent	Dispersal Habitat Acres	Percent
1	0	-	24	16	107	14
2	65	5	161	13	413	33
3	4	-	0	-	125	8
4	0	-	0	-	484	28
5	0	-	90	7	49	4
6	400	19	522	25	158	7
7	359	19	131	7	49	4
8	0	-	0	-	257	31
9	0	-	0	-	318	22
10	33	1	65	3	578	26
11	0	-	177	14	404	32
12	6	1	70	10	144	21
13	1	-	81	5	300	18
14	0	-	61	6	110	10
15	0	-	0	-	284	28
16	13	1	0	-	278	17
17	63	4	39	2	336	19
18	0	-	21	5	6	2
19	No data	-	-	-	-	-
20	111	16	0	-	75	11
21	9	2	0	-	100	20
22	35	2	18	1	193	12
23	58	2	7	-	367	11

Spotted Owl Habitat

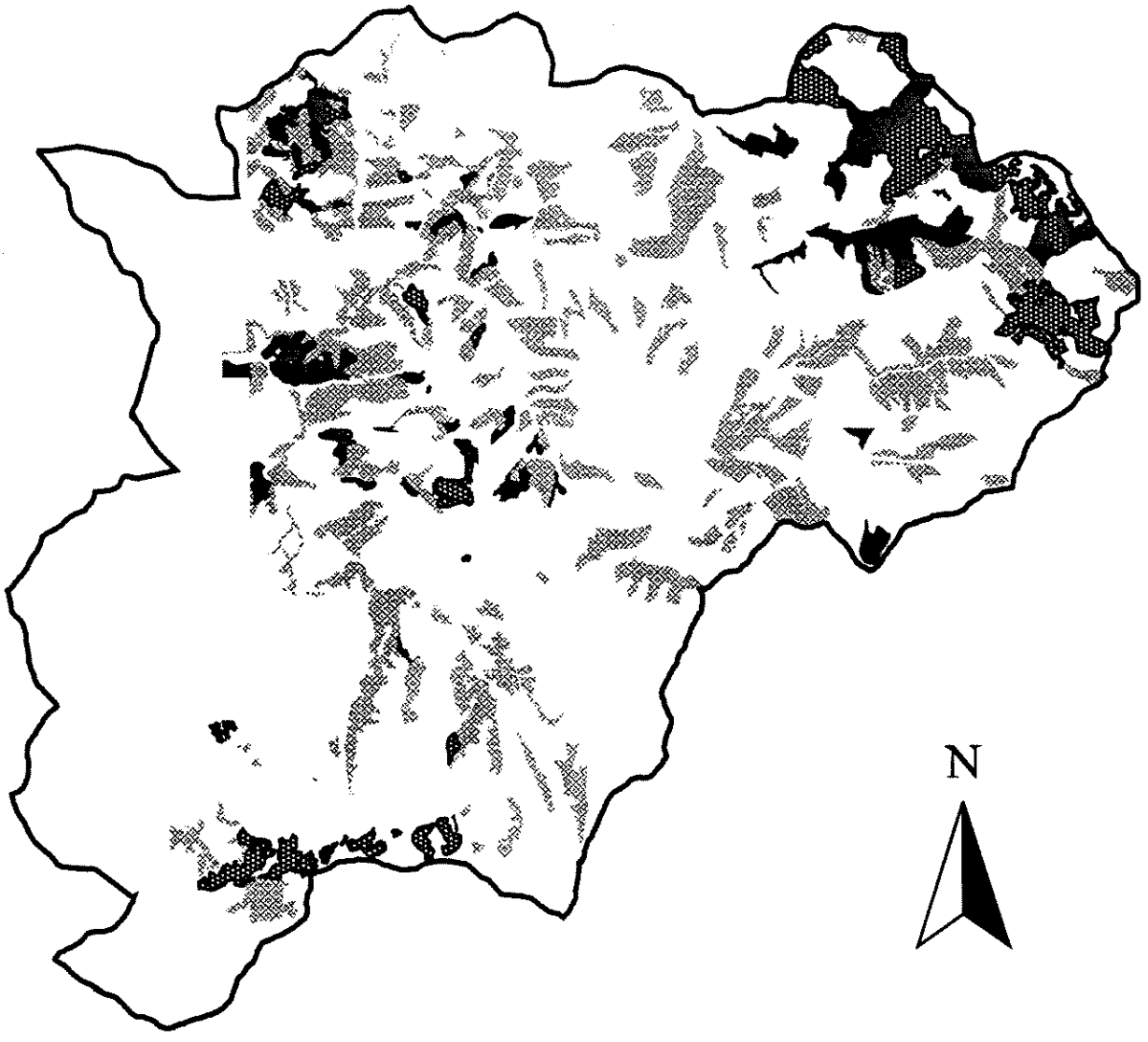


Figure 23 Spotted Owl Habitat

There is one spotted owl activity center (#8206) in the watershed, which is located in sub-basin 6. The U.S. Fish and Wildlife Service has established the minimum number of acres of nesting and foraging habitat that must be present within the home range of a spotted owl pair to maintain the viability of that pair. The thresholds are 500 acres of nesting/foraging habitat within .7 mile of the activity center, and 2,633 acres within 1.82 miles. Activity center #8206 has about 540 acres of suitable nesting/foraging habitat within .7 mile, and 2,088 acres of suitable nesting/foraging habitat within 1.82 miles. This second figure is about 545 acres below the threshold required for the home range. This activity center was established before 1/1/94, and as required in the President's Forest Plan, will require designation of a 100-acre core habitat area around the activity center.

Since the amount of old-growth habitat is limited in the watershed, most of the watershed is not likely to be inhabited by species that require this type of habitat. Possible exceptions are in sub-basins 6 and 7, which contain old stands that were missed by the fires early in the century. These stands, however, are fragmented by recent harvest, and to a lesser extent by younger stands that were regenerated following the fires. For this reason, there is very little interior old-growth habitat in the watershed. It is likely that late-successional species with moderate to large home ranges inhabiting these sub-basins also utilize habitat outside of the watershed to the northeast in the upper Canyon Creek and Trout Creek watersheds. This means that the old-growth stands in sub-basins 6 and 7 contribute to the habitat quality of an area largely outside of the watershed.

Two important habitat elements of old-growth stands are abundant large snags and down woody material. In general the watershed is lacking in snags. Most of the snags created by the fire were felled in the 1960's to reduce the potential for new fire starts. The snags that still persist from the fire are soft and generally less than 20 feet tall. The stands that were regenerated following the fires do not yet contain large trees that could be expected to become snags, or be killed to create snags. The old growth stands that escaped the fires, however, contain abundant large snags.

Logs resulting from falling snags created by the fire are fairly abundant, but they are in advanced stages of decay. Since most of the conifer stands in the watershed are young, it will be decades before there is again a source of large woody debris. For this reason large woody debris may be deficient between the period of time when existing logs have decayed, and before large logs are again recruited into the ecosystem.

The watershed does not serve as a corridor between late successional reserves on National Forest land, and since much of the non-federal land south and west of the watershed was impacted by the same fires in the early 1900's, very little old-growth habitat exists outside of the Forest boundary to the south and west. Corridors for old growth species within the watershed are also lacking.

Species such as red-legged frog, Cascade torrent salamander, Van Dyke's salamander, marten

and fisher require a large percentage of the stream side riparian reserves to be in late-successional habitat for facilitated movement within the watershed to occur. Table 19 shows the percentage of Closed Small Tree, Large Tree Single-Storied, and Large Tree Multi-Storied structure stages within the stream side riparian reserves. These structure stages are likely to contain sufficient canopy closure, and large trees to function as a corridor for species that require late-successional habitat. However, only the Large Tree Multi-Storied stage is likely to contain an adequate supply of large snags and logs required by small mammals and amphibians.

Table 19 Percentage of Corridor Habitat for Late-Successional Species in Stream Riparian Reserves. (National Forest land only).

Sub-basin	Closed Small Tree Sapling/Pole	Large Tree Single Story	Large Tree Mulit-Story
1	28%	0	0
2	48%	0	0
3	35%	0	0
4	66%	0	0
5	76%	2%	0
6	47%	5%	12%
7	34%	16%	7%
8	65%	0	0
9	31%	0	0
10	32%	0	0
11	42%	0	0
12	35%	0	0
13	35%	0	0
14	49%	0	0
15	41%	0	0
16	20%	0	0
17	48%	3%	1%
18	7%	0	24%
19	No Data	-	-

Sub-basin	Closed Small Tree Sapling/Pole	Large Tree Single Story	Large Tree Mulit-Story
20	18%	3%	16%
21	11%	0	0
22	20%	1%	0
23	38%	0	0

It is evident that potential corridors for late-successional species are highly fragmented, and for this reason dispersal for these species through and within the watershed would be difficult.

Habitat for Guild TLGG (Grizzly bear and gray wolf)

The gray wolf and grizzly bear are both habitat generalists, depending more on a stable food supply and seclusion than any particular vegetation type for high quality habitat. Large ungulates make up an important part of the diets of both species. Berry producing shrubs are another important food source for grizzly bears.

A potential sighting of two adult gray wolves was made in the Miner's Creek area of the watershed in 1992. The sighting was classified as probable, but no confirmation was made. Potential grizzly bear and gray wolf sightings have been made recently on the western side of the Yakama Indian Reservation (John Almack, WDFW, pers. com.). Because these species are so wide-ranging, the watershed should be considered potential habitat. The likelihood that it would be used depends on the ability of the animals to get to the watershed, and the quality of the habitat there.

Seclusion, which translates to security for these two species is directly related to road density. Habitat that provides seclusion for gray wolves and grizzly bears will generally have an open road density of less than 1 mile per square mile. The total road density within National Forest portion of the watershed is about 2.1 miles per square mile. While the road density is fairly high, 62% of the road miles are Maintenance Level 2 which are local, less traveled roads. Another 4 percent of the roads in the watershed are Maintenance Level 1. Although many of the roads are minimally maintained, the watershed receives a heavy amount of recreational use because of its close proximity to the Vancouver area.

See Figure 20 for a graph depicting road density by sub-basin.

While most of the sub-basins have a density of over 2 miles per square mile, there is a block of land in the southwestern part of the watershed with a density of less than 1 mile per square mile

(sub-basins 18, 20, 21, 22, and 23). This block, consisting of about 10,000 acres north of Silver Star Mountain would offer the greatest opportunity for seclusion in the watershed. In addition, the Upper Washougal River Watershed adjacent to this area, is relatively unroaded as well.

Conditions in the watershed for large ungulates, prey of wolves, are fair to good during the snow-free months. Higher ridges in the watershed have not regenerated into closed stands, and contain abundant forage. Clearcuts in sub-basins 6 and 7, as well as in adjacent watersheds to the northeast have created a good mix of forage and cover that are in close proximity. The young dense stands on the middle and lower slopes in the watershed provide good hiding cover and connectivity throughout the watershed. Optimal habitat on summer range would have 50% to 60% of the area in foraging habitat and about 40% of the area in thermal and optimal cover.

Cover Types on National Forest Land in the Watershed include open forageing (35%), hiding cover (29%), thermal cover (26%), optimal cover (5%), and non-habitat (6%).

The watershed is considered a low density zone for elk, and it borders an elk exclusion area due to agriculture and expansive urbanization on the western edge. The populations of deer and elk in the watershed are roughly estimated to be 2,000 and 200 respectively (Neal Darby, USFWS, pers. com.)

Ungulate numbers in the watershed have probably increased from the 1930's as more cover became available. In the absence of disturbance, however, numbers could be expected to drop again as forage production declines with continued forest succession. This type of fluctuation in ungulate populations has probably always occurred in the watershed in response to large disturbance events. .

Huckleberry and other berry producing shrubs will also decline in the absence of new disturbance. So, the availability of prey and forage for grizzly bears and gray wolves, while currently fair to good in the watershed, is probably declining.

Habitat for Guild TSMO (Mountain quail)

The mountain quail inhabits open montane forests with a well developed brushy understory, steep slopes around the edges of mountain meadows, and logged or burned over forest from 1,500 to 10,000 feet in elevation. Within the watershed there are about 8,536 acres of potentially suitable habitat. Currently, ecotones between midslope forested stands and open ridgetops are the most likely habitat in the watershed. As the stands regenerated after the fires in the early 1900's continue to mature, habitat for this species will probably decline.

Commercial thinning in closed conifer stands would improve habitat for this species if it resulted in a more open stand with a brushy understory.

Habitat for Guilds LKRVARG and RIVARF (Bald eagle and harlequin duck)

Bald eagle nests are usually located in multi-storied stands with old-growth components near bodies of water which support an adequate food supply.

The East Fork of the Lewis River supports an anadromous steelhead fishery from the fall through the spring months, as well as a resident trout population. There are no reported bald eagle sightings in the watershed, however, it is possible that eagles would forage in the river, especially during times when steelhead are spawning. It is not likely that bald eagles would nest in the watershed because a high number of large fish would not be in the watershed during the brood rearing period, and because of a lack of old growth stands near the river.

The harlequin duck breeds almost exclusively along swift-flowing mountain streams with gradients of 1 to 7 percent. Vegetation along these streams is typically mature or old growth western red cedar, Douglas fir, and western hemlock. Nests are usually built in dense vegetation, rocky cavities, piles of woody debris, undercut stream banks, cliff cavities above the stream, or in hollow trees or snags in the forest adjacent to the stream. As with the bald eagle, the lack of old growth stands along the East Fork Lewis River limits potential nest sites for harlequin ducks in the watershed.

Habitat for Guild LKRVA (Cope's giant salamander)

The larva and neotenes of Cope's giant salamander most commonly inhabit small rocky creeks, streams, and seeps; and occasionally cold mountain lakes. Apparently, this species only rarely transforms into a terrestrial form in nature and is known primarily in the larval and neotenic forms. (Neoteny is a phenomenon where a salamander remains in larval form while acquiring sexual maturity to become reproductively active.) For this reason, it is nearly always found in rivers and perennial streams.

Cope's giant salamander is nocturnal, spending the day concealed from view beneath rocks or in other hidden cavities in the stream. At night it forages along the stream bottom, or in the moist splash zone along the edge of the stream. It lays eggs in underwater chambers formed between large rocks or under large woody debris.

As with salmonid fish species, streams with a rocky/gravelly bottom containing abundant large woody debris and boulders would provide good habitat for this salamander. A description of the habitat condition in the streams in the watershed can be found in the fisheries section.

Habitat for Guild LAKEARO (Spotted frog)

The spotted frog is nearly always found in or near a perennial water body such as a spring, pond, lake, or sluggish stream. It is most often associated with non-woody wetland plant communities.

Over the past 50 years, the range of the spotted frog in western Oregon and Washington has been dramatically reduced. Destruction and degradation of habitat, and introduction of bullfrogs and non-native fish that would prey on the tadpoles species are probably two reasons for the decline.

The two small lakes within the watershed that form the headwaters of the East Fork (sub-basin 7) are suitable habitat for spotted frogs. Both lakes have been stocked with brook trout as recently as 1994 (about 200 fingerlings in each lake). The presence of trout, especially since the fish were artificially planted, would affect the ability of spotted frogs to survive in the lakes because of predation on tadpoles. Habitat potential is thus reduced, but the lakes may still be suitable. No amphibian or fish surveys have been conducted in these lakes.

Habitat for Guild TLC (Golden eagle)

This guild is discussed due to the report of a golden eagle nest in the watershed in sub-basin 22. It is in an area that is Administratively Withdrawn. The nest was reported in 1985, and it was inactive that year. Additional information states there were "reports of golden eagles in the area over several years" prior to 1985. On 7/21/95 an immature golden eagle was seen flying in sub-basin 6, which indicates that nesting occurred in or near the watershed in 1995.

Golden eagle nests are typically located on cliffs, although in some situations tree nests are not uncommon. The area around Silver Star Mountain has suitable cliff nest sites, and it contains non-timbered habitat where golden eagles could forage.

Potential conflicts in the vicinity of the nesting habitat include potential mine development in the Copper Creek drainage and increased recreation development and use in the vicinity of suitable cliff sites near Silver Star Mountain.

Habitat for Guild SPCL (Larch Mountain salamander, peregrine falcon, and Townsend's big-eared bat)

Members of this guild require some special habitat feature in order to inhabit an area. The Larch Mountain salamander is typically associated with steep, wooded talus slopes where the rocks are of small size (.5 to 2.5 inches in length). Protection from long periods of sun exposure is usually provided by trees or adjacent rock formations. Overstory trees are often Douglas fir, Oregon ash, and big-leaf maple. In the absence of shade, seeps that keep the talus moist can increase suitability of the habitat.

In addition to talus, this species also occupies forest stands in the southern Washington Cascade range that have not undergone stand level replacement for centuries, and thus have characteristics typical of old growth forests. Salamanders were found to be distributed in patches and, in some cases are locally abundant in late-seral forests in the Western Hemlock Zone. In virtually all cases where salamanders were located a few very large Douglas fir trees and snags were found in the stand (typically residuals from the previous large-scale disturbance).

Larch Mountain salamanders have been reported at Zig Zag Lake, which is less than one-quarter mile northeast of the watershed boundary in the Canyon Creek Watershed, and in the Copper Creek drainage in the Upper East Fork of the Lewis River Watershed.

Potentially suitable habitat can be found throughout the watershed. There are estimated to be about 1,100 acres of talus in the watershed. Much of this is in large talus fields in the vicinity of Silver Star Mountain and is not well shaded. The edges of these talus fields may be suitable, however, where trees provide shade. Old-growth stands are generally located in the northeast part of the watershed (near Zig Zag Lake) and may contain suitable habitat.

Peregrine falcons are dependant on high sheer cliffs for nest sites and on a plentiful prey base consisting of song birds, especially those associated with riparian areas and waterfowl.

No surveys have been done for this species in the watershed, and there are no known historical eyries. The reported presence of a golden eagle nest on a cliff site in the watershed indicates that the cliff may also be suitable for peregrine falcons. Although the presence of golden eagles would likely preclude nesting by peregrine falcons in the same area, their requirements for nest sites are similar. The most suitable cliffs are located in sub-basin 22.

Townsend's big-eared bat is a sensitive species that requires wooden structures and caves or abandoned mines for roosting sites and hibernacula. There are no known caves in the watershed; however there are old mine tunnels in the Copper Creek drainage that may be suitable for bats. The mines are located on active claims, although there is no mining activity occurring at this time. Any additional development of these mines would obviously make these sites unsuitable for bats, at least temporarily. There have been no reports of this species in the watershed.

Elk and Deer Winter Range

There are about 8,131 acres of biological winter range in the watershed. It is generally located in the lower elevations along the mainstem of the East Fork Lewis River, and along Copper Creek. Winter range on private land in the watershed has not been mapped, but since the majority of the private land is situated below 2,000 feet elevation, it probably functions as winter range as well.

See Figure 24 for a map of winter range in the watershed.

Acres and percent of four cover types on National Forest in Biological Winter Range in the watershed include open forage - 2,765 acres (34%), hiding cover - 2,114 acres (26%), thermal cover - 309 acres (38%), and optimal cover - 163 acres (2%).

The standard in the Forest Plan for winter range states that 44 percent of the area should be in optimal cover. It is not known how much optimal cover existed in the watershed before 1902 but it is assumed that it would have ranged from 45 percent to 70 percent.

The thermal cover stands are single-story conifer stands, and while they provide thermal cover benefit, they lack the snow-holding capacity of a multi-storied stand. In addition to better snow interception, multi-storied stands usually contain more forage that dense single story stands. Multi-storied stands commonly have small openings that produce forage, and contain more arboreal lichen that deer and elk use for winter forage. The large fires in the early 1900's probably converted a lot of mature timber to open forage areas, and now a majority of these areas have regenerated into young close-growing conifer and hardwood stands. This is reflected in the large amount of thermal and hiding cover in the watershed.

Hiding cover is found in close-growing conifer or hardwood stands where the trees are not large enough to provide much thermal cover benefit. These stands are also well-shaded, but produce more forage that the thermal cover stands.

While optimal cover is lacking, thermal cover appears to be well-distributed within the winter range. Two exceptions are the Little Creek and Green Fork sub-basins (sub-basins 4 and 5). A majority of the cover in these sub-basins is hiding cover and open forage.

Biological Winter Range

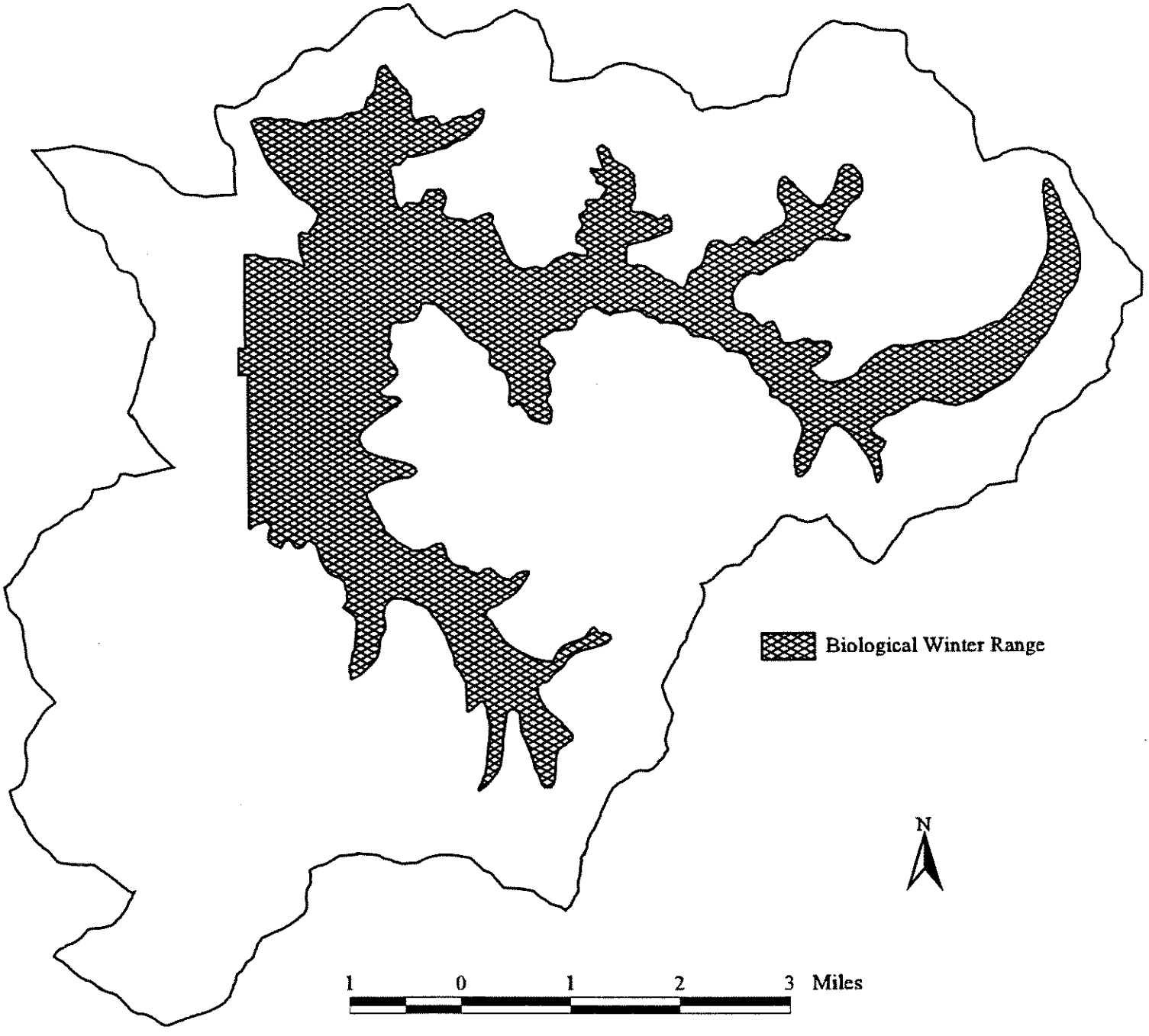


Figure 24 Biological Winter Range Map

Biological winter range in the watershed contains 31.8 miles of open roads, which equates to a road density of about 2.5 miles per square mile. This translates to more than a 50% reduction in habitat effectiveness for elk.

Human Dimension

Social Movements

With the beginning of the arrival of Euro-American settlers in the mid-1800's, the life and landscape of the Upper East Fork of the Lewis River Watershed changed. Settlement of this area in the 1800's resulted in disposal of public lands to private ownership. In the 1890's, the national policy changed from one of disposal to one of reserving public lands. During the progressive period of the early 1900's, there was a great deal of mistrust of the private sector, resulting in the establishment of National Forests. The great depression of the 1930's resulted in the creation of the Civilian Conservation Corps who made major contributions to the landscape of this area by building roads and cabins. Recreation use of the area became important following World War II due to the country's newly found prosperity. The most recent movement is that of environmental awareness that began in the 1970's.

Off-Site Passive Uses

As we look at the six social movements that have contributed to changing the life and landscape of this watershed, we see how important peoples values are as they relate to resources of the watershed.

A study by social scientists at Washington State University, Oregon State University and the University of Washington was conducted to understand and measure these social values concerning the management of the Gifford Pinchot National Forest. They surveyed communities in the Portland area, Vancouver area, rural Washington and visitors to the Forest. They found that individuals from all communities agreed on some values and widely disagreed on others.

In general, those living in rural Washington support commodity-based management (such as timber production) while Portland and Vancouver residents generally support ecosystem-based management (such as protecting the remaining "old-growth", wildlife management, Scenic River designation of the East Fork of the Lewis River and maintaining the Silver Star Roadless area or establishing it as a wilderness). Providing greater protection to fish such as salmon is supported by all communities.

A "multiple benefits" style of management which emphasizes a long-term sustainable balance between human and ecological concerns is strongly supported by all communities of this watershed. Multiple benefits means treating all uses equally rather than continuing the predominant emphasis which has been placed upon timber production in the past.

Conflict still remains about the disposition of the Silver Star Roadless Area even though many thought the wilderness designation issue was resolved with the passage of the Washington Wilderness Act of 1984. Many people believe the undisturbed character of this 7,700 acre unroaded area should be maintained while others feel that such lands should be open to development. Rural communities are most likely to support development of this roadless area. The majority of support is for relatively low levels of development in this roadless area. Many feel that timber harvest would adversely affect the character of the area. Many also feel that timber harvest within a roadless area is not always acceptable just because it can not be seen from a trail or major access road. Many agree that some roadless areas should be preserved for future old-growth. Activists support preserving them as future wilderness areas.

There is overwhelming support to legally designate the East Fork of the Lewis River as a Scenic River to protect the "scenic" characteristics of the river. Many feel logging activities (even from a distance) should not be visible from within wild/scenic corridors.

On-Site Uses

Infrastructure and Settlement

Communities

Mining Communities - During the late 1800's and early 1900's, Copper City and Texas Gulch became established as mining towns. Texas Gulch was located along the East Fork of the Lewis River. Only a few rock foundations remain. Copper City, located in the Copper Creek drainage, had as many as 150 inhabitants in 1890. The lack of mineral development resulted in the demise of these towns.

Timber Communities - According to Melissa Carlson-Price, eighty percent of her county Skamania, lies within the Gifford Pinchot National Forest, 7% in State timberland and 11% is private timberland. For over 100 years timber was the one industry of the county. At one time there were four mills in the county, 31% of wage earners worked in the timber industry and 40 percent of wages were attributed to timber production.

She tells how times have changed with recent changes in management direction on federal lands. These changes created a "real crisis in the community and in families" she

said creating unemployment and uncertainty.

Federal timber revenues which have provided funding for county government services (an average of $4 million annually) will soon be effected because of the drastic reduction in the timber being sold on federal lands.

Road Access

The Upper East Fork of the Lewis River Watershed is accessible primarily by forest roads (See Table 20) and forest trails.

Road access from the town of Yacolt to the Forest Boundary is primarily on County Road 12 to Road 42 which is an east - west link across the watershed to Road 54. Access from Chelatchie is primarily by Road 54 which connects to Road 53 leading to Road 42. Road 41 links County Road 12 to the town of Wind River. Road 43 provides additional access from Wind River to Road 41.

Table 20 Estimated Public Use by Major Roads

Road Section	Season of Use	Traffic Count	No. of Visitors
Road 42	Yearlong to Sunset	28,797	80,600
Road 41	Seasonal	12,893	36,100
Road 4109	Seasonal	1,175	3,300
Road 54	Seasonal	44,170	123,600*

* Not all of the visitors traveling along Road 54 will enter this watershed.

Commercial Uses

Mineral Development

In the late 1890's, copper and gold were discovered near the headwaters of the East Fork of the Lewis River (Moen 1977). Several hundred claims were soon staked with as many as 150 people living in the town of Copper City. The mining districts of Copper City, Copper Canyon, Miners Creek and Bald Knob soon developed. By the turn of the century, copper, gold, silver, lead and zinc had been discovered. Platinum was also discovered with about 1.5 ounces being produced prior to 1903.

The Yacolt Burn in 1902 swept through approximately 290,000 acres and destroyed much of the virgin timber in the area bringing an abrupt halt to many local mining operations. Fires in 1917, 1918, 1919, 1922, 1927, and 1929 destroyed the structures of many mines. Some resumed but at many sites capital was no longer available. Mining activities in this area ceased during the depression of the 1930's.

Around 1930, the existing mining districts were consolidated into the Washougal district. The Washougal Mining District was one of two districts that contained the majority of the metallic mineral occurrences in southwest Washington. Production from these claims was insignificant.

From 1940 to 1960, some sporadic prospecting for copper and gold occurred. Around 1960 several major mining companies undertook geochemical stream-sediment sampling projects. Some copper turned up but subsequent geological investigations proved discouraging. The most favorable area for copper appeared to be near Miners Queen Prospect on Copper Creek. It was not until 1975 that Amoco Minerals Company began an expensive drilling program for low-grade copper deposits in the Copper Creek area.

According to production records published by the U.S. Bureau of Mines from 1903 to 1976, less than $1,000 of placer gold was removed.

In 1995, Assessment work was performed on approximately 139 mining claims (Load and Placer) within this analysis area. Records show that there are approximately 300 mining claims that have had assessment work completed since 1990. Some recreational gold panning occurs in this area.

Filming

At least three commercial filming permits have been issued for this area. In 1990, a filming permit was issued for Walt Disney's production of the "Fugitives" filmed on the north side of Silver Star. In 1993, two commercial filming permits were issued for the Silver Star and Sunset areas. These types of commercial activities are expected to continue in the future.

Grazing

This area was grazed by livestock as early as 1931 and continued off and on until 1964. Old range allotment descriptions indicate that about 2,000 acres in this watershed were dominated by grasses. This included a native "coarse sedge grass" and tame" grasses that became established in the burn areas. A local rancher grazed 40 head of cattle in the Silver Star area in the early 1960's.

Campground Development

The Sunset Campground was built in 1985 at the site of the Sunset Guard Station and CCC Camp. This campground consists of a developed campground with 18 camp units and a developed day-use area. There is a mobile home being used as a caretakers residence. This campground has some potential to be managed by concession.

Developed facilities were constructed years ago at the 4th of July Camp on Road 41.

Hydropower Development

In January of 1981, an Appraisal Report was prepared by the Federal Energy Regulatory Commission of the hydroelectric resources of the Lewis River basin. This appraisal identified one potential conventional site that would affect this watershed (see table 21). As a result, the Lewis Basin Limited Partnership proposed one project located at Horseshoe Falls.

Table 21 Potential Hydroelectric Development

Project Conventional	Stream	Head (Ft)	Installed Capacity	Average Annual Generations
Horseshoe Falls	East Fork Lewis River	440	18.	82.3

Recreation Use

Most people visit the Upper East Fork of the Lewis River Watershed for recreation activities. Camping, mining, rock climbing, picnicking, berry picking, sightseeing, hunting, fishing, backpacking, hiking, horseback riding, boating, rafting, kayaking, mountain bike riding and motorcycle riding are the primary recreational pursuits.

Attractions in the area include Silver Star Roadless Area, Silver Star Special Scenic Interest Area, Zig Zag Moon Lakes Special Wildlife Interest Area, Lookout Mountain Arch, Sunset Recreation Area, and the East Fork Lewis River (proposed by Forest Service as an addition to the National Wild and Scenic Rivers System).

Hunting

This watershed includes the Washougal Game Management Unit #568 and the Siouxon Game Management Unit #572. Hunting for deer and elk has occurred for hundreds of years. Dispersed camping is part of the hunting experience. Hunting camps spring up each year throughout this area during the fall months. They range from structures made of dimensional lumber to pole and viscuine shelters.

Recreation Mining

Some recreation mining occurs mostly in Copper Creek, Miners Creek, Bolin Creek, Snass Creek and the East Fork of the Lewis River. Although some day-use recreation mining occurs, most recreational mining includes dispersed camping.

Driving For Pleasure

Because of outstanding viewing opportunities occurs on the many roads accessing the watershed driving for pleasure is a popular recreation activity. Roads 41 and 42 are examples of roads that provide great views.

Dispersed Recreation

Roaded Recreation - About 73% (998,940 acres) of the Forest provides roaded recreation opportunities (Roaded Natural and Roaded Modified). This watershed analysis area contains about 24,576 acres (83% of NFS land in analysis area) of Roaded Natural and Roaded Modified recreation (See Figure 24).

Unroaded Recreation - About 14 % (193,370 acres) of the Forest will be made available for non-wilderness unroaded recreation. This is important to help alleviate some overcrowding in Wilderness. This watershed analysis area contains about 4,957 acres (17% of NFS land in analysis area) of Semi-Primitive Non-Motorized recreation (See Figure 24). All of the semi-primitive non-motorized area is within the Silver Star, "SD"Special Emphasis "MAC". In 1986, the Gifford Pinchot National Forest Travel Plan designated the Silver Star Area as non-motorized to protect the unique and fragile plant communities from damage and to protect its semi-primitive recreation value. Motorized vehicles are not authorized within this area, but the existence of old roads and fire breaks built prior to this designation are temptations for unauthorized use. These old roads are being blocked and converted to trails (1995 Contract) which should help to reduce this temptation.

Recreation Opportunities Spectrum

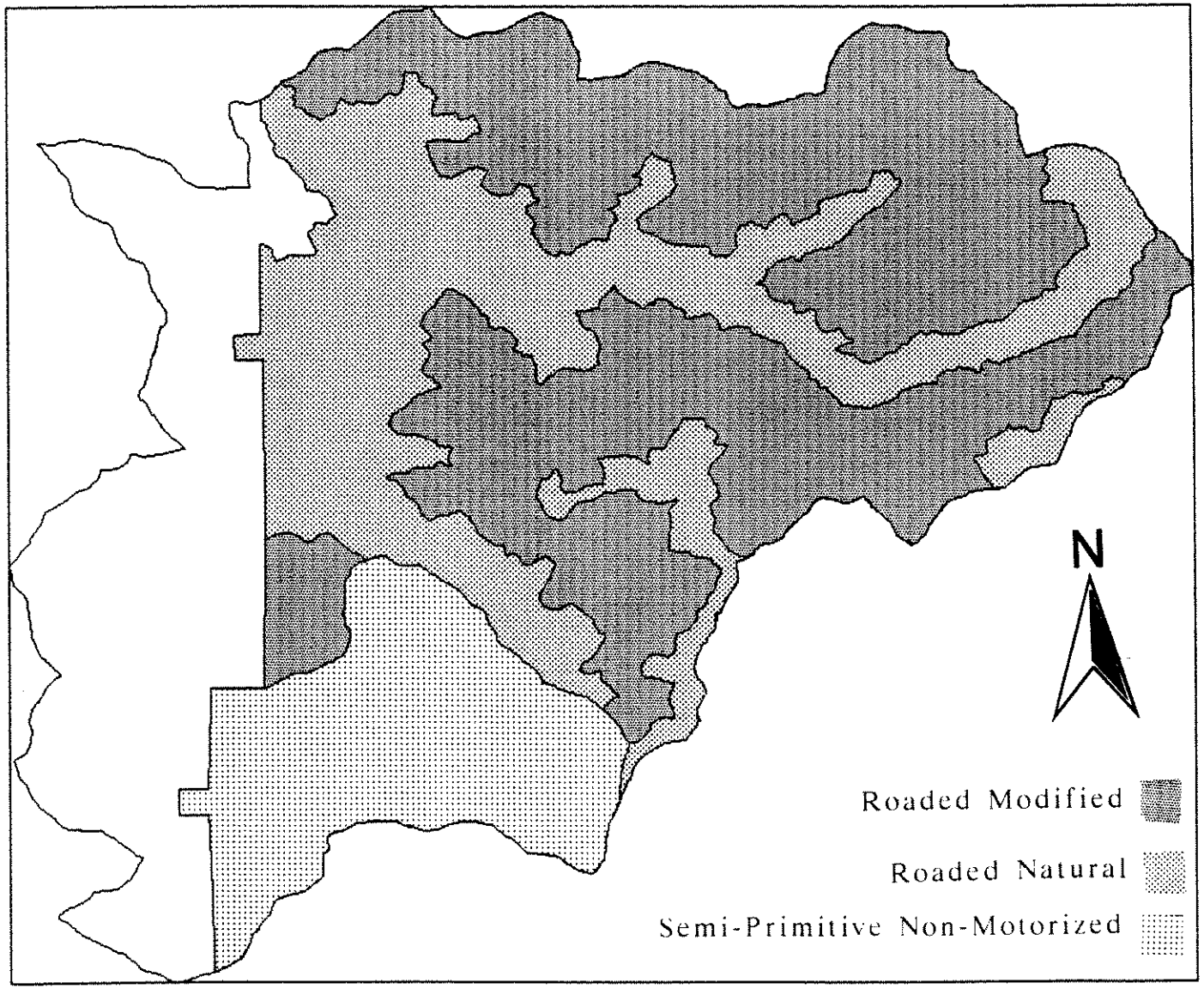


Figure 25 Recreation Opportunity Spectrum

Developed Recreation

Four recreation facilities are located within this analysis area:, one Recreation Area (Campground, Day Use Area and trailhead), two formal trailheads and one developed camp site. These developed recreation facilities and their use are reflected in Table 22. The Sunset Recreation Areas is the second most developed campground in the area. It was constructed in 1985. The Silver Star and Bluff Mtn Trailheads are now under construction as part of the Roads to Trails Project.

Table 22 Developed Recreation Facilities

Recreation Site	Facility Type	# PAOTS	# Visitors
Sunset	Recreation Area	200	18,000
Silver Star	Trailhead	24	3,300
Bluff Mountain	Trailhead	30	1,000
4th of July	Campsite	20	1,000

Trail Development

In 1990, a trail system plan for the Forest was developed in cooperation with various trail user groups including the Forest Trails Task Force. There are 11 trails (27.4 miles) within the Upper East Fork of the Lewis River Watershed (See Figure 25). Each trail is assigned a management level with associated standards and guidelines for management and a permitted use (1990 GPNF Forest Plan). In 1993, the Wind River District Ranger approved a Silver Star Trails Plan that modified items in the Forest Plan. In 1995, there were several roads to trails and restoration projects completed in this area. Table 23 is a listing of trails located within this analysis area.

Off-Road Vehicles (ORV) Trails - There are two trails (6 miles) that provide ORV trail opportunities within this watershed. East Fork # 139 and the Summit Springs # 173 trails are the only assigned ORV trails. There are 18.5 additional miles proposed to extend the Summit Springs Trail and to provide a loop opportunity from the Sunset Campground. All of these trails, existing and proposed, share use of the trails with Equestrians, Hikers and Mountain Bikers. There are no single use ORV trails identified. Off-trail travel by ORV's is generally not permitted, except for over snow machines.

National Scenic Trail - The Chinook Trails Association proposes to establish the Chinook Trail (a loop trail around the Columbia River Gorge National Scenic Area). This trail would connect to the Pacific Crest National Scenic Trail, formerly the Cascade Crest Trail. This proposal

would connect the DNR's Tarbell Trail to the Pacific Crest Trail by means of the Chinook Trail # 180B, Ed's Trail # 180A, Bluff Mtn Trail # 172 and construction of either the Silver Creek Trail # 172A or continuation of the Bluff Mtn Trail # 172. The trailsegments within this "Scenic" area could become part of a Chinook National Scenic Trail.

Table 23 Recreation Trails

Trail Number	Name	Use Type	Manag. Level	Miles Existing
139	East Fork	E	III	3.0
165	Copper Creek	D	III	
170	Green Fork	E		Delete Trail
172	Bluff Mtn.	B	II	6.1
172.1	Bluff Mtn.	D	III	
172.2	Bluff Mtn.	D	Outside	Analysis Area
172A	Silver Creek	B	III	
172B	McKinley	D	III	
173	Ridge	E	III	
173.1	Summit Springs	E	III	3.0
173.2	Summit Springs	E	III	
173.3	Summit Springs	E	Outside	
173.4	Summit Springs	E	Outside	Analysis Area
173A	Summit Springs	E	III	
173B	Sunset	E	III	Analysis Area
174	Brush Creek			
175	Star	B	II	
175B	Starway	D	Delete	Delete trail
180	Star Creek	D	III	3.3
180A	Silver Star	A	III	Proposal
180B	Ed's	D	III	3.6
180C	Chinook	D	III	1.7
180D	Sturgeon	D	III	2.8
180E	S. S. Summit	B	II	1.3
180F	Star VP	D	III	0.4
	Pyramid			0.9
				1.3

A=Hiker only, B=Horse, Hiker, C=Hiker, Mountain Bike, D=Horse, Hiker, Mountain Bike
E=Horse, Hiker, ORV, Mountain Bike

Roads to Trails - During the Access and Travel Management planning (AT) and Roads to Trails (RTT) planning processes, the Pyramid, Sturgeon, Silver Star and Bluff Mtn trails were considered as part of the Silver Star Project. This RTT proposal converted some existing roads to trails. The first three trails (6.2 miles) are to be managed for equestrians, hiker and mountain bikes. The fourth trail (2.3 miles) is to be managed for horse/hiker only.

Table 23 shows the management for the trails in this watershed. The type of use permitted is shown according to present management. Type of use is broken into five categories.

Recreation Resources

Semi-Primitive, Non-Motorized

The analysis area contains about 4,957 acres of Semi-Primitive Non-Motorized recreation that have been given a Special Interest "Scenic" Designation. The area is dominated by a ridge connecting three major peaks, west to east: Silver Star Mountain, 4390 feet above sea level; Little Baldy, 3920 feet; and Bluff Mountain, 3985 feet. Steep slopes and ridges drop off of this central ridge into the Copper Creek Basin to the north, and the Washougal River basin to the South. Ridges and peaks in the area tend to be steep with many rock outcrops, bluffs, talus slopes and waterfalls, making the area outstanding in its geologic and scenic features. There is a unique 20 acre stand of old-growth noble fir that survived previous fires exists in the Rock Creek drainage. The spectacular flowering displays attract hundreds of visitors each year. The fragile plant communities are unique. Cold-water corydalis a sensitive plant species has been documented to exist in this area. Much of this area has seen fire occurrence. The area appears undisturbed from a distance.

A high probability of experiencing isolation from sights and sounds of other humans exists in this area. Opportunities for solitude vary by time and location. The area is more heavily used during the summer and fall. Some portions of the area receive more use than others. Portions of the area are only accessible by cross country travel. This provides for a challenging experience and a greater potential for isolation and solitude.

Recreation Trails

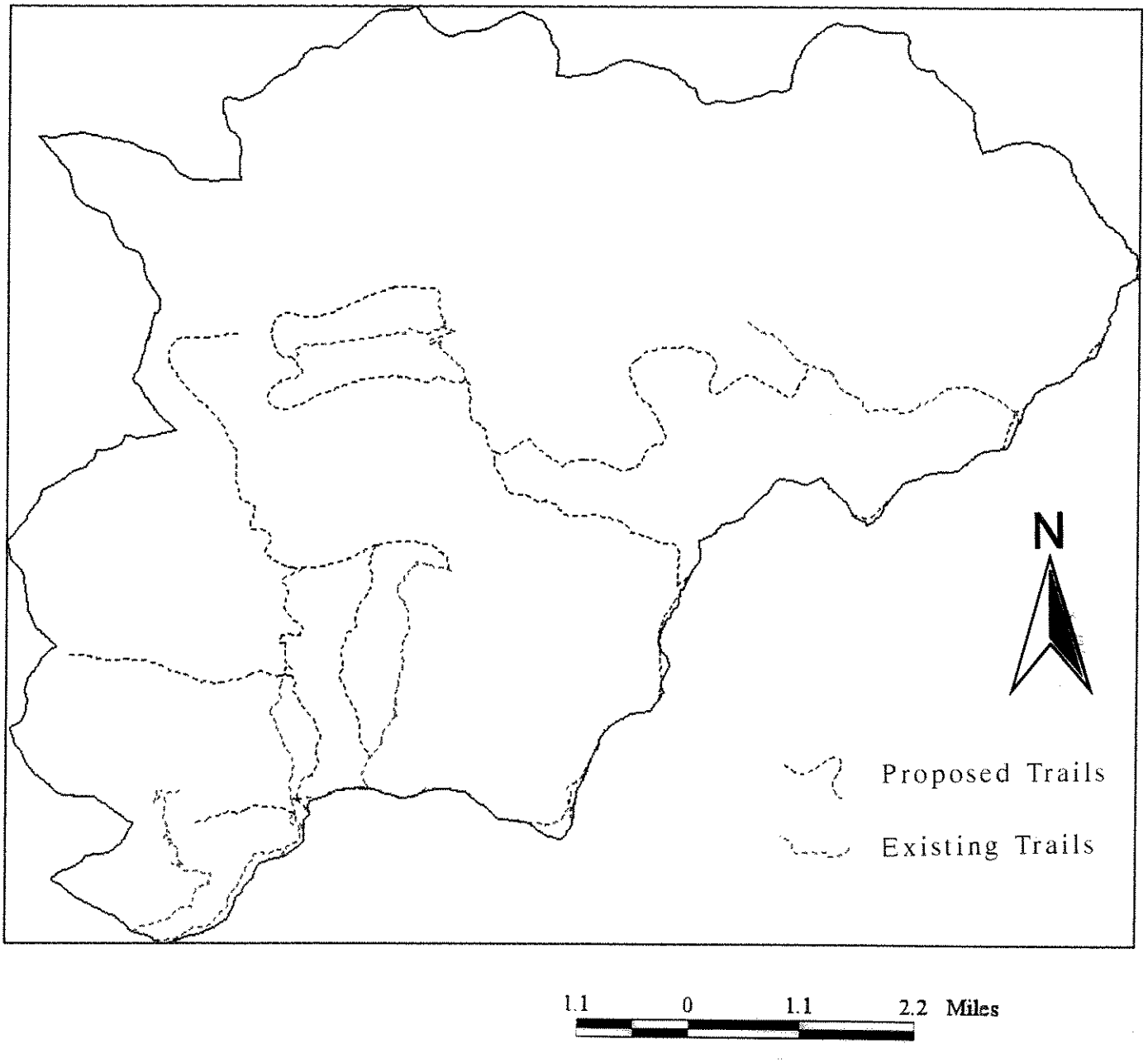


Figure 26 Recreation Trails

The area contains numerous cultural resource sites including Native American camp sites, mining camps and early Forest Service Fire Lookouts.

Roadless Areas

About 7,700 continuous acres of unroaded land, inside and outside this analysis area, were evaluated for potential wilderness eligibility as part of RARE II (Roadless Area Review and Evaluation). Of this, 4,133 acres are located within the Upper East Fork of the Lewis River Watershed Analysis Area (See Figure 27). The conditions are about the same as described above in SPNM since most of the roadless area is within the SPNM area. The roadless area provides opportunities for hiking, hunting, mountain biking, horse riding, cross country skiing, berry and mushroom picking in a semi-primitive, non-motorized setting.

Access has been limited to people with vehicles and experience suited to rough, steep roads and thus excluded others. With the road work just completed on RD 4109, access has been changed to allow access by two wheeled and low clearance vehicles.

The decommissioning of a section of RD 4109, Sturgeon Rock road, Pyramid Rock road and RD 4100502 will increase the size of this roadless area.

Scenic and Recreation Rivers

Location - The East Fork of the Lewis River originates near Cougar Rock approximately 40 miles east of La Center, Washington in SW1/4 Sec. 8, T.4N., R.6E., WM. Total river length is 43.3 miles. The first 10.9 miles cross the Gifford Pinchot National Forest, with the remaining 32.4 miles crossing predominantly private land with some State and County river access. The East Fork empties into the Lewis River four miles upstream from the latter's confluence with the Columbia River.

The entire river was found to be eligible for inclusion in the National Wild and Scenic Rivers System. Three segments were inventoried. Segment 1 extends from SW1/4 Sec. 8, T.4N., R.6E., WM to the Gifford Pinchot National Forest boundary just downstream from Sunset Campground in NE1/4 Sec. 24, T.4N., R.4E., WM, for a length of 10.9 miles. This segment is located entirely on the National Forest. The river corridor (a strip of land located generally within 1/4 mile of the stream, as depicted on the control maps for the Gifford Pinchot LMP) in Segment 1 includes 3,940 acres of NFS land (100% of total).

Roadless Areas

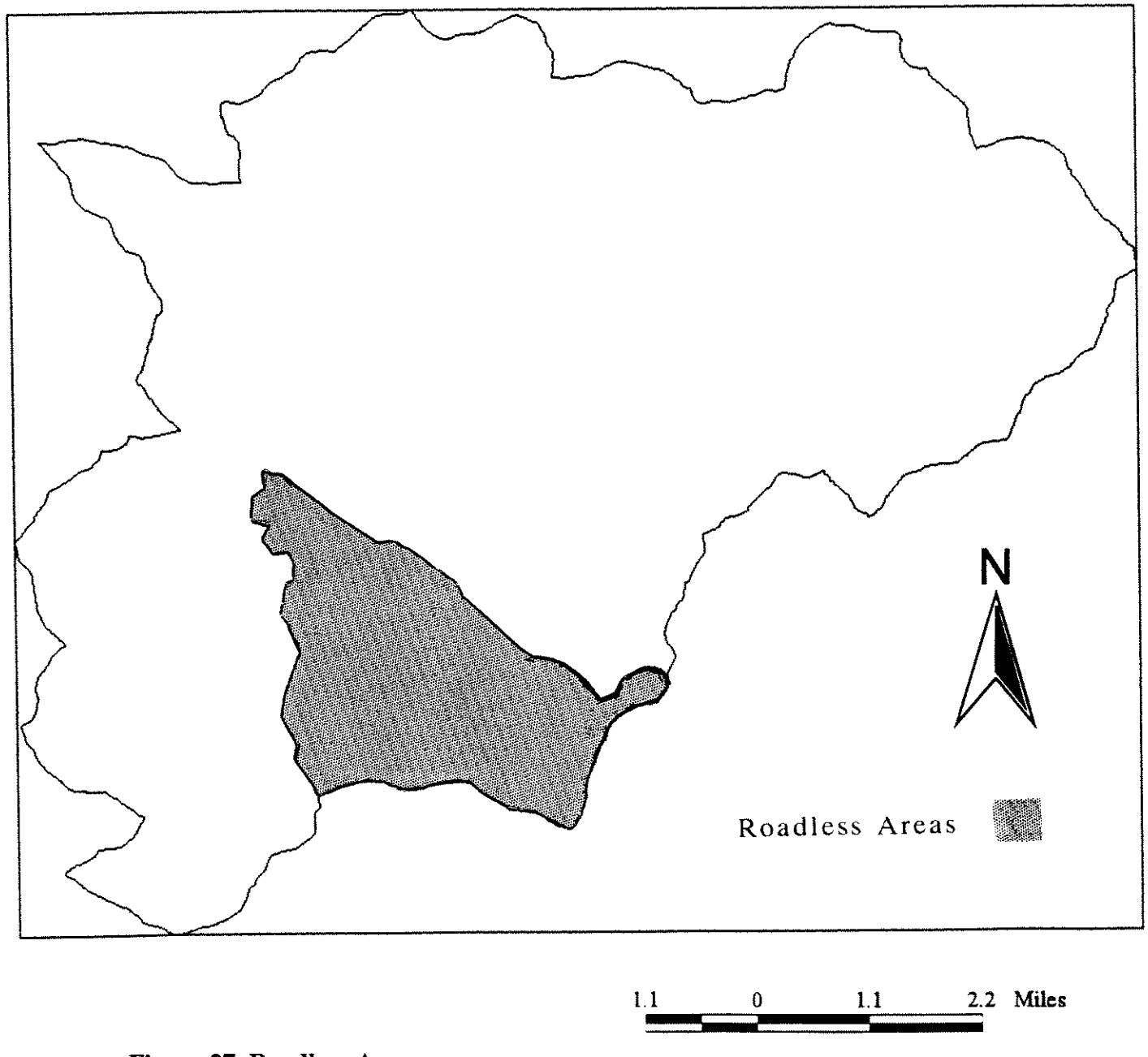


Figure 27 Roadless Areas

Segment 2 extends from the National Forest boundary downstream to the lower boundary of Lewisville County Park in SE1/4, Sec. 22, T.4N., R.2E., WM, a total distance of 15.7 miles. Segment 2 is located primarily on private land, much of which is used for recreation residences. The river corridor for this segment includes 4,928 acres, of which 4,376 acres (89%) is private and 552 acres (11%) is owned by Clark County.

Segment 3 extends from the lower boundary of Lewisville County Park downstream to the confluence with the Lewis River in SW1/4, Sec. 32, T.5N., R.1E., WM, a total distance of 17.0 miles. Like Segment 2, Segment 3 is located primarily on private land, much of which is used for agricultural purposes. The river corridor for this segment includes 5,440 acres, of which 4,993 acres (92%) are private, 50 acres (1%) are owned by Clark County, and 397 acres (7%) owned by the State of Washington.

Inventoried Classification - Segment 1 was determined eligible for scenic river classification because its shoreline is largely undeveloped and in relatively primitive condition despite the presence of roads in the lower half of the segment. Segments 2 and 3 were determined eligible for recreational river classification due to the presence of numerous roads, bridges, campgrounds, residences, and other developments within the corridor in these segments.

Outstandingly Remarkable Values - The East Fork of the Lewis River is perhaps the most popular recreational river in Southwest Washington, with the exception of the Columbia. All segments receive heavy recreation use by residents of local communities and from the nearby Portland/Vancouver metropolitan area. Most boating use takes place on Segments 2 and 3 below the Forest boundary. The presence of waterfalls and relatively low in-stream flows limit the amount of boating use on Segment 1 to occasional spring kayak trips. Sunset Recreation area, located on the north bank of the river just upstream from the Forest boundary, is the only developed recreation site in the river corridor in Segment 1. The Sunset area is a focal point for river-related recreation, primarily fishing, swimming, tubing, recreational gold panning and sightseeing at Sunset Falls. The campground and day-use area receives a combined total of about 20,000 recreation visits each year.

In addition to developed site recreation use, the East Fork receives moderate to heavy use at numerous dispersed campsites along Forest Road 42, which parallels the river upstream from Sunset Campground for six miles. Dispersed-site recreation accounts for an estimated 70,000 RVD each year. River-related recreation activities at the dispersed sites are basically the same as those originating at the Sunset developed area. Other recreation activities taking place within and adjacent to the river corridor include off-road vehicle recreation and hunting.

Big game (primarily elk) hunting occurs within the river corridor. Hunting pressure is moderate. A number of the riverside dispersed sites are utilized as hunting camps in season.

A variety of activities, level of use, and proximity of the recreation resource to the Portland/Vancouver metropolitan area combine to afford outstanding roaded natural experience opportunities in Segment 1.

All segments of the East Fork are known for the outstanding production of native steelhead. Both summer and winter race steelhead are found. The numbers and large size of the fish are noteworthy, especially for a stream this close to the major Portland/Vancouver metropolitan area. Approximately 70 percent of the steelhead caught consist of wild fish, as opposed to hatchery-reared fish. The East Fork is one of only a few rivers in the United States which consistently produce record-breaking winter run steelhead. Because of excellent summer and winter runs, the river offers a year-round sport fishery. Other anadromous and resident fish populations include sea run cutthroat trout, spring and fall chinook salmon, silver salmon, cutthroat and rainbow trout. The Washington Department of Wildlife attributes the excellence of this stream for fisheries production to the high water quality and high quality of the aquatic habitat.

Cultural and Historic Resources

The Upper East Fork Lewis River Watershed contains a variety of resources that have been used by the native populations. The Silver Star Mountain area was most likely used for hunting and berry collecting, as well as for the collection of other plant species. In recent discussions with representatives of the Yakama Indian Nation, the collection of medicinal plants in this area was specifically mentioned (Johnson Meninick, personal communication 1993). It is possible that this area figured prominently at one time in the quest for spirit power, since there are several pit features present. It is possible, however, that these talus pits represent the physical remains of other activities, particularly group hunting blinds (William Yallup and Johnson Meninick, personal communication 1993). Mr. Yallup and Mr. Meninick felt that talus pits located at the very tops of bluffs were likely to have functioned as hunting blinds, where drivers would drive the game up the hills from below. They also felt that talus pits located in saddles were likely to represent blinds used as training places for young hunters.

There are 65 recorded heritage resource sites in this analysis area. The majority are prehistoric sites that appear to span some 7,000 years of prehistory. This area contains some of the highest site density on the Forest. The whole Silver Star area would have been in the "resource catchment area" of a number of "population aggregates" (villages in the late prehistoric period - base camps in earlier times). For more information see the ethnographic overview of this analysis area prepared by Cheryl Mack on file at Monument Headquarters.

CHAPTER IV REFERENCE CONDITIONS

Introduction

This chapter explains how the existing conditions from Chapter III have changed over time as a result of human influence and natural disturbances. The following paragraphs, tables, and figures describe the known or inferred history of the landscape to know what was sustainable in the past and what changes have occurred to affect sustainability.

Geology, Physical Processes, Soils

Volcanic and glacial activity in the upper East Fork of the Lewis River have created the landscape as we see it today. Folding and faulting of this material has also influenced the landscape. Most of the material in the basin is composed of volcaniclastic material which is series of flows composed of andesites and pyroclastic breccias. These flows are dated around 28 million years ago. About 19 to 20 million years ago intrusive material pushed into these flows but cooled prior to reaching the surface. This material called the Silver Star Pluton and other smaller intrusive bodies which is composed of diorites to granodiorites. Along the margins of these plutons mineralization has occurred that is responsible for the creation of the mining district in the early 1900's. Glacial action has carved cirque basins in many of the streams headwaters.

Erosion

The reference conditions prior to human intervention for surface erosion resulted mainly from high intensity fires that burned through the area leaving little to no organic material the protect the mineral soil. During storm events the bare slopes would become susceptible to movement down slope and into streams. The finer sediment (silts and clays) would move through the system fairly rapidly while the coarser sediment would be carried at a slower rate on larger storm events. Management activities over the past century have probably increased erosion from the human caused fires and from the construction of roads.

From the little amount of evidence available, mass wasting has had a minor role in contributing sediment to the aquatic systems. The numerous avalanche tracks off many of the higher peaks and ridges that may have initially scoured the ground as they moved down slope. Most of these tracks removed vegetation in their path but didn't carry much sediment along with them.

Soil Productivity

Prior to management activities, natural processes like fine and mass wasting were responsible for loss of productivity. Fire has been the major contributor to loss of soil productivity in the East Fork by consuming most of the organic material and depleting the nitrogen and other nutrients

from the soil.

Water-Related Features, Hydrologic Processes

Beneficial Uses

Prior to human development (primarily road access) in the Upper East Fork of the Lewis analysis area, beneficial uses consisted of fish spawning, rearing, and adult holding habitat. Vulnerability of these beneficial use areas would have to be considered the same as described in the Current Condition section. A vulnerability change would only be possible if a major event such as glaciation or volcanic eruption occurred of sufficient size to change major stream channel characteristics such as channel gradient.

An examination of historic air photos (1959) revealed the channel conditions in the Upper East Fork Lewis River Watershed approximately 40 years after the major fires in the area. By comparing 1959 aerial photos with others taken in 1979 and 1989, a progression of conditions was interpreted. The following channel related items were noted.

Sediment

- Segment #B006 in the Green Fork had recent sediment deposition in 1959 from unidentified sources upstream. The channels' width in 1959 averaged 63' wide and decreased to 38' wide in 1979. Sediment input appeared to be associated with past fire and flood events.

- Segment #B010 in the East Fork had recent sediment deposition in 1959 from sources upstream. It appeared that a majority of the sediment came from Copper Creek. The channel averaged 69' wide in 1959 and decreased to 50' in 1979. Sediment input appeared to be associated with past fire and flood events.

- Segment #B005 in Slide Creek had some channel widening associated with several pre-1959 debris avalanches scattered throughout the basin. These debris avalanches appeared to be associated with the large fires in the area.

Stream Temperature

In general, stream temperature increases probably coincided with large fires in the basin. Examination of 1959 aerial photos indicated open canopies on all major stream channels and most minor channels. By 1979, these canopies were closing, but still remained fairly open. High maximum stream temperatures were probably associated with these open canopies. The Regional Ecosystems Assessment Project (REAP) suggests historic maximum stream temperatures for the entire Lewis River basin ranged between 14 and 19 degrees Celsius.

Large Wood Debris

Most reaches observed in the 1959 and 1979 air photos lacked large woody debris. The exceptions are noted below.

- Accumulations of large woody debris in the form of debris jams were noted in reaches #B005 (Slide Creek) and #B006 (Green Fork) in 1959. The jams in Slide Creek were associated with bedrock constrictions in the channel. By 1979 portions of the large jam in the Green Fork had moved downstream to form another smaller jam.

- Two small jams were noted in reach #B008 (Copper Creek).

Peak Flow

No large areas of bank erosion were observed in the 1959 photos. Channel widening was noted in reach #B006 in the Green Fork, and it can be assumed that some bank erosion was associated with this widening.

Hydrologic Changes

According to streamflow records from the East Fork Lewis River near Heisson, WA gaging station, major flood events occurred on the East Fork Lewis River in 1931, 1934, 1972, 1978 and 1986. The pre-1972 floods were probably associated with rain-on-snow precipitation events that coincided with major fires. This was probably the primary mechanism for large scale floods in the past. REAP suggests that the historic range of basin disturbance for the entire Lewis River Basin ranged between four and five percent.

Road construction contribution to peak flow increases was not a factor prior to the 1930's, due to the lack of roads in this area.

Vegetation Composition and Structures, TES Plant Species, and C-3 Lichens, Bryophytes and Fungi

Stand Structure and Composition

According to REAP, the Lewis River Basin was historically covered with broad continuous conifer stands of varying age classes. These were characterized by diverse species composition and structure, including older remnant live trees, standing dead trees, and downed logs. Wetlands and other special habitats were scattered across the landscape. The REAP document estimates that in the Lewis River Basin, late-successional vegetation covered between 45 percent and 70 percent, and early to mid-successional vegetation covered between 30 percent and 55 percent of the area.

Because the Upper East Fork of the Lewis River Watershed has apparently experienced more frequent large scale stand replacement fires than other parts of the Lewis River Basin, late-successional habitat may have been nearer to the lower end of the 45 percent to 70 percent range. This would put the historical range of early to mid-successional habitat (grass/forb/seedling, open sappling/pole/small tree, and closed sappling/pole/small tree) closer to the high end of the 30 percent to 55 percent range.

Several factors have contributed to current stand conditions. Because all three of the large fires early in the century were human caused, fire frequency is probably higher than it would have normally been. After the fires, many standing trees were felled and left on the ground. When subsequent fires started, there was an abnormal amount of fuel on the ground. The resulting hot ground fires effectively scarified the soil, reducing soil productivity. When the soil was terraced to stabilize it for planting, soil structure was further altered. Most of the off-site trees that were planted are not growing well, so have not contributed to stand structure development. Finally, single-species stands of Douglas fir have not enhanced species composition. All of these factors have probably reduced stand structure and plant biodiversity within most of the watershed.

Table 24 lists current proportions of different age classes within the watershed. It was not possible to estimate historic age classes because of the lack of snags that survived the fires at the turn of the century. Figure 28 shows current age class distribution.

Table 24 Current proportions of tree age classes in the Upper East Fork Lewis River Watershed.

Age Classes	Present Percentage
1 (0-90 years)	84
2 (91-145 years)	2
3 (146-195 years)	1
4 (over 196 years)	6
Year of Origin Unknown	7

Riparian Areas

Historically, between 50 percent and 85 percent of the stream riparian areas within the Lewis River Basin stream riparian areas were in late successional stands (REAP, 1993). Migration corridors along stream riparian areas for plants and animals were intact because they rarely burned. Currently, about four percent of the Upper East Fork of the Lewis River watershed

Current Age Class Distribution

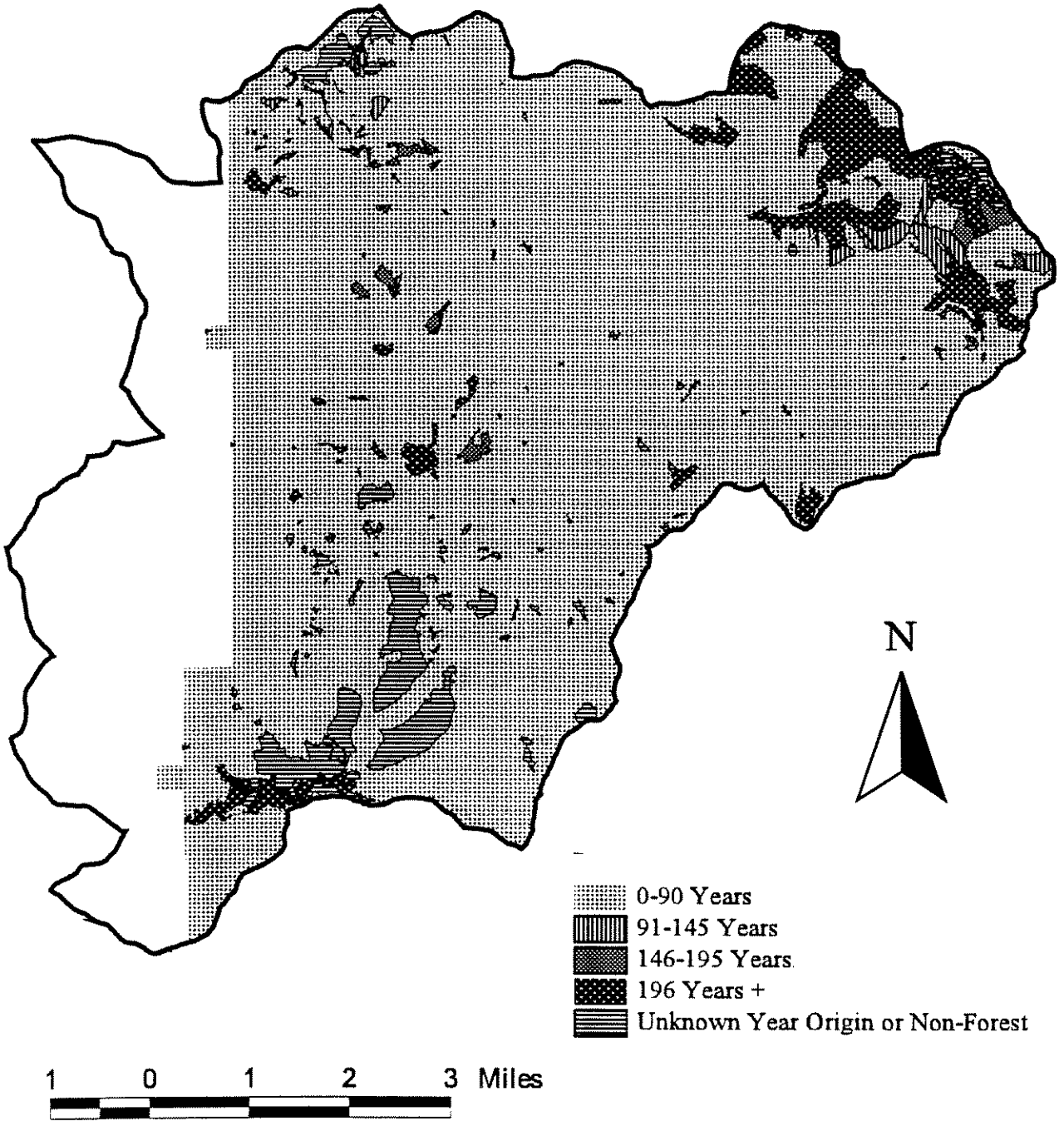


Figure 28 Current Age Class Distribution

stream riparian areas are in single- and multi-layered large tree (late successional) stands.

The REAP document (1993) also estimates between four percent and 12 percent of the Lewis River Basin stream riparian areas were historically in early successional conditions. Currently nine percent of the stream riparian areas are in early successional stages (grass/forb/seedling), and 25 percent are in hardwoods. While this is within the range of historic estimates, the current lack of up slope mature conifers near riparian vegetation has reduced some functions of stream riparian areas.

TES and C-3 Species

Because of the reduction in late successional habitat, and the reduction in structural and biodiversity due to snag removal, reduced soil productivity, off-site stocking, and single-species stocking, habitat for TES and C-3 species is below that of historic ranges.

Special Forest Products

Because of factors mentioned under TES and C-3 species, habitat for special forest products is below that of historic ranges. Consequently, pressure for these products is higher than it would be in watersheds with more habitat. This condition is enhanced by the increased pressure resulting from the areas accessability to large urban centers.

Special Habitats

Special habitats associated with late-successional stands and stream riparian areas are probably lower than historic ranges.

Aquatic Animals and Habitat

Historical aquatic habitat and population information in this basin is poorly documented. Distribution of resident and anadromous fish has been altered by road construction in the Upper East Fork of the Lewis River Watershed.

No reference information is available for the number of pieces of LWD per mile, however, given the management activities that occurred after the fires (snag removal, stream clean-out) we can assume that it was higher.

The range of natural variability for pool frequencies in the Lewis River basin has been estimated to be between 25-60 primary pools per mile (USDA, 1993). Fourteen of the twenty surveyed reaches fall within or exceed this range. This could indicate that the PIG standards are not appropriate for this watershed.

The range of natural variability for stream temperature in the Lewis River basin has been estimated to be between 14 - 19 degrees Celsius (USDA, 1993).

Terrestrial Animals and Habitat, TES Species

The fires in the early part of the century had a huge impact to habitat for wildlife species in the watershed. Photographs taken from various fire lookouts in the mid-1930's shows a landscape almost completely devoid of conifers larger than seedling size. The exception is in the Green Mountain area (sub-basins 6 & 7) where old growth stands persist today. It appears that adjacent portions of the Canyon Creek watershed to the north were also not burned by the Yacolt Burn and subsequent fires.

The photographs also show a high density of charred snags that appear to be small to moderate size (12 to 24 inches DBH). Large snags that would be evidence of old growth stands in the watershed before the fires are not apparent in the photographs. It is possible that the area had burned 100 to 150 years previous to the 1902 Yacolt burn, and that large blocks of old growth habitat have not existed there for 150 years or more.

It is assumed that historically the amount of late-successional habitat in the East Fork of the Lewis Watershed would have fallen within the 45 to 70 percent range (REAP, 1975). Since this watershed is more susceptible to dry east winds in late summer, it is likely that large stand replacement fires have occurred more frequently here than farther north in the main fork of the Lewis River. For this reason, the amount of late-successional habitat in this watershed may have been nearer to the lower end of the 45 to 70 percent range.

Aerial photos taken in 1958 and 1959 show that there was a still high density of standing snags in most of the watershed at that time. It is apparent from the photos, however, that some snags were blown down by east winds sometime after the fires. From these photos, it is apparent that down woody debris was abundant in most watersheds. The logs are light colored in the photos, so they were the result of snags created by the fire, and not logs already on the ground at the time of the fires.

As the watershed has revegetated since the fires, habitat conditions for some guilds of species have improved, while conditions have deteriorated for others. Guilds of species that require open habitat, and are likely to use homogenous patches would have been common in the watershed for the first twenty or thirty years following the fires. These species would be expected to be less common now. In contrast, guilds of species that use pole and small tree structure stages, and use aggregates of different types of habitat are likely to be more common than they were 50 years ago. In addition, species that are dependant on snags for a part of their life cycle would be expected to be less common now than they were 40 years ago.

Human Dimension

The area within the Upper East Fork of the Lewis River Watershed has seen a long history of human use. This area was once intensively used and even managed by Native Americans. The current routes of travel appear generally to be in the same location as the earliest historic routes. In the more distant past, the hunting of large mammals, fishing, and the quarrying of stone for tools were important activities on the Forest. In the more recent past quest of spiritual power and gathering of huckleberries, beargrass, cedar bark and other plant foods and medicines were sought in the area.

The settlement pattern of the native populations in this area involved winter residence in semi-permanent villages situated in sheltered locations along either a major river or tributary, and seasonal camping at root digging grounds, fishing stations, and hunting and berrying locations (Ray, 1939). The seasonal salmon runs along the Columbia and its major tributaries formed the emphasis of their subsistence economy, but people took advantage of a wide variety of plant and animal resources throughout the year.

Historically trails or cross country travel provided the only access into the area. Roads were not constructed until after the turn of the century.

Mining activities were occurring by the late 1800's, with as many as 150 people living in the Copper City area in 1890. There were approximately 200 mining claims by the late 1800's.

Prior to 1900, the entire watershed provided primitive, unroaded (roadless) recreation opportunities. The entire length of the East Fork Lewis River was wild in character.

There were no developed recreation areas during this reference period. Dispersed camping was the norm.

CHAPTER V INTERPRETATION

Introduction

Chapter V compares the existing, historical, and reference conditions of specific ecosystem elements by explaining significant differences, similarities, or trends and their causes. The capability of the system to achieve key management plan objectives is also explored.

The issues, such as surface erosion, soil productivity, beneficial uses of water, etc., are each addressed in turn. The comparisons, explanations, and discussions for each issue are presented in a series of tables and paragraphs to enable the reader to follow the logic of the analysis.

Using the information detailed in the above mentioned tables and paragraphs, the team began integrating this information spatially, i.e. displaying which sub-basins were of concern. This display, see Table 24 Synthesis Table, uses a matrix of rows and columns to show ratings of 27 different factors for each sub-basin. Thus, sub-basins having more than one ecological concern are readily apparent. These compilations of data, information, and interpretations form the basis for recommendations which are explained in Chapter VI.

Dominant Processes

During the analysis of current and reference conditions in the watershed, and the identification of issues and key questions for soil, hydrology, terrestrial vegetation, fisheries, wildlife, and the human component, several processes that shaped the watershed became obvious. These processes were both natural and human induced. The processes that shaped the watershed at the landscape level are described below.

Because of the complexity of ecological systems, the interrelatedness of all ecosystem components, the scale at which the analyses were performed, and the limitations of humans to accurately identify key biotic and abiotic processes that influence an ecosystem, it is unlikely that all processes were necessarily identified. The following list serves as a starting point for future analyses. To minimize redundancy, the tables and paragraphs that follow the processes list will reference these process descriptions.

Fire:

The fires that have burned in this watershed have changed vegetation structure from multi-layered large trees to small trees and grass/forbs/seedlings. This change in vegetative cover has resulted in reduced cover for wildlife species, increased stream temperatures due to lack of stream cover/shading, and a decrease in large woody debris

recruitment potential over the long term. Fires have reduced soil productivity by removing nutrients normally provided by rotting wood, and by scorching and killing soil organisms and altering soil chemistry/morphology.

Fire Prevention:

Snag removal programs from the 1930's to the early 1960's were initiated to minimize the potential for fire ignitions due to lightning and reduce the rate of spread caused by spotting. The felling of snags greatly reduced the available habitat for cavity dwellers and decreased the large woody debris available on and immediate and long term basis for recruitment into streams.

Road construction to access high fire danger areas and to assist in the snag felling operations greatly increased the potential for surface erosion and mass wasting through hillside failure.

Roading:

Roads in this area have extended the stream channel network through roads and ditch lines along roads. These factors may increase peak flows through road cut slope interception of subsurface flow and routing it to surface waters using road ditch lines as "pseudo channels". Some culverts do not allow fish passage resulting in fragmentation of fish habitat. Roads and culverts can not only block upstream migration of resident fish, they can alter the flow pattern of large woody debris through the system and increase sediment input (Furniss et.al. 1991).

Road access to some portions of the watershed has resulted in heavier harvesting pressures on some Special Forest Products. Harvest pressures will increase as more people come to the area.

Commodity Extraction:

Because of fire history, and the lack of large trees, timber harvest has been low in this watershed. Commercial thinning of young stands has been the primary timber harvest type activity in this watershed.

Recently Special Forest Products harvest has increased substantially, leading to the closure of the Silver Star area to harvest. This could increase harvesting pressures on the remnant late-successional stands in other parts of the watershed, particularly sub-basins 6 and 7.

Recreation Activities:

Increased recreation activities, particularly along the road corridors and in the Silver Star area, have elevated pressures on some special forest products. The ease of access, proximity to large urban centers, and increasing numbers of harvesters, combined with the lack of data on population viability and best harvest techniques for most special forest product species, may result in overharvest of some species.

Reforestation:

Early reforestation efforts in this watershed included slope terracing, stocking with trees from off-site seed sources, and planting of large tracts of Douglas fir. These activities, coupled with the reduced soil productivity, have resulted in slower than typical vegetation succession. In some areas trees are stunted and have barely reached the small tree phase, despite their age. Off-site trees are beginning to die, and biodiversity is low in many areas.

ISSUE: Surface Erosion

Components of Issue	Locations	**Current** Conditions Compared to **Reference** Conditions	Dominant **Processes**	Significant **Trends** Or Rates of Change
Roading	sub-basins 9, 13,6,7, & 17. Road 4104 in particular.	Increased roading has increased sediment input to streams	Poor road construction practices Side cast of waste material High use of roads Wet weather use Non-cohesive soils Surfacing types	Increase in erosion
Fire		Decrease in erosion potential from fires due to the fire suppression efforts made over the last 30 to 40 years.	Fire Wind	Decrease from fire due to fire supression techniques.
Volcanic		Volcanic activity in the basin is at a low compared to the referance conditions. Small seismic events may take place with minimal amount of soil movement.		No trend noticable.
Glacial		Glacial activity is also at a low compared to referance conditions. It is one factor in shaping the landscape as we see it today.		No trend noticable.

Components of Issue	Current Management Objectives and Desired Future Conditions	Current Conditions Compared to Management Objectives & Desired Future Conditions
Roading	For each existing or planned road, meet the Aquatic Conservation Strategy. ROD C32 & B11 Minimize sediment delivery to streams from roads. ROD C33	Existing roads need to be evaluated for their capability to introduce sediment into the stream system. New construction should follow the Aquatic Conservation Strategies for road management
Fire	Current management objectives are to suppress fire in the basin which would keep erosion at a low.	

Summary for Surface Erosion: Road construction has had a tendancy to increase sediment into streams over the past century. Most of this increase occurs in the first 3 to 5 years of construction or until an increase in vegetation on the fills and cuts starts to reduce soil movement. The amount of sediment in transport from roading depends on many variables which makes it difficut to quantify the amount of sediment eroding from any portion of the road. These quantified numbers are based on some data in the basin and on interprelation of data from similar roads that have survey data available. These numbers show a low to moderate amount of sediment being tranported from the roads to streams compared to other areas on the forest.

In the past fire has been a major process for soil movement. Fires such as the Yacolt burns of 1902 destroyed much of the organic matter, which left soils susceptible to erosion during subsequent storm events. These fires also volatilized some of the nutrients which in turn slowed the growth of new vegetation. This left the slopes bare for a longer period of time causing more erosion to occur.

ISSUE: Beneficial Uses

Components of Issue	Locations	**Current** Conditions Compared to **Reference** Conditions	Dominant **Processes**	Significant **Trends** Or Rates of Change
Beneficial Use-Sediment	Lower Green Fork (Sub-basin 5) and East Fork Lewis (Sub-basin 1)	All channels observed have either adjusted to pre-1959 sediment input or are in the process of recovering.	Channel morphology-Majority of stream reaches are erosion and transport, so they are not highly sensitive to sediment input.	Channel segments have either fully recovered or are recovering from sediment input.
	Sub-basins 7,9,13	Chronic input of fine sediment now compared to episodic input of fine sediment in the past.	Surface erosion from roads.	Unchanged to slight recovery.
Beneficial Use-Water Temperature	Lower Copper Creek (Sub-basin 12) and East Fork Lewis (Sub-basin 10)	Current range of maximum water temperatures are 18.3-19.5 degrees Celsius compared to a historic range of 14-19 degrees Celsius (USDA, 1993).	Fire	Recovering as canopy closes over Lower Copper Creek and E.Fk. Lewis.
Beneficial Use-Large Woody Debris	Lower Green Fork (Sub-basin 5) and Slide Creek (Sub-basin 2)	The amount of late seral stage within riparian reserves has decreased from approximately 50-80% (USDA, 1993) to 3.5% currently.	Fire and snag felling	Recovering as large conifers return to the riparian reserves.
Beneficial Use-Peak Flow	Lower Copper Creek (Sub-basin 12) and Lower Green Fork (Sub-basin 5)	All channels observed have either adjusted to pre-1959 bank erosion or are in the process of recovering.	Channel morphology-Majority of channel types are not highly susceptible to bank erosion from increased peak flow.	Channel segments have either fully recovered or are recovering from bank erosion.

Components of Issue	Current **Management Objectives** and **Desired Future** Conditions	**Current Conditions Compared to Management Objectives & Desired Future Conditions**
Beneficial Use-Sediment	Existing beneficial uses shall be maintained and protected, and no further degradation which would interfere with or become injurious to existing beneficial uses will be allowed.[1] Turbidity shall not exceed 5 NTU over background turbidity when the background turbidity is 50 NTU or less.[2]	Current condition within management objectives and desired conditions
Beneficial Use-Water Temperature	Existing beneficial uses shall be maintained and protected, and no further degradation which would interfere with or become injurious to existing beneficial uses will be allowed.[3] Temperatures shall not exceed 16.0 degrees Celsius due to human activities.[4]	Current condition within management objectives and desired conditions
Beneficial Use-Large Woody Debris	Existing beneficial uses shall be maintained and protected, and no further degradation which would interfere with or become injurious to existing beneficial uses will be allowed.[5]	Current condition within management objectives and desired conditions

[1]Water Quality Standards for Waters of the State of Washington

[2]Ibid

[3]Ibid

[4]Ibid

[5]Ibid

Components of Issue	Current **Management Objectives** and **Desired Future** Conditions	**Current Conditions Compared to Management Objectives & Desired Future Conditions**
Beneficial Use-Peak Flow	Existing beneficial uses shall be maintained and protected, and no further degradation which would interfere with or become injurious to existing beneficial uses will be allowed.[6] The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.[7] The distribution of land use activities, such as timber harvest or roads, must minimize increases in peak flows.[8]	Current condition within management objectives and desired conditions

[6]Ibid

[7]ROD B11

[8]ROD B9

Summary for Beneficial Uses: Stream segments containing beneficial uses are in some phase of recovery from past fires and floods in the watershed. In general, those segments containing steelhead spawning and rearing habitats are more transport type reaches that are fairly stable. The exception is the lower reach of the Green Fork, which appears to be very sensitive to sediment input, LWD accumulations, and bank erosion. The major threat to beneficial uses in the analysis area appears to be high stream temperature and lack of in-channel LWD due to riparian area recovery that is still very much underway.

ISSUE: Hydrologic Change

Components of Issue	Locations	**Current** Conditions Compared to **Reference** Conditions	Dominant **Processes**	Significant **Trends** Or Rates of Change
Peak Flow Increase - Vegetation Related	Sub-basins 2,7,10,11,12,20,21,22 ,23	96% of the watershed in early successional stands currently compared to 8-12% (USDA, 1993) of the watershed historically.	Fire	Recovering as large conifers return to the sub-basins.
Peak Flow Increase - Road Related	Sub-basins 1,2,10,11,13,17,19	Approximately 694 miles of stream channel currently compared to 572 miles historically.	Road systems have increased the length of stream channels.	Maintain current levels.

Components of Issue	Current **Management Objectives** and **Desired Future** Conditions	**Current Conditions Compared to Management Objectives & Desired Future Conditions**
Peak Flow Increase - Vegetation Related	The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.[1] The distribution of land use activities, such as timber harvest or roads, must minimize increases in peak flows.[2]	Current condition within management objectives.
Peak Flow Increase - Road Related	See Above	Current condition compared to management objectives is unknown due to lack of knowledge as to the amount of increased peak flow, if any, resulting from roading.

[1]ROD B11

[2]ROD B9

Summary for Hydrologic Change: In general, sub-basins within the analysis area are recovering from fires that occurred during the first half of this century. Analysis found that 87% of the sub-basins in the area have increased peak flow due to removal of the mature conifer vegetation component by these fires. Roading has also contributed to the situation by increasing stream lengths in the area by 21%, thus contributing more surface water to streams.

ISSUE: Stand Structure and Composition

Components of Issue	Locations	Current Conditions Compared to Reference Conditions	Dominant Processes	Significant Trends Or Rates of Change
Age Class Proportions and Distribution	All sub-basins	Only 4% of the watershed has late successional stand structure, compared with historic ranges of 45-70%. These stands are concentrated in two sub-basins (6 & 7).	Fire Fire prevention Commodity Extraction	The progression towards historic conditions is proceeding more slowly than typical.
Stand Structure Diversity	All sub-basins	Structural diversity within early seral stands has changed from even-aged stands with pockets of large green trees, snags, and downed wood to stands of dense even-aged trees with little or no remnant forest.	Fire Fire prevention Commodity Extraction	The progression towards historic conditions is proceeding more slowly than typical.
Biodiversity	All sub-basins	Plant, lichen, fungi, and bryophyte biodiversity has decreased as structural and compositional heterogeneity has decreased.	Fire Fire prevention Reforestation	The progression towards historic conditions is proceeding more slowly than typical.

Components of Issue	Current **Management Objectives** and **Desired Future** Conditions	**Current Conditions Compared to Management Objectives & Desired Future Conditions**
Age Class Proportions and Distributions	Restoration and maintenance of environmenal quality are of critical importance.[1] Area closure may be employed to reduce disturbance to sensitive plants and fungi populations. This includes places where unique, uncommon, or vulnerable habitats for plants or fungi are found.[2]	Age class proportions and distributions are below desired future conditions.
Stand Structure Diversity	The sustainability of all the Forest' natural resources, including the species that inhabit them, will be provided for by management.[3] The interrelationship of all components of the natural environment are recognized.[1]	Stand structural diversity is below desired future conditions.
Biodiversity	Plant biodiversity will be considered in planning.[3, 4] "Survey and manage" standard and guideline will provide benefit to vascular plants, lichens, bryophytes, and fungi.[5]	Biodiversity is below desired future conditions.

[1] National Environmental Policy
[2] GPNF Forest Plan, Amendment 11, 2-74
[3] ROD p.5
[4] National Forest Management Act
[5] GPNF Forest Plan, Amendment 11, 2-63

Summary for Stand Structure and Composition: Stand structure and composition in this watershed is considerably outside of the historic ranges of natural conditions. This is the result of a combination of several factors. The fires that burned in the early part of the century have resulted in lowered soil productivity. Early reforestation efforts included the planting of off-site stock, and single-species stands. Because of the lowered soil productivity, and the unsuitability of off-site trees, regeneration is proceeding slower than expected, and plant biodiversity is very low in some areas. Very little (four percent) late-successional

habitat exists in the watershed, and most (88 percent) of the vegetation is in early- to mid-successional stands and hardwoods. Stream riparian areas and adjacent uplands have very little coniferous cover, consequently, many riparian functions are impaired. Because of the fire history, very little timber harvesting has occurred in this watershed.

ISSUE: Riparian Reserve Fragmentation (Terrestrial Vegetation Concerns)

Components of Issue	Locations	**Current** Conditions Compared to **Reference** Conditions	Dominant **Processes**	Significant **Trends** Or Rates of Change
Reduced Structural Diversity	Sub-basins 2, 4, 5, 8, 11, 14, 17 have greater than 45% closed sapling/ pole/small trees.	While stream riparian areas are within historic ranges of early successional stands (4-12%), the high proportions of hardwoods and closed sapling/pole/small trees suggests reduced structural diversity.	Fire Fire prevention Reforestation Commodity Extraction	Succession is proceeding more slowly than typical.
Reduced Conifers in Stream Riparian Areas and Adjacent Uplands	Sub-basins 2, 3, 5 & 6 are high priority. Evaluate 9, 10, 11, 13 & 17.	Large coniferous trees are present in amounts substantially below historic levels.	Fire Fire prevention Reforestation Commodity Extraction	Succession is proceeding more slowly than typical.
Impaired Functional Roles of Stream Riparian Ecosystems	Sub-basins 2, 3, 5 & 6 are high priority. Evaluate 9, 10, 11, 13 & 17.	Because of reduced structural and compositional diversity, some stream riparian ecosystem functions are impaired.	Fire Fire prevention	Succession is proceeding more slowly than typical.

Components of Issue	Current **Management Objectives** and **Desired Future** Conditions	**Current Conditions Compared to Management Objectives & Desired Future Conditions**
Reduced Structural Diversity	Restoration and maintenance of environmental qualitly are of critical importance.[1]	Structural diversity is below desired future conditions.
Reduced Conifers in Stream Riparian Areas and Adjacent Uplands	The sustainability of all the Forests' natural resources, including the species that inhabit them, will be provided for by management.[2]	Stand composition is below desired future conditions
Impaired Functional Roles of Stream Riparian Ecosystems	The interrelationship of all compoenents of the natural environment are recognized.[1] "Survey and manage" standard and guideline will provide benefit to vascular plants, lichens, bryophytes, and fungi.[3]	Ecosystem roles are impaired, are not meeting management objectives, and are below desired future conditions.

[1] National Environmental Policy
[2] ROD p.5
[3] GPNF Forest Plan, Amendment 11, 2-63

Summary for Riparian Reserve Fragmentation (Terrestrial Vegetation Concerns):
Riparian Reserve vegetational composition and strucure, particularly stream riparian ecosystems and their adjacent uplands, are not within the historic range of variability. The coniferous component in stream riparian areas and uplands is lacking, and riparian functions are impaired. Fire history and lowered soil productivity have resulted in slower than typical successional processes. Opportunities exist to enhance stream and upland riparian areas.

ISSUE: TES Plants and C-3 Species

Components of Issue	Locations	**Current** Conditions Compared to **Reference** Conditions	Dominant **Processes**	Significant **Trends** Or Rates of Change
Reduced Habitat	All sub-basins	Late-successional conditions are substantially lower than historic ranges	Fire Fire Prevention Commodities Extraction	Succession is proceeding more slowly than typical.
Lowered Biodiversity	All sub-basins	Late-successional conditions are substantially lower than historic ranges	Fire Fire Prevention Commodities Extraction	Succession is proceeding more slowly than typical.
Population Viability	All sub-basins	Population viability for many TES and C-3 species is unknown	Lack of data	Unknown
Dispersal Capabilities	All sub-basins	Dispersal capabilities for many TES and C-3 species is unknown	Lack of data	Unknown

Components of Issue	Current **Management Objectives** and **Desired Future** Conditions	**Current Conditions Compared to Management Objectives & Desired Future Conditions**
Reduced Habitat	Restoration and maintenance of environmental quality are of critical importance.[1] The interrelationship of all components of the natural environment are recognized.[1]	Current amounts of late-successional habitat are below management objectives and desired future conditions.
Lowered Biodiversity	Plant biodiversity will be considered in planning.[2, 3] "Survey and manage" standard and guideline will provide benefit to vascular plants, lichens, bryophytes, and fungi.[4]	Current amounts of late-successional habitat are below management objectives and desired future conditions.
Population Viability	Sustainability of all the Forests' natural resources, including the species that inhabit them, will be provided for by management.[3] Research activities may be ongoing and proposed in all land allocations.[5]	Data are lacking to ducument population viability.
Dispersal Capabilities	Sustainability of all the Forests' natural resources, including the species that inhabit them, will be provided for by management.[3] Research activities may be ongoing and proposed in all land allocations.[5]	Data are lacking to document dispersal capabilities for some species.

[1] National Environmental Policy Act
[2] National Forest Management Act
[3] ROD, p.5
[4] GPNF Forest Plan, Amendment 11, 2-63
[5] GPNF Forest Plan, Amendment 11, 2-53

Summary for TES Plants and C-3 Species:

Less than five percent of the watershed has been surveyed for TES plants; two plant species have been documented. Although no formal surveys have been conducted for C-3 species, one vascular plant and one aquatic lichen are documented. Since most TES and C-3 species are associated with late-successional habitats, and only four percent of the watershed is in late-successional conditions, these habitats in particular should be inventoried. Late-successional habitats act as refugia for these species, and serve as a source for recolonization as adjacent habitat becomes suitable.

ISSUE: Special Forest Products

Components of Issue	Locations	**Current** Conditions Compared to **Reference** Conditions	Dominant **Processes**	Significant **Trends** Or Rates of Change
Closure of Silver Star Special Botanical Area	Sub-basins 16, 17, 18, 20, 21, 22, 23.	Roading and associated recreation activities have increased pressures in this area. Some remnant late-successional habitat is present. Numbers and distribution of late-successional associated species are probably lower than historical ranges.	Roading Recreation Activities Fire	Harvesting pressures are increasing Succession towards late-successional conditions is proceeding slower than typical.
Population Viability	Sub-basins 5, 6, 7, 12, 16, 18, 20, and 21 have remnant habitat	Because of reduced numbers and distribution, and increasing human pressures, population viability could be impacted.	Fire Reforestation Roading Recreation Activities	Recreation uses are increasing Succession towards late-successional conditions is proceeding slower than typical.

Components of Issue	Current **Management Objectives** and **Desired Future** Conditions	**Current Conditions Compared to Management Objectives & Desired Future Conditions**
Closure of Silver Star Special Botanical Area	Area closure may be employed to reduce disturbance to sensitive plants and fungi populations. This includes places were unique, uncommon, or vulnerable habitats for plants and fungi are found.[1] Restoration and maintenance of environmental quality are of critical importance.[2]	Closure of Silver Star will enhance special forest product habitat.
Population Viability	Sustainability of all the Forests' natural resources, including the species that inhabit them, will be provided for by management.[3] Research activities may be ongoing and proposed in all land allocations.[4]	Because population viability is unknown for many special forest product species, populations could be adversely impacted through over harvest.

[1] GPNF Forest Plan, Amendment 11, 2-74
[2] National Environmental Policy Act
[3] ROD p.5
[4] GPNF Forest Plan, Amendment 11, 2-53

Summary for Special Forest Products:

Many species are being used as Special Forest Products, and many more are likely to be used in the future. Although population viability is unknown for many of these species, some universities have begun studies of viabilty and harvest techniques. The closure of the Silver Star area due to its increased harvest pressure because of its easy access will protect some habitats and species from over harvest. The scarcity of late-successional habitat (four percent of the watershed) increases harvesting suitibility in this area. These areas would be good candidates for special forest product monitoring.

ISSUE: Special Habitats

Components of Issue	Locations	**Current** Conditions Compared to **Reference** Conditions	Dominant **Processes**	Significant **Trends** Or Rates of Change
Silver Star Designated Special Botanical Area	Sub-basins 16, 17, 18, 20, 21, 22, 23.	Human usage has increased as roading and recreation activities have increased. Some late-successional habitat remnants exist in this area, increasing its desirability for special forest product harvest.	Roading Recreation Activities	Human usage is increasing.

Components of Issue	Current **Management Objectives** and **Desired Future** Conditions	**Current Conditions Compared to Management Objectives & Desired Future Conditions**
Silver Star Designated Special Botanical Area	Area closure may be employed to reduce disturbance to sensitive plants and fungi populations. This includes places where unique, uncommon, or vulnerable habitats for plants and fungi are found.[1]	The closure of Silver Star to special forest product harvest will help to protect vulnerable species and habitats. The Silver Star Special Botanical Area is only designated; if approved, further direction to protect the habitat would be provided.

[1] GPNF Forest Plan, Amendment 11, 2-74

Summary for Special Habitats:

Several different special habitats for plants exist in this watershed. Because of the lowered biodiversity within this watershed, these habitats are important and could benefit from monitoring. Special habitats within the Silver Star area would be protected if the designated Special Botanical Area were approved. Special forest products in the remnant late-successional habitats will be protected by the recent closure of Silver Star to harvest.

ISSUE: Key Habitat Attributes for Salmonids

Components of Issue	Locations	**Current** Conditions Compared to **Reference** Conditions	Dominant **Processes**	Significant **Trends** Or Rates of Change
In-Channel Large Woody Debris	Slide Ck. 2, Snass Ck. 11, McKinley Ck. 13, East Fork. 7,8,9, Copper Ck.12,16,17	Below natural levels due to management activities and fire regime	Fire Fire prevent.	Increasing as ROD is implemented and riparian areas continue to mature into a late successional forest
Large Woody Debris Recruitment Potential	Rock Ck. 21, Coyote Ck. 20, Copper Ck. 23, Upper Slide Ck. 3	Likely within the range of natural condition due to the fire regime	Fire Regime	Improving through time
Primary Pools Per Mile	McKinley 13, Upper East Fork 7,8,9	Outside range of natural variability in 4 of 20 reaches surveyed as identified by REAP 1993	Fire Erosion	Maintaining/ Increasing as ROD is implemented and riparian areas continue to mature into a late successional forest
Stream Temperature	Copper Ck. 12, East Fork 10,11	Exceeds State Water Quality	Exposed channels due to fire regimes, and open canopies in riparian areas	Decreasing as canopies develop and mature

Components of Issue	Locations	**Current** Conditions Compared to **Reference** Conditions	Dominant **Processes**	Significant **Trends** Or Rates of Change
Aquatic Habitat Fragmentation	Sub-basins: 1, 2, 10, 11, 13, 17, & 19	Fragmentation has increased due to road building	Road building without fish passage	Increasing as ROD is implemented, and roads are decommissioned, and culverts replaced
		Flow of LWD thru system has decreased	Rd. Maintanance removes LWD at crossings	Maintain/Slight increase
		Flow of sediment has increased due to surface erosion of roads	Road building on native surface roads	Maintain/slight decrease as roads are removed, and others built.

Components of Issue	**Current Management Objectives and Desired Future Conditions**	**Current Conditions Compared to Management Objectives & Desired Future Conditions**
In-Channel Large Woody Debris	> 80 pieces per mile that are > 50' long and 36" DBH[1]	Of the surveyed streams 98 percent are outside the management objectives.
Large Woody Debris Recruitment Potential	Aquatic Conservation Strategy Objectives[2]	Riparian areas not currently supplying amounts and distributions of LWD sufficient to sustain physical complexity and stability.
Primary Pools Per Mile	The number of pools per mile are established by the PIG and relate to the average wetted width of the channel[3]	Of the surveyed streams 58 percent are outside the management objectives.
Stream Temperature	Stream Temperatures shall not exceed 16°C due to human activities[4]	Stream water temperature is possibly outside management objectives for Copper Creek and the mainstem of the East Fork.
Aquatic Habitat Fragmentation	Provide and maintain fish passage at all road crossings of existing and potential fish-bearing[5] New stream crossings on fish-bearing streams should be designed to allow fish passage[6]	Some existing culverts do not provide fish passage, these are not meeting management objectives.

[1]Columbia River Policy Implementation Guide

[2]ROD B-11

[3]Columbia River Policy Implementation Guide

[4]Water Quality Standards for Waters of the State of Washington

[5]ROD S&G's C-33

[6]GPNF Forest Plan

Summary for Key Habitat Attributes for Salmonids: Components of salmonid habitat in the Upper East Fork Lewis River Watershed are affected by the following natural and human induced processes: Fire, Harvest/Management Activities, Road Construction. Each of these processes has influenced the condition of habitat in the watershed.

Large catastrophic fires have resulted in riparian areas that are composed of mature hardwoods, with a very minor component of conifers. This has resulted in a limited supply of large woody debris that is available to the stream channel. Lack of LWD in the channels could be contributing to a lack of pools in the channels as well, which results in a lack of quality habitat for the salmonid species that use this watershed. The high component of hardwoods in the riparian areas however, results in densely closed canopies that protect the smaller channels from changes in stream temperature. Along the larger channels (i.e., mainstem East Fork, Copper Creek) the canopies have not closed and the channels appear to be responding to changes in temperatures as a result of limited shade.

Management of the watershed after the fires also affected the habitat available for salmonids. The salvage of burned/unburned material lead to the construction of roads, and probably included salvage of material along and adjacent to the stream channels, again removing potential sources of LWD. A snag falling campaign that was initiated in the 1960's to protect forest workers and visitors also resulted in a decline of available LWD. Road construction resulted in loss of available habitat when fish were not provided adequate passage facilities through culverts. Roads constructed on native surfaces also deliver additional sediment to the stream channels that can alter in-channel conditions decreasing quality habitat (i.e., filling in pools, silting in spawning beds, etc...).

Overall, the aquatic habitat conditions appear to be in a state of recovery from the large fires of the early 1900's. Pools are forming, and LWD is available in the sections of the watershed that were not burned by these large fires (sub-basins 6 and 7).

ISSUE:Habitat for Threatened, Endangered, and Sensitive Species

Components of Issue	Locations	**Current** Conditions Compared to **Reference** Conditions	Dominant **Processes**	Significant **Trends** Or Rates of Change
Conditions for species requiring late-successional habitat.	Watershed-wide.	Amount of late-successional habitat less than reference conditions. (Approximately 4% compared to 45% - 70% historically). Existing late-successional habitat is more fragmented than historical conditions. Snag density in the watershed is lower than reference. Density of large logs may be similar to reference conditions, however existing logs are well decayed and there are few hard snags and logs to replace them.	Fire, timber harvest, snag falling.	Trend is toward an increase in large tree habitat, and multi-storied habitat through commercial thinning, and forest sucession.
Conditions for species requiring seclusion from human disturbance (low road density).	Watershed-wide.	The road density is higher than reference conditions, and human use of the watershed is significantly higher. Opportunities for seclusion are best south of the 41 Rd.	Road construc-tion for fire prevention and timber harvest.	Under the President's Forest Plan the trend is toward a reduction in road density through watershed restoration projects.
Conditions for species requiring open forested habitat.	Watershed-wide.	Development of dense pole and small tree sized conifer stands after the fires has decreased available habitat.	Forest succession following the fires.	Trend is continued slow reduction in habitat. Commercial thinning to wide spacing may partially offset this loss.

Components of Issue	Locations	**Current** Conditions Compared to **Reference** Conditions	Dominant **Processes**	Significant **Trends** Or Rates of Change
Conditions for aquatic amphibian species.	Riparian Reserves, and the lakes in sub-basin 7.	Introduction of brook trout into the lakes has reduced habitat quality for amphibians. Road crossings in Riparian Reserves have fragmented corridors. Increased shading in Riparian Reserves as a result of succession following the fires has improved condition in these areas.	Introduc-tion of exotic species, and forest succession .	Slow trend to development of more large tree habitat in Riparian Reserves through forest succession. Riparian Reserves will be protected under the ROD.
Conditions for Townsend's big-eared bat.	Mines in Copper Creek drainage.	Mine tunnel development has increased the potential roosting and hibernating sites in the watershed.	Mining activity.	Use of these sites by bats will depend on the suitability of the tunnels, and future mining activity at the sites.
Conditions for Larch Mountain Salamander.	Watershed-wide.	Fires early in the century may have rendered much of the watershed unsuitable. Increased shade resulting from forest succession has improved conditions. Snag falling has resulted in large soft logs that may be habitat. Large talus fields that contain moist microsites due to seeps may have remained suitable regardless if fire effects. These areas could serve as source habitats from where individuals can move to repopulate other sites.	Fire, forest succession and snag falling.	Snag falling has resulted in little recruitment of additional hard logs. Trend is toward development of large trees and more uneven-aged stands through commercial thinning.

Components of Issue	Locations	**Current** Conditions Compared to **Reference** Conditions	Dominant **Processes**	Significant **Trends** Or Rates of Change
Conditions for golden eagle and peregrine falcon.	Nesting habitat in sub-basin 22.	Recreational use in the vicinity of the cliffs (both non-motorized and unauthorized motorized use) has probably reduced the suitability of this area.	Recrea-tional activity.	Population increases in southwest Washington will probably result in an increase in recreational use of this area. Restoration projects may be implemented to reduce motorized use.

Components of Issue	Current Management Objectives and Desired Future Conditions	Current Conditions Compared to Management Objectives & Desired Future Conditions
Conditions for species requiring late-successional habitat.	Landscape areas where little late-successional forest persists should be managed to retain late-successional patches. This standard and guideline will be applied in 5th field watersheds in which federal forest lands are currently comprised of 15% or less late-successional forest.	The 5th field watershed currently contains about 4% late successional habitat.
Conditions for species requiring seclusion from human disturbance.	In Key Watersheds: No new roads will be built in roadless areas. Reduce existing system and non-system road mileage outside roadless areas. If funding is insufficient to implement reductions, there will be no net increase in the amount of roads in Key Watersheds.	Only 4% of the road mileage in the watershed is listed as Level 1 (closed). There are opportunities to decommision additional mileage as part of watershed restoration.
Conditions for aquatic amphibian species.	Standards and guidelines in the Forest Plan prohibit and regulate activities in Riparian Reserves that retard or prevent attainment of Aquatic Conservation Strategy.	Riparian Reserves will be identified in the watershed.
Conditions for golden eagle and peregrine falcon	Survey historic and potential nest sites. Prepare site-specific management plan for nest sites, roost sites, and foraging areas if use occurs. Management activities, and human intrusion should be excluded from March 1 to August 1 if use occurs.	Potential nest sites in the watershed have not been surveyed since implementation of the Forest Plan. It is not known if recreation use is impacting the suitability of cliff sites in the watershed.
Conditions for Larch Mountain salamander	Forest Service policy is to ensure that species listed as "sensitive" do not become listed as threatened or endangered.	Surveys for this species will be conducted in the watershed to determine its presence and distribution. Surveys will be conducted on potentially affected sites before ground-disturbing activities.

Summary for TES Species: Fires in the early part of the century greatly reduced the amount of late-successional habitat in the watershed, and had a significant impact on wildlife species that require this type of habitat. Subsequent effort to suppress fires, including sang falling, and road/fireline construction further affected habitat. The proximity of the watershed to the

Portland/Vancouver metro area has resulted in a high amount to recreational use, affecting habitat for species that require seclusion.

ISSUE: Deer and Elk Winter Range

Components of Issue	Locations	**Current** Conditions Compared to **Reference** Conditions	Dominant **Processes**	Significant **Trends** Or Rates of Change
Optimal Cover.	In biological winter range.	Currently about 2% of the biological winter range is optimal cover. It is assumed that the watershed contained 45% - 70% late-successional habitat (optimal cover) before the fires in the early part of the century.	Fire.	Slow trend toward development of optimal cover through forest succession. Commercial thinning in single-age stands may accelerate development of optimal cover.
Recreation use and other human activity.	In biological winter range.	Current road density is about 2.5 miles per square mile. Mineral development in the Copper Creek drainage introduced roading in winter range in the early 1900's, but the watershed was largely unroaded for the first half of the century. Dispersed camping and hunting at higher levels than reference as a result of improved access.	Road construction for timber harvest, mining, and fire prevention.	Under the President's Forest Plan the trend is to reduce road density through watershed restoration projects.

Components of Issue	Current Management Objectives and Desired Future Conditions	Current Conditions Compared to Management Objectives & Desired Future Conditions
Optimal Cover	Maintain 44% of biological winter range in optimal thermal cover. Optimal and thermal cover blocks should be should be at least 60 acres in size, and dispersed through the winter range.	Currently about 2% of the biological winter range is optimal cover.
Road density	Roads not needed for through traffic or access to an active project or a specific recreation destination should be closed, either permanently or seasonally from December 1 to April 1, to prevent wildlife harassment.	No roads in winter range are closed seasonally or permanently, although indications are that the watershed does not receive significant winter recreation use.

ISSUE: Recreation Use

Components of Issue	Locations	**Current** Conditions Compared to **Reference** Conditions	Dominant **Processes**	Significant **Trends** Or Rates of Change
User Conflict	All Sub-basins.	Recreation use has greatly increased since the turn of the century. New ways to recreate can create conflict.	Road Development Recreation use	Approx. 10% / year Increase
Dispersed Use - Unroaded Rec	Sub-basin #12, 16, 17, 18, 20, 21, 22, 23	Historically, 100% was unroaded. Today only 17% within the Forest is roadless.	Road Development	Increase in unroaded recreation use is expected.
Dispersed Use - Roaded Rec	Sub-basin # 1-11, 13-15, 19	Historically, none of this area was roaded. About 83% within the Forest is roaded recreation today. Dump sites and dispersed campsites are showing up throughout this area.	Road Development	Increase in roaded recreation use is expected. Number of campsites and dump sites will increase.
Dispersed Use - ORV Use	Sub-basin # 9, 10, 11,12 13, 14,	ORV use did not occur prior to the 1900's. Today, two trails (six miles) are designated for ORV use.	Road Development	Increase in ORV use is expected
Dispersed Use - Driving for Pleasure	Ridge tops and Mountain Peaks.	Overlooks and scenic vistas were only accessible by trail. Today some are also accessible by road.	Road Development	Driving for pleasure is expected to increase.

Components of Issue	Locations	**Current** Conditions Compared to **Reference** Conditions	Dominant **Processes**	Significant **Trends** Or Rates of Change
Developed Recreation Use	Sunset Rec Area, 4 th of July Camp, Silver Star and Bluff MT. Trailheads.	No recreation development existed historically. Today the Sunset Recreation Area receives a variety of use. 4 th of July Camp was used historically.	Road Development	Use of developed sites is expected to increase.

Components of Issue	Current Management Objectives and Desired Future Conditions	Current Conditions Compared to Management Objectives & Desired Future Conditions
User Conflict	Allow for the greatest mix of activities to occur without conflict. [1] Social, physical and managerial settings will be monitored to assure that recreation attributes which facilitate the desired opportunity setting are being protected. [2]	In some areas, the mix of activities is such that user conflict develop. In some cases, activities just happen without proper planning.
Dispersed Use - Unroaded Rec	14% of the Forest will provide for non-wilderness unroaded recreation, including Semi-Primitive, Non-Motorize recreation.	Silver Star Area provides SPNM recreation. Some old roads still exist that need to be decommissioned or converted to trails.
Dispersed Use - Roaded Rec	About 73%t of the Forest will provide for roaded recreation (Roaded Natural and Roaded Modified). [2] Management of these lands will emphasize high quality dispersed recreation opportunities in a predominantly natural setting	Roaded Natural and Roaded Modified recreation is provide here. Dispersed camp sites and dump sites may be impacting soils, vegetation and water bodies as a result of over use of unplanned campsites.
Dispersed Use - ORV Use	ORV trails will be constructed in Semi-Primitive Motorized and Roaded Modified areas. [4]	ORV use is light on two trails (six miles). Opportunities exist for additional ORV trails. ORV's are being used in areas designated as closed to motorized use. Some 4x4 vehicles go around road closures.
Dispersed Use - Driving for Pleasure	Overlooks and scenic vistas will be improved or established along roads and managed for scenic values. [2]	Viewpoints exist with outstanding views. Some driving for pleasure in areas closed to motorized use.
Developed Recreation Use	Facilities will be constructed and existing facilities rehabilitated to meet demand. Emphasis will be to improve existing popular campgrounds and to complete vegetative management plans. [3]	The Sunset Recreation Area was constructed in 1985. A vegetation management plan is needed for this facility.

Summary for Recreation Use:

Road construction that provided access to fire lookouts and for timber related activities has changed the character of the watershed. The watershed has moved from one that was totally roadless in 1900 to one that is only 17% roadless today.

The demand for recreational opportunities in this area is increasing each year. Approximately two-thirds of the Vancouver and rural southwest Washington residents visit the Forest several times each year. The rate of increase in recreation use is expected to exceed the Washington State population increase of 18 percent from the year 1990 to the year 2000.

We can expect an increase in the number of illegal dump sites, an increase in dispersed campsites, and an increase in activities such as drug manufacturing, crime and conflicts between user groups. These adverse impacts could degrade the environment and reduce the quality of recreational experiences.

The demand for special forest products will continue to increase and will create a need to develop more regulations for managing these resources.

ISSUE: Semi-Primitive, Non-Motorized Recreation (SPNM)

Components of Issue	Locations	**Current** Conditions Compared to **Reference** Conditions	Dominant **Processes**	Significant **Trends** Or Rates of Change
Number of Roads	Sub-basins # 16, 17,18, 20, 21, 22, 23	All of this analysis area was SPNM at the turn of the century. Only 4,957 acres are SPNM today.	Road construction for timber harvest, mining and fire prevention.	Under the NW Forest Plan the trend is to reduce number of roads through watershed restoration.
Access	Roads that originate from outside the area.	Old roads, trails and fire breaks built prior to roadless designation are temptations for vehicular use that did not occur historically	ORV Use Road Development	ORV use is expected to increase
Visitor contacts	Throughout the area.	Current visitor contacts may exceed historical use but are still below 15 trail encounters between visiting parties each day. Historic group size may have exceeded 20 people.	Recreation use Road Development	Number of contacts each day are expected to increase. Improvements to roads may accelerate use.

Components of Issue	Current Management Objectives and Desired Future Conditions	Current Conditions Compared to Management Objectives & Desired Future Conditions
Number of roads	The existing roads in Silver Star area will be closed and rehabilitated. Road closures on adjacent land may help to provide the physical setting needed for the SPNM experience .[1]	Some roads and fire breaks still exist. However, Roads to Trails conversions are restoring SPNM attributes.
Access	No road or ORV use is permitted. Trail standards may range from very difficult to least difficult. Some trails may be provided for exclusive use of hikers. Trails will be designed to disperse use and to provide scenic views.[2]	Some roads remain, tempting use. Trail standards are Maintenance Level II and III. Only Ed's trail is exclusive to hikers. Trails do tend to disperse use and provide views- more are needed.
Visitor Contacts	Manage area so no more than 15 trail encounters between parties occur each day. Groups should not be larger than 20 persons.[3]	Generally there are less than 15 trail encounters between parties occurring each day. Groups should not be larger than 20 persons.

1. GPNF, Forest Plan, IV-15&16.
2. GPNF, Forest Plan, Amendment 11, Chapter 2, page 44.
3. GPNF, Forest Plan, Amendment 11,, Chapter 2, page 45.

Summary for SPNM: The entire watershed was "Primitive" prior the 1900's until roads were constructed to provide access to the area for fire prevention in the 1930's. The watershed has moved from one that was primitive to one that has only 4,957 acre of SPNM.

The demand for recreational opportunities of all kinds is increasing each year. Old roads, fire breaks and roads that terminate at the boundaries of this SPNM area may tempt off road vehicle users to drive around road closures and access this area by motorized vehicle.

Roads are being decommissioned or converted into trails. This will improve the probability of experiencing isolation from sights and sounds of other humans. Future trails will be designed to disperse use and to provide scenic views. The area will be managed so no more than 15 trail encounters between parties occur each day and groups should not be larger than 20 persons.

ISSUE: Cultural and Historic Resources

Components of Issue	Locations	**Current** Conditions Compared to **Reference** Conditions	Dominant **Processes**	Significant **Trends** Or Rates of Change
Heritage Resource Sites	Known sites exist in all sub-basins except 18 and 19.	Cultural sites were in better condition before 1900. Human activities have impacted many of these sites. Many historic sites were constructed since 1900.	Road development, Rec Development, Timber Harvest, mining activities and erosion.	Potential impact to these sites increases as human activity increases.

Components of Issue	**Current Management Objectives and Desired Future Conditions**	**Current Conditions Compared to Management Objectives & Desired Future Conditions**
Heritage Resource Sites	All heritage resources sites will be evaluated prior to any potential project impact. Monitoring for other impacts, such as erosion and vandalism, will occur. Interpretation of appropriate heritage resource properties will be completed for the benefit of the general public.[1]	Heritage site surveys are conducted prior to any potential impacts. Additional funding for monitoring is needed. Interpretation is also needed.

1. GPNF Forest Plan, Amendment 22, Chapter 2 page 24.

Summary for Cultural and Historic Resources: This area contains some of the highest heritage site density on the Forest. It is thought that this area would have been in the "resource catchment area" of a number of "population aggregates". Nearly all of the known sites were recorded in conjunction with archaeological surveys for specific timber sales, recreation or engineering projects. Consequently, the inventory is skewed toward management activities and does not represent actual prehistoric or historic site distribution and density. These heritage resource sites require protection and appropriate interpretation. Monitoring for impacts to this resource is needed.

ISSUE: Scenic and Recreation Rivers

Components of Issue	Locations	**Current** Conditions Compared to **Reference** Conditions	Dominant **Processes**	Significant **Trends** Or Rates of Change
Scenic Values	Sub-basins 1, 2, 5, 6, 7, 9, 10, 11, 13 road	Historically this river was wild and inaccessible by road. Now the river has both scenic and recreation characteristics. The river is accessible by the Road 42 which parallels it for a ways.	Road development, Rec Development, Timber Harvest.	The scenic values remain constant

Components of Issue	Current Management Objectives and Desired Future Conditions	Current Conditions Compared to Management Objectives & Desired Future Conditions
Scenic Values	Until Congress takes action, values which make this river eligible and suitable for Wild and Scenic Rivers designation will be protected on the Forest.[1]	Current conditions meet management objectives and desired future condition.
	Some structures, farming and evidence of timber harvest may be visible, but the shorelines are largely undeveloped. The river is accessed in some places by road and in some a major travel route parallels the river. A challenging interaction with the natural environment is available.[2]	Some dispersed sites may need to be manipulated to meet Ag. Cons. Strat. objectives.
	Recreation sites may be established in close proximity to the river but should be widely spaced, blend with natural. landscape and be screened from the river.	The Sunset Recreation Area is within this area. A vegetation management plan is needed to assure meeting management objectives.
	ORV use may be permitted on designated trails.	Some trails have been proposed within this area.
	Timber harvest will be consistent with retention visual objectives.	

1. GPNF Forest Plan, IV-19.
2. GPNF Forest Plan, Amendment 22, Chapter 6 page 36.

Summary for Scenic and Recreation Rivers: The East Fork Lewis River was historically a Wild River prior to human entry. Recreation development has occurred along this river. Although they were established in close proximity to the river, recreation sites were widely spaced and blend with the natural landscape. A vegetation management plan is needed to assure that sites are screened from the river.

Horse/hiker/mountain bike/ ORV trails have been proposed within this watershed. A proposal is that they originate from the Sunset Recreation Area.

Until Congress takes action, values which make this river eligible and suitable for Wild and Scenic Rivers designation will be protected on the Forest.

ISSUE: Roadless Areas

Components of Issue	Locations	**Current** Conditions Compared to **Reference** Conditions	Dominant **Processes**	Significant **Trends** Or Rates of Change
Number of roads and Wilderness Potential	Sub-basins 12, 16, 17, 18, 20, 21, 22, 23	All of this analysis area was roadless at the turn of century. Only 4,133 acres are roadless today. Development has and could change the areas future potential for wilderness designation compared to reference conditions.	Road development Timber Activities	With the roads to trails conversions and decommissioning of trails, the size of the roadless area is increasing. The goal would be to become the same area as that of the SPNM area.

Components of Issue	**Current Management Objectives and Desired Future Conditions**	**Current Conditions Compared to Management Objectives & Desired Future Conditions**
Number of roads Wilderness potential	The existing roads in Silver Star area will be closed and rehabilitated. [1] This area, that attracted the most interest from the public, exhibits high levels of roadless/wilderness values and will remain roadless.	Roads and fire brakes still exist, however, Roads to Trail conversions and road decommissioning will restore area attributes and increase size of roadless area. Present management objectives will improve current conditions and move area towards the desired future conditions.

Summary for Roadless Areas:

Only 4,133 acres that are roadless today. Development has and will continue to change the area's potential for wilderness designation. This roadless area received high interest from the public during the Forest planning process. The area exhibits high levels of roadless/wilderness values. Present management objectives will improve current conditions and move the area towards the desired future conditions.

ISSUE: Mineral Development

Components of Issue	Locations	**Current** Conditions Compared to **Reference** Conditions	Dominant **Processes**	Significant **Trends** Or Rates of Change.
Mining activities	Sub-basin 9, 12, 16, 17, 22, 23	Mineral development peaked during the late 1800's. Two mining towns evolved about 1900.	Mining activities and road development	Sporadic since the turn of the century. Number of new claims is expected to decline.

Components of Issue	Current Management Objectives and Desired Future Conditions	Current Conditions Compared to Management Objectives & Desired Future Conditions
Mining activities	Allow for exploration, development and production while monitoring to insure they are conducted in an environmentally sound manner.[1] Lands will be reclaimed for other productive purposes.	Exploration, development and production is allowed. Funding for monitoring of activities is needed. Claims continue so land is not being reclaimed

Summary for Mineral Development:

Mining activities have been sporadic since the turn of century. Without new discovery techniques, improvements and changes to supply / demand, the number of new mining claims are expected to decline. Monitoring is needed to insure mining activities are conducted in an environmentally sound manner.

Synthesis Table

Table 25, Synthesis Table, integrates some of the above information by displaying which sub-basins in the watershed comprise areas of concern. The 23 sub-basins are listed as rows in the table. Each of the sub-basins is rated for 27 factors, shown in the columns in the table. For some factors the degree of concern is rated as high, medium, or low. Other factor concerns are rated as present or absent with an "X" indicating sub-basins with concern. This does not necessarily mean the un-designed sub-basins are trouble free, rather, the concerns were of too low magnitude to be rated.

Readers are urged to read the following definitions of ratings for the 27 factors to understand the information in Table 25. The abbreviated column headings are for reference only.

Column Heading Definitions:

Definitions of Ratings for Table 24, Synthesis Table Columns

1. **Surface Erosion Roads** - Sub-basins with soil types where road construction has the potential for producing sediment from exposed surfaces.

High: Sub-basins where greater than 30 tons/square mile/year comes from roads will be rated as "High". See Geology/Soils specialist report for soil erosion ratings by soil mapping unit.

Medium: Sub-basins that have 15 to 30 tons/square mile/year comes from roads will be rated as "Moderate".

Low: Sub-basins where less than 15 tons/square mile/year comes from roads will be rated as "Low".

2. **Soil Productivity** - Basins that have not been affected by catastrophic fires in this century are blank in the Synthesis Table. Sub-basins with an "X" are those where soil productivity has been affected by fire.

3. **Beneficial Use - Sediment** - Sub-basins that contain a beneficial use whose location is vulnerable to sediment input. Only sub-basins that contain identified steelhead spawning and rearing habitat are shown in the table.

High: Aerial photo measurements showed stream channels widened greater than 25 percent over the past 30 years as a result of sediment input.

Medium: Aerial photo measurements showed stream channels widened between 10 and 25 percent over the past 30 years as a result of sediment input.

Low: Aerial photo measurements showed stream channels widened between 0 and 10 percent over the past 30 years as a result of sediment input.

4. **Beneficial Use - Temperature** - Sub-basins that contain a beneficial use whose location is vulnerable to stream temperature increases. These sub-basins contain stream reaches where monitored stream temperatures exceeded 16 degrees Celsius and also contain identified steelhead spawning and rearing habitat.

5. **Beneficial Use - LWD** - Sub-basins that contain a beneficial use where stream channel characteristics allow the accumulation of Large Woody Debris. Only sub-basins that contain identified steelhead spawning and rearing habitat are shown in the table.

High: Aerial photo analysis showed reaches with relatively high amounts of Large Woody Debris.

Medium: Aerial photo analysis showed reaches with moderate amounts of Large Woody Debris.

Low: Aerial photo analysis showed reaches with relatively low amounts of Large Woody Debris.

6. **Beneficial Use - Peak Flow** -Sub-basins that contain a beneficial use where stream banks are prone to erosion during peak flow events. Only sub-basins that contain identified steelhead spawning and rearing habitat are shown in the table.

High: Aerial photo analysis showed reaches with relatively high amounts of stream bank erosion.

Medium: Aerial photo analysis showed reaches with moderate amounts of stream bank erosion.

Low: Aerial photo analysis showed reaches with relatively low amounts of stream bank erosion.

7. **Peak Flow Changes - Vegetation** - Sub-basins where vegetation changes have caused increased peak flow. Only sub-basins that contain vegetation information are shown.

High: Peak flows have increased greater than 5.0 percent compared to flows from a fully-forested condition.

Medium: Peak flows have increased between 3.0 and 5.0 percent.

Low: Peak flows have increased less than 3.0 percent.

8. **Peak Flow Changes - Roading** - Sub-basins where roading has intercepted otherwise sub-surface flow and routed it to the surface, ultimately increasing peak flows downstream. See discussion in Water-Related Features, Hydrologic Processes in Chapter III.

High: Sub-basins where road ditch lines have increased the effective stream channel lengths by more than 30 percent.

Medium: Sub-basins where road ditch lines have increased the effective stream channel lengths between 10 and 30 percent.

Low: Sub-basins where road ditch lines have increased the effective stream channel lengths by less than 10 percent.

9. **Riparian Reserve Structure Stages**: Sub-basins where Riparian Reserve structure stages deviate significantly from historic levels. Historic ranges were estimated between 30 percent and 55 percent early successional structure stages.

High: >60% in early- to mid-successional structure stages.

Medium: between 50% and 60% in early- to mid-successional structure stages.

10. **Affected Plant Biodiversity**: Sub-basins where vascular plant, lichen, fungi, and bryophyte biodiversity is probably below historic levels due to lowered proportions of late-successional structure stages. Historical ranges of late-successional habitat were between 45% and 70%.

High: Less than 1% late-successional habitat exists.

Medium: Between 1% and 24% late-successional habitat exists.

11. **TES and C-3 Plant and Cryptogam Species**: Sub-basins where TES plants and C-3 species are documented, or where high quality late-successional habitat remains.

High: TES plants documented.

Medium: C-3 plants, lichens, fungi, or bryophytes documented.

Low: Sub-basins with late-successional vegetation.

12. **Special Forest Products -** Sub-basins that are closed to special forest product harvest (Silver Star area), or have have high quality special forest product habitat (late-successional structure stages).

High: Silver Star closure area.

Medium: High quality special forest habitat present.

13. **Pools Per Mile** - Sub-basins where stream surveys have been completed on stream reaches within this sub-basin are marked. Unmarked spaces indicate no surveys have been completed in this sub-basin. Values indicate a condition of Poor, Fair, or Good, ranges (e.g., P-G) indicate that reaches with varying conditions were found in this sub-basin. Criteria for values are described below:

Poor: Streams contain <50 percent of the desired number of pools based on the average wetted width of the surveyed channels.

Fair: Streams contain 50-99 percent of the desired number of pools based on the average wetted width of the surveyed channels.

Good: Streams contain or exceed 100 percent of the desired number of pools based on the average wetted width of the surveyed channels.

14. **Large Woody Debris** -Sub-basins where stream surveys have been completed on stream reaches within this sub-basin are marked. Unmarked spaces indicate no surveys have been completed in this sub-basin. Values indicate a condition of Poor, Fair, or Good, ranges (e.g., P-G) indicate that reaches with varying conditions were found in this sub-basin. Criteria for values are described below:

Poor: Streams contain < 40 pieces of large woody debris that is longer than 50 feet, and > 36" DBH.

Fair: Streams contain 40-79 pieces of large woody debris that is longer than 50 feet, and > 36" DBH.

Good: Streams contain 80 or more pieces of large woody debris that is longer than

50 feet, and > 36" DBH.

15. **Large Woody Debris Recruitment** - Sub-basins where the current recruitment potential for large woody debris falls into one of the following categories:

High: The majority of the sub-basin has riparian areas that are currently able to supply LWD to the aquatic system.

Medium: The majority of the sub-basin has riparian areas that are currently moderately able to supply LWD to the aquatic system.

Low: The majority of the sub-basin has riparian areas that are currently not able to supply LWD to the aquatic system.

16. **Road Densities** - Sub-basins marked have road densities that exceed 3.0 miles per square mile.

17. **Aquatic Habitat Fragmentation** - Sub-basins where road/stream crossings equal or exceed 1.5 road/stream crossings per stream mile.

18. **TES Species** - Sub-basins where there are recorded sightings of Threatened, Endangered, or Sensitive species; or where the best potential habitat for these species is found.

19. **Late Successional Habitat** - Sub-basins that contain remnant significant late-successional habitat. Minimum requirements for significant habitat are: at least 100 acres of large tree multi-storied stands, and these stands must be in patches at least 60 acres in size.

20. **Biological Winter Range** - Sub-basins that contain biological winter range for deer and elk.

21. **Snag Creation** - Sub-basins marked as having potential for snag creation:

High Potential - Sub-basins where at least 25 percent of the conifer stands have an average diameter at breast height (DBH) of 15 inches or more.

Moderate Potential - Sub-basins where between 10 percent and 25 percent of the conifer stands have an average DBH of 15 inches or more.

Low Potential - Sub-basins where less than 10 percent of the conifer stands have an average DBH of 15 inches or more.

Late successional stands in the watershed generally contain abundant snags, and snag

creation should not be done in these stands. This habitat improvement activity should be done in second growth stands where snags are deficient.

22. **Recreation Use** - Sub-basins where recreation use has the potential to adversely affect the natural resources and to create user conflicts.

High - Greater than 100,000 visitors per year.

Medium - 50,000 to 100,000 visitors per year.

Low - Less than 50,000 visitors per year.

23. **Semi-Primitive, Non-Motorized Recreation** - Sub-basins where human activity has the potential to adversely affect the recreation setting (remoteness, naturalness and access).

24. **Cultural and Historic Resources** - Sub-basins where human activity has the potential to adversely affect known cultural and historic sites. It is expected that many additional sites exist but have not been surveyed.

25. **Roadless Areas** - Sub-basins where human activity has the potential to adversely affect the roadless character of Silver Star Roadless Area.

26. **Scenic and Recreational Rivers** - Sub-basins where human activity has the potential to adversely affect the Scenic and Recreational River characteristics of the East Fork Lewis River pending possible addition to the National Wild and Scenic Rivers System.

27. **Mineral Development** - Sub-basins where mineral development has the potential to adversely affect the natural resources and create user conflicts. It is expected that additional sub-basins may have mineral development as new claims rea filed. As these sub-basins are identified, they should be added to this list.

Table 25 Synthesis Table

	Surface Erosion Roads	Soil Productivity for Vegetation	Beneficial Use - Sediment	Beneficial Use - Temperature	Beneficial Use - LWD	Beneficial Use - Peak Flow	Peak Flow Changes - Vegetation	Peak Flow Changes - Roading	Riparian Reserves Structure	Affected Plant Bio-diversity	TES Plants C-3 Species	Special Forest Products	Pools Per Mile	Large Woody Debris	Large Woody Debris Recruitment	Road Densities	Aquatic Habitat Fragmentation	TES Animal Habitat	Remnant Late-Succession Habitat	Elk and Deer Winter Range Habitat	Snag Creation	Recreational Use	Semi-Primitive Non Motorized Rec.	Cultural and Historic Resources	Roadless Areas	Scenic Recreation River	Mineral Development
1.Anaconda	M	X				M	H	H	H					M	X	X			X	L	M		X	X		X	
2.Slide	M	X	M	H		H	H	H	H			P	P	M	X	X			X	M	L		X	X	X		
3.Middle Slide	L	X				M	M	H	H	M		P	P	L					X	L	L		X	X			
4.Little	M	X	L	L	L	M	M	H	H					M					X	L	L		X	X	X		
5.West Green	L	X	L-M		M	L-M	M	H	M	L	M			M					X	L	M		X	X	X		
6.Upper Green Fk.	M						L	H	M	L	M			H			X	X	X	H	M		X	X			
7.Upper East Fk.	H						H	M	M	H	M	P	P-G	H			X	X		H	M		X	X	X		
8.Upper EF West	M	X						H	H			F	P	M					X	L	L		X	X	X		
9.Upper EF East	H	X	L	M	L-M		M	H	H			G	P	M					X	L	L		X	X	X	X	
10.Middle E. Fork	M	X	L-M	X	L		H	M	H	H		P-G	P	M		X			X	L	M		X	X			
11.Snass	M	X					H	H	H			P	P	M		X			X	H	L		X	X			
12.Lower Copper	L	X	M	X			M	H	H		M	G	P	H			X		X	L	L		X	X		X	
13.McKinley	H	X					M	H	H	H		P	P	M		X			X	L	L		X	X			
14.Upper EF Trib.	M	X					M	L	H	H	H			M					X	L	M		X	X			
15.Poison Gulch	L	X					M	L	H	H				M					X	L	L		X	X			
16.Summit	M	X					M	M		H	H								X	L	L		X	X	X	X	
17.Bolin	M	X		X			M	H	H	M	H	G	P	M		X	X		X	L	L		X	X		X	
18.King	L	X					M	M	H	M	L	H		M					X	L	L		X	X	X		
19.West King	M	X						H						M		X	X			L	L		X	X			
20.N/S Coyote	L	X					H	M	H	M	H	H		L					X	L	L		X	X			
21.Rock	L	X					H	M	H	M	L	H					X	X	X	L	L		X	X		X	
22.Star	L	X					H	L		M	L	H		H			X		X	L	L		X	X	X	X	
23.U/Mid Copper	L	X					H	L	M	H	L	H	P	M						L	L		X	X	X		X

Anticipated Social or Demographic Changes or Trends

The trends in social use and values associated with this watershed reflect the public's diverse response to national policies and local interests. People will continue to seek necessities of life (food and shelter) and will also look to this area for spiritual and emotional well-being.

The demand for year-round recreational opportunities is primarily on weekends and holidays. Approximately two-thirds of the Vancouver and rural southwest Washington residents visit the Forest several times each year. Developed sites are full during peak seasons of use and the overflow moves out to dispersed recreation sites (Porter, December 1993).

Sightseeing, picnicking, camping, hiking, nature study, hunting, fishing and winter sports are the most popular recreation activities for the Forest in order of participation. The demand for recreation activities from 1990 to 2000 is expected to exceed the Washington State population increase of 18 percent. Forecasted increases in activity demand are highest for Nature study, hiking, mountain biking, photography and four-wheel-drive riding (Porter, December 1993).

It is expected that during the next decade the Forest can expect increased use primarily by middle-aged and older users with advanced education and higher disposable incomes, who will be looking for a greater variety of activities (Porter, December 1993).

We can expect an increase in the number of illegal dump sites and activities such as drug manufacturing, crime and conflicts between user groups. These adverse impacts could degrade the environment and decrease the quality of recreational experiences.

The demand for Special Forest Products will continue to increase and will create a need to develop more regulations to manage these resources.

Attracted by the quality of life compared to other parts of the nation, people will be drawn to Southwest Washington in greater numbers. With these population increases, the demand for housing is expected to increase. The need for a sustainable flow of wood products from the National Forests will become even more acute.

Basin Linkages

The ID Team took the information developed during integration on pieces of the watershed and included an analysis of linkages of those pieces. This step was an attempt to understand the different flows and linkages and what ramifications those connections might have on management objectives. The resulting efforts were grouped into Water Flows, Animal Flows, and People Flows across the landscape.

In order to keep the objectives focused, the group used the following questions to help keep the

objectives clear:

-Which sub-basins are connected?
-What is connecting these sub-basins?
-What is the importance of this connection?
-What can we do (and where)?

WATER FLOWS

Sediment Routing

Which sub-basins are connected?

1) Roads providing moderate levels of surface erosion were identified in sub-basin 6. This sediment is easily transported to sub-basin 5 (Green Fork) which contains beneficial uses (steelhead spawning and rearing) located in stream reaches that are vulnerable to sediment input.

2) Sub-basin 17 has high road densities that provide a sediment source from surface erosion, to sub-basin 12 (Copper Creek) which contains beneficial uses (steelhead spawning and rearing) located in stream reaches that are vulnerable to sediment input.

What is the importance of this connection?

Fine sediment is mobilized from road surfaces by water and transported downstream where it is deposited in lower gradient response reaches. This sediment can degrade steelhead spawning and rearing habitats by filling in spawning gravel and other important habitat such as pools.

What can we do (and where)?

Restoration such as road decommissioning, road weatherization, and erosion control/slope stabilization projects can be implemented in an effort to reduce sediment. These projects can be done in sub-basins 6 and 7. See Chapter VI for additional discussion of these activities.

Large Woody Debris

Connected basins

Riparian reserve areas in sub-basins 2 and 3 could provide sources of LWD to a

beneficial use reach, if the stands contained large conifers.

Riparian reserve areas currently containing large conifers in sub-basin 6 provide sources of LWD to a beneficial use reach in the Green Fork (sub-basin 5) near its confluence with the East Fork.

Importance of connection

Large woody debris enters the aquatic system through a variety of processes (direct entry from side slopes, transport from upstream sources, and landslides). Due to geomorphic conditions certain reaches (response) are better able to temporarily store and use available LWD (lower gradient, meandering channels etc.). When LWD is available to these reaches it stays in place for longer periods of time, creating higher quality habitat for salmonids. Activities in the riparian areas and up slope areas affect the quantity and distribution of LWD in the stream channel.

Recommendations

Placement of in-channel LWD can immediately increase the quantity of LWD that is available to the channel. Manipulation of species composition and structure of the riparian areas can also increase the rate at which LWD becomes available to channels. See Stream Enhancement and Riparian Treatment recommendations in chapter VI for descriptions of appropriate activities.

Stream Temperature

Connected basins

Lack of canopy cover over stream channels can influence stream temperatures. Canopy areas in sub-basins 1, 10, 11, 12, and 17 expose more than 50 percent of the East Fork and Copper Creek stream channels. This could be influencing stream temperatures (downstream) in sub-basins 1 and 2.

Importance of connection

Canopy cover can be an important determinant in stream temperatures. The large fires that occurred across this watershed burned many riparian areas. The recovering riparian areas have not reached a successional stage where large tree canopies are developed. Stream temperatures affect the productivity of stream channels and the growth and survival of many aquatic organisms. Activities in the upstream sub-basins will influence the downstream conditions as the water flows downstream through other sub-basins.

Recommendations

Manipulation of the species composition and structure within riparian areas can improve the canopies ability to provide shade to the stream channels, thereby reducing stream temperatures. See the Riparian Treatment recommendations in chapter VI for descriptions of appropriate activities.

ANIMAL FLOWS

Habitat Effectiveness - Interior Habitat/Roads

Which sub-basins are connected?

Sub-basins 8, 14, and 15 may serve as a linkage between the eastern portion of the watershed and the roadless area in the southern part of the watershed. These sub-basins have a low road density, or have roads that are primarily on the edge of the sub-basin leaving the majority of the sub-basin unroaded. The saddle across McKinley Ridge between Poison Gulch and Miner's Creek may be an important connection in this linkage, and it is important to maintain cover in this area.

These sub-basins are also adjacent to a large unroaded are to the south that forms the headwaters of the Washougal River. It is likely that wildlife species would move through these sub-basins to access the Washougal watershed.

What is the importance of this connection?

Most wildlife species will avoid the disturbance created by motor vehicle traffic, and as a result, habitat near open roads is often used less than habitat in unroaded areas. It is desirable to maintain areas that have low road densities within a watershed to facilitate movement of wildlife species that have large home ranges.

What can we do (and where)?

Discourage additional road building in these sub-basins.

PEOPLE FLOWS

Recreation Setting Effectiveness - SPNM/Road Access

Which sub-basins are connected?

Roads providing access to a semi-primitive, non-motorized recreation area can influence the experience of isolation and solitude. Sub-basins 12, 16, 17 18, 19 20, 21, 22 and 23 provide access to the Silver Star Special Interest Area that is semi-primitive and non-motorized.

What is the importance of this connection?

The recreation experience of isolation from sights and sounds of other humans is an important aspect of semi-primitive, non-motorized recreation. Roaded access to sub-basins that contain SPNM recreation can affect the quality of the desired recreation experience (remoteness, naturalness and access). The maintenance level of these roads could also affect the amount and type of use these roads receive. Access to SPNM areas should be limited to people with vehicles suited to rough and steep roads.

What can we do (and where)?

Converting roads-to-trails will restore SPNM recreation to sub-basins 17, 18, 20, 21, 22 and 23. Maintenance levels for roads that provide access to the boundaries of SPNM areas could be reduced to levels that discourage low clearance vehicle use in sub-basins 12, 16, 17, 18, 19, 20, 21, 22 and 23.

CHAPTER VI RECOMMENDATIONS

Introduction

From the information gathered, interpreted and displayed in previous chapters, the ID team identified those management activities that could move the system toward reference conditions or management objectives, as appropriate.

The management activities are sorted into three categories:

Restoration Activities
Monitoring Activities and
Commodities and Development

For each of the 23 recommended activities, an explanation of the rationale for the recommendation is presented. This is displayed under four sub-headings for each recommendation in turn, as follows:

A. What is it? Specific description of the recommended activity.

B. Ecosystem conditions and/or functions that would be altered, maintained, or restored.

C. Appropriate timing, sequencing, and general location. Show priorities for sub-basins.

D. The anticipated rates and time lines for achieving the management objectives.

The locations of recommended activities (by sub-basin) are shown in Table 26 - Recommendations by Sub-basins. Table 26 shows the full array of recommended activities where readers may see which sub-basins contain more than one recommendation.

Restoration Activity

ROAD DECOMMISSIONING

A. What is it?

Road decommissioning is the action of removing a road from the transportation system and returning to a stable configuration to revegetate and recover. This action includes but is not limited to culvert removal, construction of water bars and cross-drains to control surface water runoff (such as where ephemeral draws cross the roadway), fill slope removal in areas of unstable road fill, and subsoiling or ripping of the road running surface in areas of soil compaction. Subsoilers are large shanks attached to a tool bar mounted to the rear of a crawler tractor.

Following equipment operations, all exposed soil is seeded and fertilized. Annual grasses such as cereal rye are utilized to provide quick cover while not adversely affecting the re-establishment of native vegetation (native species are preferred and if available will be used). Conifers may also be planted on these sites. Native species are preferred for re-establishment of vegetation. Finally, a closure berm is constructed to prevent vehicular access to the treated area.

B. Ecosystem Conditions and/or functions that would be altered, maintained or restored?

The purpose of decommissioning roads is to reduce habitat fragmentation in uplands and Riparian Reserves, erosion rates from roads, mass wasting hazards, and peak flows. It will also improve habitat quality for wildlife species that are sensitive to human activity and provide quality hunting, fishing, and recreation areas.

C. Appropriate timing, sequencing, and general location. Show priorities for sub-basins.

Upper Green Snass McKinley Bolin Upper Green = 4200511 Snass = ? McKinley = 4104 504 4104 503 Bolin = ?

Sub-basins that are a priority for this treatment include 6, 11, 13, and 17.

Among restoration recommendations for the watershed, this is given a high priority.

D. The anticipated rates and time frames for achieving the management objectives.

Benefits derived from reducing aquatic fragmentation begin immediately after project implementation. It takes 20 or more years to realize the benefits related to reducing upland habitat fragmentation. One immediate benefit is reduced sedimentation. The benefits relating to reduced surface erosion and reduced peak flows are realized within five years as vegetation is established on exposed soil. The time line for achieving these benefits is dependent on funding available later.

Restoration Activity

ROAD WEATHERIZATION

A. What is it?

Road weatherization involves stabilizing a road that is not currently needed for transportation, but will be needed in the future (10-20 years from the present). This involves putting the road in a stable configuration that will not create resource damage while requiring a minimum of road maintenance. This action includes but is not limited to construction of water bars and cross-drains to control surface water runoff (such as where ephemeral draws cross the roadway), fill slope removal in areas of unstable road fill, and to a lesser extent, culvert removal and to subsoiling or ripping of the road running surface in areas of soil compaction.

Following equipment operations, exposed soil is seeded and fertilized. Annual grasses such as cereal rye are utilized to provide quick cover while not adversely affecting the re-establishment of native vegetation. Finally, a closure berm is constructed to prevent vehicular access to the treated area.

B. Ecosystem Conditions and/or functions that would be altered, maintained or restored?

Weatherizing roads reduces surface erosion rates from roads, including the cut banks and fill slopes. It also reduces the amount of surface water flow, helping to reduce peak flows in the watershed.

C. Appropriate timing, sequencing, and general location. Show priorities for sub-basins.

Sub-basins where this treatment is a priority are those primarily in Matrix, which have a high road density, and where surface erosion is a concern, but where roads are needed for future timber sales or for fire control purposes.

Isolated roads or individual that are are a priority for this treatment are located in sub-basins: 6, 7, 9, and 13.

Among restoration recommendations for the watershed this is given a low priority. Isolated opportunities exist for this type of activity in this watershed.

D. The anticipated rates and time frames for achieving the management objectives.

Benefits relating to decreased surface erosion and mass wasting will take up to five years as vegetation establishes on exposed soil. Some immediate benefits will be derived relating to peak flow decreases by allowing moisture to infiltrate the soil profile in ripped areas, routing flow away from road ditch lines. Another immediate benefit is reduced sediment that results from vehicle use on these roads. The time line for achieving these benefits is dependent on availability of restoration funding.

Restoration Activity

SILVICULTURAL TREATMENTS TO ACCELERATE DEVELOPMENT OF UPLAND SAPLING/POLE & SMALL TREE STANDS

A. What is it?

Precommercial thinning: Chain saws are used to fell trees in closed sapling/pole stands (less than 8 inches D.B.H.). Lacking a market, felled trees are left in place where they fall. Minor species in the stand are favored as leave trees to promote species and structural diversity. Leave trees are irregularly spaced to promote structural diversity.

Commercial thinning occurs in stands of closed small tree stands, generally about 8 inches to 15 inches D.B.H.. Felled trees are bucked and yarded to a landing and are hauled to markets by truck.

Fertilization: Helicopters are used to spread nitrogen fertilizer in urea form over young managed stands which have been previously thinned. Application is done in the spring or fall when temperatures are relatively cool but not during heavy rains.

Interplanting and planting: Tree and shrub seedlings are hand planted in areas where vegetation or species diversity is lacking.

B. Ecosystem Conditions and/or functions that would be altered, maintained or restored?

Upland silvicultural treatments accelerate development of large diameter trees and species and structural diversity in stands. The result is quicker development of stand characteristics towards mid and late successional size and structure.

Thinning (precommercial and commercial) results in fewer trees using limited resources (nutrients, moisture, light). Residual trees respond with accelerated diameter growth. Variations in tree species, genetic traits, and microsites, along with some gradual inseeding of new trees, result in variable height growth of trees and gradual development of different canopy levels. The diverse stands which develop provide quality habitat for many wildlife species and provide root strength and snow interception for watershed protection.

Fertilization results in a temporary increase in available nitrogen (approximately 10 years duration). Trees respond with accelerated height and diameter growth. Variable responses among trees result in enhanced development of different canopy levels. The resulting structural diversity provides quality wildlife habitat and root strength and snow interception for reduced peak flows and watershed protection.

Interplanting and planting results in establishment of diverse vegetation on exposed sites. This initiates or enhances development of quality wildlife habitat and reduces erosion and peak flows.

C. Appropriate timing, sequencing, and general location. Show priorities for sub-basins.

Upland silvicultural treatments are conducted spring through fall when areas can be accessed.

These treatments are recommended

(a) in sub-basins with greater than 35 percent of stands in closed sapling/pole or closed small tree stand structures, and

(b) in sub-basins where vegetation removal has increased peak flow more than 5 percent.

Sub-basins identified as priority for this treatment are 2, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17, 20, 21, 22 and 23.

Among restoration recommendations for the watershed these treatments as a group were assigned a medium priority. This type of restoration activity could help create optimal thermal cover in winter range in a shorter time frame. The need in other areas is not immediate at this time.

We did not assign relative priorities for treatment to individual sub-basins. Relative priorities should be assigned to specific stands based on stand condition rather than to sub-basins.

D. The anticipated rates and time frames for achieving the management objectives.

Treatments will generally take place within 1 to 3 years after the need is identified. Silvicultural treatments enhance movement towards desired conditions but many years of stand growth, natural disturbance, and other dynamics contribute to gradual development of desired conditions.

Restoration Activity

SILVICULTURAL TREATMENTS TO ACCELERATE DEVELOPMENT OF RIPARIAN SAPLING/POLE & SMALL TREE STANDS

A. What is it?

Release of understory conifer trees by cutting overtopping hardwood trees. Reducing overhead competition will accelerate development of large conifer trees in riparian areas where large conifers are scarce. Crews walk to scattered hardwoods between 100 and 300 feet from stream channels and use chain saws to fall hardwood trees directly overhead and adjacent to young conifer trees. Trees are left in place where they fall. This treatment is recommended for riparian hardwood stands with a small component of conifers in the under story. The objective is to encourage development of a mixed stand of hardwoods and large conifers.

Interplanting of conifer tree seedlings to increase the conifer component of riparian stands: Adding confers to hardwood riparian stands enhances species and structural diversity and allows for future recruitment of quality large woody material. Conifer seedlings (western redcedar, western hemlock, and Douglas-fir) are hand planted in areas where vegetation or species diversity is lacking. Trees are planted between 100 feet and 300 feet from channels, in existing openings or small openings which are created with chain saws to facilitate open growing of seedlings. Seedlings may be protected with vexar tubing or netting to prevent browse damage.

Thinning of conifers in riparian areas to accelerate development of large conifer trees: Chain saws are used to fell young conifers. Trees are left in place where they fall. Minor species in the stand are favored as leave trees to promote species and structural diversity. In riparian reserves, emphasis is on thinning wide enough to avoid the need for future thinning or other stand manipulation (falling of larger trees may be more likely to result in soil disturbance).

B. Ecosystem Conditions and/or functions that would be altered, maintained or restored?

Overstory release provides conifers with additional light and, to a lesser degree, moisture and nutrients. Conifers respond with accelerated diameter growth. Interplanting of conifers enhances species diversity. Thinning of conifers results in fewer trees using limited resources and residual trees respond with accelerated diameter growth. Accelerating conifer development in riparian areas provides quality future habitat for fish and wildlife and reduces erosion and peak flows.

C. Appropriate timing, sequencing, and general location. Show priorities for sub-basins.

Treatments are conducted spring through fall when areas can be accessed.

These treatments are a priority in sub-basins with riparian areas lacking in large conifers. Highest priority areas are those with beneficial uses immediately downstream. The highest priority sub-basins to evaluate for treatment are 2, 3, 5, and 6. Other sub-basins to evaluate include 9, 10, 11, 13, and 17.

9 Upper EF
10 Middle EF
11 Shasta
13 McKinley
17 Bolan

2 Slide
3 Middle Slide
5 West Green
6 Upper Green

Potential treatment areas should be walked by an integrated resource staff group with expertise from silviculture, watershed/fisheries, and wildlife/ecology to evaluate site specific treatment needs and methods.

Among restoration recommendations for the watershed, these treatments were assigned an high priority. Sub-basins 2 and 3 are linked, as are 5 and 6. These sub-basins have a shortage of large wood. Treatments that create large wood will provide long-term results.

D. The anticipated rates and time frames for achieving the management objectives.

Treatments will generally take place within 1 to 3 years after the need is identified. Silvicultural treatments enhance movement towards desired conditions but many years of stand growth, natural disturbance, and other dynamics contribute to gradual development of desired conditions.

Restoration Activity

REHABILITATE ROCK QUARRIES

A. What is it?

Rehabilitating rock quarries could include stabilizing soil to reduce surface erosion, replacing topsoil, and seeding to encourage re-establishment of native species. Quarries could also be designated as waste sites for adding soil material to enable recontouring where possible.

Before treatment, site specific determinations should be made as to the value of the existing uses at each quarry. Analysis of created habitat features such as talus and rock head walls, and dispersed recreation uses should be included in the rehabilitation plan.

B. Ecosystem Conditions and/or functions that would be altered, maintained or restored?

The objective of this treatment would be to reduce sedimentation, increase water infiltration and increase soil productivity at these sites.

C. Appropriate timing, sequencing, and general location. Show priorities for sub-basins.

Sub-basins where this treatment is a priority are those that contain rock quarries that are no longer needed. These sub-basins include: 10 and 12 → Lower Copper
↘ done

Among restoration recommendations for the watershed, this is rated as low priority.

D. The anticipated rates and time frames for achieving the management objectives.

Some immediate benefits will be derived relating to peak flow decreases by allowing moisture to infiltrate the soil profile in ripped areas. Time frames for achieving these benefits are dependent on availability of restoration funding.

Restoration Activity:

STREAM ENHANCEMENT

A. What is it?

Stream channels would be modified through the addition of LWD or boulders to create additional or higher quality salmonid habitat. Structures could be added in several ways 1) large machinery used to place boulders/LWD, 2) helicopters used to place boulders/LWD 3) hand winching of existing on-site material into different locations or 4) a combination of one or all of these methods. Large woody debris would not be removed from existing riparian areas, but instead would be located through reconnaissance of blow-down sites, and from other off-site locations.

B. Ecosystem Conditions and/or functions that would be altered, maintained or restored?

Channel morphology indicates that specific reaches are better able to "use" large woody debris. These reaches are likely suitable for stream enhancement of existing condition to bring the channel into the range of natural variability for pools per mile and pieces of LWD per mile. Channels would become more complex, and pools would be created enhancing salmonid habitat for both spawning and rearing.

C. Appropriate timing, sequencing, and general location. Show priorities for sub-basins.

Enhancement activities could proceed after an intensive stream survey of the reach is completed, and designs for the structures are developed. Design of the project would receive peer review prior to implementation. Work would likely occur during the late summer (low water times). Sub-basins with "response" reaches where this activity may be appropriate include: 2 (Slide) and 5 (Green Fork).

Among restoration activities, this is rated as a high priority. Sub-basins 2 and 5 have sensitive response reaches and beneficial uses making them the first areas to consider this activity in at this time.

D. The anticipated rates and time frames for achieving the management objectives.

Time frames for this activity are dependant on receiving restoration funding. A project of this scope and scale could cost as much as $100,000, and would need to be prioritized with other restoration activities both in this sub-basin and across the Forest.

Restoration Activity

SNAG CREATION

A. What is it?

Create snags in stands that have an average diameter at breast height (D.B.H.) of at least 15 inches to compensate for the general lack of snags in the watershed. Snag densities in existing late-successional stands are generally sufficient to meet desired conditions, therefore this restoration will generally be done in second growth stands.

B. Ecosystem Conditions and/or functions that would be altered, maintained or restored?

Snag densities in the watershed are below levels specified in the Forest Plan. This restoration project would move habitat conditions closer to the desired condition for Matrix lands (snag density sufficient to support 40 percent of the potential population of cavity excavators, and 100 percent of the potential population of black-backed and white-headed woodpecker).

C. Appropriate timing, sequencing, and general location. Show priorities for sub-basins.

Sub-basins that contain a relatively high percentage of stands that have an average of at least 15 inches are 2, 6, 7 and 11. This project is most likely to be implemented with KV funds as timber is sold and harvested in the watershed.

Among restoration activities this is rated as a high priority. Sub-basins 2 and 11 are in particular need of this type of restoration activity.

D. The anticipated rates and time frames for achieving the management objectives.

In addition to created snags, snag levels in the watershed will increase through natural mortality. Even so, it will take many years, or decades to achieve the desired condition.

Restoration Activity

EROSION CONTROL/SLOPE STABILIZATION

A. What is it?

Erosion control/slope stabilization is the action of stabilizing actively eroding areas such as mass wasting sites, road cut and/or fill slopes, and stream banks, in an effort to reduce sediment input. This involves primarily soil bioengineering techniques such as planting trees and shrubs, live fascine bundles and live staking, erosion control blankets, hydromulching, and installing live cribwalls.

B. Ecosystem conditions and/or functions that would be altered, maintained or restored?

The major condition restored is sediment regimes that more reflect historic conditions.

C. Appropriate timing, sequencing, and general location. Show priorities for sub-basins.

Sub-basins where this treatment is a priority are those areas that are known or suspected sediment sources that have the potential to deliver sediment to beneficial use areas.

Sub-basins that are a priority for this treatment are: 6, 7, 9, 11, 13, and 17.

Among restoration recommendations for the watershed this is given a low priority.

D. The anticipated rates and time frames for achieving the management objectives.

Benefits relating to reducing surface erosion and mass wasting will take three to five years after project implementation to begin to see results of reduced sedimentation. This is due to the time necessary for the vegetation to establish on exposed soil. Time frames for achieving these benefits is dependent on availability of restoration funding.

Restoration Activity:

ROADS TO TRAILS CONVERSIONS

A. What is it?

Converting roads to trails includes subsoiling of the road running surface in areas of soil compaction as described under Road Decommissioning. The width of the road bed will be reduced to meet the trail standards appropriate for designated trail usage and trail management level. Culverts may be removed, and water bars will be constructed where necessary to control water runoff. Fill slopes may be pulled back to refill cut slopes.

Portions of roads not left as trail surface will be revegetated and seeded. Road closure berms will be constructed to prevent vehicular access to the treated area. Trailheads including signs, information boards and parking lots will be constructed where needed. Trail connector signs will also be installed as needed.

B. Ecosystem conditions and/or functions that would be altered, maintained or restored?

Converting roads to trails will reduce or eliminate existing roads within the Silver Star Roadless Area, restore the semi-primitive, non-motorized character of the Silver Star Special Interest Area, and increase the acreage of roadless and SPNM recreation within the Forest.

Impacts to heritage resource sites and to vegetation will be reduced with decreased vehicle access.

C. Appropriate timing, sequencing, and general location. Show priorities for sub-basins.

Priority for converting roads to trails to reduce or eliminate roads within existing Roadless Area are within sub-basins 17, 21, 22 and 23.

Priority for converting Roads To Trails to restore SPNM recreation are within sub-basins 17, 18, 20, 21, 22 and 23.

Priority for converting Roads-to-Trails to increase number of acres of roadless and SPNM recreation are within sub-basins 12, 16, 17, 18, 20, 21, 22 and 23.

Among restoration activities this is considered a medium priority activity.

D. The anticipated rates and time frames for achieving the management objectives.

Benefits to the resources including heritage resource sites, vegetation and probability of humans experiencing isolation from sights and sounds of other humans will begin immediately after project implementation.

Restoration Activity:

RECREATION SITE REHABILITATION

A. What is it?

Recreation sites are manipulated to return them to acceptable standards within the Aquatic Conservation Strategy objectives. Rehabilitation could include replacing topsoil, ripping soils to increase water infiltration, installing water bars, reseeding grasses, replanting trees and shrubs, removing trash, restricting access, temporary or permanent site closures and signing.

Work could consist of minor tasks to reduce the amount and area of disturbance, seasonal restrictions on use of the area to allow for natural site recovery, or total site rehabilitation with permanent closure of the site.

B. Ecosystem conditions and/or functions that would be altered, maintained or restored?

Rehabilitation would bring recreation sites within acceptable standards for loss of vegetation, amount of barren ground, water infiltration and proximity to lakes and streams.

C. Appropriate timing, sequencing, and general location. Show priorities for sub-basins.

Priority sub-basins are those that contain either developed or dispersed recreation sites that exceed acceptable standards.

Priority sub-basins are 5, 6, 9, 10, 11, 17, 20, 21 and 22.

The planning for this type of restoration activity has a high priority at this time for this watershed.

D. The anticipated rates and time frames for achieving the management objectives.

A dispersed recreation plan is needed for this area. Funding is needed to inventory sites, to develop a site-by-site Rehabilitation Plan and to develop a contract package for project implementation. Once funded, the following time frame for achievement would apply:

Year one - Dispersed recreation plan
Year two - Design narrative and site planning
Year three - Contract Preparation and Project Rehabilitation implementation.

Monitoring Activity:

RECREATION USE

A. What is it?

Monitoring of social, physical and managerial settings to assure that recreation attributes which facilitate the desired opportunity setting are being protected. Establish baseline terrestrial and aquatic sampling at campsites, lakes and streams and along trails. Establish baseline recreation use data of dispersed campsites and on trails. Assess these conditions, the values of these areas and the amount of use as they relate to the Recreation Opportunity.

B. Ecosystem conditions and/or functions that would be altered, maintained or restored?

Monitoring would identify locations where unacceptable user conflict and resource damage (vegetation trampling, erosion, soil compaction, etc.) is occurring as a result of high recreation use. Mitigation to reduce the impacts could then be proposed and implemented.

C. Appropriate timing, sequencing, and general location. Show priorities for sub-basins.

Sub-basins where the monitoring would be a priority are those within developed recreation sites, ORV trails, and areas of highest use: 1, 5, 6, 7, 10, 11, 14.

There is a high need for this type of monitoring.

D. The anticipated rates and time frames for achieving the management objectives.

Use baseline recreation use data to develop impact monitoring studies to evaluate whether objectives of Forest Plan are being met. Once funded, the following time frame for achievement would apply:

Year one: Conduct Recreation Impact Monitoring Studies along with Recreation Site Rehabilitation Planning.

Out-years: If recreation impacts contribute to the area is exceeding acceptable standards, management guidelines would be introduced to reduce or mitigate impacts.

:

Monitoring Activity:

MINERAL DEVELOPMENT

A. What is it?

Monitoring of mining activities to insure that they are conducted in an environmentally sound manner.

B. Ecosystem conditions and/or functions that would be altered, maintained or restored?

Monitoring would identify locations of mining activity where environmentally unsound practices are occurring. It would also identify lands that could be reclaimed for other productive purposes.

C. Appropriate timing, sequencing, and general location. Show priorities for sub-basins.

Sub-basins where this monitoring would be a priority are those with known claims: 9, 12, 16, 17, 22, 23.

There is a high need for this type of monitoring.

D. The anticipated rates and time frames for achieving the management objectives.

Existing mining claim locations are known and the number of new claims is expected to decline. Monitoring is limited to new Letters of Intent or Operating Plans.

Monitoring Activity:

RECREATION USE IN SILVER STAR SPECIAL INTEREST AREA

A. What is it?

Monitoring of social, physical and managerial settings within the Silver Star Special Interest Area to assure that recreation attributes (remoteness, naturalness and access) which facilitate Semi-Primitive, Non-Motorized recreation are being protected. Establish baseline recreation use data of dispersed campsites and trails. Assure no more than 15 trail encounters between parties occur each day and groups are not larger than 20 persons.

B. Ecosystem conditions and/or functions that would be altered, maintained or restored?

The purpose of monitoring recreation use would be to identify locations of unacceptable user conflict, of ORV use, and where isolation is impacted by human activity. Mitigation to reduce the impacts could then be proposed and implemented.

C. Appropriate timing, sequencing, and general location. Show priorities for sub-basins.

Sub-basins where the monitoring would be a priority are those where isolation and remoteness would be impacted: 16, 17, 18, 20, 21, 22, 23.

There is a high need for this type of monitoring.

D. The anticipated rates and time frames for achieving the management objectives.

This monitoring would facilitate providing isolation and solitude for recreationists seeking this type of experience. Management objectives would continue to be meet with this monitoring activity. It is possible that without this monitoring, immediate deterioration of solitude would occur.

Monitoring Activity:

STREAM TEMPERATURE

A. What is it?

Monitoring to ensure that stream temperatures are within State water quality standards, and if not, identify where problems exist.

B. Ecosystem Conditions and/or functions that would be altered, maintained or restored?

Maintain or restore the functions of aquatic ecosystems that depend upon cold water temperatures.

C. Appropriate timing, sequencing, and general location. Show priorities for sub-basins.

Sub-basins 1, 9, 10, 11, 12, 14, 16, and 17 are a priority for this monitoring. They are located along Copper Creek and East Fork of the Lewis River.

There is a high need for this type of monitoring.

D. The anticipated rates and time frames for achieving the management objectives.

Identifying area that are not within State water quality standards could happen within a short time if funding is received. However identifying the causes of water temperature problems within a reach, would probably not be done until the next iteration of watershed analysis in the watershed.

Monitoring Activity:

STREAM SURVEYS

A. What is it?

Stream surveys would collect data on the condition of aquatic and riparian habitat, and may include characterization of riparian vegetation, channel type and stability, bank stability, substrate type, and fish species present and their distribution.

B. Ecosystem Conditions and/or functions that would be altered, maintained or restored?

Collecting stream survey data would help to identify which stream reaches do not meet the desired condition. These streams would then be a priority for restoration.

C. Appropriate timing, sequencing, and general location. Show priorities for sub-basins.

Sub-basins that are a priority for this monitoring are those for which there is no existing stream survey data, and/or where there is a high likelihood of future management actions. These sub-basins in prioritized order are, 5 & 6 (Green Fork), 4 (Little Creek), 23 (Miners Creek), 17 (Bolin Creek) 16 (Summit Creek), 22 (Star Creek), and 15 (Poison Gulch).

Since this type of monitoring is ongoing, there is only a medium priority to emphasize in comparison to other monitoring needs.

D. The anticipated rates and time frames for achieving the management objectives.

Stream surveys are completed at a rate of about 12-20 miles per year depending on availability of funding and management activity levels. There are approximately 104 miles of streams in these sub-basins. At current funding and management activity levels these surveys would be completed within a minimum of five to nine years.

Monitoring Activity:

FISH SURVEYS

A. What is it?

Survey fish populations to identify which species inhabit a given stream, particularly where there is a potential for anadromous fish to utilize available habitat for spawning and rearing. Information collected would include: habitat type, type of use by salmonids, and population estimates. The survey methods could include: redd counts, smolt trapping, snorkeling, and electroshocking.

B. Ecosystem Conditions and/or functions that would be altered, maintained or restored?

Results from the monitoring would allow better decisions to be made in the future regarding habitat management for the salmonids that utilize this watershed. It may also help to define limiting factors of reproduction success.

C. Appropriate timing, sequencing, and general location. Show priorities for sub-basins.

Sub-basins that are a priority for this monitoring are those for which there is a known population using the habitat or a high likelihood of habitat available for use. These sub-basins are, 1, 2, 4, 5, 8, 9, 10, 11, and 12.

Since this type of monitoring is ongoing, there is only a medium priority to emphasize in comparison to other monitoring needs.

D. The anticipated rates and time frames for achieving the management objectives.

Surveys are completed annually on known spawning areas depending on availability of funding and management activity levels. Additional surveys such as smolt trapping would require an increase in funding that may or may not be available. This type of survey could continue until populations recover, or limiting factors are identified and restoration efforts have been implemented.

Monitoring Activity:

AMPHIBIANS

A. What is it?

Monitoring for the presence of Larch Mountain salamander and Van Dyke's salamander.

B. Ecosystem Conditions and/or functions that would be altered, maintained or restored?

The objective of this monitoring is to increase knowledge about the types of habitat where these species are most likely found. It will allow better decisions to be made in the future regarding what is needed to preserve these species.

C. Appropriate timing, sequencing, and general location. Show priorities for sub-basins.

Sub-basins that are a priority for this monitoring are those that are in and adjacent to sub-basins where these species have been found in the past. Sub-basins with the highest priority are 6, 7, 12, 16, 17, 22, and 23.

Surveys would be done according to established protocol, which requires surveys to be conducted generally in April and May.

Since this type of monitoring is ongoing, there is only a medium priority to emphasize in comparison to other monitoring needs.

D. The anticipated rates and time frames for achieving the management objectives.

Monitoring should begin as soon as funding is available, and increased knowledge gained from monitoring would be an immediate benefit.

Monitoring Activity:

RIPARIAN RESERVE REHABILITATION MONITORING

A. What is it?

Long-term monitoring of stream riparian area structure and functions to determine whether restoration activities are creating/enhancing conditions similar to those that existed historically. Monitored activities would include hardwood thinning to release understory conifers already present, planting of conifers in stream riparian areas and adjacent uplands to act as future large woody debris sources, placement of in-stream large woody debris, and vegetation, wildlife, and C-3 species monitoring. The opportunity exists to work cooperatively with the PNW research group, the area Ecology group, and Universities.

B. Ecosystem conditions and/or functions that would be altered, maintained or restored?

Conditions and functions to be restored include development of conifers for future large woody debris input, standing conifers to intercept snow and moderate stream-flow pulses, and enhanced biodiversity.

C. Appropriate timing, sequencing, and general location. Show priorities for sub-basins.

A monitoring proposal should be written, and baseline data in treatment and control areas should be collected before restoration activities begin. Each targeted function, and monitoring objectives, will dictate timing and intervals of subsequent monitoring.

Sub-basins 2, 3, 5, and 6 are highest priority. Evaluate sub-basins 9, 10, 11, 13, and 17.

There is a high need for this type of monitoring.

D. The anticipated rates and time frames for achieving the management objectives.

Ongoing.

Monitoring Activity:

MONITOR CLIFF NEST SITES FOR RAPTORS

A. What is it?

Monitoring suitable cliffs in the watershed to determine if and where raptor nesting is occurring. Potential cliff nesting raptors in the watershed are golden eagle, and peregrine falcon.

B. Ecosystem conditions and/or functions that would be altered, maintained or restored?

The objective of the monitoring is to identify whether there are conflicts between maintaining the site as suitable for golden eagle or peregrine falcon nesting and existing and expected future recreation use and mineral development. The goal is to maintain the suitability of cliff nest sites for raptors.

C. Appropriate timing, sequencing, and general location. Show priorities for sub-basins.

Monitoring the nest should be done on an annual basis beginning in 1996, and if active nests are located, monitoring should be done on an annual basis to determine whether the pair is successfully reproducing, and how many young are fledged. If no active nests are found in the first year of monitoring, surveys should continue at least every other year. Surveys of the amount and types of recreation use should be made beginning in 1996. The most likely cliff sites are in sub-basins 22 and 23.

There is a high need for this type of monitoring.

D. The anticipated rates and time frames for achieving the management objectives.

Assuming funding, it may be possible to have recommendations for mitigating impacts by the next analysis iteration for this watershed.

Monitoring Activity:

VERIFICATION OF ECOLOGICAL INVENTORY DATA

A. What is it?

Much of the vegetation, soil, and water data used in this analysis is from air photo and map analysis and has not been field verified. The highest priority need is verification of locations of and ecological conditions within large tree stands, and locations and ecological data for TES species, C-3 species, class IV streams, wetlands, and potentially unstable soils. Field vegetation surveys have been completed on less than 50 percent of the watershed. Less than five percent of the watershed has been surveyed for TES species and there have been no field surveys for C-3 species in the watershed.

B. Ecosystem Conditions and/or functions that would be altered, maintained or restored?

An accurate inventory will enable better decisions to be made regarding potential projects.

C. Appropriate timing, sequencing, and general location. Show priorities for sub-basins.

Field verification of ecological data is a high priority in all sub-basins.

D. The anticipated rates and time frames for achieving the management objectives.

The most efficient and effective way to verify ecological data is to use systematic surveys throughout the watershed. Areas in the watershed should be stratified based on conditions and issues and prioritized for surveys. Historically funding for ecosystem condition surveys has been very limited with the best opportunities for field surveys occrring during project analysis. The amount of funding available along with the scope of issues will determine actual survey priorities and accomplishment levels. Since most projects are anticipated to occur in the Matrix, a higher amount of field verification is expected to occur in Matrix lands than in Administratively Withdrawn areas.

Commodities:

OLD-GROWTH FRAGMENT RETENTION

A. What is it?

The Northwest Forest Plan ROD specifies that in watersheds where less than 15 percent old-growth conditions exist, old-growth fragments will be retained. This retention is to benefit species associated with late-successional habitats. Only about four percent of this watershed is in large tree single- and multi-layered stands (late-successional conditions). Because of the 15 percent retention rule, no commodities extraction should occur within old-growth fragments until greater than 15 percent old-growth exists.

B. Ecosystem conditions and/or functions that would be altered, maintained or restored?

Late-successional habitats, conditions, and species composition and diversity will be protected in existing old-growth fragments. These fragments will also function as refugia, sources for old-growth associated species that will recolonize adjacent areas within the watershed.

C. Appropriate timing, sequencing, and general location. Show priorities for sub-basins.

Sub-basins 6 and 7 contain the majority of the old-growth fragments, with traces in 5, 16, 17, 18, 20, 21, 22, and 23. All old-growth fragments within these sub-basins will be exempt from commodities extraction until greater than 15 percent of the watershed exhibits old-growth conditions.

D. The anticipated rates and time frames for achieving the management objectives.

The 62 percent of the watershed in mid-seral structure stages will have to be assessed periodically within the next several decades to determine when some stands have reached old-growth conditions. It may take at least a century before these stands develop the conditions found in old growth stands. Commercial thinning and planting shade-tolerant conifers can be implemented to enhance late-successional conditions in these stands. These enhancements may accelerate late-successional habitat development, requiring less time than natural successional processes.

Commodities and Development:

POTENTIAL FOR RECREATION DEVELOPMENT

A. What is it?

Develop both a Dispersed Recreation Plan and a Developed Recreation Plan for this watershed. Future recreation site development should include both winter and summer recreation opportunities including:

1. Provide a diverse range of dispersed recreational, interpretive and education opportunities.

2. Provide a full range of trail experiences and difficulty levels for a variety of users.

3. Provide safe, well-maintained facilities for developed recreation within a full range of development levels.

B. Ecosystem conditions and/or functions that would be altered, maintained or restored?

The objective of this recommendation would be to manage recreation use based upon sound recreation practices. This would help to maintain present ecosystem conditions within acceptable standards and to deter future degradation of the watershed by unplanned use. This would allow for management of recreation sites in the watershed while addressing attainment of Aquatic Conservation Strategy objectives.

C. Appropriate timing, sequencing, and general location. Show priorities for sub-basins.

Dispersed recreation and developed recreation planning is needed for the entire watershed. Sub-basins where future recreation development is expected are 9, 10, 11, 12, 13, 14, 15, 16, 17, 22, and 23.

D. The anticipated rates and time frames for achieving the management objectives.

Recreation Planning for use of this watershed begins the process for achieving management objectives. Some immediate benefits will be derived as each individual development occurs. The longer we wait to plan for expected use, the more impact recreation will have on the watershed.

Commodities and Development:

OPPORTUNITIES FOR TIMBER HARVEST

A. What is it?

The Upper East Fork of the Lewis River Watershed Team reviewed current and desired conditions and identified sub-basins appearing to have the most timber harvest opportunities in the next five years. Because the amount of late successional stands is less than the 15 percent required in the Northwest Forest Plan, harvest opportunities for several decades will be limited to commercial thinning. Commercial thinning is described in Amendment 11 of the Gifford Pinchot National Forest Land and Resource Management Plan. Treatments would include retention of riparian reserves (untreated) in accordance with standards and guidelines in current management direction and site specific stand objectives.

B. Ecosystem Conditions and/or functions that would be altered, maintained or restored?

Timber harvest (commercial thinning) provides commodities for human social/economic benefit including raw materials for wood products manufacturing and associated employment. Much of the Upper East Fork of the Lewis is in land allocations with programmed timber harvest. The desired condition on these lands is a range of tree size classes distributed throughout the landscape in proportions and patterns similar to those occurring prior to settlement. The goal on these allocations is to have highly productive diverse stands yielding a sustained timber supply and meeting other multiple use goals such as those for wildlife and visual resources.

Many closed tree stands in the watershed are in of commercial thinning to maintain or enhance growth rates for timber production and habitat development.

C. Appropriate timing, sequencing, and general location. Show priorities for sub-basins.

Figure 28, shows areas available for commercial thinning based on land allocation and stand condition. The allocations for these areas include timber emphasis and deer and elk winter range.

D. The anticipated rates and time frames for achieving the management objectives.

Timber harvest opportunties will be evaluated annually. It is estimated that a commercial thinning timber sale will be implemented about every 3-5 years in this area for the next 2-3 decades.

Stands Suited For Commercial Thinning In The Next Decade

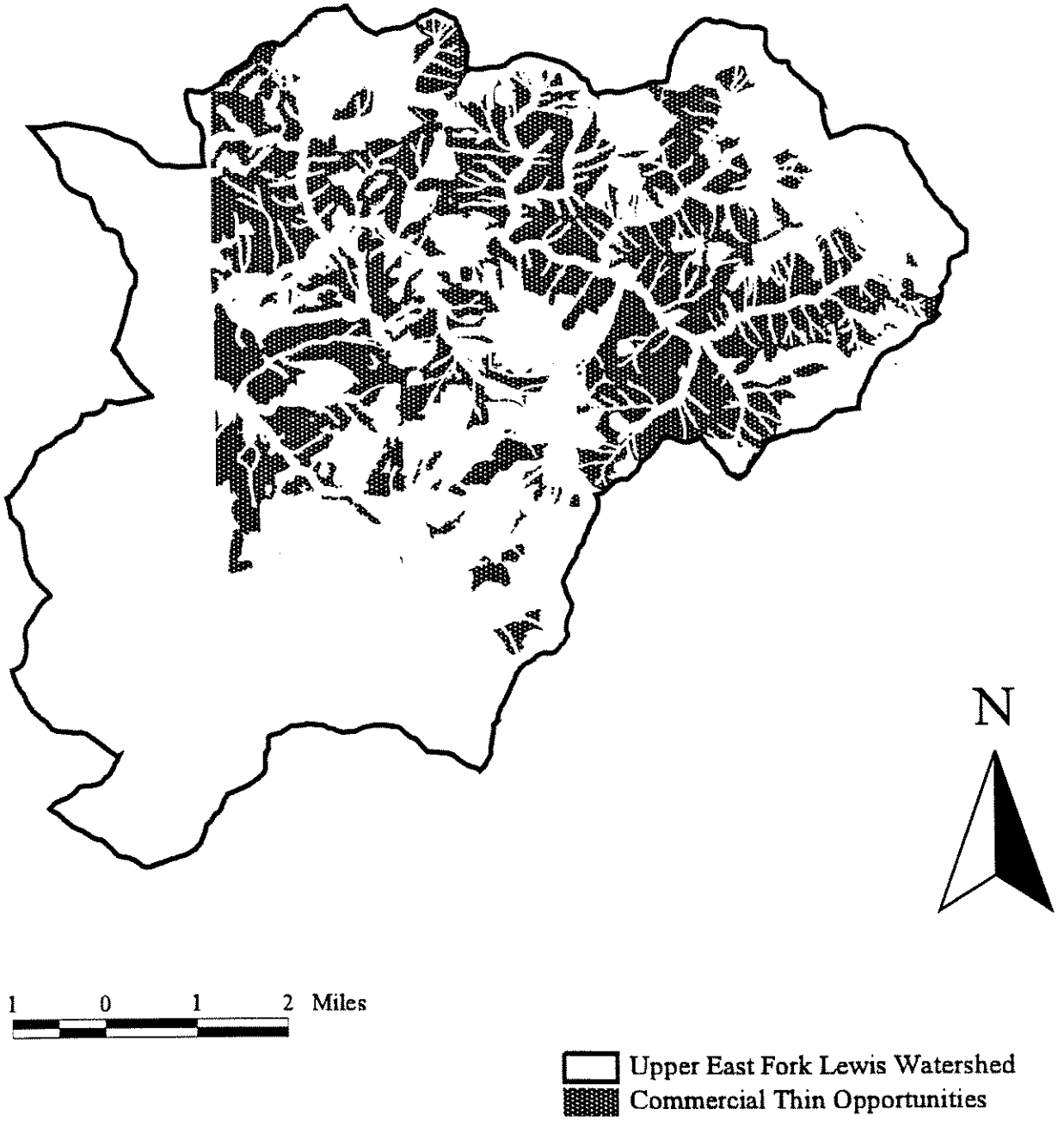


Figure 29 Stands Suited for Commercial Thinning In The Next Decade

Riparian Reserve Widths

Current condition of the riparian reserves is not conducive to revising the interim widths that have been established by the ROD. The condition of riparian reserves in this watershed has been dictated by past fires. Many of the reserves are hardwood dominated, and contain few if any mature conifers. This condition is not providing all the functions of a healthy riparian area. Specifically impaired functions include: special habitat for many species, large wood delivery to riparian zones, shade, and water quality. Upslope areas are in much the same condition, however, the hardwoods are replaced with immature conifers. For these reasons we recommend that the interim widths be maintained.

For a discussion of recommended silvicultural treatments to accelerated development of stands within the Riparian Reserves see page VI-6.

Table 26 Recommendations by Sub-basins

	Restoration										Monitoring										Commodities		
	Road Decommission and Tilling	*Road Weatherization*	*Silviculture in Uplands*	*Silvicultural in Riparian*	*Rock Quarry Rehabilitation*	*Stream Enhancement*	*Snag Creation*	*Erosion Control Slope Stab.*	*Roads to Trails*	*Recreation Site Rehabilitation*	*Recreation Use*	*Mineral Development*	*Recreation Use on Silver Star*	*Stream Temperature*	*Stream Surveys*	*Fish Surveys*	*Amphibians*	*Riparian Rehab. Monitor*	*Cliff Nest Sites for Raptors*	*Verify Eco Inventory*	*Old Growth Fragment Retention*	*Recreation Site Development*	*Opport. Timber Harvest (thin)*
1.Anaconda										X			X		X				X			X
2.Slide			X	X		X	X								X		X		X			X
3.Middle Slide				X		X											X		X			X
4.Little			X											X	X				X			X
5.West Green			X	X		X				X	X				X	X		X		X	X		X
6.Upper Green Fk	X	X	X	X		X	X	X		X	X				X		X	X		X	X		X
7.Upper East Fk		X	X				X	X			X						X			X	X		X
8.Upper EF West			X													X				X			X
9.Upper EF East		X	X	X				X		X		X		X		X		X		X		X	X
10.Middle E. Fork			X	X	X						X			X		X		X		X		X	X
11.Snass	X		X	X			X	X		X	X			X		X		X		X		X	X
12.Lower Copper			X		X							X		X		X	X			X		X	X
13.McKinley	X	X	X	X				X										X		X		X	X
14.Upper EF Trib			X								X			X						X		X	X
15.Poison Gulch			X																	X		X	X
16.Summit												X	X	X	X		X			X	X	X	X
17.Bolin	X		X	X				X	X	X		X	X	X	X		X	X		X	X	X	X
18.King									X				X							X	X		
19.West King																				X			
20.N/S Coyote			X						X	X			X							X	X		
21.Rock			X						X	X			X							X	X		
22.Star			X						X	X		X	X		X		X		X	X	X	X	X
23.U/Mid Copper			X						X			X	X		X		X		X	X	X	X	X

APPENDIX A

GLOSSARY

GLOSSARY

303(d): Sections of rivers, coastal waters, estuaries, and lakes that don't meet the state of Washington water quality standards. These standards include temperature, bacteria, siltation, oxygen levels, nutrients, and toxic compounds or heavy metals. These sections are identified by the Washington State Department of Ecology as a result of the Clean Water Act.

C-3 species: Old-growth associated species identified in the ROD to be protected through survey and management standards and guidelines. Four Survey Strategies have been identified in the ROD:

1: manage known sites
2: survey prior to activities and manage sites
3: conduct extensive surveys and manage sites
4: conduct general regional surveys

DBH: Diameter of a tree at breast height.

Guild - Groups of wildlife species that would be expected to react to different distributions and amounts of habitats in similar ways.

Limits of Acceptable Change (LAC): A pre-determined threshold or limit to the amount a site or area can change without exceeding acceptable standards for that site or area..

People At One Time (PAOT): The capacity of a recreation site in terms of People-At-One-Time (PAOT). The number of people that can use the area all at the same time.

Policy Implementation Guide (PIG): This refers to the Columbia River Basin Policy Implementation Guide which was developed in 1991 to document the implementation schedule for salmon restoration in the Columbia River Basin.

President's Forest Plan Allocations:

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

Riparian Reserves - As a key element of the Aquatic Conservation Strategy (ROD, page B-9), the Riparian Reserves provide an area along all streams, wetlands, ponds, lakes, and unstable and potentially unstable areas where riparian dependent resources receive primary emphasis.

Matrix - Those federal lands not designated in other categories. Most timber harvest and other silvicultural activities would be conducted in that portion of the Matrix with suitable forest lands, according to standards and guidelines.

Large Woody Debris: Pieces of wood larger than 50 feet long and 36 inches in diameter at the large end.

Mass Wasting or Mass Movement: Dislodgement and downslope transport of earth material as a unit under direct gravitational stress. The process includes slow displacements such as creep and rapid movements such as landslides, rock slides, and falls, earthflows, debris flows and avalanches. Agents of fluid transport (water, ice, air) may play a subordinate role in the process.

Monitoring: A process of collecting information to evaluate if objective and anticipated or assumed results of a management plan are being realized or if implementation is proceeding as planned.

Reference Conditions: Those conditions which describe the known or inferred history of the landscape so we may know what was sustainable in the past and what changes have occurred to affect sustainability.

Refugia: a region of relatively unaltered conditions that remains as a center of relict forms of plants and animals that may re-colonize adjacent impacted habitats as they become suitable. Singular: refugium.

Seclusion Habitat - Refers to habitat for grizzly bears and gray wolves that is more than one mile from a road open to motorized vehicles.

Sediment: Solid material of any size, both mineral and organic, that is in suspension and is being transported from its site of origin by air, water, gravity, or ice, or has come to rest on the earth's surface either above or below sea level.

Survey strategy: One of four survey strategies for C-3 species identified in the ROD. See C-3 for explanations of strategies.

Wilderness: Undeveloped federal land retaining its primeval character, without permanent human habitation or improvements. It is protected and managed to preserve its natural condition. Wilderness areas are designated by an act of Congress.

APPENDIX B

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REFERENCES

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APPENDIX C

ISSUES AND KEY QUESTIONS

Issue: Surface Erosion - Roads

Surface erosion from roads has been a major contributor to sedimentation to streams in the past. New construction and within the first two to three years is when most of the sediment is transported. After this time growth on the fill slopes and cut slopes help alleviate this problem but in areas near stream crossings the problem can continue to influence stream habitat for many years. Poor construction practices in the past have created numerous problems recently from fill slope failures that directly and indirectly move sediment into many streams.

Key Questions:

1. What are the roads' erosion potential?
2. Are contributing activities present?
3. Is sediment delivered to streams?
4. What roads are sensitive to forest practices?
5. What is the potential effect of sediment on public resources?
6. What is the baseline sediment level?
7. What are the amounts and types of sediment contributions from forest practices?

Issue: Soil Productivity

Fire has played a major role in this sub-basin in characterizing soil productivity. Very hot fires as indicated in some of the burns have destroyed soil nutrients and sterilized what soil remained.

Key Questions:

1. What is the extent of soil productivity loss due to fires and past forest management activities in this watershed?

Issue: Beneficial Uses of Water

The Upper East Fork Lewis River watershed analysis area contains many beneficial uses that are influenced either directly or indirectly by the aquatic system. The state water quality

standards regulations are in place to protect the existing and designated uses of water. These include water supply, recreation, and growth and propagation of fish and other aquatic life. A complete list of these beneficial uses, their vulnerability, and future trends are not known at this time. Due to time constraints, the analysis will focus on fish spawning and rearing beneficial uses for this iteration.

Key Questions:

1. What are the beneficial uses in the Upper East Fork Lewis River analysis area related to anadromous and resident salmonids? Where are they located?

2. What aquatic parameters are these beneficial uses most sensitive to changes in (sediment, water temp, etc.)?

3. What is the current condition of water quality in the watershed? Are beneficial uses being met?

4. Are any of these locations vulnerable to changes in these sensitive parameters?

   a. What do current conditions and/or changes from past conditions indicate about the effect of input variables (heat energy/temperature, sediment) on the beneficial uses of water bodies?

   b. What is the vulnerability of water bodies to potential changes in water quality?

5. What processes within the watershed influence or could potentially influence the quantity and quality of input variables (wood, water, sediment) delivered to water bodies vulnerable to specific water quality parameters?

   a. What potential sources of input variables (sediment, water) could enter vulnerable water bodies?
   b. Do land use practices and/or natural processes contribute input variables?

   c. What is the potential for delivery of adverse levels of input variables to vulnerable water bodies?

6. What are the reference conditions of these input variables?

7. What is the future trend of the parameters relating to beneficial uses?

8. Are their any restoration and/or monitoring possibilities?

Issue: Hydrologic Changes

Past disturbances such as wildfire in the analysis area may have influenced basin hydrology by increasing peak flows during fall and winter storms, and decreasing summer low flows. Human activities such as timber harvest and road building have occurred throughout the watershed, and may influence the timing and quantity of runoff as well.

Key Questions:

1. What are the current watershed conditions influencing hydrologic response?

2. How do management activities and past disturbances influence streamflow regimes? Where are these influences occurring?

3. What is the history of floods and disturbance of hydrological significance?

4. What is the effect of changes in water available for runoff of flood peaks?

5. What is the future trend of the basin hydrology?

6. Are their any restoration and/or monitoring possibilities?

Issue: Stand Structure and Composition

Fire history and subsequent fire prevention activities have altered stand structure and composition, age class distributions of forested plant communities, and plant, lichen, fungi, and bryophyte biodiversity. All sub-basins are substantially below the estimated historic ranges of late-successional vegetation.

Key Questions:

1. What are the current stand structures and compositions?

2. How does this compare with past conditions?

3. Which plant, lichen, fungi, and bryophyte species are vulnerable to conversion of multi-layered canopies to single-layer canopies are present in the watershed?

4. What are the implications for future conditions?

Issue: Riparian Reserve Fragmentation

Some critical components of terrestrial habitat within Riparian Reserves have been altered by fragmentation, influencing the capacity of these ecosystems to provide effective habitat for riparian dependent species. Disruption of connectivity between these areas can potentially result in species isolation. This can lead to undesirable changes in species composition, use, and ecosystem functions within Riparian Reserves.

Key Questions:

1. What are the current stand structures within Riparian Reserves?

2. Which TES, C-3 and other species have been impacted by changes within the Riparian Reserve?

3. What are the best restoration strategies to mitigation for fragmentation of stream Riparian Reserves, and to enhance functioning of these areas?

4. Where are the unfragmented riparian habitats that could serve as refugia?

5. How can species and ecosystem functions be monitored within Riparian Reserves?

Issue: TES and C-3 Species

The Endangered Species Act and President's Forest Plan mandant that we monitor for threatened, endangered, and sensitive (TES), and late successional dependent (C-3) species respectively. Less than about 5% of the watershed has been surveyed for TES species, and none of the watershed has been surveyed for C-3 species.

Key Questions:

1. Which TES species are present, and where?

2. Which TES and C-3 species are likely to occur, and in which habitats?

3. Has habitat fragmentation impacted TES or C-3 population viability?

4. How can population viability of TES and C-3 species be monitored?

5. Has disruption of dispersal corridors impacted population viability?

What is the inventory of the existing Recreation Opportunity Spectrum (ROS) found in this watershed?

What are the conditions of the (ROS) "setting indicators" for each ROS class found in this watershed?

Are there any roadless areas remaining in this watershed that could be reconsidered for wilderness? If so, have activities occurred that have diminished the roadless area's future potential for wilderness designation?

How does the density of open roads in this area affect recreation?

What have been the historic human uses and activities in this watershed?

What types and intensity of human use and activities take place in this watershed?

What affect have these human activities had on recreation in the area?

What is the future trend for recreation?

What affect will potential future human activities have on recreation in this watershed?

What affect will implementation of the President's Forest Plan have on recreation.

What affect will human activities have on maintaining the integrity of the area's cultural resources.

Other low or medium rated issues include:

Issue : Cumulative Effects of Management Activities on Populations of Salmonids in the Watershed

Anadromous salmonids travel throughout the watershed during their life cycle. Urbanization of the lower watershed (outside analysis area) combined with management activities in the upper watershed may be affecting the salmonid populations

1. What effect are downstream habitat conditions having on upstream populations of salmonids?

2. Are upper watershed management activities synergistically combining with downstream existing conditions to produce negative effects to the salmonid populations in the watershed?

Issue : Fire and Fuels

In the past, large catastrophic fire has been a change agent at the landscape (watershed) scale. The potential for large-scale stand replacement fire still exists.

Issue : Noxious Weeds

Disturbance processes often lead to invasion of unwanted "weedy" plant species. Noxious weeds and other invasive non-native plants originate from other continents, displacing and out competing native plant species. They threaten native plant diversity and reduce forage quality and availability because they are often toxic or otherwise unpalatable.

Key Questions:

1. Which noxious weed species are present?

2. How wide-spread are they?

3. How do they reproduce and are they spreading?

4. How are they being spread?

5. How are they impacting native plants?

6. Will problems develop in other areas if no control actions are taken?

7. How can noxious weeds be monitored?

8. Can they be eradicated, and how?

9. Are there any biological control agents?

Issue: Special Forest Products

Recently a number of special forest products have been promoted for utilization by the public for personal, recreational, and commercial ventures. Many different plant, lichen, fungi, and bryophyte species are currently being utilized, and more species will undoubtedly be used in the future.

Key Questions

1. Which species are of interest as special forest products?

2. Which habitats are they likely to be harvested in?

3. What are sustainable population levels for these species?

4. What functions do these species play in the ecosystem?

5. Are any species being harvested below sustainable levels?

6. What are the best harvest strategies to ensure resource sustainability?

7. What kinds of user conflicts are being encountered?

8. How can Special Forest Products be monitored to answer basic ecological/biological questions?

Issue: Special Habitats-Plants

Special habitats such as non-forested sites, wetlands, rock outcrops, caves, and talus slopes are important for biodiversity. Many sensitive plant species and plants with narrow ecological niches are associated with these habitats. Under forest wide standard and guideline FW-211 direction these habitats and their ecotones are to be protected. The designated Silver Star Botanical Special Interest Area supports several populations of the Clackamas corydalis, a State Threatened and C-3 species. Meadows with highly diverse plant communities are also present. Edible berries and mushrooms are abundant.

Key Questions:

1. Where are the special habitats in the watershed?

2. How can these special habitats be typified?

3. Are any special habitats requiring mitigation as a result of disturbance due to management practices?

4. How can special habitats be monitored?

Issue : Corridors and Connectivity

Corridors between genetically different populations of plants, lichens, fungi, and bryophytes allow for reproduction between different populations, maintaining and enhancing genetic diversity. Corridors of intact habitat are also important for dispersal of dispersal-limited species such as asexually reproductive lichens and some vascular plants.

Key Questions:

1. Where are existing corridors between intact late successional forest stands?

2. Where has forest fragmentation disrupted corridor flow?

3. How can corridors be restored?

4. Which plant, lichen, fungi, and bryophyte species might be dispersal-limited and therefore more sensitive to corridor disruption?

5. How can dispersal be monitored along corridors?

Issue : Deer and Elk Winter Range

The watershed contains a significant amount of big game winter range. The winter range area was burned by fires in the early 1900's, and is characterized by even-age conifer stands.

Key Questions:

1. How is the arrangement of timbered cover, and forage areas that currently exists meeting the needs of elk? How much of the winter range is optimal cover, and where is it located?

2. How is the density of open roads in this area affecting elk?

3. Does the watershed meet Forest management plan guidelines of 44% of the biological deer and elk winter range in Matrix being maintained in stands of trees 21 inches dbh or larger?

4. Are there roads in biological winter range that are not needed for through traffic, access to an active project, or access to a specific recreation destination that could be closed permanently or seasonally, or decommissioned?

Issue : Riparian Reserve Fragmentation

Some critical components of terrestrial habitat within the riparian reserves have been altered. This influences the capability of these ecosystems to provide effective habitat for riparian dependant species.

Key Questions:

1. Where are riparian reserves inadequate in providing dispersal habitat for threatened, endangered, and sensitive species; late-successional; and other species of concern?

2. Does canopy closure within the riparian reserves provide necessary cover for threatened, endangered, and sensitive species; and other species of concern?

3. What is the current distribution of age classes, and stand structure types within the riparian reserves?

4. Where is large woody debris deficient?

5. Where is the existing density of snags deficient?

Issue : Habitat Condition for Threatened, Endangered, and Sensitive Species

The watershed contains suitable or potentially suitable habitat for Threatened, Endangered, and Sensitive species including northern spotted owl, bald eagle, peregrine falcon, gray wolf, grizzly bear, and amphibians. Golden eagles, a non-listed but protected species may nest in the watershed.

Key Questions:

NORTHERN SPOTTED OWL

1. Are spotted owl activity centers located within the watershed? How many are there, and in what ROD land allocations are they located? Which of these are currently above "take" thresholds? When were the activity centers located?

2. How many acres of nesting, roosting, and foraging habitat are there in the watershed? What percentage of the watershed is this?

3. What is the amount of dispersal habitat (11/40 and above) in each ROD allocation within the watershed?

BALD EAGLE

1. Are occupied or potential bald eagle activity areas located in the watershed (nesting areas, foraging areas, winter roosts, and concentration areas)?

2. What type, how many, and in what ROD allocation are these activity areas?

3. Do current habitat conditions maintain or allow for increased use of activity centers?

GOLDEN EAGLE

1. Where are there suitable cliff nest sites?

2. What are the important habitat elements in the watershed that make it suitable for golden eagles?

PEREGRINE FALCON

1. Are any cliffs located within the watershed?

2. Are there any cliffs within the watershed that are historic (pre-1975) or traditional (post-1975) peregrine falcon eyries?

3. Have cliffs within the watershed been rated or monitored for peregrine falcon potential/presence?

4. If cliffs are unrated, have surveys to protocol been accomplished?

GRAY WOLF

1. Does any part of the watershed contribute to a portion of a wolf/pack territory?

2. Where are potential den and rendezvous sites?

3. What is the status of the prey base population?

4. What is the density and distribution or roads and trails in the watershed that may affect wolves?

GRIZZLY BEAR

1. What are the important food sources, and where are they located in the watershed?

2. Are there roadless areas or large areas that provide isolation from major human activity?

3. Are there developed campgrounds and major known dispersed camping areas where sanitation problems could exist?

AMPHIBIANS

1. Have any amphibian inventories been done on a project or watershed level? What species does the literature suggest may be present in the

watershed?

2. Are sensitive species (including those listed in table C-3 of the ROD) present, or based on best information, is there a possibility they can occur in the watershed?

3. Have intensive or extensive inventories been conducted in adjoining sub-watersheds? If so, can these inventories be extrapolated to the watershed being analyzed?

Issue : Quantity and Quality of Key Habitat Attributes for Resident and Anadromous Salmonids

Current aquatic habitat conditions are a result of past natural and human induced processes that have occurred in the watershed. Fire regimes, and road building, combined with increased human populations in the watershed have through time altered stream habitats and aquatic communities.

1. What is the current and historic range, and species composition of salmonids in the analysis area.

2. What is the current condition of the following key habitat attributes: Pools per mile, Large woody debris per mile, stream temperature?

3. Are any of these habitat variables of concern given the current condition? If they are a concern where are they located?

4. Is there any high quality and or unique habitat located in the analysis area (spawning, rearing, holding etc...)?

5. Where have natural flows through the aquatic system (salmonids, LWD, sediment, etc.) been altered by human activities? How has this affected the connectivity of the aquatic system?

6. Which areas in the riparian reserve network are providing allocthanus material to the aquatic system?

7. Where are the sources of future Large Woody Debris?

8. Does canopy closure within the riparian reserve network maintain appropriate stream temperatures for aquatic species?

9. Have there been any introductions of aquatic species in the watershed that could threaten the viability of native aquatic species (i.e., predation, competition, disease)?

10. Are there habitat areas that have been degraded, that have a high potential for restoration and or monitoring activities?

11. What is the future trend of habitat quantity and quality for salmonids in this watershed?

Issue : Impacts on Natural Resources by Recreation Use

Forest users have been able to utilize the many varied recreation opportunities as a result of better accessibility. The Silver Star Scenic Special Interest Area, the Silver Star Roadless Area and the East Fork Lewis River (pending addition to the National Wild and Scenic River System) and numerous cultural and historic site are located within this watershed.

KEY QUESTIONS:

What types and intensity of historic recreation use have occurred in this watershed?

What are the cultural resources found within this watershed?

What types and intensity of recreation use occur here at present?

Where do these recreation uses occur?

Why and how have these uses developed?

What are the needs and/or opportunities for recreation?

How will future demand for recreation impact the natural resources?

What affect will implementation of the President's Forest Plan have on recreation impacts on the natural resources?

What management direction is needed to provide for recreation opportunities and to provide for protection of natural resources?

Issue : Impacts to Recreation Associated With All Human Activity

The Upper East Fork Lewis River watershed analysis area contains a variety of recreation settings and opportunities. Access to this area has brought about an increase in both recreational and non-recreational activities. This increase in human activity threaten the recreation resource and user expectations. The end product of recreation management is the experience people have.

KEY QUESTIONS:

APPENDIX D

LIMITATIONS OF THE ANALYSIS, CONFIDENCE IN THE ANALYSIS, DATA GAPS, AND IMPLICATIONS OF THESE LIMITATIONS FOR MANAGEMENT

LIMITATIONS OF THE ANALYSIS, CONFIDENCE IN THE ANALYSIS, DATA GAPS, AND IMPLICATIONS OF THESE LIMITATIONS FOR MANAGEMENT

Geology, Physical Processes, Soils - by Jim Chamberlin, Geologist

Surface Erosion

Erosion data was compiled form the transportation data base. Along with the watershed analysis process, an access and travel management road inventory is going on. This new data will greatly enhance future analysis in the watershed. At this time confidence in the data is around 60 to 70%. The limitations of this means that some areas may not be analyzed to provide the best information for making the best decisions on the transportation system.

Soil productivity

Data for soil productivity is lacking in providing specific information on where problems exist. Inferred data such as past harvest activities on gentle slopes that may have been tractor logged is what was used to determine potential problem areas. Confidence levels from this data are less than 50% due to the data gaps that could be filled in. Field surveys should be done to identify specific areas of concern and used for identifying treatment prescriptions. Limitations for management may be improper identification of potential restoration projects.

Beneficial Uses of Water - by Mark Kreiter, Hydrologist

Confidence in analysis - Moderate-High

Limitations of the analysis - Limitations of this analysis include:

- Reference conditions were determined primarily from 1959 air photos. Some information from other sources such as REAP was used to supplement the air photo information. This leads to fairly good relationships back to the mid-1940's, but very unclear prior to this time.

- Stream temperature analysis only used existing data available at the time of the analysis. This was limited to two stations in the analysis area.

- The peak flow portion of this analysis could not address channel bed scour, which is very important in determining quality of spawning and rearing habitat.

Data Gaps

- Stream temperature data was not available for a majority of the streams in the analysis area.

- Field data that was pertinent to hydrologic interpretations such as width/depth ratios, pebble counts, v* was missing. This needs to be collected as part of stream surveys.

- Historic and reference information on stream temperatures and other physical stream channel parameters such as pools per mile and amounts of LWD is lacking for this area.

- There is a need to complete level II road surveys so possible restoration opportunities as well as potential sediment sources can be identified.

Implications for Management

Management decisions relating to activities such as restoration or timber harvest may not be as fully informed using this general information. Accurate identification of priority restoration areas may be less likely without the more specific information, due to the lack of establishment of cause and effect relationships. We might focus restoration for sediment control in a sub-basin that has high activity levels and generates some sediment, and miss the sub-basin that has less activity but generates large amounts of sediment.

Hydrologic Condition - by Mark Kreiter, Hydrologist

Confidence in analysis - Moderate-Low

Limitations of the analysis - Limitations of this analysis include:

- Entire analysis was modeled using GIS data. No field verification of vegetation data was done to determine the accuracy of the information.

- Coefficients for the model were regional coefficients in some cases. Using coefficients that are not generated from the analysis area lowers the models accuracy.

- Assumptions in the model decrease the reliability of the resulting data. The model makes assumptions like the two year storm is responsible for the 2 year flood. This is rarely true in this area.

- The peak flow portion of the beneficial use analysis could not address channel bed scour, which is very important in determining quality of spawning and rearing habitat.

- Confidence is low for analysis in sub-basins 1, 12, 18, 19, 20, and 21 because DNR model only considered National Forest land due to lack of vegetation data for private and other land in the geographic information system database.

Data Gaps

- There is a need for field verification of the vegetation layer to improve the accuracy of the data.

- Field data that was pertinent to hydrologic interpretations such as width/depth ratios, pebble counts, v* was missing. This needs to be collected as part of stream surveys.

- There is a need to complete level II road surveys so possible restoration opportunities can be identified.

- A detailed review of the location of class IV streams is needed.

- There is a need to collect vegetation data (crown closure, DBH, tree species) for non-National Forest lands.

Implications for Management

Management decisions relating to activities such as restoration or timber harvest may not be as fully informed using this general information. Accurate identification of priority restoration or timber harvest areas may be less likely without more specific information, due to the lack of

establishment of cause and effect relationships. Establishing cause and effect relationships is very difficult using the general information contained in this analysis.

The relationship between potential peak flow increases from vegetation removal and those from roading for this area are not known. This might lead to a restoration program that identifies the wrong priority for projects, slowing down attainment of the management objectives.

Inconsistencies Data Gaps and Management Limitations - By Chiska Derr, Botanist

Terrestrial Vegetation Analysis

Confidence in Analyses

This section identifies concerns about the quality and accuracy of the data that were used to analyze this watershed. All data came from GIS files; there was no ground verification of the numbers or categories produced by GIS.

The GIS vegetation layer was created primarily from timber inventory data and photo interpretation. The GIS specialist estimated that more than half of the total Central Skills Center vegetation layer was based on photo interpretation, and has never been ground verified. Also, roughly 3/4 of the watershed had previously been managed by other districts, so none of the Central Skills Center specialists had experience on that land.

Timber inventory data are not ecological data. Unfortunately, as the only data we have, they were used to make the ecological interpretations within this document.

Given the source and quality of the data used, the four high priority issues are rated according to the botanists comfort with the accuracy of the GIS data, and how well it represents what is actually going on out in the Middle Lewis Watershed.

Issue: Stand Structure and Composition

Confidence: LOW to MODERATE

Discussion: The nature of data and lack of field verification lead to this confidence rating.

Issue: Riparian Reserve Fragmentation

Confidence: MODERATE

Discussion: Because data on timber harvest activities are up to date, numbers and maps depicted areas of Riparian Reserve fragmentation fairly well. Confidence about the conditions within the fragmented areas was lower due to lack of field verification.

Issue: **Special Habitats-Plants**

Confidence: LOW

Discussion: The lack of data about special habitats, and the assumption that most special

habitats are wetlands and will be protected by Riparian Reserve designation, lowered confidence in the data analysis.

Issue: **TES and C-3 Species**

Confidence: LOW to MODERATE

Discussion: The lack of data on C-3 species inspired low confidence. Because some data exist for TES species, confidence in that analyses is low to moderate.

Data Gaps and Implications for Management

Issue: **Stand Structure and Composition**

* none of the GIS stand structure data have been verified

* little to none of the GIS stand composition (ecoclass) data have been verified

* no comprehensive plant inventories have been conducted

Implications for Management:

Issue: **Riparian Reserve Fragmentation**

* baseline data on intact stream and wetland riparian functions are lacking

* baseline data on many riparian-dependent vascular plants and all lichens, bryophytes, and fungi species are lacking

* there are no baseline data on intact riparian area vegetation or functions within to watershed to compare with riparian areas whose functions we will be "restoring"

* none of the harvested stream riparian vegetation is being monitored to see how well it is growing back

* harvested stream riparian area functions, such as nutrient input and bank stabilization from live vegetation, are not being monitored

Issue: **TES and C-3 Species**

* general surveys for TES species have not been conducted

* ecological and distributional data are lacking for TES and C-3 species within the watershed

Issue: Corridors and Connectivity

* there is no list of plant, lichen, bryophyte, or fungi species dependent upon corridors for dispersal

* biological and ecological data are lacking for most dispersal-limited plants, lichens, bryophytes, and fungi

Issue: Ecosystem Management Strategies

* most plants, lichens, bryophytes, and fungi are not being monitored to determine if our ecosystem management strategies are providing for their sustainability

Issue: Special Forest Products

* biological and ecological data on most special forest product plants, lichens, bryophytes, and fungi are lacking

* the sustainability of these species is unknown

* harvested populations are not being monitored

Issue: Noxious Weeds

* noxious weeds in the watershed are poorly documented

* spread of noxious weed is not being monitored

Issue: Special Areas-Plants

* special areas for plants are not documented

Implications for Management

Management decisions based on the data analyzed for this document would probably not be based on actual conditions within some portions of the watershed. General ecological inventory data needs to be collected and analyzed to further identify areas for restoration and other projects. Unidentified special habitats for plants and C-3 lichens, bryophytes, vascular plants, and fungi could be impacted or destroyed without adequate surveys and habitat descriptions. Unmonitored

noxious weed populations could spread. Special Forest Product species viability and sustainability could become compromised, leading to the listing of new species.

Key Aquatic Habitat Attributes, and Aquatic Habitat Fragmentation - by Debbie Hollen, Fisheries Biologist

Confidence Estimates

Following is a discussion of the confidence in the analysis, limitations of the analysis, data gaps, and implications of these limitations for management. This discussion is presented by analysis group (LWD/Mile and LWD recruitment, Primary Pools/Mile, Stream Temperature, and Aquatic Habitat Fragmentation).

LWD/Mile

Confidence in analysis - **Low - Moderate**

Limitation of the Analysis include:

Data for this analysis came from the disticts stream survey files and database. There is a moderate confidence in the original data collected due to the protocol used to identify large pieces of wood (i.e., visual estimation of size) during the stream surveys. This is an acceptable level of confidence, however, data are only available for approximately fifty percent of the fish bearing streams (10 percent of all streams) in the analysis area, totalling only 24.8 miles, Using this limited amount of data across the entire watershed analysis area greatly comprimises the confidence.

Standards have been set at the Regional level, however, no watershed or basin wide analysis has been completed to verify these standards for this area. The stream channels in this area are high gradient channels that transport material such as wood and sediment fairly quickly. A standard of 80 pieces per mile may be too high, based on the channel morphology of this watershed.

Recruitment potential of LWD was based on an aerial photo analysis using 1989 photos. The confidence in this portion of the analysis is high. Limited ground truthing of size and species was completed in select areas (along mainstem East Fork). All identifiable channels were analyzed, however, many of the class IV channels were not sampled. This data is not comparable to the GIS data that is presented by other specialists due to the way the GIS data was collected (stand exams in upland areas). This information gives a more accurate picture of the riparian areas, while that information is more accurate for evaluation of upland areas.

Data Gaps:

- Stream surveys cover primarily fish bearing sections of stream, class IV channel tributaries and many class III tributaries are not surveyed. Only 10 percent of all the streams in the watershed have been surveyed.
- Vegetation data from GIS does not separate riparian vegetation from upland

vegetation.

- No watershed or basin wide standards for habitat quality.
- No riparian area specific vegetation inventories are available
- No pristine stream survey data to develop relationships between current conditions in managed sub-basins with those in un-managed sub-basins.
- No data has been collected on Private Land within the watershed.

Implications for Management:

Managers need to consider the small amount of data and the lack of data available for this analysis, and recognize that this analysis is not complete and needs to be verified in the field at the sub-basin level, before management decisions are made.

Primary Pools/Mile

Confidence in analysis - **Low - Moderate**

Limitation of the Analysis include:

Data for this analysis came from the disticts stream survey files and database. There is a moderate confidence in the original data collected due to the protocol used to identify pool size (i.e., visual) during the stream surveys. This is an acceptable level of confidence, however, data are only available for approximately fifty percent of the fish bearing streams (10 percent of all streams) in the analysis area, totalling only 24.8 miles. Using this limited amount of data across the entire watershed analysis area greatly comprimises the confidence.

Standards have been set at the Regional level, however, no watershed or basin wide analysis has been completed to verify these standards for this area. The stream channels in this area are high gradient channels with many small pocket pools that may not meet the requirements of a primary pool as identified in the survey protocol. The standard is based on the width of the stream channel however, gradient and channel morphology are not considered.

Data Gaps:

- No pristine stream survey data to develop relationships between current conditions in managed sub-basins with those in un-managed sub-basins.
- No data has been collected on Private Land within the watershed.

Implications for Management:

Managers need to consider the small amount of data and the lack of data available for this analysis, and recognize that this analysis is not complete and needs to be verified in the field at the sub-basin level, before management decisions are made. Consideration also needs to be given to the fact that until pool standards are developed at the watershed scale for each watershed in the Forest we will not have an accurate picture of the severity of the existing situation.

Stream Temperature

Confidence in analysis - **Moderate - Low**

Limitation of the Analysis include:

This analysis was done with the most complete data years between 1974 and 1992. No data is available after 1992. There are several missing years and years with less than 30 data points, averages on these years were not included in the analysis. With over 280 miles of stream in the watershed, two stations in the lower watershed , do not adequately represent the water temperatures across the watershed. These stations will not identify sources of warm water temperatures or "hot" spots.

Data Gaps:

- No riparian specific data to quantify shade, species compositions and existing condition of riparian reserves.
- No pristine water temperature data to develop relationships between current conditions in managed sub-basins with those in un-managed sub-basins.
- Stream temperature data is not available for a majority of streams in the watershed. Where it was available, it was incomplete and ended in 1988 (some scattered data available after 1988).

Implications for Management:

Managers need to consider the small amount of data and the lack of data available for this analysis, and recognize that this analysis is not complete and needs to be verified in the field at the sub-basin level, before management decisions are made.

Aquatic Habitat Fragmentation

Confidence in analysis - **Moderate - Low**

Limitation of the Analysis include:

This analysis was done using GIS data for road/stream crossings. It assumes that every stream crossing fragments the aquatic habitat. It assumes that none of the crossings are bridges which would presumably have less of an impact to the aquatic enviroment, and would allow a natural flow of sediment, wood, and organisms. It also assumes that all the roads and streams are present in the database. There are however, many small spur roads that are not currently in the database. There may be streams that are missing, from the database, however, this GIS layer was recently updated. The analysis uses an index value of 1.5 crossing per stream mile as a critical value. This number represents approximately one-third of the data values, however there is no basis for this value in the literature.

Data Gaps:

- Database without all the roads present

- Database without all the streams present
- Information on culverts and whether they pass fish is not available.
- Information on the condition of roads on Private Land within the watershed is not available.

Implications for Management:

This analysis is a surrogate for quantifying the amount of impact created by the number of roads in the watershed on the aquatic ecosystem. The analysis is logical, and serves a purpose for identifying the impacts, however it is a surrogate and has many assumptions about the impacts that roads and their management have. It should also be noted that this surrogate is intuitive in nature and has not been peer-reviewed or evaluated under strict scientific standards.

Wildlife-Related Issues - by Mitch Wainwright, Wildlife Biologist

My confidence in the acreage figures of structure stages within the watershed is moderate because a majority of the data has not been verified on the ground. In some cases the data found on the structure stage GIS layer seem inconsistent with the data found on the spotted owl habitat layer. However, I think the data is sufficiently accurate to be able to make the conclusions in the analysis, and these conclusions would not radically change if more accurate data were available.

There is very little data available on historic wildlife sightings in the watershed, and there have been few surveys in the watershed for the species that are listed in Chapter 3. The habitat conditions previous to the Yacolt fires are largely unknown and difficult to estimate.

There is little information available on the effects of riparian habitat fragmentation on the species discussed in the analysis. It is known that excessive fragmentation can affect dispersal and migration of many species, however there are no established threshold levels between what is suitable and unsuitable. Since the amount of mid and late-successional habitat in Riparian Reserves in the watershed is quite low, confidence in the conclusion that habitat is highly fragmented for these species is high.

Information of what constitutes suitable habitat for elk, grizzly bears and gray wolves is fairly well documented. The road density figures are moderately to highly accurate. One data gap is the number of roads that are currently closed, and which "closed" roads are still receiving motor vehicle use.

Complete on-the-ground surveys of cliffs, caves, and talus slopes have not been done. The analysis was dependent upon Monument records, and in the case of cliffs, on aerial photography. Small tallus fields, and those that are found in timbered stands could not be mapped because there are no records kept of locations of this type of habitat. It is assumed that these types of sites would be located during project analysis.

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Human Dimension - by Reed E. Gardner

Confidence in analysis - Moderate to High for the Silver Star Area
Low to Moderate for remainder of analysis area

Limitations of the analysis include:

The cultural inventory and analysis is skewed toward management activities and thus does not represent actual prehistoric or historic site distribution and density.

There is a need to conduct a Social Assessment - an effort to assess the consequences to human populations of any public actions that alter the way in which people live, work, play, relate to one another, organize to meet their needs and generally cope with society.

Use data came from field visits and road traffic counters that were installed this season. We really do not know what user expectations are nor do we know how well these expectations are being met.

Data Gaps:

* Only cultural and historic resource sites have been recorded in conjunction with archaeological surveys for specific timber sales, recreation or engineering project.

* Recreation use data (type, location, expectations, quality of experience, timeframes and amount) was not available except on a limited basis at the Sunset Recreation Area and as part of the total dispersed use on the District.

* Public use road data was not available for all roads (both ends of road segments) within the analysis area. Some road data was only available for only one end of the road segment crossing through the analysis area. Data is needed for traffic on both ends of roads 41, 4104, 4107, 4109, 42, 4200510, 4205, 4211, 4220 and 53.

* Baseline data on the impact of recreation use on the natural resources is not available.

* No date exists on how much and where special forest products are being gathered.

Implications For Management: Due to the lack of information on total use of the watershed, it is possible that management activities may negatively affect user expectations and the quality of their experience. Without a Social Assessment, we may focus our efforts on areas of percieved need while missing areas that will aid in the attainment of desired management objectives.

APPENDIX E

VEGETATION STAND STRUCTURE DEFINITIONS

VEGETATION STAND STRUCTURE DEFINITIONS

Gifford Pinchot National Forest

Text by Chiska Derr, John Haglund, and Ken Cosentino

June 1995, Version

Stand structure/seral stage definitions have been developed for Western Oregon and Washington based on a number of different criteria (Hall et al. 1985). Structure definitions based in part on above work combined with Forest stand data available in the vegetation database are briefly described below (as based on the 1/11/95 seral meeting). Ecoclasses are specified based on potential plant associations (Brockway et al. 1983: Topic et al 1986; Topic 1989). Major tree species can be a single species or combinations of conifer species present on the Gifford Pinchot National Forest, and are not specified.

Acceptable ecoclass codes for Grass/Forbes, Shrub/Seedling, Remnant Forest, Open and Closed Sapling/Pole, Open and Closed Small Tree, Large Tree Single Story, and Large Tree Multi-Storied are for coniferous forest only (codes that start with "C").

Grass/Forb

Early seral. Conifer openings dominated by grasses, forbs, some shrubs and conifer seedlings less than 4.5' tall (or diameter breast height (DBH) less than 1.0 inches), either of natural or human origin. Pioneer species dominate and species richness is often high. Provides foraging opportunities but no cover. Condition typically lasts two to five (occasionally 10) years.

Shrub/Seedling

Early seral. Coniferous stands dominated by shrubs and a mixture of conifer seedlings and saplings (0-20' tall, 0 to 4.9 inches DBH); natural or human origin. Pioneer species dominate and species richness is high. Provides foraging opportunities but no hiding/thermal cover. Condition typically lasts 3 to 10 years, but may persist 20 to 30 years if tree regeneration is delayed. May provide hiding cover depending on height and density of shrubs and trees.

Remnant Forest (Light Forest)

Early seral; ecoclass either western hemlock, Douglas-fir, or western red cedar. Stands with little understory development (grass and forbs present) and an open canopy (0% to 40% cover) of large trees. Cover results from residual conifers larger than 21 inches DBH. These stands are commonly a result of recently harvested shelterwood, or green tree retention units. Provides foraging opportunities, limited thermal protection, and may provide hiding cover. Also provides propagules of C-3 lichens and bryophytes, as well as habitat for C-3 lichens, bryophytes, fungi, amphibians, voles, arthropods and mollusks.

Open Sapling/Pole

Early seral. Coniferous stands with an open canopy (0% to 40% cover) that are dominated by sapling and pole-sized conifers of 4.5 feet tall up to 9" DBH. A shrub dominant understory is common. Provides some forage and limited hiding/thermal cover. Condition may last from 8 to 20 years, sometimes longer, depending on tree crown closure and subsequent stand treatment.

Closed Sapling/Pole

Early to mid seral. Coniferous stands with a closed canopy (40% to 100% cover) that are dominated by sapling and pole-sized conifers of 4.5 feet tall up to 9" DBH. Ground vegetation dwindles during this stage as crowns of individual trees coalesce. Tree live crown ratios become reduced as lower limbs die back from lack of sunlight. Plant diversity is generally low at this stage as dense tree cover shades out many remaining pioneer species. A shift towards shade tolerant species may become more evident later in this structure stage. Structural diversity is also quite low. The scarcity of ground vegetation limits forage, and crowded trees can reduce accessibility of stand to wildlife for cover, but can provide some hiding cover. This stand condition can persist between 40 and 100 years.

Open Small Tree

Early to mid seral. Coniferous stands with less than 70% canopy closure AND meeting one of the following size criteria: 1) Ecoclass either western hemlock, Douglas-fir, western red cedar, or grand fir and dominated by trees with stand average DBH between 9 and 20.9 inches, OR: 2) Ecoclass silver fir, mountain hemlock, lodgepole pine, park-like mountain hemlock/subalpine fir, or Engelmann spruce, with stand average DBH between 9 and 18 inches. The open canopy enhances understory development and wildlife forage and cover; these stands provide dispersal habitat for spotted owls. Stands with 60-70% canopy closure provide thermal cover.

Closed Small Tree

Early to mid seral. Coniferous stands with 70% or greater canopy closure AND meeting one of the following size criteria: 1) Ecoclass either western hemlock, western red cedar, Douglas-fir, or grand fir and dominated by trees with stand average DBH between 9 and 20.9 inch DBH, OR: 2) Ecoclass silver fir, mountain hemlock, lodgepole pine, park-like mountain hemlock/subalpine fir, or Engelmann spruce, and stand average DBH between 9 and 18 inches. Poor understory development and tree density limit wildlife habitat usefulness, although some thermal cover and dispersal habitat for spotted owls is provided. Ground vegetation is minimal. Length of time in this condition may range from 40 to 100 years or even longer in high elevation stands.

Large Tree Single Story

Mid to late seral. Closed coniferous canopy (between 40% and 100%) with only one canopy layer AND one of the following two criteria: 1) Ecoclass either western hemlock, western red cedar, Douglas-fir, or grand fir and stand average DBH greater than 21 inches, OR: 2) Ecoclass silver fir, mountain hemlock, lodgepole pine, park-like mountain hemlock/subalpine fir, or Engelmann spruce, and stand average DBH greater than 18 inches. These stands are the result of large-scale disturbances (fire, windthrow, volcanic activity, timber harvest). Their limited understory development, and lack of snag development and downed woody material limits their current quality as wildlife habitat (Hall et al. 1985), although they do provide thermal cover and dispersal habitat. These stands have excellent potential for restoration activities to mimic old-growth conditions.

Large Tree Multi-Storied

Mid to late seral. Closed coniferous canopy (between 40% and 100%) with two or more canopy layers AND one of two following size criteria: 1) Ecoclass either western hemlock, western red cedar, Douglas-fir, or grand fir and stand average DBH greater than 21 inches, OR: 2) Ecoclass silver fir, mountain hemlock, lodgepole pine, park-like mountain hemlock/subalpine fir, or Engelmann spruce, and stand average DBH greater than 18 inches. Stand structure is high in these stands (various size and layers of trees, snags, down wood). Plant diversity is also high in many cases and strongly favors shade tolerant species. Stands of old-growth are included in this category. When this stand structure is present and Douglas-fir and western hemlock codominate, optimum wildlife habitat conditions can be met (Hall et al. 1986), including thermal cover, snow interception, and optimal nesting, foraging and roosting habitat for owls.

Hardwood Shrub/Seedling

Early seral, areas where ecoclass is a hardwood type ("H" codes). Does not include areas that are of coniferous forest climax that currently have an abundance of hardwoods. Dominated by hardwood species less than 4.9 inches DBH. Typically occurring on wet or bottomland soils and/or those closely associated with riparian areas and channel

disturbance regimes. When alder is present, soil is enriched by nitrogen input. Provides good habitat for birds and other small wildlife species. When deciduous shrubby hardwood pockets are interspersed within larger conifer stands, they provide valuable seasonal canopy gaps and enhance C-3 lichen and bryophyte habitat and diversity (Neitlich & McCune 1995).

Hardwood Sapling/Pole

Early seral. Areas where ecoclass is a hardwood type ("H" codes). Does not include areas that are of coniferous forest climax that currently have an abundance of hardwoods. Stands are dominated by young hardwood trees between 4.9 and 8.9 inches DBH; small conifers may be present, but are not dominant. Typically occurring on wet or bottomland soils and/or those closely associated with riparian areas and channel disturbance regimes. When alder are present, soil is enriched by nitrogen input (up to 320 kg/ha/yr; Pojar & MacKinnon 1994). Provides good habitat for birds and other small wildlife species. When pockets of deciduous hardwood saplings and poles are interspersed within larger conifer stands, they provide valuable seasonal canopy gaps and enhance C-3 lichen and bryophyte habitat and diversity (Neitlich & McCune 1995).

Hardwood Trees (Large & Small)

Mid seral. Areas where ecoclass is a hardwood type ("H" codes). Does not include areas that are of coniferous forest climax that currently have an abundance of hardwoods. Hardwood trees with DBH 5 inches and larger. Conifers may be present, but are not dominant. Typically occurring on wet or bottomland soils and/or those closely associated with riparian areas and channel disturbance regimes. When alder are present, soil is enriched by nitrogen input. Important habitat for many neotropical migrant birds; provides ungulate forage and hiding cover. When pockets of deciduous hardwood saplings and poles are interspersed within larger conifer stands, they provide valuable seasonal canopy gaps and enhance C-3 lichen and bryophyte habitat and diversity (Neitlich & McCune 1995). Bigleaf maple host the largest biomass of canopy epiphytes in the Pacific Northwest (Pojar & MacKinnon 1994), and can function as epiphyte refugia as conifer development increases.

Water

Water covered areas including lakes, ice, running water, and intermittent streams and rivers.

Wet/Mesic

Non-forested wetlands including wet/moist shrub, forb, grass meadows. Wetlands contribute to biodiversity by providing habitats for unusual plants and animals; they also play many important hydrologic roles.

Dry Meadow/Shrub

Non-forested dry habitats including dry grasslands, meadows, shrublands, and alpine meadows and shrublands with less than 10% conifer canopy. These are naturally occurring habitats that provide valuable foraging habitat, travel corridors and connectivity between habitats.

Rock

Non-vegetated land with less than 10% potential plant cover. Can provide travel corridors and connectivity between habitats.

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