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Middle Lewis River Watershed Analysis

Gifford Pinchot National Forest
Mount St. Helens National Volcanic Monument

First Printing - July, 1995

MIDDLE LEWIS RIVER
WATERSHED ANALYSIS

Gifford Pinchot National Forest
Mount St. Helens National Volcanic Monument

July, 1995

EXECUTIVE SUMMARY

The 102,093-acre Middle Lewis River Watershed is comprised of National Forest (85,055 acres) and State and private (17,038 acres) ownerships. The area has been divided into 28 sub-basins for analysis by an interdisciplinary team.

In this first iteration of analysis, the following 16 issues are analyzed: Mass Wasting; Surface Erosion from Roads; Soil Productivity; Beneficial uses of Water; Hydrologic Changes; Riparian Reserve Fragmentation; Stand Structure and Composition; Threatened, Endangered, and Sensitive (TES) Plants; Special Plant Habitats; Fire and Fuels; Aquatic Habitat Fragmentation; Key Habitat Attributes for Resident Salmonids, TES Animal Habitats; Late Successional Reserves and Spotted Owls; Elk and Deer; and Recreational Use and Development.

Characterization

Formed by volcanic and glacial processes, the topography is rough with multiple ridge crests separated by steep, deeply dissected valleys. In the southeast portion, however, at elevations of 3,000 to 5,000 feet (in the Indian Heaven Wilderness Area) the terrain is more gently sloping and is dotted with many small lakes. Drained by the Lewis River and its tributaries into Swift Reservoir, the watershed is vegetated by coniferous forest plant associations which provide habitat for 573 terrestrial animal species.

Current Conditions

The watershed contains numerous mass-wasting features (landslides and debris flows) distributed in all sub-basins adjacent to the Lewis River. The Indian Heaven Area is relatively stable.

Roading has been a major contributor of sediment to streams since road construction began in the 1930's. Road density for the entire watershed is relatively high at 2.5 miles per square mile. Ten sub-basins have densities greater than 3.0 miles per square mile.

Past logging with ground-based systems has compacted soils in 14 sub-basins.

Several "beneficial-use" stream reaches are used as spawning, rearing, and holding habitat by bull trout and other resident salmonids. These uses are vulnerable to changes from sediment, stream temperature, large woody debris (LWD), and peak flows.

The vegetation of the Middle Lewis River Watershed has been categorized into seven zones (or ecoclasses) based on plant species present, their proportions and potential vegetation. Vegetation is further classified by structure stages. Since about 1950, 28 percent of the watershed has been harvested, with a much higher proportion of that harvest occurring on privately-owned lands. In ten sub-basins more than 25 percent of the riparian reserves have been harvested. One federally-listed Threatened plant species and

The Lone Butte Wildlife Emphasis Area contains a near-optimum cover to forage ratio for the resident elk herd; however, the size and arrangement of habitat blocks preclude maximum use by the animals.

The 9,300 acres of elk and deer biological winter range within the watershed is located in LSR along both sides of the Lewis River. As timbered cover stands develop in the LSR, forage may become insufficient for this area to function as winter range.

Human use is widespread through the watershed, with concentrated numbers and activities near access roads, trails, and developed sites. Commercial use includes hydroelectric generation and study of potential sites, outfitter and guide operations, and harvest of timber and special forest products. A variety of seasonal recreational activities are pursued over the landscape without benefit of a comprehensive recreation management and development plan. A relatively high number of dispersed camping sites have sprung up over time, and high use is causing adverse effects within the Wilderness as well.

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 processes and glaciers have created a landscape naturally prone to movement through mass wasting and surface erosion. Soil movement has been accelerated by roading and to a lesser degree by timber harvest.

Sites of beneficial water use have been impacted by past floods associated with rain-on-snow events that probably coincided with major fires.

Past vegetation patterns were shaped predominantly by large, stand-replacement fires, changing thousands of acres at a time. Over the past 50 years, timber harvest and related activities have altered stand structure, composition, and distribution across the landscape by creating numerous small openings containing little if any standing multi-layered old trees and down woody material. Accordingly, plant and animal habitats have changed.

The distribution of fish within the watershed has been sharply altered by construction of roads and the three dams on the main stem of the Lewis River.

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 16 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.

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INTRODUCTION

Management direction for the National Forest lands comprising the Middle Lewis River watershed (Figure 1, Vicinity Map) are 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 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 President's Forest Plan. The President's Forest Plan (PFP) provides extensive management direction, including land allocations, see Figure 3 President's Forest Plan Allocations Map, that comprise a comprehensive ecosystem management strategy. A major part of this strategy is the Aquatic Conservation Strategy (PFP, page B-9) which has four components (PFP, Page B-12)

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

The Middle 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 associated with relatively high road densities and unstable ground.
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 Middle 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 if a particular proposal or management action meets the Aquatic Conservation Strategy objectives (PFP, page B-11).

Land Allocations

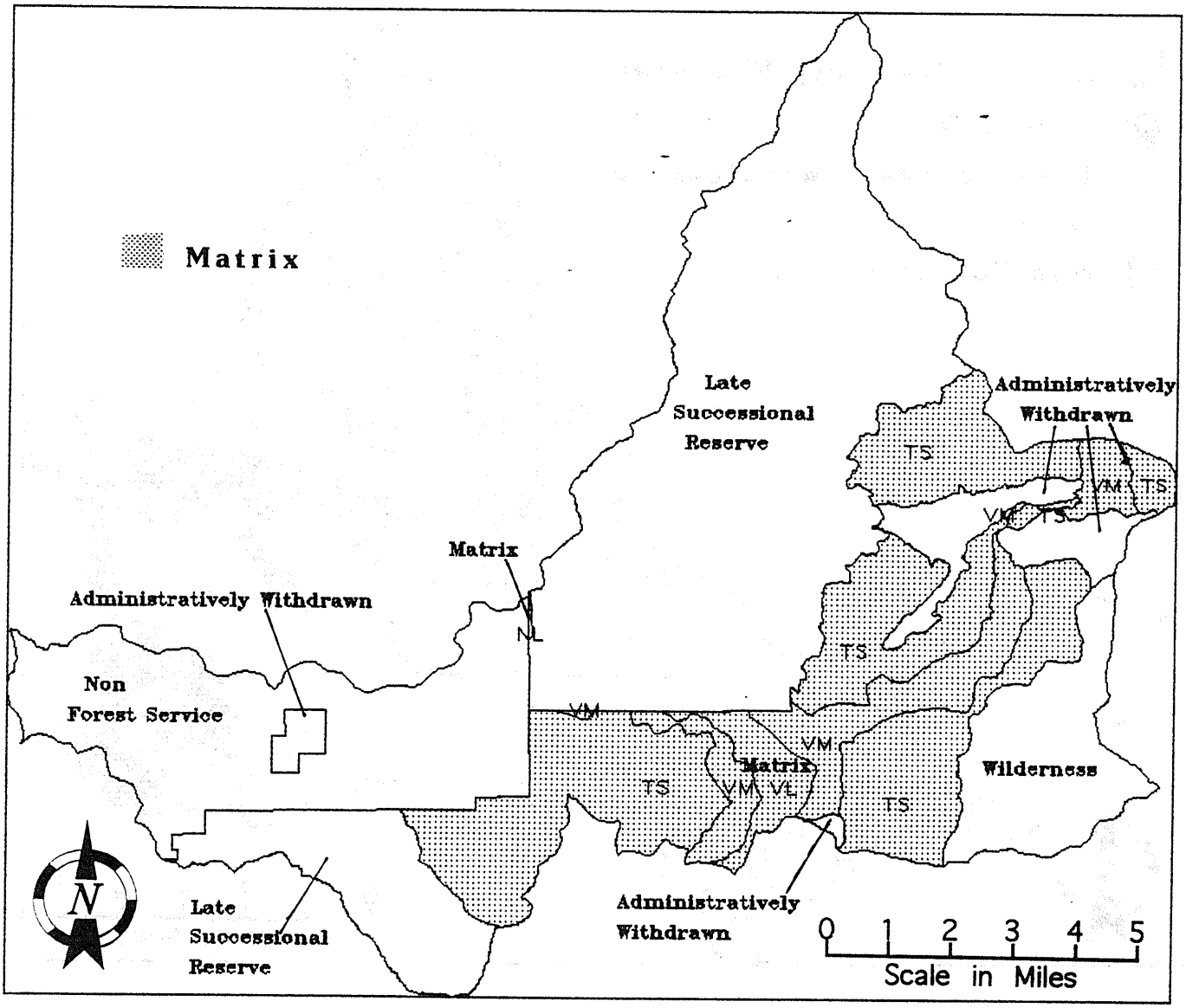


Figure 2 Land Allocations

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 Middle 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,
Resource conditions within the watershed, and

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. This is to describe the known or inferred history of the landscape to so we may know what was sustainable in the past and what changes have occurred to affect sustainability.

CHAPTER I CHARACTERIZATION

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

The Middle Lewis River Watershed Analysis Area encompasses an area of National Forest lands within the Lewis River drainage and its side tributaries, beginning at the confluence with the Muddy River and extending eastward to include Alec Creek and Chickoon Creek. Lands draining into Crab Creek, Big Creek, Little Creek, Meadow Creek, Rush Creek, Curly Creek, Outlaw Creek, Hardtime Creek, and Miller Creek are included. To the west, the Analysis Area also includes the mixed-ownership lands drained northward by Flat Creek, Timber Creek, Drift Creek and Range Creek to Swift Reservoir. See Figure 4, Ownership Map.

The Analysis Area is divided into 28 sub-basins Figure 5, Sub-basins Map.

The Middle Lewis River Watershed, which covers more than 102,000 acres, ranges in elevation from 1,008 feet at Swift Reservoir to 5,925 feet at the summit of Lemei Rock. All the land, water, plants, animals and people within this area make up the watershed ecosystem.

Formed by volcanic and glacial activity, the topography is rough with multiple ridge crests separated by steep, deeply dissected valleys. Most of the Middle Lewis River Watershed is composed of steep interbeds of basalt and andesite with thinner pyroclastic flows. Past glacial activity has over-steepened the terrain making it susceptible to deep-seated landslides. In the Indian Heaven area, lava flows which are believed to have formed beneath glacial ice are unique to this part of the National Forest.

The climate is maritime with prolonged overcast and precipitation and a narrow range of daily and annual temperature extremes. Winters are mild and wet, and summers are warm and dry.

Major surface water features in the analysis area include: (1) a series of small lakes and various sized wetlands southeast of the Lewis River, (2) stream dominated surface flow northwest of the Lewis River, and (3) Swift Reservoir which was created by damming the Lewis River. No Washington State Department of Ecology 303 (d) "water quality limited" segments occur in the area. These are segments identified by the Washington State Department of Ecology, as exceeding state water quality standards. According to water quality monitoring data, this portion of the Lewis River has exceeded the State water quality standards for stream temperature 18 times between 1975 and 1988.

Sub-basins

06 A	Miller Cr.	06 P	Meadow Cr/Lone Butte
06 B	Curly Cr.	06 Q	Upper Rush Cr.
06 C	Hardtime Cr.	06 R	Pepper Cr.
06 D	Outlaw Cr.	06 S	Little Cr.
06 E	Front Wall Tribs.	06 T	Lower Rush Cr.
06 F	Placid Lake	06 U	Sidewall Tribs
06 G	Skookum Mdw/Big Cr.	06 V	Big Cr.
06 H	Alec Cr.	06 W	Sidewall Tribs
06 I	Copper Cr.	06 X	Cussed Hollow
06 J	Middle Falls/Lewis R.	06 Y	Spencer Cr.
06 K	Cayuse Mdw/Big Cr.	06 Z	Sidewalls Curly/Rush
06 L	Chickoon Cr.	08 I	Timber Cr.
06 M	Crab Cr.	08 J	Drift Cr.
06 N	Upper Meadow Cr.	08 Y	Tribs to Swift Res.

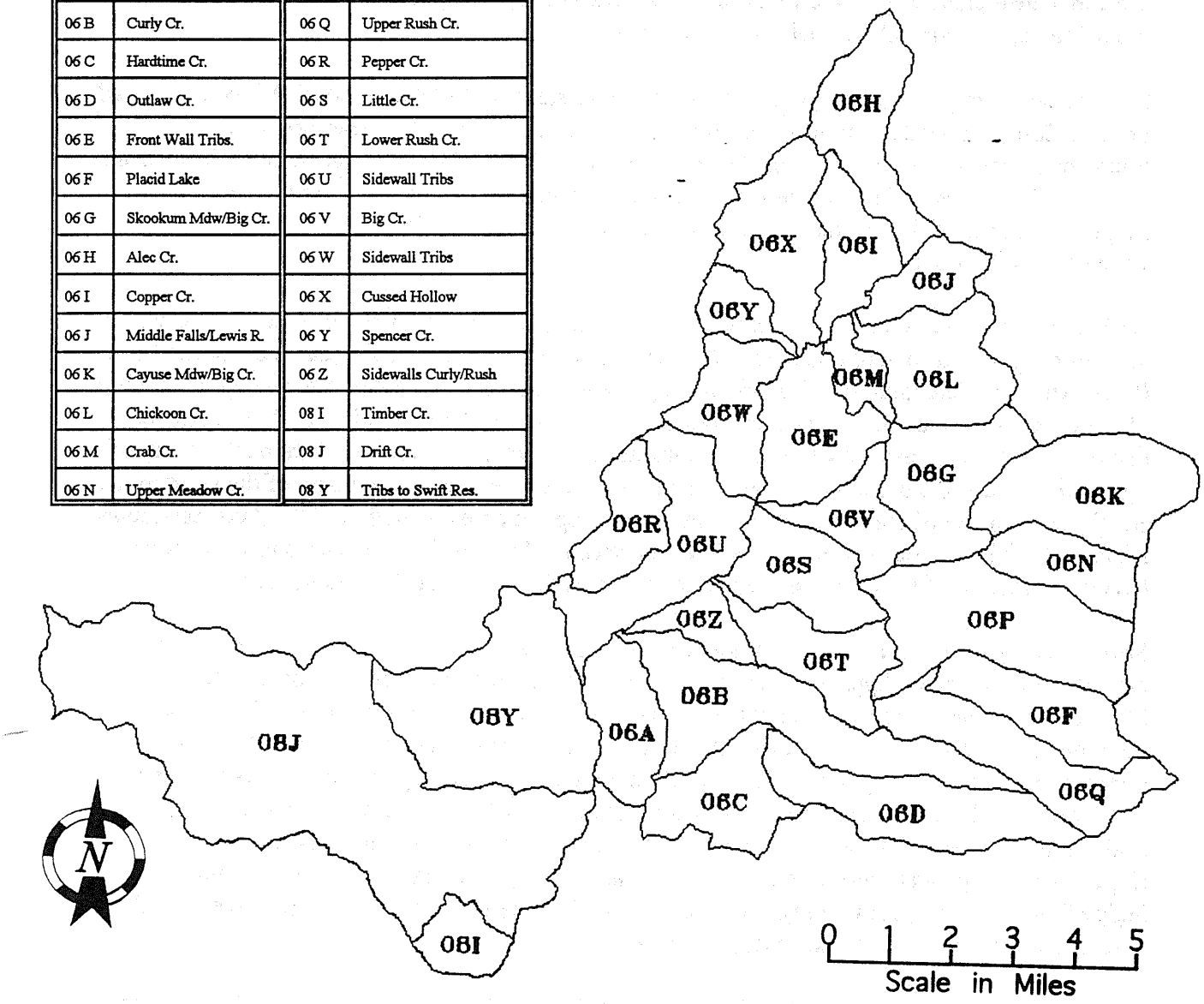


Figure 5 Sub-basins Map

Vegetation Zones (Ecoclasses)

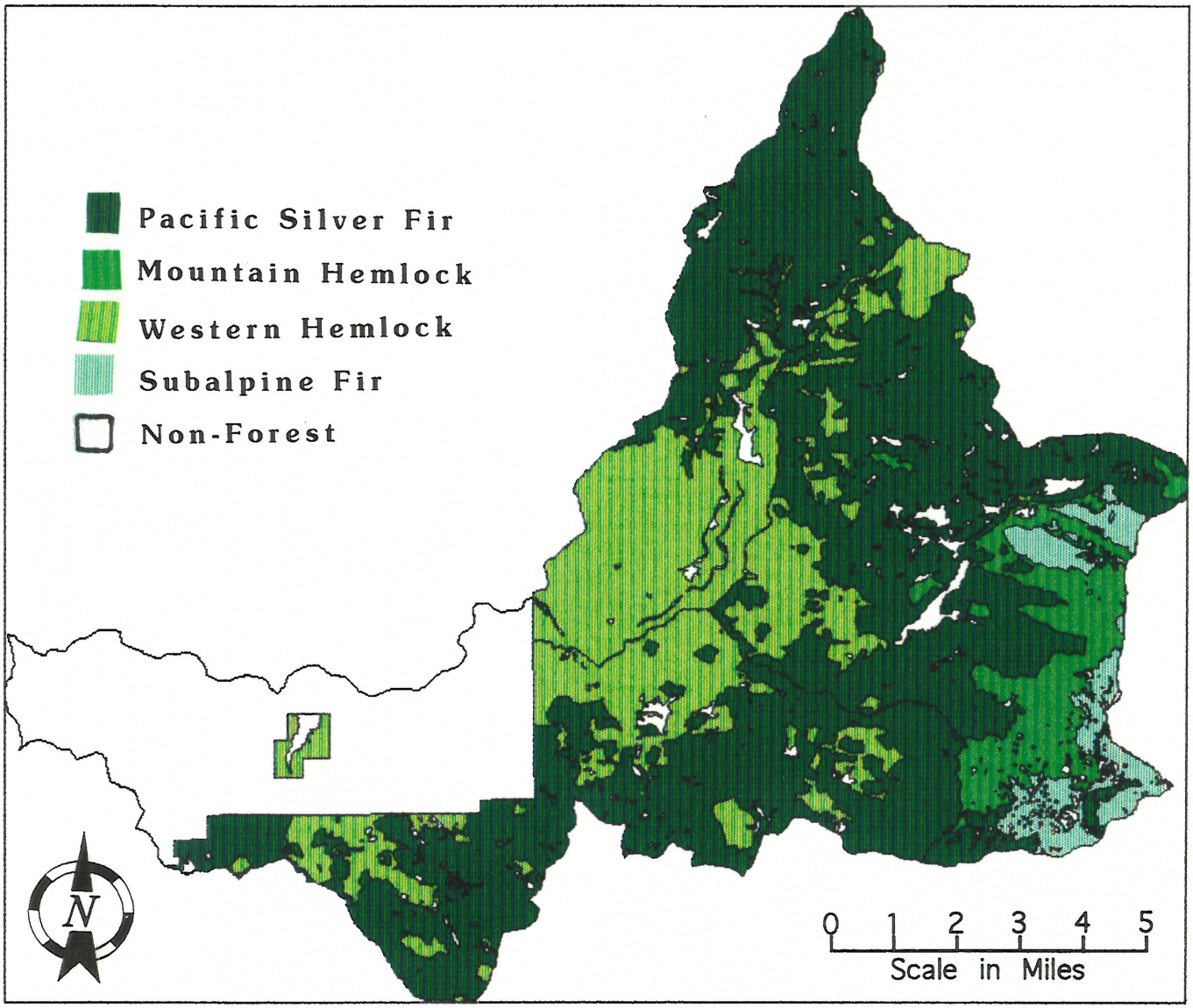


Figure 6 Vegetation Zones (Ecoclasses)

Riparian Reserves

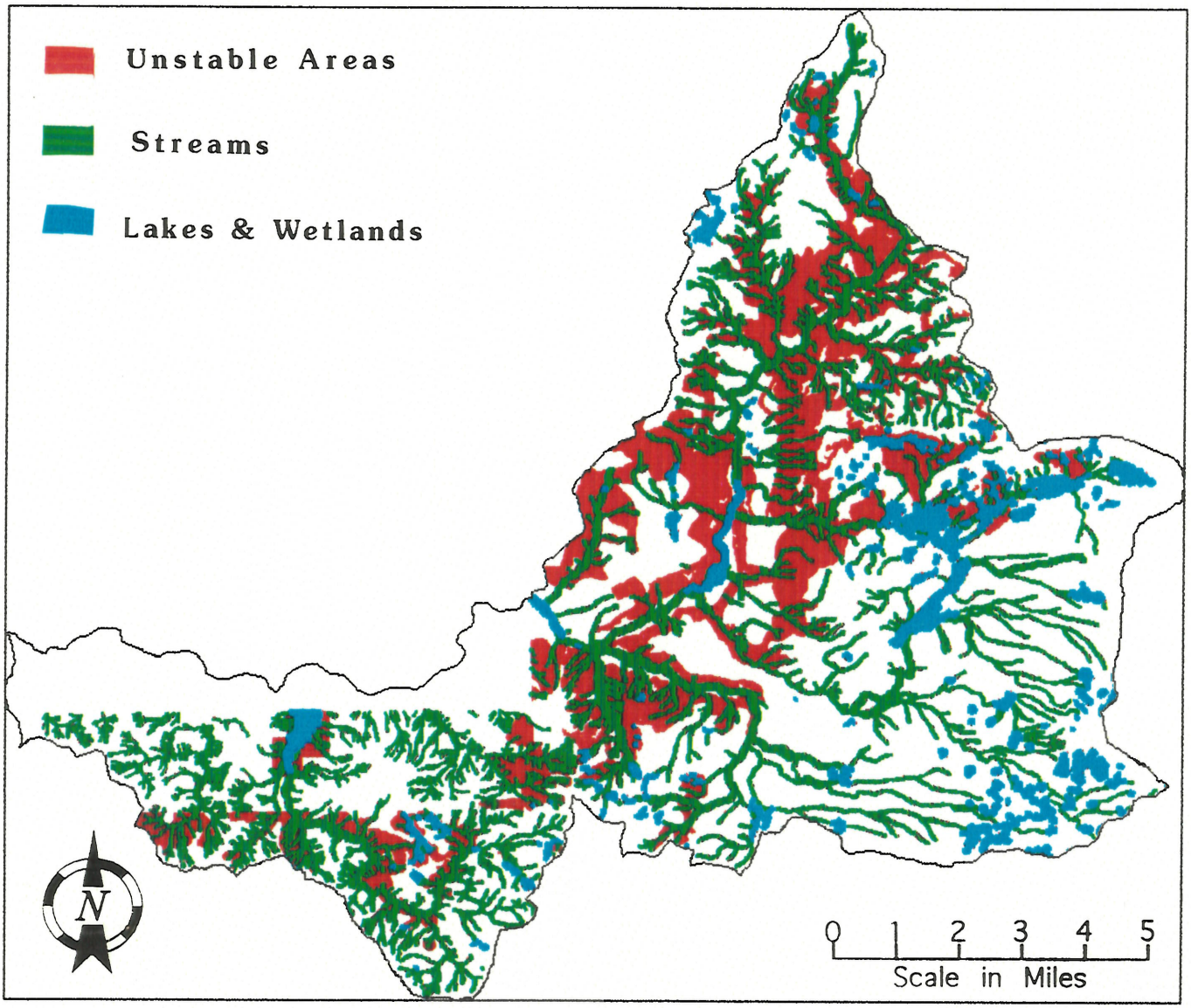


Figure 7 Riparian Reserves

animals both within the watershed and between Late Successional Reserves. Some organisms benefitting from Riparian Reserves include: fish, mollusks, amphibians, vascular plants, lichens, fungi, bryophytes, American marten, red tree voles, bats, marbled murrelets, and northern spotted owls. Riparian Reserves occupy 36,523 acres (36 percent) within the Middle Lewis River Watershed.

Archaeological surveys have documented 34 sites of prehistoric human use in the analysis area. Annually, small hunting and gathering groups moved into the higher elevations out of low elevation winter residences following resource availability. Evidence suggests they utilized game animals, berries, medicinal plants, and toolstone. Historically, Native American people collected relatively large quantities of huckleberries in the Indian Heaven and Paradise Hills area and reportedly used fire to promote their continued growth.

Until the dams and reservoir development (and associated roading) of the 1950's and 1960's, trails provided the primary access for human use of the Middle Lewis area. Subsequent road extensions paved the way for higher levels of timber harvest and further road development. Recreational use (sightseeing and dispersed camping) increased substantially with the improved accessibility. As use increased, facilities such as toilets were added to manage the human impacts to the ecosystem. Drawn by many attractions, most people visit the Middle Lewis Watershed year round for recreational activities. The Lewis River is a proposed addition to the national Wild and Scenic Rivers system. Timber management, including harvest, will continue on some lands under current land and resource management plans.

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 Middle Lewis River Watershed.

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

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.

The ID team invited Federal and State agencies, as well as Indian Tribes to assist with building a list of Issues and Key Questions needing to be analyzed. On May 11, 1995, the team met with the following representatives from those organizations who responded:

Tod Williams and Neal Darby, US Fish and Wildlife Service
Matt Longenbaugh, National Marine Fisheries Service
Ron Lee, Environmental Protection Agency
Nora Jewett, Washington Dept. of Ecology, and
Rollie Geppert, Washington Dept. of Fish and Wildlife.

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 up-to-date list of Issues and Key Questions was compiled. See Appendix C, List of Issues and Concerns.

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 Middle 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.

- **Stand Structure and Composition:** Timber harvest patterns and fires have altered stand structure and composition across the landscape by converting multiple-layered stands to single layer stands dispersed small patches. This has diminished diversity and distribution of plants, lichens, fungi, bryophyte, and animal species in some areas.

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

- **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 other plant species of concern are associated with these habitats. Under forest-wide standard and guideline FW-211 direction, these habitats and their ecotones are to be protected.

- **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.

- **Aquatic Habitat Fragmentation:** Aquatic habitat in the watershed has been fragmented and altered by road building, and hydro-electric development. Roads dams, and culverts alter the flow pattern of large woody debris and sediment in the system, as well as block fish passage to upper stream reaches.

- **Key Habitat Attributes, Resident Salmonids:** Road building and timber harvest combined with naturally unstable soils have through time altered the stream habitats and aquatic communities. This combined with hydro-electric development has affected the availability and quality of key habitat attributes for resident and anadromous salmonids.

- **Habitat for TES Species:** The watershed contains suitable or potentially suitable habitat for threatened, endangered, and sensitive (TES) species, including northern spotted owl, bald eagle, peregrine falcon, gray wolf, grizzly bear, and amphibians.

- **Late Successional Reserves and Spotted Owls:** Portions of two Late Successional Reserves (LSR's) are located within the watershed. Past timber harvest within the LSR's has left a portion of these areas unsuitable for spotted owls.

- **Elk and Deer:** The public has shown high interest in management of the elk herd at Lone Butte. A management plan has been written for this herd. The watershed contains elk and deer winter range.

- **Recreational Use and Development:** Installation of recreational facilities in the watershed has followed in the wake of road building for hydro-electric development and timber harvest. Future recreational use and development needs to be preceded by comprehensive planning.

CHAPTER III CURRENT CONDITIONS

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

Geology, Physical Processes, Soils

When analyzing the Middle Lewis River Watershed as a source of sediment, one first examines the geology and landform which in this case shows considerable variability. The geology is volcanic in origin with interbeds of andesitic and basaltic flows with pyroclastic flows and tephra deposits. Most soils are derived from volcanic ash deposits and colluvial deposits from weathered bedrock.

In the south and southeast portion of the watershed (Indian Heaven Area) glaciers have carved the area into gentle slopes with shallow soils and relatively stable landforms. Some mass wasting has been identified, but these areas have little adverse effect on aquatic habitats and water quality. However, the breaks in slope from there to the Lewis River and the adjoining tributaries are over-steepened slopes, where bedrock has weathered into clay and silt which in turn has caused some large deep-seated slope failures.

Mass Wasting

The Middle Lewis Watershed has numerous mass-wasting features (landslides and debris flows) that have impacted streams within the watershed, and prior to the construction of Swift Reservoir, downstream as well. Many soils having a high potential for mass wasting are mapped within the watershed (see Figure 8, Unstable Areas). Some of these mapped areas are concerns for causing detrimental effects in the identified beneficial-use areas and response reaches of the Lewis River and contributing streams (see Figure 9, High potential for sediment delivery to beneficial use areas).

All of the sub-basins bordering the Lewis River contain areas of concern from mass wasting and should be examined prior to initiating any ground disturbing activities.

Surface Erosion

Since road construction began in the 1930's and 1940's roading has been a major contributor of sediment to streams. The greatest amount of sediment coming from roads occurs during construction and in the following two or three years. After this, vegetation becomes established on the fill slopes and cutslopes helping to reduce problems. Uncontrolled traffic during wet seasons could contribute to sediment production. To a lesser degree, rock quarries that are no longer needed produce sediment through erosion. Road condition inventory data which will provide better information on actual problems that can be corrected in the future by restoration programs is presently being collected.

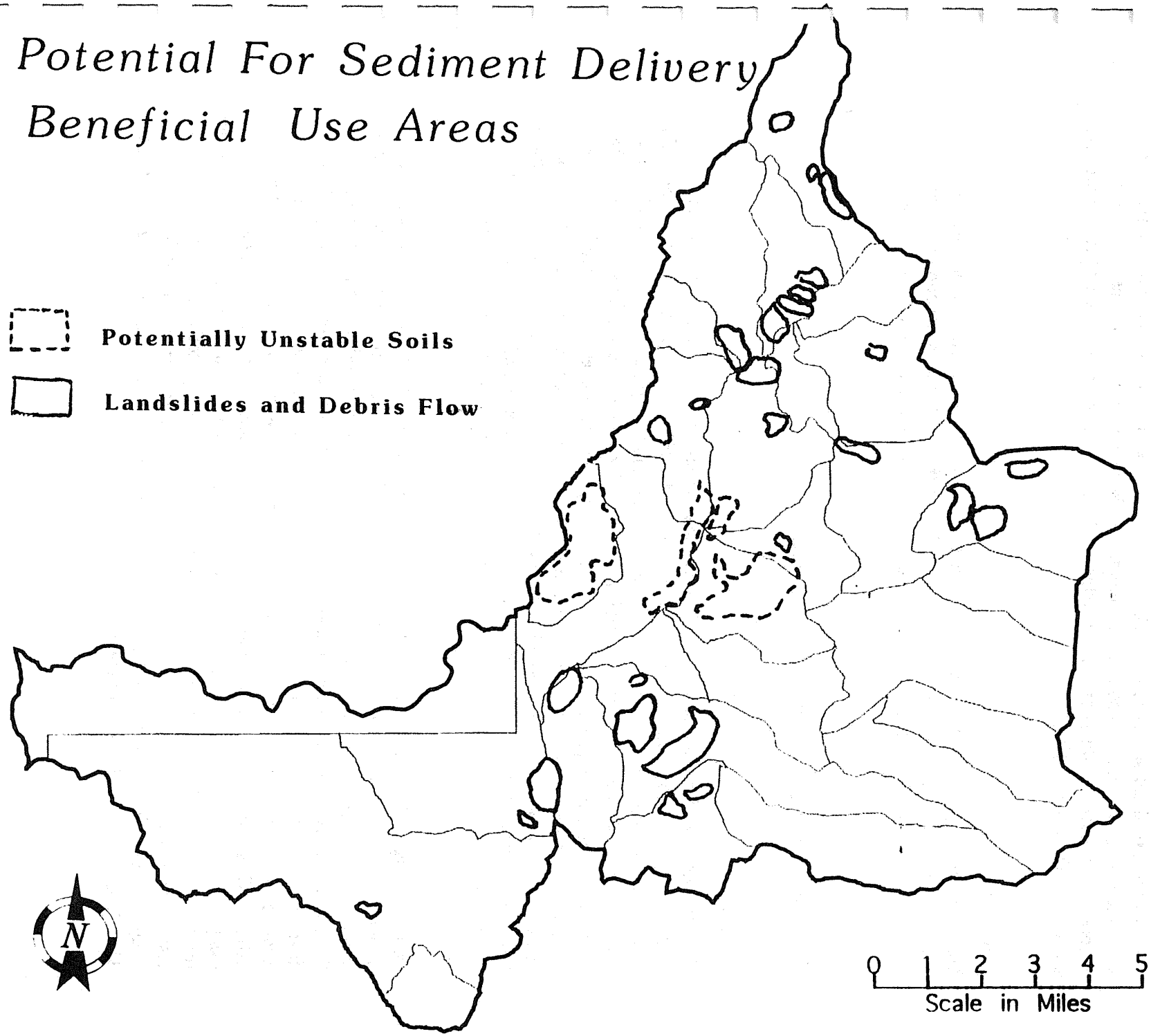


Figure 9 High Potential For Sediment Delivery To Beneficial Use Areas

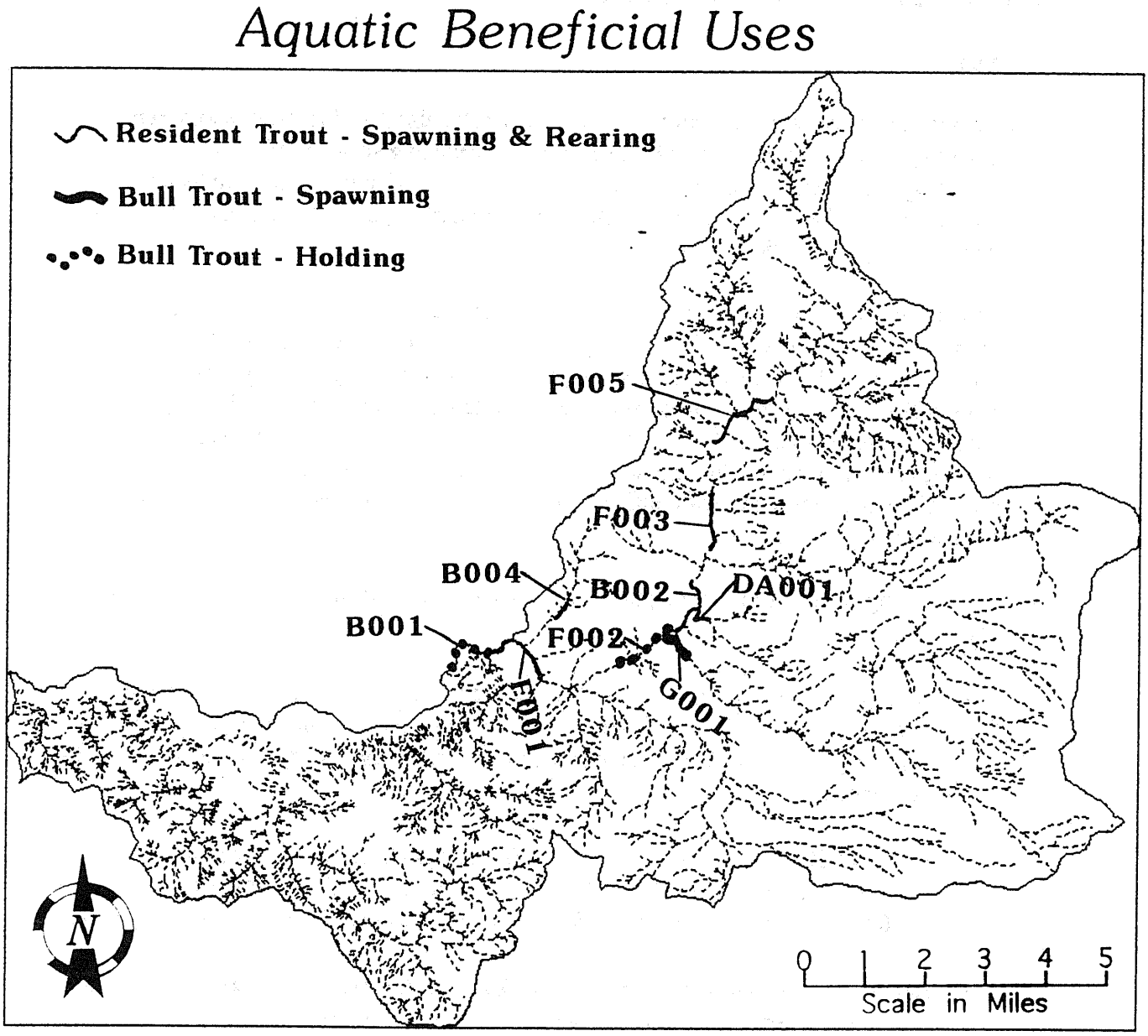
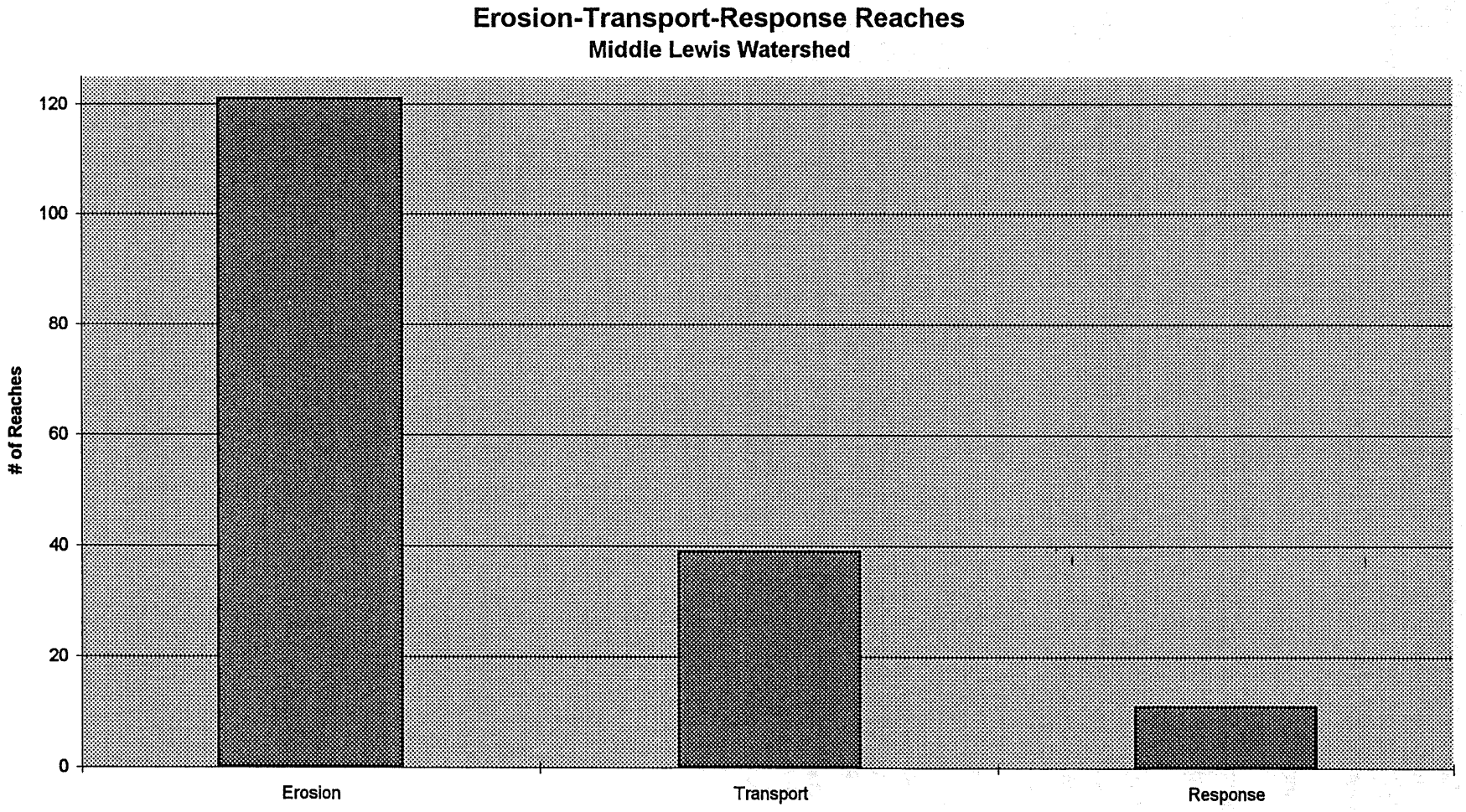


Figure 10 Aquatic Beneficial uses in Middle Lewis Watershed



The graph only includes those channels that were either surveyed or inventoried through air photograph interpretation, and does not include all stream channels within the middle watershed

Figure 11 Erosion-Transport-Response Reaches in the Middle Lewis Watershed

Stream Segments

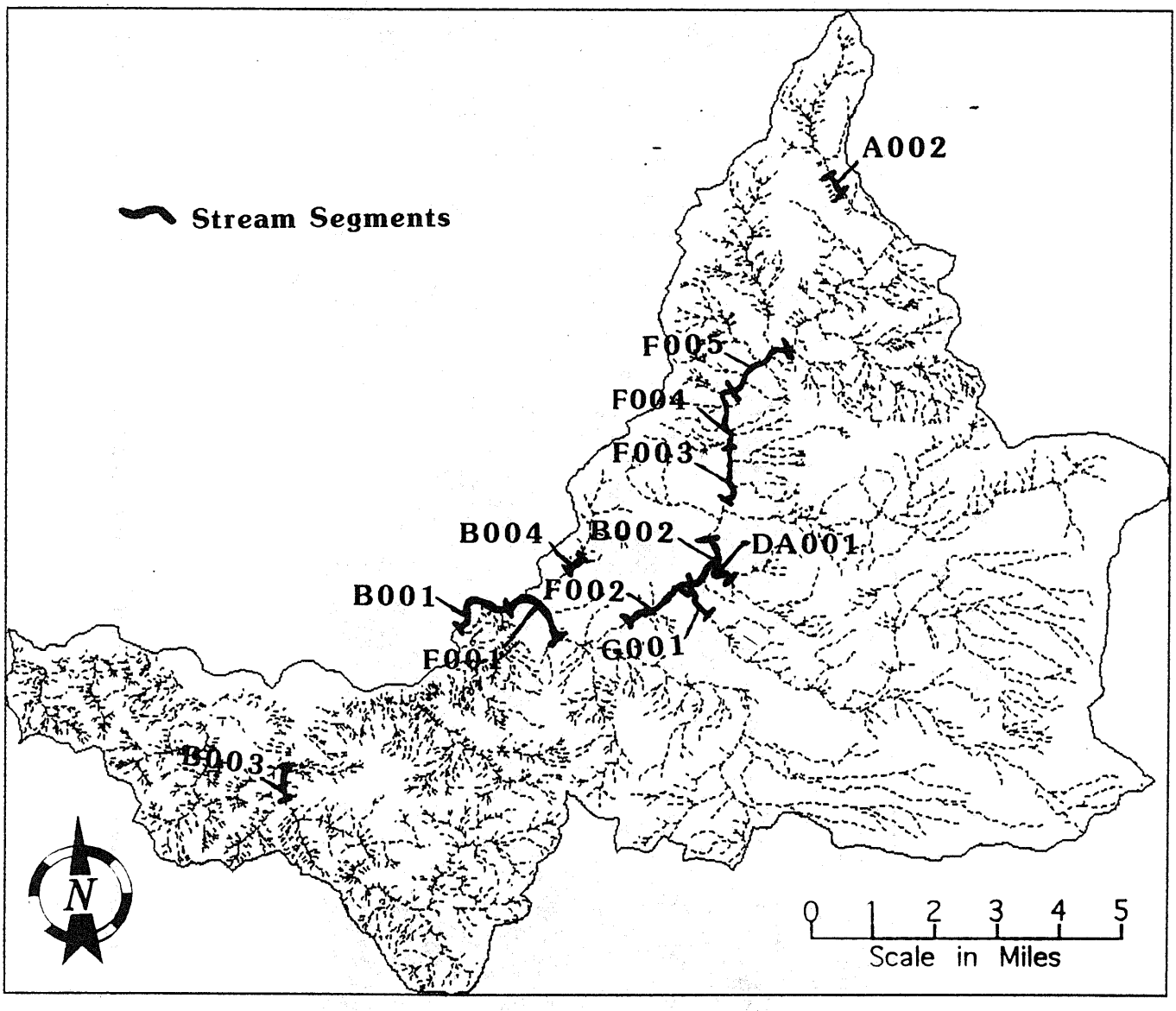


Figure 12 Response Stream Segments That Were Analyzed Using Historic Air Photographs

An analysis of maximum 7-day average stream temperatures was done with the most complete data sets available for the low flow period of June-September. Maximum 7-day average temperatures were calculated for these years to assess impacts to aquatic organisms (Figure 14, Maximum 7-day Average Temperature for Lewis River).

Low levels of shade produced by relatively young riparian vegetation in individual sub-basins may be contributing to increased temperatures. Sub-basins in the Middle Lewis Analysis Area that have more than 25 percent of the Riparian Reserves adjacent to streams (perennial and intermittent) removed by timber harvest include 06D, 06J, 06V, 08I, and 06P. Refer to the Upper Lewis Watershed Analysis document, March, 1995, for a list of sub-basins with more than 25 percent Riparian Reserves removed in the Upper Lewis area.

It is difficult to draw conclusions about cause/effect relationships with respect to stream temperature for the following reasons: 1) a large amount of missing data (only 1 year of complete records out of 13 years of operating the monitoring stations) 2) lack of other monitoring stations in the watershed and 3) site specific riparian shade data is not available. It is important, however, to note that state standards were still being exceeded at this monitoring site as late as 1988.

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 of response reaches were made from 1959, 1979, and 1989 aerial photos:

- Large woody debris is present in reach #F001 (See Figure 10, Aquatic Beneficial Uses, Page 21) of the Lewis River in two small log jams on upstream portions of small islands. This material was deposited during the 1970's floods. The number and size of debris jams is smaller than in 1979 and the amount of dispersed large woody debris is less.

- Moderate amounts of large woody debris are present in reaches #F003 and #F005 (See Figure 10, Aquatic Beneficial Uses, Page 21) of the Lewis River dispersed in channel margins and alongside channels of islands.

- High amounts of large woody debris are present in reach #G001 (See Figure 10, Aquatic Beneficial Uses, Page 21) of Rush Creek, dispersed along the entire reach.

Refer to the section of this chapter discussing Aquatic Animals and Habitat, TES Species, for areas that are low in large woody debris recruitment potential for the analysis area.

Peak Flow

Peak flow increases may affect a channel by increasing 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 only addresses bank erosion since stream substrate data is not available to evaluate increased channel bed scour frequency and magnitude.

- High amounts of bank erosion are present in reach #B002 (See Figure 10, Aquatic Beneficial Uses, Page 21) of the Lewis River, concentrated near the confluence of Little Creek and the Lewis River.

- Moderate to high amounts of bank erosion are present in reach #F002 (See Figure 10, Aquatic Beneficial Uses, Page 21) of the Lewis River.

- Reaches that have smaller sections of bank erosion include #F001, #F005, and #G001 (See Figure 10, Aquatic Beneficial Uses, Page 21).

- Another fish-bearing reach not having identified spawning and rearing habitat, that has bank erosion is #F004 (See Figure 12, Stream Segments, Page 25) of the Lewis River.

Refer to the discussion about Hydrologic Changes that follows for areas that may be contributing to increased peak flow.

Summary

Table 1, below displays reaches that contain beneficial uses and the potential for those reaches to degrade when the amount of input variables such as sediment, solar radiation, wood, or water change.

Increased Peak Flow From Management Activities

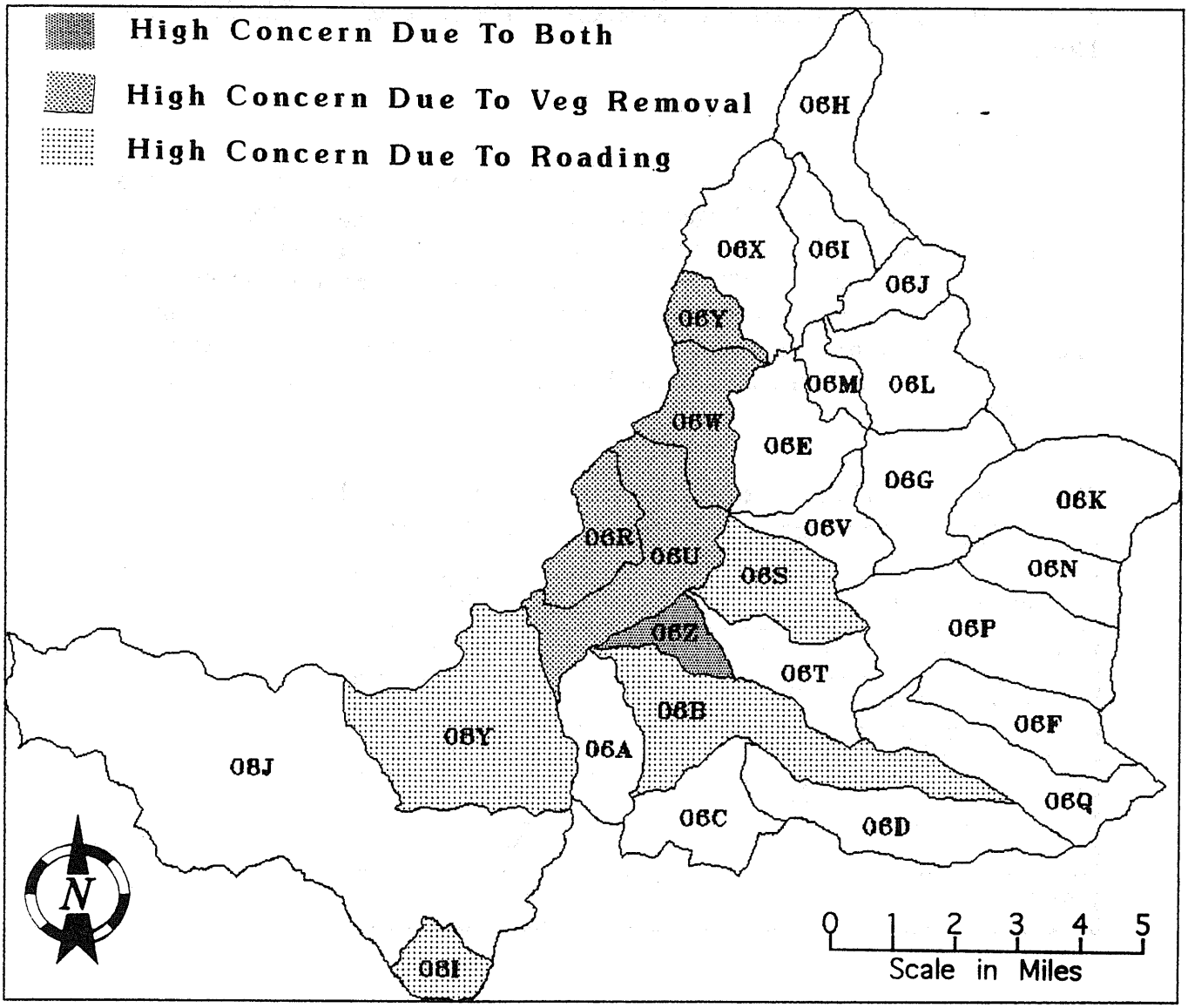


Figure 15 Increased Peak Flow From Management Activities

Table 3 Vegetation Zones by Sub-basin in the Middle Lewis Watershed

Sub-Basin	Total	W Hemlock		Silver Fir		Mt. Hemlock		Sub-Alpine Fir		Wetland		Water		Non-Forest	
	Acres	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
06A	2400	1279	53%	1041	43%	0.00	0	0.00	0	61	3%	0.00	0	20	1%
06B	5499	2177	40%	2773	50%	227	4%	8.00	trace	99	2%	1.00	trace	212	4%
06C	2725	346	13%	2279	84%	1.00	trace	0.00	0	93	3%	0.00	0	5.00	trace
06D	4086	264	7%	3078	75%	176	4%	468	12%	50	1%	47	1%	3.00	trace
06E	3291	1419	43%	1644	50%	0.00	0	0.00	0	7.00	trace	3.00	trace	206	6%
06F	2754	0.00	0	778	28%	1327	48%	490	18%	51	2%	70	3%	38	1%
06G	3526	7	trace	2890	82%	107	3%	0.00	0	520	15%	0.00	0	0.00	0
06H	3346	64	2%	3176	95%	0.00	0	19	1%	69	2%	1.00	trace	16	1%
06I	2162	193	9%	1881	87%	0.00	0	0.00	0	6.00	trace	0.00	0	83	4%
06J	1564	1229	79%	333	21%	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0
06K	4531	30	1%	2567	57%	843	19%	688	15%	374	8%	9.00	trace	9.00	0
06L	3376	195	6%	3129	93%	0.00	0	0.00	0	21	trace	0.00	0	33	1%
06M	962	258	27%	698	73%	0.00	0	0.00	0	3.00	trace	0.00	0	2.00	trace
06N	2078	0.00	0%	234	11%	1232	59%	590	28%	22	1%	0.00	0	0.00	0
06P	5792	185	3%	3561	62%	1319	23%	294	5%	400	7%	14	trace	18	trace
06Q	3763	87	2%	1396	37%	886	24%	1189	32%	90	2%	38	1%	73	2%
06R	2031	2028	100%	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	3.00	trace
06S	2785	2239	80%	516	19%	0.00	0	0.00	0	0.00	0	18	1%	9.00	trace
06T	2708	961	36%	1731	64%	0.00	0	0.00	0	11	trace	0.00	0	3.00	trace
06U	4332	4058	94%	85	2%	0.00	0	0.00	0	0.00	0	55	1%	103	2%
06V	1869	504	27%	1338	72%	0.00	0	0.00	0	13	trace	0.00	0	15	1%
06W	2542	1145	45%	1302	51%	0.00	0	0.00	0	1.00	trace	8.00	trace	86	3%
06X	3499	264	8%	3110	89%	0.00	0	0.00	0	88	3%	0.00	0	37	trace
06Y	1112	34	3%	1074	97%	0.00	0	0.00	0	0.00	0	0.00	0	4.00	trace
06Z	1102	1023	93%	54	5%	0.00	0	0.00	0	0.00	0	0.00	0	17	2%
08I	1233	196	16%	1015	82%	0.00	0	0.00	0	1.00	trace	0.00	0	21	2%
08J	18874	2451	13%	5819	30%	0.00	0	0.00	0	152	trace	161	0	122	trace
08Y	7150	385	6%	905	13%	0.00	0	0.00	0	2.00	trace	0.00	0	23	trace
TOTAL H20SHED	102093	23034	27%	48439	57%	6118.00	7%	3745	4%	1491	2%	427	1%	1799	2%

Grouped Coniferous Vegetation Structure Stages

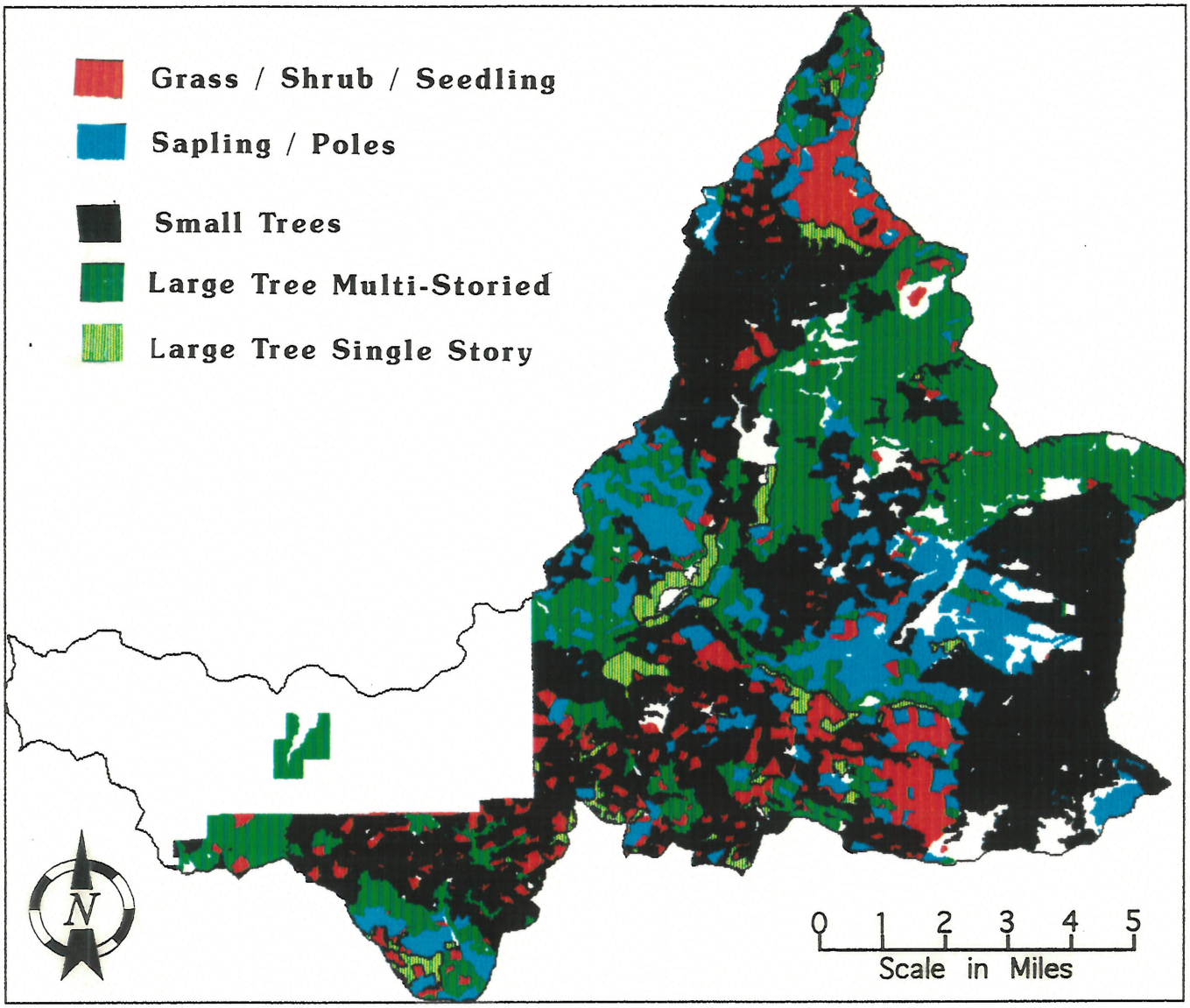


Figure 16 Grouped Coniferous Structure Stages

Grouped Other Vegetation Structure Stages

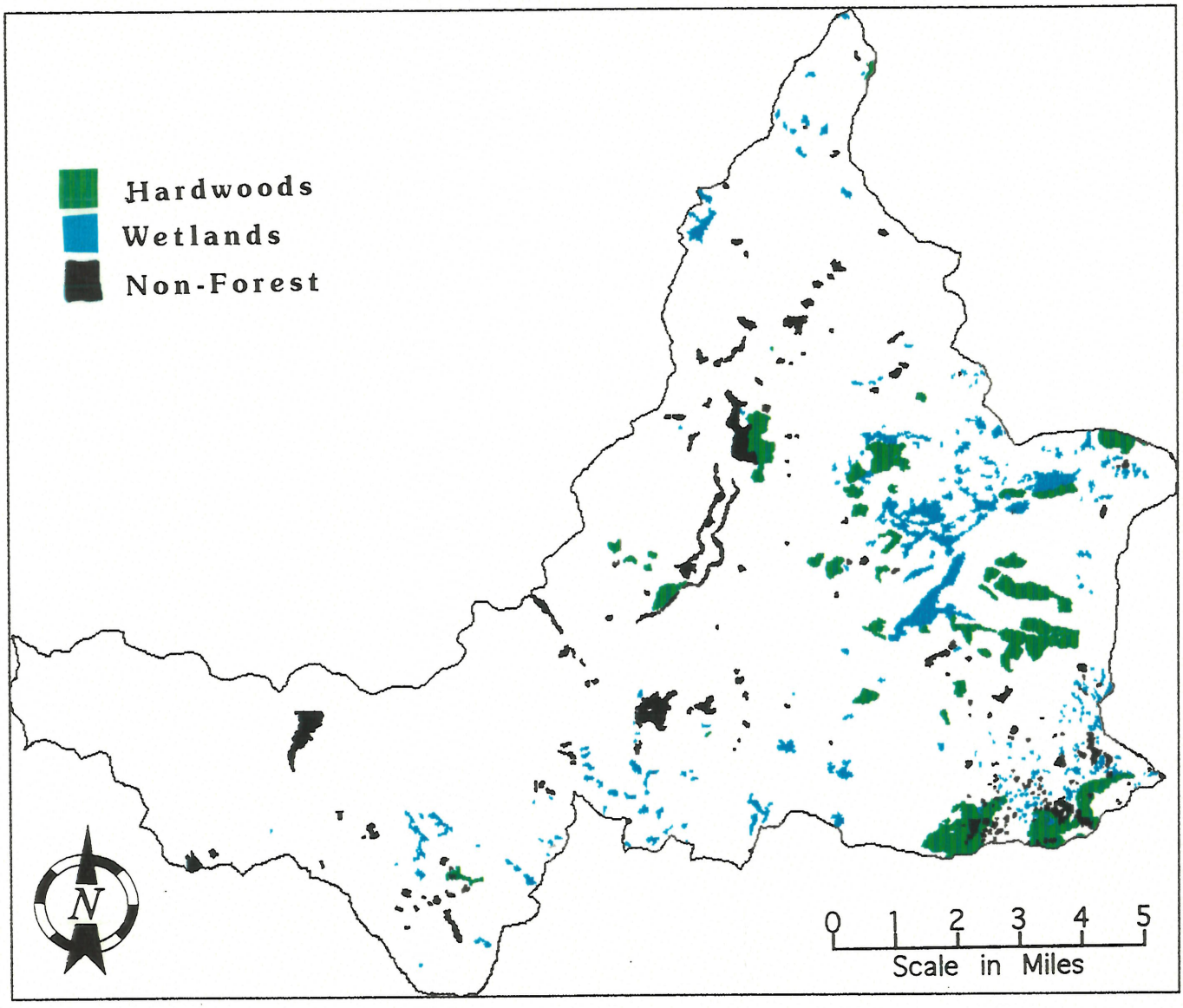


Figure 17 Grouped Other Vegetation Structure Stages

Table 5 Grouped Vegetation Structure Stages for Sub-basins Within the Middle Lewis Watershed.

Sub-Basin	Total Acres	Percent Harvested	Percent Grass-Sap	Percent Open Sap S-T	Percent Closed Sap - ST	Percent Lg Tree 1-Layer	Percent Lg Tree Multi-Layer	Percent HW	Percent Non-Forest
06A	2400	18%	13%	21%	40%	12%	11%	0%	4%
06B	5499	40%	25%	10%	48%	7%	5%	0%	6%
06C	2725	21%	15%	25%	38%	7%	12%	0%	0%
06D	4086	34%	25%	28%	15%	3%	10%	16%	2%
06E	3291	13%	13%	13%	16%	4%	50%	7%	6%
06F	2754	14%	0%	16%	75%	0%	2%	1%	6%
06G	3526	23%	23%	12%	20%	0%	41%	7%	15%
06H	3346	35%	32%	32%	10%	2%	21%	1%	3%
06I	2162	10%	27%	5%	52%	13%	0%	0%	4%
06J	1564	46%	11%	19%	2%	0%	48%	0%	0%
06K	4531	4%	1%	16%	17%	0%	52%	5%	8%
06L	3376	8%	2%	5%	13%	0%	74%	<1%	2%
06M	962	9%	2%	2%	1%	0%	69%	0%	<1%
06N	2078	13%	0%	34%	0%	0%	0%	0%	1%
06P	5792	56%	3%	39%	33%	1%	3%	13%	7%
06Q	3763	23%	13%	34%	35%	2%	4%	7%	5%
06R	2031	43%	3%	36%	20%	0%	40%	0%	<1%
06S	2785	32%	6%	6%	68%	1%	16%	16%	1%
06T	2708	49%	4%	13%	44%	9%	20%	0%	<1%
06U	4332	46%	5%	20%	32%	11%	25%	2%	3%
06V	1869	34%	3%	20%	48%	2%	21%	6%	2%
06W	2542	29%	7%	36%	48%	0%	6%	0%	<1%
06X	3499	23%	59%	29%	53%	0%	1%	0%	4%
06Y	1112	2%	2%	97%	0%	0%	0%	0%	<1%
06Z	1102	47%	23%	9%	36%	9%	5%	0%	1%
08I	1233	55%	15%	13%	31%	18%	22%	0%	2%
08J	18874	19% NF	17% NF	4% NF	54% NF	2% NF	30% NF	<1% NF	6% NF
08Y	7150	23% NF	23% NF	4% NF	54% NF	2% NF	2% NF	0%	2% NF
H2OShed	102093	28% NF	12% NF	20% NF	36% NF	4% NF	21% NF	3% NF	4% NF

Sub-basins 08J and 08Y, which are primarily private, show structure stages for National Forest (NF) lands only.

Riparian Reserves

Many acres of riparian ecosystem, especially stream riparian areas, have been harvested (Figure 18, Harvested units within Riparian Reserves). The removal of riparian vegetation has left streams vulnerable to erosion and aquatic habitat degradation, has reduced or eliminated migration corridors for animals and plants, and impaired connectivity between areas of old growth habitat. Timber harvest by sub-basin and within Riparian Reserves is summarized in Table 6, Page 38. Table 7 highlights sub-basins where greater than 25 percent of the Riparian Reserve has been harvested.

Table 7 Sub-basins within the Middle Lewis Watershed where 25 percent or more of the Riparian Reserves has been harvested.

Sub-Basin	% Sub-Basin In Riparian Reserve	% Sub-Basin Riparian Reserve Harvested
06B	40%	25%
06D	23%	25%
06H	52%	30%
06J	47%	53%
06P	25%	42%
06R	59%	50%
06U	50%	35%
06W	62%	30%
08I	26% of NF land	51% of NF land
08J	22% of NF land	12% of NF land *
08Y	12 % of NF land	73% of NF land

* Fifty-nine percent of this sub-basin is not National Forest (NF) land, the majority of which has been harvested.

Harvested Units Within Riparian Reserves

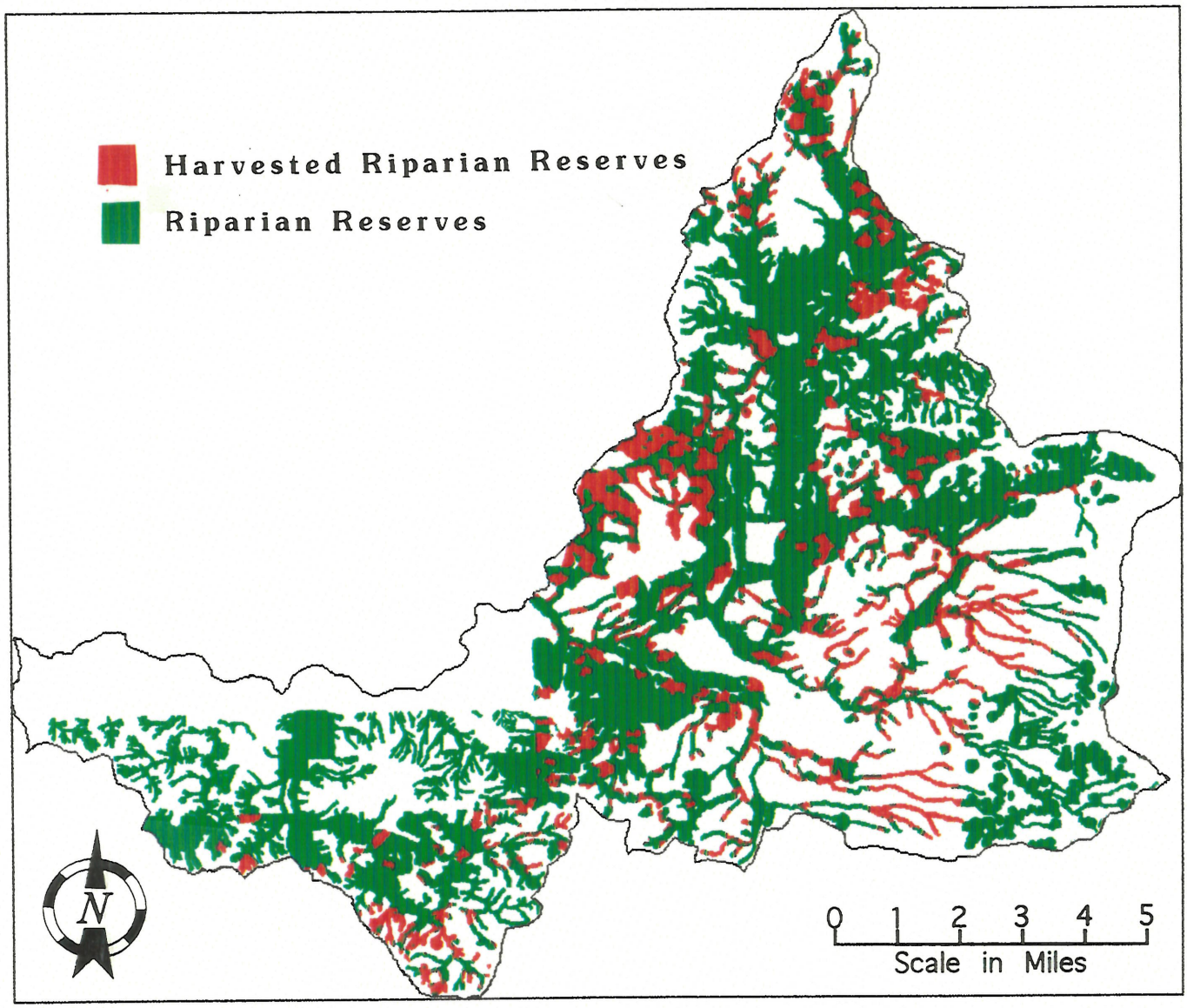


Figure 18 Harvested Units Within Riparian Reserves

TES Plants

Of the 35 TES vascular plant species either documented or suspected to occur in the Mt. St. Helens Administrative Unit, two State listed Threatened and four State listed Sensitive species have been found within the Middle Lewis Watershed (Table 8).

Table 8 Documented and suspected TES plant species within the Middle Lewis Watershed.

Species	Federal Status	State Status	C-3 Status	MLWA	MSH Unit
Agoseris elata	-	S	-	S	S
Botrychium lanceolatum	-	S	-	S	D
B. lunaria	-	S	-	D	D
B. minganense	-	S	-	S	S
B. montanum	-	S	-	S	S
B. pinnatum	-	S	-	D	D
Carex atrata var. erecta	-	S	-	S	D
C. densa	-	S	-	S	S
C. interrupta	-	S	3	D	D
C. scopulorum v prionophylla	-	S	-	S	S
Chrysolepis chrysophylla	-	S	-	S	D
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

Found along 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 typicallyl course gravels free of other understory competitors. Riparian buffers are especially important for this species.

Pleuricospora fimbriolata (fringed pinesap)

Found in the duff and humus layer in shaded coniferous forests from southern Washington to California.

Sisyrinchium sarmentosum (blue-eyed grass)

Local endemic found in Klickitat, Skamania, Clark and adjacent counties. Occurs in moist meadows and streamsides between 1900' and 2500' elevation.

C-3 Species (ROD C-49)

Data on C-3 lichens, bryophytes, and fungi are almost non-existent for the Middle Lewis watershed, and no formal surveys have been conducted. Table 9, lists C-3 lichens documented on the Mt. St. Helens Administrative Unit and suspected to occur in the Middle Lewis Watershed. Table 10, lists C-3 fungi documented in the Paradise Hills area and suspected to occur in other portions of the watershed.

Table 10 Fungi on C-3 Survey and Manage list (ROD C-49) known to occur on the Middle Lewis Watershed Analysis area (Paradise Hills DEMO).

Species	Acronym	Survey & Manage Strategy	DEMO Unit
Cantharellus cibarius	CACI	3,4	5,6
Cantharellus subalbidus	CASU	3,4	1,2,3,4,5,6
Gomphus floccosus	GOFL	3	1,2,3,4,5,6
Hydnum repandurn	HYRE	3	6

Special Habitats: Plants

Riparian areas and old-growth provide the majority of special plant habitat. Although many riparian areas have been impacted by timber harvest activity, the creation and restoration of Riparian Reserves is intended to protect special plant habitat in the future.

Fire and Fuels

Historically, wildfires have been a major natural change agent in the forest landscape of the Middle Lewis River Watershed. Fire has been an integral part of the forest ecosystem, affecting wildlife habitat, vegetation dynamics, soil properties and watershed hydrology. From studying maps, aerial photos, and tree fire scars, it appears that large, low frequency, high-intensity stand replacement fires occurred throughout the area prior to European settlement in the mid 1800's. Historically, Yakama, Klickitat and Cowlitz Native American groups set fire to logs for drying berries, and lingering fires sometimes spread. Fires may have also been set intentionally to maintain berryfields or to keep hunting areas open. Non-Native American settlement in the local area began in the 1850's, and many fires were set to clear land. Many large fires at the turn of the 20th century were started as a result of increased human presence and careless burning practices. Lightning may have also accounted for many of the observed fire scars in the area.

The natural fire regime of the Middle Lewis is similar to other Western Cascade forest locations; major fires at any point are infrequent (50 to 400 year intervals) but catastrophic in their effects. Highly productive sites and long-lived tree species associated with the Douglas-fir Zone accumulate great quantities of intermediate to large class fuels. Fine fuels, the most readily ignitable, are present in relatively small amounts. Fine fuels reach their maximum dryness in July and August, while larger fuels do not usually dry out until September. The eruption of Mount St. Helens in 1980 modified the fuel characteristics of the area somewhat in that much of the fine fuel was covered with one to two inches of ash and/or pumice thus reducing both the potential rates of spread and intensity. Most fires in any given year occur in July and August, but the majority of these are less than 10 acres in size. Most of the larger fires, and virtually all of the catastrophic fires, occur during late August to early October, usually in September, the period of high East winds.

Since 1930 very little of the watershed area has burned due to wildfire. Areas that show signs of large historical fire include Cayuse Meadows/Squaw Butte, Hungry Peak, Crazy Hills and much of the Lewis River Valley bottom. While there is no method to accurately describe the size and perimeters of these fires they are estimated

Large Historical Fires
1900 - 1930

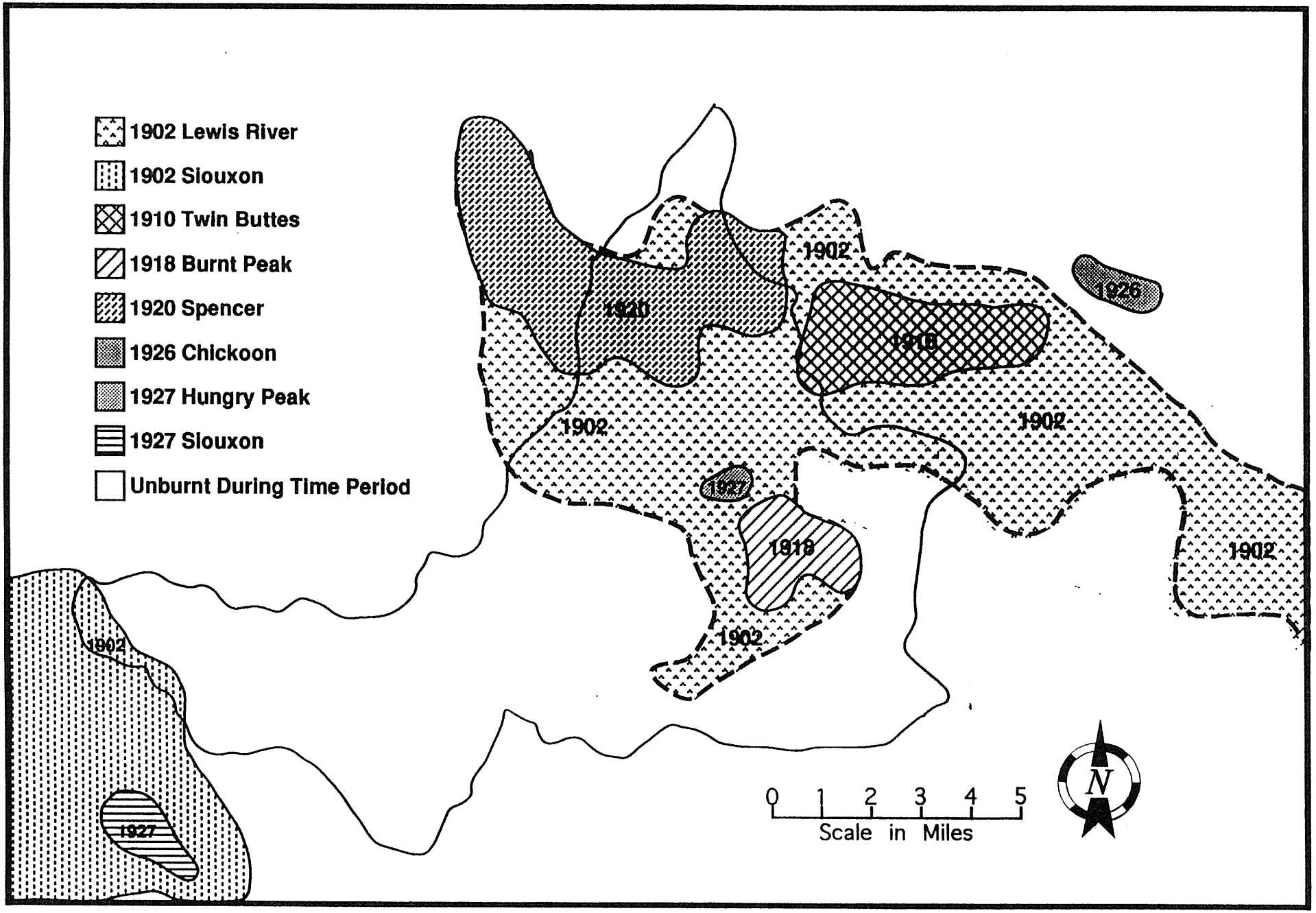


Figure 19. Large Historical Fires

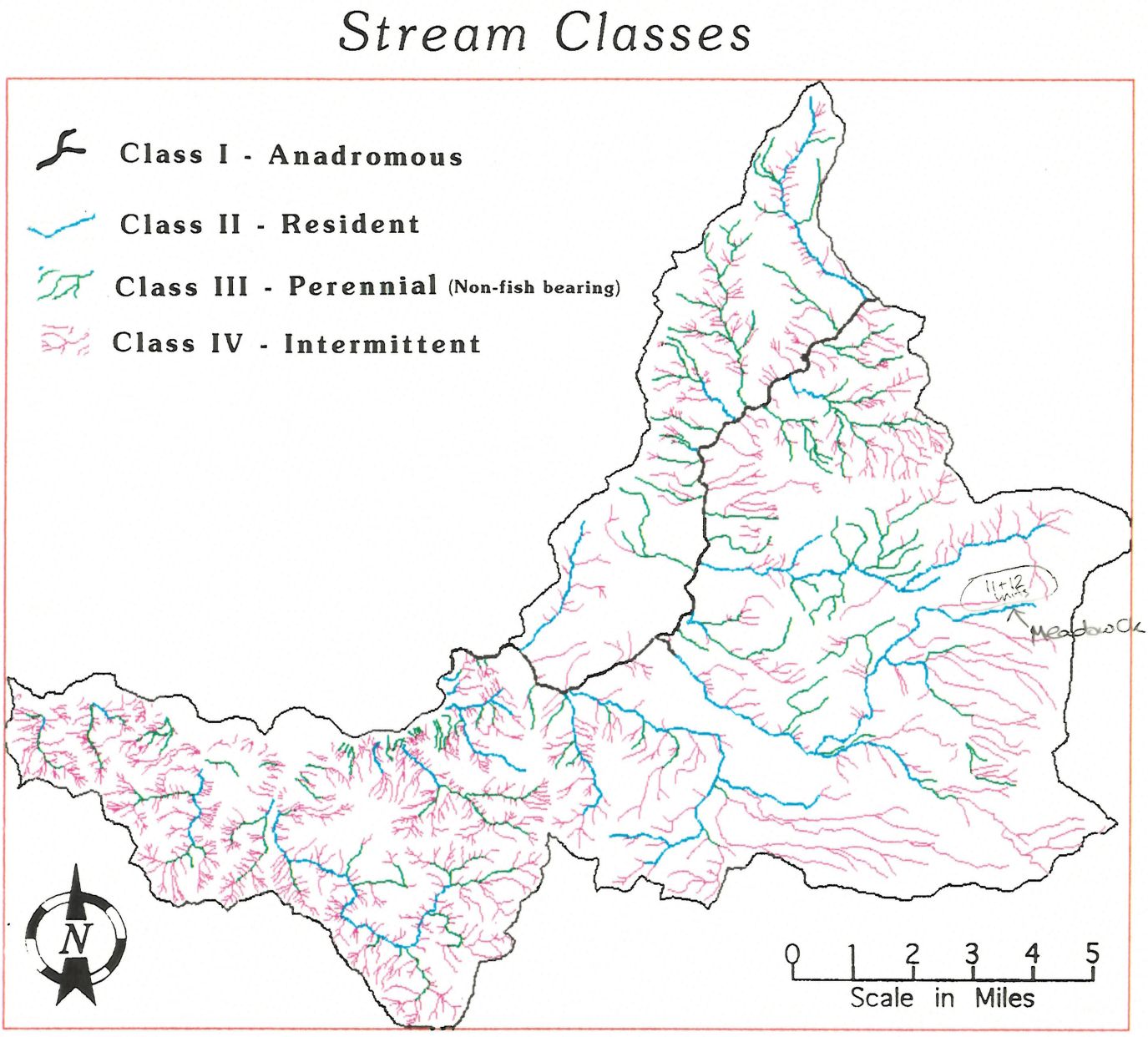


Figure 20, Stream Classes In the Middle Lewis River Watershed

Stream habitat surveys have been completed on approximately 12.5 miles of stream in seven of the sub-basins. Lake habitat surveys have been completed on four of the lakes all of which lie in sub-basins 06D, 06F, and 06Q.

Lake survey data indicate fish are not reproducing, therefore a stocking program is necessary to continue offering recreationists fishing opportunities. Fish growth is greatest in lakes with large prey such as crawfish. Recreation impacts include human waste problems and campsites located within riparian areas adjacent to lake shores (Bair, 1991).

Fish are the focus of this discussion because information about aquatic organism populations is limited. Fish currently occupy about 77 miles of stream in the watershed. Resident species include: rainbow, cutthroat, bull and eastern brook trout, whitefish, large scale sucker and sculpin.

Aquatic organisms are sensitive to a variety of disturbance factors and have specific habitat requirements for their life stages. The most sensitive habitat factors for species present are displayed in Table 11 Habitat Sensitivity Factors for Aquatic Organisms, by Life Stage.

Existing habitat conditions were evaluated using the following aquatic habitat attributes: pieces of LWD per mile, primary pools per mile, water temperature, and aquatic habitat fragmentation.

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 sideslopes). Management activities 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 Guide (PIG) contains standards for quantities of LWD in western Cascade streams to provide quality salmonid habitat. In surveys, streams are evaluated against this standard to determine a rating of Good, Fair or Poor. Streams rated as "Good" meet or exceed the standard of 80 pieces per mile. "Fair" streams contain 40-79 pieces of LWD, and streams in "Poor" condition contain less than 40 pieces of LWD per stream mile. Stream survey data indicate 15 percent of the surveyed streams are rated as poor, 16 percent are rated as fair, and 69 percent are rated as good (Figure 21, Large Woody Debris per Mile).

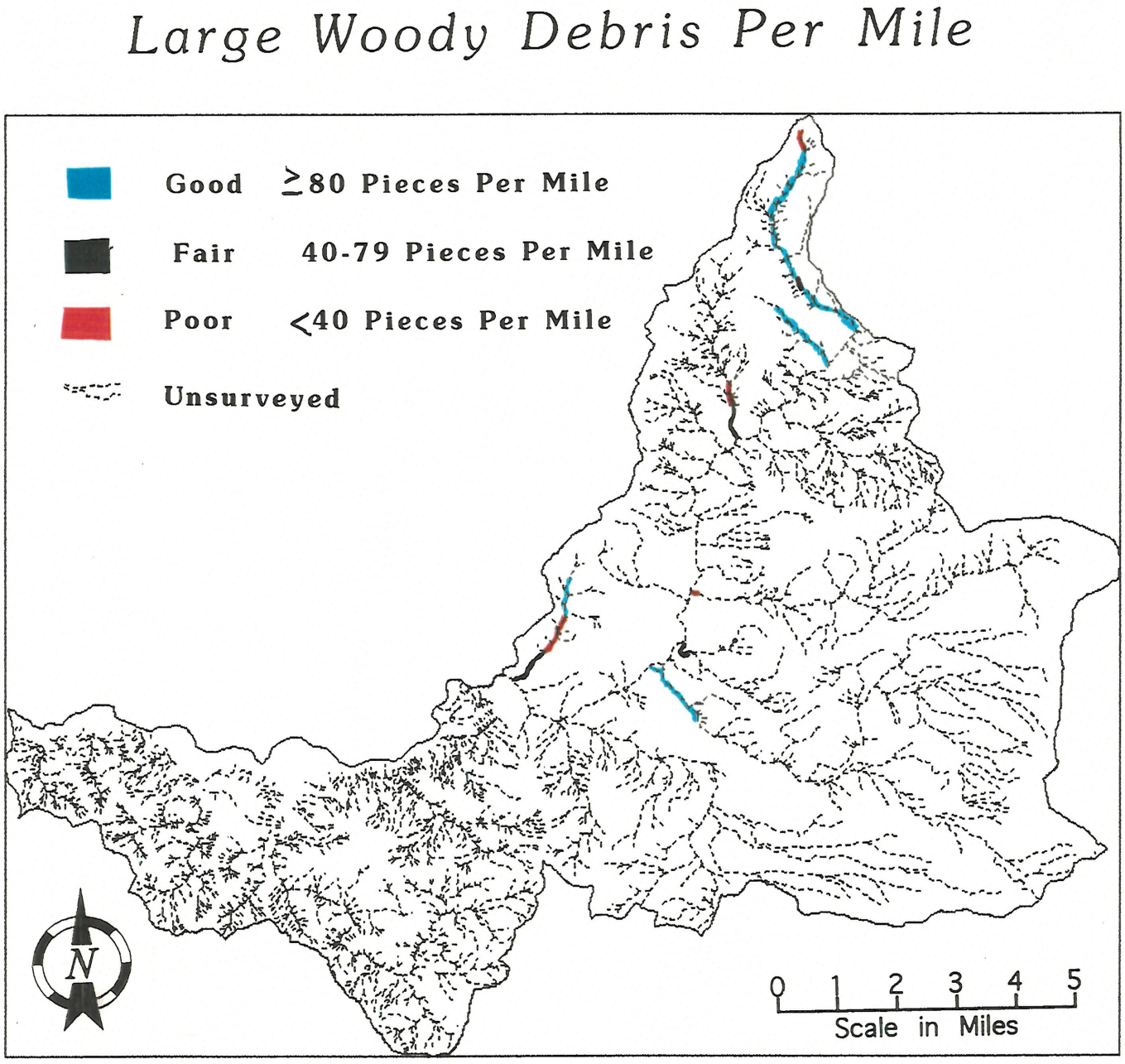


Figure 21 Large Woody Debris Ratings Per Mile For Surveyed Streams In The Middle Lewis Watershed

Timber harvest has been increasing in the basin since 1950. Although harvest techniques have substantially improved through time the impacts from early management remain. Greater than 25 percent of the stream Riparian Reserve area in four of the sub-basins has been harvested (Figure 22, Percent Stream Riparian Reserves that have been harvested). Across the watershed, approximately 10 percent of the stream Riparian Reserves have been harvested in the past 35 years.

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 pool habitat 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 and determines the hydraulic controls that create pools.

The PIG contains standards for quantities of pools per mile (based on stream width) needed to provide quality salmonid habitat (Table 12). For the 12.5 miles of streams that have been surveyed, streams are evaluated against this standard to determine a rating of Good, Fair or Poor. Streams rated as "Good" meet or exceed the quantity of pools based on stream 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 56 percent of the surveyed streams are rated as poor, approximately 26 percent are rated as fair, and approximately 18 percent are rated Good. (Figure 23, Primary Pools per Mile)

Table 12 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

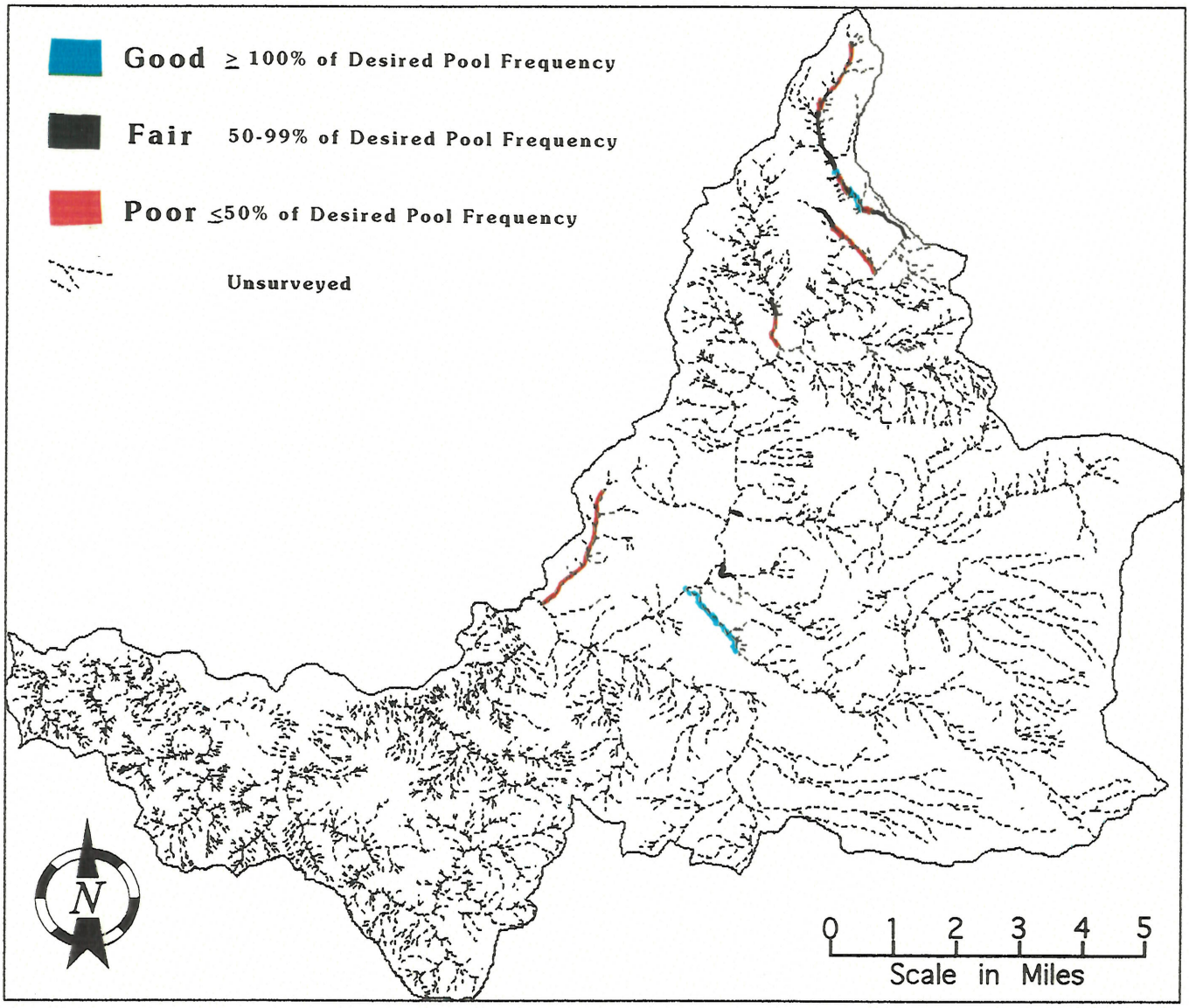


Figure 23 Primary Pool Ratings Per Mile For Surveyed Streams In The Middle Lewis Watershed

Stream Temperature

Water temperature is a major factor influencing the composition and productivity of aquatic ecosystems. Fish, aquatic macroinvertebrates, and other aquatic organisms are affected directly and indirectly by changes in water temperatures. Specifically stream temperature influences the timing of salmonid migration, spawning, incubation rates, growth, distribution, resistance to parasites, food supply and quality, and tolerances to diseases and pollutants (Bjornn and Reiser 1991).

Stream temperature monitoring was initiated in 1976 at the Lewis River gage and continued until 1988 when funding was discontinued. The Lewis River gage is located approximately 8 miles downstream from Upper Falls. The data collected has numerous gaps, sometimes of an entire year. The most complete data sets available were analyzed for the low flow period of June - September. Maximum 7-day average temperatures were calculated for these years to assess impacts to aquatic organisms (Figure 14, Maximum 7-day Temperatures for Lewis River, Page 28). Although the maximum 7-day average temperatures meet the state water quality standard, the optimum spawning and rearing temperatures for bull trout and other salmonids are exceeded. There are also several data points in the measured data set where the stream temperature exceeds the state water quality standard of 16 degrees Celsius for a single day.

Aquatic Habitat Fragmentation

Roads can be an important factor in the decline of fish populations. Culverts and/or other road crossings can fragment the aquatic habitat. Roads and culverts cannot only block upstream migration of resident fish, they can alter the flow pattern of LWD through the system, and can increase sediment input (Furniss et. al. 1991).

The current road density in the entire watershed stands at 2.53 miles per square mile with 773 road/stream crossings. Some individual sub-basins' road densities, however, exceed 4.5 miles per square mile (Figure 24, Road densities by sub-basin in the Middle Lewis Watershed) with as many as 255 road/stream crossings. The effects of fragmentation may be compared by using an index based upon the number of road crossings over streams per unit of stream length in each sub-basin. Sub-basins 06B, 06I, 06J, 06S, 06Y, 06Z, and 08J were within the highest one-quarter of the values (Figure 25, Riparian Reserve Aquatic Habitat Fragmentation) which indicates they have received the most intense degree of habitat fragmentation caused by roads. Sub-basin 06Z had the highest value of 3.1. This small watershed (1100 acres) with only 3.1 miles of stream had 10 stream crossings. The aquatic habitat fragmentation index value is 1.28 over the entire watershed, indicating more than one crossing for each mile of stream.

The Lewis river has 3 major hydro-electric dams along the North Fork. These dams block the migration of anadromous salmon to the upper reaches of the watershed where they once spawned. The dams have also altered the available habitat in the Lewis river by converting over 25 miles of stream habitat to lake habitat, including the approximately 9 miles which make up Swift Reservoir on the North West boundary of the Middle Lewis watershed. This has significantly altered the distribution and abundance of both resident and anadromous fish in the Middle Lewis watershed.

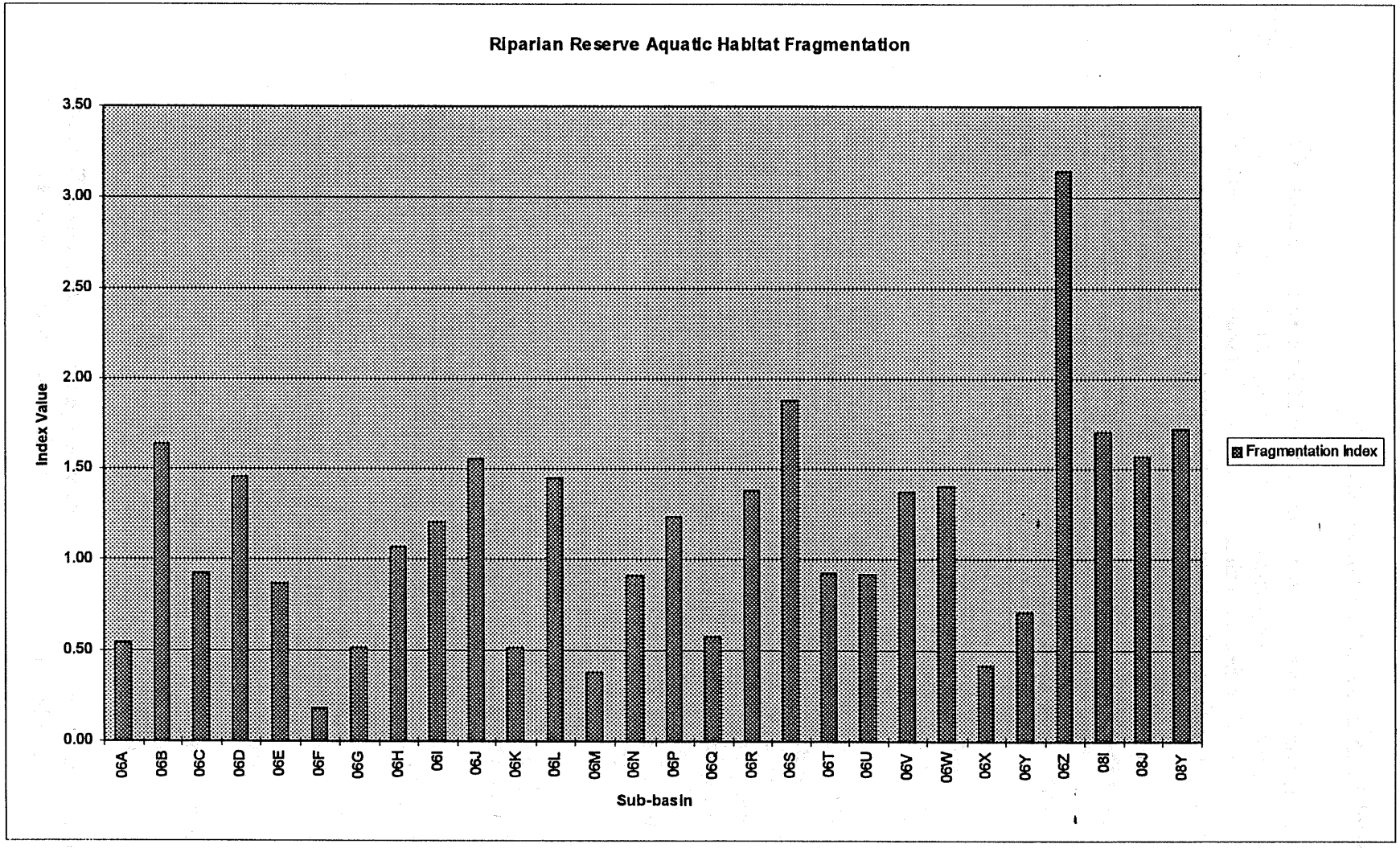


Figure 25 Riparian Reserve Aquatic Habitat Fragmentation

reports in the watershed. No animals were seen, but the reports were based on howling and tracks, and all occurred in 1991 in sub-basin 08J.

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 must be present.

The species listed above were placed in the following guilds:

Terrestrial Group

Guild Code	Patch Configuration	Home Range	Structure Stage	Species
TLMLT	Mosaic	Large	Large Tree	Northern spotted owl Northern goshawk Fisher American marten Pileated woodpecker
TLGG	Generalist	Large	All	Grizzly bear Gray wolf
TSGG	Generalist	Small	All	Red-legged frog Cascades frog
TSMO	Mosaic	Small	Open	Mountain quail

Riparian Group

Guild Code	Water Body	Aquatic Association	Structure Stage	Species
LKRVARG	Lakes/Rivers	Aquatic and Riparian	All	Bald eagle
LKRVA	Lakes/Rivers	Aquatic		Common loon
RIVARF	Riverine	Riparian	Forested	Harlequin duck

Special Habitat Group

Guild Code	Special Habitat	Species
SPCL	Lava/Talus	Larch Mountain Salamander
SPCL	Abandoned Buildings	Townsend's big-eared bat
SPCL	Cliffs	Peregrine falcon

Habitat for Guilds TLMLT and TSGG

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.

Spotted Owl Habitat

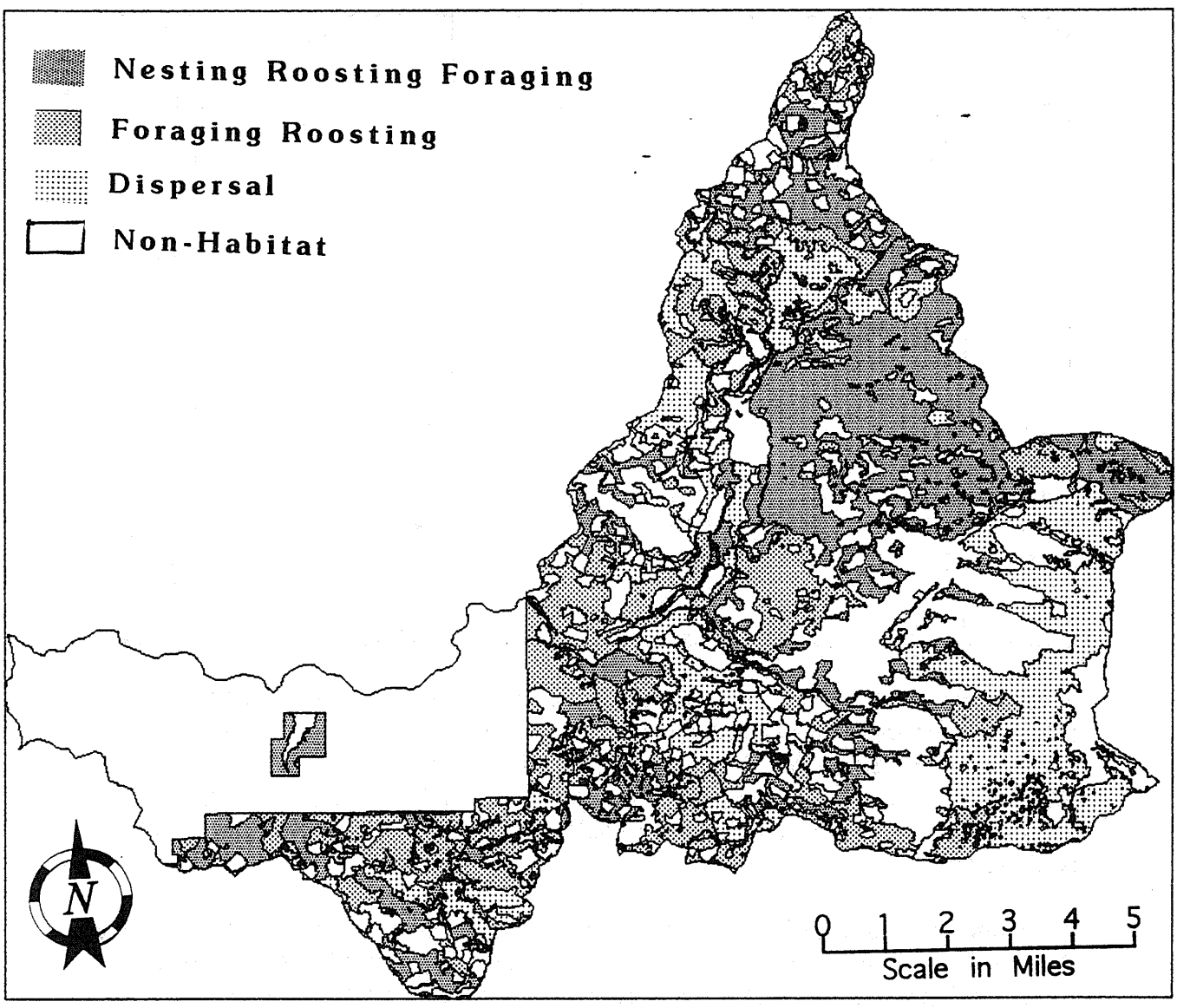


Figure 26 Suitable Spotted Owl Habitat

Interior Forest Habitat

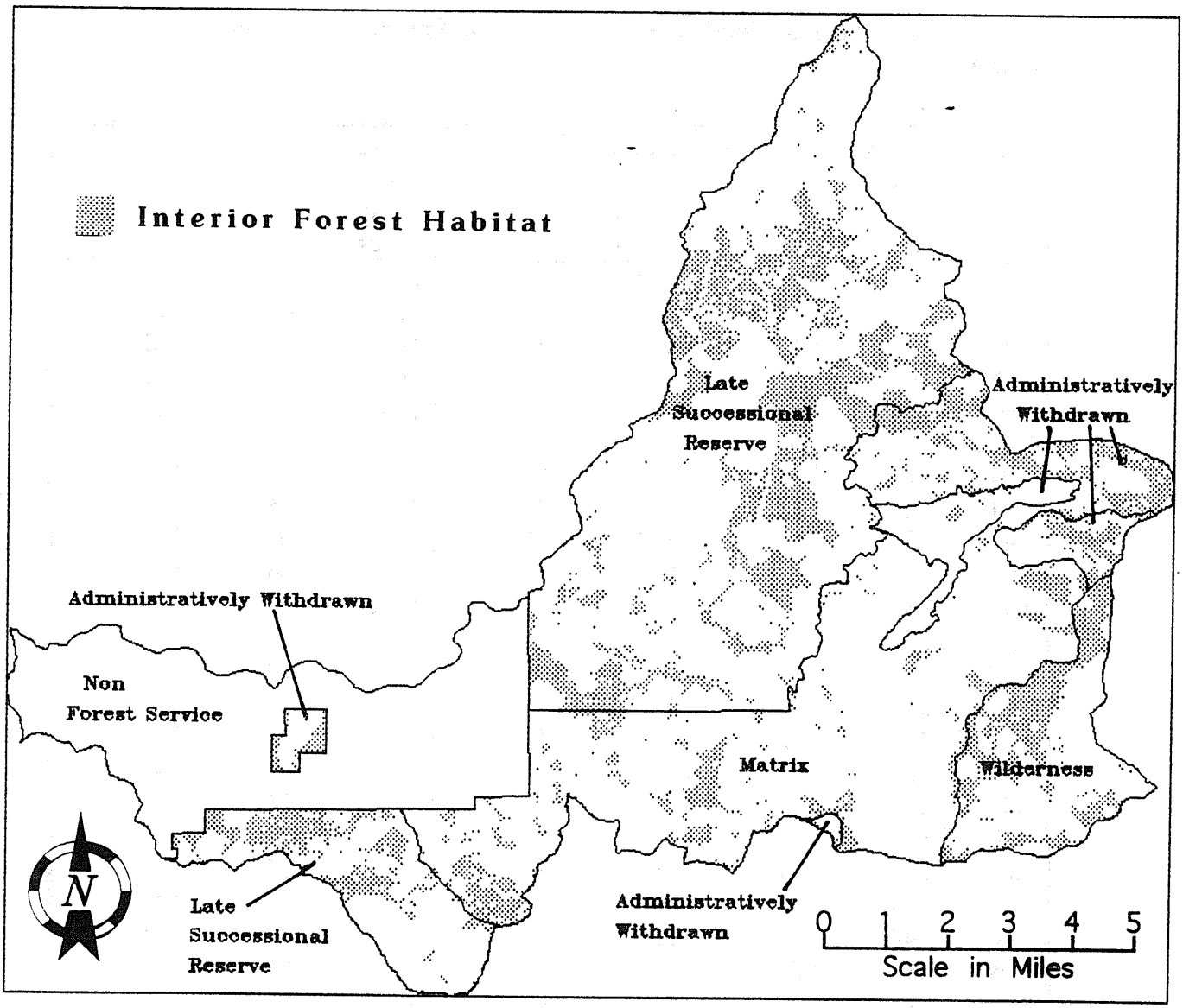


Figure 27 Interior Forest Habitat

Of these sub-basins only 06L, 06M, and 06Z contain at least 80 percent of the habitat in the Riparian Reserves in a closed canopy condition. The sub-basins between the LSR's contain a relatively low proportion of Large Tree Multi Storied habitat. Commercial and pre-commercial thinning in these Riparian Reserves may be beneficial to accelerate the development of large trees.

Table 14 shows that the Riparian Reserves may not be functioning well as corridors for late-seral dependent species. Deferring harvest of stands in the Matrix in areas where the Riparian Reserves are in an early-seral condition until such time as existing early-seral habitat develops into mid-seral habitat should be analyzed at the project level. This mitigation may help to preserve important mid- to late-seral habitat that exists near streams, but outside of the buffer widths specified in the ROD. These stands may be functioning as corridors where suitable habitat is lacking in nearby stream Riparian Reserves.

There are 20 known owl site centers within the watershed. Four of these are located in the Matrix, and the remaining 16 are in the LSR's. Of the four in the Matrix (814, 836, 839, and 3002), two (836 and 839) are near or below "take" thresholds set by the US Fish and Wildlife Service. Owl site center 836 is in sub-basin 06C, and site center 839 is in sub-basin 08Y. These owls do not have enough high quality habitat within their home ranges to remain a successfully reproducing pair. Although the other site centers in the Matrix contain sufficient habitat to be above the "take" threshold, the available habitat is highly fragmented.

A majority of spotted owl nesting habitat within the watershed is located in the Late Successional Reserves (LSR), but a relatively large amount of nesting habitat is in Matrix in sub-basins 06G and 06L.

Portions of two spotted owl Critical Habitat Units (CHU) are within the watershed. Their boundaries approximate the boundaries of the LSR's. One difference between the boundaries of the LSR's and the CHU's is that a large portion of sub-basin 06G, that is within the CHU boundary, is not within the LSR. This sub-basin contains 2,229 acres of nesting habitat. Although the habitat is fragmented, it may be important to the maintenance of spotted owl populations until more suitable habitat develops in the LSR. The total amount of the Critical Habitat Units in the watershed is 41,646 acres.

Habitat for Guilds LKRVARG and RIVARF

The harlequin duck breeds almost exclusively along swift flowing mountain streams with gradients of 1.0 to 7.0 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.

Habitat for Guild TSMO

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 elevation. Structure stages likely to provide habitat for the mountain quail are (1) Large Tree Single Story, and (2) Remnant Forest which resembles units harvested with a shelterwood prescription

Within the watershed there are 2,946 acres of Large Tree Single Story, and 1,323 acres of Remnant Forest. In the absence of wildfire, and with clear-cut logging, habitat for this species has probably declined since the turn of the century. With implementation of the President's Forest Plan, habitat in the LSR's and Riparian Reserves will decline, but habitat in the Matrix may increase with the requirement for 15 percent retention.

Habitat for Guild TLGG

The gray wolf and grizzly bear are both habitat generalists depending more on food supply and seclusion than any particular vegetation type for high quality habitat. Large ungulates make up an important part of the diet of both species. Another important food source for the grizzly bear are berry producing shrubs.

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 1.0 mile per square mile. The total road density within the watershed is high at about 2.5 miles per square mile. Table 15 shows average road density for all roads by sub-basin.

watershed the most likely habitat for grizzly bears and gray wolves. Another area that may be important lies in the southern end of the watershed, in sub-basin 08J. This sub-basin is adjacent to a fairly large unroaded area south of Siouxon Peak.

Habitat for Guild SPCL

The peregrine falcon is dependent on high sheer cliffs for nest sites and a plentiful prey base of song birds, especially those associated with riparian areas, and waterfowl.

No surveys for this species have been conducted in the watershed, and there are no known historical eyries. Recent sightings on the Mt. St. Helens National Volcanic Monument have been to the north in the blast zone near Mt. St. Helens. The cliffs found in the watershed do not appear to be high enough to be suitable for peregrine falcons. One marginally suitable cliff site in the watershed is located on private land near Eagle's Cliff in sub-basin 08Y. Another marginally suitable cliff is found on the west side of Spencer Butte just outside of the western edge of the watershed.

The Larch Mountain salamander is typically associated with steep wooded talus slopes that include large amounts of decaying plant material and little soil. Overstory trees are often Douglas fir, Oregon ash, and big leaf maple.

In addition to talus, Larch Mountain salamanders occupy forest stands in the Southern Washington Cascade Range that have not undergone stand level replacement for centuries, and thus, have characteristics typical of mature and old-growth forests. Salamanders were found to be distributed in patches, and in some cases, locally abundant in late-seral forests of the Western Hemlock Zone. Stand understories were sparse and composed of few herbaceous and woody species. Cascade Oregon grape (*Berberis nervosa*), prince's-pine (*Chimaphila umbellata*), bunchberry dogwood (*Cornus canadensis*), and Red huckleberry (*Vaccinium parviflora*) were the understory species most commonly associated with salamander microhabitats. In virtually all cases where salamanders were found a few very large Douglas-fir trees and snags were present in the stand (typically residuals from the previous large-scale disturbance). Salamanders were often found in piles of bark at the bases of large snags. (Crisafulli 1995 Draft)

Surveys for this species have been conducted in portions of the watershed, and it was found at one site in sub-basin 06H. Larch Mountain salamanders were found at several sites in the Upper Lewis Watershed and are likely to be found at more sites in the Middle Lewis Watershed. Past timber harvest that may have reduced or eliminated the shade over talus slopes or other suitable sites could have impacted this species.

Townsend's big-eared bat typically utilizes abandoned bridges and buildings for summer roosts, and caves for summer roosts and winter hibernaculum. One known natural rock formation in the watershed may support this species. The formation known as House Rock Pits is located in sub-basin 06U. The pits are a series of earth cracks near a cliff edge above the Lewis River, and were first found and inventoried in 1979. The cracks were formed when a triangular block of basalt slid outward toward the cliff edge. The deepest crack forms a single room cave with two entrances.

Elk and Deer Habitat

Lone Butte Elk Herd

The Lone Butte wildlife emphasis area lies entirely within the watershed. Extending generally from Lone Butte on the south to Hungry Peak and Squaw Butte to the north, it contains about 12,400 acres. Forest roads outline the perimeter of the emphasis area: 3230 on the north, 2400 and 3000 on the east and southeast, 3211 and 3220 on the southwest and west.

The area encompasses a complex of large meadows, with three prominent meadows: Lone Butte Meadows Skookum Meadow, and Cayuse Meadow. Additional named meadows are: Hungry Peak, Tillicum, Handshake, Meadow Lake, and Crazy Hills. Numerous smaller meadows dot the landscape. Big Creek and Meadow Creek drain the area to the Lewis River. It lies within the following sub-basins: 06G, 06K, 06N, 06P, and 06V.

The Lone Butte wildlife emphasis area is an important elk corridor between lower elevation winter range along the Lewis River and higher elevation summer range in the vicinity of Indian Heaven Wilderness. It is an elk calving area and may also act as winter range in less severe winters. Because of its proximity to Vancouver and Portland, and the presence of the elk herd, the area receives significant recreation use. For these reasons, the area is highly suited to habitat improvement projects to maintain or improve conditions for elk and deer.

Table 16 shows the breakdown of habitat within the emphasis area.

Table 16 Cover:Forage within Lone Butte wildlife emphasis area

Habitat	Acreage	% Of The Emphasis Area
Forage	5,646	46%
Hiding Cover/Forage	389	3%
Thermal Cover	4,715	38%
Optimal Thermal Cover	1,582	13%

Winter Range

There are 9,323 acres of biological big game winter range mapped for National Forest lands in the watershed. This winter range block is generally along both sides of the Lewis River and is entirely within LSR. Figure 28, is a map displaying biological winter range on National Forest in the watershed. There is no Management Area Category winter range in the watershed. Table 17 shows acres of winter range on National Forest by sub-basin.

Table 17 Acres Of Winter Range On National Forest Land

Sub-Basin	Acres
06A	123
06B	33
06E	1576
06H	177
06I	437
06J	218
06L	97
06M	156
06R	1441
06S	871
06T	147
06U	2094
06V	173
06W	1035
06X	281
06Y	68
06Z	301
08Y	97

Since the mapped biological winter range is within LSR, there may be conflicting objectives in the future as that LSR develops more timbered cover. In the absence of natural disturbance such as small fires and windthrow, there may not be sufficient forage available for this area to function as winter range.

Non-federal land in sub-basins 8J and 8Y are also winter range. Recent extensive clearcutting on much of the private land in these sub-basins has reduced or eliminated the effectiveness of these areas as winter range. This increases the importance of the habitat available on National Forest.

Human Dimension

Off-Site Passive Use Values

People value the landscape, ecosystems and existence of cultural sites even though they may not visit or see them. These passive use values may be closely associated with other traditional culturally-motivated values (such as protection of the environment).

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 and establishing wilderness areas). 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 receives strong support from all communities. 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 roadless areas even though many thought the wilderness designation issue has been largely resolved. Many people believe the undisturbed character of unroaded areas exceeding 5,000 acres in size should be maintained while others feel that such lands should be open to development. Rural communities are most likely to support development of roadless areas. The strategy receiving the most widespread support is for relatively low levels of development in roadless areas. Many feel that timber harvest would adversely affect the character of such areas. 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.

There is overwhelming support to legally designate all rivers currently eligible as "wild" or "scenic." Many feel logging activities (even from a distance) should not be visible from within wild/scenic corridors.

Cattle, Sheep and Goat Grazing Permits

Grazing permits have been issued for grazing cattle, sheep and goats within this watershed. Sheep were introduced to the this area during the 1890's in the search for suitable summer range. Since that time when nearly 100,000 ewes plus lambs ranged over the area, controls have reduced the number to levels compatible with the proper management of the resource. For the past 20 years the use has varied from no use in 1970 to as high as 16,200 sheep months in 1978. The lowest number of sheep months of use during this period was 2,300. The present use is 6,000 sheep months.

A portion of this watershed is part of the Twin Buttes Sheep and Goat Allotment. An Allotment Management Plan (AMP) was revised in 1991 to bring management into compliance with the Gifford Pinchot National Forest Land and Resources Management Plan (Forest Plan) (Ch. 36 CFR 219.10).

The Allotment plan permits utilization only within present grazing capacity. The present capacity is estimated to be 10,437 animal unit months. The present use is at 14 percent of capacity. Distribution is achieved through open herding.

The range condition is considered good. No range damage or deterioration due to sheep grazing has been identified.

One permittee is currently using the allotment.

The majority of operators that maintain a sizable number of sheep throughout the year are located in the eastern part of the state. In the east grazing is limited to irrigated acreage. Production from this irrigated land is used to carry over the livestock through the winter feeding period. In summer it is necessary to acquire the privilege to graze the sheep in areas that maintain palatable forage throughout the summer months. This summer forage is available in the Twin Buttes Allotment, and thus is of significant importance to the holder of a permit to support an economical long-term operation.

The stability of family ranches that depend on revenues received from raising sheep and associated products, depends on their ability to lease grazing land during the summer months. To own this necessary acreage is prohibitive, because of the high cost. Only the very large operator or the corporate enterprises can afford this kind of investment. The future planning of family ranches require longer term commitment than a year-to-year agreement. To promote stability of these operations, term permits are granted to qualified applicants. The applicants that have a resource base that will support such a commitment, and have proven their dependability are considered qualified.

Recreation

Historical Background

Until the 1950's, trails provided the primary access into the Middle Lewis River Watershed. These trails were used primarily for hunting, fishing, and berry picking and also for administrative use for fire access and maintenance of the trails themselves.

Road construction associated with the development of dams and reservoirs on the Lewis River created additional road access to the area. This led to an increase in timber harvest. The area became even more accessible because of the additional roads that were created for logging. The continuation of Road 90 upstream along the Lewis River, as an example, provided easy access to spectacular views of waterfalls. Waterfall viewpoints became popular destinations for day use and camping. Other dispersed recreation sites started appearing as the area became more and more accessible.

As use of these undeveloped sites increased so did the impact on the forest resources. Once these dispersed recreation sites were identified, the Forest Service gradually provided some development and management such as installation of toilets. No comprehensive recreation management plans have been written to guide the development of these recreation facilities.

A recreation planning effort was conducted for the development of the Lower Falls Recreation Area as identified in the Comprehensive Management Plan for Mount St. Helens National Volcanic Monument.

The historic recreation use patterns in the watershed were severely disrupted by the eruption of Mount St. Helens in 1980. Development of the Mount St. Helens National Volcanic Monument and improvements to Roads 25, 30, 51 and 90 has resulted in a great increase in local, regional and international use of this area.

Most people visit the Middle Lewis River Watershed for recreation activities. Camping, picnicking, berry picking, sightseeing, hunting, fishing, backpacking, hiking, horseback riding, boating, rafting, kayaking, mountain bike riding and motorcycle riding are the primary summer recreational pursuits. Winter recreation includes snowmobiling, cross-country skiing and snow playing. The watershed receives about 20 percent of the total winter sports use on the Gifford Pinchot National Forest.

Attractions in the area include Drift Creek, Indian Heaven Wilderness Area, Siouxon, Upper Wind River Winter Sports Area, Lone Butte and Lewis River (proposed by Forest Service as an addition to the national Wild and Scenic Rivers System).

Developed Recreation

Ten recreation facilities are located within this analysis area. There is one Recreation Area (Campground, Day Use Area and interpretive trail) one developed campground, one interpretive site, two Sno*Parks, two viewpoints, two shelters and one formal trailhead. These developed recreation facilities, their site capacity in people-at-one-time (PAOT) and their use are shown in Table 20. Constructed in 1992 Lower Falls Recreation Area is by far the most developed facility in the area.

Table 20 Developed Recreation Facilities Middle Lewis River Watershed

Recreation Site	Type Facility	#PAOTS	#Visits
Lower Falls	Recreation Area	195	17,850
Middle Falls	Parking Lot	20	400
Curly Creek Falls	Viewpoint	32	12,000
Big Creek Falls	Interpretive Site	32	3,500
House Rock	Shelter	8	50
Lewis River	Campground	24	200
Kumback Shelter	Shelter	8	50
Lone Butte	Sno*Park	200	16,000
Mount St. Helens	Viewpoint	5	50
Old Man Pass	Sno*Park	300	11,600

Trails

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 30 trails (69 miles) within the Middle Lewis River Watershed (Figure 29, Recreation Trails). Each trail is assigned a management level with associated standards and guidelines for management (1990 GPNF Forest Plan). Table 21 is a listing of Trail Management Levels by individual trail.

Wilderness Trails

Seventeen trails totaling 48 miles (no motorized or vehicular use) lie within the Indian Heaven Wilderness. Ten of these (20 miles) are located within this watershed. Emphasis is on reconstruction of existing trails to protect the Wilderness resource.

Recreation Trails

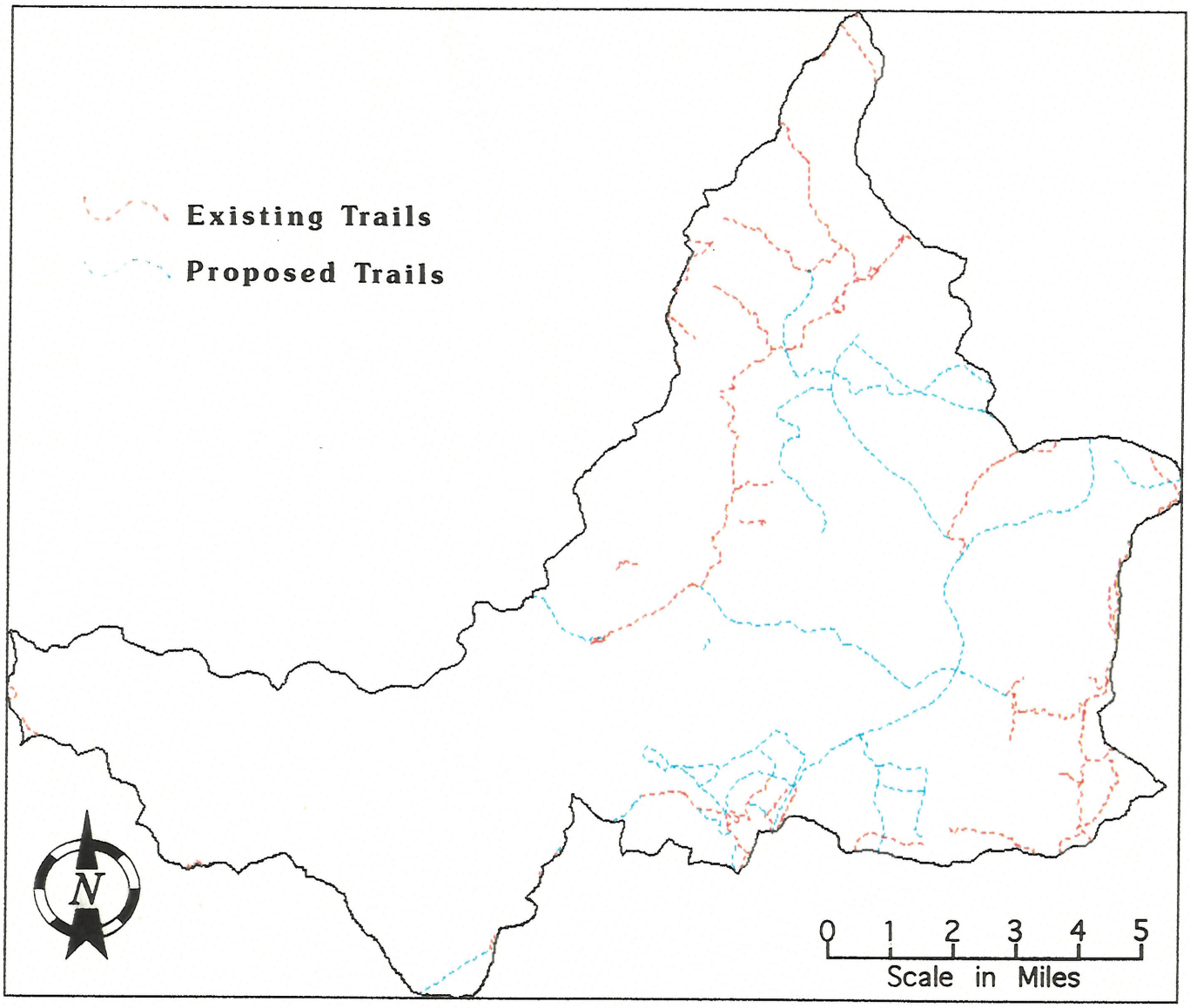


Figure 29 Recreation Trails

Non-Wilderness Trails

There are twenty trails (totaling 49 miles) outside Wilderness in this watershed. They are managed to maintain a balanced spectrum of travel opportunities with difficulty, mode of travel, distance, and designation of use taken into consideration. Conflicting trail uses should be separated when possible.

Off-Road Vehicles (ORV) Trails

The Forest Trail System provides for a variety of ORV trail opportunities. The objective is to develop loop trail systems and to minimize resource damage and user conflicts. Off-trail travel by ORV's will generally not be permitted, except for over snow machines. Crab, Wright Meadows and Paradise Hills Trails are the only assigned ORV trails within this watershed. During the Access and Travel Management planning (ATM) and Roads to Trails (RTT) planning processes, the Stabler Camp and Craggy Peak trails were considered as part of the Alec Creek Project. This RTT proposal would construct some new trails and convert some existing roads to trails. These trails would be managed for horse, hiker, ORV, and mountain biking use.

National Scenic Trail

Of particular interest to recreation users is the Pacific Crest National Scenic Trail, formerly the Cascade Crest Trail. This is one on the two trails initially designated to the National Scenic Trail system by an Act of Congress in October of 1968.

Winter Use Trails

A winter trail system provides cross-country skiing and snowmobiling opportunities. The Forest has a cooperative agreement with the State of Washington for grooming and installing winter trail signs. Groomed snowmobile trail mileage varies from year to year depending on logging activities and snow conditions.

Table 21 shows the management for the trails in this watershed. The type of use permitted is shown for both summer and winter seasons. Type of use is broken into five categories for summer use and three categories for winter use.

CHAPTER IV REFERENCE CONDITIONS

Introduction

Chapter IV, Reference Conditions, 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

Various volcanic processes have taken place in the last 10-12,000 years that have had a major effect on the landform of the Middle Lewis River Watershed. Seven to eight tephra deposits (including the 1980 eruption) from Mt. St. Helens have occurred over the past 10,000 years. Tephra eruptions are wind dependent and historical records show the prevailing winds 50 to 80 percent of the time are to the Northeast, East and Southeast. Deposits from tephra can have long range effects on sediment transport as they are mostly loose, unconsolidated material easily subjected to erosion from rain. Some of the 1980 deposits are still working their way through the system. Eruptions from volcanic centers in and around Indian Heaven have also occurred within the last 10,000 years emitting lava and pyroclastic flows in the area. Glacial activity in the south east portion of the area (Indian Heaven) have also influenced the shape of the land.

Mass Wasting

Geologically the reference conditions for the watershed are glacial and volcanic in its formation. Volcanic activity has been the source for material that has produced the landform for most of the watershed. Glacial activity is responsible for the most recent shaping of the landscape other than wind and water erosion that is constantly going on. Weathering characteristics of pyroclastic material is to fine silts and clays. These soils are very susceptible to sliding especially if water is present. This has probably been the cause of many of the large deep seated landslides noted in the Lewis River Drainage and its tributaries especially Miller Creek and Curly Creek.

Surface Erosion

Natural conditions for surface erosion were mainly from high intensity fires that would burn through areas leaving bare slopes and tephra fallout from volcanic eruptions in the area, such as Mt. St. Helens. During storm events the bare slopes and loose soils became susceptible to erosion. When management activities started to occur in the watershed surface erosion from road construction and harvest increased. No quantitative information is available for amounts of sediment increase due to these activities, but all literature and visual observations show that sediment from roads is a major contributing factor in adding sediment to streams.

Segments #B002, F001, F002, and F005 in the Lewis River all experienced channel widening from sediment deposition after the floods in the 1970's.

Segment #F003 in the Lewis River has been narrowing since 1959.

Stream Temperature

Little is known about reference stream temperatures. In general, stream temperature increase probably coinciding with large fires in the basin. The Regional Ecosystem Assessment Project, 1993 (REAP) suggests historic maximum stream temperatures for the entire Lewis River basin ranged between 14 and 19 degrees Celsius. The maximum stream temperatures specific to the Middle Lewis River Analysis Area is not known.

Large Woody Debris

Reach #F002 had moderate amounts of large wood along channel margins prior to 1959. Most of this wood was removed during the floods of the 1970's.

Moderate amounts of large wood were deposited in jams and dispersed single stems in reach #F001 after the 1970's floods.

Reach #G001 in Rush Creek has contained high amounts of large woody debris throughout the photo sequence.

Peak Flow

Reach #F005 in the Lewis River had an area of bank erosion prior to 1959. No large areas of bank erosion were noted prior to 1959, in the other reaches that contain beneficial uses.

Reaches #F002 and B002 had bank erosion related to the 1970's floods.

Hydrologic Changes

As discussed in the Upper Lewis River Watershed Analysis, major flood events occurred on the Lewis River in 1934, 1972, 1973, and 1974. Data is missing from 1934 to 1955, due to loss of the stream gage from flooding. In the past, large floods were probably associated with rain-on-snow precipitation events that coincided with major fires. Lack of roading would remove this influence on peak flow increases in reference conditions. REAP suggests 4 to 5 percent of the entire Lewis River Basin's ground cover and infiltration capability was disturbed at any one time.

Historic(1895) Age Class Distributions

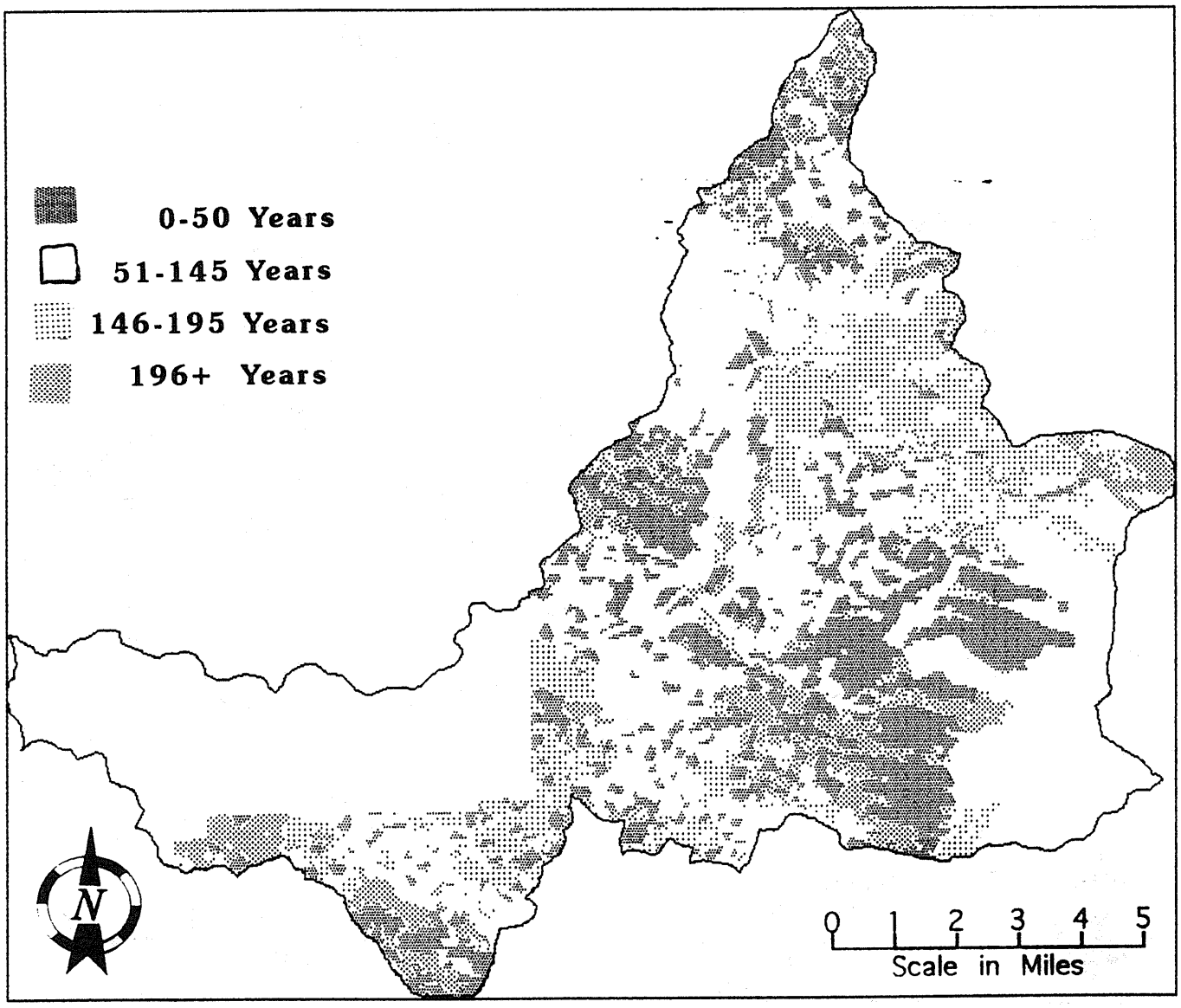


Figure 30 Historic Age Class Distribution

Riparian Areas

According to USDA 1993 estimates, between 50 percent and 85 percent of the stream riparian areas within the Lewis River Basin were in late successional stands. Migration corridors along stream riparian areas for plants and animals were intact because they rarely burned. Many old-growth and riparian special habitats for TES Plants and C-3 species were intact and scattered across the landscape. Currently, only 31 percent of the Middle Lewis Watershed stream riparian areas are in single and multi-layered large tree (late successional) stands.

The USDA 1993 document also estimates that historically between 4 and 12 percent of the Lewis River Basin stream riparian areas were in early successional conditions. By comparison, 10 percent of the stream riparian areas in the Middle Lewis Watershed area have been harvested within the past 45 years so are now early successional. This does not include private lands where nearly all the stream riparian areas have been harvested.

Fire and Fuels

See the discussion of Fire and Fuels in Chapter III.

Aquatic Animals and Habitat

Historical aquatic habitat and population information in this basin is poorly documented. However, rainbow and cutthroat trout are known to have been quite abundant in the Lewis River and its tributaries and ranged in size up to 18 inches with a 12 inch average (WDG, 1957). The distribution of resident fish has been altered by road construction and the construction of the dams on the mainstem of the Lewis River.

Anadromous fish populations including coho, steelhead, and chinook spawned in the Lewis River and its tributaries upstream to the barrier at Lower Falls (approximately river mile 73) prior to the construction of Merwin dam in 1931. When the first dam was constructed approximately 53 miles of mainstem habitat and numerous miles of tributary habitat was blocked. This dramatically altered distribution and abundance of these species in the watershed.

No reference information is available for the number of pieces of LWD per mile; however, we can assume that historically LWD was higher than the current condition because of the impacts of logging and road building.

The range of natural variability for pool frequencies in the Lewis River basin has been estimated to be between 25 and 60 primary pools per mile (USDA, 1993). Eighteen of the thirty-one surveyed reaches fall within or exceed this range. This could indicate that the PIG standards are not appropriate for this watershed. (See page 52, for a description of the PIG standards).

Human Dimension

The area within the Middle Lewis River watershed has seen a long history of human use. Areas that we now call "Wilderness" were once intensively used and even managed by Indian people. The general routes of travel used prehistorically are generally tend to be in the same location as the earliest historic routes, based on clustering of prehistoric and peeled cedar site locations along these 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, and in the more recent past huckleberries, beargrass, cedar bark and other plant foods and medicines were sought in the area.

Areas of use included lake shores, meadows, stream confluences, river terraces, ridgelines and saddles. Their locations and assemblages are consistent with a model of seasonal transhumance by small hunting and gathering groups, who moved into the higher elevations out of low elevation winter residences, following resource availability. The variety of resources utilized is probably reflected in the variety of environmental settings in which the sites are found, but undoubtedly included game animals, berries, medicinal plants, and toolstone.

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 locales (Ray 1939). The seasonal salmon runs along the Columbia and its major tributaries (including the Lewis River) formed the emphasis of their subsistence economy, but people took advantage of a wide variety of plant and animal resources throughout the year.

In general this watershed was all unroaded prior to 1900.

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 mass wasting, surface erosion, soil productivity, etc., are each addressed in turn. The comparisons, explanations, and discussions for each issue are presented in a similar series of tables and paragraphs to enable the reader to follow the logic of the analysis.

Using the information detailed in the above tables and paragraphs, the team began integrating this information spatially, i.e. displaying which sub-basins were of concern. This display, see Table XXX Synthesis Table, uses a Matrix of rows and columns to show ratings of 22 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.

Surface Erosion

Issue	Current Conditions Compared to Reference Conditions	Dominant Processes and Causal Mechanisms
Surface Erosion	Increase of sediment input into streams primarily from road construction.	Poor road construction practices. Sidecast of waste material.

Discussion: Dominant processes and causal mechanisms explaining the relationship between current and reference conditions:
Low-standard road construction in the past has created many maintenance problems. These problems, have in turn, created further problems as wasted material from maintenance has been sidecast in areas that have themselves been unstable. This has created many sidecast failures, especially on steeper slopes.

Description and Explanation of Trends:
In the past, roads were constructed to low-cost minimum standards, mostly to access locations for timber harvest. Since then road construction standards have improved, but sedimentation from roads is a continuing problem. Most erosion occurs the first year or two after construction, or until new vegetation becomes established. Then sedimentation is reduced, but not halted.

Issue	Current Management Objectives and Desired Future Conditions
Surface Erosion	For each existing or planned road, meet the Aquatic Conservation Strategy objectives.[1] Minimize sediment delivery to streams from roads.[2]

[1] ROD Roads management C 32 & B 11
[2] ROD Roads Management C 33

Issue	Current Conditions Compared to Management Objectives and Desired Future Conditions
Surface Erosion	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.

Discussion: Major natural and human-caused changes in the system that have fundamentally altered the capability to achieve reference conditions, key management plan objectives, or desired future conditions:
Roads in the National Forest are necessary to meet all objectives of resource management. Sedimentation from roads will continue, but can be minimized to an acceptable level to meet water quality and fisheries habitat objectives. Roads should be evaluated and unnecessary ones decommissioned as a part of watershed restoration. At this time, the evaluation has not been completed.

See table on road erosion rates based on soil types in each sub-basin in the Geology/Soils specialist report.

Beneficial Uses

Issue	Current Conditions Compared to Reference Conditions	Dominant Processes and Causal Mechanisms
Beneficial Uses	1. Anadromous fishery has been eliminated in this portion of the Lewis River Basin.	Blockage of upstream migration from dams.
	2. The amount of late seral stage within riparian reserves has decreased from approximately 50-85% (USDA, 1993) to 25% currently.	Riparian vegetation used to be removed by wildfire or directly by debris torrents. Recently the primary agent for removal of late-seral vegetation is timber harvest and road building.
	3. The historic range for maximum stream temperature is 14-19 degrees C (REAP) and currently it is 7.2 to 17 degrees C.	Removal of riparian vegetation by wildfire, timber harvest, and road building.
	4. Primary source of sediment historically was landslides and surface erosion associated with fire and rain-on-snow precipitation events. Primary source of sediment currently is landslides associated with roads and timber harvest triggered by rain-on-snow precipitation events and surface erosion associated with roads.	Landslides associated with wildfires, timber harvest, and road building.
	5. Currently, many landslides are devoid of large wood.	Lack of large wood due to timber harvesting and road building.
	6. The flow of large wood, sediment, and water has been interrupted on small streams by road crossings.	Interruption of flow of wood, sediment, and water by roads and road maintenance.
	7. Channel aggradation from the 1970's floods is roughly equivalent to aggradation from the last significant flood prior to this time (1940's or 1950's).	Majority of reaches are transport and erosion, so they are not highly sensitive to sediment input.
	8. Approximately 751 miles of stream channel compared to 604 miles historically.	Road systems have increased the length of stream channels.
	9. Currently, 5 sub-basins have at least a 5% increase in discharge during a 2-year storm when compared to fully forested conditions.	Removal of trees by timber harvest and fire.

Description and Explanation of Trends:
In general, the trend for the above conditions is recovery. This is due to a restoration program that will stabilize or decommission existing roads in the area and restore the large tree component in Riparian Reserves and the LSR. Designation of the Lewis River as a Tier 1 key watershed, and retention of trees in new harvest units will also assist in recovery of the aquatic environment.

Issue	Current Management Objectives and Desired Future Conditions
Beneficial Uses	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] Temperatures shall not exceed 16.0 degrees C due to human activities.[3] Historic range of maximum stream temperatures in the Lewis River Basin was 14-19 degrees C.[4] Turbidity shall not exceed 5 NTU over background turbidity when the background turbidity is 50 NTU or less.[5] 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]

[1] ROD B11
[2] ROD B9
[3] Water Quality Standards for Waters of the State of Washington
[4] REAP
[5] Water Quality Standards for Waters of the State of Washington
[6] Ibid

Issue	Current Conditions Compared to Management Objectives and Desired Future Conditions
Beneficial Use	Current peak flow is outside management objectives for sub-basins 06R, 06U, 06W, 06Y, 06Z due to the vegetation component, and 06B, 06S, 06Z, 08I, 08Y due to roading. Stream water temperature is possibly outside management objectives for the Lewis River. Turbidity - not able to determine if it is within management objectives due to insufficient data to determine "background" level for turbidity.

Issue	Current Management Objectives & Desired Future Conditions
Stand Structure and Composition	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] Research activities may be ongoing and proposed in all land allocations.[2] "Survey and manage" standard and guideline will provide benefit to vascular plants, lichens, bryophytes, and fungi.[3] Plant biodiversity will be considered in planning.[45] The sustainability of all the Forests' natural resources, including the species that inhabit them, will be provided for by management.[6] The interrelationship of all components of the natural environment are recognized.[7] Restoration and maintenance of environmental quality are of critical importance.[8]

[1] GPNF Forest Plan, Amendment 11, 2-74
[2] GPNF Forest Plan, Amendment 11, 2-53
[3] GPNF Forest Plan, Amendment 11, 2-63
[4] National Forest Management Act
[5] ROD p.5
[6] Ibid
[7] National Environmental Policy
[8] Ibid

Issue	Current Conditions Compared to Management Objectives & Desired Future Conditions
Stand Structure and Composition	Because of the lack of plant, lichen, fungi, and bryophyte ecological surveys within the Matrix, unidentified unique, uncommon, or vulnerable habitats existing in the Matrix but not within the LSR would not be protected.

Issue	Current Management Objectives & Desired Future Conditions
Special Habitats-Plants	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] Research activities may be ongoing and proposed in all land allocations.[2] "Survey and manage" standard and guideline will provide benefit to vascular plants, lichens, bryophytes, and fungi.[3] Plant biodiversity will be considered in planning.[4,5] The sustainability of all the Forests' natural resources, including the species that inhabit them, will be provided for by management.[6] The interrelationship of all components of the natural environment are recognized.[7] Restoration and maintenance of environmental quality are of critical importance.[8]

[1] GPNF Forest Plan, Amendment 11, 2-74
[2] GPNF Forest Plan, Amendment 11, 2-53
[3] GPNF Forest Plan, Amendment 11, 2-63
[4] National Forest Management Act
[5] ROD p.5
[6] Ibid
[7] National Environmental Policy
[8] Ibid

Issue	Current Conditions Compared to Management Objectives & Desired Future Conditions
Special Habitats-Plants	Because of the lack of plant, lichen, fungi, and bryophyte ecological surveys within the Matrix, unidentified unique, uncommon, or vulnerable habitats existing in the Matrix would not be protected.

Issue	Current Management Objectives & Desired Future Conditions
Riparian Reserve Fragmentation	Research activities may be ongoing and proposed in all land allocations.[1] "Survey and manage" standard and guideline will provide benefit to vascular plants, lichens, bryophytes, and fungi.[2] Plant biodiversity will be considered in planning.[3],[4] The sustainability of all the Forests' natural resources, including the species that inhabit them, will be provided for by management.[5] The interrelationship of all components of the natural environment are recognized.[6] Restoration and maintenance of environmental quality are of critical importance.[7]

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

Issue	Current Conditions Compared to Management Objectives & Desired Future Conditions
Riparian Reserve Fragmentation	Current management activities have the potential to mitigate for Riparian Reserve concerns addressed by the GPNF Forest Plan, Amendment 11, the National Forest Management Act, the ROD, and National Environmental Policy.

Issue	Current Management Objectives & Desired Future Conditions
TES and C-3 Species	Research activities may be ongoing and proposed in all land allocations.[1] "Survey and manage" standards and guidelines will provide benefit to vascular plants, lichens, bryophytes, and fungi.[2] Plant biodiversity will be considered in planning.[3],[4] The sustainability of all the Forests' natural resources, including the species that inhabit them, will be provided for by management.[5] The interrelationship of all components of the natural environment are recognized.[6] Restoration and maintenance of environmental quality are of critical importance.[7]

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

Issue	Current Conditions Compared to Management Objectives & Desired Future Conditions
TES and C-3 Species	The lack of general plant and ecological surveys limits our knowledge of TES and C-3 species.

Issue	Current Conditions Compared to Management Objectives and Desired Future Conditions
Fire and Fuels	Current management direction is for control strategy of all fire within LSR, even though desired future condition would benefit from fire inclusion.

Discussion: Major natural and human-caused changes in the system that have fundamentally altered the capability to achieve reference conditions, key management plan objectives, or desired future conditions.

A fire management plan for LSR's has not been completed, although the GPNF Forest Plan as amended does specify suppression strategies. For the time being, in LSR's, we are to suppress wildfire to avoid loss of habitat in order to maintain future management options. In Riparian and Late-Successional Reserves, the goal of wildfire suppression is to limit the size of all fires. Rapidly extinguishing smoldering coarse woody debris and duff should be considered to preserve these ecosystem elements. When watershed analysis, province-level planning, or a Late-Successional Reserve assessment is completed, some natural fires may be allowed to burn under prescribed conditions.

Description and Explanation of Trends:
Implementation of the PFP will lead to a trend of recovery for this issue. The Riparian Reserves will reduce/change the way riparian areas are harvested, ensuring that the harvest activity is beneficial to the aquatic resources. This will provide a more consistent supply of LWD to the stream channels. Restoration activities will (1) reduce the number of roads across the watershed, (2) increase the future supply of LWD from previously harvested areas, and (3) decrease the amount of sediment that is contributed to the stream systems by roads. Restoration activities will plant riparian areas with vegetation which will eventually shade streams, thereby reducing water temperatures.

Issue	Current Management Objectives and Desired Future Conditions
Key Habitat Attributes:	
Pools	The number of large pools per mile are established by the PIG and relate to the average wetted width of the channel.[1]
LWD	$\geq$ 80 pieces per mile that are $\geq$ 50' long and 36" DBH.[2]
Temp.	Stream temperatures shall not exceed 16.0° C due to human activities.[3]

[1] Columbia River Basin Policy Implementation Guide
[2] Ibid
[3] Water Quality Standards for Waters of the State of Washington

Issue	Current Conditions Compared to Management Objectives and Desired Future Conditions
Key Habitat Attributes:	
Pools	Of the surveyed streams 82 percent are outside the management objectives.
LWD	Of the surveyed streams 31 percent are outside the management objectives.
Temp.	Stream water temperature is possibly outside management objectives for the Lewis river.

Discussion: Major natural and human-caused changes in the system that have fundamentally altered the capability to achieve reference conditions, key management plan objectives, or desired future conditions.
Stream channel morphology may prevent LWD from holding in the system and creating pools. Ninety-four percent of the stream reaches in the watershed are transport or erosional reaches with high gradients that move LWD and sediment through the system quickly, preventing the formation of long-term stable pools and high-quality spawning areas.

Issue	Current Management Objectives and Desired Future Conditions
Aquatic Habitat Fragmentation	Provide and maintain fish passage at all road crossings of existing and potential fish-bearing streams.[1] New stream crossings on fish-bearing streams should be designed to allow fish passage.[2]

[1] ROD S&B's C33
[2] GPNF Forest Plan

Issue	Current Conditions Compared to Management Objectives and Desired Future Conditions
Aquatic Habitat Fragmentation	Some existing culverts do not provide fish passage, these are not meeting management objectives.

Discussion: Major natural and human-caused changes in the system that have fundamentally altered the capability to achieve reference conditions, key management plan objectives, or desired future conditions.
Some main system roads in the watershed block fish migration through culverts. Because culvert replacement is expensive, decades may elapse before all road crossings provide fish passage. Swift dam will likely remain in place; therefore, fish passage from downstream areas can only be improved by modifying the dam to allow for passage. No plans for a passage facility at Swift or at any of the other downstream dams currently exist.

Description and Explanation of Trends:
With implementation of the ROD, it is likely that the amount of old-growth habitat in the watershed will increase. Currently, about 25 percent of the watershed is in large-tree, multi-storied condition. Since the LSR's constitute about 42 percent of the watershed, and additional acreage is in Riparian Reserves, eventually more than 50 percent of the watershed could be in an old-growth condition. This assumes no large disturbance events. In any case, the amount of old-growth should increase above 25 percent.

Designation of Riparian Reserves will improve habitat along streams, around lakes, and wetlands for species such as Cascade frog and harlequin duck. In addition, it will provide less fragmented travel corridors through the Matrix for species that require overhead cover.

Within the Matrix, outside of Riparian Reserves, the amount of mature and old-growth habitat will decrease.

Under provisions in the ROD, the trend is to reduce road density. Decommissioning roads as a part of watershed restoration will improve habitat for large ungulates, benefiting wolves, and grizzly bear. It will also reduce fragmentation of travel corridors improving the dispersal capability of less mobile species.

New requirements to monitor for Larch Mountain salamander will reduce the probability that this species will be impacted by project activities.

Issue	Current Management Objectives and Desired Future Conditions
Habitat For Threatened, Endangered, And Sensitive Species	Maintain habitat sufficient to support all native and desired non-native animal populations.[1] Conserve species listed as threatened or endangered, and conserve the ecosystems upon which they depend.[2] Ensure that species listed as "sensitive" do not become listed as threatened or endangered.[3] Bald Eagle: picnicking, camping, blasting, firearm use, timber harvest, and low-level aircraft operations should not be allowed within 1,300 feet of nests and roosts during periods of eagle use. These activities should be regulated for up to 2,600 feet where eagles have line-of-sight vision.[4]

[1] Forest Management Act
[2] Endangered Species Act
[3] Forest Service Policy
[4] GPNF Forest Plan, Amendment 11, Chapter 2

Late Successional Reserves

Issue	Current Conditions Compared to Reference Conditions	Dominant Processes and Causal Mechanisms
Late Successional Reserves	1. Late-successional habitat is less than reference, and exists in smaller blocks.	Timber harvest.
	2. The amount of late-successional habitat within 300' of streams is less than reference.	Timber harvest and road construction.
	3. Density of large snags and logs within the LSR's is lower than reference.	Timber harvest, fire suppression.

Discussion: Dominant processes and causal mechanisms explaining the relationship between current and reference conditions:
The pattern of wildfires historically created large blocks of early- to mid-seral habitat, with scattered remnant late-successional habitat within these blocks (primarily along stream drainages and some ridgelines). Large late-successional blocks occurred in wetter areas. While the blocks were relatively large, they were arranged in a mosaic pattern. Many of the fires were hot enough to consume all the trees; however, many left behind a high density of large fire-hardened snags that persisted for many decades.

Timber harvest since the 1950's has resulted in relatively small blocks of early-seral habitat within larger blocks of mid- and late-seral habitat. The effect of this, combined with associated road construction, has significantly reduced the amount of interior late-successional habitat.

About one-third of the habitat within the LSR's in the watershed is currently unsuitable for spotted owls. This is due to past timber harvest and road construction. An additional 15 percent is dispersal habitat that is not suitable for roosting or nesting.

Description and Explanation of Trends:
The trend in the LSR's is toward development of more late-successional habitat and an increase in interior habitat. This trend assumes that wildfires will be controlled while they are relatively small. As units that were harvested within the past 30 years continue to grow, the fragmenting effects that they had on surrounding late-successional habitat will diminish. Road decommissioning that will likely be part of watershed restoration will also decrease fragmentation as these roads are re-vegetated and eventually support trees.

In the absence of scheduled timber harvest, the density of snags in the LSR will increase as mature trees are killed by insects or disease. While the ROD allows salvage in LSR's, the needs of species dependent on snags and logs are priority in these areas.

Elk And Deer Habitat

Issue	Current Conditions Compared to Reference Conditions	Dominant Processes and Causal Mechanisms
Habitat Suitability	Available habitat consists of relatively small blocks of forage and cover that are well interspersed. The resulting ratio of edge habitat to interior habitat has improved conditions for elk and deer compared to reference.	Timber harvest.
	High road density has negated some of the benefit of the fragmented habitat.	Road construction.
	Arrangement of cover and forage blocks is less than optimum at Lone Butte wildlife emphasis area.	Timber harvest, and subsequent large blow-down events.

Discussion: Dominant processes and causal mechanisms explaining the relationship between current and reference conditions:
The pattern of wildfires historically created large blocks of early to mid-seral habitat, with scattered remnant late-successional habitat within these blocks (primarily along stream drainages and some ridgelines). Large late-successional blocks occurred in wetter areas. Since these cover and forage blocks were large, there were many areas that were either too far from cover, or too far from forage to receive optimum use by elk and deer.

Timber harvest since the 1950's has resulted in relatively small blocks of early-seral habitat within larger blocks of mid- and late-seral habitat. The effect of this has been to increase the amount of edge habitat, which is the area that receives the majority of elk and deer use.

High road density within the watershed has offset some of the benefits of increased edge.

Description and Explanation of Trends:
Timber harvest in the Matrix will continue to create forage areas interspersed with cover; however, optimal thermal cover (large-tree, multi-storied stands) will probably decrease with implementation of the ROD. Within the LSR, which contains the biological winter range, the trend will be a reduction in forage, and an increase in cover as early-seral stands mature. The resulting mix of forage and cover in the winter range could eventually be less than optimum. Road decommissioning as a part of watershed restoration or timber sale mitigation will help to offset some of the cover-forage ratio effects by increasing the habitat suitability near the closed roads.

Recreation Use

Issue	Current Conditions Compared to Reference Conditions	Dominant Processes and Causal Mechanisms
Recreation Use	Recreation use has greatly increased since the turn of the century.	Road development associated with dam building and timber harvest has increased access.
	Recreation (summer & winter) opportunities have also increased.	Technology has created a variety of new ways to recreate.
	Recreation use (camping) in some areas exceed acceptable standards.	Demand exceeds supply.

Discussion: Dominant processes and causal mechanisms explaining the relationship between current and reference conditions:
Development of dams and reservoirs on the Lewis River and associated road construction created additional primary road access to the area. With better primary road access came an increase in timber harvest. Road construction associated with timber activities increased access to areas that were previously only accessible by trail.

New technologies have brought about new ways to recreate. The development of new equipment, such as ORV's and mountain bikes, has created an increase in demand for recreational opportunities.

Description and Explanation of Trends:
The demand for recreational opportunities (both summer and winter) is primarily on weekends and holidays. These developed sites are full during peak seasons of use, and the overflow moves out to dispersed recreation sites. Approximately two-thirds of the Vancouver and rural southwest Washington residents visit the Forest several times each year. About 70 percent of campground users return to the same site or area. About 85 percent of dispersed campsite users return to their same favorite areas, while 74 percent of the day users return to the same areas. About 50 percent of the Wilderness users are first-time visitors. About 86 percent of the Forest visitors are over the age of 30 years. They are well educated, with 93 percent having at least a high school education. Nearly 56 percent are employed, and 29 percent retired. The majority of visitors have household incomes of more than $25,000 per year (Porter, December 1993).

The most popular recreation activities in order of participation are sightseeing, picnicking, camping, hiking, nature study, hunting, fishing and winter sports. Nature study, hiking, mountain biking, winter sports and 4-wheeling are expected to show the greatest increase in activity demand.

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.

Issue	Current Conditions Compared to Management Objectives and Desired Future Conditions
Recreation Use	In some areas, the mix of activities is such that user conflict develops. Activities just happen without proper planning. New technology and improved equipment generate new recreation activities that are not planned for (such as mountain bikes). Impacts to soils, vegetation and water bodies are a result of over use of unplanned dispersed campsites. User conflicts and campsite degradation exists in areas. About 78% of campsites are not in compliance with Limits of Acceptable Change in wilderness.

Discussion: Major natural and human-caused changes in the system that have fundamentally altered the capability to achieve reference conditions, key management plan objectives, or desired future conditions.
Technology has changed faster than we have been able to plan. The demand for recreational opportunities at certain sites has exceeded nature's ability to recover the area in supply. Dispersed recreation planning is too little and too late. Campsites are impacting soils, vegetation, lakes, and streams.

Issue	Current Conditions Compared to Management Objectives and Desired Future Conditions
Unroaded Areas	High road densities within the watershed decrease primitive and semi-primitive opportunities which are the predominant setting preference for most activities on the Forest.

Discussion: Major natural and human-caused changes in the system that have fundamentally altered the capability to achieve reference conditions, key management plan objectives, or desired future conditions.
Many of these roads are high-use roads that will not be closed. Recreation planning for this watershed is needed.

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

High: Where greater than 50 percent of the sub-basin has soil types with "High" erosion ratings. See Geology/Soils specialist report for soil erosion ratings by soil mapping unit.

Medium: Where greater than 50 percent of the sub-basin has soil types with "Moderate" erosion ratings.

Low: Where greater than 50 percent of the sub-basin has soil types with "Low" erosion ratings.

4. **Soil Productivity - Compaction** - Sub-basins where past timber harvest has left compacted soils.

High: Relatively high percentages of harvested units were logged with ground-based systems.

Medium: Moderate amounts of harvested areas were logged with ground-based systems.

Low: Relatively low percentages of harvested areas were logged with ground-based systems.

5. **Beneficial Use - Sediment** - Sub-basins that contain a beneficial use whose location is vulnerable to sediment input.

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.

6. **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.

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.

11. **Harvested Riparian Reserves** - Greater than 25 percent of the Riparian Reserve (includes water-related, stability-related, and wetland-related reserves) in this sub-basin has been harvested.

12. **Affected Plant Bio-diversity** - Sub-basins where plant bio-diversity has been affected by timber harvest and associated activities.

High: More than one half the historic amount of late-successional stands have been harvested, and Greater than 25 percent of the Riparian Reserves have been harvested.

Medium: Greater than one half the historic amount of late-successional stands have been harvested, and Greater than 50 percent of the sub-basin is occupied by closed-canopy conifer stands consisting of saplings/poles/small trees.

Low: More than one half the historic amount of late-successional stands have been harvested, and Between 35 and 50 percent of the sub-basin is occupied by closed-canopy conifer stands consisting of saplings/poles/small trees.

13. **Human Caused Ignitions** - Sub-basins where experienced judgment predicts a potential increase in human-caused ignitions because of increased human use.

High: Predict higher than 30 percent increase in ignitions.

Medium: Predict a 15 to 30 percent increase in ignitions.

Low: Predict a 5 to 10 percent increase in ignitions.

14. **Pools Per Mile** - Sub-basins where stream surveys show a "Poor" rating for pools per mile. See Aquatic Animals and Habitat, TES Species section in Chapter III.

15. **Large Woody Debris** - Sub-basins where stream surveys show a "Poor" rating for large woody debris per mile. See Aquatic Animals and Habitat, TES Species section in Chapter III.

Table 23 Synthesis Table

	Mass Wasting Beneficial Use	Mass Wasting Harvet Roading	Surface Erosion Roads	Soil Productivity - Compaction	Beneficial Use - Sediment	Beneficial Use - Temperature	Beneficial Use - LWD	Beneficial Use - Peak Flow	Peak Flow Changes - Harvest	Peak Flow Changes - Roading	Harvested Riparian Reserves	Affected Plant Bio-diversity	Human Caused Ignitions	Pools Per Mile	Large Woody Debris	Harvested Stream Riparian Reserves	Road Densities	Aquatic Habitat Fragmentation	Suitable Habitat in LSR	Interior Habitat in LSR	Recreational Use	Unroaded Areas
06 A - Miller Cr.	H	H	H	M				L	L	M							L					M
06 B - Curly Cr.	H	M	H	H					M	H	X	H					X	H	X		X	
06 C - Hardtime Cr.	L	L	H	M					M	M								L			X	
06 D - Outlaw Cr.			M	H					M	M	X	H				X		M			X	M
06 E - Front Wall Tribs.	H	H	M	M	H		H	M	M	M								L			X	M
06 F - Placid Lake			M	M					L	L		M	L					L			X	H
06 G - Skookum Mdw/Big Cr.	M	M	L	H					L	L								L				
06 H - Alec Cr.	M	H	H	H					M	M	X	H	L				X	M				
06 I - Copper Cr.	H	H	H	L					M	M		M	M	X				M			X	H
06 J - Middle Falls/Lewis R.	L	H	H	M					M	M	X					X	X	H				
06 K - Cayuse Mdw/Big Cr.	M	M	M	M					L	L			H					L			X	M
06 L - Chickoon Cr.	M	M	M	M					L	M								M				
06 M - Crab Cr.	L	M	M	L					L	L								L				M
06 N - Upper Meadow Cr.			M	M					L	M			H					L				H
06 P - Meadow Cr/Lone Butte		L	M	H					M	M		H	L			X		M			X	
06 Q - Upper Rush Cr.			M	H					L	M		L	L					L			X	H
06 R - Pepper Cr.	H	H	H	M	M		M	L	H	M	X			X			X	M				
06 S - Little Cr.	H	H	M	M	M		L	H	M	H		M					X	H				
06 T - Lower Rush Cr.	H	M	M	H	H		H	H	M	M		H					X	L			X	
06 U - Sidewall Tribs	H	M	H	L	H	X	H	H	H	M	X							L			X	
06 V - Big Cr.	L	H	M	M					L	M						X	X	M				
06 W - Sidewall Tribs	H	H	H	M	H		H	M	H	M	X	H						M		X		
06 X - Cussed Hollow	H	M	H	M					M	L		M	M	X	X			L				M
06 Y - Spencer Cr.	M	M	H	M					H	M			M					L				H
06 Z - Sidewalls Curly/Rush	M	M	H	L					H	H		L					X	H	X			
08 I - Timber Cr.	L	L	L	M					M	H		H				X	X	H		X		
08 J - Drift Cr.	M	M	M	M					M	M	X							H				
08 Y - Tribs to Swift Res.	M	H	H	M	L	X	L	L	M	H	X		L				X	H			X	

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 20 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 timeframes for achieving the management objectives.

The locations of recommended activities (by sub-basin) are shown in Table 24 - Recommendations by Sub-basins. Table 24 shows the full array of recommended activities where readers may see which sub-basins contain more than one recommendation.

D. The anticipated rates and timeframes for achieving the management objectives.

The benefits derived from reducing aquatic fragmentation will begin immediately after projects are implemented. It will take 20 or more years to realize the benefits related to reduced upland habitat fragmentation. Another immediate benefit is reduced sedimentation that normally results from vehicle travel on these roads. The benefits relating to reduced surface erosion and reduced peak flows would be realized within five years as vegetation is established on exposed soil. Timeframes for achieving these benefits is dependent on availability of funding.

Restoration Activity

RESTORE SOIL PRODUCTIVITY BY SUBSOILING AND/OR TILLING.

A. What is it?

Subsoilers are large shanks attached to a tool bar mounted to the rear of a crawler tractor. The subsoilers are hydraulically pushed into the ground or allowed to self draft, depending on the tool type. A blade or wing attached to the bottom of the shank increases soil shattering and reduces tractor draft. Subsoiling temporary roads and landings would be done to a depth of 18 to 24 inches. Two or more passes may be required on these heavily compacted areas. Skid trails would be treated to a depth of 12 to 18 inches depending on the frequency of use. Normally one pass would be sufficient.

Water bars would be constructed where slopes exceed 10 percent. This can be done by simply raising the subsoiler out of the ground for a few feet, which will break the continuity of the furrows and leave a berm of soil and organic debris. Equipment such as the "Tilth Subsoiler", which is commercially available should be used.

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.

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

The purpose of ripping and tilling is to break compacted soil layers that inhibit root development and moisture penetration. The result would be an increased capacity to grow vegetation on these sites and reduced surface water flow.

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

Sub-basins that are rated as a priority for this recommendation are those where a relatively high percentage of the sub-basin was logged by ground-based systems resulting in compacted soils.

Sub-basins that are a priority for this treatment are: 06B, 06D, 06G, 06H, 06K, 06N, 06P, 06Q, 06R, 06T, 06U, 06W, 08I, and 08Y

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

D. The anticipated rates and timeframes for achieving the management objectives.

This treatment should be done immediately after a unit is harvested. It may not be appropriate to subsoil skid trails that are well stocked with trees that are greater than 4 feet tall.

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,

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

(c) in sub-basins where plant biodiversity has been affected by timber harvest and associated activities.

Sub-basins identified as priority for this treatment are: 06B, 06D, 06G, 06H, 06I, 06J, 06P, 06Q, 06R, 06S, 06T, 06U, 06V, 06W, 06X, 06Z, 08I, 08J, 08Y.

Among restoration recommendations for the watershed these treatments as a group were assigned a Medium priority.

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 timeframes 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.

(b) in sub-basins with a high percentage of closed pole and small tree stand structures.

Sub-basins identified as priority for this treatment are: 06B, 06D, 06F, 06I, 06J, 06N, 06P, 06Q, 06R, 06S, 06T, 06U, 06V, 06W, 06X, 08I, 08Y.

Among restoration recommendations for the watershed these treatments as a group were assigned a Medium priority.

Relative treatment priorities to individual sub-basins were not assigned. Relative priorities should be assigned to specific stands based on stand conditions rather than to sub-basins.

D. The anticipated rates and timeframes 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, 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: 06A, 06F, and 06X.

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

D. The anticipated rates and timeframes 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. Timeframes for achieving these benefits is dependent on availability of restoration funding.

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 within the watershed that are a priority for this monitoring are those that have major streams with limited or no temperature data. These sub-basins are: 06E, 06H, 06J, 06P, 06R, 06T, 06U, and 08Y.

D. The anticipated rates and timeframes 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:

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 adjacent to sub-basins where these species have been found in the past. Sub-basins with the highest priority are: 06H, and 06J.

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

D. The anticipated rates and timeframes 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:

FISH SURVEY.

A. What is it?

Survey fish populations to identify which species inhabit a given stream, particularly which streams are inhabited by bull trout, and to determine population trends. The survey would include electroshocking and/or snorkeling to identify the type of species present, and the number of individuals.

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 bull trout, helping to preserve this species. It may help to identify declining populations and reasons for the decline.

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

Sub-basins that are a priority for this monitoring are those where bull trout are known to exist. The sub-basin with the highest priority is 06T.

D. The anticipated rates and timeframes for achieving the management objectives.

Portions of this monitoring activity are currently underway, with results expected by the end of 1995. Depending on the results of the current project and funding sources in the future, this work could continue until the bull trout population has fully recovered.

Monitoring Activity:

BALD EAGLE AND RECREATION USE AT SWIFT RESERVOIR.

A. What is it?

Monitoring bald eagle nesting at Swift Reservoir, and identify possible conflicts with ongoing recreation activity in the vicinity of the nest.

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

The objective of the monitoring is to identify if there are conflicts between maintaining the site as suitable for bald eagle nesting, and existing and expected future recreation use. The goal is to maintain the suitability of the site for nesting bald eagles.

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 to determine if the pair is successfully reproducing, and how many young are fledged. Surveys of the amount and types of recreation use should be made beginning in 1996. The bald eagle nest site is in sub-basin 08J.

D. The anticipated rates and timeframes 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 large tree stands, TES species, C-3 species, class IV streams, wetlands, and potentially unstable soils. Field vegetation surveys have been completed on approximately 50 percent of the watershed. Less than 5 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 timeframes 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. Funding for ecosystem condition surveys has been very limited. The best opportunities for field surveys have been 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 LSR's, Wilderness, and Administratively Withdrawn areas.

Commodities and Development:

ALLOW PROJECT ANALYSIS TO CONSIDER VARYING RIPARIAN RESERVE WIDTHS.

A. What is it?

Rather than automatically using the standard widths in the Amended Forest Plan, allow project analysis to evaluate site specific Riparian Reserve widths. Analysis for specific projects within the watershed should consider how past and potential activities within the current Riparian Reserves may affect how these areas function in the watershed. Site specific analysis will also refine mapping that was done at a very small scale, such as unstable or potentially unstable areas.

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

It may be possible to conduct silvicultural treatments and/produce goods and services from the area that is currently within Riparian Reserves to enhance how they function. Conversely, where past timber harvest has impacted Riparian Reserves, it may be desirable to consider deferring harvest in certain upland stands to maintain functions such as travel corridor connectivity.

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

Sub-basins where activities within the Riparian Reserves may be allowed are those that have a low percentage of the reserve already harvested, where there is relatively flat ground, and where there is little or no concern for mass wasting and erosion. These sub-basins are: 06C, and 06K.

Sub-basins where it may be desirable to defer harvest in upland stands are those that have had a high percentage of harvest in stream Riparian Reserves that have fragmented corridors. These sub-basins are: 06B, 06D, 06H, 06J, 06P, 06R, 06S, 06U, and 08I.

D. The anticipated rates and timeframes for achieving the management objectives.

Evaluation of projects within these sub-basins for appropriateness of this recommendation may begin immediately. Site specific analysis at the sub-basin scale must document the objectives and rationale for changing the widths of reserves.

Areas Available For Timber Harvest

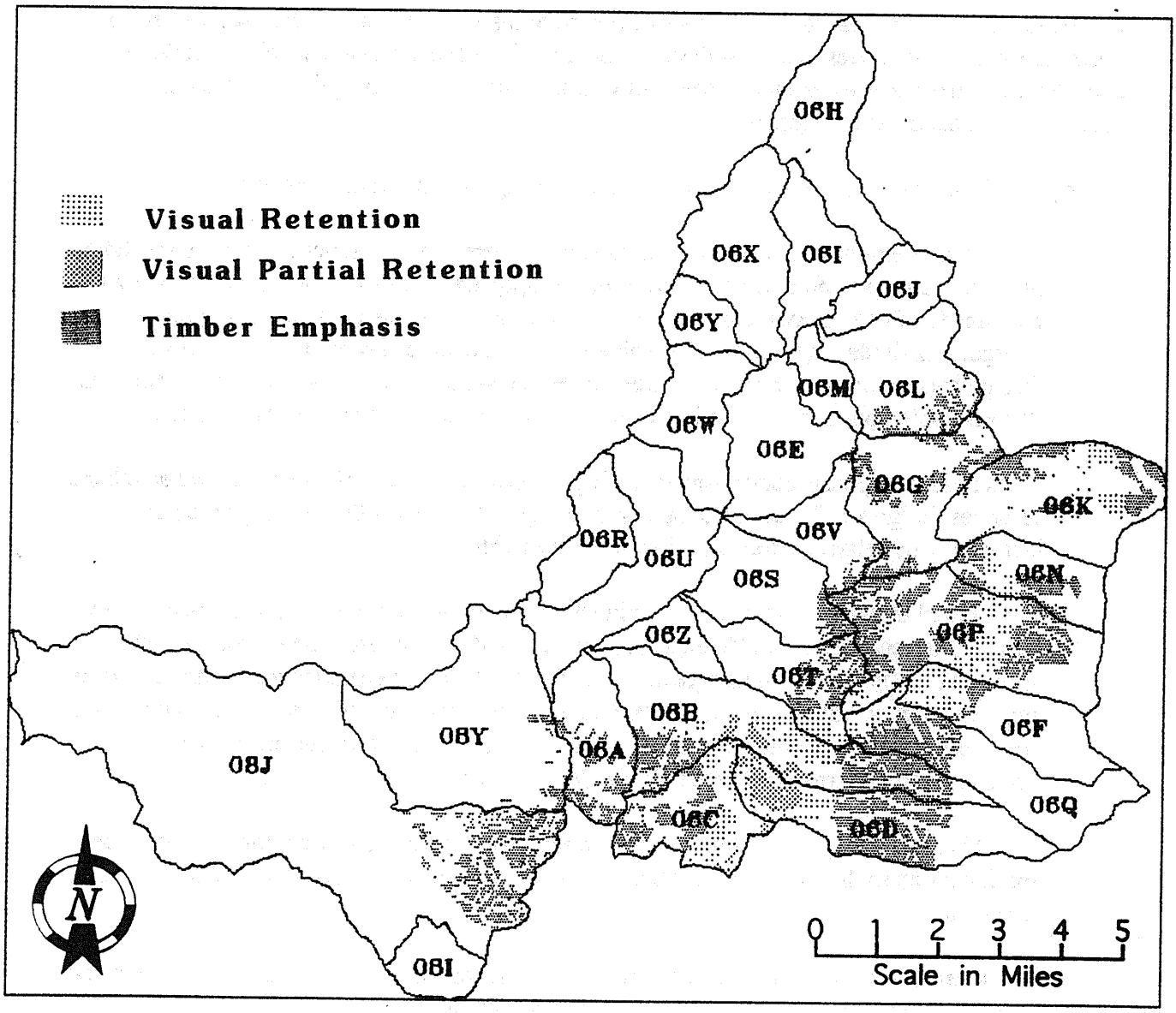


Figure 32 Areas Available For Timber Harvest

Recommendations by Sub-basins

Some sub-basins contain recommendations for more than one activity. Readers may be interested in seeing all recommended activities described above arrayed for each sub-basin. Accordingly, Table 24 - Recommendations by Sub-basins, shows this information in one place.

Inconsistencies between higher order plans, ecosystem capabilities, and reference conditions

Stand Structure and Composition:

The objective of LSR management is to protect and enhance conditions of late-successional and old-growth forest ecosystems (GPNF Amendment 11 1995). While this objective may be met within a specific portion of the watershed (the LSR), some habitats and components of late-successional and old-growth ecosystems may not be adequately protected if they occur in the Matrix but not within the LSR. Ecosystems are complex, and their components and inter-relationships are often under-studied and poorly understood. Very little ecological data is available from areas within the Matrix.

Special Habitats-Plants

The assumption that all special habitats for plants are riparian or wetland ecosystems, which will be protected by the Riparian Reserve allocations, leaves other special habitats with the Matrix vulnerable to timber harvest and related activities. Vascular plant, lichen, bryophyte, and fungi inventories and ecological data collections within the Matrix would aid in the identification and subsequent protection of other special habitats.

TES and C-3 Plant Species

Because most of the vegetative data collected within the watershed has been based on timber inventories, TES and candidate species have probably been overlooked at many sites. Inventories of vascular plants, lichens, fungi, and bryophytes have not been conducted within the watershed, and are not planned for the future. These inventories could yield valuable information on the ecology and distribution of these organisms within the watershed.

Ecosystem Management Strategies

Historically fire has played a large role in maintaining species and ecological diversity and processes within the watershed. According to the ROD, all fire will be suppressed within the LSR. This could lead to unnatural conditions with high fuel loads, low landscape heterogeneity and lowered vascular plant, lichen, fungal, and bryophyte biodiversity.

Although the ROD specifies that the LSR is to promote late-successional and old-growth species and conditions, no data exist on what those species or conditions are within the watershed. As a starting point, an inventory of identified late-successional associated species and their locations within the LSR should be conducted. Research and monitoring of old-growth conditions and processes, and the succession of younger stands towards old-growth conditions, should be conducted.

Big Game Winter Range

Amendment 11 of the Gifford Pinchot Forest Plan addresses management of big game winter range in the Matrix, but not in other allocations (6-21). In the Middle Lewis Watershed all of the biological winter range is in Late Successional Reserve (LSR), and as such cannot be managed to optimize

Table 24 Recommendations by Sub-basin

	Restoration									Monitoring											Commodities	
	Road Decommisioning	Road Weatherization	Subsoiling and/or Tilling	Silviculture in Uplands	Silviculture in Riparian Areas	Recreation Site Rehabilitation	Rehabilitate Rock Quarries	Recreation Use in Wilderness	Stream Temperature	Stream Surveys	Amphibians	Riparian Treatment Effects	Fish Survey	Winter Recreation Use	Bald Eagle/Recreation Use at Swift	Recreation use on Plants at Drift Cr.	Verification of Eco. Inven. Data	Recreation Site Development	Consider Riparian Reserve Width	Opportunities for Timber Harvest
06 A - Miller Cr.						X	X									X	X			
06 B - Curly Cr.	X	X	X	X	X	X		X						X			X	X			
06 C - Hardtime Cr.														X			X	X	X	X	
06 D - Outlaw Cr.			X	X	X	X		X						X			X	X		X	
06 E - Front Wall Tribs.	X	X							X	X							X	X			
06 F - Placid Lake					X	X	X	X						X			X	X			
06 G - Skookum Mdw/Big Cr.	X	X	X	X						X				X			X			X	
06 H - Alec Cr.	X	X	X	X					X		X	X					X	X			
06 I - Copper Cr.					X	X											X	X		X	
06 J - Middle Falls/Lewis R.	X	X		X	X	X			X	X	X						X				
06 K - Cayuse Mdw/Big Cr.			X			X								X			X		X	X	
06 L - Chickoon Cr.	X	X								X							X			X	
06 M - Crab Cr.																	X				
06 N - Upper Meadow Cr.			X		X	X		X		X							X			X	
06 P - Meadow Cr/Lone Butte	X	X	X	X	X	X		X	X	X				X			X	X		X	
06 Q - Upper Rush Cr.			X	X	X	X		X						X			X	X			
06 R - Pepper Cr.	X	X	X	X	X	X			X								X				
06 S - Little Cr.	X	X		X	X	X											X				
06 T - Lower Rush Cr.	X	X	X	X	X	X			X				X	X			X	X			
06 U - Sidewall Tribs		X	X	X	X	X			X								X				
06 V - Big Cr.	X	X		X	X	X											X	X			
06 W - Sidewall Tribs	X	X	X	X	X												X				
06 X - Cussed Hollow		X		X	X	X	X										X			X	
06 Y - Spencer Cr.																	X				
06 Z - Sidewalls Curly/Rush	X	X		X													X				
08 I - Timber Cr.	X	X	X	X	X												X	X			
08 J - Drift Cr.	X	X		X											X	X	X	X			
08 Y - Tribs to Swift Res.	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 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.

Appendix B

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Appendix C

ISSUES AND KEY QUESTIONS

ISSUES AND KEY QUESTIONS

ROCKS, GEOLOGIC PROCESSES, SOILS

Issue: Mass Wasting

The Middle Lewis River has numerous past active and active landslides and debris flows within its boundaries. Management activities have reactivated some slides that were inactive or increased active areas that were somewhat active before (such as along the 90 Rd. by Crab Creek). Some of the landslides and debris flows have impacted streams while others have not. Other areas of noted mass wasting are in the Squaw Butte area, Miller Creek and Curly Creek Areas and along Drift Creek.

Key Questions:

1. Is there evidence of, or potential for mass wasting in the watershed?

2. What mass wasting processes are active?

3. How are mass wasting features distributed throughout the landscape?

4. What physical characteristics are mass wasting features associated with?

5. Do landslides deliver sediment to stream channels or other waters?

6. Do forest management activities create or contribute to instability?

7. What areas of the landscape are susceptible to slope instability.

Issue: Surface Erosion, Hillslopes

Surface Erosion on hillslopes becomes a concern when slopes are left bare (to natural soil) after management activities such as skidder harvest and hot burns that removes the natural duff. It becomes more of a concern on steep slopes (greater than 50%) as the material has more of a tendency to move downslope toward streams.

Key Questions:

1. What is the hillslope erosion potential?

2. Are contributing activities present?

3. Is sediment delivered to streams?

4. What areas are sensitive to forest practices?

logged units have had mixed results. Monitoring results elsewhere in Region 6 have been similar.

Key Questions:

1. What is the extent of soil productivity loss due to past forest management activities in this watershed?

2. What measures will be applied in future activities to ensure that soil productivity will be maintained?

3. What rehabilitative measures will be undertaken to correct existing soil damage?

8. Are their any restoration and/or monitoring possibilities?

Issue: Hydrologic Changes

Past management activities in the Middle Lewis River watershed analysis area may have influenced basin hydrology by increasing peakflows during fall and winter storms, and by decreasing summer low flows. Activities such as timber harvest and roadbuilding have occurred throughout the watershed and may influenced the timing and quantity of runoff.

Key Questions:

1. What are the current watershed conditions influencing hydrologic response?

2. How do management activities 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?

5. Which areas are susceptable to windthrow or insect infestations?

6. How can restoration of harvest units help develop late successional plant communities?

7. How can restoration projects be monitored to determine how developing late successional plant communities compare with those occurring as a result of natural processes?

8. Where are the blocks of existing interior forest, and how large are they?

9. Which interior forest dependent plant, lichen, fungi, and bryophyte species are present on the watershed?

10. How can these species be monitored?

Issue: Riparian Reserve Fragmentation

Fragmentation of riparian reserves has altered the connectivity of these areas, possibly resulting in species isolation. This may lead to undesirable changes in species composition and use within riparian reserves and between late successional reserves.

Key Questions:

1. How much of the riparian reserve has been previously managed and when?

2. How many road crossings are present within each sub-basin?

3. How have stream crossings/road area impacted the actual area of riparian reserves?

4. Which TES, C-3, and other species have been impacted by changes within the riparian reserve?

5. How have aquatic and terrestrial communities been altered by management within the riparian reserve?

6. What are the best restoration strategies to mitigation for fragmentation?

7. What are the ranges of natural variability in stand age and structure within riparian reserves?

8. Will further riparian reserve fragmentation result in genetic isolation of any species?

9. For species of concern, where are there areas of unfragmented riparian habitat that could serve as refugia?

8. Have there been any documented extinctions in the watershed?

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 outcompeting 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 Habitats

Areas such as non-forested sites, wetlands, rock outcrops, caves, and talus slopes provide unusual habitat and are important for biodiversity. Many sensitive plant species and plants with narrow ecological niches are associated with these habitats. Under forestwide standard and guideline FW-211 direction these habitats and their ecotones are to be protected. Known special habitats include: Cayuse Meadow, Hungry Peak Meadow, South Campground Meadow, Skookum Meadow, Lone Butte Meadow, McClellan Meadows, Drift Creek, Spencer Peak/Spencer Butte, Paradise Hills, and the huckleberry fields.

Key Questions:

1. Where are the special habitats in the watershed?

2. Are special habitats included in GIS?
3. How can these special habitats be typified?

4. Which processes have helped to develop these habitats?

8. Is there an optimal time to harvest these species?

9. What are the best harvest strategies to ensure resource sustainability?

10. What kinds of user conflicts are being encountered?

11. Should any current special forest products not be harvested?

12. How can special forest product species be monitored to answer basic ecological/biological questions?

FISHERIES

Issue: Population viability of bull trout in the Lewis River.

Approximately 100 individuals are suspected in the Swift reservoir population. A viable population should contain approximately 500 spawning pairs or a minimum of 1000 individuals. This population may require extensive protection to ensure that the remaining individuals have the highest likelihood of recovery.

Key Questions:

1. Where do bull trout hold during pre-spawn time, and where are important spawning and rearing areas?

2. How long do they stay in these areas?

3. What is the current condition of important habitat variables (water temp, pools, LWD, substrate)?

4. Are any of these habitat variables of concern? If so where are they located?

5. What is the vulnerability of those areas to changes in input variables such as LWD, coarse and fine sediment, water (quality/quantity)?

6. Have activities occurred that have altered the amount and rate of these input variables? If so, what are the activities and where did they occur?

7. What is the future trend of habitat quality for bull trout?

8. Are there any habitat areas that have been degraded that have a high potential for restoration and or monitoring activities?

Issue: Availability and quality of key habitat attributes for resident salmonids.

Current aquatic habitat conditions are a result of past natural and human induced processes that have occured in the watershed. Road buildiing and timber harvest combined with naturally unstable soils have through time altered the stream habitats and aquatic communities.

Key Questions:

1. What is the current range, species composition, and relative abundance of resident salmonids in the analysis area?

2. What is the historic range, species composition, and relative abundance of resident salmonids in the analysis area?

3. What is the current condition of important habitat variables (water temp, pool quality)?

Issue: **Cumulative effects of management activities on downstream anadromous fish populations.**

Downstream populations of fall chinook contribute significantly to the Columbia river population of this species. Management activities such as timber harvest or road building which may have cumulative off-site effects could impact this relatively small population of fish.

Key Questions:

1. Is there evidence of cummulative impacts associated with management activities (road building or timber harvest) within this watershed? If so where, and what activities ?

2. Do these effects reach critical habitat areas (downstream of the dams)?

3. What future management activities could contribute to cummulative downstream effects critical to the survival of the fall chinook population?

4. What are the likely interactions between populations in this watershed and populations in surrounding watersheds, based on knowledge of both habitat and species distribution?

5. Are there any restoration and or monitoring opportunities?

Issue: Aquatic Habitat Integrity

Critical components of aquatic habitats within the riparian reserves have been altered. This may influence the capability of these ecosystems to provide effective habitat for riparian dependent species.

Key Questions:

1. What sources of sediment are present within each sub-basin?

2. Which areas are susceptable to bank erosion?

3. Which areas are providing allocthanous nutrient sources?

4. Where are the sources of future large woody debris?

5. Which TES and other species have been impacted by changes in the condition of the riparian reserve?

6. Does canopy closure within the riparian reserve maintain appropriate stream temperature for aquatic dependent species?

7. How have changes in the array and landscape pattern of riparian plant communities affected aquatic macro invertebrates?

8. What is the spatial and temporal hydrologic connectivity of aquatic components within and between watersheds?

Key Questions:

1. Where are riparian reserves inadequate in providing dispersal habitat for threatened, endangered, and sensitive species; late-successional; and management indicator species?

2. Does canopy closure within the riparian reserves provide necessary cover for threatened, endangered, and sensitive species; and management indicator species?

3. What is the current distribution of age classes, and stand structure types within the riparian reserves?

4. What is the range of variability of coarse woody debris amounts in terrestrial and riparian systems?

5. Where is large woody debris defecient?

6. Where is the existing density of snags deficient?

Issue: The GPNF Forest Plan (as ammended) mandates that we monitor for late successional dependent (C-3). None of the watershed has been inventoried for C-3 species.

Key Questions:

1. Which C-3 species are likely to occur on the watershed, and in which habitats?

2. Has habitat modification impacted any C-3 species population viability?

3. How can population viability of C-3 species be monitored?

4. Has disruption of dispersal corridors impacted any C-3 species population viability?

Issue: Wildlife species in the watershed are valued for both consumptive and non-consumptive uses and have an economic value.

Key Questions:

1. What is the historic and current distribution of species and their habitats in the watershed?

2. What is the role of this watershed in the overall maintenance of species viability.

3. How are species richness and diversity influenced by the landscape pattern of plant communities, seral stages, and special habitats in the watershed?

4. What are the likely interactions between populations in this watershed and populations in surrounding watersheds, based on knowledge of habitat and species distribution?

6. What is the amount of dispersal habitat (11/40 and above) in each ROD allocation within the watershed?

7. How much (percent and total acres) of the dispersal habitat are in Riparian Reserves, Administratively Withdrawn Areas (for those which may provide long-term protection), Congressionally Reserved, 100-acre cores, and other smaller (< 10,000 acres) LSR's? Is the total greater than 50%?

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 land management allocations are these activity areas?

3. Do current habitat conditions maintain or allow for increased use of activity centers?

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 ben 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?

4. Where is potential denning habitat (generally above 5000 feet elevation in areas where deep snow accumulates)?

HUMAN DIMENSION

Issue: **Road development associated with hydorelectric projects and timber harvest has provided access to and within this watershed.**

Forest users have been able to utilize the many varied recreation opportunities as a result of better accessibility. Installation of recreation facilities have come in response to this increase in use. There may be a need for additional recreation planning for the management of this watershed as it relates to recreation use and future development.

Key Questions:

1. What have been the historic human uses and activities in this watershed?

2. What types and intensity of recreational use occur here at present?

3. Why and how have these uses and activities developed?

4. What management direction is needed to provide for recreation opportunities and to provide for protection of natural resources?

Issue: **Development of roaded access into this watershed has opened areas that were inaccessible in the past. Future activities and associated roads have a potential to open new areas that are presently unroaded.**

Key Questions:

1. What areas should be opened in the future?

2. What areas should not be opened in the future?

3. What areas should be closed that are open today?

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

Mass Wasting

Information for completing the Mass Wasting module was based on existing data, forest geologic resources and conditions and the forest soils resource inventory. Air photo review of different photo flights were used for verification and modification of some of the areas. Confidence in the data is better than 80% for the existing landslide areas and greater than 70% for the potentially unstable soils. This is based on the inventory collection techniques used and on when the data bases were compiled. More field verification would increase the confidence level in both data sets to greater than 90%. Limitations based on the confidence levels is that areas of instability were probably not identified and some mapped areas may not be a concern. Implications would be that further field work will need to be done at the NEPA level in order to make a project viable.

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.

Implications for Management

Management decisions relating to activities such as restoration or timber harvest may not be 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.

Due to the lack of information such as beneficial use areas, it is possible that management activities may negatively affect a beneficial use that was previously unknown. Degradation may also occur if the accuracy of the vulnerability assessment is low. We may think an area has a low vulnerability to sediment input based on the limited analysis, but in actuality the area is very vulnerable to sediment.

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.

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

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, 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 districts 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 two percent of the streams in the analysis area, totaling only 12.5 miles. Using this limited amount of data across the entire watershed analysis area greatly compromises 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 the amount of the stream riparian reserve that has been harvested in the past. It assumes that very small or no stream side buffers were left in place along the streams, and that this area is now in an early-mid seral stage.

Data Gaps:

- Stream Surveys cover only two percent of the streams in this analysis area.
- 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
- No pristine stream survey data exists to develop relationships between current conditions in managed sub-basins with those in un-managed sub-basins.

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.

Data Gaps:

- No riparian specific data to quantify shade, species compositions and existing condition of riparian reserves.
- No pristine water temperature data exists 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 environment and which 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, even though 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, but 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.

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. It is only a surrogate and has many assumptions about the impacts that roads and their management have. All of these items need to be considered when evaluating this information.

Human Dimension - by Reed Gardner,

There is a need to conduct a Social Assessment - an effort to assess (estimate in advance) the consequences to human populations of any publics or 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.

There is a need to know where and how much special forest products are being gathered.

Recreation use data (type and intensity) was not available except for developed recreation sites. The type and intensity of dispersed use for this analysis area is included in the totals reported by Mount St. Helens NVM and Wind River Ranger District. It was not possible to extract reliable dispersed use information from this reporting system. Reliability for the amount of use for developed recreation sites is High in those sites with traffic counters and with hosts. Reliability of others is Low. Current, accurate use figures (type and intensity) are also needed for non-site use such a viewing from roads.

Public use road data was not available for all major roads in the analysis area. Current traffic counts are needed for roads 24, 30, 31, 32, 51, 64 and 65. Reliability for data on roads with traffic counters is high.

There is a need to inventory all dispersed recreation sites in the analysis area. Sites have generally not been inventoried outside of wilderness.

There is a need to complete LAC impact surveys on both developed and dispersed recreation sites so possible site rehabilitation figures can be identified.

There is a need to inventory and map specific sites that are special to people or that have important views and unique features that can aid in understanding how people interact with the watershed.

Confidence in analysis: Low-Moderate

Appendix E

VEGETATION STAND STRUCTURE DEFINITIONS

VEGETATION STAND STRUCTURE DEFINITIONS
Gifford Pinchot National Forest

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.

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

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.