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West Fork of Hood River Watershed Analysis

Mt. Hood National Forest
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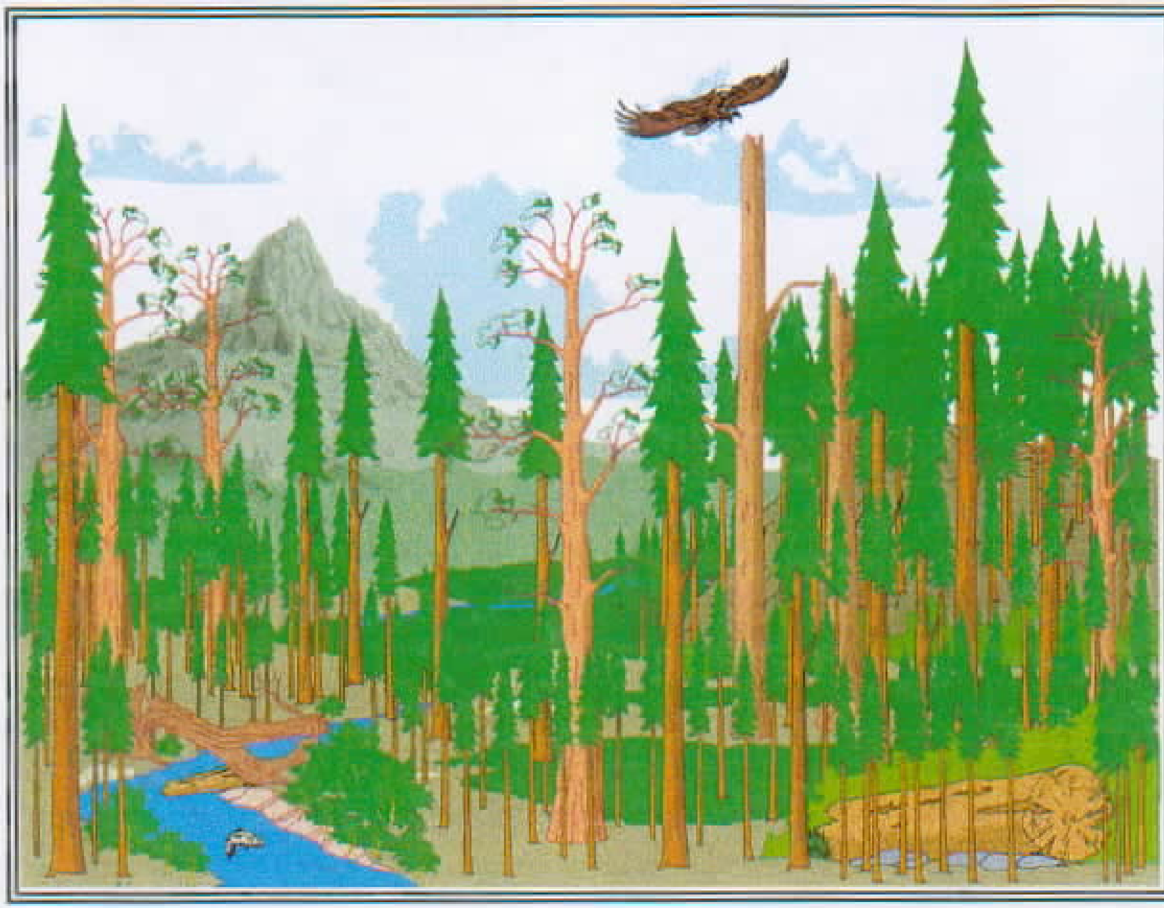

West Fork Hood River Watershed Analysis

First Iteration

Eastside Watershed Analysis Team
West Fork Stewardship Team

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EXECUTIVE SUMMARY

Introduction

West Fork watershed is partially a Tier 1 Key Watershed and partially a non-Key Watershed under the Northwest Forest Plan. Tier 1 Key Watersheds were selected for directly contributing to anadromous salmonid and bull trout conservation. Watershed Analysis is required prior to all management activities, except minor activities such as those Categorically Excluded under the National Environmental Policy Act (NEPA) (ROD p. B-19). This watershed covers approximately 65,500 acres between Mt. Hood and the mainstem Hood River. About 65% of the watershed, or 42,728 acres, is National Forest System Lands. Longview Fibre and Hood River County own most of the remaining 35% of the watershed.

We divided West Fork into three principle subwatersheds based on geomorphology, hydrology, climate, and vegetation: West Fork, Lake Branch, and Green Point. West Fork and Lake Branch subwatersheds comprise the Tier 1 Key Watershed and are similar in terms of climate and vegetation. Green Point subwatershed is a non-Key Watershed and very different from the other two subwatersheds in all four factors.

We chose 1900 as our breakpoint year for evaluating the range of natural conditions (RNC). Euro-American occupation and use of West Fork watershed was limited until 1900, and little information exists on typical conditions before that date. In 1855, the treaty with the Middle Tribes of Oregon was signed, transferring the watershed into the ownership of the US Federal government. Settlement activities began shortly thereafter near West Fork watershed, but relatively little activity occurred within the watershed until the late 1890s.

We used General Land Office survey notes, a survey of the Cascade Range Forest Reserve, and accounts published by the Hood River County Historical Society to describe past conditions in as much detail as we could. We also used this information along with hints from the present condition to speculate on probable past conditions since we did not have much detail. We used a variety of information sources to describe the current conditions.

We discussed vegetation in terms of general structure types based on those described by Oliver and Larsen (1990). We added four types (Mature Stem Exclusion, Riparian Hardwood, Riparian Conifer, and Riparian Mix) to those originally described (Stand Initiation, Stem Exclusion, Understory Reinitiation, and Old Growth). We renamed the Old Growth structure type to Late Seral Multistory, but the stands are essentially as described in *Forest Stand Dynamics*. These eight structure types should describe every stand in the watershed.

We also examined the probable range of occurrence through time for each structure type, which we considered RNC. We found the range was so broad (20-80%) as to be meaningless.. In other words, almost anything we did or did not do in terms of timber harvesting levels would place us within this range. Therefore, it seemed more valuable to focus discussions on the landscape *patterns* of the past and present.

The focus of many discussions in this document was on disturbance regimes and processes. These regimes and processes include both natural events, such as lightning-caused fires, floods, and erosion, and human-caused events, such as timber harvesting, road construction, and fish stocking. Changes in processes and the addition of processes were key to understanding the current condition of the watershed and how we might need to alter our management to meet the intent of the Northwest Forest Plan.

This document contains an expanded appendix to include many of the specialists reports and working notes on past conditions and disturbance processes and regimes. A list of various species that are either found or suspected in the West Fork watershed are also found in this section.

Public Involvement

Direct public involvement consisted of one public meeting held at the Rockford Grange Hall, just outside of Hood River, on August 9, 1995, and direct contacts. Indirect public involvement occurred through recent planning documents, such as the recent Environmental Analysis (EA) completed for several timber sales on Mt. Defiance and the Eastside Access and Travel Management planning effort. We received a few letters in response to the mailing announcing the public meeting. We talked to several people directly, such as Dan Fink of Longview Fibre, Jerry Bryan of Farmer's Irrigation District, and John Kelley of the Confederated Tribes of Warm Springs. Other agencies contacted included:

- US Fish and Wildlife Service,
- Oregon Department of Forestry
- Oregon Department of Fish and Wildlife,
- Oregon Natural Heritage Program,
- Portland Water Bureau,
- Hood River County Water Master, and
- Hood River County.

Stewardship Involvement

The West Fork stewardship team was heavily involved in the entire analysis process. We depended on the stewards to describe existing conditions and past activities, and to synthesize the information. The stewards were an integral part of the analysis from start to finish.

Constraints on Analysis

Little data was stored in a format that allows query via GIS or ORACLE. Instead, we depended on "living databases" in the form people who have worked on the district for many years. In some cases, we lacked data for the National Forest System Lands. In other cases, we lacked data for the non-federal lands, did not have access to data in a readily useable form, or did not receive the data within the time constraints.

The time and data constraints resulted in a qualitative analysis that is more general in nature. Thanks to the cooperative efforts from Longview Fibre, Hood River County, Oregon Department of Forestry, and Oregon Department of Fish and Wildlife, we were able to discuss the entire watershed qualitatively. We integrated the goals, objectives, and plans of the other owners into discussions on disturbance processes and disturbance effects and various key questions.

Issues and Results

The stewardship team and the watershed team developed seven main issues. Each issue had a dominant theme and several key questions which we attempted to answer. We phrased the questions in a "yes" or "no" answer format with explanation following. We did not answer two key questions since they depend on a Landscape Design, a stewardship team responsibility.

Issue 1–Introduced Plants and Animals. We found several interactions between native and non-native plants and animals, but only a few are significant. In some cases, the non-natives were considered desirable or at least acceptable by the Forest Service in the recent past. An example of this type of interaction is seed mixes used for erosion control or wildlife forage enhancement but which persist and spread, occupying habitat that native species would otherwise use.

Significant findings in this issue include:

- We may need to use chemical control methods to bring certain noxious weed species populations down to levels controllable by other methods.
- Introduced and non-native fish may compete with populations of native fish.
- Introduced cinnabar moth is also feeding on native *Senecio* species, not just tansy ragwort, with unknown effects.
- Introduced fish probably have altered the ecosystem in high elevation lakes that did not support fish historically.
- At least one plant, three mammals, four birds, and three fish stocks are no longer found in the West Fork watershed.

Issue 2--Species Presence and Viability. We often lack sufficient information, adequate strategies, or adequate tools to assure the continued presence of some species and the continued viability of species limited to West Fork watershed. We cannot identify many of the species listed in the C-3 table, much less assure their continued presence. Tools to help us deal with many of these species have been slow to arrive. Species that require large home ranges, a diversity of habitats, or highly specialized habitats often do not have adequate strategies, such as wolverine. In some cases, the direction and strategies are adequate, but we lack the tools to help assess how various management alternatives will help us meet the direction. One example of this is the lack of snag models suitable for the crest of the Cascades and the eastside.

Significant findings in this issue include:

- The best red tree vole habitat in West Fork occurs on Longview Fibre lands. We are unsure if the species will persist in the watershed on the more marginal habitat on National Forest System Lands or if it will be temporarily extirpated from the watershed.
- We do not anticipate that the other landowners will provide enough suitable habitat to assure the continued presence of species that depend on large snags, such as certain bats and white-headed woodpeckers, or great gray owls.
- Strategies are needed at the regional or interagency scale to assure the continued presence of wolverine, Townsend's big-eared bat, mountain quail, Cascade fox, red legged frog, plant species on the State Review and Watch lists, and certain special and unique habitats.
- Connectivity has been broken either within West Fork watershed or between West Fork and other watersheds for snag dependent species, red tree vole, plants in special and unique habitats, and species with large home ranges that use a mosaic of large trees.
- West Fork provides important connections at the metapopulation scale for species with both eastside and westside, inland and coastal populations.

Issue 3--Recreation. Recreation use levels in West Fork watershed, like elsewhere on the Forest, continue to increase. Activities that are stable are so due to limitations of facilities. So far, recreational conflicts are limited between the various activities. Most recreational use in the watershed is focused at Lost Lake, in wilderness areas, and on the Pacific Crest National Scenic Trail. The opportunities for new or different recreational experiences are limited. Recreational users intending to use National Forest System Lands generally do not cause significant problems for the other owners even though the National Forest boundaries are poorly marked.

Significant findings in this issue include:

- The main conflict between users occurs between mountain bikers and motor vehicles and wheelchair users, particularly around Lost Lake.
- Illegal use of mountain bikes in wilderness and on the Pacific Crest National Scenic Trail has proven persistent.
- Dispersed camping has greater impacts to soil, water, vegetation, wildlife, and fish than does developed camping due to the widespread nature of the activity, the lack of site controls, and the lack of monitoring.
- The largest threat to other resources posed by recreational use is lack of adequate budgets to maintain recreational facilities, inform and educate visitors about proper uses and methods, restore or close degraded sites, and enforce existing regulations.

Issue 4—Disturbance Regimes. In general, management activities since 1900 have had little impact on disturbance regimes, with the possible exception of much of Green Point subwatershed. Management activities have altered the probable outcomes of certain disturbances by altering the functioning of various systems and the ability to either absorb or recover from disturbances. The biggest changes from pre-1900 conditions are the change in landscape pattern, the loss of certain landscape elements, such as downed wood and snags, and the loss of connectivity across the landscape and within the Hood River system.

Significant findings in this issue include:

- Timber harvesting on National Forest System Lands left insufficient numbers of snags and downed logs until the 1990s.
- The lack of riparian and in-stream downed wood and decayed wood has dramatically altered aquatic ecosystems.
- Human activities have not only reduced potential refugia within West Fork watershed, but across the Hood River basin, leaving many populations highly susceptible to otherwise limited disturbances.
- The current landscape pattern is dramatically different from the pre-1900 characteristic landscape pattern. Openings on National Forest System Lands are more atypical of the historic landscape pattern than many openings on other ownership's.
- Standards and guidelines for Matrix lands in the Northwest Forest Plan were not designed to cope with a major forest health problem where significant numbers of trees are dead and dying.

Issue 5—Other Ownership's. The other owners within the watershed are managing their lands as industrial forest. As a result, these lands will probably not provide for late successional dependent species. The revised State Forest Practices Act is intended to increase riparian area protection. The act has not had sufficient application or trial to know if these areas will provide dispersal habitat or main habitat for late successional dependent species. Riparian management areas under this Act are significantly smaller than the Riparian Reserves in the Northwest Forest Plan. Chemicals are used for a variety of purposes in the watershed, with the highest uses by the orchard industry near the mouth of West Fork Hood River.

Significant findings in this issue include:

- Acquisition of the Longview Fibre in-holding along West Fork Hood River would greatly add to the terrestrial, riparian, and aquatic habitat and connectivity over the long-term.
- Farmers Irrigation District is willing to help improve aquatic and riparian habitat and connectivity in Green Point subwatershed, but needs to assure the district members that they are receiving their full allocated water rights. The District is actively pursuing water conservation to improve water use efficiency and is no longer trying to obtain additional water rights.

- Limited monitoring data suggest that current stream temperatures have been driven by railroad logging and National Forest logging in West Fork and Lake Branch subwatersheds and by logging, wildfire, and irrigation withdrawals in Green Point subwatershed.
- The Aggregate Recovery Percentage rating, based on 1991 vegetation data (the latest available) is 71.5% for the entire watershed, and 66.3% for Lake Branch subwatershed. The applicable thresholds of concern are 75% for Green Point and West Fork subwatersheds and 82% for Lake Branch subwatershed. Additional harvesting has occurred on all ownership's since 1991.

Issue 6--Extractive Forest Products. This issue discusses tribal treaty rights as well as the more traditional forest products such as timber, firewood, common minerals, and other special forest products. We can best meet our treaty obligations by helping to restore anadromous fish runs. Our responsibility is to assure adequate spawning and rearing habitat to meet the population goals for various species and runs. Due to on-going efforts at restoring main habitat features, such as in-channel wood and log jams, anadromous fish habitat has shown substantial improvements. The greatest risk to these improvements is fine sediment generated by roads and management related debris flows, particularly since West Fork watershed is generally unstable and prone to mass wasting.

Significant findings in this issue include:

- The Forest has several chronic road maintenance problems in West Fork watershed and a declining road maintenance budget. Maintenance has been inadequate recently, particularly on Maintenance Level 2 roads, and several cross drain culverts are partially blocked. We will probably not be able to deal with all these problems before major blockages and blow-outs begin to occur.
- Surface water is not over-allocated on a legal basis, but is over-allocated on an ecological basis, particularly in Green Point subwatershed. Because the net water available for allocation in August and September is very small, the Oregon Water Resources Board has stated they will not allocate any more consumptive rights for surface water in West Fork watershed.
- Current direction is probably adequate to halt the decline of known native fish stocks and habitat; however, halting the decline also depends on dealing with problems outside the watershed and/or beyond the jurisdiction of the Forest Service. Identified problems include on and off Forest urbanization, diversions with unscreened or non-functioning fish screens, ocean fisheries, and altered habitat.
- Management activities by the other owners plus the BPA powerline could restrict the Forest's ability to meet Mt. Hood and Northwest Forest Plan objectives. Problems include difficulty in attaining adequate hydrologic recovery, providing adequate connectivity, and road-related impacts to several resources.
- The estimated sustainable sale quantity is approximately 2.5 MMBF per year from West Fork watershed.

Issue 7--Bull Run Management Unit Buffer. This issue revolved around various management strategies designed to protect the quality and quantity of Portland's main water supply. The buffer area extends into West Fork watershed, which does not provide water to the city of Portland.

Significant findings in this issue include:

- Major climate cycles drive the fire regime of West Fork. This portion of the watershed experiences a very long return interval (300-500 years). Large wildfires in this part of the Forest burn under such severe conditions that stand age and condition are largely irrelevant; the entire forest is in a "burnable" condition.
- Implementing restrictions on activities, such as timber harvest and recreation, in West Fork watershed to protect Portland's water supply will have no impact on the quality and

quantity of that water unless the city is awarded a right to water from West Fork and exploits that right.

- The ability or inability of LSR and Riparian Reserve designations to protect the Bull Run watershed from human activities and natural disturbances in West Fork watershed is moot. Activities and disturbances in West Fork watershed do not pose a significant risk to the Bull Run watershed. West Fork watershed is at greater risk from a fire originating in Bull Run watershed than vice versa. See also the significant findings above.

Recommendations

Chapter 6 consolidates the recommendations generated by this analysis. Chapter 5 contains the background information that accompanies these recommendations. Chapter 6 also contains the recommendations on Riparian Reserve widths and discusses the need for culvert and bridge replacement to meet the 100 year flood requirement under the Northwest Forest Plan. We discuss the probable trends in vegetation and habitat on the non-federal lands based on their current management and what we know of their goals and objectives. We developed Desired Future Conditions for the National Forest System Lands based on the answers to the key questions, the Mt. Hood and Northwest Forest plans, existing policy / direction, and our understanding of disturbance processes in the watershed.

Restoration Projects

The analysis pointed out several potential restoration projects. We prioritized the list of projects based on problems revealed by analysis. Restoration priorities are based on the consideration of actual resource damage / significance, benefits to species of concern identified in the analysis, and activities designed to accelerate the attainment of desired vegetative structures.

Restoring species extirpated from the watershed is a difficult project to rank. In many cases, these species were extirpated due to human activities that may be considered acceptable. Further, the species have been gone so long from a wide area that the effects of losing them can not be detected. The continuing level of human activity makes species restoration somewhat problematical. We ranked some species restoration projects as Moderate and others as Low.

Data and Analysis Gaps

We identified several data and analysis gaps. Many gaps were due to a simple lack of data, such as snag inventories, and a lack of time to collect the data. A few gaps exist because prior to this watershed analysis the information was not deemed necessary, such as fire history on Mt. Defiance. Developing further refinements of Desired Future Conditions will require data collection and analysis in areas usually not inventoried, such as wilderness streams. Most analysis gaps are tied to the data gaps.

Old Growth

Using the stand structure types we described, we mapped the existing Old Growth (Late Seral) using first hand information, aerial photo interpretation, and contacting the other owners. The Northwest Forest Plan requires that we protect all existing old growth in watersheds with 15% or less on federal lands (ROD p. C-44). We did not identify any Old Growth on the other owners. Only 19% of the watershed is in an Old Growth stage. Most of this Old Growth is above 3000 feet elevation. There is very little interior habitat associated with it due to high fragmentation across the watershed. Old Growth is concentrated in a U-shaped band along Wacoma Ridge, in and just north of the Mt. Hood Wilderness, and along Blue Ridge/Red Hill area. Several small isolated stands are found throughout the watershed.

CHAPTER 1

Introduction

CHAPTER 1: INTRODUCTION

Introduction

This analysis covers the West Fork of Hood River watershed in the Hood River Basin portion of the Deschutes River Province (Figure 1.1). The Hood River Basin consists of four fifth-field watersheds: West Fork, Middle Fork, East Fork, and Mainstem. West Fork watershed is the western most portion of the basin.

Setting

West Fork Hood River originates on the north side of Mt. Hood and along the Cascade crest. West Fork Hood River and East Fork Hood River join just below Punchbowl Falls near Dee to form the mainstem Hood River. The watershed lies approximately 35 miles east of Portland, 8 miles southwest of Hood River, and 7 miles west of Parkdale. The Cascade Crest forms the western boundary. West Fork covers approximately 65,000 acres, of which 65% is National Forest System lands. Hood River County and Longview Fibre are the other principal landowners.

The primary roads into West Fork are Forest Roads 13, 18, 1810, 2810, and 2820. Road 13 provides access to Lost Lake. Only Roads 18 and 1810 connect to a through-route across the Cascade crest over Lolo Pass. All other through access is "blocked" by the Mt. Hood Wilderness to the south, Bull Run Management Unit and Columbia Wilderness to the west, and impassable terrain to the north.

Over 95% of West Fork watershed lies on the Hood River Ranger District. A tiny portion north of Lolo Pass lies on Zigzag Ranger District. This piece of the watershed forms part of the buffer for the Bull Run Management Unit. A portion of the community of Dee lies in the eastern most edge of the watershed. Other significant features in West Fork include:

- Mt. Hood Wilderness (portion),
- Columbia Wilderness (portion),
- Lost Lake,
- Mt. Defiance electronic site,
- Pacific Crest National Scenic Trail,
- A private fish hatchery on Dead Point Creek, and
- The primary water supply for the City of Hood River.

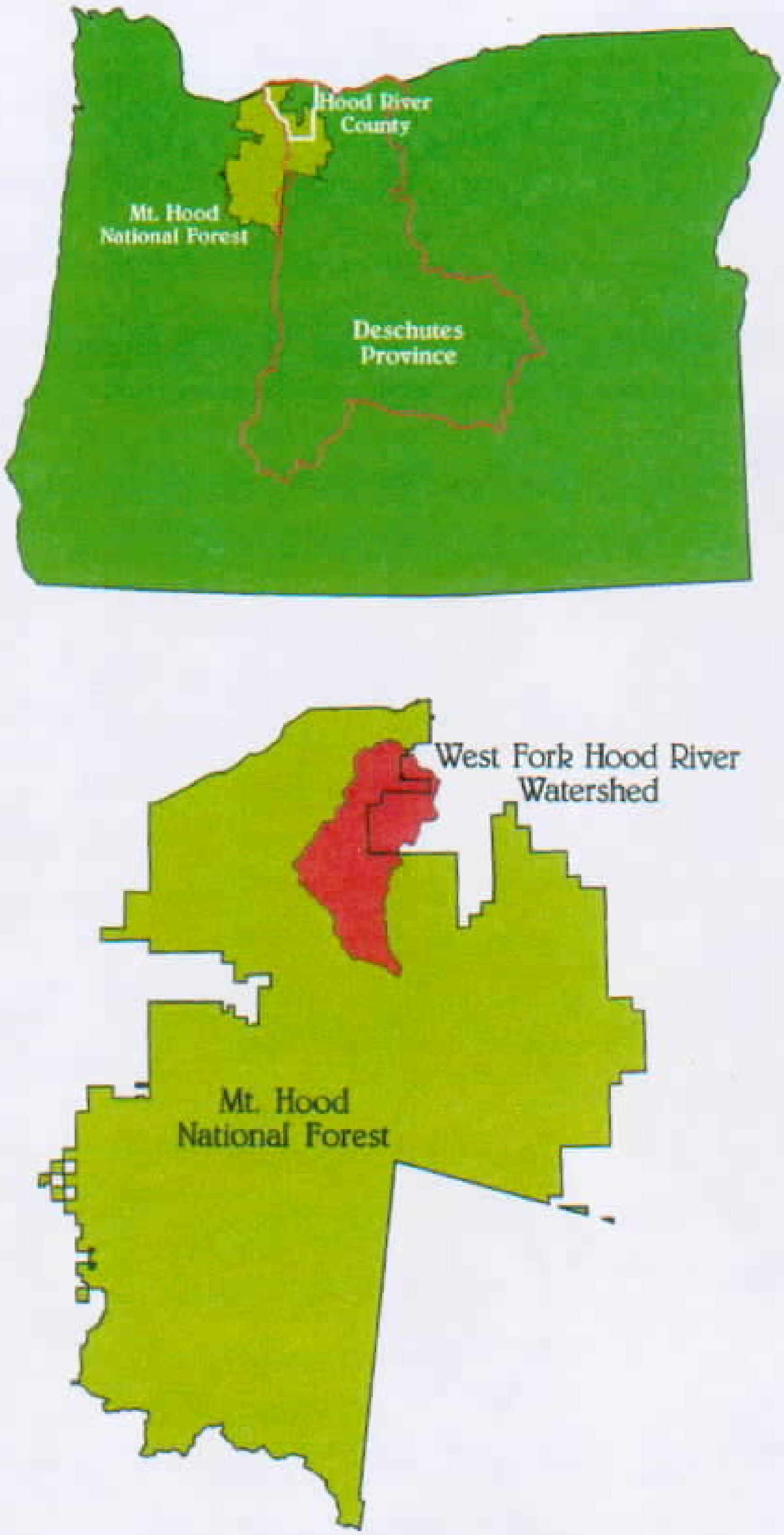

Figure 1.1. Location of West Fork watershed in relation to major features of Oregon.

Mt. Hood Forest Plan Land Allocations

Table 1.1 summarizes acres by land allocation. National Forest System Land allocations are based on the hierarchy described below:

Table 1.1 – Acres by Mt. Hood Forest Plan Land Allocations

LAND ALLOCATIONS	ACRES
Wilderness (A2)	4,350
Special Interest Area (A4)	1,912
Unroaded Recreation (A5)	323
Semi-Primitive Roaded Recreation (A6)	695
Special Old Growth (A7)	50
Key Site Riparian Area (A9)	1,231
Scenic Viewsheds (B2)	3,486
Roaded Recreation (B3)	560
Pileated Woodpecker / Pine Marten Areas (B5)	(4,195)[1]
Special Emphasis Watersheds (B6)	7,462
Deer / Elk Winter Range (B10)	1,581
Backcountry Lakes (B12)	529
Timber Emphasis (C1)	18,994
North Buffer - Bull Run Management Unit (DA2)	71
Timber Emphasis - Bull Run Management Unit DC1)	1,527
Private Land	22,696
Total Acres --	65,467

[1] These acres are included in other land allocations

'A' Land Allocations

West Fork contains seven 'A' land allocations under the Mt. Hood Forest Plan (Figure 1.2). Originally, the Mt. Hood Forest Plan included the A8--Northern Spotted Owl Habitat Area land allocation. This land allocation was eliminated before the Northwest Forest Plan was issued. The 'A' land allocations are not part of the land base used to estimate probable timber sale volumes. The management goals for these allocations are:

<u>A2--Wilderness (Mt. Hood and Columbia)</u>: Promote, perpetuate and preserve the wilderness character of the land; protect watersheds and wildlife habitat; preserve scenic and historic resources; and promote scientific research, primitive recreation, solitude, physical and mental challenge, and inspiration.

<u>A4--Special Interest Area (Lost Lake)</u>: Protect and, where appropriate, foster public recreational use and enjoyment of important historic, cultural, and natural aspects of our national heritage. Preserve and provide interpretation of unique geological, biological, and cultural areas for education, scientific, and public enjoyment purposes.

<u>A5--Unroaded Recreation</u>: Provide a variety of year-round unroaded recreation opportunities in a semi-primitive non-motorized setting and undeveloped forest environment.

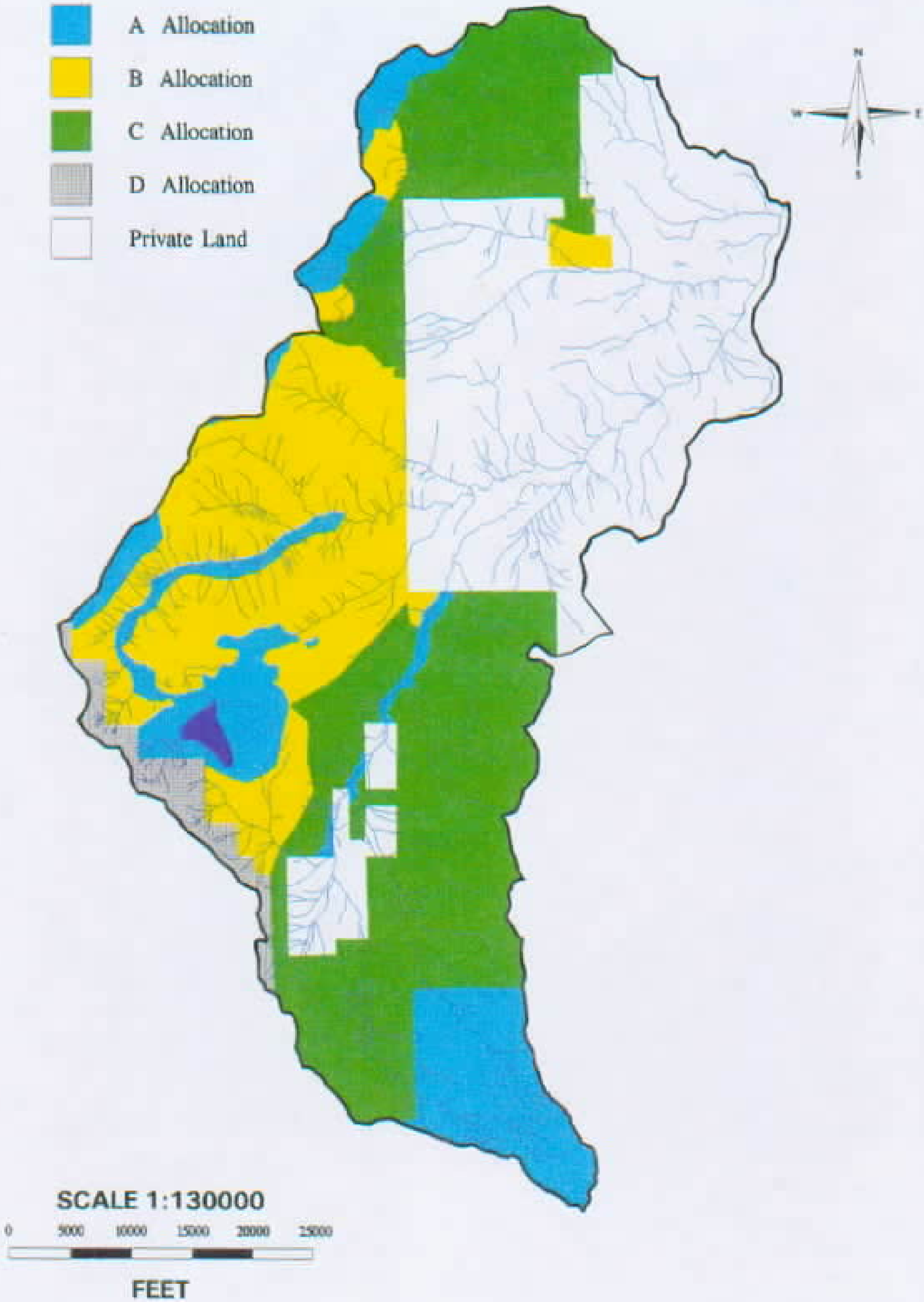

Figure 1.2. Forest Plan Allocations

A6--Semi-Primitive Roaded Recreation: Provide a variety of year-round dispersed motorized opportunities and opportunities for semi-primitive recreational experiences.

A7--Special Old Growth: Provide the many significant values of old growth forests for present and future generations. Maintain old growth to provide for wildlife and plant habitat, ecosystem diversity, preservation of aesthetic qualities, and to provide opportunities for a high degree of interaction between people and forests with old growth character.

A9--Key Site Riparian: Maintain or enhance habitat and hydrologic conditions of selected riparian areas, notable for their exceptional diversity, high natural quality and key role in providing for the continued production of riparian dependent resource values.

DA2--North Buffer, Bull Run Management Unit: (Bull Run Management Unit general goals) Serve as the main water supply for the City of Portland and its service areas, with the principal objective of the production of "pure, clear, raw potable" water of a quantity and quality that is at least as good as that historically produced. A secondary objective is the protection, management, and utilization of renewable resources found within the Management Unit. *Note: the Oregon Wilderness Act (1984) and accompanying Senate Report 98-465 and HR 1149 provided direction to preclude regulated timber harvest from the North Buffer.*

'B' Land Allocations

West Fork watershed contains six 'B' land allocations (Figure 1.2). Only one area is designated for Roaded Recreation, roughly the area between Indian Mountain and Black Lake. Lake Branch subwatershed is a Special Emphasis Watershed. Deer and elk winter range allocations lie on south aspects along West Fork Hood River, Lake Branch and Green Point Creek. Land exchanges have substantially decreased the amount of allocated deer and elk winter range in Green Point Creek since the final Mt. Hood Forest Plan was released in 1990. Backcountry lakes designated under the B12 allocation include Scout, Ottertail, and Black lakes.

The 'B' land allocations are included in the land base for regulated timber harvest but the expected volume production has been modified to account for the primary goal of the land allocation. The goals for these allocations include:

B2--Scenic Viewshed (Road 13, Lost Lake, and Lost Lake Campground): Provide attractive, visually appealing forest scenery with a wide variety of natural appearing landscape features. Utilize vegetation management activities to create and maintain a long term desired landscape character.

B3--Roaded Recreation: Provide a variety of year-round recreation opportunities in natural appearing roaded settings. A secondary goal is to maintain a healthy forest condition through a variety of timber management practices.

B5--Pileated Woodpecker/Pine Marten Habitat Area: Provide Forest wide mature or old growth forest habitat blocks of sufficient quality, quantity, and distribution to sustain viable populations of pileated woodpecker and pine marten. A secondary goal is to maintain a healthy forest condition through a variety of timber management practices.

B6--Special Emphasis Watershed (Lake Branch): Maintain or improve watershed, riparian, and aquatic habitat conditions and water quality for municipal uses and/or long term fish production. A secondary goal is to maintain a healthy forest condition through a variety of timber management practices.

B10--Deer and Elk Winter Range: Provide high quality deer and elk habitat for use during most winters. Provide for stable population of mule deer and Rocky Mountain elk on the east side and black-tailed deer and Roosevelt elk on the west side of the Cascades. Secondary goals are to maintain a healthy forest condition through a variety of timber management practices and to provide dispersed summer and developed recreation opportunities.

B12--Backcountry Lakes: Protect or enhance the recreation, fish and wildlife, or scenic values of designated lakes. A secondary goal is to maintain a healthy forest condition through a variety of timber management practices.

'C' Land Allocations

There are two 'C' land allocations within West Fork watershed (Figure 1.2). The C1 land allocation covers the most land in West Fork watershed of any single land allocation under the Mt. Hood Forest Plan. These are the lands managed primarily for wood product production. The goals for these two allocations include:

<u>C1--Timber Emphasis</u>: Provide lumber, wood fiber, and other forest products on a fully regulated basis, based on the capability and suitability of the land. A secondary goal is to enhance other resource uses and values that are compatible with timber production.

<u>DC1--Timber Emphasis, Bull Run Management Unit</u>: (Bull Run Management Unit general goals) Serve as the main water supply for the City of Portland and its service areas, with the principal objective of the production of "pure, clear, raw potable" water of a quantity and quality that is at least as good as that historically produced. A secondary objective is the protection, management, and utilization of renewable resources found within the Management Unit.

Northwest Forest Plan Land Allocations

Table 1.2 summarizes acres by Northwest Forest Plan Allocations. This Plan (Figure 1.3) amends the current Mt. Hood Forest Plan with additional land allocations and standards and guidelines.

Table 1.2 – Acres by Northwest Forest Plan Allocations

LAND ALLOCATIONS	ACRES
Congressional Reserves	4,350
Administrative Withdrawals	2,200
Late Successional Reserves	8,800
Matrix	27,421
Key Watersheds	36,944[1]
Private Land	22,696
Total Acres –	65,467

[1] Acres included in other allocations

Congressional Reserves

Mt. Hood Forest Plan land allocation A2 denotes a Congressional Reserve of Wilderness. West Fork watershed contains a slice of the Mt. Hood Wilderness and scattered small portions of the Columbia Wilderness. The Mt. Hood Wilderness was established in 1964 in the original Wilderness Act. Additions to this wilderness occurred under the 1984 Oregon Wilderness Act that also established the Columbia Wilderness.

The portion of Mt. Hood Wilderness within West Fork watershed contains a segment of the historic Timberline Trail. Scenic viewpoints and areas include Vista Ridge, Cathedral Ridge, Eden Park, and Cairn Basin. One portion of the Columbia Wilderness contains Rainy Lake, which was dammed early in the century to provide water for a lumber flume. The Mt. Hood Wilderness is a Class I Airshed while the Columbia Wilderness is a Class II Airshed.

The objective within Congressional Reserves is:

Follow the direction written in the applicable legislation or plans. Apply standards and guidelines from the Northwest Forest Plan that provide greater benefits to late-successional forest related species, unless application of the standards and guidelines would be contrary to legislative or regulatory language or intent.

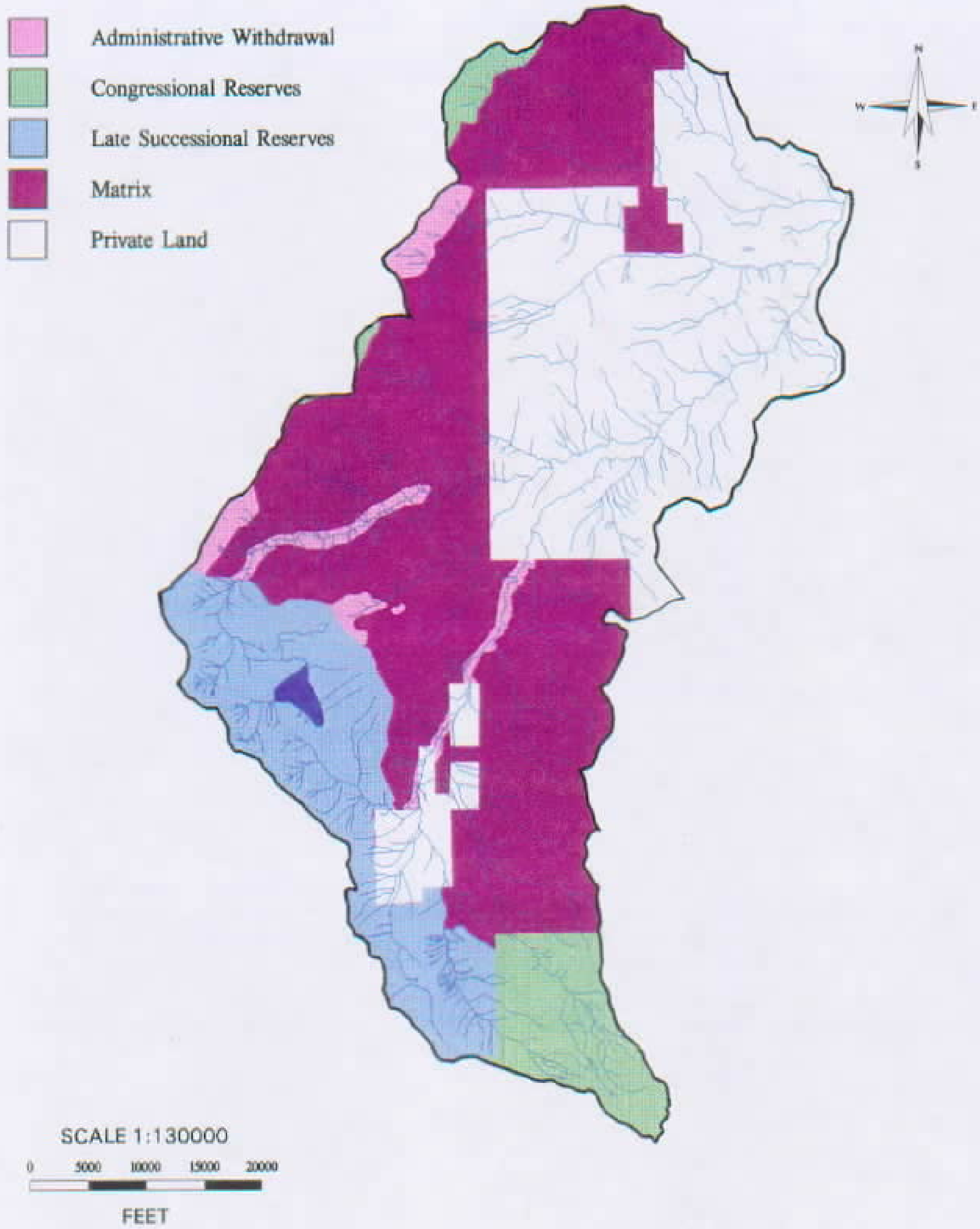

Figure 1.3. Northwest Forest Plan Allocations

Administrative Withdrawals

All other 'A' allocations in the Mt. Hood Forest Plan are administratively withdrawn from the land base used to estimate regulated timber harvest levels. Lost Lake Special Interest Area covers approximately 949 acres. This area has a Scenic and Recreation emphasis. The Unroaded Recreation and Semi-Primitive Roaded Recreation areas lie along Wacoma Ridge in the general area of Black, Ottertail, and Wacoma lakes. These allocations consist of three relatively small areas immediately adjacent to the Columbia Wilderness.

Two Special Old Growth stands were designated in the watershed. One old growth stand lies along Lake Branch, the other of the northeast slope of Lost Lake Butte. These sites were selected for their current old growth character and ease of access to Forest visitors.

The watershed contains three Key Site Riparian Areas (KSRs). One small area lies on Lake Branch just below the outlet from Lost Lake. One large KSR covers the floodplain of Lake Branch from the point where a broad floodplain first appears (approximately 2 miles below Lost Lake) to the confluence with Skipper Creek. Another large KSR includes the West Fork Hood River floodplain from Jones Creek to the Forest boundary. Private inholdings interrupt this KSR at two points along the West Fork.

The Developed Recreation sites in West Fork consist of campgrounds at the various lakes. Only one campground, Lost Lake, is large. The remainder are quite small, containing less than a dozen campsites each. A tiny portion of the North Buffer for the Bull Run Management Unit lies within the watershed north of Blue Lake.

The objective within Administrative Withdrawals is:

> Apply standards and guidelines from current plans where they are more restrictive or provide greater benefits to late-successional and old-growth related species than the standards and guidelines within the Northwest Forest Plan.

Late Successional Reserves

West Fork contains only one mapped Late Successional Reserve (LSR) that covers the area centered on Lost Lake. Lost Lake LSR includes much of the Lost Lake Scenic Viewshed (B2), part of the Lake Branch Special Emphasis Watershed (B6) and the Timber Emphasis lands (C1) in West Fork Hood River subwatershed, and all the Timber Emphasis lands in the Bull Run Management Unit (DC1) within West Fork watershed. Inclusion within an LSR essentially changes any 'B' and 'C' allocations under the Mt. Hood Forest Plan to the equivalent of an 'A' land allocation.

Lost Lake LSR incorporates some 'A' land allocations, such as Special Old Growth, much of the Lost Lake Special Interest Area, part of the Lake Branch KSRs, and all of the North Buffer for the Bull Run Management Unit within West Fork watershed. These allocations remain more-or-less intact within the LSR (see Administrative Reserve objectives above).

Late-Successional Reserves within West Fork watershed include more than the Lost Lake LSR. They also include 100 acres around northern spotted owl activity centers. There are four, 100 acre, LSRs located within the watershed.

The objective within LSRs is:

> Protect and enhance conditions of late-successional and old-growth forest ecosystems which serve as habitat for late-successional and old-growth related species including the northern spotted owl.

Riparian Reserves

Riparian Reserves replace all General Riparian areas (B7). The Interim Riparian Reserves under the Northwest Forest Plan are larger than the Mt. Hood B7 land allocation. Some of the land allocated as B12--Backcountry Lakes under the Mt. Hood Forest Plan, now falls within a Riparian Reserve for natural lakes under the Northwest Forest Plan. All KSRs fall within Riparian Reserves. Riparian Reserves are found within all of the Northwest Plan allocations.

The objective within Riparian Reserves is:

> Prohibit or regulate any activities that retard or prevent attainment of the Aquatic Conservation Strategy (ACS) Objectives.

Matrix

Matrix lands consist of all lands that are not designated as Congressional Reserve, Administrative Withdrawals, LSR, or Riparian Reserve. Matrix lands in West Fork include Scenic Viewshed, Roaded Recreation, Special Emphasis Watershed, Deer and Elk Winter Range, Backcountry Lakes, and Timber Emphasis lands. The amount of Timber Emphasis lands in the West Fork subwatershed will be less than in the Green Point subwatershed. West Fork contains relatively large amounts of unstable and potentially unstable land that will be included within the Riparian Reserves.

The Northwest Forest Plan specifically returned all land allocations for species such as pileated woodpecker and pine marten to the underlying land allocation unless local knowledge indicated that retention of these acres were warranted due to current landscape conditions. Watershed analysis should recommend which B5 areas to retain and which to return to the underlying land allocation.

The objectives in Matrix lands essentially remain the same as the applicable Mt. Hood Forest Plan land allocations. The Northwest Forest Plan does place some additional standards and guidelines on timber management activities. It also places additional requirements to meet the habitat needs of selected wildlife and plant species. Many of these species are present within the watershed.

Key Watersheds

"Key Watershed" is not a land allocation under the Northwest Forest Plan, however, designation as a Key Watershed places additional requirements on the Forest Service. Specifically, watershed analysis is required prior to management activities, except minor activities normally Categorically Excluded under NEPA. No timber harvesting can proceed within a Key Watershed without a watershed analysis. Key watersheds are the highest priority for watershed restoration.

Only part of West Fork is a Key Watershed. West Fork and Lake Branch subwatersheds are part of a Tier 1 Key Watershed. Green Point subwatershed is a non-Key Watershed. Tier 1 Key Watersheds contribute directly to the conservation of at-risk anadromous salmonids and resident fish. The West Fork subwatershed supports spring chinook, summer steelhead, and resident salmonids. It also has the potential to support Bull Trout; with low summer temperatures in several of its headwater tributaries.

Common Abbreviations

We use several abbreviations throughout this document. These are listed below. In general, we spell out the abbreviated agency, item, or phrase the first time it appears in the document and use the abbreviation thereafter.

Abbreviation	Full Name
ACS	Aquatic Conservation Strategy
ATM	Access and Travel Management
BPA	Bonneville Power Administration
CTWS	Confederated Tribes of the Warm Springs Reservation of Oregon
FID	Farmers Irrigation District
FS	USDA Forest Service
HRC	Hood River County
IPM	Integrated Pest Management
LSR	Late Successional Reserve
MBF	thousand board feet
MMBF	million board feet
NFMA	National Forest Management Act
NRCS	Natural Resource Conservation Service
ODF	Oregon Department of Forestry
ODFW	Oregon Department of Fish and Wildlife
PCT	Pacific Crest National Scenic Trail
PSQ	Probable Sale Quantity
RMA	Riparian Management Area
ROS	Recreational Opportunity Spectrum
USFWS	US Fish and Wildlife Service
VQO	Visual Quality Objective

CHAPTER 2

A History of West Fork Watershed

CHAPTER 2: A HISTORY OF WEST FORK WATERSHED

Introduction

This chapter is an overview of the human aspects and uses of West Fork watershed. Opening the discussion is a short description of how the environment was formed, the geologic history of the watershed. The remainder focuses on the history of the people who inhabited the area, divided into cultural periods.

Geology of West Fork Watershed. West Fork watershed lies within the High Cascades physiographic region. The north-south trending Cascade range began developing about 40 million years ago (mya) as a series of low volcanoes stretching east of the Pacific coastline. About 5 mya, the old range rose and tilted, creating the Blue River Ramp, and causing a rain shadow east of the mountains. At approximately the same time the High Cascades, populated by large, relatively recent volcanoes appeared (Reese 1988). About 10 mya before the High Cascades began, and ceasing as they arose, basaltic flows poured over the landscape from vents in the earth's surface. Not constant, these flows would continue for long periods and then stop for equally long periods. Sediments compressed between the flows weathered from the eroding lava as chert or petrified wood, both useful in tool manufacture by later human residents.

Starting about the same time as the basaltic flows, the Columbia River has existed for 15 million years. During the Pleistocene, with the ebb and flow of glaciers, Lake Missoula formed in western Montana as a result of an ice dam and melting glacial ice. Periodically the ice dam failed, causing cataclysmic flooding throughout the Columbia River Gorge area and valleys. The cycle of dam building and failing was repeated many times from 40,000 to 12,000 years ago. During the last phase of the final glaciation, from 15,000 to 12,000 years ago, a series of at least 40 floods, called the Bretz floods, poured through the Gorge and surroundings, carving and remolding the landscape as they passed (Allen 1984, Allen and Burns 1986, Reese 1988). These floods affected the northeastern part of West Fork watershed, causing destruction of plants and animals, and possibly causing fluctuations in fish populations.

With the beginning of the Holocene (12,000 years ago to present), the Ice Age was in its final retreat, causing the ocean level to rise about 300 feet to its present height. Volcanic activity had continued through the Ice Ages. Each successive glacial advance, however, tended to obscure the previous landscape through redistribution, erosion, and other weathering forces. The final, minor advance, called the Fraser Glaciation (29,000 to 10,000 years ago) left glacial tills 1-3 feet deep on the slopes of Mt. Hood.

The north slope of Ladd Creek exhibits a glacial moraine from the Fraser Glaciation, perhaps as far down as West Fork Hood River (Crandall 1980). In fact, these coarse, unsorted deposits resemble debris from the Pollalie eruptions of Mt. Hood dating to the same time period. In the Holocene, volcanic activity along the crest of the Cascades continues sporadically, with long, quiet periods more characteristic (Whitney 1989, Allen 1984). Mt. Hood has had minor ash, mud flow, debris flow, and pumice emissions and two major eruptive phases labeled Timberline and Old Maid. Both of these periods have either been pyroclastic or mud flow in nature, rather than lava. Only some of the extrusions and flows have traveled down Ladd Creek (Crandall 1980). Deposits from volcanic debris can be used as dating horizons. Seven different ash episodes from Mt. St. Helens, before its 1980 eruption, have been used in the area to date archaeological sites (Reese 1988). The largest Holocene eruption in the Cascade range was Mt. Mazama around 7,000 years ago in which the volcano destroyed itself and effected the entire region. The numerous older, basalt shield volcanoes, including those within the watershed, have shown little Holocene activity (Allen 1984).

Several small fault lines oriented in different directions, traverse the watershed. While no great quakes have been recorded historically, displacement of the Hood River fault indicates that movement may have occurred around 5 mya, with a more likely possibility of activity much more recently in the late Pleistocene (Allen 1984). Also, research indicates that earthquakes of a magnitude greater than 7.5 have occurred off the coastline within the last 10,000 years (Reese 1988). Parts of West Fork watershed appear susceptible to landslides, which even small quakes may start. These events have interrupted the routine existence of American Indians using West Fork watershed.

Climatic Processes. As would be expected, the end years of the Pleistocene became increasingly warmer and dryer. This trend continued into the Holocene. From about 10,500 to 8,500 years ago, the climate was similar to today's, warmer than during the Pleistocene but still relatively cool and moist. The Hypsithermal, from 8,500 to about 3,000 years ago, was warmer and drier than today, although there were fluctuations in both space and time (Reese 1988). About 3,000 years ago, the climate became cooler and sometimes more humid than at present. During this time, glaciers advanced in Alaska and on Mt. Rainier (Reese 1988) and probably on Mt. Hood.

Besides the broader climatic changes over time, conditions differ between one side of the Cascade crest and the other. Temperatures differ less than precipitation, with the westside at higher elevations being slightly cooler than the eastside in summer and about 8°F cooler in winter. On the other hand, rainfall amounts on the western edge of the watershed approach 200 inches annually while the eastern edge can receive as little as 40 inches (Green 1981). This high variation between east and west indicates that even though the regional climate can be broadly characterized for periods of thousands of years, these sweeping pictures can mask local differences. People who first inhabited the area were nomadic and their adaptations matched the regional environment. As seasonal rounds became modified to specific areas, technologies and lifestyles changed to reflect local use strategies.

The Human Picture

Because no professional excavations have been done in this watershed, there is no recognized cultural timeline particular to West Fork. There are, however, any number of such timelines for the region. Most share enough similarity that the interrelationships are easily observable. The following sequences include both cultural and functional attributes of the prehistoric and historic people using this environment. Dates are approximate.

Archaeologists are uncertain when the first humans crossed into the Americas. Some scholars suggest that humans came onto the continents 40,000 or more years ago. While possible, proof is evasive. Evidence of human-made bone or stone tools before 20,000 years ago is often problematic due to poor preservation or questionable human manufacture, lack of reliable dates, and redistribution possibilities. The first entrance onto this continent could have occurred during parts of the Fraser Glaciation, when low ocean levels would have permitted the Bering Land Bridge between Asia and Alaska to exist, or by boat along the Pacific coast (Fladmark 1983, Burtchard 1994).

Paleoindian (20,000+ to 8,500 years ago). At least by 20,000 to 15,000 years ago the first humans occupied the Pacific Northwest. These low density populations are characterized as early broad spectrum foragers who hunted megafauna, such as mammoth, and other exploitable animals on the new landscape. In this culture, housing was temporary, material possessions were limited in size and number, and all gear was portable (Mierendorf 1986). Specific campsites were located close to butchering sites or other task specific areas. Of course, the season and weather influenced campsite placement as well.

Having little control over their environment or the animals they hunted, these nomadic hunters remained flexible to survive. They were extremely mobile, traveling from one resource locality to another. Earlier foraging groups moved frequently to exploit the immediate resources available, such as mammoth or bison in tundra and steppe vegetation. Later, elk and deer were also followed into the expanding grasslands. Smaller animals were also hunted. Because they did not necessarily use the same campsites season to season, or year to year, food storage was impractical. Animal kills would have comprised much of the food base year-round. Some plant gathering during warmer seasons served as an incidental food source, as well as supplying fibers for clothing and utilitarian gear.

While food sources depended on local availability, stone tools and the raw material to make them were curated. Usually large and of high quality, well made tools were considered extremely valuable and kept for as long as they were useful. In fact, they were often abandoned long distances from their original source. Carlson (1983) and Minor (1987) recognize two projectile point traditions in the Pacific Northwest from this time period. Fluted Clovis points characterize the first style, while the second is lanceolate stemmed, such as Windust. There is some debate on whether the two styles represent distinct cultural entities or different technologies within the same foraging culture. Besides lithic or stone tools, bone tools were important for such things as spear points, pressure flaking stones, and sewing clothes and gear.

Early people traveling in this area would have been subjected to the Bretz floods at a rate of one or two every century until around 12,000 years ago. While most of West Fork watershed was not directly affected by the floods, high water tables and other occasional floods may have kept the low elevations as wetland at least part of the year. Higher terrain may not have supported vegetation until around 10,000 years ago due to glacial remnants in Ladd Creek and along Wacoma Ridge. As the climate warmed and precipitation lessened, the glaciers receded, growing season became longer, and vegetation became more diverse. Forested areas eventually covered much of the same ground and supported many of the same species that are found today. Megafauna were present, though in lesser numbers, and mesofauna, such as deer and elk, began to take advantage of the habitat changes.

Early Archaic (8,500 to 5,500 years ago). The Early Archaic is a period of transition when foragers reacted to the continuing changes in their environment. The hallmark of this time period was the Hypsithermal, which began about 8,500 years ago. The Hypsithermal, or Altithermal, was both warmer and drier than today's climate. Forests receded, and more open, park-like conditions occurred. Grasslands expanded. While human populations still relied on broad spectrum foraging, megafauna, such as mammoths, camels, and giant bison, became extinct due to several factors including environmental changes and human predation. Mesofauna, such as deer and elk, assumed a greater role as hunted animals. Early Archaic groups also hunted rabbits, beaver, otter, and muskrats along with other small mammals and birds. Intensive salmon fishing at Fivemile Rapids started during this time frame and increasing use of plants is evident.

The driving force behind foraging groups and their movements remained the distribution and abundance of big game. Some researchers believe, though, that the droughts of the Hypsithermal caused people to avoid warmer, lower elevations and flat expanses with little available water. River valleys, riparian zones, and mountainous areas served as an answer to the lack of water elsewhere.

With land use restricted and hunted species changing, human lifestyles also gradually changed. Forager group size remained about the same and absolute numbers, while growing, were still small. Interaction among groups was increasing, though, in resource areas with higher population densities. Future relationships and communications systems inside and among resident groups of the area were forming. Campsites were still temporary and probably often open air, but the distances traveled between them was less in order to stay near water, and occupancy was longer. Still, no evidence has been found of structures with any permanence or features such as storage pits or caches (Mierendorf 1986). More milling stones have been found, indicating greater use, although not dependence, on plant foods.

While milling stones gained in prominence over the course of the Early Archaic, other tools changed. Initially the projectile points are the same as the stemmed and unstemmed spear points found in Paleoindian times. The Windust is one of the more frequently seen styles. Gradually, willow leaf shaped points with tips at both ends became more common, although the two overlap. As the Windust styles faded from the record, smaller, but still large, side-notched points become more popular. These points were probably used as javelin heads with an atlatl assist for control and distance. Other frequently encountered tools include oval or ovate knives, scrapers, burins, gravers, monos, cobblestones, and hammerstones. Fishhooks have been noted, too. The interesting thing about the lithic and other tool inventory of the Early Archaic is its progression towards more specialized tools, such as fishhooks, and the fact that tools are no longer carefully managed items, transported long distances and carefully crafted. Rather, the stone used is local in origin and often of poor quality. Tools are much cruder, without the finesse seen earlier. They appear to be more expedient.

West Fork watershed should have been a fairly popular location during this time period. The climate would have been warmer, but with enough moisture to encourage mesofauna and human populations to linger for stretches of time on their migrations. Based on pollen profiles, Burtchard and Keeler (1994) suggest that some of the east side of the Cascades may have been wetter as a local condition. Closed canopy forest, parklands, meadows, lakes, and rivers with associated riparian areas and all the transition systems in between would have been available. Foragers would have found mesofauna and plants for food and fiber. There were probably fish, but perhaps different or fewer species, depending on stream temperature.

<u>Middle Archaic (5,500 to 2,500 years ago).</u> There is no dramatic break between the Early and Middle Archaic, rather it starts as a question of emphasis and becomes a change in lifestyle. Beginning in this time period, populations developed a semi-sedentary foraging and collecting strategy analogous to the rise of agriculture elsewhere. Reasons for increasing social and subsistence complexity vary. The warmer, drier climate of the continuing Hypsithermal may have shrunk the territory available to foragers even further. Sporadic use of certain sites to the east of West Fork watershed, such as Fivemile Rapids, may be an indicator. These locations were intensely occupied in the Early Archaic, and Late Archaic after a return to cooler, moister conditions.

In the harsh Middle Archaic environment, Burtchard (1994) believes that the carrying capacity limits were reached. In other words, the landscape could not support more people. Forager population increases and mesofauna decreases meant that humans had to develop more effective strategies to acquire food. Mierendorf (1986), on the other hand, views hunter/gatherer intensification from a different perspective. He notes that resources in the region were abundant, but not evenly distributed and were often seasonal in nature. In both discussions, human populations were growing and an adequate food supply was a problem. Earlier social interactions as well as less frequent travel may have encouraged the evolution of settlement systems. These were semi-permanent winter villages. Village members met at certain times for organized, labor intensive collection of specific foods, such as salmon or camas, which were then stored for winter in large quantities. In addition, social activities which tie the group together occurred at these villages during winter and at major harvesting events. Deer and elk, while still important, were less predictable and no longer the major staple. At temporary and smaller seasonal camps, game animals and other secondary resources were collected, processed, and returned to the larger camp or village.

Structures are the hallmark of semi-sedentary life style. The first houses documented in the region date to between 5,500 and 5,000 years ago. All of these were semi-subterranean; the walls and roof were built over a hole dug in the ground. Two villages discovered near the north shore of the Columbia each contain over ten circular to oval housepits. Other structures from various sites include storage pits, which are also most important in a more sedentary society, and hearths and ovens for cooking. At Wildcat Canyon, possible wells for water may date to this time (Dumond and Minor 1983). Essentially, people were learning to modify their environment to more effectively exploit it. These settlements were probably located in the most convenient spots possible to reach a broad range of stable and seasonal resources.

Trade, already done to a small degree, became more important locally, using long established routes. With fewer resources but in greater quantities, trading fish, roots, and berries for other foods or raw materials including shells from the coast, and stone such as obsidian, soapstone, nephrite and copper was a natural product of this lifestyle. Information was also traded. Cultural and self identities became more visible. Some of the stone and shells received in trade were used to make jewelry for personal ornamentation. Pendant, beads, and stone pipes date to this time. No rock art from the watershed is known, but in surrounding areas, hunting scenes showing men with atlatls and dogs in pursuit of game are similar to dated samples elsewhere in the region (Keyser 1992). One instance of cremation burials dating to the close of this period indicates a concern with an afterlife. Zoomorphic art and other sculptures date to the Middle Archaic and woodworking for personal or ceremonial objects have been found. Everyday tools and artifacts occasionally show design or decoration as well.

The diagnostic artifact during the Middle Archaic is a stemmed triangular point with a broad neck. This projectile type comes in a variety of styles and was used as a dart in association with an atlatl. Lanceolate and leaf-shaped points continue, but are not common. Other stone tools include gravers, choppers, celts, hammers, retouched flakes, atlatl weights, ground slate knives and points, grinders, mortars, and recurrent woodworking tools. Tool kits indicate that with other resource intensification, hunting technology from the Early Archaic is adequate to obtain deer and elk as needed. Tools used for food processing are frequent at some sites, and more tools related to home construction appear as time progresses. Not readily preserved, but necessary to their hunting and gathering activities would have been a variety of bone tools and basketry.

Because of the scarcity of known sites in and around West Fork watershed, how it was used during the Middle Archaic is unclear. Many sites to the east which would have served as winter villages show less occupation at this time. Any possible sites along the Columbia River to the west were destroyed about 725 years ago by the Bonneville or Bridge of the Gods Landslide which caused catastrophic flooding. Within the watershed itself, plants such as huckleberries and beargrass would have grown on the mountain slopes and some mesofauna would have roamed forests and transition zones. Fish populations would have fluctuated with climatic warming. Lower elevations may have been too hot and dry to allow frequent forager habitation. On the other hand, if the lowlands were more favorable than areas to the east, or if desirable plant resources grew in wet meadows, the area may have been used frequently. However, most seasonal hunting and gathering would have depended on the location and distance from a main village.

Late Archaic (2,500 to 500 years ago). The key concept in the Late Archaic is intensification. About 500 to 1000 years before this period began, the climate became cooler and moister once again, with local and short term fluctuations. Plants and animals reentered areas abandoned during more severe drought conditions, and foraging human populations moved with them. Sites along the Columbia near the Long Narrows, such as Fivemile Rapids, which were inhabited only sporadically during the Middle Archaic became important settlements once more. Whether descendants of the same groups or other foragers reoccupied these areas, is not known.

Apparently the opportunity to expand physically also led to population growth. This growth along with the resulting increasing density was the primary cause of the social and technological adaptations of the time. Semi-permanent settlements became larger and greater in number. As before, each was centered on lowland resource areas with smaller camps in upland and task specific localities. Some may have approached year-round habitation. In the Middle Archaic, winter villages contained under 20 housepits and only a few are documented. In the Late Archaic, winter villages are more common and averaged 30 housepits per settlement. One site at the confluence of the Deschutes and Columbia Rivers contains 132 housepits, although they may not all be contemporary. Split plank sleeping benches are located inside along the wall and sometimes evidence of mat wall coverings is present. Larger ceremonial or dance houses appear at this time.

The Bridge of the Gods Landslide resulted in a stretch of the Columbia near Cascade Locks becoming depopulated. Before the catastrophe, only circular or oval housepits were found. Shortly after that event, rectangular housepits villages appear. Minor (1986) believes this is an indication of Chinookan immigration from the coast, rather than the development of a new housing style by an already present culture. The Chinookans may have expanded into the vacuum created by the floods to relieve their overpopulation problem, and perhaps increase their influence and territory.

The hallmark of the intensification of the Late Archaic is the development of the bow and arrow. This invention is so important that it ushers in the time period. No real change in diet appears, but with more people to feed, hunters were taking more deer and elk to supplement their fishing. Gradually they were finding it necessary to expend more time and energy to acquire the same or fewer numbers of animals. The bow and arrow would also be more efficient in warfare, which Burchard (1994) lists as one result of the high population densities.

Trade and immigration networks were far reaching by this time. Many sites have non-local items which could only be the result of trade over long distances. Shell beads of olivella and dentalium, steatite and other stone, as well as other utilitarian and ornamental materials are more frequently found.

While greater contact with other cultures, both far and near, occurred, there was an emphasis on village and self, or cultural identity, too. Ceremonies and ritual dances, for instance, increased a sense of group identification. Shells, carved beads, pendants, and other forms of personal ornamentation are more numerous and exhibit greater decoration than ever. Carved charm stones or pebbles are noted at several sites. Pipes, stone sculptures, and other ornaments also increase. This time period contains the most rock art known in the Pacific Northwest. Both petroglyphs and pictographs concerning various themes are concentrated in the Long Narrows-Deschutes area. In addition, most stone cairns, walls, and depressions are constructed in this time period, although dating them is a problem. These markers represent the physical and spiritual preparation needed for a youth to find a guardian spirit. Burials are found more frequently and different villages handle their dead in a variety of ways, such as flexed or in talus, showing a sense of identity as well as respect for the dead. Grave goods are found in some burials.

Tools show more decoration, indicating ownership and curation. Many of the same tools recur from other periods, only more often, such as food processing implements and notched netsinkers for fishing. Woodworking tools are more frequent in the archaeological record. They were needed for structures, dugout canoes, houseposts, and other carving. Because this time period is closer to our own, occasional wedges, awls, and points made out of antler and bone are found. Dart points remain, atlatls are still in use, but arrow point frequency increases as the period progresses. Owners of certain tools, especially the decorated tools, may have been craftsmen, responsible for specific types of stone or wood art, tool, or basketry manufacture.

Use of West Fork watershed was probably more intense. Now cooler and moister, most areas would have seen forays of seasonal hunters and gatherers. The confluence of West Fork and East Fork Hood River may have had a more semi-permanent village where several seasonal groups could realign before returning to their summer or winter village. Many of the same resources mentioned in other sections would have been exploited and many of the same locations were probably used year after year. About 1500 years ago, Mt. Hood occasionally spewed pyroclastics and ash, which would have affected the area residents. Most effects were felt on other faces of the mountain.

Ethno-Historic (starting about 500 years ago). The Ethno-Historic period begins with the arrival of Euro-Americans and Russians on the continent. The Little Ice Age, which lasted until about 150 years ago, was already causing some differences in land use and lifestyle. Although it took several centuries after Europeans first landed on the continent for the first explorers and traders to visit the Pacific Northwest, their material goods, horses, and diseases preceded them.

Characterized by instability and change, disease decimation is the hallmark of the period. Because the Columbia River was a main route for travel and trade and the Long Narrows (later The Dalles) was the most important trade center, all epidemics in the region passed through the area. Evidence shows that village sites are abandoned and reoccupied. While large population losses from disease were probably the cause, climate may have also been a factor. Glacial rivers were fuller and swifter. Plant resource locations may have altered. Settlement systems would have adaptively shifted. Another reason may have been the introduction of the horse about 300 years ago, around 1730. With travel time between resources shortened and locations near adequate fodder for horses needed, changes in long-held settlement patterns may have been necessary.

Ships arriving off the Pacific coast in the late 1700s and the subsequent overland trade and expansion changed land use and social systems. The original inhabitants, whose populations were already fractions of their original size, found themselves becoming specialized, but subordinate laborers supplying furs, food, and other resources to Euro-American entrepreneurs. Different villages did attempt to control certain territories along the Columbia and other major rivers, as well as resource locations for camas. Fur traders, for instance, conflicted with American Indians over the right of residents to require tribute near portages. Accumulated population losses made even more threatening villages around the Cascades ineffectual by the 1830s, however (Beckham 1984).

Internally, both Columbia Plateau and Northwest Coast influences seem more evident. Indications include the arrival of horses and rock art styles associated with the epidemics, which appear related to images from the Plateau and the Great Plains, and the continuing number of rectangular housepit shape villages, which are traditionally coastal. By the time of Euro-American contact, circular style housepits are no longer found in the Cascades area and to the west. Further expansion of the Chinookans from the coast may have been related to the depopulation caused by the first smallpox epidemic in the 1770s. By the 1830s, however, Klickitat Sahaptans had usurped Chinookans and other inhabitants on the north side of the river. In general, there was a reshuffling and amalgamation of peoples accompanying population loss and, in some cases, village extinction.

Trading relationships remained important through the 1700 and 1800s, and may have lessened conflicts among groups. Beginning a generation or two before the first known epidemics, the first horses were traded into the area. Their use for travel and to pack and carry more and heavier items helped expand trade distances as well as increase the types and number of items traded. With the Columbia River serving as the hub of the economic system, the American Indian groups in the area were among the first in the region to acquire Euro-American and Russian goods entering the market around the same time. Trading relationships were so strong that Lewis and Clark had trouble acquiring needed supplies which the villagers had, but were earmarked for specific destinations.

By the 1840s, the market demand for furs had decreased and Euro-American immigrants were coming to settle the land. Along with the immigrants came government officials, missionaries, and miners. Most of these people had little understanding or respect for the original inhabitants. Treaties of the 1850s confined most American Indians to reservations. Many of their cemeteries were burned and by the early 1900s relic collectors were looting and pillaging remains of villages and cemeteries. Some American Indians, however, retained their traditions and have taught them to their descendants.

From populations as high as 2-4 persons per square kilometer on the coast during the Late Archaic, as much as an 85% decrease in population through epidemic disease is suspected by 1841. Crowded and unhygenic village dwellings made an excellent breeding ground for several diseases including smallpox, measles, tuberculosis, and malaria. Once ill, the traditional sweatlodge treatment for fever and avoidance of Euro-American medicines increased the death rate. Venereal disease took its toll not only in death but in increasing infertility rates. Effects of the population collapse may be seen in the "Ghost Cult" art style, such as the petroglyphs near Horsethief Lake, in cremations and burial vaults made to hold large numbers of dead, and in the figurines found with some of the burials. Various cults, such as the Ghost Cult, may have arisen from the social disorganization and observable mortality as well as differences in mortality in the newcomers (Minor 1988, Boyd 1990).

The first known epidemic was smallpox in the 1770s, with mortality possibly as high as 30%. The disease recurred in 1801. This strain may have been less virulent, combined with the immunity in survivors of the first outbreak, as mortality was only 10-20%. Tuberculosis arrived before 1800. Either smallpox or measles struck in 1824-5, and measles again in 1848. Both of these outbreaks killed another 10-20%. In between these two viral epidemics, malaria raged through The Dalles and the Columbia Basin in general for several years in the early 1830s. There was no recovery of social and cultural continuity after malaria became endemic following the initial outbreak. Dysentery and typhus arrived with the Euro-American immigrants in the 1840s, often accompanied by measles and smallpox (Boyd 1990).

While other American Indian groups may have used West Fork watershed, the two groups that most commonly visited the area were probably the Hood River Chinookans and one or two groups of Tenino from the east. Although their villages were only six miles apart when Lewis and Clark passed through the Long Narrows area, the two spoke distinctly different languages. The Chinookan's dialect was related to Chinookans to the west. Tenino was one of several Sahaptan dialects, which had more in common with the Nez Perce language than to that of their close neighbors. Both groups believed in village autonomy--a person owed allegiance to the village rather than the tribe. There was no central government. Instead, these peoples were related by a social network that had no name until Euro-Americans arrived, and were only united by a language and customs.

Although both groups had a social hierarchy, it was more recognized within the Chinookan structure. Each village had an advisory chief or headman whose title was partly based on heredity and wealth. This person and his family occupied the highest rank, with associated wealth and prestige. A village could have more than one chief, such as one renowned for strategic skills in battle in the position of leader during warfare. There was also a middle class, and a poor class with few possessions and little prestige. Slaves were considered property, and outside the system. Having been kidnapped or captured during war initially, slaves could be traded and were merely representations of their owner's wealth. The Chinookans freed the children of slaves. In either group, even if a slave was freed, the stigma of having been a slave remained into future generations.

The Tenino had two subchiefs to act as spokesmen or heralds for the main chief. The Tenino chief's role was as advisor, and as haranguer on matters of conduct and morals. The only class distinctions were between free and slave. While slavery was practiced, in general the "institution [was] disapproved but tolerated" (Ray 1939). The Tenino acted as intermediaries among different slaver groups in later years. Ray (1939) notes that other ethnographers thought that slavery was a relatively recent institution, arising about the same time as horse trading began. The Tenino may have been more broad-minded than surrounding groups about slavery since their location in the area's marketplace gave them a more stable economic base.

The regional exchange network in The Dalles area extended from the Pacific Ocean to the Great Basin and southward into northern California. In the past, the Columbia River had served as the major transportation route. With the advent of the horse and swifter travel, overland trails, some of which passed through West Fork watershed, gained in importance. Salmon and other resources made The Dalles location a prime one for rendezvous and it has been used for centuries (Minor 1988). Most trading occurred between August and October. Fish and other food items were wrapped in standardized packages, shells from the coast were on strands and measured for units of exchange. The Tenino acted as middlemen, buying and reselling shells, fish, horses, slaves, furs to the North West Company and Hudson Bay Company, and the fur company's' blankets and clothes back to other tribes.

When not trading both the Tenino and Chinookans lived largely by fishing. Men fished, hunted, traded, and did some acorn and berry gathering. Women did most of the gathering and dried and smoked food for trading and storage. Some stored foods could last for two years. Chinookans fished from platforms constructed over eddies and other prime locations on the Columbia and certain tributaries using spears, gaff hooks, nets, basket traps, and weirs. The Tenino fished with weirs, dams, hoop traps, nets, hooks, spears, and harpoons, as well as poison. While salmon was most important, a variety of other fish and seafood was used by both groups. Fishing territories were absolute.

Hunting and gathering territories were less critical. In fact, parties from different villages enjoyed each other's company if they met on seasonal gathering expeditions. A variety of weapons, including bow and arrow, clubs, and traps, were used to hunt large and small animals and birds. Small drives were sometimes organized for herding prey into traps. In winter, deer were clubbed to death after being caught in high drifts. Chinookan preparation for a group hunt included five mornings of ritual sweating and praying by the leader of the expedition. The Tenino also prayed and sang in sweatlodges before a hunt, as well as to acquire good fortune before gambling.

Food was collected by each culture through a bi-seasonal round that meant moving from one fairly established village to another, with side excursions for other hunting and gathering. Summer dwellings were above ground, simple, tulle mat covered frames of which one side often served as a scaffold for drying fish. From there, excursions, usually up slopes were planned to gather berries, herbs and other plants. Sahaptan winter housepits were dug in an oval or circular shape while Chinookan housepits were rectangular. Both styles of home had sleeping benches, and carved posts decorating the doorways and sometimes elsewhere inside. A second building covered with mats instead of earth was used for cooking and other routine daily activities in winter.

Two or more families would live together, often brothers in the case of the Tenino. Both groups practiced exogamy, that is marriage to someone outside the village, even across language barriers. Marriage within the village between unrelated individuals was allowed, however. Polygamy occurred particularly among chiefs or those with wealth. The marriage ceremony was one of the most important feasts given, and with the Tenino, the position the children would hold was dependent on the amount paid to the bride's family.

Head flattening, done by many groups, including other Chinookans in the area, was not practiced by the villages commonly using the watershed. Children's hair hung straight, but adults oiled and braided their long hair, often tying it with fur and thongs. Make-up and jewelry in the form of face paints, ear pendants, shells and pins, and nose pendants were worn.

Clothes, however, were not worn during the summer around the village. When they were necessary, women wore buckskin dresses to the knee, and men wore leggings and vests or shirts. Clothing frequently had decoration sewn to it and dresses and shirts were sometimes fringed. Conical hats made of cedar repelled rain. Moccasins were used, and winter wardrobes contained mittens, mufflers and items appropriate to the weather. Mats covered benches during the colder months, and blankets of fur strips woven together provided warmth as well.

Most of the stone tools used during the Ethno-Historic period were ones used before. Firearms, and steel axes and knives were new. Since this period overlaps with Euro-American settlement, we also have examples of the basketry dishes, and ladles, spoons, pestles and mortars made partially or entirely of either bone or wood. Digging sticks, clubs, and bowls designed for subsistence, shields for warfare, and arrow shafts designed for both give a better picture of American Indian lifestyles. Dugout canoes, paddles, and bailers associated with river travel have been documented. The extensive carving and woven designs of past specialists remain part of the traditions practiced today.

Both groups lost much of their collective knowledge of a spiritual life due to population loss from epidemic diseases. On the other hand, ethnographic studies and the retention of some traditions have preserved some beliefs and practices. One of the basic tenets of the Chinookan and Tenino is the acquisition of a guardian spirit. Young children, from the ages of six or eight to pre-teen, were sent away from the village for a night of fasting, prayer and physical labor, for which they were previously prepared. These labors often consisted of piling or excavating rocks on certain talus slopes where the child was likely to encounter his or her guardian spirit. Each spirit was associated with specific powers or properties which would manifest themselves when the child was older. The spirit also acted as a teacher for moral conduct.

Guardian spirits and their songs were an essential part of the winter festival, which was held yearly over an extended period of time and included various ceremonies and dancing. The first fruits festival in the spring celebrated the arrival of the salmon and, to a lesser degree, camas and other early plants. The Tenino selected special people every year to catch and gather the first foods to be eaten at the festival. Three of the four village groups would gather for this time. They also had a second first fruits feast in July for venison, at which everyone returned from seasonal camps to celebrate before disbanding again.

West Fork watershed was used for several purposes. Some trails followed by early Euro-Americans were well established American Indian trails, used for trade routes and as access to gathering areas. Peeled cedars, including both western redcedar and Alaska yellow-cedar, are found in a number of locations. One area containing over 30 peels was used as long ago as 1833 and as recently as 1948. Huckleberry are extensive in some parts of the watershed and were an important food for much of the year. Once gathered, they were dried in large wood and rock lined hearths on site, a process taking several days. Families usually used the same fields and hearths year after year. Burning to keep underbrush from travel routes and to maintain huckleberry patches is well documented.

The watershed also contains the greatest number of rock features on the forest. Some of these may have had Euro-American origins. Others appear to correspond to descriptions of rocks altered during vision quests for guardian spirits. There is no direct ethnographic evidence, however, to confirm their function. Very few lithic finds have been made, but the watershed also contains dense undergrowth and thick duff. Seasonal hunting camps leave very few remains, which is one reason every chipped or ground stone location is important in understanding past lifeways. There is one unverified report of rock art on private land. Private land around Dee may have also contained indications of American Indian habitations for fishing, hunting, and gathering.

Euro-American Settlement (1700s to present). Arriving Euro-Americans saw the land as wild and untamed but full of potential once it was subdued. Burtchard and Keeler (1994) describe three major types of land use for the Euro-American time period:

- ◊ transient utilization, such as exploration and recreation,
- ◊ human occupation, such as homesteading, and
- ◊ commodity extraction, such as timber cutting, mining, grazing, trapping, and water use.

Initial exploration, for the most part, was done by Lewis and Clark in 1805. Their route, though, was restricted to the Columbia corridor and they never explored the surrounding tributaries or mountains. Trappers arrived a few years after Lewis and Clark passed through. They came overland and down the Columbia to trap or trade for furs. For the most part, they confined their travels to the Columbia and the major river systems where beaver and other fur-bearers could be taken. Forays into the Cascades would have been infrequent, since their time was more productively spent in the lower elevations. By the 1840s, as more settlers arrived, the fur market and some of the overexploited animals were in decline.

The first immigrant families began to stay in The Dalles in the 1830s. Missionaries arrived to convert the Native groups. Because they did not understand the culture or were seen as assisting the newcomers in taking Native lands, their missions often failed. During the 1830s, Reverend Daniel Lee began driving cattle between missions at Oregon City and The Dalles. Following older, well defined American Indian trails, he skirted what are now Bull Run and Lost lakes, then paralleled the West Fork Hood River to the Columbia. At least once he encountered a seasonal camp of huckleberry gatherers on the upper Sandy River. Considering the open condition of the trail and the huckleberry fields for much of the distance along it, the trail was probably one regularly burned by the American Indian users. While the Daniel Lee Trail was passable for livestock, it was impractical for wagons as an overland route to the Willamette Valley. The trail was abandoned after the Barlow Road opened in 1845. Another route to the Willamette area and used by Columbia River Valley residents, was the result of a government survey for a railroad south of Mt. Hood by Lt. Abbot in 1855. The railroad was never built, but the passage was followed as a wagon road.

Taking a land claim in 1854, Nathaniel Coe and his family are considered the first settlers who remained in Hood River. The river, itself, had first been called the Labiche River by Lewis and Clark, and later the Dog River, after a group of Lee's drovers got caught on one side of the river for several days without food, and had to eat a dog to stave off hunger. Mary Coe decided the name needed changing, and called it Hood Vale. On the first plat map in 1881, it is noted as Hood River. That same year, the area east of the Cascades and south of the Columbia River was encompassed into Wasco County. Hood River County separated from Wasco County in 1908. Steamboats provided early fruit growers with selling opportunities at the docks and in Portland.

The first railroad along the Columbia River offered an alternative to river travel in the 1860s. Like the earlier introduction of the horse, the railroad created new opportunities for moving people and goods from one place to another. Populations along tributary river to the Columbia were growing. In 1870, the census in Hood River listed 23 houses and 85 residents. Homesteaders looked at forested lands as marketable timber to be cleared and converted to agriculture. In the 1880s a new wave of immigrants entered with the transcontinental railroad. The first railroad depot in Hood River began serving passengers in 1882. The railroad was important for shipping fruit and timber as well as moving people. Hood River was also connected to Portland by a stage line.

In the 1880s, a small area near the East and West Forks of Hood River was settled by John Buskirk and the extended Winans family. Buskirk started strawberry farming along the West Fork and most of the Winans brothers were in timber. The town, Dee, was named for one of the stockholders in the Oregon Lumber Company. Railroad cars along with cabins served as residences around the mill until homes were constructed. Several Japanese immigrants settled in Dee, working first to cut and clear timber, and then to plant orchards. Fishing in the West Fork Hood River was considered excellent.

Early on, fruit became very important to the economy of Hood River valley. Coe had planted fruit trees with his other produce as well as running livestock. On the west side of Hood River, farmers were growing peaches and other produce long before Thomas Coon started strawberries in the 1880s. Coon saw the shipping potential of the railroad. Soon, produce being shipped all over the state and country included apples, peaches, strawberries, prunes, pears, and blackberries. In 1893, Coon and others began a farmer's cooperative, one of the first in the area.

In the 1890s, the Davenport brothers, led by Franklin, started constructing an irrigation system making use of water from Green Point subwatershed. In 1897, the flume and ditch line was 11 miles long, had a capacity of 2,000 inches of water, and reached 10,000 acres on the west side of town. Over the next two years the value of this acreage tripled and plantings of fruit crops increased. The World's Columbia Exposition in 1893 and the Lewis and Clark Exposition in 1905 brought world-wide acclaim for the area's fruit and resulting in more people moving into the valley. The mainline for Mt. Hood Railroad was completed in 1906, allowing for easier fruit transport from Dee. A new dept. was constructed in 1911 to handle the expanding business. Other industry, such as making packing boxes, developed to support the orchards. Japanese, German, Finnish and French immigrants arriving around the turn of the century worked in a variety of positions, but many eventually became orchardists. Throughout the 1900s, the fruit growers have generally flourished. Diversity in the crops has helped maintain profits (Hood River County Historical Society 1992; Donovan et al. 1994).

The timber industry also began early. In the 1860s the Eagle Creek Sawmill cut railroad trestles on the local railroad, as well as other material. The industry lagged then until the completion of the railroad, although dozens of families made money cutting cords of wood for the steamship lines along the Columbia. Small and large timber companies arose in the 1880s. Complete towns developed around sawmills and shipping plants on the mountain slopes in the Gorge and near the watershed. One of the larger operations, the Bridal Veil company, remained in business until 1960, although it changed ownership and names several times (Carr 1983).

At the mouth of Hood River, the Lost Lake Lumber Company, established in 1899, milled 200 MBF per day. Another company, the Davenport brothers began cutting timber from the Mt. Defiance and Green Point areas. The Green Point Mill was constructed to mill lumber for the irrigation flume Franklin Davenport promoted to irrigate Hood River valley. In the late 1890s, he also modified some lakes along the northwestern border of the watershed, such as Rainy Lake, to provide water for irrigation and to move logs and lumber. The need to move the sawmill closer to Dee and many subscribers reneging on promises of payment for the irrigation water forced Davenport to sell the Green Point Mill to Stanley-Smith Lumber Company sometime between 1905 and 1907. Davenport then constructed another mill on Dead Point Creek. Stanley-Smith continued logging operations, using the canal, until 1921, when the company closed the mill and sold the irrigation system to the group that eventually became Farmers Irrigation District. From 1921 to 1924, the irrigation company worked to transfer the water rights from log and lumber fluming and storage to irrigation and domestic water purposes.

In 1906, Oregon Lumber Company built a sawmill at Dee and began harvesting timber in the area. The land on Dee Flat was logged and then sold to orchardists. In 1916, the Oregon National Forest, later renamed the Mt. Hood National Forest, awarded a timber contract to Oregon Lumber Company for trees on National Forest lands along West Fork Hood River. Stanley Walters, the District Ranger during most of this time, was a proponent of leaving some trees rather than clearcutting the entire sale area. Unfortunately railroad logging technology did not allow for selective cutting, although some trees were left near the peripheries of the individual units. Yearly reports indicate that tractor logging was tried as an experiment in 1937 to achieve selective cuts, but was unsuccessful. Companies cutting on private lands made no such attempts, and clearcutting was done whenever possible. Railroad track was laid to the areas being cut each season to transport logs to the mill and pulled when harvesting in the area was completed. Fires associated with logging were common. In 1940, a fire on Lake Branch burned about 27,000 acres. Since the area had been recently logged, the fire was considered of little consequence. The timber industry remains active within the watershed today.

Besides orchards and lumbering, tourism has played a role in placing Hood River valley and the surrounding area on the map. In the early 1900s, the Columbia River Highway planned from Troutdale to The Dalles was designed and built, with some controversy, for the wealthy to drive in leisure with good views. While it served that function, the road also provided another artery for moving produce and people in general.

Lost Lake and Indian Mountain/Wacoma Ridge are two places that attract many tourists and local hikers and campers. Both locations were important prehistorically and are still used by American Indians today. Historically Lost Lake was "found" at least three different times by Euro-Americans, the last and most often heard account was in 1880. By 1910, a wagon road was completed to the lake with the help of Jake Lenz from the Forest Service and the Winans family from Dee (Hood River County Historical Society 1992). Hiking trails around Lost Lake are marked on a 1912 map of the District. In the early 1920s, the road was improved to handle automobiles. In the 1920s, there were plans to partition the shoreline on Lost Lake for summer homes, but that was never done. The only current housing is the set of cottages associated with Lost Lake Resort. The resort has been in operation since the early 1930s. Huckleberries at Lost Lake and along Wacoma Ridge draw many people in late summer. The Pacific Crest National Scenic Trail lies along Wacoma Ridge and trailheads into the Columbia and Mt. Hood wilderness also lie along the west edge of the watershed. Besides magnificent viewpoints, a series of lakes with campsites lie near the ridge line.

Three other industries which touched West Fork watershed were fish canning, mining, and sheep herding. Canneries began on the Columbia in the 1880s after a patented fish wheel made business profitable. By the turn of the century there were over 100 canneries along the river. The heavy commercial fishing began the decimation of anadromous fish runs in the Hood River system along with other river systems. Mining has always been restricted to gravel and rock and continues at much lower levels today. Sheep herding was practiced on all the mountain slopes before 1900. The high meadows and brushfields were grazed in the summer months. As more settlers moved in, however, they feared the fires set by herders to maintain and improve pasturage. The danger that the fires would spread caused many towns to restrict sheep grazing.

Other items of historic interest are the electronic site on Mt. Defiance, first installed in 1966, the Christmas Flood of 1964, and the ice storm of 1970. The Christmas Flood, a classic rain-on-snow event considered to be the equivalent of a 500 year flood, caused heavy damage along the floodplains of the Hood River system. Blowdown from the 1970 ice storm led to the first logging with helicopters on the Mt. Hood National Forest. The Skyhook Fire started in red slash within the sale area in 1971.

Historic Forest Service facilities include fire lookouts and guard stations along with their associated telephone lines, strung as early as the 1910s. Early lookouts often consisted only of a tent camp and tall tree. Constructed lookouts on towers formerly existed on Mt. Defiance, Green Point, Indian Mountain, Buck Peak, Raker Point, and Lost Lake Butte. While not inside the West Fork watershed, the lookout on Hiyu Mountain was also an important detection point for the watershed. Guard stations serving West Fork watershed were located on Mt. Defiance, Lost Lake, and Red Hill. Other historic sites documented or reported in the watershed include logging camps, old railroad beds, logging flumes, sections of old trail, dams, boy scout camps, several recreation related sites around Lost Lake, possible homesteaders' cabins, old surveyors' trees, and parts of the Pacific Crest National Scenic Trail and Timberline Trail.

CHAPTER 3

Issues

CHAPTER 3: ISSUES

Introduction

This section contains the issues and key questions that the analysis will address. The issues and key questions follow the scientific method. In other words, we have observed several items and effects in West Fork watershed. Based on these observations, we formed a *preliminary hypothesis* to explain what we think we see. This broad scale hypothesis is what we call an *issue*. We defined an issue as a clear statement of a perceived problem or conflict. The paragraphs that follow each issue statement record what we see and think is going on regarding the issue. *Key questions* are the specific hypotheses around the issue and that this analysis will test. As such they are phrased as "yes" or "no" questions.

Implicit in each issue statement and key question is the *null hypothesis*. The null hypothesis states that what we see or think is going on is not true. For example, in Issue 1 (see below) the null hypothesis is that introduced plants and animals are not successfully competing with native species and are not favored by human activities. In following the scientific method, evidence in the analysis must show that the null hypothesis is wrong and that what we see or think in going on is true.

Like any other scientific analysis, a "yes" answer to a key question also includes discussing causal factors, displaying where the problems occur as specifically as possible, and listing what corrective measures or actions might be appropriate. A "no" answer includes discussing where our perceptions are in error and what is really going on regarding a particular issue. If we cannot answer the key question, then we have an obvious data gap or analysis need. The issues and key questions were developed jointly by the Watershed Analysis Team and West Fork Stewardship Team, but focused at the watershed scale. Site-specific concerns raised by the stewards are rephrased as resource-integrated, broader scale issues or questions.

Issue 1: Introduced plants and animals may be successfully competing against native plants and animals and continual disturbance from human activities often favors the introduced species over the native species.

The Northwest Forest Plan emphasizes management of native plant and animal species over non-native species. Non-native species are those species not present in the watershed prior to 1900. Many species have been accidentally or purposefully introduced within the watershed. The Oregon State Department of Agriculture has classified some plants as noxious weeds. Other plants are not noxious weeds but are very aggressive invaders and able to spread easily. These plants succeed since they are adapted to frequent disturbance and can quickly take advantage of bare ground created by human activities. A third class of plant are those deliberately introduced to accomplish a natural resource management goal, such as improving big game forage or stabilizing eroding sites. Some of these plants form sods that may spread and do prevent native species from establishing.

All of the West Fork subwatershed lakes have been stocked with non-indigenous trout, such as brook and / or brown trout, from at least the 1950's to the present. Fish introduced into lakes have moved downstream into adjacent sections of streams and are reproducing naturally. Prior to 1990, summer steelhead and spring chinook were stocked into West Fork using out-of-basin stocks. The native stock of spring chinook was extirpated before stocking had commenced. Current stocks of steelhead include both hatchery and indigenous wild stocks.

There is some question as to whether the elk currently present in the watershed are native to the area or not. These elk are managed to provide huntable population levels. Most non-native terrestrial animal species have not been introduced deliberately. Examples of such species include opossum and English sparrows.

At least one non-native fungus has been introduced accidentally into the watershed. White pine blister rust has reduced the abundance of western white pine and has affected whitebark pine in the Mt. Hood Wilderness.

Tied in with this issue are the following key questions:

A. Are noxious weeds, as identified by the Oregon State Department of Agriculture, crowding *out native plants?*

B. Are other non-native plant species crowding out or reducing native plants? Are these species spreading? Will problems develop in other areas if no control actions are taken?

C. Are additional control actions needed to control existing or potential problems with noxious weeds and invasive non-native plants?

D. Are introduced or non-native fish out competing or displacing native species?

E. Has the interbreeding with the various introduced and non-native fish species essentially eliminated the wild fish in West Fork watershed?

F. Are the introduced species affecting any threatened, endangered, sensitive, or at-risk species?

G. Are any non-native animals reducing the populations of distributions of any native plant or animal species?

H. Have any native plants, animals, or fish been eliminated from the West Fork watershed since 1900?

Issue 2: Current information may not be adequate to assure the viability of some species on the C-3 Table and certain other sensitive, unique, and at-risk species.

The Northwest Forest Plan, in particular, attempts to address the viability of these species in the FSEIS and C-3 Table. In some cases we cannot identify the species in question without destructive sampling. In other cases sampling methodologies have not been developed. The habitat needs for many species are not clear or known. We have not looked for many of the more easily identified species. In cases where we have a fair to good understanding of the habitat needs, we are unsure if the current direction is adequate.

The National Forest Management Act (NFMA) requires that federal land management assures viability of all species that occur within federal boundaries. The Mt. Hood Forest Plan and Northwest Forest Plan emphasize certain species that are federally listed (Threatened or Endangered), may become listed (Federal Candidate), are rare on National Forest System lands within the Region (R6 Sensitive), or are considered indicators of certain habitat conditions (Management Indicator Species). While much information exists on popular megafauna, such as bald eagles and deer, little information exists on less charismatic species and plants not considered commercially important. The watershed scale is not the proper scale to assess viability of highly mobile species, but management direction and activities should assure the continued presence of such species within the watershed.

Tied in with this issue are the following key questions:

A. Do we have adequate information to assess the viability or assure the continued presence of all relevant species listed in the FSEIS, Appendix J2, and the C-3 Table should we decide to recommend changes in the Riparian Reserve widths or if the FSEIS suggested that further viability analysis was appropriate during watershed analysis?

B. Are there additional or unique species within the range of the northern spotted owl which lack adequate strategies to maintain viability?

C. Does the existing condition provide sufficient habitat to assure the continued presence of native primary and secondary cavity nesters?

D. Does current management direction provide sufficient habitat to assure the continued presence of primary and secondary cavity nesters?

E. Do we need to retain any B5 areas in Matrix lands to meet the habitat needs of the guilds of species represented by pileated woodpeckers and pine martens?

F. Are connectivity, reproduction, and dispersal habitat sufficient to allow gene flow at the metapopulation scale?

G. Does West Fork provide important habitat for species when considered at the metapopulation scale?

Issue 3: The demand for recreation opportunities is rising faster than management's ability to handle the demand and to provide, protect, or maintain the desired recreational experiences, and to protect other resources affected by recreation use.

Many recreation users in West Fork watershed come from the Portland metropolitan area, which is projected to grow rapidly for several decades. The Mt. Hood National Forest is classified as an urban forest due to the current and projected population levels. With the exception of Lost Lake, the Mt. Hood Forest Plan emphasizes dispersed recreation within West Fork. The Northwest Forest Plan emphasizes dispersed recreation over developed recreation in Late Successional Reserves and Riparian Reserves. As population levels increase on the westside and in the Columbia River Gorge, the pressure on recreational opportunities will increase, yet recreation budgets continue to decline. The more primitive recreational experiences are becoming increasingly harder to find on the Mt. Hood National Forest.

The topography and ownership patterns in West Fork results in most recreation use being concentrated around the many lakes in the watershed. High use levels often results in bare, compacted soil; loss of screening vegetation; and depleted levels of downed wood. Many of the small lakes in West Fork do not have toilets, creating sanitation problems. High use areas typically lie within the riparian zone, affecting shorelines, contributing to declines in water quality and aquatic habitat elements, and disturbing or displacing some wildlife species that depend on riparian zones.

The Columbia River Gorge is an internationally important windsurfing area. When the winds do not blow in the summer, many windsurfers look for other physically challenging recreational opportunities in the nearby area. One of the most popular alternative recreational pursuits is mountain biking. The windsurfers typically look for trails that are both long and relatively difficult. The potential to provide such trails in West Fork is present, but funding to actually develop such a system is highly questionable.

Most trails in West Fork lie within or immediately adjacent to either the Mt. Hood or Columbia Wilderness. The alpine areas within the Mt. Hood Wilderness face similar use-related problems as the small lakes. Most trail use is restricted to summer, but demand for a snowmobile trail system within West Fork is increasing.

The Regional Office has long desired to provide a 2-lane paved road over Lolo Pass into West Fork. The intention is for a Scenic Byway that runs between Zigzag and Parkdale between the Mt. Hood Wilderness and Bull Run Watershed. The current route is single-lane gravel and single-lane paved (with inter-visible turnouts) within West Fork and 2-lane paved between Zigzag and Lolo Pass. The most common destination of travelers on this route is Lost Lake. Recreation use levels at Lost Lake are at or slightly above designed capacity currently. Lost Lake lies within a Late Successional Reserve. Recently, the district has made many improvements at Lost Lake designed to reduce recreational impacts. However, there is some doubt whether enough money will be budgeted to complete this design.

Tied in with this issue are the following key questions:

A. Are the trends for the various types of recreation uses increasing?

B. Are there recreational uses that conflict with one another?

C. Have or might high levels of recreation use created detrimental impacts to soil, water, vegetation, wildlife, and fish?

D. Does West Fork provide any unique recreational experiences or opportunities not readily available elsewhere?

E. Does West Fork have the potential to provide for new or different recreational opportunities or experiences? What might be the potential impacts?

F. What level of developed and dispersed recreation use is appropriate and where is it appropriate within the LSR or Riparian Reserves?

G. Are recreation users we encourage to use National Forest System Lands causing any detrimental impacts to other landowners within the watershed?

***Issue 4:* Past management strategies did not deliberately consider how the pre-1900 disturbance processes affect what the landscape can produce and how much. Recent ecological thinking suggests that we may better meet the social demands on the environment if we better mimic the type and timing of disturbances the landscape evolved under prior to 1900.**

Long before Euro-American settlement began, various disturbance processes shaped the landscape in West Fork. These processes produced a forest considered highly desirable from both an economic and purely social point-of-view to the settlers and their descendants. These processes operated on the forest for thousands of years before Euro-American settlers began to convert forests to agriculture and began to manage forests more like an agricultural product. The general paradigm until recently was that disturbances such as fire, wind, insects, disease, and floods were "bad" for both the ecosystem and the desired products from the area. Management actions tended to try to control these disturbances and their subsequent effects in order to "improve" the land.

Recent evidence suggests that management strategies that incorporate the typical pre-1900 disturbance processes or mimic them to a greater degree are more likely to produce the desired products on a more sustainable basis. However, we have only a rudimentary understanding of these processes and how they affect what the landscape can provide.

Complicating the desire to better mimic or incorporate pre-1900 disturbance regimes is the believed loss of landscape resiliency to absorb large-scale disturbances. Before 1900, many terrestrial, riparian, and aquatic wildlife species could move to another location after a large-scale disturbance. The population dynamics of other species allowed the metapopulation to "absorb" the temporary loss in one or more watersheds while allowing eventual recovery of the species within the affected watersheds. Management practices since 1900 have significantly reduced the potential refugia for species greatly affected by large-scale disturbances, thereby reducing both species resiliency and overall landscape resiliency.

Tied in with this issue are the following key questions:

A. Has management greatly affected the pre-1900 disturbance regime?

B. Is the current landscape, including terrestrial and aquatic features, reflective of the characteristic landscape prior to 1900?

C. Has the current landscape significantly altered terrestrial, riparian, and aquatic wildlife use patterns and distribution relative to the characteristic landscape before 1900?

D. Can we adjust our vegetation management methods and timing to better reflect pre-1900 disturbance regimes and accept the consequences to other resource values? *Dropped from further analysis in this iteration. A complete answer to this question requires a landscape design, to be done at a later date.*

E. Can we treat the forest health problems within the watershed and still meet Northwest Forest Plan objectives?

F. Will the landscape look different on National Forest System lands as we change management strategies under the Northwest Forest Plan? *Dropped from further analysis in this iteration. A complete answer to this question requires a landscape design.*

Issue 5: The other owners within West Fork use the landscape in ways to meet their objectives, and not those of the Northwest Forest Plan. The Northwest Forest Plan recognizes several exceptions to plan objectives, such as the holders of existing permits and agreements (i.e. powerline rights-of-way, diversion ditches, electronic sites, etc.). These uses and objectives may result in additional restrictions on how the National Forest System lands are managed in order to meet the goals of the Northwest Forest Plan.

Private lands within the West Fork watershed are managed as commercial forests almost everywhere except the Dee Flats area. Dee Flats is managed as commercial orchards. These owners abide by State Forest Practice Rules and Agriculture Rules while the Forest Service must follow both the Mt. Hood Forest Plan and the Northwest Forest Plan. The State rules are less stringent than the two forest plans. In addition, several major special use permit holders have made more-or-less permanent changes in landscape patterns and operate under rules and agreements created long before the Mt. Hood Forest Plan.

Both Hood River County and Longview Fibre own significant amounts of the watershed, managing them as commercial forest. These entities follow the provisions contained within the State Forest Practices Act. They tend to have more tools at their disposal for managing the vegetation than the Forest Service, including the choice of pesticides and herbicides. The Forest Service still has the option to use various chemicals, fertilizers, and biological pesticides such as Bt. Orchardists within and adjacent to the watershed depend on a wide variety of chemicals to control pests and unwanted vegetation and produce fruit at an economically viable level.

The BPA powerline known as Big Eddy crosses the watershed, following the West Fork of Hood River up to Lolo Pass. This corridor carries four major lines from Celilo Converter Station in The Dalles to the Willamette Valley. The management of this corridor restricts the height of vegetation, essentially creating a permanent linear opening across the watershed.

Several irrigation diversions originate within the watershed. The irrigation districts operate under special use permits that allow them access to their ditches and diversions for maintenance purposes. Mt. Defiance is a major electronic site within the watershed. In addition to Forest Service communications equipment, the site includes communication facilities for other government entities and commercial operations.

Tied in with this issue are the following key questions:

A. Have the various vegetation and pest management methods used by landowners in the watershed detrimentally affected or benefited any C-3; threatened, endangered, or sensitive; at-risk; unique; or species of concern? Is there potential for either adverse or beneficial effects in the future?

B. Is there a need for additional measures on National Forest System lands to better maintain habitat quality and connectivity for aquatic and riparian species in association with stream diversions?

C. Does the BPA powerline corridor significantly disrupt connectivity for any C-3; threatened, endangered, or sensitive; unique; or at-risk plant or animal species?

D. Do the access roads for the BPA powerline and ditch maintenance provide major infestation points and dispersal opportunities for non-native species?

E. Has the current or past timber harvest on other ownerships affect peakflows or water temperature on any streams within West Fork Watershed?

F. Is there a need for additional land exchanges between the Forest Service and other owners to restore or enhance habitat conditions and dispersal corridors?

Issue 6: The National Forest may not be able to provide for the levels of various extractive forest products demanded by the public while meeting the goals and objectives of the Northwest Forest Plan.

The Northwest Forest Plan changed some land allocations under the Mt. Hood Forest Plan, essentially reducing the amount of commercial forest within the National Forest boundaries. In order to meet the goals and objectives of the Northwest Forest Plan, the Mt. Hood National Forest may be required to, in essence, mitigate the results of commercial forest management by the other owners in the watershed. Such mitigation may further reduce the potentially available commercial timber from National Forest System lands.

National Forest System lands within West Fork produce a variety of products. Along with commercial timber, other products include water, game fish and wildlife, common variety minerals, firewood, Christmas trees, mushrooms, beargrass, huckleberries, and many other special forest products. In addition, West Fork lies within the ceded lands of the 1855 Treaty with the Middle Tribes of Oregon. The treaty reserved certain rights to the signatory tribes, such as fishing in the "usual and accustomed places" as well as certain rights for gathering culturally important plants. Huckleberry gathering still occurs on Indian Mountain.

Tied in with this issue are the following key questions:

A. Has the district adequately provided for tribal treaty rights?

B. Are mining areas on National Forest System Lands sited in appropriate locations to meet the ACS objectives?

C. Is water currently over-allocated on either a legal or ecological basis?

D. Is current direction adequate to halt or reverse the decline of native fish stocks in the watershed?

E. Does commercial forest management by other owners restrict the Forest Service's ability to manage vegetation to meet Mt. Hood and Northwest Forest Plan objectives?

F. Can West Fork provide the needed habitat to meet state management objectives for deer, elk, and fish?

G. Can West Fork provide the projected PSQ in the Mt. Hood Forest Plan as amended by the Northwest Forest Plan?

H. Can West Fork provide the demanded levels of firewood and still meet Northwest Forest Plan objectives?

I. Can West Fork provided the demanded levels of other special forest products and still meet the Northwest Forest Plan objectives?

Issue 7: The LSR in West Fork includes a portion of the Bull Run Watershed Management Unit. The management objectives of this buffer area may conflict with the management objectives for the LSR.

A portion of the Bull Run Watershed Management Unit extends into the headwaters of the West Fork of Hood River. Water originating in this segment of the Bull Run Management Unit flows into Hood River and the Columbia River and not into the Bull Run watershed.

The Northwest Forest Plan changed the land allocation of most of this buffer area from DC-1 (Timber Emphasis) to Late-Successional Reserve. The current law governing this portion of the Bull Run Watershed Management Unit established this buffer in order to control human access into the Bull Run watershed.

In March of 1994 a bill (HR 4063) was under preparation in the House of Representatives, but died in committee. This bill would have extended the Bull Run Watershed Management Unit further into West Fork watershed. The bill had two stated purposes:

1) to protect the Bull Run and Little Sandy rivers from human and natural disturbances and

2) to allow the potential for expansion of the quantity of water from the Management Unit for the city of Portland and other entities using Bull Run water under agreements with the city.

The legislation, if enacted, would have placed additional restrictions on the uses of and management practices within the buffer zone. The bill contained specific language governing access, fire management, use of herbicides and pesticides, and timber harvest within the entire Bull Run Watershed Management Unit, including the buffer area within West Fork.

Tied in with this issue are the following key questions:

A. Would the objectives of a bill such as the one proposed in 1994, potentially result in any adverse or beneficial impacts on either our ability to manage the LSR to meet Northwest Forest Plan objectives or on other resources within West Fork?

B. Does the LSR and Riparian Reserve designations provide adequate protection to the Bull Run watershed from natural disturbances and human activities in West Fork?

CHAPTER 4

Past and Present Conditions

Chapter 4: Past and Present Conditions

Introduction

This chapter discusses past and present conditions within West Fork watershed. We chose 1900 as our breakpoint year since we have very little information on the watershed prior to 1900, and Euro-American influences such as timber harvesting had not occurred to any great degree within the watershed. Extensive timber harvesting had already begun outside the watershed and reached the watershed boundary by 1900. Shortly after 1900, Euro-Americans began to exert great influence on the vegetation and habitat conditions in terrestrial, riparian, and aquatic ecosystems.

The discussion follows a format similar to that used in White River watershed analysis. Major topics include vegetation, fish and wildlife, disturbance processes, and social uses before 1900, between 1900 and the present, and the present. To aid discussion we combined sixth field watersheds into three subwatersheds (Figure 4.1 and Table 4.1). We also examined the watershed under the climate zone concept developed during White River watershed analysis and found that about 80% of West Fork watershed as a whole and virtually all of the National Forest System Lands lie within the Crest Zone (Figure 4.2). We also mapped the major vegetative series and found that most of the watershed and virtually all of the National Forest System Lands lie within the Pacific silver fir series (Figure 4.3). The western hemlock series lies mostly east of the Forest boundary, extending only a short distance up West Fork Hood River and in a narrow band up Lake Branch. The grand fir series lies almost entirely within Green Point subwatershed and primarily on other ownership's. The mountain hemlock series occurs only on the top of Mt. Defiance and on Mt. Hood.

Table 4.1. Major subwatersheds in West Fork

Subwatershed	Sixth Field Watersheds
West Fork	Elk Creek, McGee Creek, Ladd Creek, Jones Creek, Red Hill Creek, Tumbledown Creek, Marco Creek, Camp Creek, West Fork Hood River
Lake Branch	Lost Lake, Lake Branch, Laurel Creek, Divers Creek
Green Point	Long Branch Creek, Green Point Creek, North Fork Green Point Creek, Dead Point Creek

In general, we did not develop diagnostic stand types for West Fork. Instead, we focused on stand structure types as described in Oliver and Larsen (1990). Successional patterns as discussed in the FEMAT report seemed to fit well within much of West Fork, allowing us to break the structure types into seral stages (Table 4.4). We did break the riparian vegetation into three main types: Riparian Hardwood, Riparian Conifer, and Riparian Mix (Table 4.4).

Figure 4.1 Subwatersheds in West Fork Watershed

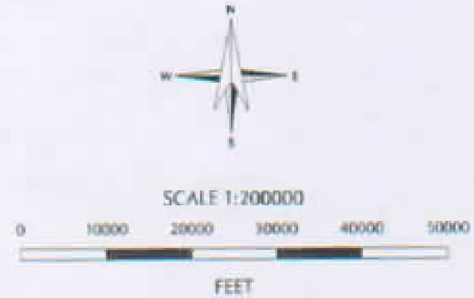

Figure 4.2 Climate Zones of West Fork Watershed

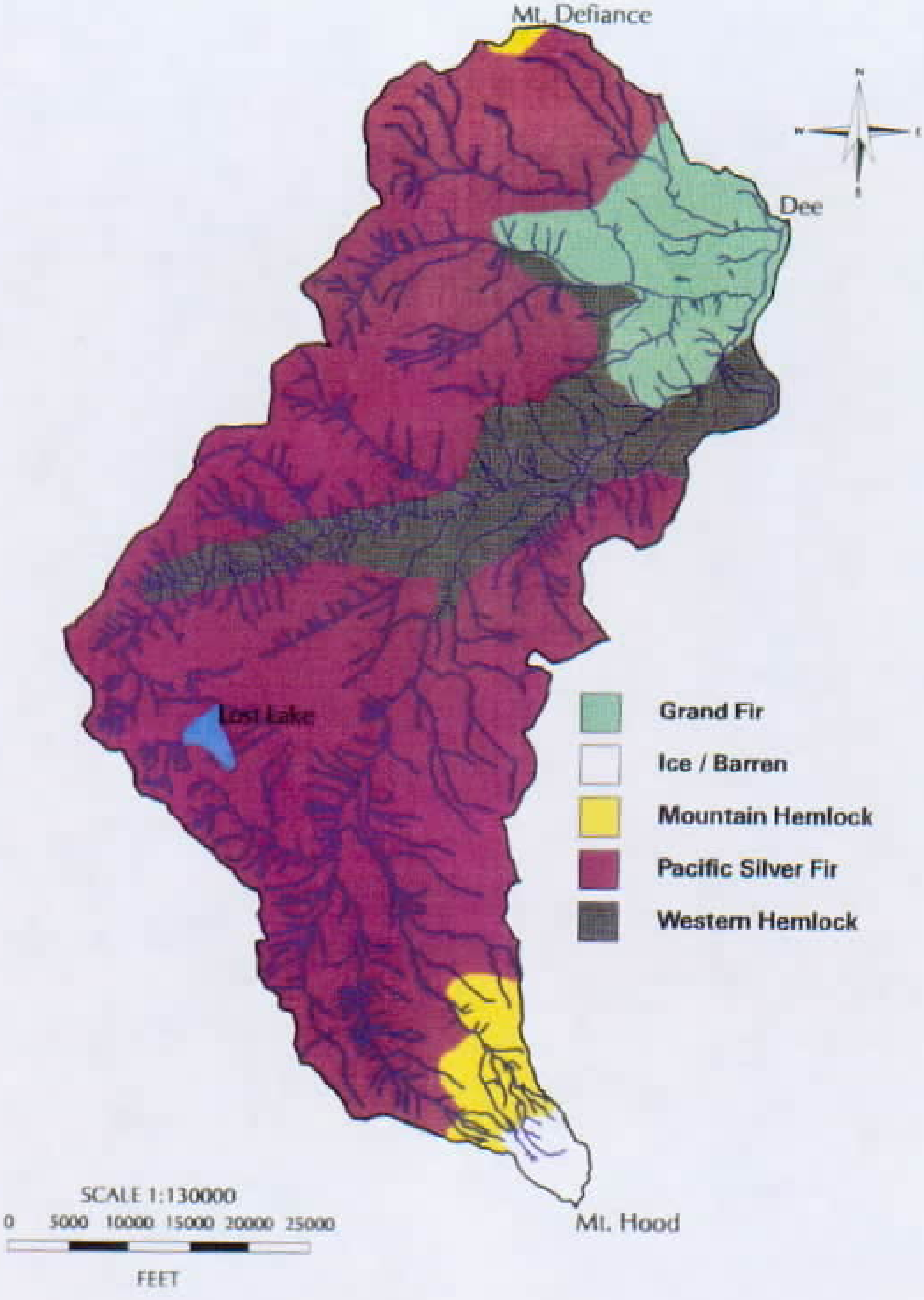

Figure 4.3. Potential vegetation series in West Fork watershed.

Conditions Before 1900

Vegetation

Before 1900, very large patches of similar type stands dominated the uplands, particularly in West Fork and Lake Branch subwatersheds (Figure 4.4). Green Point subwatershed consisted of smaller patches of similar stands and had more of a mosaic landscape pattern. The species mixes, both overstory and understory were very similar to today although the relative proportions differed. Douglas-fir was, by far, the most dominant species in the watershed (Table 4.2 and Appendix A).

Due to the disturbance regimes on the uplands of West Fork and Lake Branch subwatersheds one or two structure types tended to dominate the subwatershed at any one point in time. Major disturbances were rare and stands often reached great age. Some diversity did exist as the result of smaller scale disturbances, creating scattered smaller patches of a different stand structure within the larger matrix. Lake Branch was apparently more homogeneous than West Fork.

Table 4.2. Five most common tree species for each township in West Fork watershed.

T2N R8E	T2N R9E	T1N R8E	T1N R9E	T1S R8E	T1S R8 1/2E	T1S R9E	T2S R8 1/2E
Douglas-fir	Douglas-fir	Douglas-fir	Douglas-fir	Douglas-fir	Douglas-fir	Douglas-fir	mountain hemlock
Pacific silver fir	noble fir	Pacific silver fir	western hemlock	western hemlock	western hemlock	western hemlock	Douglas-fir
western hemlock	western hemlock	western hemlock	noble fir	western redcedar	western redcedar	Pacific silver fir	noble fir
noble fir	grand fir	noble fir	western redcedar	Pacific silver fir	mountain hemlock	mountain hemlock	Engelmann spruce
western redcedar	Pacific silver fir	mountain hemlock	grand fir	noble fir	Pacific silver fir	noble fir	western hemlock

Generally, large trees, considered excellent timber in 1901, were found on Dee Flat, at the extreme headwaters of Green Point Creek, in the canyons and sideslopes of Green Point subwatershed, in most of Lake Branch subwatershed, near the canyon bottom of West Fork Hood River, and on the slopes of Blue Ridge. The trees were considered of little value (small and/or difficult to reach) on the divide between the Hood River basin and the Columbia River tributaries north of Mt. Defiance, on the top of Mt. Defiance, and on the steep sideslopes between West Fork and Middle Fork watersheds.

Early descriptions of the understory vegetation are hard to find. The 1901 survey suggests generally open understories except near streams and wet areas and on ridgetops. The General Land Office surveys in the late 1800s suggested dense understories of brush virtually everywhere. Early settlers were able to walk or ride great distances in one day, suggesting open understories in at least part of the watershed, primarily along West Fork and Lake Branch. A cattle trail over Lolo Pass and down West Fork Hood River was used between 1838 and 1845, again suggesting a relatively open understory. American Indians maintained huckleberry patches around Lost Lake and Indian Mountain.

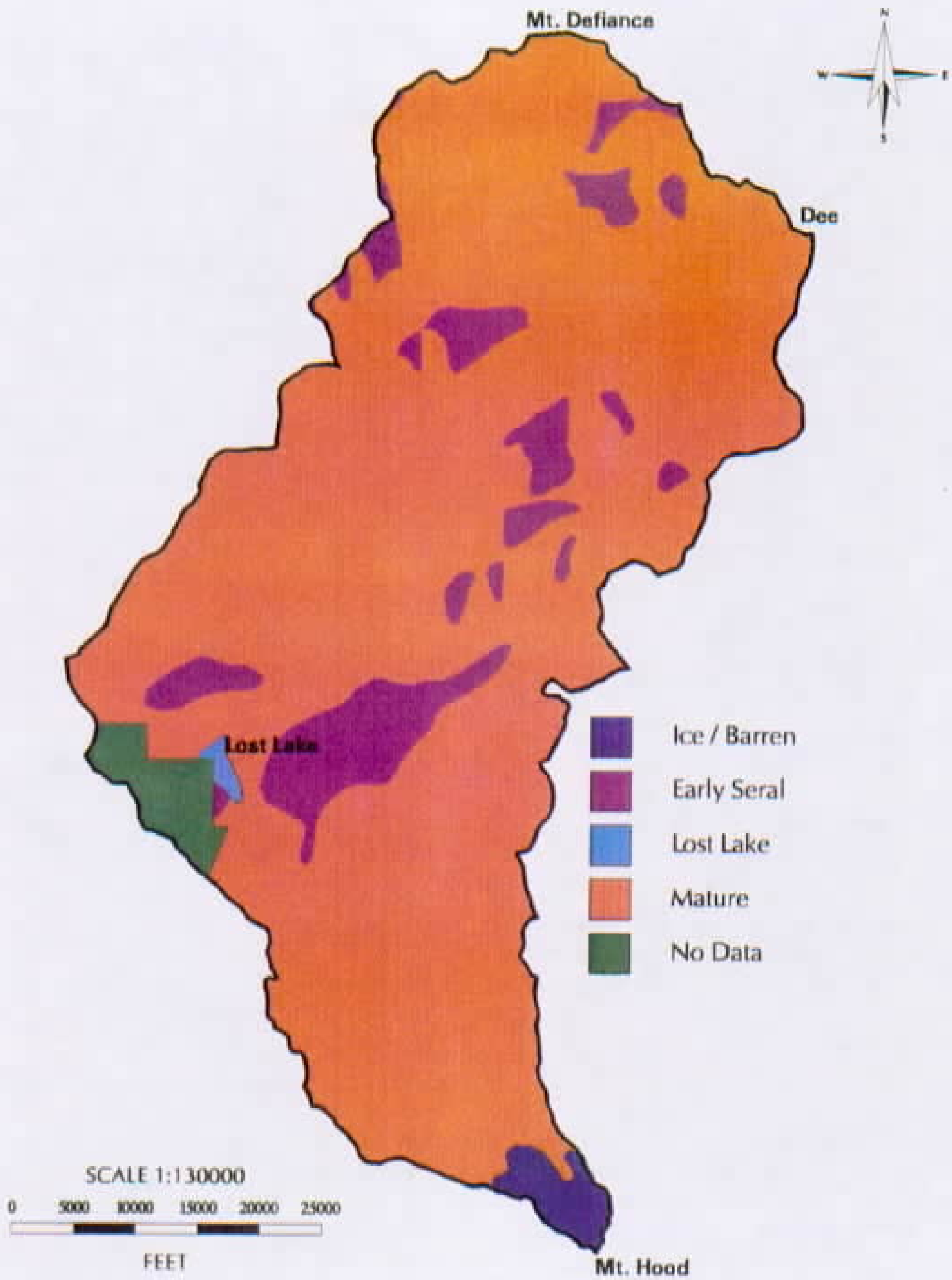

Figure 4.4. West Fork of Hood River Watershed Vegetation Pattern (Early 1900's)

Descriptions of riparian areas are even more difficult to find than descriptions of the understories. Available evidence and professional opinion suggest that the riparian areas contained more of a mosaic of stand types than the uplands. The broad and relatively gentle gradient floodplains of West Fork Hood River and Lake Branch were probably the most diverse. Species such as alder, willow, and cottonwood tended to dominate recently disturbed riparian areas. Conifers dominated elsewhere. The amount of hardwood species in the understory may have depended on stand age. The hardwood understory species in conifer dominated riparian areas certainly differed, with maples the most common species in older stands. It appears that the higher the stream gradient, the more the riparian overstory resembled the upland overstory. Understory species probably changed from rhododendron, ceanothus, chinkapin and similar species on the uplands to maple and alder in the riparian areas.

Fish and Wildlife

Most information available about fish and wildlife and their habitat pertains to large animals with little or no information about invertebrates, reptiles, amphibians, most birds, bats, and small mammals. Presence of some of these species can be inferred by their presence today. Appendix B lists species currently found in West Fork watershed.

Wolves, grizzly bears, and wolverine were probably present in the watershed. Black-tailed deer and elk populations fluctuated over a relatively wide range, depending on the time since the last major terrestrial disturbance. Bald eagles, feeding on anadromous fish were present in the lower watershed and possibly Lost Lake. Small numbers of California condor and mountain goats may have been present. Most of the time, forest conditions would have favored species adapted to or dependent on dense, closed canopy forests.

The major streams in the West Fork supported resident fish species composed of rainbow trout, cutthroat trout, and sculpins. Anadromus species such as steelhead and lamprey may also have been present. The largest impediment to migratory species was Punchbowl Falls located at rivermile 0.2. In the late 1800s, the near-vertical falls was approximately 15 feet high flowing through a steep bedrock canyon. Periods of high flow may have allowed some species to pass this falls, most likely steelhead and lamprey. Below this falls, the West Fork may have harbored chinook, coho, whitefish, and bull trout, in addition to species mentioned above.

Little species-specific information on fish is documented in the West Fork watershed from pre-1900s era, with the exception of Lost Lake and upper Lake Branch. Exploration parties in 1878 and 1880 noted that the surface of Lost Lake at dusk was "alive with trout...about the length of a Case knife, handle and all", while in Lake branch one man caught enough 8 to 12" trout from one large pool, to provide two meals for a party of seven, in less than one hour.

Downed trees and wood debris jams were common throughout West Fork watershed. Woody debris forms pools, traps spawning gravels, provides hiding cover, and provides a substrate for insects and macroinvertebrates

Disturbance Processes

Table 4.3 lists the primary disturbance types for West Fork along with the approximate scale. The scales are relative and based mostly on professional opinion. Disturbances rated "Large" are those that typically result in major changes in wildlife or fish habitat and ecologic functioning. "Small" disturbances result in minor changes in habitat or functioning. "Medium" disturbances are intermediate in effects on habitat and functioning. Generally, events with return intervals of 100 years or more or highly irregular events are rare. Those with intervals of 25-100 years are semi-common; those with intervals of less than 25 years are common. Appendix A discusses the main disturbance processes we believe had the greatest effects on West Fork watershed before 1900.

We do not have a good understanding of some disturbance types within the watershed. For example, we believe that burning by American Indians was common to maintain travelways due to evidence from elsewhere in the western United States. However, we do not know how much burning for travelways may have actually occurred in West Fork. Available information suggests that West

Fork was not used as heavily as many other watersheds on the south side of Mt. Hood and Hood River closer to the Columbia River.

In this analysis, we focused primarily on disturbances at the landscape scale, disturbances that affected many forest stands or more than half a stream. In some cases, an individual disturbance would affect only a small area but, over a relatively short period of time, occurred frequently enough to create landscape level effects. An example of this type of disturbance regime is debris torrents after a stand replacing fire.

Appendix A contains brief discussions of many other disturbances. Some disturbances occurred at the landscape level but are not included in this chapter due to their highly irregular nature, lack of evidence of significance at the landscape level, or lack of evidence that human activities have any impact on either the regime or the outcome. Examples of such disturbances include volcanic eruptions, avalanches, rockfalls and slides, and ice storms.

Many of the disturbance types interacted. For example, drought, insects and disease, fire, floods, and debris torrents and flows are closely tied together in much of West Fork. A typical scenario might be:

1. Major drought lasting several years.
2. Defoliator insect populations to reach epidemic levels. As a secondary effect, root disease levels increase dramatically and some bark beetle insect populations may increase sufficiently to reach epidemic levels.
3. Secondary agents kill large numbers of trees.
4. Opening canopies coupled with drought increase fuel loadings and dry fuels to critical levels.
5. Stand replacing fire burns over a large area.
6. Trees along edge of burn damaged by fire, allowing bark beetle populations to increase and potentially reach epidemic levels, creating more downed fuel. Within 5-10 years many snags created by fire begin to fall, creating additional fuel.
7. Increased snow accumulations and rainfall on susceptible soils on steeper slopes increases incidents of debris torrents over a large area, increases peakflows significantly, and increases the risk of significant rain-on-snow related flood events.
8. Reburn of part of the original fire area plus green forest.

Table 4.3. Major disturbance types for each subwatershed and approximate scale and frequency.

Subwatershed	Disturbance	Scale	Frequency
West Fork and Lake Branch	Stand-replacing fire	Large	Rare
	Burning by American Indians	Small - Medium	Common
	Mudflows[1]	Large	Semi-common-Rare
	1-25 year floods	Small	Common
	25-50 year floods	Small - Medium	Semi-common
	100+ year floods	Medium - Large	Rare
	Rain-on-snow	Medium	Semi-common
	Mass wasting	Small - Large	Common-Semi-common
	Beaver ponding	Small	Semi-common-Rare
	Insect epidemics	Medium	Rare
	Disease epidemics	Small - Medium	Rare
Green Point	Stand replacing fire	Large	Semi-Rare
	Underburning	Small - Medium	Semi-common
	Burning by American Indians	Small - Medium	Semi-common
	1-25 year floods	Small - Medium	Common
	25-100 year floods	Medium - Large	Semi-common
	100+ year floods	Large	Rare
	Rain-on-snow	Medium - Large	Semi-common
	Mass wasting	Small - Large	Semi-common
	Insect epidemics	Medium - Large	Semi-common-Rare
	Disease epidemics	Medium	Rare

[1] West Fork subwatershed, Ladd Creek only

Available evidence suggests that significant disturbances in West Fork and Lake Branch subwatersheds were primarily driven by climate before 1900. Significant disturbances in Green Point subwatershed were driven by soils and climate. Due to poor soils (shallow, rocky, well to excessively drained) Green Point subwatershed is more susceptible to climate fluctuations and changes of a lesser magnitude than the other two subwatersheds.

Disturbance Regimes in West Fork and Lake Branch Subwatersheds

Lake Branch and West Fork subwatersheds typically experienced stand replacing fire at the landscape level. Most of both subwatersheds falls into Fire Groups 6 (Cool, Moist Lower Subalpine) and 8 (Warm, Moist Western Hemlock and Pacific Silver Fir). Some Fire Group 10 (Upper Subalpine and Timberline Forests) exists within the Mt. Hood Wilderness and some Fire Group 4 (Moist Grand Fir) or 3 (Dry Grand Fir) lies east of the National Forest boundary near Dee. Most of the National Forest System Lands within these subwatersheds probably averaged 300-500 or more years between major fires. Maps from 1901 and 1916 and the flagging evident in many trees on exposed ridges suggest that strong west winds drove many large fires. Typical fire size would be several thousand acres.

The fire regime in West Fork and Lake Branch subwatersheds is driven by climate. In most years, topographic and physiographic features influence the probability of ignition and burning while the spatial arrangement of fuels and stand age influence the burning patterns. That is, younger stands and wetter conditions act to either slow or halt fire spread and lessen the intensity of fire behavior. Under extreme drought and high winds, however, all fuels across the landscape become susceptible to burning. The 1988 Yellowstone fires, for example, burned through all forest age classes in proportion to their presence on the landscape. Landscape features that usually served as fuel breaks, such as younger forests, rivers, and wetlands, were not effective (Turner and Romme 1994).

Under the extreme weather and fuel conditions typical of large events, the riparian area would burn, but how much would burn depended on the size of the riparian area, actual burning conditions, and chance elements. In general, a crown fire would move through the tree tops ahead of any surface fire within a broad floodplain (e.g. West Fork Hood River or Lake Branch). Surface fire spread would vary tremendously and tend to be much more spotty than the adjacent uplands. The post-fire vegetation mosaic would be much more complex within the riparian area.

Within a narrow floodplain several possible scenarios existed. In general, the crown fire would spot across the floodplain. Surface fire may or may not burn into the riparian zone depending, to a large extent, on how deeply the riparian area is incised and dryness of the surface fuels. Many riparian trees may still die through lethal radiant heating of the crowns generated from fire burning on both hillsides even if the riparian area itself does not burn.

Immediately after the fire, the large expanses of snags and varying levels of exposed soil cover the landscape. Until a vegetative cover reestablishes, the burn area would be prone to erosion from intense rainstorms, rain-on-snow events, hillslope failure, and debris torrents on susceptible slopes. Areas where brush species such as ceanothus and rhododendron dominated before the fire may develop a deep, persistent hydrophobic soil layer. Shallow, short-lived hydrophobic soil layers may form under general forests and around rocky areas.

Available nutrients would generally increase for a short period of time while total nutrients would decrease. Nutrients in the burned duff would either volatilize and become lost to the system or translocate into the soil at about the same depth as a hydrophobic soil layer would form. The greater the level of soil heating, the deeper the nutrients would translocate. These translocated nutrients would quickly leach out of the soil unless surviving or resprouting plants capture them. Unburned or lightly burned duff would decay rapidly under the warmer post-fire environment, generally persisting only 3-5 years. As the duff decayed, its nutrients would become available for plant uptake. Once the duff is gone, short-term nutrient capital would depend on leaves, twigs, and branches from the replacement plant community. The chemical contents of the various parts of angiosperms differs from gymnosperms, with unknown effects on soil microorganisms.

New snags created by the fire would not be hardened, providing many new feeding and nesting sites for cavity excavators. Existing snags would be fire hardened, essentially converting them to perch trees. One unknown is whether burned bark sloughs off a tree at a different rate than unburned bark. Any existing downed logs that remained after the fire would be smaller and fire hardened. These logs would no longer serve as biological substrates for many decay organisms and may no longer provide suitable den sites for some species.

Revegetation began quickly from propagules stored in the seedbank; propagules carried in by animals, wind, and water; and from surviving plants or plant parts. Brush initially dominated, but most plant species present before the burn were present after the burn. Certain plant species were much reduced in population levels or area covered. Some species grew very little after establishment, waiting for other species to "improve" the environment. The so-called pioneer species, such as brush, certain forbs, and shade intolerant tree species would be most apparent. A brush dominated environment persisted for only a few years on productive sites and many decades on unproductive sites.

Five to ten years after the fire, many snags would fall, generally most trees under 15 inches DBH, regardless of species; and species subject to stringy rots, such as true firs and Engelmann spruce, regardless of size. Species subject to cubical rots, such as Douglas-fir and western redcedar, could persist for many decades as standing snags.

Five to seven years after the fire, fine roots would have decayed below a critical threshold, increasing the risk of debris torrents. If snags have fallen before this threshold is reached, the downed logs would serve to absorb some of the energy created by the debris torrent and lessen the impacts and effects of smaller scale events high in the subwatershed and larger events lower in the subwatershed.

Reburn potential began building as the snags fell. In most cases, the highest reburn potential is reached 25-50 years after the fire. A reburn typically starts within the original burn but rarely covers all of it. The reburn would affect some previously unburned forest. Within West Fork and Lake Branch, the highest reburn potential is probably closer to 25 years after the first fire. These subwatersheds are productive enough that relatively "fire proof" forest appeared before age 50.

Root strength sufficient to "reanchor" the hillsides appears 30-50 years after the fire. The most productive sites reanchored within 30 years. The least productive sites or areas that reburned might have taken as long as 50 years to recover. Once the finer roots reestablished, the frequency of smaller debris torrents decreased.

Between major fires, smaller scale disturbance events create landscape diversity. These events consist of large, but relatively short-lived insect outbreaks; low and moderate intensity fires similar to the 1993 Benson Fire in the Columbia Wilderness; smaller high intensity fires on drier, exposed ridgetops; and root rot pockets in remnant old-growth stands. After several hundred years, major fires would burn again, essentially "ignoring" much of the diversity created by the other events.

Between major fires, most snags would eventually fall and a long period would follow with little or no new input of sound downed wood. What wood was present would decay and move into the rotten log categories. Few snags are created during this period as the forest is generally healthy. One result is that the typical pre-1900 disturbance regimes resulted in an extended period of time with no sound downed logs or snags. Snag creation and wood input was more episodic than continual. Lookout photos from the early 1930s show large areas with few or no snags in Lake Branch.

Insect outbreaks were also tied to drought stress. Bark beetles may be a significant disturbance factor only in connection with large fires or extreme droughts. The regime associated with disease is more mixed. Drought and insect outbreak related stress would also increase a tree's or stand's susceptibility to disease. Disease risk also increases with tree and stand age. The 1901 condition surveys indicate significant levels of root and stem disease around Lost Lake along with very old stands.

The riparian areas in West Fork and Lake Branch were subject to more frequent major disturbances than the adjacent uplands. For example, the streams in these two subwatersheds would experience 3-5 100-year flood events, on average, for every major fire event. A more frequent disturbance regime suggests more diverse and complex riparian and aquatic habitat conditions relative to the terrestrial conditions.

Mass wasting was a major force in determining riparian and aquatic habitat conditions and complexity. The most common events in West Fork and Lake Branch are debris torrents, debris flows, sidewall failures, rotational slumps, and mudflows in Ladd Creek. Debris torrents and flows are associated with high precipitation, slopes greater than 50%, loosely consolidated or unconsolidated soils, and perched water tables. Much of the upper portions of West Fork and Lake Branch contain compacted glacial till soils. Most debris torrents and flows originate in hillslope hollows, often below a slope break, that concentrate water. Sidewall failures tend to occur in deeply incised streams with unconsolidated volcanic soils and sideslopes greater than 35%. Sidewall failures are more typical of streams in West Fork subwatershed that originate on Mt. Hood.

Rotational slumps are what they sound like; a portion of the hillside slides and the entire mass rotates somewhat in the process. Rotational slumps may happen very slowly, such that the vegetation adapts and the slump is not readily noticed, or they may happen catastrophically, over a few hours. Hillsides dominated by trees with "pistol butts" indicate a rotational slump moving at moderate speed. A feature called a sag pond often develops at the top of a rotational slump. Several small lakes, or tarns, are found below Indian Mountain and may be sag ponds. Sawtooth Ridge has a tiny sag pond on its north aspect. Most rotational slumps occur in Lake Branch subwatershed.

Ladd Creek is subject to mudflows originating from Ladd Glacier. Material for the mudflow comes from the large deposit below the glacier and from sidewall failures high in the drainage. Water that triggers the mudflow comes from intense rainstorms or rain-on-snow events.

After a major disturbance, such as a flood or debris torrent, species such as alder, willow, cottonwood, and vine maple would dominate the replacement plant community. Hardwood dominated communities in lower gradient reaches would provide suitable conditions for beaver. Beaver would tend to utilize side channels in the mainstem of West Fork and Lake Branch and the mainstems of the tributaries.

Eventually conifers would establish and grow within the hardwood communities. Beaver activity, such as dam and lodge construction and maintenance, felling hardwoods for food, and flooding, would allow the hardwood dominated community to persist. Elsewhere, conifers would establish first on drier portions of the floodplains and gradually "move" into wetter portions. There may be a short period of time in which conifers dominate the riparian stand with only scattered hardwoods in the understory. Eventually, a more cathedral-like conifer stand develops, allowing hardwoods of tree size to grow in the understory. The conifer stand in this case is comprised of widely spaced, very large trees with crowns well above the forest floor. Vine maple and Douglas maple trees generally less than 30 feet tall would be prevalent in the understory.

Larger conifer trees are more resistant to damage from flood events than smaller trees. Susceptibility to flood events increases as conditions become wetter, decreasing the rooting zone. Even very large trees become susceptible to floods if the stand becomes more exposed to wind due to another kind of disturbance (fire or insects), if root disease kills a sufficient number of roots, or channel shifting undermines the tree. Debris torrents in any stream and mudflows in Ladd Creek can cause even well rooted trees to fall or could deposit enough material at the base of the tree to "smother" the roots and kill the tree. The broader floodplain in upper West Fork would likely be more diverse with more side channels than the floodplain of Lake Branch.

Disturbance Regimes in Green Point Subwatershed

Green Point subwatershed typically experienced a mix of stand replacing fire and non-lethal underburning. Fire Groups 3 (Dry Grand Fir), 9 (Dry Western Hemlock and Westside Douglas-fir), and 6 (Cool, Moist Lower Subalpine) comprise the bulk of this subwatershed. Most of the National Forest System Lands lie within the Pacific silver fir zone, normally in Fire Groups 8 and 6, but available evidence suggests that the fire regime was more typical of Fire Group 9.

The fire return interval was much more variable in Green Point subwatershed. The average may have ranged from as low as 50-100 years below about 4000 feet elevation to over 200 years above 4000 feet. The combination of Mt. Defiance, Blowdown Ridge, and Wacoma Ridge creates a rainshadow effect within Green Point subwatershed.

Below 4000 feet, fire return is driven by a combination of seasonal drought and prolonged drought. Much of the lower portions of the subwatershed would be dry enough to burn by mid-June or July in most years. Fires starting in the drier lower elevations would sweep up Green Point subwatershed, particularly during east wind events.

Frequent underburning maintained more open forests dominated by more fire resistant species, such as Douglas-fir. Fires would not have reached the area currently in the National Forest system as frequently as lower in the subwatershed, so average return interval was longer. It appears that relatively frequent underburns would have occurred for some period of time followed by an extended period without fire. During the fire-free period, fuel loadings would build and the tree canopy would become more dense as fire susceptible species, such as grand fir and Pacific silver fir, established in the stands. If the fire-free period lasted for more than 30 or 40 years, conditions would develop to support a stand replacing fire.

Underburning on Mt. Defiance was more dependent on early season fire start that crept and smoldered over an extended period of time. Initially, most of the fire behavior would consist of low flame lengths and rates-of-spread. As the season warms and dries, flame lengths and rates-of-spread would increase. Torching and short crown fire runs could occur during the warmest and driest part of the day. Either strong east or west wind events would result in larger crown fire runs. By the time the fall rains began, an individual fire could cover several thousand acres.

Immediately after the fire, many of the same effects described under West Fork and Lake Branch subwatersheds would apply in Green Point subwatershed. Snags would consist of a mix of scattered individuals and patches of varying size. Ceanothus, chinkapin, and vine maple would dominate the brushfields instead of ceanothus and rhododendron. Post fire recovery rates would be slower and brush fields are more likely to persist longer in Green Point. This subwatershed is not as susceptible to debris torrents as Lake Branch and West Fork, so this related disturbance factor may not play as large a role in landscape dynamics.

Insect outbreaks played a major role in landscape dynamics in Green Point subwatershed. These outbreaks appear to be drought-related. Other tree pests, such as bark beetles and root disease, would increase in association with the drought and defoliator insect outbreak. These secondary pests would actually kill the tree rather than the drought or the defoliator insects directly. Green Point subwatershed experiences more drought and is more susceptible to decreases in annual precipitation than West Fork and Lake Branch.

Mass wasting was much less common in Green Point subwatershed. Instead, the major erosion forces are tied to events such as floods, rockfall or rockslides, soil creep, and dry ravel. Debris torrents and flows still occurred but were more rare. Beaver activity also may have been more limited due to the steeper gradients in much of the subwatershed.

Social Uses

American Indians were the main users of the watershed until the 1840s. The various tribes present fished for salmon and steelhead at Punchbowl Falls and possibly other locations in West Fork. They collected and managed for huckleberries around Lost Lake and Indian Mountain. Huckleberries were dried using hearths near the collection sites. The huckleberry patches were burned about every seven years in the fall after collecting the year's production. They burned when berry production fell off or when tree encroachment reached an undesirable level. Since these fires were set late in the year, they rarely spread beyond the berry patch. The watershed also provided basket material, building materials, hides, furs, and medicinal and edible roots and herbs.

Before 1900, huckleberry field burning may have been a significant and frequent ignition source in the lower elevations of Green Point subwatershed. This burning would have occurred in association with maintaining travel routes along Hood River and possible fishing at Punchbowl Falls. A travel route also existed up West Fork and across Lolo Pass. We are unsure how much burning occurred in association with this travel route.

Beginning in the mid-1840s, Euro-Americans began entering the Hood River basin in large numbers. Initially settlement was in the lower Hood River valley. By the 1860s, more and more settlers were exploring the upper Hood River valley, the Dee Flat area, and the three forks of Hood River. Between 1838 and 1845, cattle were driven across Lolo Pass and along the West Fork. The first drive in 1838 was from Oregon City to The Dalles area. This trail is variously referred to as the Lee Cattle Trail and the Chitwood Trail (Hood River County Historical Society 1982, 1987).

Before 1855, most of the Euro-American use consisted of fur trapping, hunting, fishing, and exploration. In 1855, the United States government gained title to the land in West Fork watershed with the signing of the Treaty with the Middle Tribes of Oregon. In 1873, Lost Lake was first seen by Euro-Americans and named "Big Lake." It was not officially "discovered" until 1880, when it was named Lost Lake. Between 1873 and 1880, some members of the first party revisited the lake, but kept it a secret after accidentally starting a forest fire on Huckleberry Mountain.

Euro-American settlers began moving into and utilizing parts of West Fork before 1900. Dee was first settled in 1861 by the Davis Divers family. Some farming for strawberries began about 1888-1890 using water flumed from Green Point Creek. The Water Supply Company of Hood River Valley formed in 1876 and acquired water rights on Dead Point Creek within West Fork watershed as well as other streams and springs north of West Fork watershed.

The Transition Period (1900 to Present)

The Transition Period covers events in West Fork watershed between 1900 and the present. We tried to focus on major events both inside and outside the watershed that had landscape level effects on the watershed. There is some overlap with the section on past conditions and present conditions to provide continuity. Events are displayed in the form of bullet statements or very short paragraphs.

- ca 1876 Escaped campfire burns 150-200 acres on Huckleberry Mountain.
- ca. 1879 Fire burns 2000-3000 acres on Lost Lake Butte and east, cause unknown.
- 1880 Lost Lake "officially discovered" and named.
- 1893 Cascade Range Forest Reserve created.
- 1897 Rainy Lake dammed, flume constructed to Green Point Mill. Timber harvesting begins within watershed boundary on Mt. Defiance.
- 1901 Condition survey of Cascade Range Forest Reserve.
- 1902 Yacoult Complex--series of large fires in Cascades of Oregon and Washington and named after fire on Washington side of the Columbia River Gorge. Fires burned almost 100% of present-day Columbia Wilderness, with long fingers reaching into watershed at Wahtum Lake and Indian Mountain; Mt. Defiance; and most of Long Branch Creek reaching across Green Point, North Fork Green Point, and Dead Point creeks.
- 1905 Hood River Irrigation Company files for water rights on North Fork Green Point and (South Fork) Green Point creeks.
- 1906 USDA Forest Service created, Cascade Forest Reserve broken into National Forests, including the Oregon National Forest. Railroad completed to Dee; sawmill constructed; timber harvesting begins on Dee Flat. Cut over land sold to orchardists. Hood River Irrigation Company reformed as Farmers Irrigation Company.
- 1907 Fishing license required by State, limit set at 125 trout per day. Green Point Mill sold to Stanley-Smith Lumber Company.
- 1908 Hood River County created from Wasco County. Lowline Ditch constructed. Road to Lost Lake reaches as far as Cedar Springs. Oregon National Forest renamed Mt. Hood National Forest.
- 1909 Powerdale dam built across the Hood River at rivermile 4.5 by N.C. Evans and later sold to Pacific Power and Light in 1910

- 1910 Road to Lost Lake completed.
- 1911 1040 acre reburn on Lost Lake Butte (escaped campfire), 530 acre reburn on Mt. Defiance (cause unknown), 200 acre fire approximately 1 mile southeast of Rainy Lake (cause unknown).
- 1915 Mill and flume constructed on Dead Point Creek.
- 1916 Forest Service offers 7000 acre timber sale along West Fork Hood River, purchased by Oregon Lumber Company. Original appraisal based on 480 million board feet (MMBF). Brush burning causes a 480 acre fire less than 1/2 mile east of Rainy Lake, southern edge appears to have touched 1911 fire in same general area.
- 1917 Railroad reaches National Forest boundary.
- 1918 Railroad logging begins inside National Forest boundary.
- 1919 Railroad logging related fire burns approximately 350 acres in Marco Creek.
- 1920 Irrigation ditch to Dee constructed. State of Oregon constructs fish hatchery on lands donated from Oregon Lumber Company in Dead Point Creek.
- 1923 City of Hood River obtains water rights for domestic use on Cold Springs, Stone Springs, and Laurel Creek (30.5 cfs), primary water source for city.
- 1924 Oregon Lumber Company switches from steam powered locomotives and donkeys to oil burning equipment.
- 1928 Poorly managed slash burning operations results in several escaped fires, eventually burning 760 acres of federal lands in upper West Fork subwatershed (locations on Butcher Knife Ridge, Sentinel Peak, and Elk and McGee creeks).
- 1930s CCC Camp established at Lava Beds near Parkdale. Bonneville Power Administration created, Bonneville Dam constructed.
- 1930s-40s Lower two miles of Green Point Creek splash dammed to drive logs.
- 1933 Major flood in Hood River basin; flow at Tucker Bridge peaked at 33,000 cfs.
- 1943 Railroad logging ends in West Fork subwatershed, last track pulled in 1944. Original sale contract extended many times, reappraised at least once and resulted in the harvest of approximately 210 MMBF.
- 1945 World War II ends, new prosperity results in boom in housing market and birth rate.
- ca 1950 Era of intensive clearcutting begins in the Forest Service. Valley bottoms harvested first, followed by ridgetops, then midslopes.
- 1955 Oregon Lumber Company holdings sold to Edward Hines Lumber Company.
- 1956 The Dalles Dam completed and floodgates closed.
- 1957 Punchbowl Falls laddered to significantly improve upstream fish passage.
- 1959 Big Eddy-Troutdale powerlines constructed.
- 1961 Flash flood down Ladd Creek in September of 1961. Large amount of silt entered the West Fork, killing large numbers of juvenile and adult steelhead. Dead adult steelhead observed at Punchbowl and Powerdale dam, far downstream from Ladd Creek. Much of the West Fork substrate covered with large amounts of glacial sand and silt. Significant effects to several year-classes of steelhead and macroinvertebrates. As a result of the mudflow, Ladd Creek's channel was blocked and a newly formed channel entered the West Fork Hood River about one mile upstream.
- 1963 Mt. Defiance Lookout severely damaged in windstorm, tower torn down. One documented presence of bull trout in West Fork Hood River through Punchbowl Falls fish trap, installed in the fish ladder. The trap was operated from 1962 to 1964 only.

- 1964 Wilderness Act passed creating Mt. Hood Wilderness. Christmas Floods--major rain-on-snow event resulting in severe and widespread damage to roads, trails, bridges, and culverts throughout Hood River basin. Flow at Tucker Bridge measured at 75,000 cfs on Dec. 23.
- 1965 First electronic permit issued for Mt. Defiance. Era of widespread stream clean-out begins as result of 64 floods and to improve anadromous fish passage. Farmers Irrigation Company reformed as Farmers Irrigation District.
- mid 1960s Mt. Hood National Forest hands over management of county lands to Hood River County.
- 1966 Dee operations sold to US Plywood (later merged with Champion International). Lands eventually sold or traded to Longview Fibre. Mill converted from sawmill to secondary wood products.
- mid 1960s - 1971 Native spring chinook salmon went extinct in the Hood River basin.
- 1968 Mt. Hood Railroad sold to Union Pacific Railroad.
- 1970 Major ice storm damages timber throughout Hood River basin. West Fork Hood River, at rivermile 3.7, begins to downcut through a cemented mudflow, creating an ever-increasing falls. This head cut continued upstream creating a near impassable falls by the early 1980s. In 1985, ODFW, in cooperation with BPA, laddered this falls to allow continued upstream passage by anadromous fish.
- 1971 Skyhook Fire burns approximately 3000 acres in Green Point subwatershed.
- 1972 Harvest levels doubled on National Forest System Lands, era of intensive road building begins.
- 1983 Western Spruce Budworm outbreak begins on Mt. Defiance.
- 1984 Oregon Wilderness Act creates Columbia Wilderness and expands Mt. Hood Wilderness.
- 1985 EA completed for management of Mt. Defiance electronic site. Western Telecommunications, Inc. (WTCI) selected as site manager. Allows expansion of number of users for 5-7 years.
- 1988 Mt. Defiance and Lost Lake Butte sprayed with Bt to control western spruce Budworm.
- 1989 - 1990 Mt. Hood Forest Plan released. Northern spotted owl listed as a Threatened species.
- 1990 Western spruce Budworm outbreak rebuilds on Mt. Defiance.
- 1991 Primary power source for Mt. Defiance electronic site switched from diesel generators to buried electric powerline. Propane generator retained as backup power source.
- 1994 Northwest Forest Plan released, amending all Forest Plans within the range of the northern spotted owl.

Splash dams (1920 - 1940s) used to drive the logs down to a mill site caused many significant impacts on the stream systems. In many cases, the dams were constructed upstream of the logging operation to create a pond of water. The dam was then dynamited and the resulting flood picked up the logs along the stream and carried them down. In order for the splash dams to work, all unwanted logs and log jams were removed from the streams. The combination of log removal and high flows created several changes to the streams such as:

- loss of edge wood and log jams,
- channel straightening and increases in gradient and water velocity,
- loss of spawning gravels, pools, and prime holding water for young fish, and
- floodplain abandonment through downcutting.

The effects were first seen on West Fork Hood River below Ladd Creek and on Green Point Creek. Suitable fish spawning and rearing habitat declined dramatically with resulting declines in fish stocks.

By 1937, Oregon Lumber Company began to experiment with tractor logging. They gained permission to try tractor logging on National Forest System Lands using the selling point of selective harvesting. Equipment limitations associated with railroad logging required clearcutting. Evaluations of the effects of tractor logging in West Fork found just as much damage to the residual stand as railroad logging caused. The damage levels essentially resulted in clearcuts where selective harvesting was the goal.

The original sale contract required leaving seed trees to provide for reforestation. The placement and number of seed trees varied throughout the sale. Essentially, most of the reforestation came from uncut timber along the edges of each unit. Timing of individual unit harvesting allowed for excellent and rapid natural regeneration throughout the sale area.

In addition to harvesting purchased timber, Oregon Lumber Company traded land for cutting rights. These land trades eventually allowed the federal government to acquire much land around Lost Lake and to consolidate ownership patterns within the Forest boundaries.

All landowners primarily used clearcut harvest methods with some shelterwoods and commercial thinnings. In general, trees left along streams were minimal. The Forest Service did not leave any trees along intermittent streams. In the past, the forest was harvested closer to the streams than today.

Steep slopes render much of West Fork watershed unsuitable for ground based logging systems. Exceptions to this general condition include Mt. Defiance, Blowdown Ridge, and the broader floodplains of Lake Branch and West Fork Hood River. Even on National Forest System Lands partial suspension of the logs is preferred due to problems in obtaining the necessary deflection for full suspension and the costs.

The Christmas Flood of 1964 was one of the biggest events to strike the Hood River basin in recent history. The winter had been generally cold and dry up to mid-December. The ground was well frozen. Temperatures in Hood River dropped to 4°F the evening of December 18. Blizzard conditions prevailed in the Columbia River Gorge. By December 21, over 30 inches of snow had accumulated in Hood River when Chinook winds began. Temperatures rose well above freezing and heavy rain began. In less than 24 hours over 4 1/2 inches of rain fell on over 2 1/2 feet of snow on frozen ground in Hood River. Conditions were similar throughout the Hood River basin. Along with the road and trail damage the floods caused heavy damage to the fish hatchery at Dee and many irrigation diversions and ditches.

The combined effects of trapping, splash damming, railroad logging, and stream clean-out resulted in the near total loss of beaver in the West Fork watershed. Several species sensitive to the amount of human activities were extirpated from the watershed. Timber harvest created favorable conditions for deer and elk, increasing the presence of these species in the watershed but disfavored species dependent on older forests, such as northern spotted owls.

Several factors have contributed to altering the aquatic environment to the detriment of all fish stocks in the West Fork Hood River. There was extensive use of fish wheels and horse seines in the Columbia River from 1905 to 1920 that was a major factor in the overall decline of fish runs, including those from the Hood River. The widespread use of aquatic habitat and water for log transport, splash damming, and irrigation (without fish screens) in the Hood River likely killed fish outright, and disrupted recruitment for many years (1915 to 1950s). Screening was attempted sometime in the 1950s, but often the screens became inoperative during high flows or were plugged with slime and debris. These activities, along with the trapping of beaver, railroad logging, stream clean-out, and the 1961 mudflow in Ladd Creek have combined to significantly reduce fish runs in the West Fork.

Fish stocking began as early as 1930s in all lakes and several streams of the West Fork system. West Fork was not a "key" trout stream for stream stocking. Most trout were stocked in lakes and consisted of mainly non-indigenous brook trout, with the remainder consisting of brown and rainbow trout. Most lakes, with the exception of Lost Lake, were likely naturally fishless before these introductions. Anadromous fish were stocked in mainstem West Fork and Lake Branch beginning in 1961, consisting mainly of summer steelhead (1961 to present) and spring chinook (1984 to present). The indigenous stock of spring chinook likely became extinct in the mid 1960s, as numbers over Powerdale Dam declined from zero to two fish per year from 1965 to 1971. Hatchery-raised sockeye salmon and coho salmon were introduced to Lost Lake for a few years in the 1950s but that stocking has not been continued. A small number of coho and sockeye were counted over Punchbowl Falls trap in 1963, and may have been remnants of fish stocked earlier. Species stocked and timing of stocking are depicted in Table 2 in the fisheries report in the appendix.

Current Conditions (Present)

Vegetation

The current vegetation differs from the typical pre-1900 vegetation primarily in terms of landscape patterns (Figure 4.5). Before 1900, large continuous areas were dominated by one or two stand types. Currently, the landscape pattern more resembles a patchwork quilt. The proportions of the different stand types varies by subwatershed. The following discussion focuses on stand types within the Forest boundary.

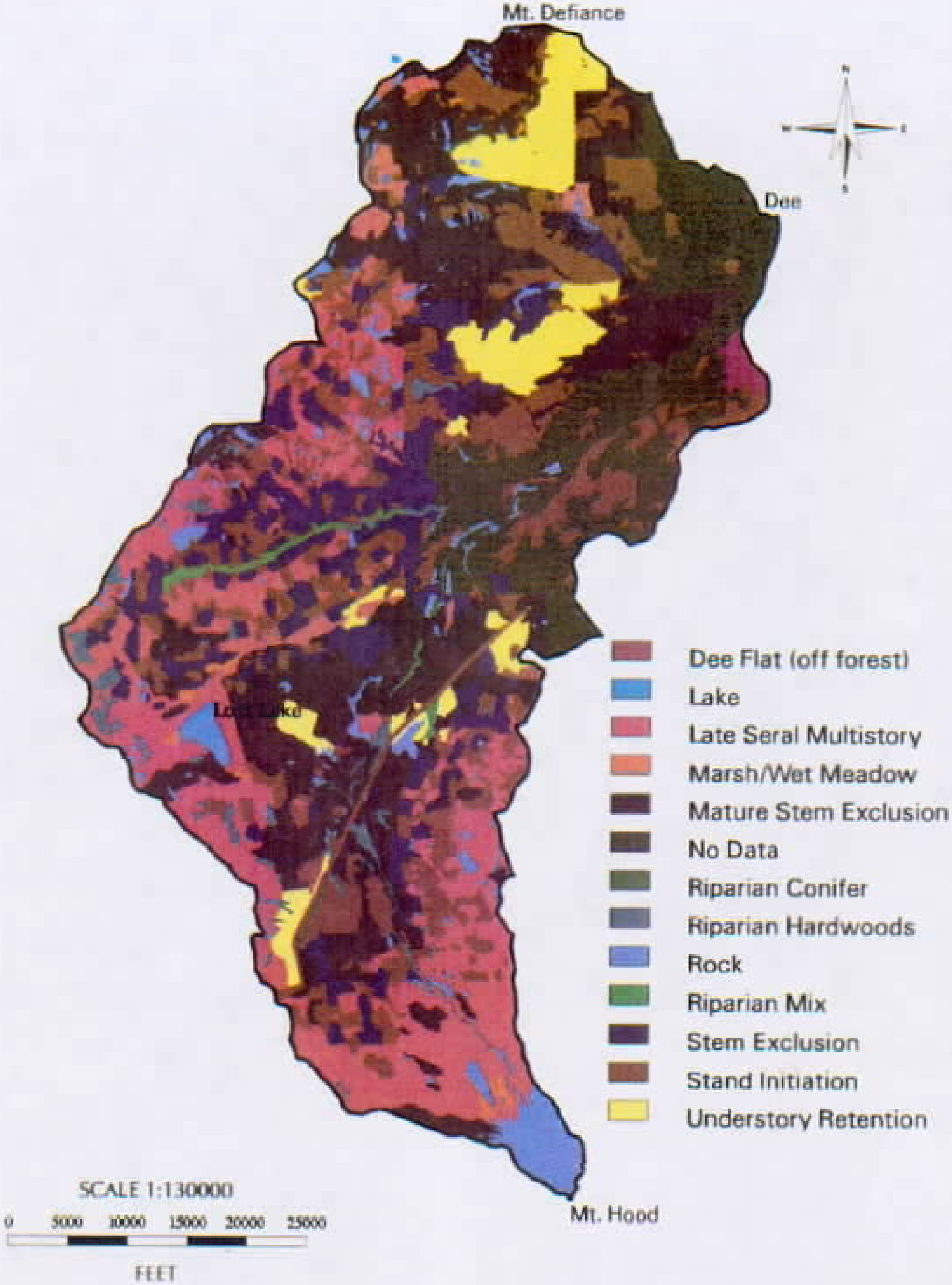

Figure 4.5. West fork of Hood River watershed vegetation pattern (present)

West Fork subwatershed contains about equal proportions of Late Seral Multistory, Mature Stem Exclusion, Stem Exclusion, and Stand Initiation structural stages on the uplands (Table 4.5). The Understory Reinitiation stage is virtually absent. The Riparian Hardwood type dominates the riparian areas, with very little Riparian Conifer type stands. The Riparian Mix stands occur most often in association with wetlands on National Forest System Lands. Riparian stands are underrepresented in Table 4.5 due to the difficulty in mapping such narrow stands. The portion of the watershed where we lack information on the exact structure types mostly falls within the Stand Initiation, Stem Exclusion, and Understory Reinitiation stages

Lake Branch subwatershed is dominated by the Late Seral Multistory and Stem Exclusion stages. These structure types are present in about equal proportions, although the Late Seral Multistory type is concentrated around Lost Lake and Wacoma Ridge while the Stem Exclusion type occurs along Lake Branch and its tributaries. The Stand Initiation structure type is the next most common on National Forest System Lands. As with West Fork subwatershed, the Understory Reinitiation stage is virtually absent. Along Lake Branch, the Riparian Mix stand type dominates, but many stands are showing signs of poor health due to extreme age. Root disease has begun to increase in the oldest stands. The Riparian Mix type is also restricted to a narrower band than was probably typical before 1900. Recently harvested riparian areas and areas of frequent disturbance, such as avalanche chutes are dominated by the Riparian Hardwood stand type. The amount of Riparian Conifer stands in Lake Branch subwatershed is not known.

Green Point subwatershed consists primarily of the Mature Stem Exclusion stand type on National Forest System Lands. Much of this subwatershed burned in the late 1920s. Areas of the longest spruce Budworm activity have moved back into the Understory Reinitiation stage. Early Seral is the next most common stand type with little Stem Exclusion and almost no Late Seral Multistory present. We do not know the relative proportions of the riparian stand types.

The younger stand types dominate on the other ownerships. These lands are mostly managed strictly as industrial forest. Land productivity allows stands to move into the Mature Stem Exclusion stage within 60 years in West Fork and Lake Branch subwatersheds and within 80 years in Green Point subwatershed. About the time a stand enters the Mature Stem Exclusion stage is when it is considered economically mature. We do not know the relative proportions of the various stand types on the other ownerships since we were not able to type and map all stands within the watershed. In general. the largest concentration of the Understory Reintiation stage occurs on Blowdown Ridge. Most of the remaining other ownerships lies in either the Stem Exclusion or Mature Stem Exclusion stages. The Late Seral Multistory stage is absent from non-National Forest System Lands.

Table 4.4 Stand type descriptions.

Stand Type	Description	Seral Stage
Stand Initiation	Young, single cohort stands whose canopy has not yet closed; seedlings and small saplings; remnants of previous stand may be present	Early
Stem Exclusion	Relatively young, single cohort stands whose canopy has closed and thinning has begun; saplings and poles; remnants of previous stand may be present	Early to Mid
Understory Reinitiation	"Middle-aged", medium sized trees with variable canopy closure; second cohort of young trees present in the understory; scattered mortality in all size classes; remnants of previous stand may still be visible	Mid
Mature Stem Exclusion	"Middle-aged", medium sized to large trees with closed canopy; crowns of second cohort intermingled with crowns of first cohort such that a second canopy layer is not readily distinguished; scattered mortality; some small clumps of snags may be present	Mid to Late
Late Seral Multistory	Main canopy dominated by older, large trees; canopy closure variable; 2-3 canopy layers distinguishable; mortality both scattered and clumped and in higher proportion of stand than other seral stages	Late
Riparian Hardwood	Riparian stand dominated by hardwoods such as alder, willow, maple, cottonwood, and so forth; hardwoods may be tree form or brush form, depending on elevation; conifers may be present but do not comprise more than 50% of the canopy closure	Early
Riparian Conifer	Riparian stand dominated by conifers, hardwood species limited to scattered individuals or small clumps in the understory and mostly of brush form	Mid
Riparian Mix	Riparian stand dominated by large somewhat scattered conifers in the overstory and hardwood trees in the understory, hardwood species mostly various maples	Late

Table 4.5. Current stand structure percentages in West Fork watershed.

Classification	Acres	Percent
Stand Initiation	12,634	19%
Stem Exclusion	7,317	11%
Understory Reinitiation	4,109	6%
Mature Stem Exclusion	14,964	23%
Late Seral Multistory	12,619	19%
Riparian Hardwood	1,176	2%
Riparian Mix	398	0.6%
Riparian Conifer	47	0%
Marsh/Wet Meadow	193	0.3%
Lakes	286	0.4%
Rock	2,839	4%
Dee Flat	274	0.4%
No Data (Private Lands)	8,620	13%

Dee Flat is a special case. This area has been converted from conifer forest to commercial orchards. Pears and apples are the dominant crops. The Forest Service has a 16 acre seed orchard on Dee Flat. Ten acres are used to grow westside Douglas fir from two seed zones (1,000-2,000 foot band and 2,000-3,000 foot band) and cottonwood for riparian planting. Six acres are fallow. The District has been considering using those six acres to grow larch, which will be addressed in the Forest genetic reserve plan.

Fish and Wildlife

Pond and Painted turtles, wolves, grizzly bears, bald eagles, and peregrine falcons have been extirpated from the watershed. If present before 1900, mountain goats and California condor are also gone. Habitat for species dependent on late successional forest has become restricted to Wacoma Ridge, Lost Lake area, and Mt. Hood Wilderness with a few scattered patches available on Sawtooth Mountain and elsewhere in Lake Branch subwatershed. Late successional forest has disappeared from other ownerships in the watershed with little or no probability of replacement. Habitat for species dependent on early successional conditions has increased considerably. The BPA powerline corridor is maintained as a more-or-less permanent early successional brush field.

Snags within early to mid-seral forests are relatively rare in the watershed. Most stands in the Stand Initiation and Stem Exclusion stages have few or no snags. Several stands in the Mature Stem Exclusion stage on Lost Lake Butte and Mt. Defiance also lack snags. Since most of these stands originated from large fires in the late 1800s and early 1900s, this condition may be part of the normal "gap" in snag creation and presence in the successional pathway; or the deficiency may be the result of early salvage of dead trees immediately after the fires.

Large downed wood distribution is also spotty. Units harvested on National Forest System Lands through the mid-1980s and virtually all the other ownerships lack large downed wood in the replacement stands. At the time most of these stands were initially harvested, all downed wood was considered a fire hazard and impediment to tree planting. Every effort was made to eliminate this material. The changes in forest stand conditions have created serious dispersal problems for certain guilds of species dependent upon down logs for some of their life requisites.

Logging and stream clean-out have created stream channels with considerably less variation in water velocities and substrate. Many areas lack the small gravels needed for both anadromous and resident fish spawning. The number and size of pools is less. Cover depends more on overhanging vegetation than substrates and logs. Parts of Lake Branch, McGee, Elk, Jones, West Fork, and Green Point have downcut to form bedrock channels and are subsequently no longer connected with their historic floodplains. As a result, flood velocities have increased, reducing habitat during higher stream flows.

In addition, sediment delivery to the streams has increased. The main causes are roads and increases in mass wasting events. West Fork watershed is prone to mass wasting naturally, due to its combination of slopes, soils, and precipitation. Since about 1958, some 205 mass wasting events have occurred in West Fork watershed of which 159 are in association with roads, clearcuts, or both. The end result is a great reduction in fish production capability.

Current fish species thought to be in the West Fork are rainbow trout (redband in North Fork Green Point tributary), sculpins, summer steelhead, winter steelhead, spring chinook, brook trout, brown trout, and kokanee (at Lost Lake). Non indigenous species include brook trout, brown trout, and kokanee. Species, by tributary, are listed in Table 1 of the fisheries report in the appendix. The current spring chinook stock are a mixture of both Carson and Deschutes stock fish that were introduced in the West Fork from 1984 to present, to reestablish a spring chinook run within the West Fork. Summer and winter steelhead are a mixture of hatchery and wild fish. In the case of summer steelhead in current years, hatchery returns are much higher than wild fish.

ODFW and CTWS reports rate wild stocks in the Hood River as "depressed" in number. A 1991 American Fisheries Society report evaluating Pacific Coast anadromous fish stocks by Nehlsen et al. rates Hood River's wild stocks of spring chinook, fall chinook, winter steelhead, coho, and sea-run cutthroat at "high risk of extinction", and summer steelhead at "moderate risk of extinction".

The nature of the current threat to these stocks, according to the report, are: spring chinook (1,4), fall chinook (1,4), coho salmon (1,2), winter steelhead (1,2,4), summer steelhead (1,4), sea-run cutthroat (1,2) where:

(1) Represents present destruction, modification, or curtailment of its habitat or range (Habitat damage, mainstem passage and flow problems, and predation during reservoir passage).

(2) Represents over utilization for commercial, recreational, scientific, or educational purposes (includes over harvest in mixed-stock fisheries).

(4) Represents other natural or man-made factors affecting continued existence (hybridization, introduction of exotic or translocated species, predation not associated with mainstem passage, competition, including negative interactions with hatchery fish, such as hybridization, competition, and disease, and poor ocean survival).

Disturbance Processes

In addition to the disturbance processes present before 1900, we have added many new ones. We have also added features that change some disturbance processes. The changes on the landscape include:

- timber harvest and salvage,
- roads,
- water diversions and conveyances,
- ditch failures, and
- recreation.

We altered the frequency, intensity, or severity of some processes. Harvesting and roading have increased the frequency of smaller debris torrents and increased the impacts of the torrents. Timber harvesting has increased the frequency of landscape level disturbance on the uplands and may have increased the frequency or severity of blowdown. Insect and disease activity may have been increased beyond the typical range of such events in Green Point subwatershed. Roads and, to some extent, recreational activities concentrated near water, have increased sediment delivery to streams.

The combination of harvest levels and planned rotations have affected the fuel complex, potential fire effects, and potential successional pathways following large fires in West Fork and Lake Branch subwatersheds. The planned rotations on C1 lands and on private lands are considerably shorter than what as typical before 1900. Fuel treatment methods and timing have different impacts on the landscape, particularly ecosystem functioning below the ground surface, than a summer or fall wildfire. Law requires that the Forest Service assure adequate conifer regeneration within five years of the regeneration cut, possibly shortening the period of time the affected area spends in the brush stage. Longview Fiber and Hood River County use herbicides to control brush and accelerate conifer regeneration. We have little understanding what role the various species of brush may play in soil functioning and nutrient cycling, so we do not know the impacts of accelerating conifer regeneration.

Large areas of West Fork subwatershed, and to a lesser extent Lake Branch subwatershed, experienced a spruce Budworm outbreak in 1986 and 1987. The outbreak declined dramatically in 1988 after spraying with Bt and has not reappeared. Interestingly, no outbreak occurred in connection with the severe drought in 1992. We have no evidence of significant bark beetle activity since 1980 in West Fork and Lake Branch subwatersheds.

A major spruce Budworm outbreak began in 1983 and continues in 1995 in Green Point subwatershed. The outbreak did lessen for two years after spraying in 1988 and then began expanding again. Currently, the outbreak affects nearly every stand north of Ottertail Lake and Long Branch Creek. Tree mortality is increasing rapidly on National Forest System Lands. Other tree pests, such as bark beetles and root disease, are increasing. This outbreak appears to be drought-related. Green Point subwatershed experiences more drought and is more susceptible to decreases in annual precipitation than West Fork and Lake Branch.

The last major mudflow in Ladd Creek occurred in the early 1960s. New slides have been noted in Ladd Creek within the Mt. Hood Wilderness, suggesting the possibility of another mudflow event in the near future.

Water diversions have reduced in-stream water in Green Point subwatershed and in West Fork subwatershed downstream of these diversions. Farmers Irrigation District holds water rights on all the creeks and several springs. The diversions on all but Rainy Creek are screened against fish passage. Farmers Irrigation District monitors stream temperature on Green Point Creek and stream flow on all diverted streams within Green Point subwatershed.

Farmers Irrigation District maintains four conveyance canals within Green Point subwatershed: Rainy Creek Canal, Stanley Smith Pipeline, Highline Canal, and Lowline Canal. Water can be diverted from any canal at a higher elevation to one at a lower elevation. Rainy Creek Canal is partially piped, but mostly an unlined, open canal between Rainy Creek and the headwaters of Gate Creek. Stanley Smith Pipeline was built in 1989 to replace an open, unlined canal originally constructed about 1889. This pipeline diverts water from Gate and Cabin creeks to Upper Green Point Reservoir just outside West Fork watershed. Highline Canal is partially piped and partially open, unlined canal. The canal was originally constructed about 1890 to carry 13.9 cfs. Originally Highline Canal diverted water from Dead Point Creek within West Fork watershed, but now Lowline Canal carries the water from Dead Point. Lowline Canal is a partially piped and partially open, unlined canal that diverts water from South Fork Green Point, Green Point, and Dead Point creeks within the West Fork watershed. The canal was originally constructed in 1905 to carry 26.4 cfs.

The city of Hood River uses Cold Springs and Stone Springs, just east of the Forest boundary on West Fork Hood River, as their primary water source. Water is piped from the springs to holding reservoirs north of the watershed. When the reservoirs are full, excess water is spilled back into the Hood River system. Currently, the city is using only about half the allocated water right at Cold Springs. The city holds additional water rights on Laurel Creek and several springs that they have not developed.

A third irrigation diversion pulls water directly from West Fork Hood River near the Camp Creek confluence. This water is conveyed through an open, unlined ditch to Dee. Leakage from this ditch is significant.

Roads not only increase the amount of sediment reaching the streams, they extend the drainage network due to the drainage ditches. Road surfaces and maintenance levels are intended to remove water quickly. The higher the number of road miles, the higher the potential for increased sediment sources.. Native surface roads are much more prone to erosion than gravel or paved roads. Culverts and bridges must be provided to cross streams if fords are not used. We only know of one ford in use across West Fork Hood River under the BPA powerlines. Some bridges, such as the Road 18 bridge across Ladd Creek, were not built to the original specifications. Culverts may present migration barriers to fish and other aquatic species and may not be large enough to handle floods beyond a certain size.

Social Uses

The lands within West Fork watershed provide a variety of consumptive and non-consumptive uses (Table 4.6). The National Forest System Lands are intended to provide a mix of uses. Longview-Fibre and Hood River County lands emphasize commercial timber over other uses. The City of Hood River owns about 30 acres at their primary water source in order to protect the source and site the equipment needed to collect the water.

Mt. Defiance is a major electronic site for both public and private entities. In 1985, the District issued an Environmental Analysis that transferred management of the private sector communications equipment to one permitee--Western Telecommunications, Inc.. This permitee is the site manager and responsible for assuring that the other users comply with the rules and regulations governing use of the site. In 1992, the District issued a Categorical Exclusion awarding a 10 year permit to Western Telecommunications to continue as site manager. Current users at Mt. Defiance include:

Mt. Hood National Forest
Washington Department of Natural Resources
Skamania County
US Army Corps of Engineers
United Telephone Company
Motorola Communications
KWSU Radio-Television Services
KOIN-TV
Fisher Broadcasting (KATU-TV)
KPDX-TV
Association of Oregon Loggers
Interstate Wood Products
Western Telecommunications

Cellular One has expressed an interest in using Mt. Defiance, also. Together, these entities provide television, telephone, broadcast radio, and two-way radio services through the Columbia River Gorge. Current facilities consist of buildings to hold the electronic equipment, a propane-powered backup electricity generator, a 150 foot tower and a 50 foot tower. Primary power to the site is provided by a buried electric cable.

Recreation use occurs year-round but is concentrated in the summer. Winter recreation is growing, but still relatively minor. Lost Lake is a unique area in high demand for many different recreation uses. West Fork contains six developed campgrounds, and numerous dispersed sites. Wahtum Lake Campground straddles the boundary between West Fork watershed and Columbia Tribs West watershed. We are including Wahtum Lake Campground in the West Fork Watershed Analysis. There are five lakes in the watershed large enough to have names, of which Lost Lake is the largest natural lake on the Forest. Most trails provide for hikers or hikers and horseback riders. Two mountain bike "trails" have been designated; one on a abandoned road and one on the Road 13 loop. There are no designated routes for off road vehicles, snowmobiles, or cross country skiers.

Table 4.6. Current uses of West Fork Watershed.

Consumptive Uses	Non-Consumptive Uses
Commercial timber	Camping (tent, RV, etc.)
Firewood	Picnicking
Boughs	Fishing (catch / release)
Huckleberries	Hiking
Mushrooms	Horseback riding and packing
Decorative plant collection (i.e. beargrass)	Driving for pleasure
Medicinal plant collection (i.e. valerian)	Mountain biking
Gravel and rock	Snowmobiling
Irrigation and domestic water	Cross country skiing
Fishing	Sightseeing
Hunting	Photography and filming
	Mountain climbing

The Forest has been divided into a variety of Recreational Opportunity Spectrum (ROS) Classes based on land allocations in the Mt. Hood Forest Plan. In many cases we have difficulty in understanding what ROS Class we are supposed to meet in a given area since no maps were prepared during the Forest planning process and some allocations permit multiple ROS Classes, depending on location in the Forest. Figure 4.6 displays the Forest Plan ROS Class and the actual ROS class.

Wilderness has its own set of designations, called the Wilderness Resource Spectrum (WRS). These designations essentially represent further refinements of the ROS Classes of Primitive and Semi-Primitive. Only two portions of the actual spectrum are assigned to the Mt. Hood and Columbia wildernesses: Primitive Trailed and Semi-Primitive Trailed. The designation "Transition" does not refer to an actual Class. Instead it means that the area does not meet any of the WRS designations. For the most part, areas designated as Transition suffer from a lack of solitude as evidenced by more encounters than allowed by standards, intervisible and interaudible campsites, and excessive compaction and vegetation loss at campsites.

The non-National Forest System Lands do not have ROS Classes assigned to them. Their current condition meets an ROS Class of Roaded Modified, bordering on Rural. Approximately 43% of the National Forest System Lands meets the Roaded Modified category.

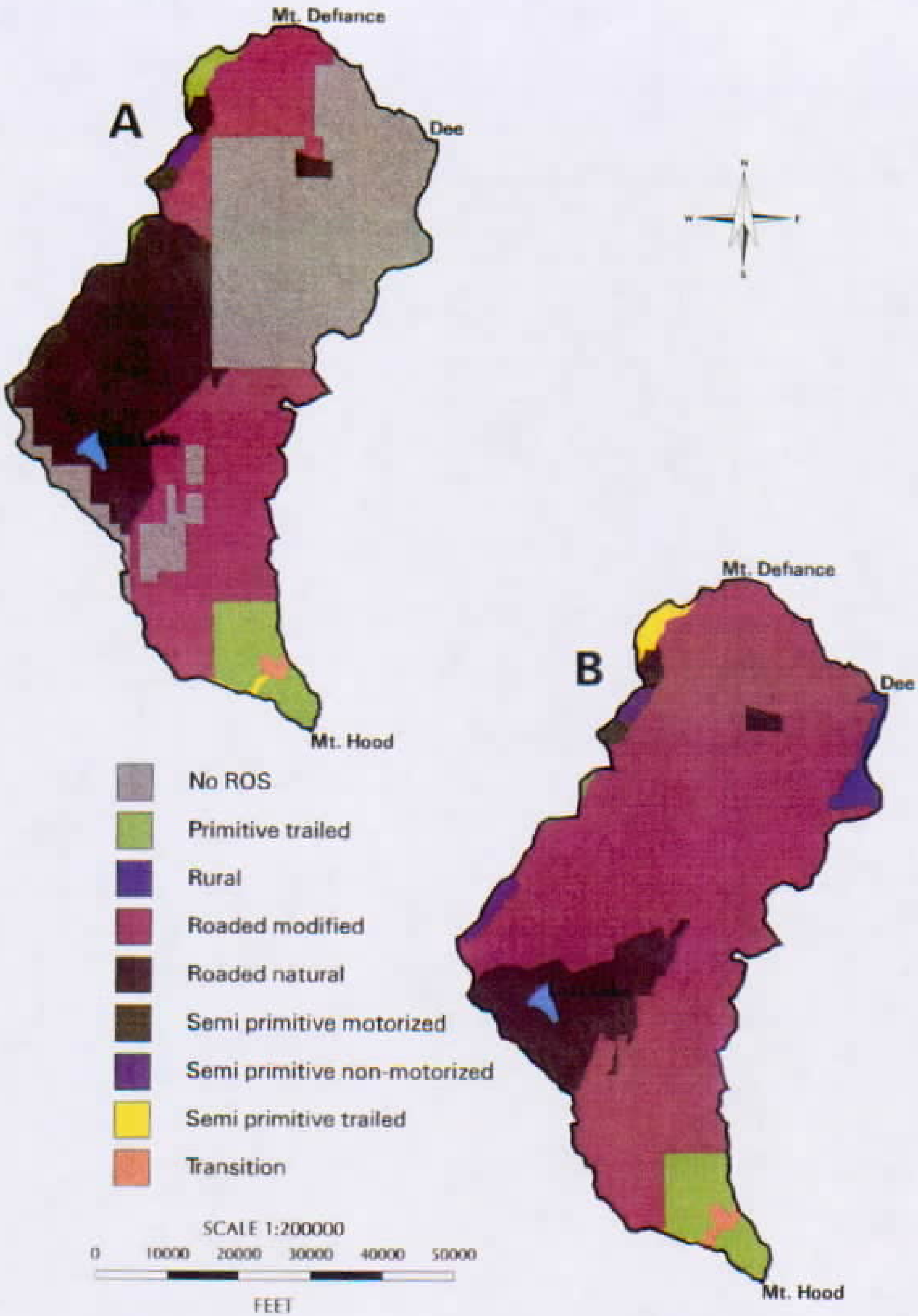

Figure 4.6. Mt. Hood Forest Plan Recreational Opportunity Spectrum (ROS) Classes (A) and existing conditions (B).

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Land management practices are also expected to result in a certain level of scenic quality, known as Visual Quality Objectives (VQOs). Table 4.7 compares VQOs with terms that describe actual scenic condition. The viewshed from Lost Lake and Road 13 influence part of the watershed. Much of the southern portion of the watershed can be seen from places like Cloud Cap Inn and Timberline Trail. The PCT runs up much of the watershed's western boundary.

Table 4.7. Comparison between VQOs and existing condition terms.

VQOs	Existing Condition
Maximum Modification[1]	Heavily Altered
Modification	Moderately Altered
Partial Retention	Slightly Altered
Retention	Natural Appearing
Preservation	Natural Appearing
[1] Not an actual VQO in the Mt. Hood Forest Plan	

We evaluated existing scenic condition using aerial photographs, some guidelines provided by a landscape architect, and professional opinion (Figure 4.7). The non-National Forest System Lands do not have scenic resource management objectives (approximately 35% of the landscape), but falls within the Heavily Altered category. Approximately 34% of the National Forest System Lands also falls in the Heavily Altered category, including almost all the C1 land allocation, which means these lands do not meet Visual Quality objectives. Meeting VQOs around the BPA powerline category may not be possible due to the overwhelming influence this corridor has on scenic quality along Roads 18, 1810, and other viewpoints in its vicinity. Very few areas exceed the assigned VQO. Relatively few areas meet the assigned VQO, largest such area lies around Lost Lake, Lost Lake Butte, and West Fork KSR.

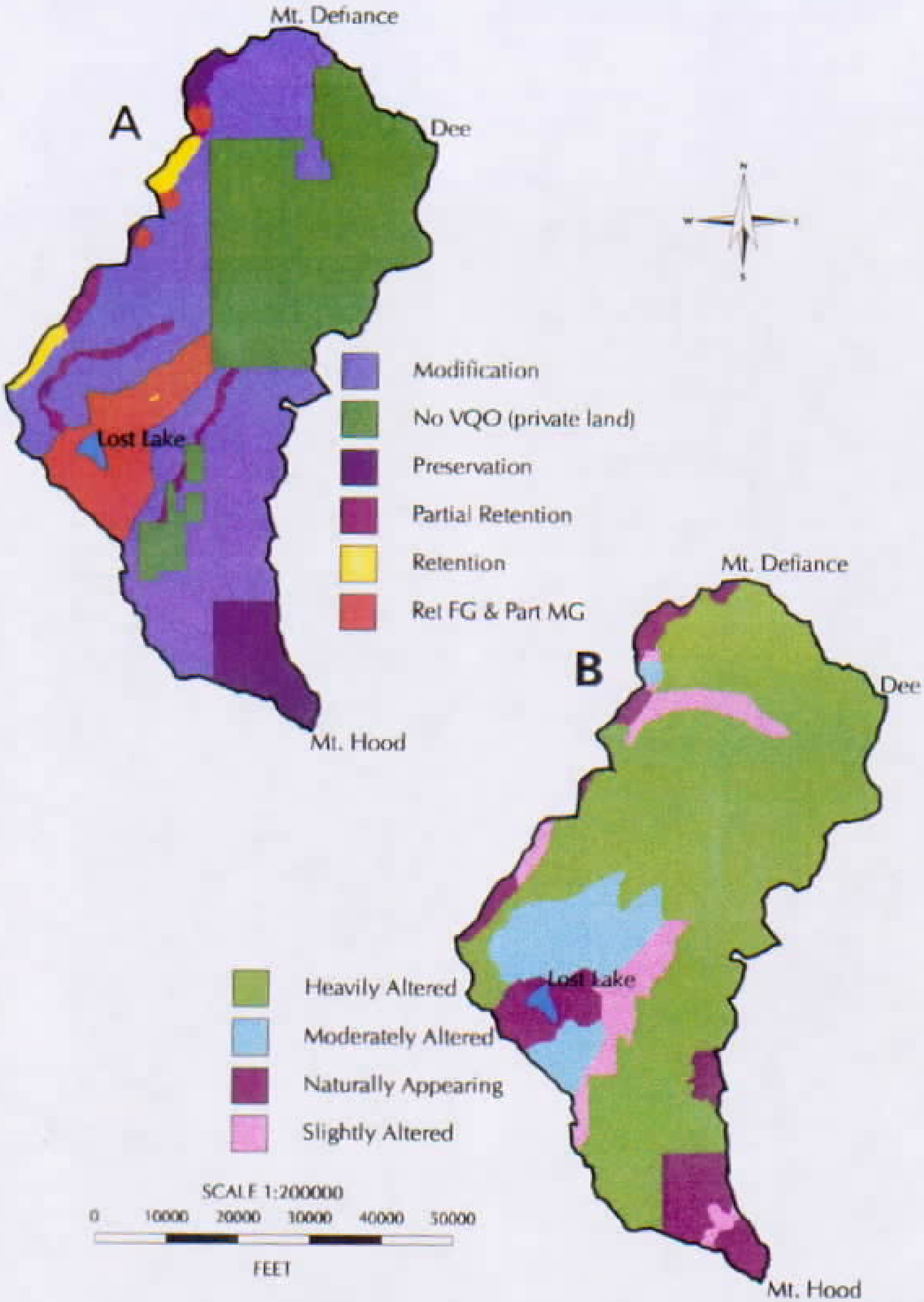


Figure 4.7. Mt. Hood Forest Plan VQOs (A) and existing scenic conditions (B).

Note: RET:FG,PRET:MG,BG = Retention-Foreground; Partial Retention-Middleground, Background

Critical Trends

Vegetation

- Forest health continues to decline on Mt. Defiance. Spruce Budworm population levels decreased in 1995 but Douglas-fir bark beetle populations increased.
- Conifer growth rates in Lake Branch subwatershed are sufficient to allow relatively rapid recovery from hydrologic, scenic quality, and recreational setting viewpoints. Recreational setting on National Forest System Lands should recover from Roaded Modified to Roaded Natural within 10-20 years. Scenic quality on National Forest System Lands should recover from Heavily Modified to Moderately Modified within 20-30 years.
- Many plantations in Lake Branch subwatershed are reaching age and size conditions that indicates a need for thinning to maintain growth. Older plantations in West Fork subwatershed are starting to reach the same conditions.
- The cumulative level of harvesting in the West Fork watershed has moved the watershed to a hydrologic recovery category of Concern.
- Late successional forest covers only 19% of the watershed and is limited in distribution primarily to the edges of the National Forest System Lands (Wacoma Ridge, Mt. Hood Wilderness, and Red Hill/Blue Ridge). No significant amount of late successional forest is known on other ownerships.

Wildlife and Fish

- The District has successfully pursued partnerships and agreements with other agencies and landowners in the watershed to improve fish habitat in West Fork Hood River. One agreement with Longview Fibre allowed the Forest Service to place over 500 logs and boulders in West Fork Hood River and McGee Creek on Longview Fibre lands. The most recent project used a Chinook helicopter to move full length trees complete with root wads from a blowdown area on Sawtooth Ridge to West Fork Hood River about four miles above Dry Run Bridge. Partners included US Fish and Wildlife Service, ODFW, and the Forest Service.
- A large supplementation program by ODFW and CTWS, funded by BPA, are currently attempting to augment runs of summer steelhead, winter steelhead, and spring chinook within the Hood River basin. Beginning in 1990, returning wild steelhead were held to be used as broodstock for this project. Spring chinook stock will consist of Deschutes stock fish raised within the Pelton Ladder and acclimated at smolt stage within the Hood River. Run size goals for the various fish runs are in Table 4 of the fisheries report in the appendix. The degree of intermixing of hatchery and indigenous stocks of steelhead are not known, though genetic samples have been taken for testing. Currently results are not back from this study. The degree of interactions between hatchery and native fish are also continuing to be studied, being an area of concern.
- Farmers Irrigation District (FID) has undertaken fish habitat improvement projects in Green Point subwatershed, such as placement of logs and boulders and removal of fish passage barriers. In spring 1994, FID used a helicopter to place over 250 logs at 14 sites in the lower two miles of Green Point Creek. The irrigation district is also planting a variety of conifers, hardwoods, brush, and forbs at four eroding sites. These projects were funded by a grant from the Governor's Watershed Enhancement Board and planned with the assistance of Forest Service personnel.

- Farmers Irrigation District has developed a water conservation plan designed to make more efficient use of existing water rights rather than pursuing acquisition of additional water rights. Some specific conservation and restoration methods include:
    A. Replace existing fish screens on Green Point, North Fork Green Point, Gate, and Cabin creeks with lower cost, more efficient "overshot" screens.
    B. Collect and analyze baseline flow data for impacted stream reaches.
    C. Continue watershed restoration efforts including riparian planting, uplands planting, and woody debris restoration.
    D. Continue monitoring results of completed watershed restoration work in Green Point Creek.
    E. Complete headgate control, gauges, and remote telemetry systems to make more efficient use of available water and monitor flow.
    F. Pipe Farmers, Highline and Lowline canals to reduce leakage and blowouts.
    G. Determine summer in-stream flow restoration requirements and take appropriate actions to increase summer in-stream flows.
    H. Create incentive rate programs to reduce water use.
    I. Continue agency cooperation and interaction.
- The Forest recently signed a Memorandum of Understanding with Longview Fibre that allowed the FS to place logs into West Fork Hood River within the Longview Fibre lands and Longview Fibre agreed to a 100 foot RMA along that portion of the river where the habitat improvement work occurred.
- The combination of ownership pattern and owner objectives creates a major dispersal barrier for wildlife species with medium to small home ranges and that need late and mid-successional forest.
- Overall, aquatic habitat conditions are improving on National Forest System Lands and riparian habitat conditions have ceased declining and should start improving soon. Upland habitat conditions for species dependent on old, closed canopy forest have stabilized, but are not expected to begin functioning soon for late successional dependent species.

Disturbance Processes

- Management activities appears to have increased the rate of mass wasting above natural levels. Recovery back towards typical background levels may take as long as 40-50 years regardless of whether action is taken or not.
- As funds allow, high risk erosion roads have been closed on National Forest System Lands throughout the watershed.
- Fire exclusion appears to have affected the fire regime on Mt. Defiance.
- Lack of adequate federal road maintenance funding has reduced the capacity of the road system's drainage network to handle typical peakflow events. Many ditches and cross-drain culverts are now partially plugged.
- Water temperatures in West Fork Hood River have been declining since the 1960s, indicating recovery from the railroad logging in the 1920s and 30s. No trend in temperature data has been detected from the recent logging on the Longview Fibre inholding.
- Water temperatures in Lake Branch have been increasing since the 1960s, primarily related to high levels of logging on National Forest System Lands. We expect temperatures to begin decreasing within the National Forest boundary in the near future.

- Water temperatures in Green Point Creek have increased and stabilized, since the 1950s, primarily due to logging, water withdrawals, and wildfires. These temperatures have not returned to the 1950s temperature regimes.

Social Uses

- Recreation use of Mt. Hood Wilderness is increasing rapidly at most trailheads in West Fork watershed. Certain popular campsites, such as Cairn Basin, Eden Park, and McNeil Point, are overused and do not meet the Wilderness Resource Spectrum assigned to the locations. Conditions at these sites may not meet ACS Objectives.
- Removal of destination signing has reduced use at the smaller high elevation lakes.
- Use levels at Lost Lake Campground have moderated with reconstruction, increased fees, and management.

CHAPTER 5

Results

CHAPTER 5: RESULTS

Issue 1: Introduced plants and animals may be successfully competing against native plants and animals and continual disturbance from human activities often favors the introduced species over the native species.

A. Are noxious weeds, as identified by the Oregon State Department of Agriculture, crowding out native plants?

Yes. Table 5.1 lists the noxious weeds present or potentially present in the West Fork of Hood River watershed. Scotch broom (*Cytisus scoparius*) under the BPA powerlines appears to be crowding out native shrubs. This species has the potential to spread out from the powerline corridor up and down the road system. None of the remaining noxious weeds present within the watershed have been associated with significant declines in native forb / grass, species diversity, and /or populations. Some reductions are associated to introduced plants that are not classified as noxious and to intensive recreation use. If left unchecked, knapweeds (*Centaurea* spp.) are the most likely to begin displacing native species.

Table 5.1. Noxious weed species known or suspected to occur in West Fork watershed.

Rating	Species	Locations
A	None known to occur within watershed	None
B	scotch broom -- Cytisus scoparius	Big Eddy powerlines, roadsides
	spotted knapweed -- *Centaurea maculosa*	Roadsides, landings, recently disturbed areas
	Canada thistle -- Cirisium arvense	Wilderness horse trails
	diffuse knapweed -- Centaurea diffusa	Roadsides, landings, recently disturbed areas
	yellow toadflax -- Linaria vulgaris	Only one site documented in watershed
	St. Johnswort -- Hypericum perforatum	Roadsides, landings, recently disturbed areas
	houndstongue -- Cynoglossum officinale	Documented east of watershed
T	tansy ragwort -- Senecio jacobea	Roadsides, landings, recently disturbed areas

B. Are other non-native plant species crowding out or reducing native plants? Are these species spreading? Will problems develop in other areas if no control actions are taken?

Yes. Most introduced plants are primarily associated with erosion control and wildlife forage enhancement projects. Fast growing, deep rooted species palatable to wildlife, such as orchard grass (*Dactylis glomerata*), timothy (*Phleum pratense*), birdsfoot trefoil (*Lotus corniculatus*), and smooth brome (*Bromus inermis*) tend to persist in the environment. These species have spread beyond the area they were planted and occupied habitat that native plants might otherwise use. In general, however, the problem is considered minor in West Fork watershed.

The Northwest Forest Plan emphasizes native species over non-native, particularly in LSRs and Riparian Reserves. The Forest Service also recently changed its policy to emphasize the use of native plants over non-natives in various projects, such as erosion control and wildlife forage enhancement. The eastside districts of the Mt. Hood National Forest have started a native plant propagation program, but it currently suffers from inadequate funding. Since the program is very new, the amount of available material (seeds, starts, and cuttings) is still relatively small and inadequate for the amount needed.

C. Are additional control actions needed to control existing or potential problems with noxious weeds and invasive non-native plants?

Yes. The Oregon State Noxious Weed Policy and Classification System (1995) lists three different ratings for noxious weeds (Table 5.1):

1. "A" designated weed -- a weed of known economic importance which occurs in the state in small enough infestations to make eradication / containment possible; or is not known to occur, but its presence in neighboring states make future occurrence in Oregon seem imminent.

   Recommended Action: Infestations are subject to intensive control when and where found.

2. "B" designated weed -- a weed of economic importance which is regionally abundant, but which ma have limited distribution in some counties. Where implementation of a fully-integrated statewide management plan is infeasible, biological control shall be the main control approach.

   Recommended Action: Limited to intensive control at the state or county level as determined on a case-by-case basis.

3. "T" designated weed -- a priority noxious weed designated by the State Weed Board as a target weed species on which the Department will implement a statewide management plan.

Knapweeds need a more aggressive approach to control than is presently used. Knapweeds are the most widespread noxious weeds, found along virtually every road in the watershed. Population levels of these species are high enough that chemical control for 3-5 years may be needed to bring the populations down to levels amenable to other control methods. Hand pulling and mowing knapweeds after they have developed buds, is not effective. Like many composites, the knapweed bud will flower and develop viable seeds even after pulling or mowing. Roots left in the ground after hand pulling will resprout and produce a new plant.

Scotch broom under the BPA powerlines may need more aggressive control measures. The plant is so widespread that even if it is eradicated elsewhere in the watershed, the population under the powerlines will provide a "reinfection" point.

Canada thistle has entered the watershed via horse manure and contaminated hay. Horses will eat thistle buds, which will still produce viable seed in the horse's gut. The main contamination points are the Pacific Crest Trail and Wahtum Lake trailhead. West Fork of Hood River is one of the few watersheds where thistle is well established in the wilderness but is limited elsewhere.

There are two other weeds that are not found in West Fork watershed, but may become established. This first is hydrilla (species name not given), a fast growing aquatic weed that is a significant problem in the southern United States. Hydrilla is the plant most often used in aquariums. Hydrilla has also been found in several counties of California and Washington, though not yet in Oregon. Once established in a lake, river, or canal, this plant quickly takes over the area, eliminating fish spawning habitat, degrading water quality, reducing water movement, clogging intakes and fish screens, and entangling in boat motors and other aquatic recreational equipment. Hydrilla spreads from one water body to another on boats, motors, trailers, bait pails, fishing tackle, and possibly waterfowl.

The second is purple loosestrife (*Lythrum salicaria*). Purple loosestrife is established in the Hood River valley and has spread as far as Odell. The flowers are very showy, growing in dense elongate spikes up to six feet tall. The plant spreads by rhizomes and prefers moist to wet environments. It spreads rapidly in suitable environments and is difficult to eradicate.

Noxious weed detection on the National Forest is currently opportunistic within the agency rather than systematic. That is, no regular surveys of noxious weeds using FS employees occur or are planned. Instead, the Forest contracts with Oregon Department of Agriculture (ODA) for noxious weed surveys. In turn, ODA subcontracts the surveys to the local counties and, occasionally, other individuals such as members of the Native Plant Society of Oregon.

Noxious weed control is accomplished by both FS employees and contractors. In the 1970s and early 80s, tansy ragwort (*Senecio jacobea*) control included a mix of chemical spraying and manual and mechanical control efforts. Cinnabar moth (*Tyria jacobeae*) was introduced in the late 1980s to control tansy. In recent years, the only control action taken by FS employees has been hand pulling of isolated populations. The Forest contracts with Hood River County for other noxious weed control actions. The other landowners either take control actions themselves or contract with the county. Chemical and biological control methods are the most commonly used on the other landowners.

D. *Are introduced or non-native fish out-competing or displacing native species?*

Maybe. Potentially, introduced fish may be competing with native fish and other aquatic species. To answer this and following questions we used the following definitions:

* Wild fish - Naturally spawned fish belonging to an indigenous population.
* Indigenous - Species or stock descended from a population that is believed to be present in the same geographical area prior to the year 1800 or that resulted from a natural colonization from another indigenous population.
* Exotic - Fish which originate through human intervention from a different population.
* Stray - Hatchery fish spawning naturally in a location different from intended.
* Native - Indigenous fish.
* Hatchery fish - Fish incubated or reared under artificial conditions for at least a portion of its life.

<u>Stocked trout and indigenous fish / wildlife</u> All lakes within the West Fork of the Hood River subbasin have been stocked with hatchery fish, Table 5.2 displays the documented fish stocking within the West Fork drainage. Exotic fish species such as brook and brown trout have strayed downstream from stocked lakes and have naturalized in several tributaries throughout the drainage. Brook trout are now found in Lake Branch and Green Point subdrainage, but as yet, have not been detected in the West Fork subdrainage. Brown trout are now naturalized in Lake Branch. This is evidenced by observations of paired up brown trout in spawning colors and observations of fall-constructed redds in upper Lake Branch. A small number of brown trout are counted through Powerdale dam each year as they migrate into the Hood River, further suggesting that brown trout are naturalized. These fish presumably originate from strays out of Lost Lake and are returning to Lake Branch to spawn. Brook and brown trout cannot interbreed with rainbow trout, but may compete for habitat. High lakes within the West Fork, with the exception of Lost Lake, were probably naturally fishless in the past. Currently these lakes harbor no other fish species besides stocked brook trout. Studies throughout British Columbia and the western United States have noted that amphibians are the dominant predator in naturally fishless streams and lakes (Liss et al, 1995 {Northern Cascades}, Orchard, 1993 {British Columbia}, Powell, 1993 {Alberta}). Introduced fish predators effect changes in zooplankton and amphibian populations, thus altering the trophic structures.

Records from early pioneers in the late 1800's documented that Lost Lake, Lake Branch, and the mainstem West Fork had indigenous trout populations. North Fork Green Point Creek has recently been found to contain an indigenous population of redband rainbow trout (an inland subspecies of rainbow trout). Thus far, this is the only known redband population within the Hood River basin, and is a Forest Service Region 6 and State of Oregon listed sensitive species. Though most would agree there is some degree of interaction and/or competition between exotic stocks and indigenous species (Vincent 1987, Glova and field-Dodgson 1995), the extent of this interaction is complex and difficult to extrapolate from one stream system to another. Currently, native species (rainbow trout) outnumber non-indigenous species (brook and brown trout) in all streams where both occur. The current practice of stocking non-indigenous trout may be a better option to stocking native species, because of the possibility of interbreeding and altering of genetics, if the stocked and indigenous trout are of the same species. Brook and brown trout may compete with rainbow trout but cannot interbreed with these indigenous stocks. The issue of high lakes stocking is complex and objectives need to be spelled out before broad general guidelines or recommendations are made.

Stocked Anadromous Smolts and Indigenous Fish Interaction Competition between hatchery smolts and indigenous fish could potentially occur depending on the freshwater residence time of hatchery smolts. If smolts migrate out from the Hood River subbasin fairly quickly, there would likely be minor interactions with native fish. The extent of interaction between wild and residualized hatchery fish, and how it will ultimately impact indigenous populations, is unknown. This issue is currently being monitored by ODFW and CTWS personnel with the Hood River Production Plan.

Table 5.2. Documented fish stockings in West Fork watershed.

Stream	Species Stocked[1]
Green Point Subwatershed	
Rainy Lake	brook trout (1960 to present)
Black Lake	brook trout (1960 to present)
Ottertail Lake	brook trout (1960 to present)
Green Point Creek	rainbow trout (1955-56 only, Hood River and Oak Springs)
Lake Branch Subwatershed	
Lost Lake	brook trout, brown trout, kokanee (1950's-60's--stocks unknown) rainbow trout (1950's-60's--Hood River, unknowns, Oak Springs, Willamette River, Roaring River; 1980's to present--Willamette River, Deschutes River) sockeye salmon (mid 1950's only--stocks unknown) Coho salmon (1958--stocks unknown)
Scout Lake	brook trout (1950's to present)
Lake Branch	summer steelhead (1962-1975--Hood River, unknowns, Washougal; 1975-1985--Skamania River) rainbow trout (1954-56 only--Hood River, unknowns, Oak Springs)
West Fork Subwatershed	
West Fork Hood River	spring chinook (1984-1991--Carson, Clackamas, Deschutes; 1992 to present--Deschutes) summer steelhead (1961-1978--Hood River, Cascade, unknowns, Washougal; 1975 to present--Skamania) winter steelhead (1962 only--stock unknown) rainbow trout (1950-56 only--Hood River, unknowns, Oak Springs)
[1] Years and broodstocks in parenthesis	

E. Has the interbreeding with the various introduced and non-native fish species essentially eliminated the wild fish in the West Fork watershed?

Probably Not. Resident Trout With exception of Lost Lake, very few resident fish were stocked in the West Fork that could interbreed with indigenous stocks. Most stocked fish were brook or brown trout which cannot interbreed with native rainbow or cutthroat trout. Possible interbreeding of hatchery rainbow and indigenous rainbow stocks may have occurred in Lost Lake and Lake Branch. Rainbows stocked into Lost Lake were composed of native Hood River fish, as well as stocks from Willamette and Roaring Rivers, which are selected as a fall-spawning stock. Not knowing what species or stock were present in Lost lake, it would be hard to decipher the extent of interbreeding, but it would likely have only affected a local area; mainly Lake Branch subdrainage.

Anadromous Stocks There are still questions as to what anadromous species may have been indigenous in the West Fork system. Several reports mention that passage may have been hindered naturally by Punchbowl falls at rivermile 0.25 before a fish ladder was constructed in 1957. On the other hand, a 1963 Oregon Game Commission Report, enumerating steelhead passing over Punchbowls Falls via the ladder notes that, " some steelhead, and possibly an occasional salmon, ascend the falls without using the ladder and therefore are not counted". In either case, pre-1900 anadromous fish numbers in the West Fork were likely much smaller than current numbers due to improved passage over several natural barriers. On a broader scale, spring chinook, summer steelhead, winter steelhead, and coho were indigenous to the Hood River system and were passing into the West Fork after the fish ladder was built.

Spring chinook. Indigenous spring chinook within the Hood River essentially became extinct in the late 1960's. Stocking began around 1984, and was composed of all hatchery fish. There are considered no wild spring chinook left in the Hood River system.

Summer steelhead. Steelhead have been stocked into the West Fork since 1961. Brood stocks of hatchery fish were composed of Hood River, Cascade (hatchery), Washougal, and Skamania fish, though predominately Hood River and Skamania stocks were used. The Hood River Production Master Plan, prepared by ODFW and CTWS in 1991, maintain that, "it is unlikely these naturally produced fish are a mixture of stocks, because spawning of Skamania steelhead peaks from mid-January to mid-February while spawning of Hood River summer steelhead peaks in April-May. Thus, spawning of the two stocks are temporally isolated." The report further concluded that naturally produced fish remaining in the Hood River are predominately from indigenous stock, because it is unlikely that Skamania stock, with spawning time so different from native stock, could successfully reproduce.

Winter steelhead. Winter steelhead currently use Green Point Creek within the West Fork drainage. Winter steelhead were only stocked into the West Fork for 1 to 2 years, but were from an unknown stock. On a larger scale, hatchery winter steelhead smolts from non-native stocks have been released into the Hood River drainage periodically since 1962. From 1962 to 1976, smolts were from several different unknown or out-of-basin stocks. From 1978 to 1992, smolts were mainly from Big Creek broodstock. A 1991 ODFW / CTWS report concluded that "poor returns of Big Creek steelhead coupled with their early peak spawning has probably precluded introgression of genes to the indigenous stock". Beginning with 1991/92 run year, all stray and Big Creek stock hatchery fish (identified by fin marks) were not allowed past Powerdale dam. This program was established to prevent non-indigenous stocks from spawning above the dam, in accordance with guidelines established in ODFWs Wild Fish Policy.

Coho and Sockeye salmon. Coho and sockeye salmon were not likely indigenous to the West Fork of the Hood River. They were stocked into Lost Lake for a few years in the mid-1950's. Neither species have been seen in the West Fork during recent surveys.

The extent of interbreeding of hatchery and indigenous stocks of summer and winter steelhead is unquantified. As part of the Hood River Production Plan, a genetic monitoring program has been initiated to better define the degree of interbreeding between the indigenous and hatchery stocks in the Hood River. The Production Plan will also be monitoring any post-project impacts on indigenous populations of resident fish. Results and interpretation are not currently available from earlier samples, but should answer the interbreeding question more definitively in the near future.

F. *Are the introduced species affecting any threatened, endangered, sensitive, or at-risk species?*

Yes, to an unknown degree. There are several federal and state sensitive aquatic species in the West Fork, including redband/inland rainbow trout, Cope's Giant salamander, cascade frog, and tailed frog (Marshall et al 1992). Table 5 in the Appendix Fisheries report lists known amphibian species within several West Fork Hood River tributaries.

Amphibian. The effects of introducing exotic fish into high lakes and subsequent movement into streams within the West Fork is potentially changing the population sizes and persistence of amphibians within these reaches. Of particular concern are the potential effects of introducing fish into lakes that did not contain them naturally. Brook trout were stocked into several small lakes many decades ago. At that time, people did not consider what impacts such an activity might have on the native ecosystems. Therefore, no studies were conducted of the various aquatic life forms before stocking began. We suspect that the stocking had deleterious effects on the native aquatic organisms, potentially changing species compositions and population levels.

Without long term monitoring data, it cannot be assumed that amphibians, invertebrates, or other indigenous aquatic organisms are declining within the West Fork watershed as a result of fish stocking. The potential for population decline exists for these lesser studied organisms, such as mollusks, zooplankton, macroinvertebrates, and local amphibians. Future studies of high lake ecology would be of great value towards understanding the interaction of stocked fish and lake ecology.

Fish. Brook trout could potentially compete with redband/inland rainbow trout in North Fork Green Point Creek. Surveys of Gate Creek in 1979, 1991, and 1995 and of Rainy Creek in 1991, detected only brook trout in these streams. The 1991 survey recorded more than ten adults and many juveniles in one pool above the diversion at rivermile 0.6. Below the diversion, habitat consisted of discrete pools with de-watered areas in between with each pool sustaining one-to-five adults. These creeks, as well as their headwater lakes, may have been fishless before the introduction of brook trout into the upstream lakes. There is concern for a small, isolated population of redband trout recently found in North Fork Green Point Creek which is fed by both Gate and Cabin Creeks. A snorkel survey in 1991 of North Fork Green Point Creek revealed only redband trout from rivermile 0.0 to 4.2. This seems to indicate a separation between the two species at this time.

G. *Are any non-native animals reducing the populations or distributions of any native plant or animal species?*

Yes. Eight main introduced/native species interactions are known in the West Fork watershed. Several other animal species have been introduced into the watershed but the extent or even presence of competition with native species is unknown. Examples of these species include the house mouse (*Mus musculus*), house sparrow (*Passer domesticus*), opossum (*Didelphis virginiana*), and ring-necked pheasant (*Phesianus colchicus*). Ring-necked pheasant was deliberately introduced as a game species east of the watershed and has migrated into West Fork. In addition to the non-native animals, one non-native introduced fungus has been introduced into the watershed with detrimental impacts to two native trees.

Cinnabar moth/native *Senecios*. Significance unknown. Hood River County introduced Cinnabar moth in the 1980s to control tansy ragwort. The larva also feed on native *Senecios* and may cause reductions, particularly species with limited distribution and low populations.

Turkey/Gray squirrel. Insignificant. Wild turkey (*Meleagris gallopavo*) was introduced east of the watershed but has slowly migrated into the watershed. Acorns and ponderosa pine seeds are a major food source for both adult turkeys and the native western gray squirrel (*Sciurus griseus*), also known as the silver gray squirrel. Oregon white oak is limited to a handful of locations at the lowest elevations of the watershed. Sites are small, isolated, very rocky, dry south aspects along streams. Ponderosa pine is not very abundant either, although more widespread than Oregon white oak.

Barred owl/Northern spotted owl. Insignificant. Habitat fragmentation throughout the western United States and Canada has allowed the barred owl (*Strix varia*) to spread from it's original range in the east and Rockies to habitat in the Cascades. The barred owl, a close relative of the northern spotted owl (*Strix occidentalis*), appears to be better adapted to fragmented old growth and late successional habitat than the northern spotted owl. In the presence of barred owls, northern spotted owls do not compete except where late successional and old growth habitat remains in relatively large, unfragmented blocks. The Northwest Forest Plan recognized the impact of fragmentation and the relationship between barred owls and northern spotted owls as one reason for designating relatively large LSRs.

Starling/Cavity nesting species. Insignificant. The imported starling (*Sturnus vulgaris*) is a very aggressive cavity nesting species which is known to take over cavities from less aggressive species, especially bluebirds (*Sialia* spp.).

Brown-headed cowbird/Other birds, especially neotropical migrants. Insignificant. The brown-headed cowbird (*Molothrus ater*) was native to the Great Plains and Midwest. Relatively recent fragmentation of forested habitats in the West has contributed to the cowbird expanding its range to include the western United States. The brown-headed cowbird is a parasite, using other birds' nests to lay their eggs. The result is a failed nesting year for the host species. Female cowbird do not appear to seek host nests much more than a few hundred feet into a timber stand. Since adult birds usually forage near agricultural areas and areas of human habitation, cowbirds are most likely found low in West Fork watershed on non-National Forest System Lands.

Non-indigenous and Introduced fish/Indigenous fish. Significance unknown. Trout were documented in Lost Lake and Lake Branch around 1887, but it was never clearly stated whether these species of fish were redband/inland rainbow, coastal rainbow, or possibly even cutthroat trout. Four different non-indigenous species (brook trout, brown trout, kokanee, and coho) have been introduced into Lost Lake. In addition, rainbow from out-of-basin populations such as Willamette River, Roaring River, and Deschutes River have been stocked into Lost Lake. At rates of 10,000 to over 100,000 fish per year into the 240 acre lake, these introduced fish likely competed with indigenous trout in Lost Lake for food, spawning habitat, and cover components within the lake. The extent to which they reduced the native fish population won't be possible to separate from other factors such as timber harvest and habitat changes around Lost Lake, especially with the limited documentation of past densities or stock type.

Introduced fish/Native amphibians. Significant. The smaller lakes in the watershed, such as Rainy, Black, and Ottertail, may have been fishless. Research in North Cascades National Park found that salamanders are the top predators in many naturally fishless lakes (Liss et al. 1995). Stocking fish into otherwise fishless lakes introduces a new predator that can feed on the salamanders as well as many of the salamander's prey species. Northwestern salamander (*Ambystoma gracile*) and rough-skinned newts (*Taricha granulosa*) are toxic in both the larval and adult forms, so can co-exist with the introduced fish (Leonard et al. 1993). Rough-skinned newts and Northwestern salamanders may gain a competitive advantage when introduced fish prey on the competitors of these two species. The non-native fish also may crowd out or eliminate species of mollusks and invertebrates that are palatable to the fish.

Bullfrogs/Pond turtle. Insignificant. Bullfrogs (*Rana catesbeiana*) prey on the young of pond turtles. However, what pond turtle habitat may have existed in West Fork has been eliminated. All past habitat existed on non-federal lands in the lower elevations of the watershed.

H. Have any native plants, animals, or fish been eliminated from the West Fork watershed since 1900?

Yes. At least one plant, three mammals, four birds, and three fish specied / stocks may have been extirpated from West Fork watershed (Table 5.3). Lynx (*Lynx canadensis*) is a species occasionally reported in the watershed, however, we doubt as to whether it was ever present. An old book on the mammals of Oregon describes a subspecies known as the Cascades bobcat--*Lynx rufus pallescens* (Bailey 1936). This bobcat is described as paler in color with less black on the face, ears, and tail than the bobcat typical of western Oregon. It also describes a subspecies further east that was even paler (Rocky Mountain bobcat--*Lynx rufus unita*) and suggests that the Cascades bobcat was a transitional form between the Rocky Mountain form and the northwestern form (*Lynx rufus fasciatus*). Old trapping terms for the Cascades and Rocky Mountain bobcats include "Oregon lynx" and "Hudson's Bay lynx." Further, a range map for lynx shows it extending along the Cascade crest from the south to the south and west flanks of Mt. Hood. This map strongly suggests that any lynx in the Hood River basin was restricted to the upper end of East Fork Hood River.

A large canid inhabits portions of the Cascades which may be wolf (*Canis lupus*) or wolf-dog crosses. This animal probably is not native to Oregon, but the result of introductions by breeders, escaped animals, and dumped animals. The canid may be present in West Fork watershed or could eventually migrate into the watershed. West Fork has a higher probability of supporting this canid than many other watersheds due to the proximity of the Mt. Hood and Columbia wildernesses and the Bull Run Management Unit, which have considerably fewer people.

Wolverine (*Gulo gulo*) has not been extirpated but has been reduced in population. West Fork watershed provides some foraging habitat in winter throughout much of the watershed, especially in high snow years. During these periods, recreational use of much of West Fork is limited, affording the wolverine a relatively "people free" landscape. The level of human activity in the summer makes it unsuitable for wolverine denning and foraging. Road closures would increase the available habitat.

Pacific lamprey and potentially Western brook lamprey may have once used the West Fork. The loss of Pacific lamprey, along with the other anadromous fishes, probably has had major effects on of the entire Hood River system. Pacific lamprey died *en mass* after spawning, forming a major part of the available nutrients for the food chain. Further, the ammocoetes, live in the sediment for 3-6 years before moving to sea. The ammocoetes are filter feeders, thus very sensitive to changes in water quality and quantity. Toxic spills, large quantities of fine sediment, and de-watering hit the juveniles hard since they are unable to move away from the afflicted area, unlike fish. Little information exists on western brook lamprey, other than they were resident, were also filter feeders as ammocoetes, did not eat in the adult form, and were somewhat toxic so had few natural predators.

There are a few species that have not been extirpated from the watershed but are very limited in distribution. These species would be highly susceptible to habitat loss or over harvesting:

◊ Alaska yellow-cedar (*Chamaecyparis nootkatensis*) is at the eastern limits of its main range in West Fork. Further east, it appears only as isolated individuals or small clumps, or disjunct populations. Most of the Alaska yellow-cedar in the watershed is found near Black Lake, where portions have been harvested. Harvesting of this species should occur with caution since it is limited and strongly associated with wetlands.

◊ Great gray owl (*Strix nebulosa*), if present, is limited to the eastern edge of the watershed, on private and county lands. Much of West Fork watershed does not provide suitable habitat for this species and the bulk of potentially suitable habitat lies on other ownerships. As a result, surveys for great gray owl are not warranted on the National Forest System Lands.

- ◊ Species which depend on Oregon white oak acorns are limited to scattered, small pockets of habitat on the eastern edge of the watershed. None of the species known to depend on acorns are considered rare in the main part of their range further east.
- ◊ Cascade red fox (*Vulpes fulvus cascadensis*), or yellow fox, was a species described in 1936, but not currently. The range map for this species shows it as a mountain species in the Cascades, northern Coast Range, Blue Mountains, and Steens Mountain (Bailey 1936). This fox was described as slimmer and lighter than the so-called Rocky Mountain red fox (*Vulpes fulvus macrourus*) that inhabited the Blue Mountains. It was also a distinctly different color, yellow as opposed to red. The Cascade red fox typically inhabited open grassy parks and meadows within forested mountains. Current descriptions for red fox (*Vulpes vulpes* or *Vulpes fulva*) do not describe a yellow phase. Some range maps do not include the Cascade Mountains within the range of red fox while others do (Whitaker, Jr. 1980, Burt and Grossenheider 1964).

Table 5.3. Species or stocks extirpated from West Fork watershed.

Species	Habitat	Probable Cause for Loss
villous cinquefoil *Potentilla villosa* var. *parviflora*	Rock crevices in high alpine areas of Mt. Hood Wilderness	Cause unknown, known from only one location in 1956, plant has not been located since. Last reported site in Oregon.
grizzly *Ursus horribilis*	Large, relatively unroaded forests and high mountains	Habitat loss, hunting
wolf *Canis lupus*	Forests with a mix of stand types and openings	Hunting
mountain goat *Oreamnos americanus*	Steep slopes and benches along cliffs; usually at or above timberline. Unknown if population was ever present in Oregon.	Limited available habitat limited population, domestic livestock diseases
peregrine falcon *Falco peregrinus*	Open wetlands near cliffs	Pesticides, human disturbance
bald eagle *Haliaceetus eucocephalus*	Near rivers and lakes	Loss of anadromous fish runs, pesticides
California condor *Gymnogyps californicus*	Open hillsides and mountain slopes	Cause unknown, limited populations, may have only used area for foraging. Condor reported along Columbia River by Lewis and Clark in early 1800s
common loon *Gavia immer*	Nests on large lakes	Nesting habitat loss, human disturbance. Bull Run Lake formerly named Loon Lake, loons are occasionally seen foraging at Bull Run Lake. Were probably present at Lost Lake.
Hood River spring chinook salmon *Oncorhynchus tshawytscha*	Spawns in cold, lower gradient, streams and rivers	Habitat loss and alteration, over fishing, and out-of-basin conditions.
Pacific lamprey *Entosphenus tridentatus*	Spawns in cold mountain streams; juveniles are non-mobile filter feeders	Habitat loss, reduced water quality, sedentary larval stage, passage barriers, and out-of-basin conditions.
western brook lamprey *Lampetra richardsoni*	Juveniles are non-mobile filter feeders	Habitat loss, reduced water quality, sedentary larval stage, passage barriers, and out-of-basin conditions.

We did not develop restoration recommendations for Cascade red fox, grizzly bear, wolf, or common loon. We do not have enough information about Cascade fox to know if it is or was a distinct species or subspecies of red fox. We believe the management actions needed to provide for the return of grizzlies, wolves, and loons have unacceptable social costs. For example, to restore loon, we would have to almost completely close Lost Lake to recreational use.

Issue 2: Current information may not be adequate to assure the viability of some species on the C-3 Table and certain other sensitive, unique, and at-risk species.

A. Do we have adequate information to assess the viability or assure the continued presence of all relevant species listed in the FSEIS, Appendix J2, and the C-3 Table should we decide to recommend changes in the Riparian Reserve widths or if the FSEIS suggested that further viability analysis was appropriate during watershed analysis?

No. We do not have enough information to assess the viability or assure the continued presence of any fungi, lichens, bryophytes, or mollusks from the C-3 table that may be present in West Fork watershed. In most cases, we cannot identify the species in question. West Fork has the potential to support ten species of C-3 mollusks associated with the Columbia River Gorge since the northern edge of the watershed borders the Gorge. Several ponds in the watershed contain a species of fingernail clam, but we do not know if any are *Pisidium ultramontanum*.

Of the other species, we do have enough information to assess the continued presence of any that may be present or is documented in West Fork watershed:

* C-3 Amphibians. Larch Mountain salamander is the only species likely to occur in West Fork. Its presence has not been documented, but if found, we do have enough information on the species' needs to assure its continued presence.

* C-3 Mammals. Red tree vole (*Phenacomys longicaudus*) prefers coniferous forests in the mountain hemlock and Pacific silver fir series below 3000 feet elevation. The best habitat consists of at least 300 acres of forest dominated by trees 21 inches DBH and larger and with at least 30% canopy closure. The best identified habitat lies on the Longview Fibre in-holding along West Fork Hood River, with some marginal habitat on National Forest System Lands in the same general area. Marginal habitat lacks one or more of the attributes listed above. All the habitat mapped in West Fork was railroad logged between 1918-1943, with the bulk harvested in the mid-1920s to mid-1930s.

  Longview Fibre is harvesting portions of the area mapped as the best habitat. If the species cannot persist in the mapped marginal habitat, then it may disappear from West Fork watershed for an unknown period of time. The best late successional forest in West Fork lies around Lost Lake, which is above 3000 feet. The habitat is not present in most of the watershed below 3000 feet.

* C-3 Vascular Plants. Three C-3 plant species have been documented in West Fork watershed--candystick (*Allotropa virgata*), *Botrychium minganense*, and *Botrychium montanum*. Candystick occupies moist, closed canopy forests with a thick duff layer. The *Botrychium* spp. occupy floodplains and alluvial seeps and fans. All three species might not be adequately protected by the recommended Riparian Reserves and Lost Lake LSR. Draft species management guidelines suggest a minimum 600 foot buffer.

The C-3 Table in the Northwest Forest Plan has several omissions that can be found elsewhere in the text of the document. These species are actually Survey and Manage species and should be considered when answering this key question. Of the species mentioned in the text, four are likely to occur in West Fork watershed and we have enough information to evaluate their continued presence.

* Bats. Three survey and manage bat species should be present in West Fork watershed--silver haired bat (*Lasionycteris noctivagans*), long-eared myotis (*Myotis evotis*), and long-legged myotis (*Myotis volans*). All three species depend on snags and trees. Silver haired bat prefers to roost and nest in dense forest and feed in openings, while the other two species are more generalists. All three species are limited by the number of suitable snags. As long as we meet the present direction for primary cavity nesters, we should also provide sufficient habitat for these three bats on National Forest System Lands. We do not think that other ownerships in the watershed will provide snags of sufficient size for these bats.

* Great gray owl (*Strix nebulosa*). Great gray owl is associated more with semi-open forest, usually associated with meadows, wetlands, or other openings. Most of the potential habitat lies on Hood River County and Longview Fibre lands, with very little potential habitat on National Forest System Lands. The management objectives for Hood River County and Longview Fibre may conflict with the great gray owl. The National Forest System Lands are generally too high in elevation to assure the continued presence of great gray owl.

B. Are there additional or unique species within the range of the northern spotted owl which lack adequate strategies to maintain viability?

Yes. We considered the existing direction as adequate, but there is no strategy to meet the direction for at least five terrestrial animal species. We are not mandated to develop a management strategy for species in decline but are not yet listed as threatened, endangered, or sensitive. An example is the plants listed on either the State Review or Watch lists. In addition, there are some special and unique habitats where no adequate strategy exists. In all cases below, we recommend that an appropriate strategy be developed to provide for the continued presence within West Fork and overall viability.

Wolverine. Wolverine are limited by the level of human presence; the more humans are present, the less wolverines will use an area. As such, this species needs large refugia, covering several hundred square miles, where human presence is limited. It also needs separate refugia for summer and winter needs as well as connecting corridors. There are no studies of wolverine habitat needs in the Cascades. All available studies have focused on the northern Rockies and Canada. Based on the available studies, wolverines use a variety of forested and open environments. They appear to do best in areas with large deer and elk herds.

The LSR strategy does not discourage human presence and doesn't necessarily provide an adequate prey base. The Oregon Cascades do not support large herds of deer and elk, which may limit the available prey base. Since the species has not been studied, we do not know what other species would make up for the lack of large deer and elk herds. The Mt. Hood National Forest has been working on a strategy to provide large refugia. West Fork is not expected to provide a refugia or part of one but could provide a connecting corridor.

Townsend's big-eared bat (*Plecotus towsendii*). This bat is not a riparian or late successional dependent species. It forms large colonies and requires a large shelter with adequate air ventilation and temperature regulation, such as a cave, mine, or abandoned building. This species is very sensitive to human disturbance and temperature fluctuations, especially during hibernation. Even slight changes in temperature from one too many people in the hibernaculum can cause individuals or groups to break hibernation. If hibernation is broken long enough, death may result before winter ends or the individuals may not have sufficient energy reserves immediately after winter to survive the first few weeks of spring. Townsend's big-eared bat may never have been very common on the Mt. Hood National Forest due to the lack of natural caves.

Mountain quail (*Oreortyx pictus*). This rare species is a federal candidate for listing under the Endangered Species Act. Mountain quail typically prefer open forest with a brush understory. Potential habitat in West Fork is limited to the Transition Zone in Green Point subwatershed and the very lower end of West Fork subwatershed. Hood River County and Longview Fibre own most of the potential habitat, but some potential exists on National Forest System Lands on Mt. Defiance. We suspect mountain quail are present in West Fork watershed.

Cascade fox (*Vulpes fulvus cascadensis?*). This fox is a high elevation, forest species. It has been mentioned in historic accounts and trapping journals. A fox-like animal has been spotted crossing Highway 35 near White River. Of the two foxes depicted in current field guides, both red fox (*Vulpes vulpes*) and the gray fox (*Urocyon cinereoargenteus*) are low elevation species associated with a mix of forest and openings. The lower elevation red fox is probably not native to Oregon.

Red legged frog. The Riparian Reserves and LSR strategies provide adequate breeding habitat and some foraging habitat. However, this species can be found several hundred yards from water for several months of the year, making this a terrestrial ground frog. Fall rains trigger the period of highest movement across the land. In addition, its egg masses are attached to decay pockets on in-stream logs. Many Riparian Reserves cannot provide adequate habitat. The current strategies may not provide adequate dispersal and foraging habitat. The effects of road kill on the species viability, at least at the watershed scale, are unknown.

State Review (List 3) and Watch (List 4) plant species. Ten plant species on the either the State Review or Watch list have been documented in West Fork (Table 5.4). All ten species occur in special or unique habitats. Surveys are not required for species on either list. Two of the ten species were recently moved from the Sensitive list. Species have moved from the Watch Plant list, the lowest level, to the Threatened and Endangered list (List 1) within one year. Species on lists 3 and 4 either need more information before their status can be determined (List 3, or Review), or are of concern but considered either stable or too common to list even (List 4, or Watch). However, without surveys, the status of species on both lists is difficult to determine. A strategy is needed to keep declining plant species from becoming listed.

Table 5.4. Plant species on State List 3 and 4 present or probable in West Fork watershed.

Scientific Name	Common Name	Status	Habitat
Lycopodium annotinum	stiff clubmoss	4	Floodplains, alluvial seeps and fans. Status downgraded, documented in West Fork watershed
Hieracium longiberbe	long-beaked hawkweed	4	Dry, rocky, somewhat compacted sites. Status downgraded, documented in West Fork watershed
Polystichum kruckebergii	Kruckeberg's sword-fern	4	Talus. Known to occur on Hood River Ranger District, no surveys
Poa laxiflora	loose-flowered bluegrass	4	Moist, mid-elevation forests on exposed sites in fog drip zone. Known to occur on Hood River Ranger District, no surveys.
Anastrophyllum minutum	liverwort	3	McNeil Point, last surveyed in 1979
Conostomum tetragonum	moss	3	McNeil Point, last surveyed in 1979
Marsupella condensata	liverwort	3	McNeil Point, last surveyed in 1979
Nardia japonica	liverwort	3	McNeil Point, last surveyed in 1979
Polytrichum sphaerothecium	liverwort	3	McNeil Point, last surveyed in 1979
Gymnomitrion cocinnatum	liverwort	3	McNeil Point, last surveyed in 1979

Special and unique habitats. We identified four habitats unique in West Fork watershed and one special habitat that is relatively abundant in both West Fork watershed and the Mt. Hood National Forest. These include:

* Pine-oak (*unique*)--restricted to steep, very rocky south aspects on other ownerships at low elevations in the watershed.
* Dry meadows (*unique*)--one such meadow exists near Black Lake. It contains many species typical of the Eastside Zone growing in an area normally associated with the Crest Zone.
* Forested Talus (*unique*)--Talus slopes in areas sufficiently wet to support forest. Larch Mountain salamander lives in forested Talus with at least 40% canopy closure below 3000 feet.
* Forested rock (*unique*)--forest growing within a boulder field; boulders are typically very large and moss-covered.
* Talus (*special*)--rock field composed of angular rocks of varying size with little vegetation.

Only the pine-oak habitat is not found on National Forest System Lands within West Fork watershed.

C. Does the existing condition provide sufficient habitat to assure the continued presence of native primary and secondary cavity nesters?

No. There are sufficient snags currently to assure the continued presence of some primary and secondary cavity nesters, but not all. The existing snags may not be adequately distributed across the watershed to assure connectivity and dispersal needs of several of these species. Most stands in the Stand Initiation and Stem Exclusion stages have few or no snags. A sufficient number of trees were marked as leave snags but did not last through the timber sale or fuels treatment and site preparation. Some snags were felled as safety hazards. Some burned down during fuels treatment and site preparation. Occasionally snags close to roads are stolen for firewood. Lastly, some snags simply fell shortly after management activities ended. The result is an insufficient size of useable snags persisting for many years.

Cavity nesters that depend on snags in late successional habitat have a problem in that the available Late Seral Multistory stands are limited to only 19% of the watershed and are concentrated above 3000 feet elevation. Black backed woodpeckers (*Picoides arcticus*) and three-toed woodpeckers (*Picoides tridactylus*) require snags in late successional forest below 3000 feet. There may not be enough snags of sufficient snags below 3000 feet for these two species to persist.

On private lands, snags are mostly concentrated in riparian areas. These snags are inadequately distributed for species that are highly territorial. Bluebirds, for example, require snags spaced several hundred feet apart to provide habitat for several pairs.

White-headed woodpeckers (*Picoides albolarvatus*) require large soft snags in ponderosa pine dominated forest. Most of the potential habitat for this species is on non-National Forest System Land. The planned rotations and preferred species mean that white-headed woodpeckers probably conflict with management objectives. Large soft snags of any species or size are extremely rare outside the Late Seral Multistory stands.

In general, the watershed lacks sufficient snags for connectivity and dispersal for three main guilds of cavity nesters:

1. Medium home range, mosaic of large trees species (TMMLT),
2. Medium home range, contrast species (TMC), and
3. Small home range, mosaic of small tree species (i.e. acorn woodpecker-*Melanerpes formicivorus*) (TSMST)

D. Does current management direction provide sufficient habitat to assure the continued presence of primary and secondary cavity nesters?

Yes. Current direction is adequate. However, there are no snag models applicable to the Cascade Crest and Eastside. Such models would be helpful in determining how many trees to mark for future snags and how long we might expect snags of various sizes and species to last. At present, we can only guess.

E. Do we need to retain any B5 areas in Matrix lands to meet the habitat needs of the guilds of species represented by pileated woodpeckers and pine martens?

Yes. Four B5 habitat areas are recommended for retention to maintain connectivity for the guild of species represented by pine marten (*Martes americana*). All B5 areas identified with the Mt. Hood Land and Resource Management Plan FEIS, within Lost Lake LSR and the two wildernesses, are recommended to be returned to the underlying land allocations (Figure 5.1). It is also recommended to return all pileated woodpecker (*Dryocopus pileatus*) habitat areas outside the LSR and wildernesses to the underlying land allocations.

We recommend retaining the following pine marten habitat areas (Figure 5.1):

- 6221M--needed to provide a dispersal link around non-National Forest ownerships immediately east of the habitat area. This B5 area provides the lowest elevations possible on National Forest System Lands to link Mt. Defiance to Lake Branch subwatershed.
- 6211M--needed to maintain older forest in Lake Branch subwatershed. Lake Branch is heavily cut-over on all ownerships. It will be several decades before suitable habitat develops elsewhere in the subwatershed.
- 6161M--needed to maintain connectivity between West Fork subwatershed and Middle Fork watershed at lower elevations.
- 6141M--needed to maintain connectivity between West Fork subwatershed and Middle Fork watershed at higher elevations.

F. Are connectivity, reproduction, and dispersal habitat sufficient to allow gene flow at the metapopulation scale? (Metapopulation is a set of partially isolated populations belonging to the same species.)

No. Connectivity has been broken for several species either within West Fork watershed or between West Fork and other watersheds. Of particular concern are the following:

* Snag dependent species: the lack of snags in younger stands may have broken connections throughout the watershed. See the answer to Key Question 2C for more detail.
* Red tree vole: habitat loss on private and Federal lands may have reduced the suitable habitat below a critical threshold. See the answer to Key Question 2A for more detail.
* Species guild Terrestrial, Large home range, Mosaic of Large Trees (TLMLT): stand conditions on non-National Forest System Lands do not provide habitat for species with large home ranges that use a mosaic of large trees (northern spotted owl, northern goshawk, pileated woodpecker, pine marten, and fisher). Management on National Forest System Lands cannot fully provide the needed connections. Disposal and connectivity around the north side of Mt. Hood is a concern.
* Plants in Unique and Special Habitats: many meadows, seeps, floodplains, and headwater springs have clearcuts or roads right up to their edges. In most cases, special and unique habitats are not directly linked, but we do not know what indirect links may have existed before cutting and roading.

In general, the most critical break in connectivity and dispersal occurs in an east-west direction. On National Forest System Lands, fragmented patches of late-seral forest were created through decades of timber harvest. The lands east of the National Forest boundary were heavily forested prior to 1900. These lands have been converted either to orchards or short-rotation commercial forest, breaking the east-west link across the upper Hood River Valley. In addition, land exchanges have affected a similar link north-south between Mt. Defiance and the remainder of West Fork watershed.

G. Does West Fork provide important habitat for species when considered at the metapopulation scale?

Yes. West Fork watershed provides a connection between eastside populations and westside populations for several species of plants and animals. If the entire watershed were managed for short-rotation commercial forest, a critical dispersal link could be lost. Examples of species that could be affected by loss of the dispersal network include the northern spotted owl, plant species occupying unique or isolated habitats, plants occupying the transition areas between east and west, harlequin duck, some mollusks, and / or other late-seral associated species with small home ranges.

West Fork, due to its climate and position on the larger landscape, is an area where it is possible for intermediate plant species to appear and evolve. Hood River basin provides the majority of harlequin duck habitat on the Mt. Hood National Forest and West Fork watershed provides the most habitat in the Hood River basin. We are unsure why this should be, but speculate that it may be tied to one or more factors such as:

◊ a greater productivity in the forage base,

◊ a shorter flight distance from the Columbia to reach suitable habitat, or

◊ less people using the river (most of Hood River basin is not floatable or boatable).

West Fork provides important habitat for several anadromous fish species, but the available habitat is not fully occupied. Most anadromous fish spawn east of the Forest boundary in West Fork watershed, even though habitat is available within the Forest boundary.

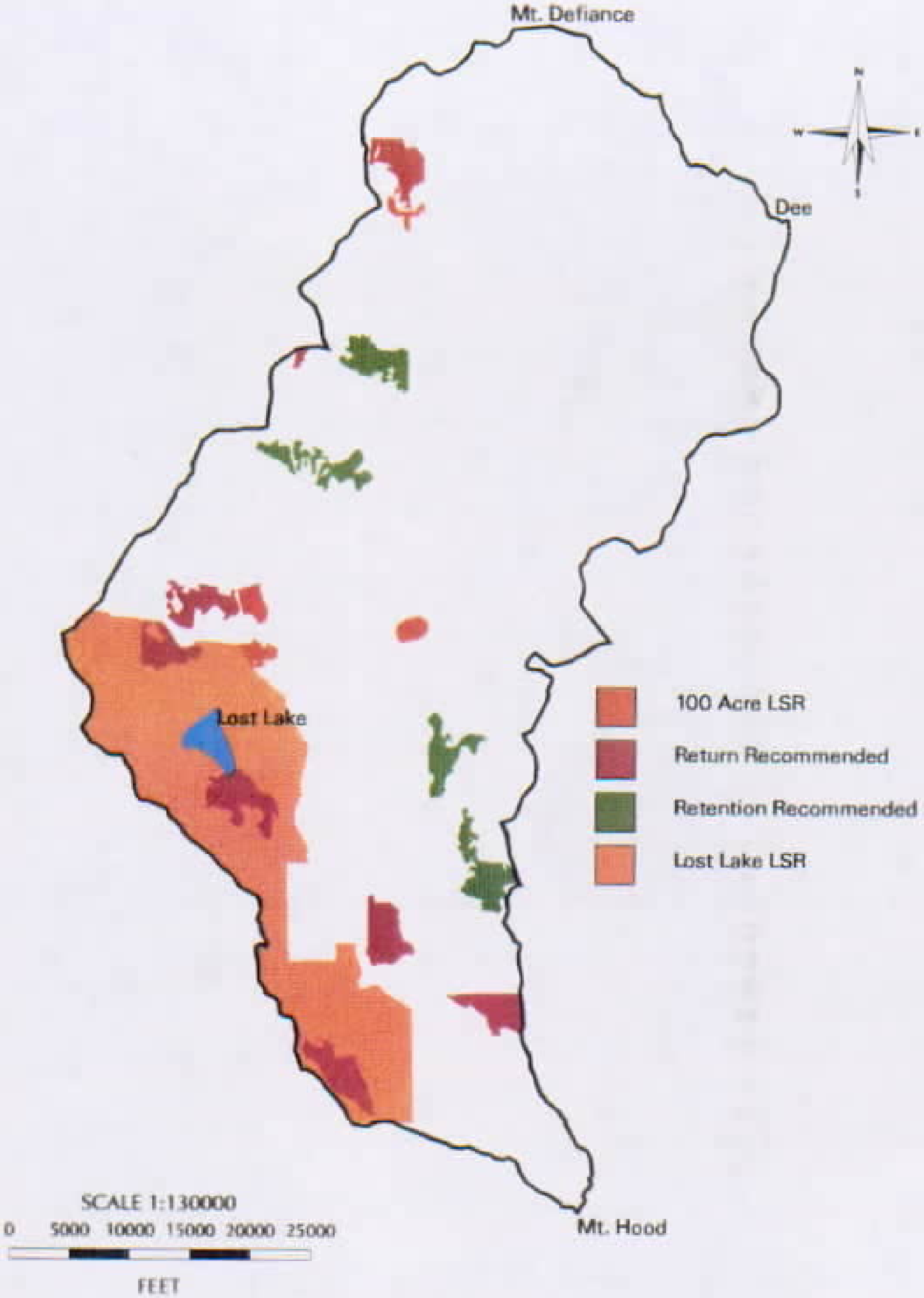


Figure 5.1. Recommended B5 areas to retain and return.

The Hood River Basin is an important transition zone between many coastal and inland populations of fish and amphibians. Species / stocks with easternmost boundaries near Hood River include: Lower-Columbia coho, coastal cutthroat (and its sea-run form), winter steelhead, NW salamander, Cope's and Pacific Giant Salamander, cascade torrent salamanders, and red-legged frog. Hood River is also somewhat unique in that both winter and summer steelhead stocks are present within the subbasin. A population of redband / inland rainbow trout have also been recently documented, when in the past, the Hood River was considered to be with in the range of coastal rainbow stocks.

West Fork contains several lakes and ponds between 3600 and 4200 feet in elevation along Wacoma Ridge that were fishless before 1900. Fish stocking may have greatly reduced the amphibian populations and changed the species compositions of these groups as well as invertebrate and zooplankton species compositions.

Connections are rather tenuous for species that depend on late successional forest for most or all of their life needs. Based on the most recent information we could locate, late successional forest is found on only 19% of the watershed and found only on National Forest System Lands. Most of this forest lies above 3000 feet in elevation. The forest is very fragmented, particularly on National Forest System Lands. Of the late successional forest remaining, it has a lot of edge such that relatively little of it functions as interior habitat.

The retained B5 areas and the Riparian Reserves are dominated by early successional forest; they are not functioning as late successional forest, as is the goal under the Northwest Forest Plan. Lastly, many of the C-3 plants (fungi, lichens, bryophytes, and vascular plants) are late successional associates. Some of the lichens have been documented as occurring on the Mt. Hood National Forest, although no surveys specific to West Fork watershed have been conducted. Based on what information we have on the typical habitat, it seems likely that we could expect to find many of these lichens in this watershed.

Issue 3: The demand for recreation opportunities is rising faster than management's ability to handle the demand and to provide, protect, or maintain the desired recreational experiences, and to protect other resources affected by recreation use.

A. Are the trends for the various types of recreation uses increasing?

Yes. Table 5.5 displays the major use types and trends in use levels, based on local knowledge. The fastest growing uses are mountain biking, fishing, and wilderness uses. Increases in some uses are limited by the availability of appropriate facilities, for example horse use, overnight use in Green Point subwatershed, and winter recreation. Camping in developed campgrounds is limited by the number of available sites. Those available are filling sooner than in the recent past. Most sites are full by Friday, if they are going to fill. Barrier-free facilities exist only at Lost Lake. Windsurfing is a new activity on Lost Lake but is limited by the size of the lake. Horse use would increase if Skyline Trail and the horse camp at Lost Lake were completed.

The Forest has not designated any motorized trails in West Fork. However, unauthorized off road vehicle use occurs between Kingsley Campground and Rainy Lake. The District must continually re-barricade the roads and trails between these two locations. Unauthorized mountain bike use occurs in both wilderness areas and on the Pacific Crest National Scenic Trail (PCT).

Access and Travel Management planning efforts found a rising demand for winter recreation opportunities and motorized trails. Widely fluctuating snow levels tend to limit winter recreation opportunities; in higher snow years Lost Lake would be a popular destination, particularly if cabins were available to rent at Lost Lake Resort. If Road 18 were plowed further up from Zigzag, winter recreation use around Lolo Pass would likely increase. Off road vehicle users expressed an interest in a trail system that would connect Kingsley Campground to Rainy and Wahtum lakes.

Table 5.5. Trends in recreation use levels within West Fork Watershed.

Use Type	Trend	Comments
Horseback Riding	Stable	Limited by facilities
Mountain Biking	Increasing	
Hiking	Increasing	
Wilderness	Increasing	Day us increasing, overnight use decreasing
Fishing	Stable-Slightly Increasing	
Hunting	Stable-Slightly Increasing	More tags are available than are sold
Swimming	Increasing	Mostly east of National Forest
Kayaking	Increasing	All east of National Forest
Developed Camping	Stable	Lost Lake often over full, other campgrounds rarely full
Dispersed Camping	Increasing	Heaviest on Lake Branch, mostly associated with overflow from developed camping.
Off Road Vehicles	Increasing	No designated trails
Cross-Country Skiing	Increasing	No groomed trails or snow-parks
Snowmobiling	Increasing	No groomed trails or snow-parks

B. *Are there recreational uses that conflict with one another?*

Yes. At present the main conflict between users occurs between mountain bikers and motor vehicles and between bikers and wheelchair users. West Fork has few mountain bike trails, one being Road 13. Road 13 is not very suitable for mountain biking due to heavy vehicle traffic, numerous blind corners, high speeds by both motor vehicles and mountain bikes, and lack of a bike lane. Several near accidents have occurred between mountain bikers and motor vehicles, particularly on the two-lane portion of the road. The risk of collisions between motor vehicles and mountain bikes is increasing on other roads as well, particularly in the Mt. Defiance area. To maintain good traction and control, bikers must ride in the wheel tracks on gravel roads, placing them directly in the path of on-coming vehicles.

Road 13 is not well suited for families to mountain bike since rarely are all family members in adequate condition to handle the grade and it can be very difficult to properly supervise children on a bike. One result is that families are biking on trails designed for wheelchairs even though biking is prohibited on such trails. These trails are not designed for mountain bikes. Bikes can rut the trail to the point that people in wheelchairs cannot negotiate the trail. The problem is particularly acute at Lost Lake. Many people take bikes to Lost Lake and expect to ride there. The District recommends that visitors to Lost Lake looking for mountain biking opportunities use Jones Creek Road (Road 1340). The reconstructed portion of the Old Skyline Trail (655) at Lost lake is also open to mountain bikes. Other trails open to mountain bikes include Rainy-Wahtum (409) and Ant Hill (406B).

Mountain bikers have been caught riding within the Mt. Hood Wilderness, Columbia Wilderness, and on the PCT. Mountain biking is not a permitted use in wilderness or on the PCT.

While not a problem at present, there may be potential for conflict between snowmobilers and cross-country skiers going to Lost Lake. The concessionaire is considering winter rentals of the cabins at Lost Lake. Cabin availability would increase the desirability of Lost lake as a winter destination. Since there are no groomed trails, skiers would likely use the snowmobile tracks, creating a similar problem as now exists between mountain bikers and motor vehicles on Road 13.

To address the conflict between mountain bikes and other uses, the initial solution would be to designate a mountain bike trail network that connects to Lost Lake and includes loops or segments suitable for families. However, such a system would require maintenance while trail maintenance budgets are decreasing to the point that we cannot adequately maintain the present trail system.

If snowmobiling and skiing use to Lost Lake begins to increase, explore arrangements with local clubs or the concessionaire to groom separate tracks for snowmobiles and skiers. The two lane portion of Road 13 is wide enough that it should be able to provide for both uses.

C. Have or might high levels of recreation use created detrimental impacts to soil, water, vegetation, wildlife, and fish?

Yes. Wahtum Lake Campground suffers from compaction and loss of screening vegetation. The facility was not designed for the level of use it receives. The vault toilet is too small, rotting, leaking, and has poor access for pumping.

The campground and day use facilities at Lost Lake Campground were redesigned to address compaction and vegetation loss problems and to reduce the number of campsites along the shore. Unfortunately the horse camp, day use area, shoreline campsites, and amphitheater remain unfinished. No additional money has been appropriated to complete this work.

The District is finding it harder and harder to maintain the trail system to a level that meets the ACS objectives. The greatest problems lie with increasing use levels and decreasing maintenance budgets. Barrier free trails are the most expensive to maintain, followed by horse and mountain bike trails. Hiker only trails are the least expensive to keep up. The PCT requires the most frequent maintenance due to the use levels and its designation as a National Scenic Trail.

The District has used various programs with volunteers, disadvantaged youth, and alternative service sentencing for some maintenance. However, these groups can only handle basic maintenance, such as brushing or logging out trails and minor tread work. Due to high turnover and the need for experience to maintain trails to certain standards, these alternative maintenance methods have only limited utility. If the current budget trend continues, we will be faced with closing trails and facilities or reducing maintenance standards. If the number of recreational facilities declines, those remaining will experience further increases in use levels and the need for still more maintenance. The potential result is recreational facilities that may retard or prevent attainment of ACS objectives.

Much of the dispersed camping in Lake Branch is more a result of Lost Lake Campground filling than true dispersed camping. Use in many dispersed sites along Lake Branch and on Sentinel Spur (road 1340-620) is as heavy as use in the developed sites. These dispersed sites do not have sanitation facilities, hardened approaches and parking areas, fire rings, or other features designed to control use and protect surrounding resources. As a result, dispersed camping has a much greater impact on other resources than developed camping.

Use levels in the Mt. Hood Wilderness and on the PCT do not meet the designated WRS and ROS class. As use levels increase, the impacts on other resources increase. The WRS and ROS classes for the Mt. Hood Wilderness and PCT are meant to reflect a landscape with little sign of human presence, such as litter, eroding trails, bare ground at campsites, and so forth. Since the Mt. Hood Wilderness and the PCT lie largely in the higher subalpine and alpine zones, these areas (i.e. Cairn Basin) are easily damaged by excessive use and heal slowly. The Forest is using the Limits of Acceptable Change (LAC) process and Mt. Hood Forest Plan standards and guidelines A2-031 through A2-035 to address these concerns. The Mt. Hood Forest Plan lists a set of actions, in order of increasing restrictions to correct problems identified in the LAC process:

1. The First Action shall be public information and site restoration (A2-032).
2. The Second Action shall be use of regulations, I. e. if the first action is unsuccessful, restrict recreational activities by regulations (A2-033).
3. The Third Action shall be to restrict number of users. If the first and second actions are unsuccessful, restrict numbers of visitors to the carrying capacity level (A2-034).
4. The Fourth Action shall be to close the area to all users. If the first, second, and third actions are unsuccessful, close the area to all recreational use until the area is rehabilitated and restored to wilderness condition (A2-035).

The high levels of recreational use have also affected wildlife use patterns and lake dynamics. The high numbers of roads and irregular use means that the various wildlife species do not adapt to the presence of vehicles. As such, the roads displace deer and elk and change their use patterns. The number of roads discourages potential wolverine use of the watershed. Most wolverine use would likely be restricted to foraging in winter. The number of roads also increases the potential for poaching, especially in the Red Hill area. We believe that most poaching in the watershed is associated with subsistence hunting.

Running with hounds displaces several species around Lolo Pass. While hunting with hounds is no longer legal, people can still use hounds to chase various animals. The most common species pursued are bobcat, cougar, and bear.

Lost Lake is one of the few areas in the watershed with a large amount of intact late successional/old growth forest. The area also supports a large number of wetlands. The level of recreation use may have caused declines in amphibians and large carnivores that use old forest and wetlands. Before 1900, bald eagles may have foraged on both Lost Lake and Bull Run Lake, but the current level of recreation use discourages bald eagle use. Lost Lake may have supported loons before 1900. Bull Run Lake used to be called Loon Lake and loons have been seen foraging at Bull Run Lake. No nesting occurs there, possibly because of the large drawdown zone that develops. Loons are another species sensitive to high levels of recreation use.

Two cliff sites (Indian Mountain and Vista Ridge trail), that show high potential for peregrine falcon nesting, occur within the watershed. One site is adjacent to a trail and the other is near a road. Human use of the trail and road is irregular enough that the falcons do not adapt. Each time a person or vehicle appears, it would startle the nesting bird. Peregrines do not build nests, but hold the eggs on their feet. When startled, the parent bird stands up, potentially causing damage or loss of the eggs, particularly since falcon eggs still show signs of shell thinning from pesticides. No current peregrine presence or nesting has been documented in the watershed.

Fish stocking to meet recreational demands either has occurred or continues to occur in lakes that were naturally fishless before 1900. In fishless lakes, salamanders are often the top predators. The introduced fish may displace the salamanders as top predators and prey on the non-poisonous species, such as Cope's giant salamander. Poisonous species, such as Northwestern salamanders and rough-skinned newts, gain a competitive advantage over the non-poisonous species. Further, brook trout have moved out of some lakes and naturalized in the streams. Brook trout compete with the native species for food and spawning and rearing areas. Large areas of the West Fork drainage are closed to fishing to protect natural spawning areas for anadromous fish; from Punchbowl Falls at rivermile 0.2 to dry Run Bridge at rivermile 8.2. Lake Branch is closed from its confluence with West Fork to rivermile 5.5. Each summer, people are seen in these areas fishing or signs of their activities are left behind.

D. Does West Fork provide any unique recreational experiences or opportunities not readily available elsewhere?

Yes. Table 5.6 lists the recreational facilities of international, national, and regional significance. All the unique opportunities are centered around Lost Lake. Lost Lake is the largest and deepest *natural lake on the Mt. Hood National Forest. Lake levels have been increased by 20 inches via* a small dam at the outlet, but this increase is insignificant when compared to a lake depth of 175 feet. Further, the dam does not serve a hydroelectric generating facility or irrigation district. Rather, it exists to control the lake level for recreational purposes. One result is that Lost Lake *does not have the "bathtub ring" of bare shore that typifies most other dammed natural lakes on* the eastside of the Forest.

The access to Lost Lake is controlled at the one major entry point, unlike other lakes on the Eastside with road access. Once the number of visitors reaches a certain level, the access can be closed. Controlled access allows the District and the concessionaire to provide a higher quality recreation experience at Lost Lake than at other lakes on the Eastside.

The north shore of Lost Lake offers a stunning view of Mt. Hood. This view is one of the most photographed views on the Mt. Hood National Forest, both commercially and non-commercially. The view and the presence of old growth forest around the lake also make Lost Lake a desirable spot for location filming of movies and commercials. Lost Lake also has one of the few barrier free trails through an old growth stand.

All other recreational opportunities are not particularly unique, although the quality of experience may be highly desirable. Many of the opportunities, such as hiking; horseback riding; gathering mushrooms, huckleberries, boughs, and beargrass; fishing; dispersed camping, and so forth are available elsewhere in the Hood River basin and on the Eastside of the Mt. Hood National Forest.

Table 5.6. Significant recreational opportunities in West Fork watershed.

Significance	Sites
International	Pacific Crest National Scenic Trail, Mt. Hood Wilderness, Lost Lake
National	Columbia Wilderness
Regional	Kayaking on West Fork Hood River east of Forest boundary

[1] Significance based on consistent use by visitors from other countries (International), states other than Oregon and Washington (National), and outside Hood River County (Regional)

E. Does West Fork have the potential to provide for new or different recreational opportunities or experiences? What might be the potential impacts?

Yes. Potential new experiences include providing for winter recreation, an off road vehicle route, an Auto Tour, and a scenic route over Lolo Pass. We also examined developing more hiking trails outside Riparian Reserves and Lost Lake LSR, but opportunities are very limited due to declining budgets and the lack of destinations that lie outside these Reserves. The District has already planned a mountain bike trail in the Mt. Defiance area.

There is an opportunity to provide for groomed snowmobile and cross country ski trails in West Fork and Lake Branch subwatersheds. Trail possibilities include Road 13 to Lost Lake (discussed in key question 3B), Road 18 or a combination of Roads 18 and 1810 to Lolo Pass, and various roads in the Red Hill area. Use of Road 18 as a snowmobile route would require an agreement from BPA, since they own part of the road, and Longview Fibre, to cross their lands. In all cases, there is a problem in funding the construction and maintenance of new snow-parks. Oregon Department of Transportation opposes any new snow-parks in the Highway 35-26 corridor. They state that they cannot bring on the equipment and personnel needed to maintain additional snow-parks. Providing such trails would increase winter use of the watershed, with subsequent impacts on wildlife. West Fork is tentatively suitable for wolverine use in winter due to the low level of winter recreation. Increasing winter recreation use could eliminate West Fork watershed from the land base potentially capable of supporting wolverines.

The Big Eddy powerline corridor includes a native surface road that runs beneath the lines to provide maintenance access. At present, this road is not designated as an off road vehicle route. However, we do not know how desirable such a route would be since riders would be exposed to high tension powerlines along the entire route. Bonneville Power Administration maintains the powerline corridor in an early successional stage, so the route would not travel through any forest. Further, BPA uses herbicides along at least part of the route to control conifers. The route crosses private land, so an agreement might be needed with Longview Fibre. Lastly, the route includes a ford across West Fork Hood River. At present, the river shows signs of trying to change course at this ford and flow down an abandoned channel. Additional use across the ford might accelerate channel shifting.

A two lane paved road runs between Zigzag and Lolo Pass. After crossing into West Fork watershed, the road splits. Road 18 becomes a poorly maintained single-lane gravel road that is mostly owned by BPA between Lolo Pass and the junction with Road 1810. This road is a valley bottom road with poor alignment, steep grades, erosion problems, and inadequate bridges across Elk and McGee creeks. Road 1810 is a single-lane gravel road wholly owned by the Forest Service that winds down Lolo Pass via Elk and McGee creeks. That road is a mid-slope road on unstable slopes prone to debris torrents.

The District analyzed the two roads in 1991 to decide which should be managed for public passenger car traffic. Using the resource objectives of the Mt. Hood Forest Plan, the analysis recommended use of Road 1810. Traffic count data over Lolo Pass shows a wide range of use. Annual daily use ranges from 56-140 vehicles.

Constructing a higher standard road would dramatically increase recreation use in West Fork and Lake Branch subwatersheds. In turn, an increase in use would increase the conflicts already noted in Key Question 3B between user groups and between recreation and other resources. We believe that recreational facilities in West Fork watershed are at capacity or slightly over capacity. Increased use would also increase problems associated with illegal uses, such as mountain bikes in wilderness and on the PCT.

Another new recreational experience would be to develop and install and Auto Tour along Road 13 that discusses land management. The tour could consist of numbered signposts placed at selected locations and a brochure. Road 13 forms a loop, allowing for many opportunities to discuss various aspects of land management for visitors going to Lost Lake or for those would wish to drive the loop. The signs would need to be of durable materials to lessen vandalism. We may need to construct or reconstruct turnouts along parts of Road 13 to allow visitors to safely pull out of traffic at each stop.

F. What level of developed and dispersed recreation use is appropriate and where is it appropriate within the LSR or Riparian Reserves?

Lost Lake Campground and Resort is the only developed facility within Lost Lake LSR. This LSR provides only minimal opportunities to develop additional facilities. Any opportunity would be limited to Sentinel Spur, which amounts to an extension of Lost Lake and not a new facility in the typical sense. The only developed facilities in the Riparian Reserves are campgrounds at Black, Ottertail, Wahtum, and Scout lakes. Campground reconstruction has already occurred at Rainy, Black, Ottertail, and Scout lakes. Use levels at Wahtum Lake Campground exceeds the available capacity.

Developed recreation probably has fewer overall impacts on meeting the objectives of LSR and Riparian Reserves than dispersed recreation does. Developed recreational facilities have more controls in place on use types and levels and the sites are monitored regularly in order to ascertain maintenance needs if nothing else. Dispersed recreation is not monitored nor do many sites have any controls on use types or levels. Most dispersed camping is an overflow of developed camping, but is not controlled. Dispersed campers often drive to or set up camp along the edges of streams, lakes, ponds, and wet areas. Many dispersed campers are willing to go where we direct them, but we have no coherent method of directing.

Dispersed recreation in West Fork subwatershed is limited by steep topography, dense vegetation, and the ownership patterns. Use levels decrease as distance from Dry Run Bridge increase. Lake Branch subwatershed is the most intact from an ownership standpoint; there are no in-holdings within the Forest boundary. We don't expect dispersed use levels along Lake Branch to increase unless we develop a trail system along the creek. Use levels along Lake Branch dropped when the District began restricting firewood cutting to designated areas only. Topography, dense vegetation, and ownership patterns limit dispersed use in Green Point subwatershed. Longview Fibre seasonally restricts public access while Hood River County does not. Dispersed recreation use within the LSR and Riparian Reserves appears to be at capacity for most sites and slightly above in a few sites.

G. Are recreation users we encourage to use National Forest System Lands causing any detrimental impacts to other landowners within the watershed?

No. Neither the County nor Longview Fibre felt that recreation users we encourage cause any detrimental impacts to their holdings. Problems have been noted, but were considered minor. In some cases, the problems are associated with hunting, which is an activity encouraged by the State. Problems included vandalism, failure to close gates, and similar incidents. Probably the most serious problem are dispersed campers who occasionally start fires. Longview Fibre does not encourage camping. Over Memorial Day weekend in 1995, a camper along Elk Creek started a fire that reached two acres, destroying or damaging several trees in a plantation and leave trees. While not documented, District personnel suspect that National Forest users may occasionally take firewood, Christmas trees, and boughs from other owners.

In the past, Road 2820 was a county road. The Forest Service took over the maintenance of this road several years ago. The County believes that visitors heading up to the Columbia Wilderness damage the 2820 road. They feel the traffic is heavy enough to contribute significantly to the loss of gravel on the curves and washboarding.

Longview Fibre has extensive in-holdings in West Fork subwatershed. Both Longview Fibre and Hood River County have in-holdings in Green Point subwatershed. Access to the National Forest System Lands from Dee is across a large area of other ownerships. The National Forest boundary is not well marked anywhere in the watershed. Neither Longview Fibre nor Hood River County post their lands against trespassing. Longview Fibre generally places gates on their roads to seasonally restrict access, but usually opens them during hunting seasons.

Issue 4: Past management strategies did not deliberately consider how the pre-1900 disturbance processes affect what the landscape can produce and how much. Recent ecological thinking suggests that we may better meet the social demands on the environment if we better mimic the type and timing of disturbances the landscape evolved under prior to 1900.

A. Has management greatly affected the pre-1900 disturbance regime?

Yes. It appears that management activities have caused significant changes in the fire and insect regimes in Green Point subwatershed and in the mass wasting regime throughout the watershed. We have added three major disturbances to the watershed: timber harvesting, roading, and water diversion. Benefits from these changes include:

◊ Building the economy of Hood River county,
◊ Increasing habitat for species with small to medium sized home ranges and that prefer early and mid-successional forest,
◊ Increasing access to forest lands and associated economic and recreational activities.

Conversely, the detriments from changes in the disturbance regimes include:

◊ Loss of high quality aquatic and riparian habitat,
◊ Declining forest health on Mt. Defiance, and
◊ Decreasing habitat for species that depend on late successional forests.

Management activities have had no effect on events such as ice storms, mudflows, and volcanic eruptions. We are unsure if management activities had a significant effect on native disease levels and outbreaks. We do not have enough evidence of probable past disease regimes to be sure.

One disease has been added to the West Fork watershed--white pine blister rust (*Cronartium ribicola*). White pine blister rust was introduced into the United States in the early 1930s. This fungus causes stem and branch cankers on five-needled pines. Eventually the tree will die from the disease. Various *Ribes* species, (currants and gooseberries), are alternate hosts for the fungus, allowing it to persist in the environment. Western white pine (*Pinus monticola*) was significantly reduced in the watershed both by the blister rust and by an major salvage effort in the 1950s and 60s. One objective of the salvage was to harvest trees before they were killed. All western white pines within reach of the available technology and without regard for tree genetics were removed. This salvage program may have resulted in the removal of individual trees with some genetic resistance to white pine blister rust. Maintaining western white pine in the watershed now depends on an extensive genetics program that is attempting to select for genetic resistance to the disease.

Whitebark pine (*Pinus albicaulis*) is also susceptible to white pine blister rust but has not been significantly reduced. No genetics program is in place for whitebark pine. Studies have only just begun to examine the relationships between white pine blister rust and whitebark pine. We are uncertain what effect the addition of this disease has had on ecosystem dynamics and whether the effects are significant.

Management activities have not influenced the occurrence of floods, but have influenced the outcomes. Various management practices, such as splash damming, riparian stand harvest, and stream clean-out have removed much of the in-stream and riparian wood. Culverts and bridges change flood hydraulics, particularly when they are not large enough to pass both the flow and debris (rocks, sediment, plant material, and logs). Upland harvesting has probably increased the peakflows of smaller floods (2-5 year events) and changed these increases from an acute type of disturbance associated with a major fire, to a more chronic type of disturbance. Roads have converted part of the watershed into permanent opening with a generally water impervious surface. Drainage ditches extend the stream network and, in a few cases, reroute flow patterns from one stream to another.

The period of splash damming only lasted about 20 years, but contributed to the cumulative effects on the aquatic systems. Splash damming was similar to a natural flood in that both involve a large amount of water moving through the system. Splash damming was also somewhat similar to a mudflow in that the system experienced a "wall" of water rushing through the system instead of water levels in the stream rising and falling. Mudflows, however, are only typical of Ladd Creek and occur infrequently. Splash damming caused flooding at different times of year than most natural floods and caused several floods in a year. Because of the purpose of splash damming and log drives, the streams did not have any flood energy dissipaters in the system, causing far more changes in stream morphology than a natural flood. Natural floods more "rearranged" aquatic habitat where splash dam floods typically removed habitat.

Management activities do not appear to have significantly altered the fire regime in West Fork and Lake Branch subwatersheds. Occurrence of the major stand replacing fires are driven by climate, with a long interval between such fires. Management has had some impact on the smaller and more moderate intensity fires within this regime. For example, burning of huckleberry fields no longer occurs, but has been partially replaced by other types of human caused fires, such as escaped campfires and slash burning. Slash burning occurs at a different time of year and different intensity than pre-1900 human-caused fires. However, we concluded that these changes are relatively insignificant when compared to the major climate-driven fires. Assuming that insect outbreaks are closely tied to the fire regime, since both are driven by many of the same climatic factors, then management activities have not changed the insect outbreak regime in West Fork and Lake Branch subwatersheds.

Management activities on both National Forest and other owners probably have significantly altered the fire and insect regimes in Green Point subwatershed. Fire exclusion has caused a shift in species compositions and stand densities above what might be typical of the characteristic landscape before 1900. In turn, these changes have supported epidemic levels of western spruce budworm (*Choristoneura occidentalis*) and, most recently, Douglas-fir bark beetle (*Dendroctonus pseudotsugae*). The problems are more acute and widespread on National Forest System Lands since timber harvesting is under many more constraints than the adjacent owners.

Timber harvesting and its associated activities are new disturbances added since 1900. Harvesting and fuel treatment remove more biomass than disturbances such as fire or debris torrents. Site preparation, herbicides, and planting are designed to accelerate conifer regeneration and compress successional development in the early stages. Herbicide use is limited on National Forest System Lands, but continues on the other ownerships. The changes harvesting and its associated activities have caused are discussed in more detail in Key Question 4B.

Literature on site productivity suggests that we can remove most of the biomass on a site without significantly reducing site productivity for one time. Productivity is not affected, since the subsequent forest essentially draws on the nutrient capital stored in the soil. If we continue to remove most of the biomass without long-term replacement, then we could expect site productivity to decline. Similar declines are, in part, responsible for the forest health problems in Europe and productivity declines in the southeastern United States. The combination of leaving little biomass behind and short rotations could result in "mining" the soil of nutrients.

Fertilizing is only a stop-gap measure that provides nutrients only over a very short period of time. Studies in the Southeast are finding significant changes in soil species compositions, chemistry, and ecosystem functioning with repeated fertilization, particularly when not using "balanced" fertilizers.

B. Is the current landscape, including terrestrial and aquatic features, reflective of the characteristic landscape prior to 1900?

No. A major component missing from the aquatic and riparian ecosystems is large wood. Physical habitat from old growth trees is a major component in the West Fork Basin. The West Fork Basin is in the transitional climatic zone between the wetter west side of the cascade and the dryer east side where precipitation ranges from 130 to 80 inches of precipitation per year. Vegetation is mostly characteristic of the lower elevation of the Pacific silver fir zone. Rain on snow events and subsequent flashy high volume flows are common. As such, large wood has played a historically large role in providing the habitat needed to allow the development of large native runs of salmon and steelhead in a flashy high flow environment.

The role of large woody material creates habitat by stratifying water velocity and provide the hydraulics which allow smaller sized gravel to be retained in stream channels. More importantly the large wood provides cover and refuge habitat for juvenile salmonids at different flows. Spawning gravel and rearing pools are basic habitat requirements for salmonids. Large wood plays a significant role in providing the roughness elements which break up riffle sequences and provide channel variation.

Past logging practices and the policy of wood removal in the West Fork have created channels which are monotypic in velocities and substrate. Following wood removal, low and high velocity variation was diminished. Velocities became less stratified and more monotypic throughout the channel. Total physical habitat for adult and juveniles was reduced in quantity and quality.

Current instream habitat conditions in the West Fork Basin are far less than historic levels. Where possible, instream projects have been designed and implemented to increase stream structure and roughness. It has been the goal to increase local carrying capacity for anadromous salmonids within project reaches in order to increase overall basin production.

Most of the accessible, high priority stream reaches within the West Fork on National Forest System Land have had large wood stream restoration projects. These projects were designed to benefit chinook and steelhead habitat. Stream reaches on Elk creek, Jones creek, McGee creek and Red Hill creek within Longview Fibre land could be restored in the future. This could be accomplished through Challenge Cost Share Cooperatives or completed following land trades with the Forest Service. Longview Fibre has been a partner in the commitment to improve habitat on a portion of the West Fork on their land. This project was funded by BPA and used Forest Service personnel to implement. It is hoped this could continue at some point in the future.

In the terrestrial ecosystems, the area covered by the various structure types is within the range of natural conditions, particularly since the ranges are so broad as to be almost meaningless. However, the landscape pattern created by the different structure types is well outside the pre-1900 pattern (Figure 5.2). Before 1900, the infrequency of large-scale landscape disturbances would allow the older stand structure types, Mature Stem Exclusion and Late Seral Multistory, to persist on the landscape for many decades, if not several centuries. The younger structure types; Stand Initiation, Stem Exclusion, and Stand Reinitiation; would be present for relatively short periods of time.

Before 1900, created forest openings were typically very large and ameboid shaped with feathered edges. Now, openings are small and geometrically shaped with sharp edges. Openings on National Forest System Lands are more atypical of the historic landscape pattern than many openings on the other owners, primarily due to the size differences. The landscape pattern in Green Point subwatershed was somewhat more patchy than in West Fork and Lake Branch subwatersheds. The BPA powerline corridor has created a permanent, linear opening across the southern third of the watershed. Result of the current pattern are a highly fragmented landscape, little interior habitat for late successional dependent species, and little late successional habitat below 3000 feet..

Harvesting and fuel treatments have reduced snags, existing large wood, and potential large wood throughout the watershed. In turn, long-term site productivity may have been reduced in units harvested between 1960 and 1990 on National Forest System Lands and between 1940 and the present on other lands. We began leaving more snags and downed logs on National Forest System Lands in the early 1980s, however these elements often did not make it all the way through harvesting and fuel treatment. By 1990, the District was having much more success at leaving the desired materials. Hood River Ranger District is required to leave more snags and downed logs under the Mt. Hood Forest Plan than other ownerships are required to leave under the State Forest Practices Act. Further, the non-federal landowners can concentrate snags in riparian management areas whereas the Forest must provide snags across the landscape. Roads have converted part of the landscape into permanent openings.

C. Has the current landscape significantly altered terrestrial, riparian, and aquatic wildlife use patterns and distribution relative to the characteristic landscape before 1900?

Yes. The current landscape has altered terrestrial, riparian, and aquatic wildlife use patterns and distributions.

The road and trail systems in the watershed provide much greater access to humans. People disperse over a wider area, over a greater portion of the year, and in far greater numbers than before 1900. Even if no timber harvesting had occurred, the level of human use would alter the use levels and patterns of several species, particularly those with large home ranges or that cannot tolerate disturbance at irregular intervals.

Timber harvesting has reduced use or eliminated species that depend on late successional forest and with medium to large home ranges. Conversely, it has favored species that prefer earlier successional forest with small to medium home ranges. In general, this change means higher populations of huntable species, such as deer and elk, and lower populations of rarely seen species that are not hunted, such as northern spotted owls and wolverines. The Hood wildlife management unit, which includes West Fork watershed, meets the state population objectives for deer, but not for elk.

Before 1900, if a catastrophic event, such as a fire, changed a significant portion of West Fork watershed, then suitable habitat for late successional forest species was likely available in adjacent watersheds. For species present in West Fork, the only adjacent watershed with significant refugia potential is Bull Run.

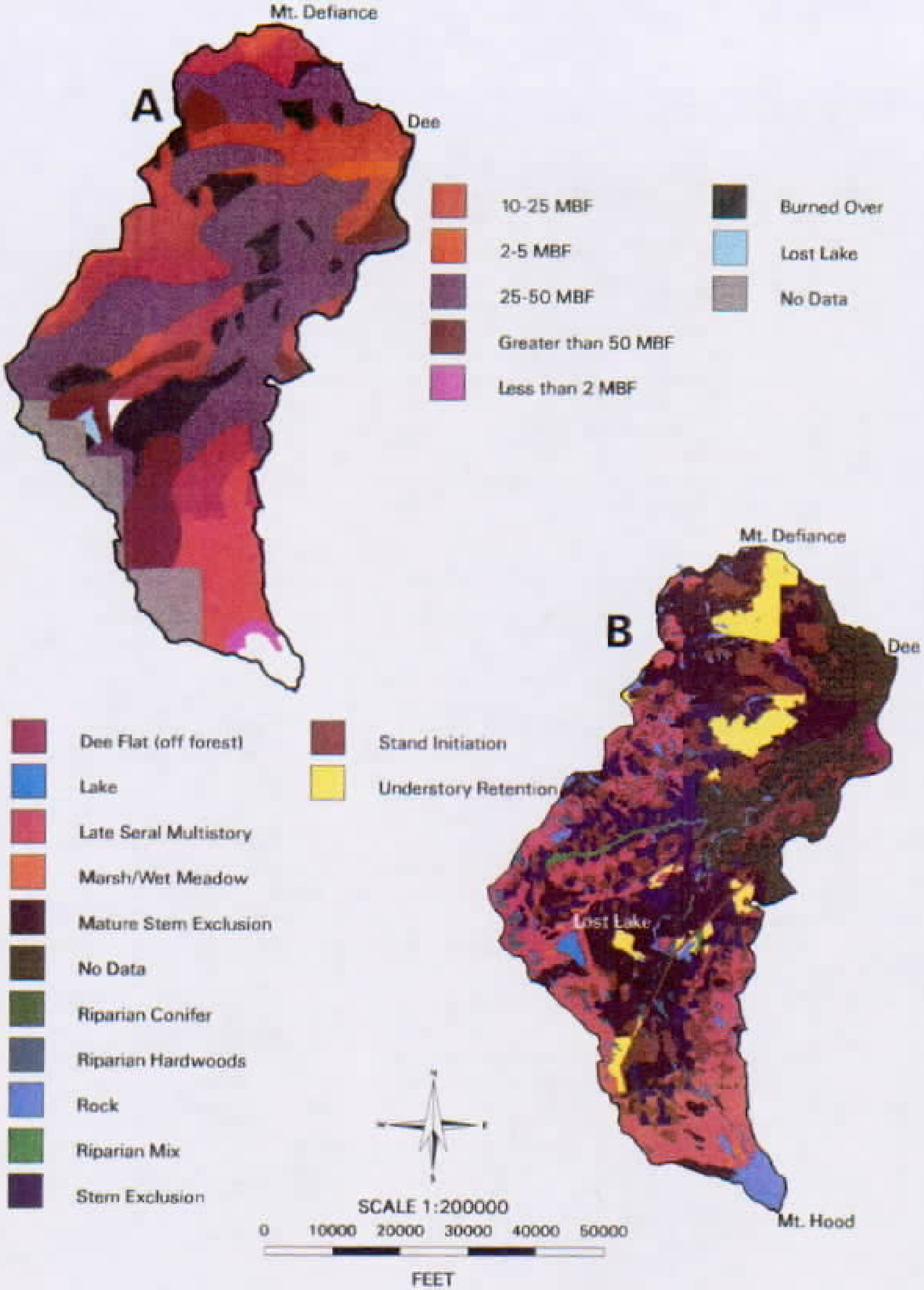


Figure 5.2. Landscape pattern typical of pre-1900 conditions (A) verses current landscape pattern (B).

Riparian corridors often serve as important dispersal corridors for terrestrial species as well as providing habitat elements for aquatic species. These corridors can be crucial for species that depend on closed canopy forests where the riparian corridors pass through areas with open canopy forest on the uplands. The combination of timber harvest and roading has narrowed and fragmented these corridors. The loss of dispersal habitat along these corridors may be more critical east of the Forest boundary than within the Forest boundary. Both Longview Fibre and Hood River County are managing on different rotations than the National Forest under the Mt. Hood Forest Plan (50-60 years, 80-90 years, and 100-120 years, respectively). Late successional forest will not appear on Longview Fibre and Hood River County lands as long as these rotations remain.

Before 1900, Hood River valley was covered with forest, allowing all species to disperse across the valley. Most of Hood River valley has been converted to agriculture or to relatively short rotation commercial forest. The alteration in the landscape design means that species have a much more difficult time dispersing across the Hood River Valley. Species with small to medium home ranges and dependent upon late-seral habitat may attempt to avoid the valley. Other ownerships extend to the subalpine zone on the south side of Mt. Defiance. If there are any species on Mt. Defiance that need late successional forest but will not or cannot use subalpine forest, these species may now be isolated from the rest of the watershed due to this change in landscape pattern. The problem is most acute for species with small home ranges and narrow environmental tolerances. The only connection may be along riparian corridors left under the State Forest Practices Act.

Due to public concerns about forestry practices on private lands, during the end of the 1980s, the Board of Forestry to the Oregon Department of Forestry conducted a public forum during December of 1990. The Board concluded from the input received that changes in the stream classification system and protection rules might be needed to better match the levels of stream protection with beneficial uses.

On September 1, 1994, the Forest Practice Water Protection rules were amended. These new State regulations contain a new water classification system based on scientifically sound water and riparian management principles and appropriate measures that are designed to protect the beneficial uses. This explicit target for the protection of water quality is a significant change from the past. Monitoring will be important, since a number of assumptions have been made to describe the streamside and other vegetation retention targets. Whether these targets will ultimately meet the various needs of the streams will need to be documented through future monitoring.

The Riparian Management Area (RMA's) retained under the State Forestry Practice Act are typically narrower than the Interim Riparian Reserves retained under the Federal Northwest Forest Plan. These recommended widths for National Forest system Lands were designed to provide a high level of fish habitat and riparian protection until watershed and site analysis can be completed. Whether the State RMA's or the Federal Riparian Reserves will adequately function to provide effective dispersal corridors will depend on future monitoring and evaluations. Only then will we be able to further understand what best management and stewardship practices are required for maintaining hydrologic, geomorphic, and ecologic processes that directly affect standing water bodies, such as lakes, ponds, wetlands, streams, stream processes, and fish habitat.

Other changes in wildlife use patterns and distributions include:

◊ Irrigation withdrawals reduce aquatic habitat availability and connectivity for aquatic and riparian associated species, especially where streams are de-watered. The problem is more acute in summer when water demand is high, both for irrigators and for maintaining lower in-stream water temperatures.

◊ Big Eddy corridor is maintained in a perpetual early seral condition to protect the powerlines. Bonneville Power Administration uses herbicides, usually Tordon, to maintain this vegetative condition on other ownerships. Currently, they must use other vegetation management methods on National Forest System Lands. One result is that the powerline corridor contains high numbers of non-native plants and noxious weeds, particularly scotch broom. The corridor seems to serve as a re-infestation center for these non-native plants.

◊ Increased human use has reduced the levels of use by certain wildlife species, particularly those generally "intolerant" of human presence, and altered the distributions of many species, primarily due to roads, dispersed recreation, Lost Lake development. (see also Key Question 3C).

The distribution of anadromous fish has increased in West Fork (from pre-1900) due to laddering of Punchbowl and Moving Falls. Pre-1900 records by pioneers repeatedly mentioned West Fork, Lake Branch, and Lost Lake areas as containing incredible numbers of trout (Coons 1873, FS files 1991, Winans 1991). While passage was improved for anadromous and migrational fish species with the laddering of Punchbowl and Moving Falls, degradation of aquatic habitat had been occurring in the West Fork over the last 100 years. The early settlement period of Hood River Valley in late 1800 to early 1900 drastically changed aquatic conditions. The first log drives started around 1889, and splashdamming on the West Fork started in 1901 (Pope, 1992). Resident trout in the West Fork were affected by large scale loss of habitat associated with these log drives as well as later stream cleanout projects. Other factors that contributed to habitat loss included timber harvesting and homesteading methods that cleared off large tracts of land and disturbed the soil and hastened sediment run-off. Over fishing also played a part in decreasing fish runs as evidenced by the many historical records noting fishing as a common activity and an important supply of food for early pioneers. Concern for fisheries prompted the first fishing license in 1907, where 125 trout a day was the limit. Local as well as out-of-basin affects from extensive logging, inadequately screened water diversions, over fishing in Hood River, over fishing with fishwheels and horse seines on the Columbia River, and severely altered habitat in both Hood River and the Columbia River, contributed to the decline of anadromous fish runs.

D. Can we treat the forest health problems within the watershed and still meet Northwest Forest Plan objectives? (Formerly Question E)

Yes. Mt. Defiance currently has the greatest forest health problems in West Fork watershed. Western spruce budworm has been at elevated levels since 1983. Douglas-fir bark beetle also reached high levels in 1994, resulting in significant mortality, particularly of Douglas-fir. The amount of mortality is affecting the desired future condition of the area. Western spruce budworm was sprayed in 1988, which brought a two year decline in the epidemic. Root disease may also be significantly higher on Mt. Defiance, but the above-ground insect outbreaks mask any below-ground disease problems.

Mt. Defiance falls into Matrix lands under the Northwest Forest Plan. Of the standards and guidelines for Matrix lands, the one with the most potential to affect treatment of the forest health problem is the green tree retention requirement. The Northwest Forest Plan requires that we retain 15% of the stand as green trees in regeneration harvest units. In general, at least 70% of these trees should be in patches at least 1/2 acre (0.2 hectares) in size or larger. The remainder should consist of scattered individuals and clumps smaller than 1/2 acre.

Because we did not spray in the 1990s, we probably have foreclosed on stand treatment options. The combination of drought conditions and 10 years of defoliation probably created ideal conditions for the Douglas-fir bark beetle outbreak. Mt. Defiance has a diversity of species but currently is, and "always" has been dominated by host species, in particular Douglas-fir. The insects have had less impact on noble fir than Douglas-fir.

Non-host species growing in this area include lodgepole pine, western white pine, and western hemlock. Host species are Douglas-fir, Pacific silver fir, grand fir, noble fir, and Engelmann spruce. There may not be a sufficient number of non-host species to meet the 15% green tree retention guidelines, particularly due to reductions in western white pine caused by white pine blister rust and the early salvage program.

Given the probable pre-1900 characteristic forest and the current forest, it appears that fire exclusion has not necessarily increased the number of host species; rather, it has increased the stand density past a critical threshold. Mt. Defiance has shallow, rocky, well-drained soils. Even though the National Forest System Lands receive abundant moisture, the effective water holding capacity of the soil means that growing conditions are more typical of a site that receives considerably less annual precipitation. Although Mt. Defiance falls into the Crest Zone in terms of vegetation series (Pacific silver fir) and average annual precipitation, the disturbance regime and site conditions are more typical of the Transition Zone.

The most recent silvicultural prescriptions in the Mt. Defiance area to improve the forest health specified thinning to about an 18 foot spacing and reducing the amount of Douglas-fir in the stands. More trees have died since these prescriptions were developed and the EA signed. We may now need to salvage the same ground, but will need to reevaluate the final results after the current sales are harvested.

Interestingly, the Mica Timber Sale lies next to one of the current sales (Bronze Timber Sale). Portions of the Mica sale area were fertilized in 1989 with an aerial application of nitrogen in the fall. It was thinned to a 24 foot spacing (70-90 trees per acre) in 1992. When the sale was logged, the top 20% of the tree crowns was defoliated. The leave trees are now much greener than the adjacent stands and the effects of the insects much less. Various people working on recent timber sales in the Mt. Defiance area have noted that some Douglas-fir trees break buds later in the spring than most Douglas-firs in the area. These "late breakers" have not been nearly as defoliated as the other Douglas-firs.

These observations suggest several items for consideration. Douglas-fir trees that break bud relatively late in the spring are less affected by spruce budworm, perhaps because development of the larvae are delayed past a critical point. Thinning to a wider spacing, or fewer trees per acre, may reduce defoliation levels. Fertilizing in fall may also confer some advantage, perhaps by improving the nutritional status of the tree sufficiently that it can recover quicker or easier from defoliation as well as better resist Douglas-fir bark beetle. Thinning to a wider spacing should also reduce moisture stress, allowing individual tree defenses against bark beetles to remain higher.

We believe that breaking the insect outbreak requires drastically dropping the stand densities over a wide area to reduce moisture stress. Descriptions of the township that includes Mt. Defiance in 1901 suggest a sparse stand dominated by large Douglas-fir. Thinning several hundred to several thousand acres, removing bark beetle infested trees, underburning, and promoting genetic and species diversity should accomplish that task. To meet the green tree retention standard, we need to leave trees that we expect to live.

The intent of the green tree requirements is to provide structural diversity in the next stand. However, this standard and guideline was not written to deal with an on-going epidemic. We have two basic strategies to deal with forest health problems. The first strategy is to help avoid an outbreak by reducing tree and stand stress under certain conditions. When dealing with this strategy, the green tree retention guideline should be met except under very unusual circumstances.

The second strategy requires that we deal with an outbreak by reducing or removing susceptible and host trees or species. When dealing with this second strategy, we cannot be expected to meet the green tree retention guideline if we do not expect the leave trees to live. Instead, we must look to meet the long-term objective of the guideline--structural diversity--and accept short-term fall-downs to both break the epidemic and meet the long-term objective.

Issue 5: The other owners within West Fork use the landscape in ways to meet their objectives, and not those of the Northwest Forest Plan. The Northwest Forest Plan recognizes several exceptions to plan objectives, such as the holders of existing permits and agreements (i.e. powerline rights-of-way, diversion ditches, electronic sites, etc.). These uses and objectives may result in additional restrictions on how the National Forest System Lands are managed in order to meet the goals of the Northwest Forest Plan.

A. Have the various vegetation and pest management methods used by landowners in the watershed detrimentally affected or benefited any C-3; threatened, endangered, or sensitive; at-risk; unique; or non-target plant or animal species? Is there potential for either adverse or beneficial effects in the future?

Yes, For vegetation; **Maybe,** for pest management. Vegetation management has detrimentally affected C-3, threatened, endangered, sensitive, at-risk, unique, and non-target plant and animal species. A few benefits also exist, but we concluded that the detriments outweighed the benefits. Most of the species above are associated with late successional forest or special and unique habitats.

The various vegetation manipulation practices have generally benefited species that prefer contrast, or edge, habitats, such as deer and elk. With only a very few exceptions, most of these species are very abundant elsewhere. In some cases, deer and elk are so abundant as to be considered pests in and around orchards. Vegetation management on all ownerships has adversely affected species that depend on late successional forests. Late successional forest has disappeared from the non-National Forest portion of the watershed, approximately 35% of the acres within the watershed, and is not expected to appear there again, given the management objectives of these owners. The exception being perhaps the RMA's retained under the State Forestry Practices Act. The intent of these areas are to achieve and maintain a streamside timber stand that will function similarly to mature forest conditions.

Turn of the century logging removed all wood possible as saw logs, as fuel for logging equipment, or burned as unwanted slash. Harvesting of the second and even third forest has begun on the other ownerships. While these owners leave more material than past operations, the short rotations do not allow full recovery. There are no incentives for the other owners to grow late successional forest and plenty of disincentives. The shorter rotations also mean that material left on the uplands is smaller and will not persist as long in the ecosystem.

The aquatic habitat has also been affected by roads associated with vegetation management on all ownerships. The primary impacts are removal of large wood, reduced large wood potential, and increased fine sediment input from roads that cross or parallel streams.

Pest management includes both undesirable plants as well as animals. Chemical use (herbicides, insecticides, miticides, and fungicides) has created both beneficial and detrimental impacts to the species listed in the key question. However, the benefits generally have been short-lived and are outweighed by the detriments. Tables 5.7 and 5.8 list several pesticides commonly used in forestry and orchards.

Known benefits from chemical uses have been to maintain canopy closure and accelerate redevelopment of the forest. Spraying insecticides to control defoliating insects helps maintain existing canopy closure, benefiting species that depend on closed canopy forest. Accelerating development of coniferous forest through brush control favors species dependent on forested conditions over those dependent on brushy conditions.

Before the 1980s, all landowners and land managers, including the Forest Service, used a wide variety of chemicals to control brush, undesirable plants, and insect pests. Before World War II, most forestry chemicals were not very effective. After World War II, organic chemicals, particularly those based on chlorinated hydrocarbons, came into widespread use. Insect control widely depended on the use of one chemical--DDT--which was very effective. The management strategy at the time was eradication.

Insecticides often have impacts far beyond their intended target, particularly when applied in excessive amounts or when improperly handled. The target species is usually at the lower end of the food chain. Most insecticides are or were broad-based, affecting many species and genera when used, not just the target species. Some insecticides have specific restrictions or warning on spray timing to avoid killing certain beneficial insects, such as honey bees. However, none of these chemicals have warnings or restrictions designed to protect other non-target species. We do not know what direct and indirect impacts spraying insecticides has on the food chain. It is possible that this may impact aquatic macroinvertebrates by affecting their adult permanence.

Chlorinated hydrocarbons or their breakdown products tend to persist in the environment. They also tend to accumulate in the tissues of animals higher in the food chain. Bioaccumulation is why DDE, a breakdown product of DDT, causes eggshell thinning in raptors that depend on fish. Even though DDT was banned in 1964, DDE may still be affecting eggshell thickness of ospreys, bald eagles, and peregrine falcons. Sprays can also directly kill fish due to improper handling. The 1963 Oregon Game Commission report noted two fish kills in the Hood River basin that resulted from cleaning spray equipment.

Because these chemicals and their by-products bioaccumulate, effects are possible on humans that eat fish regularly. Anadromous fish species that feed closer to shore run a greater risk of becoming contaminated from runoff than do fish that feed farther out to sea. Fish in the Columbia River have been tested in some reaches and people have been warned to limit their consumption of certain resident fish caught in certain reaches. Fish have not been tested in the Hood River system, even though a wide variety of chemicals are used by the orchard industry. Past use of insecticides by the orchard industry was somewhat indiscriminate. Since the 1970s, however, orchardists have fine tuned spray programs to use the minimal amount needed sprayed at the right time to get maximum effect.

Beginning in the 1980s, Integrated Pest Management (IPM) became the strategy of choice. The objective in IPM is control, not eradication. Chemical insecticides and herbicides are only one tool used. Biological controls are more widely favored, since the control mechanism, in theory, becomes self-sustaining. However, once released biocontrol organisms cannot be recalled or recaptured. The Forest Service essentially suspended use of chemical insecticides and herbicides in 1983 after a lawsuit and the release of the FEIS on managing competing and unwanted vegetation. Bonneville Power Administration currently does not have permission to use herbicides to control vegetation on National Forest System Lands, but can do so on other ownerships.

Since the 1970s, the Mt. Hood National Forest has not had to contend with a major bark beetle outbreak. All insect outbreaks have been defoliators, specifically spruce budworm. The preferred control method is to spray *Bacillus thuringiensis* (Bt), a bacterium that affects moth and butterfly larvae. Recently, the use of Bt has been questioned since it affects the larvae of all species of butterflies and moths in the area at the same developmental stage. The concern mostly relates to unintended effects on other species, such as bats, that depend on either the adult or larval stages of non-target species. There is also a lack of information on whether any C-3 plant species may be pollinated by non-target butterflies or moths.

Also in the 1980s, Hood River County released the cinnabar moth to control tansy ragwort. The moth has caused significant reductions in this noxious weed, but also feeds on native *Senecio* species. The effects of cinnabar moth feeding on the native plants has not been documented. Wasco County is experimenting with a fly whose larva feed on the roots of knapweeds. This fly has been released in The Dalles City Watershed. It may eventually make its way into West Fork watershed if not released beforehand.

Herbicide use has been more limited. Before the 1980s, all landowners and managers in the watershed used herbicides to control brush and accelerate conifer regeneration. Bonneville Power Administration used additional herbicides to control conifer regeneration under the Big Eddy-Troutdale powerlines.

Table 5.7. Common forestry pesticides currently or potentially used in West Fork watershed.

Trade Name	Chemical Name	Purpose	Remarks
Esteron 99	2,4-D	Brush and conifer control	
Garlon	Trichlopyr	Maple and evergreen brush control	
Roundup	Glyphosate	Deciduous brush and noxious weed control	Often prevents sprouting
Tordon 101	Picloram and 2,4-D	Brush and conifer control	Reduces sprouting, restricted use pesticide
Banvel	Dicamba	Brush and conifer control	Reduces sprouting, not as effective as picloram, persists in soil up to 6 months
Paraquat	Paraquat	Brush and conifer control	
Malathion	Malathion	Various insects	
Sevin	Carbaryl	Various insects	

Table 5.8. Pesticides used or potentially used on apples and pears.

Class	Trade Name	Chemical Name	Crop
Fungicides	Agri Strep	streptomycin	apples, pears
	Bayelton	triadimeton	apples, pears
	Bordeaux	copper sulfate & hydrated lime	apples, pears
	Captan	captan	apples
	Dithane M45, Manzate 200, Mancozeb	mancozeb	apples, pears
	Dodine, Syllit	dodine	apples, pears
	Lime sulfur	calcium polysulfate	apples, pears
	Polyram	metiram	apples
	Procure	triflumizole	apples, pears
	Rally	myclobutanil	apples
	Rubigan	fernarimol	apples
	Thiram	thiram	apples
	Ziram	ziram	apples, pears
Insecticides	Ambush*, Pounce*	permethrin	pears
	Asana*	esfenvalerate	pears
	Bt	Bacillus thuringiensis	apples
	Cygon, Defend	dimethoate	apples
	Diazinon*	diazinon	apples, pears
	Guthion*	azinphos-methyl	apples, pears
	Imidan	phosmet	apples, pears
	Lorsban	chlorphyrifos	apples, pears
	Mitac	amitraz	pears
	Morestan	oxythioquinox	pears
	Penncap-M*	methyl parathion	apples, pears
	Provado	imidacloprid	apples
	Sevin	carbaryl	apples, pears
	Supracide*	methidathion	apples, pears
	Thiodan	endosulfan	apples, pears
	Vydate*	oxamyl	apples, pears
Miticides	Apollo	clofentezine	pears
	Carzol	formetanate hydrochloride	apples, pears
	Kelthane	dicofol	pears
	Omite	propargite	apples
	Savey	hexythiazox	pears
	Vendex	fenbutatin oxide	apples, pears
* Restricted use pesticide			

B. Is there a need for additional measures on National Forest System Lands to better maintain habitat quality and connectivity for aquatic and riparian species in association with stream diversions?

Yes. The greatest need is for connectivity in the aquatic ecosystems of Green Point subwatershed. Parts of several streams are de-watered at least part of the year. For example, Farmers Irrigation District (FID) diverts all of Gate Creek to a pipeline. However, only part of the water is diverted into the pipeline and the remainder is sent back to the creek. Gate Creek is dry between the diversion and where surplus water is returned to the stream. Both the Forest Service and FID would like to divert only the allocated water right to the pipeline. Farmers Irrigation District must assure their customers that they are receiving their full water right. This and other diversions that de-water stream segments break connectivity for aquatic species and for some riparian species.

In addition to the breaks in connectivity for resident fish in Green Point subwatershed, there are breaks in connectivity for anadromous fish outside West Fork watershed. Some fish screens on the mainstem Hood River below the confluence with West Fork Hood River are inadequate or have maintenance problems. During these periods, steelhead may enter the irrigation canals and spawn rather than moving further up the Hood River system to spawn on National Forest System Lands.

Lastly, there are some localized connectivity problems on Mt. Defiance for riparian associated species. No intermittent streams cross onto National Forest System Lands in the extreme northeast corner of the Mt. Defiance area. Stream orientation is east-west in Green Point subwatershed. This situation creates a north-south connectivity problem between this northeast corner and the remainder of National Forest System Lands to the south. No additional measures may be needed east-west in this area since the adjacent land management does not provide any late successional habitat. The greatest connectivity problem is for animals with small home ranges.

C. Does the BPA powerline corridor significantly disrupt connectivity for any C-3; threatened, endangered, or sensitive; unique; or at-risk plant or animal species?

No. The BPA powerline corridor is not wide enough to act as a significant barrier for any of the above mentioned species. The presence of vegetation allows dispersion of small animals. The corridor provides a benefit in that BPA maintains the corridor in a brushy condition, providing long-term habitat for species that depend on deciduous brush. Outside the powerline corridor, we typically accelerate conifer re-establishment to meet reforestation requirements under the National Forest Management Act (NFMA). This act requires evidence of full stocking by conifer seedlings within five years of regeneration harvest, even though the same level of regeneration after a natural disturbance may take ten to twenty years under most conditions. The reforestation requirements result in the brush stage lasting five to 15 years less than was typical before 1900.

The configuration of the powerline corridor (linear) is not the best for some early seral associates. There are no medium or large snags to attract cavity nesters, such as bluebirds. Maintaining the corridor in an early seral condition requires the land to remain outside the range of natural conditions with unknown long-term consequences on soil functioning and nutrient cycling. We are also unsure how many different species actually use the corridor as regular habitat due to the powerline hum. It may be worthwhile to place nest boxes and bat boxes along the edge of the corridor to attract some species.

D. Do the access roads for the BPA powerline and ditch maintenance provide major infestation points and dispersal opportunities for non-native species?

Yes. The powerline corridor provides an infestation point for scotch broom, tansy ragwort, knapweeds, and St. Johnswort. The ditch maintenance roads provide infestation points for knapweeds and St. Johnswort. While not present in West Fork watershed, the ditch roads may provide an infestation point for purple loosestrife, a relatively new noxious weed now established as far as Odell.

E. Has the current or past timber harvest on other ownerships affect peakflows or water temperature on any streams within West Fork Watershed?

Yes. In general, the current stream temperatures are not a problem for resident and anadromous fish currently present in the system. Harvesting and associated roading on all ownerships has increased peakflows for smaller events, but probably not significantly affected larger events. Based on the Aggregate Recovery Percentage Model, we believe that the harvesting effects on peakflow are typical of what has been found in virtually all other watershed analyses outside of wilderness areas.

Stream temperature is very sensitive to riparian canopy closure. Clearcuts can affect air temperature 300 feet from the unit edge, which, over time, may affect water temperature

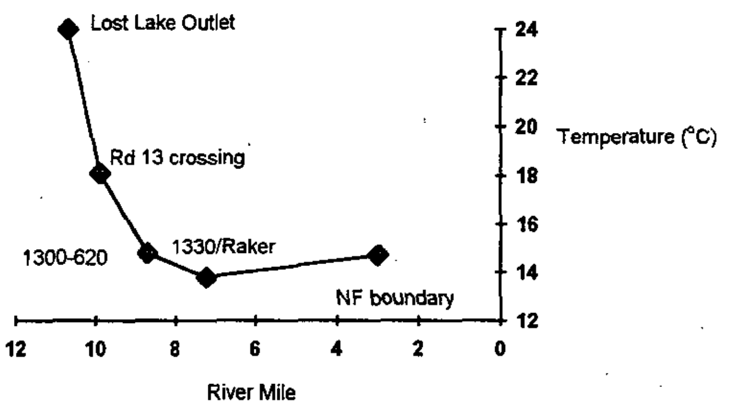
The lower West Fork mainstem is well shaded, but portions of the upper West Fork and many tributary creeks are not. Ladd Creek helps to moderate temperature increases in West Fork Hood River due to the significantly cooler glacial meltwaters it contains.

Spot temperature data taken in 1963 suggests that West Fork is now cooler. Between 1942 and 1963, maximum temperatures in West Fork near the confluence with East Fork reached 63-64°F (17.2-17.8°C); currently, maximum temperatures at Dry Run Bridge do not exceed 58°F (14.4°C). Riparian conditions below Dry Run have essentially not changed since the 1940s, therefore, it can be assumed that changes in conditions above Dry Run could have driven the changes in stream temperature. Tributaries, such as Lake Branch, could have influenced temperatures near the East Fork confluence.

Portions of the Lake Branch subwatershed riparian areas are currently poorly shaded due to the existence of a seral condition of hardwoods with scattered conifers. This subwatershed has smaller tributaries than West Fork subwatershed. Lake Branch has greater fluctuations in daily temperature and seasonal flow levels than West Fork subwatershed.

Lake Branch is significantly warmer when it leaves Lost Lake than at the Forest boundary (Figure 5.3). The surface of Lost Lake and the large open wetland at the head of Lake Branch allows water to heat up. Wood debris jams used to cover the outlet, reflecting radiant energy and potentially keeping temperatures cooler before 1900. The small dam at Lost Lake, at the outlet, raised the lake level, but much of the area now flooded is very shallow and heats readily. There is currently no wood debris and this may affect high temperatures at the outlet.

Figure 5.3. Water temperature on Lake Branch (idealized July average daily maximum).



Approximately 2 miles below Lost Lake, at the end of a bedrock channel, Lake Branch goes underground in an area of very deep glacial tills during the summer. How far the stream travels underground before emerging and the length of time the stretch remains dry depends on the year.

Most of the current stream temperature problems in Lake Branch subwatershed, below the dry reach, could be attributed to harvesting on National Forest System Lands. At the Forest boundary, stream temperatures approach or reach 58°F (14.4°C) in June and July, when the sun angle is the least favorable. Water temperature starts to rise near the Road 1330 crossing. For several miles below this point, there are several clearcuts with little or no riparian buffer. Available data suggests that Lake Branch would be cooler if a more intact riparian buffer was present. Lake Branch is starting to recover from National Forest harvesting. Longview Fibre is preparing to harvest portions of the lower Lake Branch. This harvesting will occur under the new State Forest Practices Act, which should provide greater protection to the riparian area than before.

Green Point subwatershed appears to have always been naturally warmer than Lake Branch and West Fork subwatersheds. Environmental conditions in Green Point subwatershed differ from the other two in that it has less precipitation, warmer air temperatures, more open south aspects, and shallower soils. Green Point subwatershed does not have as many high elevation springs as the other subwatersheds.

Available data suggests that stream temperatures in Green Point subwatershed have warmed in excess of that allowed by current Mt. Hood National Forest Plan standards. The primary factors are timber harvesting, Skyhook Fire, and water withdrawals. Green Point Creek and, possibly, Long Branch Creek have experienced the greatest changes due to the Skyhook Fire (1971) and subsequent salvage. All trees within the high intensity portion of the burn were salvaged, both live and dead. All streams in Green Point subwatershed have water withdrawn for irrigation, power generation, or both.

Changes in peakflow are driven by changes in vegetative cover, as are changes in stream temperature, and also by changes in infiltration rates. Less vegetative cover often results in an increase in snowpack. Under forested conditions, the tree canopy captures a significant portion of the annual snowfall and much of this snow evaporates off the trees (sublimes) rather than melting. At present, we have "substituted" clearcutting and shelterwoods for wildfire such that the amount of the watershed in an open condition likely falls within the range of natural conditions. However, the sizes, shapes, and distribution of those openings are not within the range. Further, these openings lack the snags and downed logs that played an important role in the hydrologic cycle.

We have changed the infiltration rate of the watershed, although we do not know if the change is statistically significant. Roads have converted forested areas into "permanent" openings and permanent areas of low or no infiltration. Road density for West Fork watershed is 4.7 miles per square mile of open, driveable road. This figure underestimates the actual road density since we do not have maps of all the roads on other ownerships. The high road density within the watershed, probably has resulted in some increase in peakflow.

Peak annual flows in this watershed usually occur between December and February, due to rain-on-snow events. Snowmelt typically peaks in April. Lowest flows tend to occur in September or early October. West Fork watershed has more similarities with streams west of the Cascade crest on the Mt. Hood National Forest than with most watersheds east of the crest.

On all ownerships, drainage ditches can divert water from floodplain recharge areas to another water conveyance. Riparian areas shrink and water enters the stream system much faster, rather than being stored for more gradual release later. Under current standards, other landowners in the watershed are permitted to build and retain more roads that the Forest Service is allowed. As road densities increase, the ability of floodplains and wet areas to store the water received decreases.

Before 1900, peakflow fluctuated over a wide range due to the typical disturbance regime. Immediately following a major disturbance peakflow would increase dramatically. Over time, vegetation would recover on the uplands and riparian areas and the system would return to an extended period of relative stability. The disturbance regime resulted in a wide range of expected peakflows from smaller events. Harvesting on all ownerships has probably extended the period of peakflows at the high end of the range due to the shorter rotations and greater area affected at one time.

We examined the Aggregate Recovery Percentage (ARP) for all sixth field watersheds in West Fork watershed. According to this model, harvesting and roading have placed Long Branch Creek, Divers Creek, and Lake Branch at the highest risk of increased peak flow of the 1-10 year rain on snow events (Table 5.9). North Fork Green Point Creek is harder to evaluate since much of this sixth field watershed cannot support closed canopy forest for an extended period of time. The large open slopes on Green Point and North Fork Green Point creeks allow deep snowpacks to accumulate. Since the air temperature fluctuates widely in winter, these two sixth field watersheds are highly susceptible to rain-on-snow events.

Table 5.9. ARP values for sixth field watersheds.

6th Field Watershed	Acres	ARP	Rating[1]
Green Point subwatershed		72.3%	CONCERN
Dead Point Creek	4,320	74.3%	Concern
Green Point Creek	6,192	71.0%	Concern
N. Fork Green Point Creek	4,806	76.6%	OK
Long Branch	2,158	62.4%	At Risk
Lake Branch subwatershed[2]		66.3%	AT RISK
Lake Branch	12,055	66.1%	At Risk
Lost Lake	1,582	85.9%	OK
Divers Creek	2,848	56.0%	At Risk
Laurel Creek	2,003	66.9%	Concern
West Fork subwatershed		74.3%	CONCERN
Camp Creek	1,845	75.5%	OK
Marco Creek	1,280	69.7%	Concern
Tumbledown Creek	1,211	74.9%	Concern
Red Hill Creek	1,873	70.5%	Concern
Ladd Creek	4,110	82.0%	OK
Jones Creek	2,272	80.5%	OK
McGee Creek	3,444	78.1%	OK
Elk Creek	2,049	79.6%	OK
West Fork Hood River	11,408	69.0%	Concern
ENTIRE WATERSHED	65,457	71.5%	CONCERN

[1] ARP >75% = 'OK', ARP 65-75% = 'Concern', ARP = <65% = 'At Risk'

[2] Threshold of concern = 85%, all others = 75%

F. Is there a need for additional land exchanges between the Forest Service and other owners to restore or enhance habitat conditions and dispersal corridors?

Yes. To provide consistency in management for important habitat and to partially restore former dispersal corridors, there are certain parcels which would eventually result in habitat conditions and dispersal corridors more favorable to anadromous fish, and northern spotted owl if included in federal ownership.

The first parcel we identified as critical was the Longview Fibre in-holding along West Fork Hood River. Acquiring this parcel would help:

◊ block up ownership in historic aquatic and riparian habitat,
◊ provide better connectivity for aquatic and riparian species,
◊ allow for greater restoration of anadromous fish habitat,
◊ help maintain resident fish habitat, and
◊ reduce sediment input from major sediment sources.

Much of this parcel would fall into the Riparian Reserve allocation under federal ownership. Riparian Reserve objectives emphasize creation and retention of late successional forest, aquatic and riparian functioning, and recovery of aquatic habitat. Longview Fibre will most likely manage for early to mid-seral forests.

Longview Fibre's objectives and management strategies are considered sound forestry for the industrial production of high levels of wood. We believe that West Fork Hood River, inside the National Forest boundary, provides or potentially provides critical habitat for restoration of harvestable levels of anadromous fish and for restoration. Probable short term riparian stand conditions are not expected to provide the levels of downed wood needed by natural means.

In previous discussions with Longview Fibre, they have clearly stated that they are not interested in selling their lands for cash. They are interested in trading their land for other timber producing lands. If we cannot acquire the entire in-holding in a single exchange we recommend acquiring the parcel through time by exchanging for various parcels in a priority order (Figure 5.4 and Table 5.10).

Table 5.10. Priority parcels for acquisition of Longview Fibre in-holding on West Fork Hood River.

Priority	Reason
1	Potential Sediment sources
2	Anadromous fish
3	Anadromous fish, connectivity
4	Anadromous fish, connectivity
5	Potential Sediment sources
6	Potential Sediment sources, resident fish habitat
7	Sediment sources

An alternative to acquiring the entire parcel is to purchase riparian buffers along West Fork Hood River, Elk Creek, McGee Creek, and Ladd Creek.

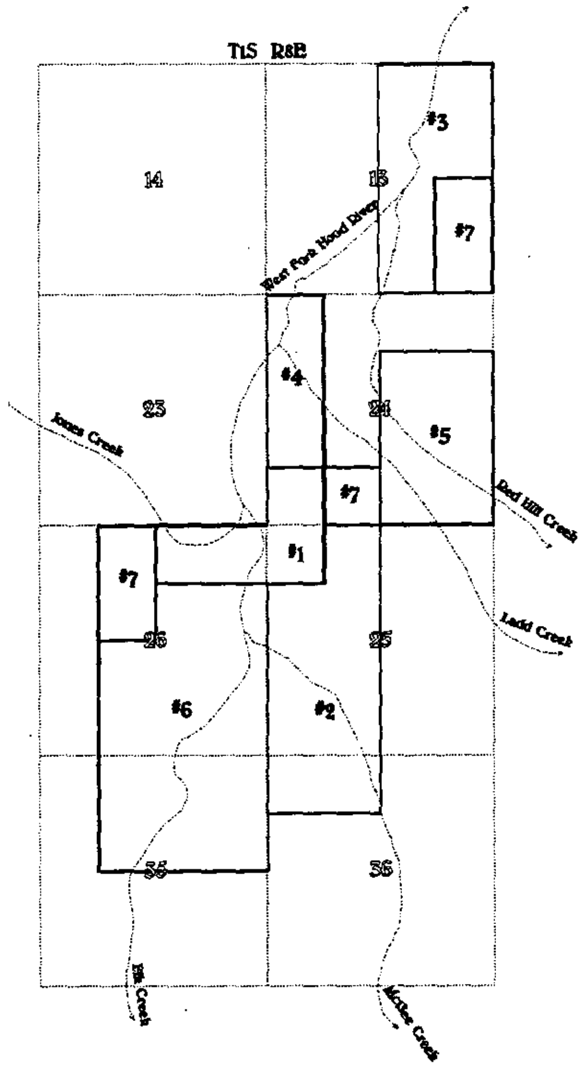


Figure 5.4. Priority ranking of portions of Longview Fibre in-holding for acquisition.

In addition to the Longview Fibre in-holding, we identified a need to acquire or re-acquire lands along the eastern boundary of current National Forest ownership. Some of these lands were recently traded to Hood River County and Longview Fibre. These lands are important for the north-south connectivity for northern spotted owl dispersal around Hood River Valley. The traded parcels also influences the connectivity and dispersal routes for species dependent on late or mid-successional forests and with smaller home ranges between Mt. Defiance and the remainder of the watershed.

Both Hood River County Commissioners and Oregon Department of Forestry personnel have expressed concerns about increasing the National Forest System acreage percentage within the County. The Commissioners do not want to reduce the Counties tax base and ODF does not want to reduce their fire protection tax base.

Issue 6: The National Forest may not be able to provide for the levels of various extractive forest products demanded by the public while meeting the goals and objectives of the Northwest Forest Plan.

A. *Has the district adequately provided for tribal treaty rights?*

Yes. The National Forest System Lands within West Fork watershed are ceded lands as defined in the Treaty of 1855. Rights specifically stated in the Treaty with the Tribes of Middle Oregon (1855) include:

> "*Provided, also,* That the exclusive right of taking fish in the streams running through and bordering said reservation is hereby secured to said Indians; and at all other usual and accustomed stations, in common with citizens of the United States, and of erecting suitable houses for curing the same; also the privilege of hunting, gathering roots and berries, and pasturing their stock on unclaimed lands, in common with citizens, is secured to them."

Currently, the Columbia River Inter-Tribal Fish Commission and the Forest Service are trying to resolve the Commission's appeal of the Mt. Hood National Forest Land and Resource Management Plan (Appeal No. 91-13-00-0123). The Confederated Tribes of Warm Springs believe that we have only "partially" provided for tribal treaty rights. They state that not only did the tribes: 1) retain aboriginal fishing rights at usual and accustomed fishing places, but 2) are entitled to 50% of the harvestable numbers destined to pass usual and accustomed fishing places, and 3) fish must be present to be taken. They strongly believe that the Tribes, States, and Federal Government share the responsibility to protect and enhance fish habitat.

Relative to habitat to produce harvestable numbers, the Confederated Tribes of Warm Springs believe that the most significant of the unresolved issues in the current appeal are the need for no cut buffers, inadequate sediment modeling, and the need for rangeland condition analysis.

The Confederated Tribes of the Warm Springs Reservation of Oregon identified many resources on the eastside of the Mt. Hood National Forest used for ceremonial, traditional, and other purposes. These include a wide variety of food plants, animals for clothing and shelter, medicinal plants, and weaving materials. At least one "usual and accustomed station" for catching anadromous fish lies within West Fork watershed.

No specific areas for gathering plants have been identified in West Fork watershed. Historic accounts and cultural resource surveys have found sites traditionally used for gathering huckleberries and peeling cedars. Some sites were still in use during the 1940s. The Northwest Forest Plan provides a higher level of protection for such resources than the Mt. Hood Forest Plan.

The only culturally important plants in West Fork in which the Confederated Tribes of the Warm Springs have expressed interest are huckleberries. There may be additional plants used by tribal members living in the Hood River Valley. The Mt. Hood National Forest and the Confederated Tribes of the Warm Springs Reservation of Oregon have drawn up a Memorandum of Understanding (MOU) around management of big huckleberry (*Vaccinium membraneceum*) but neither party has signed it. To date, Hood River Ranger District has not specifically managed for huckleberry production within West Fork watershed. Several species of huckleberry grow in the watershed and the potential to enhance berry production is quite high.

The Hood River Production Plan (HRPP) is an on-going project managed by CTWS and ODFW, in conjunction with BPA. The plan targets augmentation of stocks of summer steelhead, winter steelhead, and spring chinook currently in the basin.

CTWS and ODFW have established the following goals for the HRPP:

1. The rehabilitation program will be consistent with tribal treaty rights, US-Canada Pacific Salmon Treaty and the Columbia River Basin Fish and Wildlife Program, and other applicable laws and regulations.
2. Re-establish naturally sustaining spring chinook runs in the Hood River Subbasin.
3. Rebuild naturally sustaining summer steelhead runs in the Hood River Subbasin.
4. Rebuild naturally sustaining winter steelhead runs in the Hood River Subbasin.
5. Maintain the genetic character of naturally producing populations of salmonids native to and re-established in the Hood River Subbasin.
6. Contribute to Columbia River tribal and non-tribal fisheries, ocean fisheries, and the Council's interim goal of doubling salmon runs.
7. Achieve the following goals for adult returns to the mouth of the Hood River (Table 5.11).

Table 5.11. Run size goals for anadromous fish in the Hood River basin.

Species	Natural	Hatchery	Total
Spring chinook	400	1,300	1,700
Fall chinook	1,200	N/A	1,200
Summer steelhead	1,200	6,800	8,000
Winter steelhead	1,200	3,800	5,000
Coho	600	N/A	600
Total	4,600	11,900	16,500

The Forest Service has engaged in habitat improvement projects over several years designed to benefit both resident and anadromous fishes. Several projects have been completed in cooperation with ODFW, USFWS, BPA, Longview Fibre, and Farmers Irrigation District. The CTWS have supported these restoration efforts, but still has concerns over fine sediment and stream temperature. As discussed in Key Question 5E, stream temperatures in West Fork are within suitable ranges for anadromous fishes. Management strategies within Riparian Reserves will continue to focus on restoring riparian functions, complexity, and connectivity.

Most of the fine sediment production in West Fork watershed is related to roads and management-related debris flows. Within the West Fork both natural and management related slides and debris flows have occurred. Chronic road related sediment problems exist at the confluence of Elk and McGee creeks. Much of this sediment is road related and enters directly into the West Fork below Twin Bridges. Lake Branch has some of the clearest water during high flows, normally the period of highest turbidity, of all streams in West Fork watershed. Green Point subwatershed normally has relatively clear flows, but stream surveys have noted excessive fine sediment levels (>20% sediment ≤ 6mm) in North Fork Green Point Creek and Gate Creek.

Both to deal with the fine sediment levels and due to declining budgets, the three eastside districts on the Mt. Hood National Forest have been analyzing access and travel needs. The goals of the planning effort are:

- ◊ reduce open road densities to meet Mt. Hood Forest Plan standards,
- ◊ reduce road maintenance needs by reducing the miles of open roads, and
- ◊ reduce erosion risk and sediment production by obliterating unneeded roads.

Between 1992-1994, the District obliterated approximately 16 miles of road throughout the watershed, but primarily in Lake Branch subwatershed. The Access and Travel Management (ATM) planning identified only three primary roads in West Fork watershed which will remain open: Roads 13, 18, and 1810. Decisions were made to close approximately 26 miles of non-system roads (roads not officially part of the road system) and dead end roads and spurs. Some were obliterated in 1995. Additional analysis is needed before deciding what to do with the remaining roads. Decisions to be made include whether to retain the road or obliterate it, whether to adjust the maintenance level, and whether a seasonal closure is needed. Chronic road maintenance problems have been identified on the several major roads (Table 5.12).

Table 5.12. Chronic road maintenance problems.

Road	Problem	Location	Remarks
1310	No footings on bin wall, eroding away from base	T1N R8E sec. 25	
2820	Fill failure and debris flow	South of Black Lake	Road closed just before failure point
2820	Washout due to inadequate drainage facility	Dead Point Creek	Forest Service Road, washout located on other ownership
2810	Fill cracking	T1N R9E sec. 11	Forest Service Road, problem located on other ownership, may cause debris flow into West Fork Hood River
2810	No vegetation on cutbank, concrete barricade unable to accommodate volume and size of falling rocks, culverts plugged	T1N R9E sec. 1	Approximately 1 mile of road affected, all on National Forest System Lands
13	Rockfall mitigation fence on cutbank is failing	T1N R9E sec. 30	Forest Service Road, problem affecting other ownership
13	Debris flow from landing above	T1S R8E sec. 8	
1660	Road fill failures and debris flows	Stump Creek	
1810	Debris flow	T1S R8E sec. 25	Forest Service road, problem located on Longview Fibre land
1810-630	Debris flow and drainage problem	T2S R8E sec. 1	
1810	Debris flow and drainage problem	T2S R8E sec. 2	
Various	Inadequate drainage maintenance	Primarily Maintenance Level 2 roads	Many culverts only partially plugged, expect blowouts and washouts to develop in near future
Various	Cutbank erosion and failures	Cutbanks greater than 65% slope	Many lack vegetation, problems noted even on banks with vegetation that also seep water in the spring

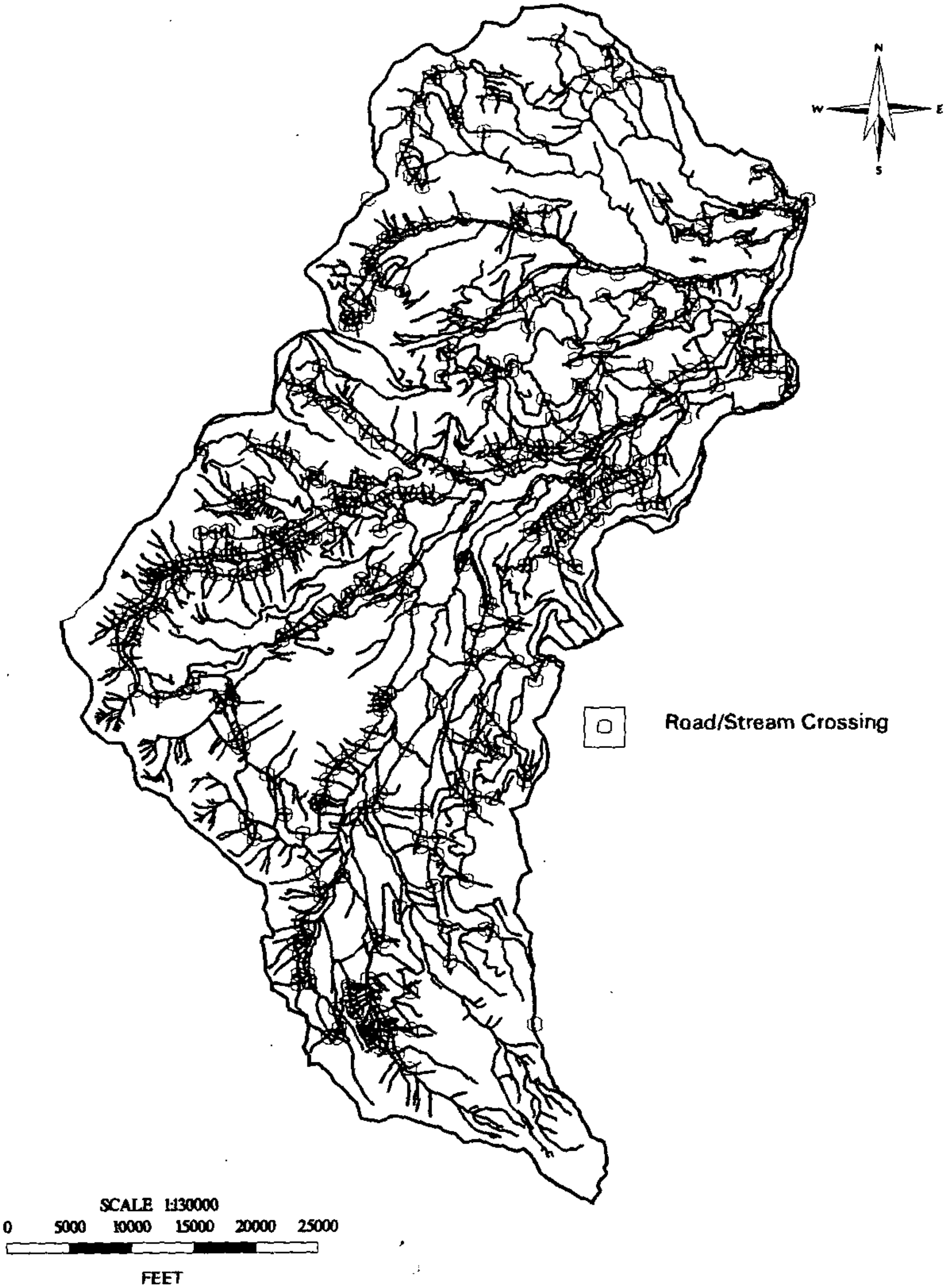


Figure 5.5. Road intersections (crossings) with streams.

In addition to the ATM planning effort, we examined which roads may be or have the potential to contribute the most fine sediment to streams within National Forest System Lands. We looked for which roads ran along streams within 200 feet and 400 feet on either side of all stream crossings. We examined the erodibility of the soil according to the Soil Resource Inventory (SRI) for the Mt. Hood National Forest (Table 5.13). We also looked at where we had chronic road maintenance problems as an indicator of erodibility and instability. Our first conclusion was that the erosion hazard ratings of the SRI need to be reexamined. We noted some severe erosion problems where the SRI hazard rating was only "moderate."

Table 5.13. Road sediment delivery potential.

Delivery Potential	Erosion Potential			
		SRI Erosion Hazard		
	Road Surface	High	Medium	Low
Within 400' of Stream Crossing	Native	0.5[1] (2.5 miles)	0.9 (4.4 miles)	0.02 (0.1 mile)
	Other	2.0 (9.6 miles)	5.6 (26.1 miles)	0.6 (2.9 miles)
Within 200' of Stream	Native	0.08 (0.4 mile)	0.02 (0.1 mile)	0.02 (0.1 mile)
	Other	0.3 (1.5 miles)	1.0 (4.9 miles)	0.6 (0.3 mile)

1 Percent of total miles of road in each category. Percent does not include rating for roads outside National Forest boundary. (Values in parentheses are miles of road)

It appears that little or no erosion hazard related to roads or management induced debris flows and torrents exists around Lost Lake or in Long Branch Creek and Dead Point Creek on National Forest System Lands. Ladd Creek is a major sediment source, but very little appears to be management related. Ladd Creek is the only glacially influenced stream in West Fork watershed. We also believe that changes in management of intermittent streams and general forest management under the Northwest Forest Plan should reduce the incidence of management induced debris flows and torrents associated with timber harvesting. At present, there is little we can do to correct existing problems except to promote rapid growth of conifers in existing clearcuts.

In addition to road closures on National Forest System Lands, road closures and obliteration's on other ownerships would reduce the fine sediment delivery potential and increase riparian and aquatic habitat quality.

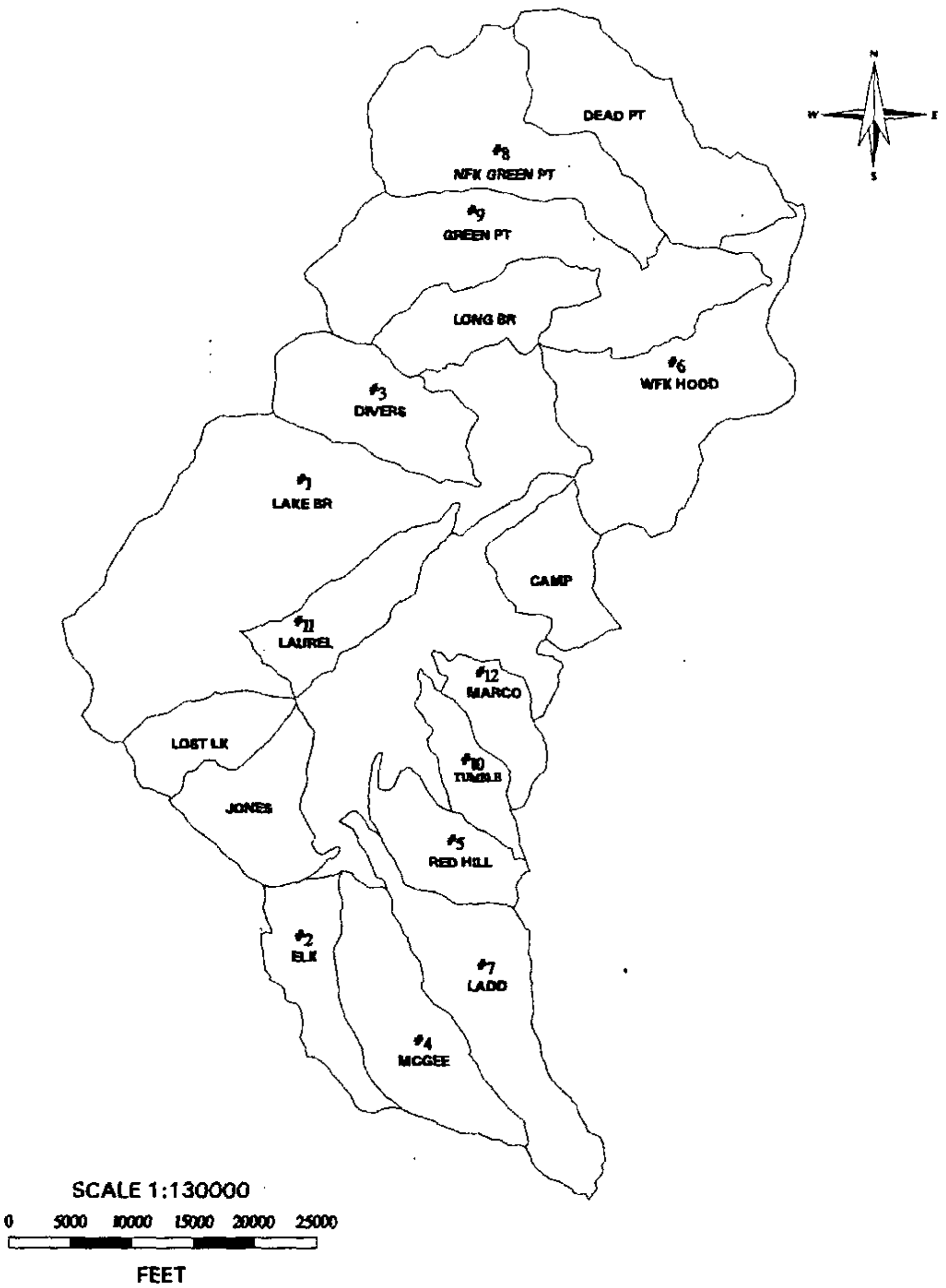


Figure 5.6. Priority ranking of sixth field watersheds for road closures / obliteration's.

B. Are mining areas on National Forest System Lands sited in appropriate locations to meet the ACS objectives?

Yes. There are only four actual mining areas (all rock pits) in West Fork watershed. Of these, the north edge of Raker Pit lies within a Riparian Reserve and Tower Pit lies in a Riparian Reserve. The other two pits, Defiance and Jones Creek, are located well away from any Riparian Reserves. The District also has several stockpiles of rock, of which some are in Riparian Reserves. Ladd Creek stockpile lies half on National Forest System Lands and half on Longview Fibre lands.

Of the four pits, only Raker has known erosion problems. This pit lies at the base of a steep hillside. The erosion potential was recognized earlier and a catch basin constructed to trap rock chips and sediment. This catch basin needs to be cleaned out yearly or it will no longer serve its purpose. Rainfall events since late October 1994 have resulted in the catch basin almost filling and the movement of some rock towards Lake Branch. At present, all rock is still within the defined pit area, but washing beyond the pit area could occur over fall and winter of 1995-96 if no actions are taken.

Stockpiles of rock are constructed for several reasons. In the past, stockpiles were constructed primarily in anticipation of road construction and maintenance needs in areas relatively far from the source pit. Most recently, most stockpiles consist of rock removed from roads before obliteration and from ditch clean out. The material from ditches also contains soil and other material.

The construction and maintenance needs for rock is less than what had been projected in the 1980s. This change is due to closing more roads than predicted, reduced harvest, and reducing maintenance standards. The number and size of stockpiles are expected to increase due to the expected number of road obliteration's. Rock pulled from obliterated roads could be used for future road maintenance on retained roads. West Fork watershed may no longer need to maintain four pits. Two pits may be sufficient when coupled with strategically placed stockpiles.

C. Is water currently over-allocated on either a legal or ecological basis?

Yes. Water is over-allocated on an ecological basis in Green Point subwatershed. **No**, water is not over-allocated anywhere in the watershed on a legal basis. All streams in Green Point subwatershed are diverted and several stream segments are de-watered in the summer. De-watering breaks riparian and aquatic habitat connectivity.

If many diversions are shut down in winter or handle reduced flows, then peakflows should remain relatively unaffected. Depending on when the diversions actually start and stop, some "bankfull" flow events may be less. If so, then Green Point subwatershed may be less capable of flushing out fine sediment from natural levels of erosion, much less sediment related to management activities. Summer baseflow is inadequate for fish in much of the subwatershed. The diversions may have reduced the riparian zone. In turn, habitat for wet site species, such as *Botrychium* species, may be reduced in places such as the de-watered floodplain of Gate Creek. De-watering may also provide a competitive advantage to upland brush species.

Some of these losses may be partially off-set by leaks from open ditches or around pipelines. Ditch leakage does not create the same type of habitat, since the leak usually occurs on an open slope. Leaks also indicate a predilection for failure and subsequent debris torrent or flow, and indicate inefficient use of water. Farmers Irrigation District has identified a need to replace much of the current system with a piped, pressurized system to gain to most efficient delivery of water.

In-stream minimum flows have been established in lower Green Point Creek for anadromous fish spawning and rearing. However, this flow rate may be insufficient for adult resident fish and some other aquatic organisms. Water diverted from Green Point subwatershed is moved into different watersheds. For example, water for hydroelectric generation is diverted into the mainstem Hood River.

Diversions also exist in West Fork and Lake Branch subwatersheds. The City of Hood River has water rights from Cold Springs, Stone Springs, and Laurel Creek for domestic use. These water sources are the city's main supply. At present, the city is utilizing only part of its rights at the springs and none of its right to Laurel Creek. The Dee irrigation diversion originates on the West Fork Hood River approximately two miles northeast of the Forest boundary. This diversion takes only a little water and the irrigation district has not been able to maintain its delivery system in good condition. Leakage from the mainline ditch is substantial. Even during the summer months parts of the Hood River Ranger District seed orchard adjacent to the ditchline are not accessible to heavy equipment because of the leakage.

Oregon Water Resources Board has indicated that no additional consumptive water rights will be approved for West Fork watershed. While the watershed is not legally over allocated, in August and September the watershed's flow levels drop to near 20% as measured near the confluence with East Fork Hood River. Further, East Fork Hood River and the mainstem Hood River are over-allocated in a legal sense. Any in-stream water rights approved would only replace existing in-stream rights. At present, ODFW holds an in-stream water right in Green Point Creek for 20 cfs from October 15 to December 31 and 40 cfs from January 1 to April 15.

D. *Is current direction adequate to halt or reverse the decline of native fish stocks in the watershed?*

Yes and No. For several indigenous stocks, current direction is too late and the stocks are considered extinct, such as Hood River chinook and coho. Runs of spring chinook and coho in the Hood River are composed of hatchery fish or their descendants. Steelhead stocks are a mixture of hatchery and wild fish.

Current direction is generally adequate to halt and / or reverse declines in habitat on National Forest System Lands that support native resident fish stocks and freshwater residence periods for anadromous stocks.

Halting or reversing the decline of anadromous fish stocks, will take the combined effort of many agencies, several countries, private companies and public support. The alteration of out-of-basin habitat, ocean fisheries, changing ocean conditions, degraded water quality, and urbanization effect fish runs, but are not within the scope of this analysis. Only Forest Service and local direction will be further elaborated.

The Aquatic Conservation Strategy objectives in the Record of Decision for the Northwest Forest Plan (ROD 1994) apply to all land managed by the Mt. Hood National Forest in the West Fork of the Hood River drainage. This plan has substantially increased stream buffer widths of all streams, including intermittent channels. Interim minimum buffers are: fish bearing streams are 300' on each side, non-fish bearing perennial streams are 150' on each side, and intermittent streams are 100' on each side. All recommended interim buffer widths were either kept or substantially increased by this analysis process due to the unstable nature of the watershed. A map and narrative of the recommended riparian buffers for West Fork Hood River subbasin is in Chapter 6, figure 6.1. Riparian Reserves are portions of the watershed where riparian-dependent resources receive primary emphasis. Activities that retard or prevent attainment of the Aquatic Conservation Strategy (ACS) Objectives are prohibited. The ACS Objectives include maintaining and/or restoring of the following: connectivity of drainage networks, physical integrity of systems, water quality, sediment regime, in-stream flows, water table, species composition and diversity, and habitat to support well-distributed populations of native species (page B-11 in ROD to Northwest Forest Plan). The desired future condition for riparian reserves is a late-successional forest stand type. Any management within the Riparian Reserves will have to meet the ACS objectives to promote attainment of the desired future condition.

The CTWS and ODFW are currently implementing a large supplementation program within the Hood River subbasin with goals to reestablish naturally sustaining spring chinook runs, and rebuild summer and winter steelhead runs. Fish run size goals are listed in Table 5.11, and includes present run size estimates. ODFW has also maintained a closure to fishing, for much of the West Fork mainstem and Lake Branch, to protect spawning anadromous stocks.

Some factors that may naturally limit fish production exist within the West Fork, including: glacial input of sediment fines each summer from Ladd Creek into the mainstem of West Fork, natural water falls and/or steep drainage topography which tends to be less productive than lower gradient systems, the steep nature of the drainage results in areas prone to mass wasting events on a regular cycle, the contribution of fines to portions of the watershed that may take several years to recover. Areas prone to landslides include McGee Creek, upper Lake Branch, Ladd Creek and portions of Green Point Creek.

E. Does commercial forest management by other owners restrict the Forest Service's ability to manage vegetation to meet Mt. Hood and Northwest Forest Plan objectives?

Yes. Hood River County manages their commercial forest management on a 90 year rotations. Longview Fibre, who owns most of the non-federal land in the watershed, manages for a 60 year rotation. Neither 90 or 60 years is sufficient time to develop late successional forest. At best, stands on the other ownerships will reach the Mature Stem Exclusion stage. At that point, the stands are commercially mature and to hold the stands longer does not make economic sense. In addition, the BPA powerline corridor is maintained in an early seral condition and requires access roads to service the lines and towers. Problems include:

Difficulty in attaining adequate hydrologic recovery. The Mt. Hood Forest Plan restricts the amount of each analysis area that can be in a "hydrologically unrecovered" state. For planning purposes, the Ranger District uses a risk prediction model (Aggregate Recovery Percentage -- ARP) to predict the susceptibility of a watershed to sustain damage from winter rain-on-snow events. This model predicts this risk solely on the basis of the state of hydrologic recovery of the vegetation and does not account for variations in climatic, geographic, or other environmental factors. Roads are never considered hydrologically recovered. Timber stands are considered hydrologically recovered when canopy closure reaches 70% and stand diameter averages 8 inches DBH; hydrologic recovery usually occurs around age 35-40 in West Fork watershed, depending on the soil productivity. In calculating hydrological recovery before harvesting National Forest System Lands, we must include all ownerships within the watershed or subwatershed. Lake Branch subwatershed is particularly restricted since it is a Special Emphasis Watershed.

If we assume that the short rotations on other ownerships means that at any one time approximately 1/2 of their land is considered unrecovered. With 35% of West Fork watershed in other ownership, an average of 17-18% of the watershed could be hydrologically unrecovered. This percent will actually vary through time and between individual sixth field watersheds and subwatersheds. However, since no more than 18% of Lake Branch subwatershed and 25% of all other subwatersheds and sixth field watersheds should be hydrologically unrecovered at any one time, harvesting on some National Forest System Lands may be restricted or may require an Environmental Impact Statement rather than an Environmental Assessment.

In Lake Branch subwatershed, other owners own approximately 16% of the subwatershed. If 8% is unrecovered at any one time, then National Forest regeneration harvesting can only occur on 10% of the subwatershed at any one time, assuming all National Forest System Lands are considered hydrologically recovered. This assumption does not include the effects of roads and road densities. This low percentage of potentially available land could force a longer rotation on National Forest System Lands than was anticipated in the Mt. Hood Forest Plan.

Other sixth field watersheds could face similar restrictions and extensions of planned rotation ages. Those most likely to be affected include Camp Creek in West Fork subwatershed and all sixth field watersheds in Green Point subwatershed. In addition to possibly extending rotations, the hydrologic recovery levels on other owners could restrict the Forest Service's ability to deal with the insect epidemic on Mt. Defiance under the auspices of an EA.

Connectivity. The only late successional habitat likely to develop on the other ownerships will be in areas of the watershed that they cannot log with the available technology. We do not expect this to be a significant part of the watershed. In essence, there will most likely be little or no connectivity for species dependent on late successional forest or older mid-successional forest on the other ownerships. This concern has been discussed in several key questions already. The Forest Service will have to provide the needed north-south connectivity between Mt. Defiance and the remainder of the watershed. East-west connectivity between both sides of Hood River valley is limited, due to ownership patterns and management objectives. This connectivity need is why we recommended retaining four B5 areas in West Fork watershed.

Roads. Roads have the potential to contribute large volumes of fine sediment in the watershed. The BPA powerline corridor may have more roads than are needed to provide adequate access to line and tower maintenance. These are all native surface roads, which can contribute high levels of fine sediment. If portions of these roads are not needed, they could be obliterated to reduce fine sediment.

On National Forest System Lands, we do not have enough funding to close unneeded roads fast enough to avoid major problems. Road maintenance funding has not been adequate for the past two years. Many culverts are partially plugged now. Even after closing unneeded roads, we doubt we will have enough funding to maintain the remaining roads sufficiently to avoid chronic problems with washouts and blowouts.

F. Can West Fork provide the needed habitat to meet state management objectives for deer, elk, and fish?

Yes for deer and fish, **No** for elk. Deer population numbers are above the targeted level whereas elk numbers are below. Population numbers are probably most limited by available winter range. Even though the Mt. Hood National Forest has designated winter range on National Forest System Lands in West Fork, in reality the winter range lies on other ownerships. The south aspects on National Forest System Lands are heavily forested and generally lack forage, with the exception of Green Point Creek in the Skyhook Burn.

Off National Forest System Lands, elk presence conflicts with orchard production. Elk can significantly damage an orchard during the winter, so are not desired. Oregon Department of Fish and Wildlife conducts many depredation hunts in winter to reduce elk numbers in the orchards. The agency is considering de-emphasizing elk through much of the Hood River basin to reduce the need for depredation hunts and reduce orchard damage.

Streams within the West Fork were stratified by gradient, using information acquired through stream and channel validation surveys from 1993 to 1995 (Figure 1 of the Fisheries report in the Appendix). Unsurveyed streams were stratified through calculations of the weighted average gradient between tributary junctions from USGS Quad maps. In perennial streams, the lowest gradient reaches (2% or less) are potential "hotspots" for fisheries production. Low gradient reaches are depositional areas for wood, and sediment. Moderate gradient reaches (2 to 4%) are transition areas for wood and sediment transport, are moderately productive for fish, and highly productive for amphibians. In headwater areas, moderate gradient reaches are most commonly boulder step-pool channels, and are resistant to management impacts (Rosgen 1994, Montgomery and Buffington 1993). High gradient reaches (4-10%) are transport zones for wood and sediment, fairly productive for most fish, and highly productive for amphibians. The typical bedrock-boulder, cascading step/pool channel morphologies are resistant to management impacts. Steep (>10%) headwater reaches are not often naturally fish-bearing. Fish may occupy these areas if they were stocked in lower gradient reaches or lakes upstream, and have moved down during higher flows (for example Rainy and Gate Creeks).

As indicated by stream gradients of 0 to 3.9 % within the West Fork, the most suitable habitat for anadromous fish may be within the mainstem, Lake Branch, the lower 1.5 miles of Green Point Creek, and the lower 1/2 mile of McGee, Elk, Red Hill, and Jones Creeks. Radio tracking data and spawning surveys have shown adult salmon and steelhead to use the entire West Fork, lower 1/2 mile of McGee Creek, Lake Branch to Diver's Creek, and the lower 1.5 miles of Green Point Creek for spawning. Resident fish distributions tie closely to gradients up to 9.9% as well as some higher gradient reaches where resident fish have moved down from stocked lakes. Along with gradient, channel type gives clues as to the stream's sensitivity to disturbance and potential for improvement and recovery. Several stream sections have been typed using Rosgen methodology (Figure 2 of the Fisheries report in the Appendix). In general, "B-type" streams or, pool-riffle and step-pool channels as classified by Montgomery and Buffington (1993), are most responsive to large wood input in streams with stable channels. In Montgomery's chapter on Response Potential of stream channels, he states that," A decrease in the supply of large woody debris (LWD) in a steeper-gradient, forced pool-riffle channel may result in significant morphological changes, including: pool loss, increased effective shear stress and potential conversion to a plane-bed morphology". Montgomery and Buffington define plane-bed channels as channels of the same gradient as pool-riffle channels, but lack well-defined bedforms and are characterized by long stretches of relatively planar channel bed. These channel types may be rare in undisturbed forests where the majority of pools and bars are LWD dominated. Rosgen suggests similar concepts, noting that most B-type systems are receptive to large wood additions to create habitat. An ODFW publication notes that productive steelhead habitat is characterized by complexity, primarily formed by large and small wood (ODFW 1995). Juveniles will take advantage of microhabitats to seek refuge from high water velocity, temperatures, and predation. Winter and summer habitat requirements are different. Considering that wild steelhead and chinook salmon remain in the freshwater system for 1 to 3 years before migrating to ocean habitat, stream habitat affects a critical portion of their life cycle. Large wood and associated complexity in habitat is generally lacking in West Fork Hood River tributaries, except where several stream restoration projects have been implemented in portions of West Fork, McGee Creek, Lake Branch and Green Point Creek. Considering the size of the trees within riparian stands around the turn of the century, large wood volume is likely much lower now than ever before in the history of the watershed. There are many opportunities to improve stream habitat if large enough wood becomes available.

Twenty two sites within the West Fork Hood River drainage were set up as monitoring points for surface fines and channel morphology (Figure 3 of the Fisheries report in the Appendix). Sample sites were selected in low gradient depositional areas (<10%) when this was available, with the assumption that fines will settle within these reaches. In tributaries where low gradient reaches were not present, the transects were set up at the mouth of the tributary. The percentage of total fines calculated, was based on Wolman (1954) "pebble count" methodology. Pieces of substrate were collected across transects that run perpendicular to the flow in fastwater riffle and pooltail crest spawning habitats (n≥100 substrate samples were taken at ≥10 transects/locations). The protocol methodology and data are on file at the Hood River Ranger Station. The current Mt. Hood National Forests Land and Resource Management Plans (LRMP) standards for surface fines within spawning areas is "<20% surface fines <1mm". Bjornn and Reiser (1991) demonstrated that survival of salmon and trout embryos decreases rapidly when fine sediment, <6 mm diameter, exceeds 20%, because eggs and fry are dependent on course substrates with high oxygen levels during development. Of the sample sites surveyed, 1 (Gate Creek) of the 22 sites did not meet LRMP standards, while 3 of the sites (Gate Creek, Upper North Fork Green Point Creek, and Deer Creek) did not meet Bjornn's standards (Table 6 of the Fisheries report in the Appendix). Overall West Fork Hood River does not seem to have significant sediment problems within fish spawning areas, with the exception of North Fork Green Point Creek just below Black lake. These monitoring sites will provide a view of trends within the West Fork system in years to follow.

As noted in Tables 5.14 and 5.15, Lake Branch (below Lost Lake & at the Forest boundary) and Green Point Creek both currently exceed the Mt. Hood National Forests Land and Resource Management Plan Standard of 14.4°C or 58°F from late July to early August. Figure 5.3 displays temperature regimes within Lake Branch. Only Lake Branch (below Lost Lake) exceed the State Water Quality Standard of 17.7°C or 64°F. During this time period, rainbow and steelhead trout are mostly in their latter stages of emergence from redds or are rearing in the stream system. In general, the preferred temperatures for salmonid fish are around 10-16°C (Behnke 1992, Bjornn and Reiser 1991), while life threatening temperatures are around 23-25°C, though fish attempt to move to areas of lower temperature when subjected to these higher temperatures. The West Fork subwatershed has temperatures low enough for bull trout use (Table 3 of the Fisheries report in the Appendix). Bull trout may attempt to colonize the West Fork or they may be present but are as yet undetected.

Lack of long term historic data precludes making definitive conclusions. Lake Branch and Green Point Creek may naturally have a higher temperature regime than West Fork subdrainage, but this is likely exacerbated by timber harvest and or the Skyhook fire. Recovery of the riparian reserve in Lake Branch and Green Point subwatersheds are critical components to restoring natural temperature regimes within the drainage (Appendix C - Hydrology Report)

Table 5.14. Water Temperature Statistics for Monitored Streams in the West Fork of the Hood River Watershed.

STREAM	7AH	7AHDate	DAYS >FPlan	ANN MAX	MAX RNG
Lake Branch - NF Bdy	15.8	8/01-8/07	24	16.7	4.5
Lake Branch - Below Lake	19.9	7/16-7/22	83	21.1	5.5
Ladd Creek	11.4	7/30-8/06	0	12.5	5.3
McGee Creek	11.2	7/17-7/23	0	11.7	2.8
West Fork Hood River	13.3	7/31-8/06	0	13.9	4.7

7AH - Seven day average high temperature. This statistic is used in the Federal Watershed Analysis Guide. The dates given specify time during which the 7AH occurred.

DAYS>FPlan - Number of days the maximun daily stream temperature exceeded the MHNF Forest Plan Standard of 14.4°C.

ANN MAX - The annual maximum stream temperature.

MAX RNG - The annual maximum diurnal temperature range.

Table 5.15. Green Point Creek Maximum Temperatures: Historical vs. Current (in degrees C)

	1950-1954	1994
June Maximum	13.3	14.4
July Maximum	15.0	17.6
August Maximum	15.6	16.6
September Maximum	13.9	13.9

Only two culverts were identified to be potential passage barriers within the West Fork Hood River. One is on No-name creek, the other is on Indian Creek. Considering the gradient of over 10% above these culverts, these tributaries may not have been naturally fish bearing. Surveys will be done to verify if there is truly a need to modify these culverts.

G. Can West Fork provide the projected PSQ in the Mt. Hood Forest Plan as amended by the Northwest Forest Plan?

Yes, although at a slightly lower level than initially calculated by the Supervisor's Office (SO). The SO estimated an average annual harvest level of 2.775 MMBF from West Fork watershed. We estimated a probable cut level using the following assumptions:

1. Average annual growth rate equals 500 BF per acre on a rotation age of 100 with commercial thinnings at age 40 and 80.
2. All Mt. Hood Forest Plan "A" allocations, the mapped and 100 acre LSRs, and all Riparian Reserves are not part of the timber base. All other lands are Matrix lands and used in the calculations.
3. No late successional forest or retained B5 area is available for harvest over the next 10 years.

We used 500 BF per acre per year growth rate to account for the different productivity levels in each of the three subwatersheds. Lake Branch is the most productive and Green Point is the least. Total National Forest ownership in West Fork watershed is approximately 42,728 acres. Removing all the unavailable lands from consideration leaves about 15,440 acres of available Matrix lands, almost all in the C1 land allocation. Theoretical timber production is then 7.721 MMBF per year. We reduced this volume by 2/3's--one third to account for past over harvesting which restricts most entries to commercial thinnings, and one third to mitigate harvesting on other ownerships in the watershed (see Key Question 6E). The end result is that 2.6 MMBF is theoretically available each year from West Fork watershed. This volume roughly equates to 60 acres of regeneration harvest or 250-500 acres of thinning each year.

The annual available volume is very little. There are several strategies that will provide the decadal PSQ and start to create patterns more typical of the pre-1900 landscape and desired future conditions. Landscape Analysis and Design will explore the strategies in more detail.

H. Can West Fork provide the demanded levels of firewood and still meet Northwest Forest Plan objectives?

Yes, provided that firewood is generated by actions and activities other than timber sales and demand does not increase. Historically, the District sold permits for 600 permits total. Currently, we sell 200 permits on average, district-wide. Permits average 2.3 cords each. The average by-product production of firewood from timber sales was 50 cords per 1 MMBF harvested. An average annual timber harvest of 2.6 MMBF from West Fork would theoretically create 130 cords of firewood. However, this estimate does not account for current market or stand conditions. Under the current market, utilization is much higher with purchasers removing down to a 2 inch top diameter and with a chip market paying more for wood than low grade sawlogs. The by-product production rate also assumes a regeneration harvest of old growth timber, which typically contains a high level of cull and unusable tops and limbs. Most stands potentially available for harvesting today are younger than 125 years and the entry is most likely to be a commercial thinning.

The amount of firewood produced varies between each sale. We estimate that current stand and market conditions would likely yield 0-10 cords per 1 MMBF harvested as a by-product. An average annual harvest of 2.6 MMBF would then produce only 26 cords, at most. Assuming that firewood production was equally allocated among the three watersheds in Hood River basin, then West Fork watershed should be expected to provide at least 67 cords. Since Middle Fork watershed is so small and West Fork watershed is the most productive, we feel it is reasonable to expect West Fork watershed to provide between 75-100 cords. Clearly alternative sources of firewood are needed to meet West Fork's share of the demand.

We believe that West Fork can provide sufficient firewood through a variety of sources. These include, but are not limited to, precommercial thinnings, roadside hazard trees, blowdown, and green firewood sales either to individuals or businesses. These alternative sources will probably require administration, much as regular commercial timber sales require. Another potential source may be roadside logs considered excess to the needs of wildlife habitat and site productivity.

Most firewood cutters on Hood River Ranger District come from either Hood River valley or the Portland metropolitan area. Many people from Hood River valley obtain their firewood from Hood River County, Longview Fibre, and the orchards. For those that cut firewood on National Forest System Lands, the Red Hill area has been the most popular location, distantly followed by Mt. Defiance.

Another potential problem with meeting the demand is whether the by-product firewood generated from harvest is actually available for collection. In general, people will not go farther than 50 feet maximum distance downhill to retrieve firewood. They usually only go about 100 feet uphill on average, depending on slope steepness and whether the wood is visible. People will travel farthest from the road on flat ground, averaging about 150 feet. If the by-product firewood is all located within the landing deck or close to the road, people will retrieve it and we can meet the demand. To assist in making the maximum firewood available, we should stipulate that purchasers sort the cull or waste material at the landing and stack potential firewood in a location and manner safe for people to access and cut.

I. Can West Fork provided the demanded levels of other special forest products and still meet the Northwest Forest Plan objectives?

Yes, as long as demand remains primarily with individuals and local residents of Hood River valley. Most special forest products are currently under free use permits, which are not restricted in availability. Bough and beargrass collectors are under fee permits which are restricted in availability. If demand increases, particularly for certain products, we will not be able to meet the demand. Requests for special forest products include landscape transplants, Christmas trees, boughs, mushrooms, fruits, berries, beargrass, forest greens, and medicinal plants.

Bough collectors prefer noble fir, but requests for western redcedar boughs is increasing. Western redcedar boughs are used in some American Indian ceremonies, although we do not know if these are ceremonies practiced by the tribes with treaty rights. Demand for fir boughs is relatively low in West Fork since the noble fir there is not of the best quality. Problems with quality include yellow or off-color foliage and undesirable branch shapes. Noble fir is also not that common in West Fork watershed, relative to other locations on the forest.

Western redcedar is often in demand elsewhere on the Forest for shakes, shingles, posts, and poles. The western redcedar in West Fork watershed is not of high quality to generate good quality products. If a demand develops in the future, West Fork will not be able to provide much redcedar. Over the long-term we will not meet the demand for Christmas trees due to lack of regeneration harvests. Most current plantations will soon be too tall. We probably cannot meet the demand for medicinal plants due to lack of supply. We also lack knowledge on the life cycles, reproduction rates, and response to collection of any medicinal plants. One species in much demand is valerian (*Valerian sitchensis*).

We may have difficulty meeting the demand for mushrooms and huckleberries in Lost Lake LSR. The District does not have a commercial demand for mushrooms, except after a large fire. However, we have no information on whether these collection activities significantly interfere with attainment of LSR objectives or not. Lost Lake LSR is a potentially high source of both mushroom species associated with late successional forest and huckleberries. Visitors to Lost Lake are particularly interested in huckleberry collection as a family outing activity. Huckleberries are common in the understories around Lost Lake. Huckleberry production depends on created openings to allow enough light to reach the brushes. Management objectives in LSRs under the Northwest Forest Plan do not emphasize management created openings, with the possible exception of those needed to meet treaty obligations.

Issue 7: The LSR in West Fork includes a portion of the Bull Run Watershed Management Unit. The management objectives of this buffer area may conflict with the management objectives for the LSR.

A. Would the objectives of a bill, such as the one proposed in 1994, potentially result in any adverse or beneficial impacts on either our ability to manage the LSR to meet Northwest Forest Plan objectives or on other resources within West Fork?

Yes. Buffer expansion into the West Fork of Hood River, would result in adverse impacts on our ability to manage Lost Lake LSR to meet Northwest Forest Plan objectives. "Late Successional Reserves are to be managed to protect and enhance conditions of late-successional and old-growth forest ecosystems, which serve as habitat for late-successional and old-growth related species including the northern spotted owl. These reserves are designed to maintain a functional, interacting, late-successional and old-growth forest ecosystem." Reading the standards and guidelines reveals an intent that LSRs should function in much the same way as wilderness, particularly once stands are older than 80 years. Lost Lake LSR is a westside type LSR, even though it lies east of the Cascade Crest. Therefore, we believe the westside related standards and guidelines are more applicable. Since the standards and guidelines prohibit timber harvest except in the event of a catastrophic event and in stands less than 80 years old, it seems to us that the intent is to allow natural processes to be the primary determinants of forest conditions within an LSR. It is not clear whether the guidelines for reducing the risk of a large-scale disturbance would apply to a westside type LSR since these guidelines are listed in the section for East of the Cascades and in the Oregon and California Klamath Provinces.

Natural processes that have the greatest influence over forest conditions in Lost Lake LSR include rare, but widespread insect outbreaks, rare, but large-scale stand replacing fire, and mass wasting. The fire regime and insect regime are tied together. Large-scale stand replacing fire probably occurs every 400-500 years in Lost Lake LSR and is driven by climate cycles. The insect outbreak regime is also driven by this same climate cycle. Various types of mass wasting events occur more frequently than stand replacing fire and insect epidemics.

Due to its size, shape, and location, we could not allow stand replacing fire to resume a more natural role in Lost Lake LSR. The LSR is relatively small, oriented north-south along the Pacific Crest, includes the Lost Lake Special Interest Area, and abuts a large private in-holding managed as commercial forest. Past fire patterns indicate that a stand-replacing fire originating within the LSR would quickly spread beyond the LSR boundaries to the east, driven by a strong west wind. Based on the past burn patterns, this likely scenario poses an unacceptable risk to Lost Lake Campground and Resort and the Longview Fibre in-holding. At maximum capacity, it appears that the road system around Lost Lake is inadequate to evacuate all visitors while allowing entry by fire suppression forces.

Since we cannot allow fire to play its natural role, we must replace it as best we can with vegetation manipulation. This would not be easy since that portion of the LSR between Buck Peak and Devil's Pulpit lies within the viewshed of Lost Lake. However, trees do not live forever. As stands age, they become increasing susceptible to disturbance. Vegetation manipulation would be needed both in an attempt to forestall the major disturbance and to start a new stand. The disturbance regime in this LSR is such that we would need to treat large areas at once to more closely mimic fire effects.

Standards and guidelines for LSRs permit thinning to encourage more rapid development of late successional forest conditions. Much of the LSR south of Sentinel Spur (Road 1340-620) has been harvested within the last 50 years. Thinning should accelerate development of late successional forest conditions.

Expanding the Bull Run buffer would severely restrict our ability to meet LSR objectives. Prescriptive legislation such as that previously proposed would not permit the District to develop silvicultural prescriptions; it would require that scientists from the Pacific Northwest Research Station (PNW) develop the prescriptions and those prescriptions would be subject to peer review before proceeding. It would not allow any vegetation manipulation unless research by PNW proves that the manipulation benefits water quality and quantity. No other objectives would be permitted. As such, we could not respond quickly to developing situations, such as attempting to avoid a catastrophic event. We likely would not be permitted to thin to develop late successional forest structures.

While benefiting water quality and quantity are laudable goals, they make no sense in the context of the proposed buffer expansion. The proposed expansion area in the Lost Lake area would not provide any water to Portland. This water all flows east into Hood River and the Columbia River. Portland Water Bureau has not been awarded any rights to the water in the existing or proposed expanded buffer. Thus, it does not seem reasonable for Portland Water Bureau to control the quality and quantity of water which is not in their watershed.

When late successional forests are relatively healthy and serving their intended function, the buffer expansion would make no difference on our ability to meet LSR objectives. When the LSR is dominated by late successional forest or already altered by a natural event, then there would be some differences between management strictly under the standards and guidelines for LSRs and under any legislation expanding the buffer. The differences may not be significant, particularly if we assume that LSRs are intended to function much as wilderness does. The LSR standards and guidelines allow for salvage following a catastrophic event whereas any buffer expansion would not. Thus under the prescriptive legislation it would be more difficult to salvage in an attempt to avoid the reburn that is typical of this fire regime.

B. Does the LSR and Riparian Reserve designations provide adequate protection to the Bull Run watershed from natural disturbances and human activities in West Fork?

No for fire and human activities, **Yes** for insects. Portland Water Bureau is most concerned about protecting the Bull Run watershed from catastrophic fire, insect outbreak, and disease levels. Buffer expansion would be intended to increase the level of protection from events originating outside the Bull Run watershed. Their strategy is based on the assumption that vegetation manipulation and recreation only increase the risk of catastrophic events.

Fire. The LSR and Riparian Reserve designations do not provide adequate protection to the Bull Run from fire for two main reasons. First, the Bull Run is at a very low risk from fires originating in West Fork watershed. Second, the fire regime of this area is driven by climate. Large scale events that would potentially threaten the Bull Run occur under such extreme conditions that land allocation and stand age are largely irrelevant.

Past burn patterns and branch flagging currently seen on trees south of Indian Mountain suggest that this area of the watershed is subject to stronger west winds than east winds. Strong west and east winds can occur any time of the year, west winds are more characteristic of mid-April through mid-September while east winds are more characteristic of mid-September through mid-April. The Lolo Pass area appears to receive at least some sheltering from east winds, although the exact mechanisms are not clear. The difference is wind patterns may be related to its position on the north flank of Mt. Hood and the resulting turbulence created by the surrounding topography.

We know that fires can easily burn from West Fork into the Bull Run under low wind conditions. In this case, the fire would be responding to the slope and burning uphill. Under low wind conditions, fires typically cross over a ridge and often stop spreading. This aspect of fire behavior is well known and documented and often figures strongly in suppression tactics. Under such conditions, a fire under low wind conditions would not burn very far into the Bull Run.

We contacted Dr. Jim Agee, who is conducting a study of disturbance history and patterns associated with the Bull Run watershed. There have been no major fires with a common boundary between Bull Run and West Fork since 1700. Apparently fires did enter the Bull Run from the Sandy River and the Columbia Wilderness in the same time period. Before 1700 it is probable that there were fires that did cross the boundary between the two waterwsheds. Dr. Agee believes these fires likely originated from the east. We believe they could have also originated from the west, based on local experience. A weather station, such as a RAWS, placed in the Lolo Pass area and used to monitor windspeeds and direction for several years would help clarify this issue. Large west wind fires tend to occur in August. Large east wind fires tend to occur in September and October.

Lastly, recent research on the Yellowstone Fires of 1988 has revealed some interesting aspects of fire behavior and burn patterns under extreme conditions. Researchers found that in very long return-interval fire regimes, fuel moisture and weather conditions needed to allow a large fire to burn are so extreme that essentially all forest lands, regardless of stand age or condition, are available to burn. Turner and Romme (1994) found that the Yellowstone Fires burned through all forest age classes in proportion to their presence on the landscape. For example, if the Understory Reinitiation Stage occurred over 30% of the landscape, then 30% of those stands burned. The bottom line is that large stand-replacing fires that could threaten the Bull Run watershed and West Fork subwatershed tend to happen under such extreme conditions that land allocation, buffer width, and stand conditions are largely irrelevant. Fire spread is characterized by very fast moving crown fires and long-range spotting over 1/2 mile from the head of the fire. Topography and soil type prevent the use of bulldozers to construct control line is most of the LSR. Many decades of fire fighting experience have shown that fire suppression efforts during major fire runs under such conditions are ineffective and extremely dangerous. It does not matter how wide the buffer is, it will not protect the Bull Run watershed from such events originating within the LSR or immediately to the east.

Human Activities. The purpose of restricting human entry, particularly recreation related entry, into the Bull Run Management Unit is to protect the water quality. Human entry is currently restricted in the present buffer to the PCT. Riparian Reserve and LSR standards and guidelines emphasize dispersed recreation over developed recreation. The expanded buffer would allow continued use of existing trails, much as would occur under LSR and Riparian Reserve designations. Restricting human activities in that portion of the buffer in West Fork watershed does nothing to protect water quality in the Bull Run, regardless of land allocation. This fact is simply because water originating in West Fork watershed does not flow into the Bull Run watershed. Therefore, the level of human activity in the LSR, Riparian Reserve, or Bull Run buffer is irrelevant to the quality of Portland's water supply.

Restricting human activities in West Fork will only potentially protect Portland's water quality when the city is awarded a water right to West Fork water and begins to exploit that right. Currently, the city has no water rights to water originating in West Fork watershed. Since recreational access is still permitted along the PCT, which runs along the ridge dividing West Fork and Bull Run watersheds, neither expanding the buffer or retaining the area solely as LSR and Riparian Reserves will make any difference.

Insects. Riparian Reserve and LSR designation would afford a higher level of protection to the Bull Run watershed than expanding the buffer. Under previously proposed legislation, vegetation management would only be allowed to improve water quality and quantity and only the scientists at PNW would be allowed to prepare the silvicultural prescriptions. These prescriptions would then be subject to peer review by the scientific community.

Under this scenario, we could not respond quickly to epidemics which may threaten to move into the Bull Run watershed. The peer review process often requires 1-2 years to complete, delaying action. It is unclear if spraying with pesticides would be allowed under that proposed legislation. Further, spraying is only a stop-gap measure. The epidemic will continue as long as the stands are dominated by host trees or the environmental stress remains high. In the area of any buffer expansion, moisture stress would be the most likely driver of a major insect epidemic. For the epidemic to persist in the same manner as on Mt. Defiance, the moisture stress would need to continue for many years, which also indicates development of the extreme conditions needed to support a major fire.

CHAPTER 6

Recommendations

CHAPTER 6: RECOMMENDATIONS

Introduction

As part of Watershed Analysis, we are required to develop a more detailed Desired Future Condition than is stated in either the Northwest Forest Plan or the Mt. Hood Forest Plan. We used a strategy that was consistent with existing policies, direction, Forest Plan Standards and Guidelines, and land allocations to develop the desired future condition for the West Fork. It is intended to translate the broad guidelines into something more specific to the West Fork watershed. Any conflicts that may arise should be the result of better ecological understanding of the watershed as a result of the analysis. We did not depend very heavily on the range of natural conditions in describing the desired condition. The range of natural conditions is so broad for most elements on which we had information, that it did not help define a strategy.

Desired Future Condition applies only to National Forest System Lands. Since we also need to discuss the future of the entire watershed, we need some way to assess what is likely to happen on the other ownerships. Our basic assumption is that the current management goals, objectives, and methods of these owners will not change in the foreseeable future. Therefore, rather than discussing the other ownerships in terms of Desired Future Condition, although these owners may have such descriptions internally, we discuss the other ownerships in term of trends, using the basic assumption above. The Trends on other ownerships is presented first, followed by Desired Future Condition on National Forest System Lands and recommendations for managing those lands.

Trends--Non-federal lands

Younger age classes and structure types dominate the landscape. Late Seral Multistory stands are found primarily in areas uneconomical to log and in the Riparian Management Areas (RMAs) provided by implementing the State Forest Practices Act. The width of RMAs varies by stream type, and provides some quality habitat for riparian associated species and some dispersal habitat for late successional dependent species. The largest snags are typically found in the RMAs and snags in general are concentrated there.

The landscape patterns created by the non-federal land owners are highly variable but at least somewhat reflective of the pre-1900 landscape pattern. Created openings vary in size and shape and tend to have abrupt edges. Hood River County lands tend to reach the Mature Stem Exclusion stage with elements of Late Seral Multistory, due to the length of their planned rotations (90 years). Longview Fibre lands occasionally reach the Mature Stem Exclusion stage, but more tend to reach the Understory Reinitiation stage before regeneration harvesting.

Stream temperatures are suitable for anadromous and resident fish on National Forest System Lands. Stream shade is adequate and a diversity of riparian tree species are found. Trees left under the State Forest Practices Act provide an adequate number of snags and downed logs to maintain pools and hold spawning gravels. The streams provide at least the same quantity and quality of spawning and rearing habitat for anadromous and resident fish as they do now.

Longview Fibre roads generally remain gated except during hunting season, limiting recreational access to their lands. Hood River County roads generally remain open, but are little used except as routes to destinations on National Forest System Lands or elsewhere. All lands are generally open during hunting season.

The lower end of the watershed remains in agriculture, such as pear and apple orchards. The private fish hatchery on Dead Point Creek continues to operate. Water quality and quantity remain suitable for this operation to continue. In general, land ownership patterns and land uses remain stable.

Desired Future Conditions--National Forest System Lands

Late successional forest dominates Lost Lake LSR, the 100 acre LSRs, and all Riparian Reserves. The B5 areas are no longer needed. The size, shape, and distribution of late successional patches in the remainder of the watershed is sufficient to maintain habitat connectivity across West Fork watershed and between West Fork and the adjacent watersheds. The location of the late successional patches varies over time. In general, the boundary between older stands and younger stands is not distinct, but fuzzy. Edge contrast between older and younger stands is not as sharp as typically seen today.

The sizes and shapes of individual forest patch types, such as Stand Initiation, Stem Exclusion, and so forth, are characteristic of the pre-1900 disturbance regime. Individual patches are very large, up to several hundred acres in size, with an irregular shape and feathered edges. The amount of edge feathering varies, with the most variation along the edge most directly exposed to the strongest winds typical of an individual subwatershed. In West Fork subwatershed, the feathering is most pronounced on the eastern edge of the patches. In Green Point subwatershed, feathering is highly pronounced on both the east and west edges.

Snags are well distributed across the landscape, occurring both as clumps or patches of varying size and as individual trees. Snags vary in size, species, and decay class. Downed logs are also well distributed across the landscape and occur in numbers and sizes more characteristic of the successional stage and ecologic capability of the site.

The Riparian Mix stand type dominates the riparian areas, occasionally broken by variously sized patches of Riparian Hardwood and Riparian Conifer stand types. Natural forces operating within the various ecosystems largely determine riparian and aquatic habitat conditions, including numbers and sizes of pools and downed logs, logjams, spawning gravels, water temperature, and turbidity.

The BPA powerline corridor is managed for low growing vegetation that does not interfere with the powerlines and reduces maintenance costs for the corridor. Parts of the corridor are used to produce various special forest products and seeds for the native plant propagation program. Stewardship programs are used to help commercial ventures provide some of these products. The edges are feathered or otherwise managed to reduce the visual impact of the corridor.

Noxious weeds are under control and considered a minimal problem. Native plants are used in all restoration, erosion control, wildlife forage, and emergency rehabilitation efforts. A native plant propagation program is in place and producing the needed levels of seeds, cuttings, and other propagules. Species management plans are in place for all applicable plant, animal, and fish species, and producing desired population levels, reproduction rates, and distributions.

The watershed provides habitat to sustain fish numbers consistent with State and CTWS objectives. Species and stocks are well distributed within natural habitat. Fish stocking is no longer needed to sustain either resident or anadromous fish populations in the streams. Fish stocking in the high lakes occurs only as needed to provide recreational opportunities, yet maintains adequate connectivity and dispersal habitat to assure the continuing populations of native aquatic and riparian associates. Limited non-indigenous fish species remain in the watershed. At least one lake is fishless and a working management strategy provides for populations of amphibians, invertebrates, and zooplankton at species compositions and population levels characteristic of the pre-1900 condition.

Northern spotted owls and other species associated with late successional forest have recovered in the watershed and are well distributed throughout. The watershed supports a diversity of terrestrial wildlife species. The only limited species are those whose habitat has always been scarce in the subwatershed. Populations of species strongly associated with a particular successional stage fluctuate throughout time, but adequate refugia are always present to allow the species to persist long enough to repopulate the area once their typical seral stage returns. Dispersal pathways exist between West Fork and the adjacent watersheds for species associated with all successional stages.

Peregrine falcons and bald eagles have returned to the watershed and are breeding regularly. Visitors occasionally spot California condors soaring over the watershed.

Visitors view a landscape pleasing to the eye with patch sizes and shapes that vary and follow the typical landform. Evidence of harvesting may be detectable, but does not dominate the landscape. Most views attain at least the Partial Retention VQO. The more developed recreational experience is found only at Lost Lake. The remainder of the watershed offers a more primitive recreational experience where encounters with others are generally limited or rare. Limited directional signing is provided except to Lost Lake. Recreational use in winter is particularly limited and focuses on the more adventuresome user. Over-snow routes have been designated, but may not be fully utilized every year due to fluctuating snow levels.

The trail network provides varying levels of challenge for both able and disabled visitors. The least physically challenging trails are found around Lost Lake. As visitors move further away from Lost Lake, the physical challenge increases. Wilderness trails and parts of the PCT are the most primitive. Trails are well located and maintained to a standard that prevents erosion or other resource damage.

Road closures and obliterations have reduced road densities to levels within Mt. Hood Forest Plan standards. The remaining roads have road management objectives and their drainage networks minimize erosion and sediment delivery to streams. Cutbanks and fill slopes are stable and fully vegetated. Roadsides are brushed and hazard trees are promptly dealt with to minimize safety concerns to Forest visitors along major travel routes, in campgrounds, and around dispersed campsites.

Dispersed campsites are located in suitable areas to provide the desired setting and minimize impacts to other resources. Vegetation provides adequate screening between individual sites. Dispersed camping is well distributed across the watershed. Informational materials help dispersed users know where to go and what to expect. Some sites are more developed than others.

Management Strategy

Downed Wood (Key Questions 4B and 4C)

- Within regeneration harvest units these loadings should remain after fuels treatment/site preparation is complete:
    1. Crest Zone: 25-50 tons per acre, at least five tree-length logs per acre. Tree-length (whole tree) should reflect the species mix of the stand and average stand diameter and height.
    2. Transition Zone: 10-20 tons per acre. at least three tree-length logs per acre. Tree-length (whole tree) should reflect the species mix of the stand and average stand diameter and height.
- At least 75% of the loading after harvest should be in material larger than 3 inches in diameter.
- Within the Crest Zone, no more than 25% of the Forest Service managed acres in each subwatershed should fall below 30 tons per acre.
- Within the Transition Zone, no more than 15% of the Forest Service managed acres in each sixth field watershed should fall below 12 tons per acre.

- At the subwatershed level, manage for the following percentages of the above tonnages after regeneration harvest within each size class:

Size Classes[1]	Zone	
	Crest	Transition
3-6 inches	10-15%	10-15%
6-12 inches	10-20%	15-25%
12-20 inches	35-40%	40-50%
20+ inches	25-45%	20-25%
[1] Average diameter of log		

- The 15% green tree retention guidelines in the Northwest Forest Plan should provide an adequate input of twigs, branches, and needles to quickly rebuild and/or maintain sufficient duff and 0-3 inch woody material to meet short-term nutrient needs. The current guidelines in the Mt. Hood Forest Plan for duff and 0-3 inch woody material may no longer be needed. Exceptions may exist to protect rare or sensitive fungi, lichens, bryophytes, and vascular plants.
- Silvicultural prescriptions and fuel treatments should assure downed wood potential remains across harvested units. One method might be to ensure the spacing between dispersed individual trees does not exceed 90% of the combined heights. For example, if two leave trees were each 150 feet tall, the spacing between these two trees should not exceed 270 feet.
- Woody material left after regeneration harvesting and fuel treatment should be more-or-less evenly distributed across the unit.
- No stream reach should be devoid of downed wood as a result of human activities such as timber harvest, firewood collection, or recreation. Do not remove any in-channel downed wood unless a clear danger is identified for personal injury or death to people, or damage to uses downstream (i.e. campgrounds, bridges, etc.).
- Monitor streams within the Columbia Wilderness and Bull Run watershed that are representative of streams in West Fork to determine the range of in-channel and riparian wood levels by Rosgen reach class, how downed wood loadings change over time and how various disturbance factors affect wood levels.
- Use the recommendations in FW-094 for the number of in-channel large wood pieces per mile only for restoration projects and only until monitoring elsewhere better determines the appropriate levels of in-channel wood.
- Develop a standard and guideline for in-channel and riparian downed wood that recognizes that wood levels vary naturally. The standard should probably be based on an entire stream basis, rather than on a reach basis.

Snags (Key Question 2C)

- Place nest boxes in or near young stands that lack snags and the BPA powerline corridor (on National Forest System Lands).
- Conduct regular surveys for snag numbers, sizes, and decay classes during stand exams, stocking surveys, or other stand inventories and create snags in those stands that are lacking.

Pools (Key Question 4C)

- Monitor streams in the Columbia Wilderness and Bull Run watershed that are representative of streams in West Fork watershed to determine the range of pool sizes and number of pools per mile.

- Develop standards based on pool quality. The standards should consider pool forming structures, Rosgen reach class, fish cover, residual pool depth, and substrates for biological activity.
- Pool filling should not occur as a result of excessive sedimentation originating from Forest Service activities, such as erosion or mass wasting associated with roads, timber harvest, recreation, and inappropriately placed rock and ditch clean-out stockpiles.

Water Temperature (Key Question 5E)

- Attempt to model the natural range of stream temperatures based on current climate data and the probable pre-1900 riparian canopy closures. Vary riparian canopy closures and cover type (deciduous verses evergreen) to simulate disturbances and recovery from disturbances.
- Monitor stream temperatures in North Fork of Green Point Creek to help determine current temperature ranges.

Sediment (Key Questions 6A and 6B)

- Use a sediment standard more reflective of the spawning needs of anadromous fish (i.e. ≤20% surface fines <6 mm) in all streams except Ladd Creek. Develop a standard for Ladd Creek that recognizes the natural glacial sediment loads in summer.
- Determine how far down West Fork Hood River sediment originating in connection with Ladd Glacier affects fine sediment loading in the mainstem. Develop a standard that recognizes the effects of this natural sediment source.
- As stream conditions recover, develop methods or guidelines to handle or incorporate sediment pulses caused by natural, or background, levels of mass wasting.
- Implement the results of the Eastside ATM planning. Favor road obliterations over road closures for unneeded roads.
- Evaluate road closure/obliteration needs by sixth field watershed in the following priority order:

  A. Lake Branch
  B. Elk Creek
  C. Divers Creek
  D. McGee Creek
  E. Red Hill Creek
  F. West Fork Hood River just east of Marco Creek
  G. Ladd Creek
  H. North Fork Green Point Creek
  I. Green Point Creek
  J. Tumbledown Creek
  K. Laurel Creek
  L. Marco Creek

- Continue partnerships with other ownerships to restore sediment producing roads and other potential areas.

- Evaluate the existing pits for need by either the Forest Service or another agency. If there is a projected need, maintain the pit in a condition that does not prevent attainment of the ACS objectives. If the pit is not needed, either use the site as a stockpile or reclaim it. Reclamation may be to a level that allows continued removal of small quantities of rock under permit for private individuals. Raker and Defiance pits are probably no longer needed for Forest Service purposes.
- Do not site stockpiles in Riparian Reserves unless the stockpile uses an existing pit or road section. Remove any existing stockpiles in Riparian Reserves with either identified or potential erosion problems.
- Develop and maintain a database of stockpile locations. The database should, at minimum, include fields on estimated volume stored, available storage capacity, and type of material stored.
- Inventory and reclaim the many small, unofficial pits used to rock short road segments throughout the watershed.

Vegetation Management

- B5 management areas managed for late successional forest should have a planned rotation of at least 200 years. The longer rotation is needed to develop and retain late successional forest and more closely mimic the pre-1900 disturbance. (Key Questions 2G and 6E).
- Due to its scarcity (19% of the watershed) and location, do not harvest any existing Late Seral Multistory stands until objectives and management strategies have been developed (Key Question 4B).
- In general, utilize even-aged management strategies in West Fork and Lake Branch subwatersheds to achieve the desired conditions. Occasional use of uneven-aged strategies may be appropriate to create landscape and stand diversity, particularly in LSRs and Riparian Reserves. Treat large continuous areas, several hundred acres in size, to develop a less fragmented landscape and a landscape pattern more typical of the pre-1900 conditions (Key Question 4B).
- Utilize a mix of even-aged and uneven-aged management strategies in Green Point subwatershed on both uplands and riparian areas. Treatment areas should vary over a wide range of sizes, from several hundred continuous acres to a minimum of 1/2 acre. Regeneration opening sizes within upland areas, should vary from 1/2 acre to 100 acres. The smaller the opening size, the greater the distance between openings to reduce fragmentation (Key Question 4B).
- Use native species or sterile non-natives for wildlife forage enhancement and erosion control seed mixes. All seed mixes should meet the state's noxious weed free seed certification tests or come from locally established native plant nurseries with certified noxious weed free growing areas. All native seed mixes should meet regional genetic guidelines (Key Question 1B).
- In the Mt. Defiance Forest Health area, set up trial prescriptions based on the Mica Timber Sale and observations in the area. Use fertilizing, thinning, and underburning in various combination. Maintain an untreated area for comparison with the trial areas. In marking Douglas-fir leave trees, favor individuals whose buds burst later in the spring than the majority of the trees. Consider varying the timing of fertilization and the type of fertilizer and thinning to different spacings. The trials should cover a large area. Leave as many green trees as can be expected to live and continue into the next stand. Leave the difference in the 15% goal in snags. Leave the largest snags that safety regulations permit.
- Work with CTWS to identify potential huckleberry production areas and develop a strategy to manage for huckleberries (Key Question 6A). One potential production area may be the BPA powerline corridor.

- Develop a strategy, or strategies, for handling the requests for various special forest products. The strategy or strategies should address where to locate various products, whether opportunities exist for active management of certain products and what management is needed, and what level of demand can be met before detrimental impacts result in loss of productivity either for the product in demand or the ecosystem as a whole (Key Question 6I).
- Focus vegetation management activities in riparian areas on restoring long term riparian stand function to improve overall water quality and provide downed wood input. Close and obliterate unneeded roads to reduce fine sediment input from road surfaces, cutbanks, fillslopes, and road failures (Key Question 2G).

Botany

- The following noxious weed control actions should occur (Key Question 1C):
    - Teach all field-going employees to recognize and report noxious weeds. Encourage employees to uproot any small isolated weed populations and report it as soon as possible to the District Noxious Weed Coordinator.
    - Manage / limit all detection weeds found in the watershed. Manually remove potential invaders, including scotch broom outside the powerline corridors.
    - Promptly reseed bare ground at landings, skid trails, and so forth with certified noxious weed free native seed or sterile non-native seed, or native shrubs. Evaluate the need for prompt reseeding after major disturbances, such as fires, floods, mass wasting, and so forth, using the same guidelines. The seed mix used should be appropriate for the project objectives.
    - Monitor noxious weed treatment areas and displacement trials in the watershed and regularly update GIS and database records of noxious weed populations.
    - Develop and maintain a standardized database for tracking noxious weed populations. The database should include fields for observation date, population size, and treatments used. The database should link with GIS data layer with a unique polygon assigned to each population of each species. Coordinate database development with other landowners in the watershed and ODA.
    - All heavy equipment used on National Forest System Lands should be cleaned before entering any project area within the watershed.
    - Use integrated pest management and more aggressive techniques to contain established infestations of knapweed, St. Johnswort, Canada thistle, and scotch broom. Consider using chemical control methods to reduce knapweeds to levels manageable by other methods.
    - Develop a public education program to help visitors recognize and report noxious weeds. Venues could include events such as county fairs as well as the Visitor's Center. Consider offering a "bounty" on noxious weeds, such as a free Christmas tree permit for a given number of bags of pulled noxious weeds.
    - Plant low growing shrubby native species along roadsides to control noxious weeds such as knapweeds and the prevent reinvasion. Potential replacements include such species as pinemat manzanita (*Arctostaphylos nevadensis*), and kinnickinnick (*Arctostaphylos uva-ursi*).
    - In cooperation with BPA, Longview Fibre, and ODFW develop a vegetation management strategy for the powerline corridor that allows use of the corridor for alternative, or special, forest products, reduces vegetation maintenance needs, reduces use of herbicides, reduces the presence of noxious weeds, and provides for wildlife habitat diversity. Consider the use of Land Stewardship contracts to accomplish these goals on National Forest System Lands.

  * Enforce an existing CFR requiring the use of certified noxious weed free horse feed in the Columbia and Mt. Hood wilderness.

- Survey 25% of unharvested areas as required in the Monitoring Plan of the Mt. Hood Forest Plan for threatened, endangered, and sensitive plants. Focus such surveys on the Mt. Hood Wilderness (Key Question 2G).
- Support development of a strategy to keep declining plant species from becoming listed (Key Question 2B).
- Help develop guidance to determine how to maintain the integrity of special and unique habitats. The strategy should discuss how to decide which examples of a habitat type to protect, how to determine which ones are worthy of protection, when differing degrees of protection are warranted, and how to maintain the connectivity between these special and unique habitats (Key Question 2B).
- In cooperation with Framers Irrigation District and ODFW, change the diversion at Gate Creek to remove only the allocated right and provide telemetry at the headgate to assure the irrigation district's customers that the allocated right is diverted (Key Question 5B).
- Resurvey the 1956 site location for *Potentilla villosa* var. *parviflora*. Conduct extensive surveys in the Mt. Hood Wilderness for this species. If found, assess the probable impacts of recreation use on existing and potential habitat and develop a species conservation guide in line with Mt. Hood Forest Plan direction (Key Question 1H).

Wildlife

- Support development of a regional interagency strategy for wolverine. The strategy should address provision for summer and winter refugia and connecting corridors, habitat diversity, and prey base needs (Key Question 2B).
- Support development of a regional strategy for Townsend's big-eared bat to provide protected habitat and hibernacula. The strategy should also address how to deal with that have the potential to create habitat, and assure genetic flow at the metapopulation scale (Key Question 2B).
- On National Forest System Lands, attempt to manage the landscape in a way that promotes North-South species flow, by developing a landscape with less "edge" (Key Question 5F).
- Conduct surveys for the Cascade Fox. If present, work to develop a protection strategy for this species (Key Question 2B).
- Help develop a strategy to provide for mountain quail habitat. Reforestation requirements under the National Forest Management Act may also be contradictory to providing adequate habitat (Key Question 2B).
- Help develop a strategy to provide for very site intensive management where many red legged frogs are present. The direction should address acceptable land management practices and timing and recreational opportunities in areas with high populations of the species (Key Question 2B).
- Help develop guidance to determine how to maintain the integrity of special and unique habitats. The strategy should discuss how to decide which examples of a habitat type to protect, how to determine which ones are worthy of protection, when differing degrees of protection are warranted, and how to maintain the connectivity between these special and unique habitats (Key Question 2B).
- Retain the following pine marten habitat areas in West Fork watershed: 6221M, 6211M, 6161M, and 6141M. These B5 areas are needed to assure adequate connectivity for the guild of species represented by pine marten. Prepare and begin to implement management plans for these areas within 5 years (Key Question 2E).
- Conduct winter track surveys for pine marten (Key Question 2E).

- Conduct or support a study of harlequin duck habitat preferences. Develop a strategy that protects or maintains harlequin duck use (Key Question 2G).
- Work with ODFW to determine if mountain goats were inhabitants of the West Fork watershed. Reintroduce if historic information confirms past presence (Key Question 1H).
- Provide and maintain north-south connectivity corridors between the northeast corner of Mt. Defiance and the remainder of National Forest System Lands (Key Question 5B).
- Acquire the Longview Fibre in-holding on West Fork Hood River (Key Questions 5A and 5F).
- If possible, acquire lands along the eastern and northern edges of current National Forest System Lands in T1N R9E (sections 5-8, 17-20, and 28-33). Efforts should focus first on acquiring and reacquiring lands within the legislated National Forest boundary (Key Question 5F).
- As a minimum, do not trade away any more National Forest System Lands in T1S R9E and T1S R8 1/2E (Key Questions 5A and 5F).
- Work with other owners and various other potential partners to provide east-west dispersal links across the watershed. If needed to provide critical links, pursue Forest Service acquisition of key lands or corridors (Key Questions 2F and 5A).
- De-emphasize management of elk on National Forest System Lands and focus on deer (Key Question 6F).
- In cooperation with ODFW, reevaluate the utility of and need for the B10 areas. If any or all B10 areas are retained, develop a strategy to provide for adequate forage through time.

Fisheries

- Work with ODFW to better maintain signing of closed areas for fishing, with explanation of regulations to protect wild fish (Key Question 3C).
- Continue to partner with ODFW to genetically sample fish stocks within the subbasin to identify new areas with sensitive stocks of rainbow (redbands), cutthroat (sea-runs), and possibly, bull trout (Key Question 2G).
- Support plans by Pacific Power and Light (PP&L) during current relicensing to enhance passage at Powerdale dam for all species including lamprey (Key Question 2F).
- In cooperation with ODFW, compare fishless lakes from adjacent watersheds to present West Fork lakes. (Key Questions 2G and 6F).
- Participate with ODFW in developing fisheries plans for lakes that will provide for native fishery opportunities and protect native biodiversity. (Key Question 1D)
- Work with ODFW to discontinue stocking with non-indigenous fish species in lakes with outlets to natural stream populations. (Key Questions 1D and 1F).
- Continue to support the various Irrigation Districts to pipe or line all open canals within the National Forest boundary (Key Question 5B).
- Continue to work with other agencies and private groups to secure in-stream water rights to provide more flow in dewatered stream segments and to support both anadromous and resident fish year-round (Key Questions 5B and 6A).
- Work with Farmers Irrigation District, ODFW, CTWS, and the county water master to assure that all diversions between the headwaters of West Fork and the Columbia River have functioning fish screens. Where diversions are located in reaches that typically carry large amounts of debris during high flows, consider moving the screen a short distance up the canal to reduce maintenance needs and assure maximum functioning (Key Question 5B).

- Work with ODFW and CTWS to insure habitat is available on forest to complement the Hood River Production Plan goal of rebuilding naturally sustaining populations of spring chinook, summer and winter steelhead runs in the Hood River drainage (Key Question 6D).
- Continue to monitor potential habitat for sensitive fish stocks, such as redband trout and bull trout, in cooperation with ODFW and CTWS. (Key Question 1F)
- Acquire the Longview Fibre in-holding on West Fork Hood River (Key Questions 5A and 5F).
- Continue to develop cooperative agreements with other ownerships to improve riparian and aquatic habitat conditions on their lands (Key Question 6A).
- Explore conservation incentives for improving aquatic and riparian habitat through the Forest Service's State and Private Forestry branch and the Forest Stewardship Program (Key Question 6A).
- Develop alternative funding sources to assist aquatic habitat restoration outside the National Forest boundary (Key Question 6D).
- Continue to work on partnerships with local watershed conservation entities. Together, work towards building strong grassroots support within Hood River valley (Key Question 6D).
- Work with CTWS, ODFW, and BPA's Supplementation Plan to support restoration of native fish runs while maintaining genetic integrity of native fish stocks (Key Question 6D).
- Continue to work with ODFW to monitor fish population trends. (Key Question 1F)
- Survey No-Name Creek and the tributary on Indian Creek for suitable fish habitat. Replace or modify culverts (passage barriers) if worthwhile. (Key Question 1F)

Scenic Resources Management (Chapter 4)

- The VQO for LSRs, Riparian Reserves, retained B5 areas, and Lake Branch subwatershed should be Partial Retention in all distance zones. All areas managed for late successional forest should be able to meet Retention in the Foreground. Lowering the VQO to Partial Retention recognizes the logistical difficulties in treating steep slopes and still meeting Retention and allows for larger treatment areas more characteristic of the pre-1900 disturbance regime than is considered typical for meeting a Retention VQO.
- The VQO for all other land allocations is adequate. It should be possible to meet a VQO of Partial Retention in all distance zones on Mt. Defiance by more closely mimicking the pre-1900 disturbance regimes. Flatter ground on Mt. Defiance should allow more use of logging technologies that are less visually disturbing, such as feller-bunchers and feller-forwarders that leave lower stumps than hand held chainsaws.

ROS Classes (Chapter 4)

- Change all Roaded Modified ROS Classes to Roaded Natural. A landscape pattern more typical of pre-1900 conditions should allow achievement of Roaded Natural conditions.
- Change the ROS Class for Ottertail Lake B12 area to Roaded Natural to better match with VQOs of Retention in the Foreground and Partial Retention in the Middleground and Background.

Recreation

- To reduce conflicts between mountain bikers and other users and resources (Key Question 3B):
    1. Improve the quality and quantity of informational signing and materials at Lost Lake trailheads, campground, and store.
    2. Convert unneeded roads to trails by ripping half the road surface, pulling the culverts, and constructing "bikable" drain dips. Such a system would require less maintenance than a new trail system.

3. Ticket violators more often and with fewer warnings, particularly where trails are well signed as to designated uses.
4. Ticket violators caught in wilderness areas and on the PCT without issuing warnings. Publicize widely that violators will be ticketed automatically.
5. Actively discourage mountain biking in areas where it is not a desired use. Publicize the consequences of engaging in illegal activities and enforce existing regulations.

- If demand develops, explore arrangements with local skiing or snowmobiling clubs or the Lost Lake concessionaire to groom trails to Lost Lake (Key Question 3B).
- Install signs at all wilderness trailheads. Develop brochures specific to each trailhead to direct and control use (Key Question 3C).
- Evaluate the site-specific impacts of heavily used dispersed campsites. Decide whether to close the site, modify the site to reduce impacts, move the site, or leave it alone. Candidate sites for some level of development include Lake Branch at Road 1330 and Sentinel Spur (Key Question 3C and 3F).
- Provide better education to all dispersed users, not just wilderness users, on proper sanitation (Key Question 3C).
- Ticket violators engaging in illegal activities and enforce existing regulations more often and consistently. Publicize both the need to follow regulations and the consequences of not following regulations more (Key Question 3C).
- Explore alternative methods of funding law enforcement beyond those already in use. Train more "field" people in Level II and IV law enforcement (Key Question 3C).
- Further explore the feasibility and desirability of providing off road vehicle routes using the BPA powerline corridor and of providing designated over-snow routes for snowmobiles, cross-country skiers, or both. Any grooming of over-snow routes should rely on local clubs or interest groups. Analysis should include alternatives with and without formal sno-parks (Key Question 3E)
- New developed recreation facilities are probably inappropriate in Lost Lake LSR and along other lakeshores. An LSR Plan is needed prior to any new development in the Lost Lake area (Key Question 3F).
- Discourage additional dispersed and developed use within Riparian Reserves in the West Fork and Lake Branch subwatersheds (Key Question 3F).
- Conduct an evaluation of actual dispersed camping along Lake Branch. Target heavily used areas for restoration, closure, or development to reduce potential negative impacts (Key Question 3C).
- If accommodating additional dispersed use and camping within West Fork is desired, concentrate efforts onto Green Point subwatershed. Featured attractions might be fishing, picking huckleberries, hiking, and so forth. Consider providing picnic tables, fire rings, and toilets in or near heavily used areas (Key Question 3F).
- Post the National Forest boundaries better at both the legislated boundary and at the boundaries of in-holdings (Key Question 3G).
- Develop a cooperative agreement with Hood River County concerning recreational opportunities and restrictions. Information and materials could be distributed through the Visitor's Center at Hood River Ranger Station (Key Question 3G).
- Consider closing Jones Creek Road (Road 1340) to motorized use but retaining the full roadbed for use as an emergency evacuation route from Lost Lake (Key Question 3B).
- Complete another transportation analysis on Road 1810 with current resource objectives from the Northwest Forest Plan as well as the Mt. Hood Forest Plan (Key Question 3E).

- Collect more intensive data on annual daily traffic over Lolo Pass and down both Road 18 and 1810 (Key Question 3E).
- Consider developing an Auto Tour along road 13 as a way to disseminate information (Key Question 3E).

Riparian Reserves

Figure 6.1 displays the recommended Riparian Reserve widths. These recommendations require ground-truthing. We developed a list of criteria for adjusting these Riparian Reserve recommendations:

- For areas with well defined canyons, widths should be determined by an Interdisciplinary Team considering wildlife dispersal and wood debris recruitment needs.
- Consolidate areas of concentrated wetlands and springs.
- Consolidate headwaters of intermittent streams in close proximity to each other.
- Around Alaska yellow-cedar swamps, provide a Riparian Reserve width of at least one site potential tree beyond the edge. Ensure that concentrated areas of small patches are connected.
- On North Fork Green Point Creek and Green Point Creek, extend the Riparian Reserve at least 3 site potential trees on the south sides (north aspects) to provide better thermal regulation within the Reserves.
- Consolidate areas of instability prone to mass wasting.
- Place Riparian Reserves of at least one site potential tree on either side along debris torrent/flow tracks that lie outside mapped intermittent stream channels.
- In active debris torrent/flow tracks, incorporate all of the starting zone and all of the run-out zone within a Riparian Reserve.
- Gradually change Reserve widths along a stream, working from the wider width to the narrower.
- Connect groups of seasonal ponds to each other and to stream Riparian Reserves to provide for dispersal of amphibians and other small riparian associated species.
- Place a Riparian Reserve of at least one site potential tree on all vernal ponds and isolated ponds, regardless of size.
- Incorporate all lands within the A9 land allocation into Riparian Reserves.
- Incorporate all of Ladd Creek alluvial fan into a Riparian Reserve.
- Decide if the ditch between Rainy Creek and Gate Creek is needed to provide aquatic connectivity. If needed place a Riparian Reserve at least one site potential tree wide on each side of the ditch. The only purpose of the Reserve is to help maintain cooler water temperatures.

In some cases, we accepted the interim Reserve width. Since portions of the West Fork watershed is prone to mass wasting, Reserve Widths often increased significantly, particularly in upper Lake Branch and West Fork subwatersheds. Site potential tree heights vary by subwatershed:

Green Point subwatershed = 115 feet

Lake Branch subwatershed = 165 feet

West Fork subwatershed = 150 feet

In addition, many portions of Riparian Reserves within the West Fork watershed are not in the desired vegetative condition of late successional forest. Management actions will be needed and are expected to promote development of late successional forest within the Reserves. Further, not all natural disturbance processes will be allowed to play their full role. For example, we cannot accept the consequences of large stand replacing fires within this watershed due to its shape and the ownership patterns. Therefore, careful management will be needed through time to mimic, as best we can, the disturbances we will continue to control.

Vegetation management within Riparian Reserves should occur only on a trial basis to test various silviculture prescriptions, logging methods, and fuel treatments for their ability to achieve the desired stand conditions. Intensive monitoring of results coupled with results of trials conducted elsewhere in similar vegetative communities should occur to develop a longer term strategy for speeding development of late successional forest.

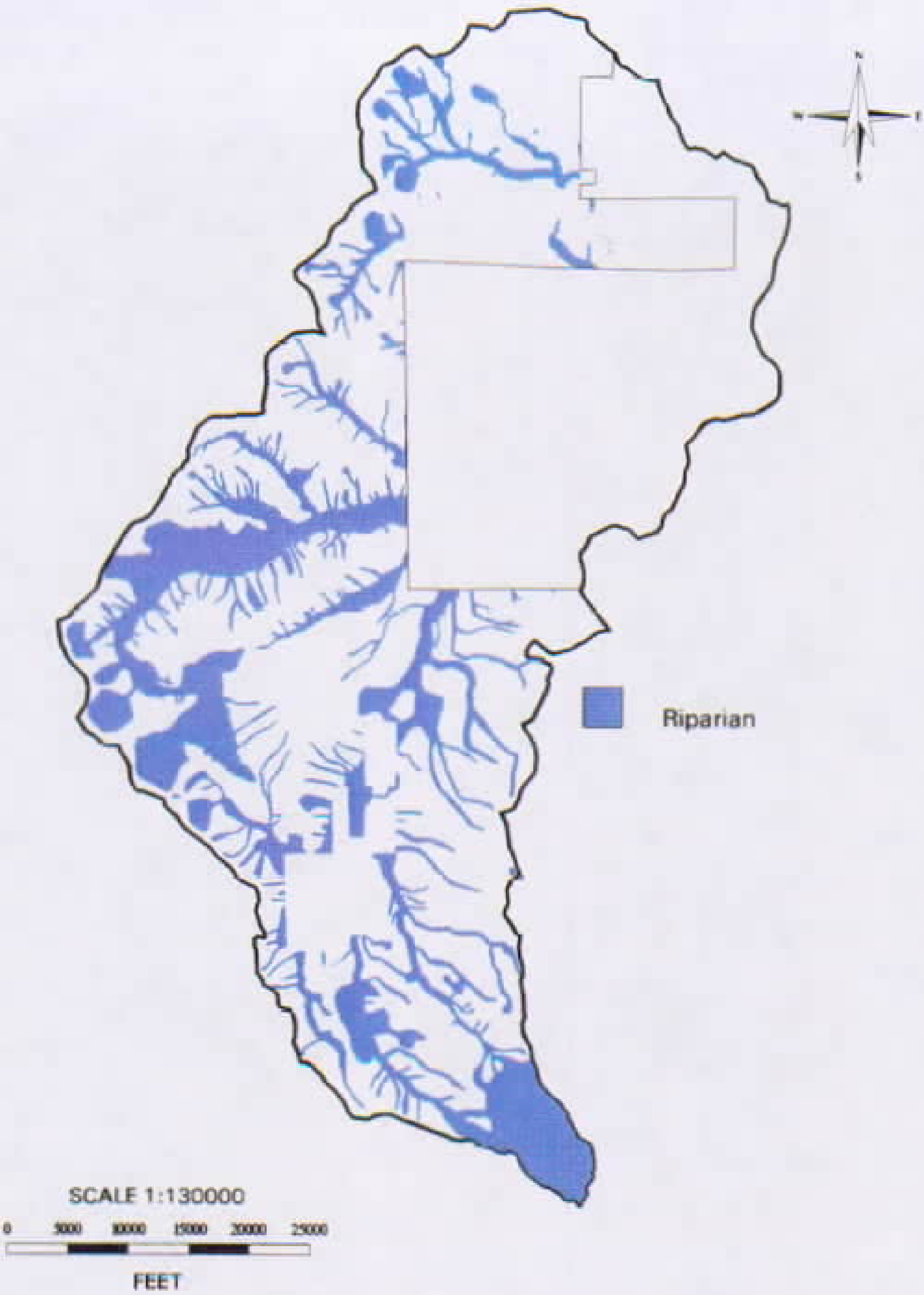


Figure 6.1. Recommended Riparian Reserves.

Culvert and Bridge Replacement

Riparian Reserves standard and guideline RF-4 states:

> New culverts, bridges, and other stream crossings shall be constructed, and existing culverts, bridges and other stream crossings determined to pose a substantial risk to riparian conditions will be improved, to accommodate at least the 100-year flood, including associated bedload and debris. Priority for upgrading will be based on the potential impact and the ecological value of the riparian resources affected. Crossings will be constructed and maintained to prevent diversion of streamflow out of the channel and down the road in the event of crossing failure.

No culverts and very few bridges in West Fork watershed are designed to handle a 100-year flood event including the associated bedload and debris. Given the general instability of the landscape, crossing failure would likely cause substantial damage to downstream riparian and aquatic habitat conditions. Lack of adequate road maintenance due to declining budgets has increased the risk of crossing failure throughout the watershed. Chronic road maintenance problems are listed in the answer to Key Question 6A.

Four bridges are of particular concern:

1. Ladd Creek bridge, a log stringer bridge, was not built to specifications following the mudflow event around 1960. The bridge is unable to pass a 50-year event. During the heavy rain event that occurred on October 31, 1994 (a 7-year event), the water level in Ladd Creek rose to just below the bottom of the log stringers and the east bank began eroding at the upper end of the concrete sealant. It appears that during a flood event much larger than the October 31 event, Ladd Creek would wash out the road and crossing to the east of the current bridge. Ladd Creek is prone to glacially induced mudflow events and natural canyon sidewall failures, and subsequent channel shifting, placing all stream crossings along its length and any other infrastructure in the alluvial fan at high risk.
2. Dry Run Bridge, on Road 18 just east of the Forest boundary, is placed just below a major bend in West Fork Hood River. Over the past several years, the river has been attempting to shift, straightening the bend. The District has attempted to forestall this shift and subsequent loss of the bridge, by placing large boulders on the south bank just upstream from the bridge. We recognize that eventually the river will shift, and sever a major access road to the watershed.
3. Divers Creek Bridge, a log stringer bridge on Road 13, is nearing the end of its structural lifespan. Log stringer bridges are considered a temporary structure, yet this crossing is considered permanent since it lies on a mainline road. The bridge has no problems in passing a 100-year event. However, it needs replacement within 5 years (before 1999) to avoid failure.
4. Raker Bridge, a log stringer bridge, is nearing the end of its structural lifespan. This bridge cannot handle a 100-year event.

Recommendations include:

- Replace Ladd Creek, Dry Run, Divers Creek, and Raker bridges with more acceptable structures placed in suitable locations.
- Consider using "design to fail" stream crossings in areas of chronic instability, such as Ladd Creek. As existing crossings fail, replace them with crossings designed to fail once a certain flood stage or event size is reached and minimize subsequent damage when the failure occurs.
- Replace all stream crossings that become migration barriers to resident or anadromous fish.
- As funds become available, gradually replace all stream crossings to meet the 100-year flood requirements.

Conflicts

I. Some Forest wide standards and guidelines in the Mt. Hood Forest Plan provide what we consider as inappropriate direction or unnecessarily restrictive direction that does not adequately recognize dynamic processes and climatic differences. We recommend amending the Mt. Hood Forest Plan with the following considerations. Many of these recommendations are the same as discussed in the White River watershed analysis. We did not evaluate standards and guidelines under specific land allocations.

- Base standards and guidelines on climatic zones and the associated disturbance processes first, then on land allocation.
- Recognize that the quantity of various habitat elements naturally varies from zero to some level and that distribution is rarely even. Analyze the quantity of a given habitat element over a larger unit. For example, evaluate average in-channel large wood and pools per mile over an entire stream rather than by reach. This strategy would recognize that some reaches may have nothing while others may have an "excess."
- No habitat element should be missing in an area as the result of management actions or land uses. Natural processes can "manage" for the minimum values, but we need to recognize that these minimums exist naturally. This strategy would also require that we have a better understanding of why a given habitat element is missing in a given location. For example, is a given stand devoid of snags because of a management action or because the stand is naturally it that portion of the successional pathway where snags are rare or missing?
- Standards and guidelines must clearly state what management activities or land uses they address. For example, timber sales can be an overwhelming influence on downed wood and snag levels while other activities and land uses have relatively little influence. We recommend that standards and guidelines not use vague terms like "management activities" unless the intent is to truly constrain <u>all</u> management activities.
- Standards and guidelines should more clearly state what is considered a management activity and what is not. Is recreation a management action or is it a land use and any steps we take to constrain or control recreation the action(s)?
- The Forest should consider reevaluating the following Forest wide standards and guidelines:
    1. FW-004--natural events will change the present stand activities; we cannot maintain the present stands without eventually taking action.
    2. FW-010--clearly state whether this standard applies only to management actions.
    3. FW-015 and 016--stabilization should only be required if we did something to increase instability or cause the area to begin moving. Earthflows are a natural sediment source. These standards should probably apply to all natural sediment sources and not just earthflow areas (i.e. naturally unstable slopes in West Fork watershed).
    4. FW-025--reevaluate whether this standard is still needed under the Northwest Forest Plan.
    5. FW-032 through 038--see the Downed Wood recommendations under the recommended Management Strategy above.
    6. FW-061 through 065--just constrain management activities and land uses, not natural events. The crown closure level should reflect the range of natural conditions for a given climate zone, not an arbitrary level. Better define "watershed stability."

7. FW-069--stabilization should be required only when management activities and land uses have destabilized an area. This standard should reflect that the "stable peak flow" is generally unknown for a given watershed and may be difficult to determine where data are confounded by such influences as water withdrawals. In general, watershed restoration should not be required on natural events unless that event occurred outside the range of natural conditions. However, we recognize that in some watersheds past management actions and land uses have had such a high impact that even natural events will require restoration (i.e. West Fork watershed) over the next 20-40 years.
8. FW-088--enhance pool numbers above the range of natural conditions only when different management on in-holdings results in a "permanent" reduction in pools below the range of natural conditions.
9. FW-090, 091, and 118--use the number of primary pools recommended by Rosgen or the range of natural numbers as determined by stream surveys in relatively intact and naturally functioning systems.
10. FW-094 and 095--use only to guide restoration efforts. Otherwise, manage for the range of natural conditions either by using survey results from relatively intact and functioning systems or by allowing natural processes to determine the "appropriate" levels.
11. FW-097--use 6 mm rather than 1 mm.
12. FW-099 and 100--redundant; better to use just FW-097 and 098.
13. FW-101--cannot monitor compliance with this standard since we cannot identify the species.
14. FW-106--refine to show 80% calculated only on the basis of the area that can naturally support forest (i.e. should not count talus areas, exposed rock, meadows, and so forth).
15. FW-110--Change to be consistent with the 1992 - 1994 Water Quality Standards Review.
16. FW-113 and 114--since we usually do not know what the natural levels are, we suggest that activities should change turbidity no more than 10% as measured pre- and post-activity or above and below the activity.
17. FW-121--appropriate to guide restoration activities, otherwise let natural forces determine piece size and length.
18. FW-136--not a problem in the Crest Zone but can be excessive in the Transition Zone where fire exclusion has altered the existing and potential levels to outside the range of natural conditions. We recommend changing this standard to 90% of naturally occurring levels to allow for more flexibility for restoration, enhancing tree growth to more rapidly develop desired stand structures, and so forth.
19. FW-137--fish habitat capability changes over time, fluctuates with disturbances, such as fire, and drought cycles. Fish habitat capability should not be reduced as the result of land uses over which the agency has some control.
20. FW-158 through 160--replaced by the Northwest Forest Plan?
21. FW-163 through 168--forest diversity elements should be based on the range of natural conditions for a given climate zone or stand type and not a "one size fits all" approach.
22. FW-192 and 193--does not apply well to the Crest Zone where the range of natural condition includes very large openings.

23. Forest Protection and Safety Section--the Forest Fire Management Action Plan (FMAP) should be updated to reflect the findings in this and other watershed analyses, assuming the recommendations are accepted. A copy of the FMAP should be available on each district to guide preparation of Escaped Fire Situation Analyses (EFSAs). We recommend the FMAP include a decision matrix on the appropriate suppression response by Northwest Forest Plan land allocation and based on time of year and level of fire danger indices. We also suggest using Energy Release Component (ERC) or a combination of ERC and Ignition Component (IC) as the appropriate indices.
24. Timber Section--standards and guidelines should address desired outcomes and not specific methods. Outcomes should reflect the range of natural conditions. For example, opening size guidelines in the Crest Zone should not encourage fragmentation. Recognize that areas of dense brush are part of the natural condition and serve a purpose we may not understand very well. Fertilizing should be recognized as only a short-term fix. We should manage for nitrogen fixing plants, such as legumes, ceanothus, and alder. These species will provide available N over a much longer period of time than fertilizers and add diversity to the forest.

We recognize that incorporating dynamic processes cannot happen immediately. However, we can begin to make some changes now.

II. There may be a conflict between the stream crossing standards in the Northwest Forest Plan (RF-4) and those in the State Forest Practices Act. The Northwest Forest Plan requires that culverts and bridges be able to handle a 100-year flood event, including the associated bedload and debris. The State Forest Practices Act requires that culverts and bridges only handle the peakflow typical of a 50-year flood event, with no mention of associated bedload and debris. Given the high instability of much of West Fork watershed, there is a potential for major impacts to other ownerships and to aquatic and riparian resources due to the differences in the two standards.

We feel there is a moderate to high risk that Forest Service crossings will pass a 100-year event, only to have the material jam up on a crossing designed to state standards. These crossings would then fail catastrophically and the possibility exists that even greater damage would result to riparian and aquatic resources and human infrastructure than if all crossings were designed to the same standard. This belief is based on the upstream failures serving to act as energy absorbers, reducing potential impacts downstream. Under the two different standards, it is possible that crossings would continue to fail further downstream than otherwise, in a domino type effect.

In addition, some crossings designed to state standards lie above crossings that will eventually be designed to the new Forest Service standard. If the upper crossing(s) fail, the probability that the lower Forest Service-designed crossing would fail increases. We believe it is very hard and perhaps not possible to design a 100-year event crossing that includes debris from upstream failures.

We recommend:

- Work with other owners in the watershed and the State to design stream crossings to pass 100 year flood events, including associated bedload and debris.

III. There appears to be some conflict between the State objectives for recreational fishing and the Forest Service's ecosystem management objectives. The State promotes fishing as a desirable recreational activity, so they stock all waterbodies capable of supporting fish at least over the summer season. Ecosystem management objectives are to promote systems that are as natural as possible while providing for goods and services. Under ecosystem management, stocking naturally fishless waterbodies has poorly understood consequences. When we do not know what our actions will have on ecosystem functioning, The Forest Service's responsibility is to either study the action on a trial basis before proceeding on a larger scale or to avoid the action or activity. The effects of stocking naturally fishless waterbodies are poorly understood. Research has only begun to explore this question.

The State recently implemented a Wild Fish Policy that has drastically curtailed stocking in streams. This policy requires that ODFW focus their efforts on managing the native fish stocks. However, stocking continues in lakes. These fish can escape into streams managed only for native fish. High lakes have been and will continue to be a popular fishing pastime for many people. A recommendation may be to work with ODFW to identify "Key" lakes to stock, while letting other return to a naturally fishless condition.

CHAPTER 7

Restoration Projects

CHAPTER 7: RESTORATION PROJECTS

Introduction

This chapter lists restoration projects on National Forest System Lands derived from the recommendations in Chapter 6 and results in Chapter 5. This list contains far more projects than we can expect funding to implement in any one year. This list is not intended to be inclusive or restrictive. As the recommendations of this analysis are applied, we expect additional restoration needs.

Projects are listed by priority. The West Fork Stewardship Team utilized the Aquatic Conservation and Late Successional Reserve strategies in the ROD, the Interagency Watershed Restoration Strategy, and the analysis of the current watershed condition and trends in preparing this chapter. Restoration priorities are based on the consideration of actual resource damage / significance, benefits to species of concern identified in the analysis, and activities designed to accelerate the attainment of desired vegetative structures.

The Number One priority project in West Fork watershed is to acquire the Longview Fibre in-holding along West Fork Hood River. Acquisition of this parcel is key to maintaining many habitat connections and functions, ranging from creating red tree vole habitat to stabilizing chronic erosion problems to providing dispersal corridors for a variety of terrestrial, riparian, and aquatic species. If acquisition must occur piecemeal, use the priority ranking displayed in Figure 5.2.

High Priority Projects

◊ Plant unstocked or understocked riparian areas with conifers and hardwoods suitable to the site to reestablish riparian connectivity. Consider using western redcedar in areas that currently lack this species. (Some work to be done in FY-96)

◊ Commercially and precommercially thin Stem Exclusion stands in Lake Branch subwatershed. Thinning area should be large enough to begin restoration of landscape pattern characteristic of pre-1900 conditions. (Some work to be done in FY-96)

◊ Thin, underburn, and plant a diversity of conifer species on Mt. Defiance over a large enough area to "break" the current spruce budworm and Douglas-fir bark beetle epidemics. Remove as many trees as needed to reduce host species distribution and moisture stress levels below critical thresholds. In order to meet the intent of the 15% green tree retention guideline leave as many green trees as can be expected to live and continue in the next stand and leave the difference in the 15% goal as snags. Leave the largest snags that logging safety regulations permit. (Some work to be done in FY-96)

◊ Develop and implement more aggressive noxious weed control measures. Use chemicals to reduce selected species to population levels more controllable by biological, mechanical, and hand methods.

◊ Acquire funding to support and expand the native plant propagation program, including seed collection, seed storage, growing starts, and providing cuttings. (Some work to be done in FY-96)

◊ Place nest boxes for secondary cavity nesters, such as bluebirds, within the BPA powerline corridor and in or around Stand Initiation stands that lack snags.

◊ Work with ODFW and CTWS to provide for naturally sustained runs of anadromous fish.

◊ In cooperation with Farmers Irrigation District, replace the existing diversion structure on Gate Creek to limit withdrawals to allocated right only. The new diversion structure should allow flow above the allocated right to remain in Gate Creek. (To be done in FY-96)

- ◊ Maintain the sediment catch basin at Raker Pit. (To be done in FY-96)
- ◊ North Lake Trail Relocation--reroute portions of Trail 423 to avoid two wet crossings.
- ◊ Complete reconstruction of Lost Lake Campground. First priority is to complete work on lakeshore campsites.
- ◊ Dispersed Campsite Management--evaluate dispersed campsites along Lake Branch and at Cairn Basin in the Mt. Hood Wilderness. Restore selected sites to control use levels and parking, restore ground and screening vegetation, reduce erosion, and move campsites away from streambank or wet areas.
- ◊ Review the previous analysis of Sentinel Spur dispersed sites. Harden selected sites, remove remaining sites, and install a toilet. No sites should be closer than 1 mile (approximately) to Lost Lake Campground.
- ◊ Wilderness Information and Education-- Install signs at all wilderness trailheads. Develop brochures specific to each trailhead to direct and control use.
- ◊ Erosion control--reduce sediment delivery potential at stream crossings and from roads within 200 feet of a stream by adding gravel to the road surface or stabilizing cutbanks and fill slopes. Priority by sixth field watershed is: (Some work to be done in FY-96)
  - A. Lake Branch
  - B. Elk Creek
  - C. Divers Creek
  - D. McGee Creek
  - E. Red Hill Creek
  - F. West Fork Hood River east of Marco Creek
  - G. Ladd Creek
  - H. North Fork Green Point Creek
  - I. Green Point Creek
  - J. Dead Point Creek
  - K. Long Branch Creek
  - L. Tumbledown Creek
  - M. Lost Lake
  - N. Laurel Creek
  - O. Marco Creek
- ◊ Replace or restore the existing bin wall along Road 1310.
- ◊ Clean out partially plugged culverts throughout the watershed. Highest priority are those culverts in sixth field watersheds with high instability--Lake Branch, Green Point Creek, Elk Creek, McGee Creek, Divers Creek, and Ladd Creek. (Most work to be done in FY-96)
- ◊ Work with BPA to reevaluate the road system under the powerline corridor. Improve mainline road system and obliterate unneeded roads.
- ◊ Replace Dry Run Bridge approach to withstand a 100-year event.
- ◊ Replace Divers Creek Bridge with a more permanent structure before 1999. (Survey/Design to be done in FY-96)
- ◊ Follow through on Eastside ATM planning to obliterate, stormproof, and / or maintain roads within the watershed. Table 7.1 displays the proposed FY-96 program. In out years, focus on closures an obliterations using the sixth field watershed priorities listed above. (Some work to be done in FY-96)

Table 7.1. Proposed road obliterations.

Road	Approx. Length	Surface Type	Comments
1300-640	0.25 miles	aggregate	Only last half of the road
1300-650	0.76 miles	aggregate	
1300-720	2.20 miles	aggregate	
1310-620 & 628	0.62 miles	aggregate	
1310-661	0.80 miles	aggregate	Only from the 663 junction to the end
1320	0.78 miles	aggregate	Only from the switchback to the end
1330-620	0.50 miles	pit run	
1340-011	0.22 miles	aggregate	
1340-012	0.25 miles	native	
1340-620	0.48 miles	aggregate	
1350	2.00 miles	aggregate	From slide area to end
1350-631	0.39 miles	pit run	
1810-620	0.20 miles	aggregate	
1810-630	0.76 miles	aggregate	
1811	1.00 miles	aggregate	
2820	0.70 miles	aggregate	From Black Lake to the end, include spur roads
2810	0.20 miles	aggregate	
2810-640	1.20 miles	aggregate	
2810-660	0.37 miles	native	Tower TS, Unit 2
2810-650	0.70 miles	native	
1310-641	0.54 miles	aggregate	
1340-620	0.50 miles	aggregate	From the 621 junction to the end
1350-012	0.90 miles	native	
1350-620	0.42 miles	aggregate	
1640-670	1.39 miles	aggregate	
1650-650	0.21 miles	unknown	No road log
1660	2.00 miles	aggregate	
1670	2.40 miles	aggregate	
1300-700	0.50 miles	pit run	
1310-640	0.30 miles	aggregate	Just the FS section
1350-011	0.50 miles	pit run	
1640-671	0.39 miles	aggregate	
1640-680	0.33 miles	native	
Grand Total	24.76 miles		

◊ In cooperation with ODFW stop stocking of one lake and monitor the changes in amphibian, invertebrate, and zooplankton species compositions and populations. Monitor one non-stocked lake in Herman Creek (Columbia Wilderness).

- ◊ Use logs to restore spawning and rearing habitat for anadromous and resident fish in Red Hill Creek, Elk Creek, and Jones Creek.

Moderate Priority Projects

- ◊ Rainy Lake Campground restoration. Redesign and reconstruct campsites and parking area to reduce compaction, control use levels, and restore riparian and screening vegetation.
- ◊ Thin alders in riparian stands to improve or promote conifer growth along portions of West Fork Hood River, McGee Creek, and Lake Branch to obtain Late Successional stand characteristics. (Some work to be done I FY-96)
- ◊ Develop Land Stewardship contracts with BPA for the powerline corridor to provide special forest products, control noxious weeds, and reduce the vegetation maintenance costs and needs under the powerlines.
- ◊ Restore amphibian and macroinvertebrate habitat in portions of McGee Creek and Lake Branch by placing decayed logs in the stream and riparian area. (Some work to be done in FY-96)
- ◊ Construct a log boom / jam across 2-5 acres of Lost Lake to create refugia for waterfowl, fish, and amphibians, and to increase the potential for bald eagle use.
- ◊ Peregrine falcon habitat -- obliterate the 1310-669 road to encourage peregrine falcon nesting habitat. (To be done in FY-96)
- ◊ Fish, Wildlife, and Plant Information--place an information kiosk at Lost or use the five previously mentioned signboards (one per loop). Information materials would likely consist of descriptions of habitat improvement projects and objectives, tips on watchable wildlife, identifying noxious weeds, and so forth.
- ◊ Replace Ladd Creek Bridge with structure able to pass a 100-year flood event and designed to fail and minimize downstream impacts during a mudflow event.
- ◊ Acquire lands within the Forest boundary to improve connectivity and dispersal. Desired lands are T1N R9E sections 5, 6, and 7.

Low Priority Projects

- ◊ Reconstruct Wahtum Lake Campground. Redesign and reconstruct parking area and campsites to control use levels, better designate actual trailhead, and restore screening vegetation and ground cover. Replace leaking vault toilet.
- ◊ Plant understocked Stand Initiation stands with a variety of conifer species suitable to the individual site and alder for nitrogen fixing. (Some work to be done in FY-96)
- ◊ On a trial basis, thin young Riparian Conifer stands in riparian areas in either Lake Branch or West Fork subwatershed to promote vegetative diversity and more rapid development of large conifers. (Some work to be done in FY-96)
- ◊ Thin and/or underburn upland stands in the North Fork Green Point Creek to reduce stocking levels and increase species diversity for forest health.
- ◊ Work with CTWS to develop huckleberry production areas in the watershed. Strongly consider use of the BPA powerline corridor as one production area.
- ◊ Create Townsend's big-eared bat habitat in Lost Lake LSR by placing artificial caves made of modified culverts along obliterated roads. (Some work to be done in FY-96)
- ◊ Work with USFWS to restore California condor to the Columbia basin.
- ◊ General Recreation Information--in cooperation with Hood River County develop informational materials about recreational opportunities on other ownership's in the watershed and appropriate rules and regulations governing use.

- ◊ Replace Raker Bridge with a more permanent structure. (Survey/Design to be done in FY-96)
- ◊ As funds become available, replace all other stream crossings to meet the 100-year flood event requirements. In areas of high instability, consider using "designed to fail" structures/construction.
- ◊ Acquire lands outside the current Forest boundary to improve connectivity and dispersal. Desired lands are T1N R9E sections 18, 19, 30, 31, 32, and 33.

CHAPTER 8

Data and Analysis Gaps

CHAPTER 8: DATA AND ANALYSIS GAPS

This chapter lists the data and analysis gaps that affect this document. Data gaps occur when we have insufficient information. Analysis gaps occur when we lack the information to analyze, lack the time to conduct the analysis, or lack the appropriate skills, guidelines, or models to conduct the analysis.

Item	Data Gap	Analysis Gap
Snags	Snag numbers, sizes, species, decay classes	Snag distribution and sufficient numbers to meet management direction; range of natural conditions by stand structure/age
		Snag model appropriate to Cascade crest and assisted
Downed Logs	Downed log numbers, sizes, and decay classes in all stand structure types	Downed log distribution and sufficient numbers to meet management direction; range of natural conditions by stand structure/age
Terrestrial Wildlife Species	Confirmation of the former presence of mountain goats and Cascade fox.	
	Confirmation that Cascade fox is a separate species from red fox.	
	Harlequin duck habitat preferences.	Quality and quantity of available harlequin duck habitat
	Recreational impacts on terrestrial wildlife.	
	Wolverine use and presence in the West Fork Watershed.	
	C3 Mollusks presence in the West Fork Watershed.	
	East-West dispersal of late seral species.	
	North-south dispersal of late seral species.	
Amphibians	Amphibian connectivity from the result of fish stocking	
Fish species	Confirmation of past and present fish species and stocks prior to 1900.	

Item	Data Gap	Analysis Gap
Mass wasting	Rate and size of mass wasting events before 1900	Natural rate of mass wasting
		Mass wasting occurrence rate resulting from land management activities
Aquatic and riparian habitat elements	Typical numbers, sizes, and decay class of downed and in-stream logs; size and quality of pools; water temperature; riparian stand type distribution	Range of natural conditions for downed and in-channel wood and pools by Rosgen channel type; annual and daily temperature fluctuations; and various riparian stand types
		Comparison between range of natural conditions and existing conditions to better determine priorities for restoration
Green Point subwatershed	Range and average fire return intervals on Mt. Defiance	Pre-1900 fire regime and subsequent successional pathways on Mt. Defiance
	Disturbance ecology	Link between fire regime and insect outbreak regime on Mt. Defiance
	Diagnostic stand types	Describing typical late successional stand type and intermediate stand types and probable ranges of natural conditions (percent of occupancy on the landscape)
Long-term site productivity		Possible effects of removing most or all downed woody material in older plantations on tree growth, wildlife habitat, and wildlife species compositions
Pesticides	Water and stream bottom sediment chemistry	Potential impacts of persistent pesticides or their breakdown products on macroinvertebrate populations and species compositions, fish populations and spawning success, western brook lamprey, Pacific lamprey ammocoetes, and human health effects of consuming fish caught in West Fork system
	Threatened, endangered, sensitive, at risk, and C-3 plant species pollinated by moths and butterflies	Potential impacts of spraying Bt or Sevin on non-target moths and butterflies

Item	Data Gap	Analysis Gap
Native/Non-native interactions		Effects of introduced and non-native fish species on native fish, invertebrates, amphibians, and zooplankton
Connectivity		Need for connection via Gate Creek Ditch between Gate Creek and Rainy Creek
Biological controls	Non-target Senecio species consumed by cinnabar moth	Effects of cinnabar moth on non-target Senecio species compositions, populations, and distributions
Sediment Regimes	Hydrologic monitoring of 5th field watersheds.	Baseline information and how it relates to future management activity

Appendix A

Range of Natural Conditions and Desired Conditions
Working Notes

APPENDIX A: RANGE OF NATURAL CONDITIONS AND DESIRED CONDITIONS WORKING NOTES

Summary of Historical Information on Vegetation within West Fork Watershed

Survey of the Cascade Range Forest Reserve

The Cascade Range Forest Reserve was created on 28 September 1893 and was the largest of the forest reserves at that time. West Fork watershed falls within the northern portion of the reserve. At the time of the survey, the reserve boundary did not include any lands within T2N R9E and T1N R9E. The surveyors examined both townships anyway, for reasons unknown. The survey was conducted in 1901 and the results published in 1903. The surveyors also prepared a set of maps depicting the forest conditions. Vegetative polygons were based on the estimated commercial timber volume, although the cruising rules used were not included in the report. The maps were prepared on linen paper, which has yellowed. We obtained color copies of these maps, but the yellowing has made interpretation of some polygons difficult. The discussion below focuses, as much as possible, on West Fork and the Hood River basin.

General Information: Mt. Hood was measured as 11,225 feet high and was constantly steaming on the south side about 1000 feet below the summit. Along the eastern rim, the surveyors noted hot rocks in many places and sulfurous fumes from many fissures. The glaciers were already receding. Ladd Glacier was estimated at 230 acres; no estimate was made of the size of Glisan Glacier.

Climate. The northern portion of the Reserve generally did not receive rain between July 1 and late September. Rains normally began falling sometime in September, but the rainy season was not considered to start until early November. The period of general rains usually lasted until sometime in May. Up to 10 feet of snow commonly fell in the upper elevations in winter. Snowstorms were usually followed by rains and warm Chinook winds. Between 1891 and 1899, Cascade Locks averaged 80 inches of annual precipitation while Hood River averaged 43 inches.

Minerals. The northern portion of the Reserve is generally mineral poor. Some gold was found in Lake Branch approximately two miles below Lost Lake. The quantity available was considered uneconomical to mine. Lake Branch also had a warm spring near the confluence with Laurel Creek.

Dead and Defective Timber. In 1894, large numbers of pine butterflies (*Neophasia menapia*) killed most of the whitebark pine on the north slopes of Mt. Hood. A large percentage of the grand fir was dead and western white pine was declining rapidly. The causes of this mortality was not known. The surveyors only noted two defects affecting a large percentage of the trees. Douglas-fir and some other species in moist places often showed extensive signs of polyporus fungi. Wind shake was a serious defect of Pacific silver fir and western hemlock, with up to 60% of the trees affected in some areas.

Commercial Timber. The demand for timber was low on the Reserve as the available supply outside was expected to last many years. Four mills were in operation within the Hood River basin. One mill located at the mouth of Hood River was operating below its capacity of 200 MBF per day due to the difficulty in transporting logs from the forest. Two splash dams had recently been completed on Hood River and a railroad extended three miles south of the town of Hood River.

Trees within the Reserve were generally uniform in size. Natural regeneration was scarce in areas of thick duff and dense canopies. The (climatic) climax species were regeneration while the seral species were not. Douglas-fir was the most dominant species on recent burns and cut-over lands in the western portion of this part of the Reserve. In general, western hemlock, Pacific silver fir, and Engelmann spruce were increasing; grand fir, Douglas-fir, and ponderosa pine were remaining more-or-less stable; and noble fir, western white pine, and western redcedar were decreasing. These last three species were considered among the most valuable of timber species. It was not unusual to see stands with 50-100% Douglas-fir in the overstory and 100% western hemlock and/or Pacific silver fir in the understory.

Water Supply. Irrigation in the Hood River valley usually began in May, shortly after the rainy season ended. Typical irrigated crops were fruit trees and strawberries. Two large ditches withdrew water from Hood River and numerous small ditches withdrew from several tributaries. In 1901 the supply form the available ditches was not adequate to meet demand, but the surveyors felt that adequate water existed in the Hood River basin to support all current and potentially irrigated land.

Agriculture. No lands suitable for agriculture existed within the Hood River portion of the Reserve above 2500 feet. Dee Flat area east of the lava beds was rated as well adapted to fruit growing or other crops. The land was covered with good timber but was also noted as mostly "burned or barren."

Grazing. Possibly some sheep grazing occurred in old burns within West Fork watershed. The description suggests that cattle grazing did not occur within the Reserve boundaries in West Fork.

Fires. Before the Reserve was established. human-caused fires were common. These included both careless fires and those deliberately set to destroy "hornet's nests", remove barriers to travel, and to increase or maintain grazing areas. The number of fires decreased after the Reserve was established. Fires were more numerous but less extensive and destructive north of Mt. Hood than south. Many of the restocked areas on the condition map are older burns with small trees.

Inholdings. Some 2040 acres of timbered lands were purchased in T1S R8E. No other inholdings existed within the boundaries of the Reserve.

Specific Townships.

- T2N R8E: Old burn on divide between Herman Creek and Green "Paint" Creek partially restocked and overgrown with huckleberries. Formally a favorite place for Indians. At the extreme headwaters of Green Paint Creek under the divide is a heavy stand of valuable timber. Extremely rocky soil with many spots of exposed shell rock.
- T1N R8E: Timber of little value on divide between Hood River basin and Columbia River tributaries. Excellent timber in canyons and on slopes. Ridges are rocky; canyons have good soil, though shallow. All of timber in Lake Branch could be driven down that stream to West Fork during "freshets" (periods of high run off).
- T1S R8E: West Fork Hood River, Lost Lake and Laurel Creek contain largest and most extensive stands of timber in northern portion of the Reserve. Canyon of West Fork covered by sand and boulders washed down from Mt. Hood. These deposits are covered by sandy soil or black loam to 3-4 feet deep. Timber mainly Douglas-fir, western hemlock, and western redcedar of large size, but much is defective. Many swampy spots with dense undergrowth along creeks. Rhododendron thickets along ridges, almost impossible to travel through. Western white pine formerly abundant but mostly dead now. West Fork and Lake Branch could be logged using splash dams. Lost Lake is a natural reservoir which could hold an "immense volume of water" for later release down Lake Branch or carried through the low pass southward to West Fork.
- T1S R8 1/2E: Steep sidehills or benches along the divide between West and Middle Forks. Timber of little value on steep slopes. Good timber near canyon bottom of West Fork, mostly Douglas-fir.
- T1S R9E: Good timber on slopes of Blue Ridge, mostly Douglas-fir on lower slopes and canyons. Excellent western redcedar in swampy creek bottoms.

- T2S R8 1/2E: Timber of little value except along canyons of West Fork.
- T2S R9E: Timberline ranges from 6000-6500 feet. Mountain hemlock and whitebark pine most common. Some grazing areas above timberline. Woods below timberline are open with a grassy understory but very thin soil. Soil highly erodible, light volcanic ash or glacial deposits of sand, gravel, and rock
- T1N R9E: On old burn lies between West Fork and Lake Branch with dense growth of willow and ceanothus. Broad sloping ridge between West Fork and Middle Fork has excellent timber. From Lake Branch north is good timber except in old burns. Homestead or cash entries filed on virtually all quarter sections.
- T2N R9E: Mt. Defiance is a "great pile of broken rock." Except on higher slopes, timber is of excellent quality. Four sections on the eastern side have been logged. Cutting was done by mills on site and the lumber was flumed to the railroad. All logged areas and many other tracts burned over.

LAND CLASSIFICATION

(acres)

	T2N R8E	T2N R9E	T1N R8E	T1N R9E	T1S R8E	T1S R8 1/2E	T1S R9E	T2S R8 1/2E
Timbered	14,597	19,112	12,868	19,852	8,306	5,375	16,867	1,630
Burned	5,007	2,280	2,637	3,526	2,366	385	5,035	
Cut	970	2,110						
Grazing	155	160	58	5				240[1]
Cultivated	335			35				
Restocked	1,496	46	441				388	
Water					208			
Barren							750	3,890
Arable							1,328	

[1]Zigzag drainage within the township

STOCKING BY SPECIES

(MBF)

	T2N R8E	T2N R9E	T1N R8E	T1N R9E	T1S R8E	T1S R8 1/2E	T1S R9E	T2S R8 1/2E
ponderosa pine		940					900	
western white pine	473	3,695	1,331	461	3,439	530	2,486	
lodgepole pine	690	5,299				1,892	10,982	
grand fir	305	13,456	913	15,381	1,264	122	17,591	33
noble fir	5,807	16,746	22,174	21,117	11,326	770	19,237	647
Pacific silver fir	18,221	11,179	40,211	6,317	13,026	2,814	26,845	
subalpine fir	1,377	954						80
Douglas-fir	131,784	291,488	214,785	468,641	353,379	65,363	286,807	2,754
western hemlock	13,188	13,512	32,387	24,136	107,605	14,861	69,726	179
mountain hemlock	2,083	5,874	12,751	13,065		3,488	26,357	4,290
western redcedar	4,349	6,225	7,562	18,588	17,838	5,173	15,861	64
Alaska yellow-cedar		1,280	58	127				
Engelmann spruce		3,032					1,267	458
western larch							81	
cottonwood							17	

STAND CHARACTERISTICS

	T2N R8E	T2N R9E	T1N R8E	T1N R9E	T1S R8E	T1S R8 1/2E	T1S R9E	T2S R8 1/2E
Avg. height clear timber (ft)	42	43	33	35	41	42	40	22
Avg. diameter (in)	18	20	18	21	25	10	18	14
Duff Depth (in)	2.25	1.5	2.25	1	2.5	2	2	--
Litter	Medium	Medium	Medium	Medium	Medium	Medium	Light	Light
Reproduction	Light	Light	Light	Medium	Light	Light	Medium	Medium

General Land Office Survey Notes

Information on the overstory and understory is plotted on a 1:24,000 clear acetate overlay for the watershed. Survey information dates from 1859 through 1897, with most notes dating from the mid-1880's. Copies of the survey notes are found at Hood River Ranger Station. We did not use notes from surveys after 1910. We have notes only for T2N R8E, T2N R9E, T1N R8E, and T1N, R9E. Township 2 North, Range 8 East was not subdivided. Only a small portion of T1N R8E was subdivided. The township containing Lost Lake was subdivided (T1S R8E), but the district does not have a copy of the survey.

Surveyors for the General Land Office had instructions regarding selection of witness trees and how they were to characterize the land surveyed. Each section corner was to have four bearing trees, one for each quadrant. The surveyors were to select sound, healthy trees which were expected to live for some time. Trees were marked within 300 links (198 feet) of the corner. Two trees, one of each side of the survey line, were to be marked at the half-mile point of each line. This point was called the quarter section.

The set of notes available are poor quality copies, often difficult to read. Further, the quality of surveyors varied tremendously. Surveyors noted the dominant tree species and understory characteristics. For the overstory and understory, the species are listed in order of dominance. Survey notes sometimes include topographic descriptions, widths of streams crossed, roads crossed, and entry into and out of burns, prairies or meadows, swamps, and brushfields. In order to maintain straight lines, the surveyors of townships containing the West Fork had to mark and note bearing trees on each bank. We could use this information to reconstruct the width and location of West Fork and compare it to the current width and location.

Surveying townships in West Fork is complicated by the curvature of the earth, which is corrected for beginning at the Willamette baseline by insertion of a half township. Range 8 1/2 gradually widens to the south, eventually becoming a full township somewhere in central Oregon. Immediately south of the Willamette baseline the half township is only two sections wide. In addition, the easternmost tier of sections in R8E and westernmost tier in R9E north of the Willamette baseline are larger than 640 acres.

Only the surveys for T2N R8E and T2N R9E were more than minimal quality. The survey of T2N R9E included a relatively detailed description of the township. The surveyors also noted the species and diameter of every tree that intersected the survey line. This information was not noted on the surveys for T1N.

The Willamette Baseline was resurveyed several times. Some of the earliest survey notes available are of such poor quality that it appears that the surveyor never actually walked the ground. Subsequent surveys often failed to locate the bearing trees listed and the species noted differed considerably.

Oregon Lumber Company

West Fork watershed was greatly influenced by the Oregon Lumber Company in the early part of the 1900s. *Switchback to the Timber* (Pope 1992) documents the history of the Oregon Lumber Company and Mt. Hood Railroad, including the activities within West Fork watershed. This section summarizes the company's activities within the watershed.

The Dee sawmill was initially built in 1906 on the East Fork of Hood River, near its confluence with West Fork. It was partially powered by a 32 foot dam on the East Fork. Initially the mill depended on company owned timber along the Middle and West Forks of Hood River. By 1913, most of the company land in Middle Fork was harvested and attention switched to West Fork.

The first rail lines from Dee extended south between the East and Middle Forks on Dee Flat. As Dee Flat was logged, the land was sold and converted to orchards. The 1901 Forest Reserve maps depicted Dee Flat as containing over 50 MBF per acre of timber. In 1913, the rail line extended 3 miles from the mill. By May 1915, the mainline extended to Deer Creek with a spur along West Fork to "Camp Overall" near the confluence of West Fork and Lake Branch. At the end of 1916 the mainline probably crossed Camp Creek and reached a unnamed flat where a logging camp was established. By 1920, the railroad reached Upper Camp near Ladd Creek. It is not clear if the railroad extended beyond Ladd Creek, but cultural resource files on the district suggest it eventually ended near McGee Creek.

In May 1916, the Forest Service announced that it was considering a 350 MMBF sale along West Fork Hood River, directly in the path of the rail line under construction. The sale would potentially cover 7000 acres and the purchaser would have 10-12 years to harvest the timber. The sale area would be replanted and seed trees were to be left. The sale was advertised in July 1916 at 330 MMBF covering 7020 acres. The available volume was approximately 70% Douglas-fir. Minimum bid prices were $1.20 per MBF for Douglas-fir, western redcedar, and noble fir; $2.50 per MBF for western white pine; and $0.50 per MBF for western hemlock. By June 1917, the sale was 365 MMBF covering 7340 acres. Oregon Lumber Company had pushed the logging railroad into the sale area by that time.

The company began logging on this sale shortly after its purchase and continued through the 1920s and into the early 1930s. No logging or milling occurred in winter. Generally the loggers were laid off first in late fall/early winter and were the second group of workers rehired in spring. The off-season varied, depending on snow conditions. Most years, the mill closure lasted from mid-December until Mid-March. During heavy snow years, closure might last from Mid-October to late May. Oregon Lumber had a higher utilization standard than most mills. This company milled material down to 8 inches whereas industry standard was 12-14 inches. Smaller material and less valuable species were used to fuel the locomotives and yarding donkeys until 1924. In 1924, this equipment was converted from steam to oil.

Several wildfires occurred in West Fork in connection with the railroad logging; several wildfires from other sources also threatened the logging operations or its equipment. Fires mentioned in *Switchback* include:

- August 1917: fire started in vicinity of Sandy Flat along the West Fork, approximately 6-7 miles from Dee. The fire burned 480 acres, 1/2 mile of track, and 2 bridges and damaged 2 steam donkeys.
- July 1919: fire started on Dead Point Creek near a sawmill. The mill burned, but the fire was prevented from spreading into the timber. Several weeks later, the fire rekindled and burned the hills just west of Winans. It spread to the south pushed by strong winds. A second large fire started in July near the logging camp and burned approximately 11 MMBF of federal timber.

- In 1926 a slash fire escaped and burned 100 acres.
- July 4, 1940: an abandoned campfire on Lake Branch took off and burned toward Dee Flat and Trout Creek Ridge. This fire burned 2500 acres before control efforts succeeded.

Along with fires which affected West Fork were train wrecks. Pope documented several wrecks of locomotives and log cars. This equipment was always retrieved, repaired, and placed back in service. While not discussed anywhere, these wrecks and salvage operations probably affected any streams nearby due to petroleum spills, and, possibly, hillside scarring needed to bring in and anchor the salvage equipment.

In addition to harvesting federal timber in West Fork, Oregon Lumber Company often traded land for land and land for cutting rights. In 1921, Oregon Lumber traded 192 acres of land north and east of Lost Lake for cutting rights on 160 acres on West Fork approximately 4 miles southeast of Lost Lake. Lost Lake Lodge was eventually constructed on this land. Sometime after 1932, Oregon Lumber traded 920 acres along the access to Lost Lake for cutting rights on land closer to their active operations. Sometime before 1921, the Company donated land to the state for a fish hatchery on Dead Point Creek near Punchbowl Falls. This hatchery is now privately owned and operated. In one of the biggest trades, Oregon Lumber swapped 663 MMBF of timber and land for 623 MMBF of federal timber. This trade consolidated scattered land and timber tracts within the Forest boundary and blocked up the ownership pattern.

Oregon Lumber Company began experiencing financial difficulties in the 1930s. In 1955, all of Oregon Lumber Company's assets were sold to the Edward Hines Lumber Company. Today, Longview Fibre owns most of the former Oregon Lumber land. In 1966, Champion International bought the Dee Mill and terminated lumber manufacture. The mill is now employee-owned and operated. Today the mill uses wood waste from other mills to manufacture hardboard and similar secondary wood products.

Disturbance Processes in West Fork Watershed

Watershed analysis requires that we understand disturbance processes, their role in the watershed, and how management has influenced them. Disturbance processes leave features. In turn, features provide or serve different ecosystem functions, such as wildlife and fish habitat, sediment filtering, and so forth. Further, features can influence disturbance processes. If we can better understand the interactions between disturbance processes and the resulting features, we can better understand how the ecosystem(s) work and what effects human actions may have on the system.

We approached this task by defining some terms, listing the various disturbance processes for West Fork along with their frequencies and typical locations, and describing the regime around a particular disturbance process. We tried to figure out what processes and regimes were typical of the pre-1900 landscape and what is typical in the current landscape. We then tried to estimate which processes or regimes have changed, which may have essentially vanished, and which have been added. Finally, we tried to describe what roles the major disturbance processes usually play in the ecosystem. We did not analyze natural and human-caused events separately. Instead we felt it was more holistic to look at all processes regardless of cause. In some cases, notably fire, separating natural from human causes is virtually impossible since humans have been burning the landscape for several millennia.

Then we looked at various features on the current landscape and tried to describe how they may have influenced disturbance processes. We looked at what processes a given feature could change and the associated features that drive the change in a given process. In this portion of the analysis we only examined features created since 1900.

Definitions

Disturbance process - events which cause changes in landscape features which are readily visible and measurable. The events usually occur over a brief period of time and usually can be viewed. Under this definition, climate cycles and changes are not considered disturbance processes. In this analysis only events that operate at the watershed or landscape level are considered. Examples of events are fires, epidemic insect outbreaks, debris torrents, and timber harvest.

Features - items on the landscape which can be visited and are measurable, including both natural and human-made or altered items. Examples of features are created openings, roads, ponds, and stream channels.

Frequency - how often a particular process is likely to happen at a given intensity and severity within the watershed. Frequency is not necessarily tied to the event happening on a particular piece of ground.

Duration - how long and event typically lasts, **not** how long the effects associated with an event typically last.

Intensity - aerial extent of a given event, such as acres or miles; how many features are affected. This definition differs from the term *fire intensity.*

Severity - how drastically an event changes a feature or group of features. This term differs from the term *fire severity.*

Acute - a disturbance regime where several decades typically pass between events on the same piece of ground or feature.

Chronic - a disturbance regime where few decades or years typically pass between events on the same piece of ground or feature.

Disturbance Process	General Frequency	Typical Duration	Typical Location	Features Affected*
Fire	50 -200+ years	1 day to several months	Entire watershed	Plant communities, *stand structures*, seral stages, buildings
Epidemic Insect Outbreaks	Periods of high stress and where host species dominate	2-10 years	Forested lands	Plant communities, stand structures, seral stages
Epidemic Disease Outbreaks	Periods of high stress and where host species dominate	2 years - several decades	Entire watershed	Plant communities, stand structures, seral stages
Floods, including rain-on-snow events	Various	1-5 days	Primarily below 3000 feet elevation	Stream channels, pools, ditches, ponds, buildings, roads, communities, plant Dee, stand structures, seral stages
Mudflows/Debris Torrents	Irregular	1 day	Ladd Creek for mudflows, slopes over 60% in West Fork and Lake Branch subwatersheds for debris torrents	Stream channels, pools, plant communities, stand structures; seral stages, roads, trails, dispersed campsites
Pyroclastic Flows	Highly irregular	1-5 days	Tributaries of West Fork originating on Mt. Hood, West Fork Hood River	Stream channels and pools, buildings, roads, trails, Dee, plant communities, stand structures, seral stages
Lateral Blasts	Highly irregular	Minutes	West Fork subwatershed	Stream channels and pools, buildings, roads, trails, Dee, plant communities, stand structures, seral stages
Ashfall	Highly irregular	1 day to several weeks	Entire watershed	All features in the watershed
Timber Harvest	Annually	Mostly spring through fall over a 1-5 year period	Commercial forest	Plant communities, stand structures, seral stages, roads, trails, stream channels and pools

Disturbance Process	General Frequency	Typical Duration	Typical Location	Features Affected*
Wind	Highly irregular	1-2 days	New openings along exposed ridges and funneling stream channels, leave strips between regeneration cuts, very old stands	Created openings, stand structures, stream channels
Mass Wasting	Irregular	1-5 days	Slopes greater than 60% where average annual precipitation exceeds 100 inches	Stream channels and pools, plant communities, stand structures, seral stages, roads, trails
Avalanches	Highly irregular	1 day	Mt. Hood, Wacoma Ridge	Stream channels, plant communities, stand structures, seral stages
Beaver Ponding	Irregular	N/A	Perennial streams	Stream channels, plant communities, stand structures, seral stages
Erosion	Annually	Primarily during snowmelt and high intensity storm events	Entire watershed, especially on unpaved roads and steep trails	Stream channels and pools, ponds, ditches
Rockfall/Slides	Highly irregular	Unknown	Entire watershed	Talus, cliffs
Water Withdrawals	Annual	Generally year-round	Green Point subwatershed, West Fork Hood River	Downstream riparian plant communities; stand structures; species compositions; stream channels and pools; terrestrial, riparian, and aquatic species compositions and use patterns
Fish Stocking	Annually	Spring through Fall	Streams and lakes	Fish, amphibian, and macroinvertebrate populations, and species composition.
Ditch Failures	Highly irregular	1-5 days	Hillslopes between diversion point and flat ground	Plant communities, stand structures, seral stages, roads, ditches, stream channels and pools

*Primary or direct effects only; does not include secondary or indirect effects.

We attempted to classify the disturbance regime for each process. A disturbance was considered Acute when several decades would typically lapse before that particular disturbance would occur again. A disturbance was Chronic if it typically occurred fairly frequently, such as annually to less than 5 decades. This time span relates more to the "typical" life span of the various landscape elements, rather than what is typically considered "frequent" from a human perspective. A disturbance was considered as High in intensity and severity if it usually covered more than 100 acres or 3 miles of stream, or was likely to affect human communities. Disturbances rated Low in intensity and severity typically cover less than 100 acres or less than 1 mile of stream.

Disturbances rated as Mixed in intensity and severity consist of those where the effects are highly dependent on the conditions at the time of disturbance or the size of the disturbance. For example, the first debris torrent in several decades down a stream usually has dramatic effects, but any subsequent debris torrents down the same channel before recovery stops such movements has relatively few additional effects. As another example, one year an avalanche may run out an existing chute while in another year the avalanche may enlarge the chute.

In our rating system, we came up with disturbance regimes that were Acute/High, Acute/Mixed, Chronic/High, Chronic/Mixed, and Chronic/Low. We could not think of a process where the regime was Acute/Low. The table on the following page displays what we believe the pre-1900 regime was and the current regime. The disturbances not present on the landscape before 1900 are not rated for that period.

Disturbance Process	Pre-1900 Regime	1900-1940 Regime	Current Regime
Fire	Acute/High	Acute/High	Acute/High
Epidemic Insect Outbreaks	Acute/High	Acute/High	Acute/High
Epidemic Disease Outbreaks	Chronic/Low	Chronic/Low	Chronic/Mixed
Floods	Acute/High	Acute/High but may have begun to alter magnitude of some events in West Fork Hood River	Acute/High but may have altered magnitude or frequency of 25 year and less events
Mudflows/Debris Torrents	Acute/High	Acute/High but may have begun to alter magnitude of debris torrents in West Fork Hood River	Chronic/Mixed
Pyroclastic Flows	Acute/High	Acute/High	Acute/High
Lateral Blasts	Acute/High	Acute/High	Acute/High
Ashfall	Acute/High	Acute/High	Acute/High
Timber Harvest	Not Applicable	Chronic/High in West Fork Hood River	Chronic/High
Wind	Unknown	Unknown	
Mass Wasting	Acute/High	Acute/High but mat have begun affecting frequency in West Fork Hood River	Chronic/High
Avalanches	Acute/High on Mt. Hood Acute/Mixed other locations	Acute/High on Mt. Hood Acute/Mixed other locations	Acute/High on Mt. Hood Acute/Mixed other locations
Beaver Ponding	Chronic/Mixed	Insignificant in West Fork Hood River and Lake Branch Chronic/Mixed all other suitable streams	Insignificant
Erosion	Acute/Mixed	Chronic/Mixed in West Fork Hood River	Chronic/Mixed
Rockfall/Slides	Acute/Mixed	Acute/Mixed	Acute/Mixed
Water Withdrawals	Not Applicable	Chronic/High	Chronic/High
Fish Stocking	Not Applicable	Chronic/High	Chronic/Mixed
Ditch Failures	Not Applicable	Chronic/Mixed	Acute/Mixed

Due to their highly irregular nature, lack of evidence of significance at the landscape or watershed level, or lack of evidence that management has had any impact on the regime, the following processes were not analyzed further: pyroclastic flows, lateral blasts, ashfall, avalanches, rockfall/slides, and ditch failures. The remaining disturbance processes are discussed in more detail in the next section. Certain disturbance processes that may dramatically affect management strategy and decision-making are discussed in still greater detail. These processes include fire, insects and disease, floods (or peakflows), water withdrawals, fish stocking, and debris torrents. Peakflow analysis will be conducted under a hydrologic analysis in a separate appendix. The impacts of timber harvesting as a disturbance process are woven through the discussions on fire, insects and disease, floods, and debris torrents.

Roles of Disturbance Processes

Many disturbances play similar roles in ecosystem functioning. The roles listed below are not intended to include any judgment on the desirability or acceptability of each set of roles. It is simple an attempt to objectively state how a given process acts on the environment.

Process	Type	Role in the Environment
Fire	Natural and Human Caused	Recycle nutrients; reduce stocking levels, ladder fuels, fuel loadings; favor fire-adapted/dependent plant and animal species; scarify seeds; create snags and snag patches; begin secondary succession; alter levels of insect and disease activity; increase frequency of debris torrents
Insect Epidemic	Natural	Reduce stocking levels of host species, create snags and snag patches, recycle nutrients, create canopy gaps, begin secondary succession (often in conjunction with fire)
Disease Epidemic	Natural	Reduce stocking levels of host species, create snags and snag patches, recycle nutrients, create canopy gaps, begin secondary succession (often in conjunction with fire)
Mudflows/Debris Torrents	Natural and Human Caused	Redistribute downed woody material, change stream channel, scour streambanks, create new pools, fill in pools, begin secondary succession in floodplain, bring in new spawning substrates, bury existing spawning substrates, create frost pockets
Floods	Natural	Redistribute downed woody material, scour streambanks, clean out and create pools, fill pools, begin secondary succession in riparian zone.
Timber Harvest	Human Caused	Commodity production, reduce stocking levels, create canopy openings or gaps, favor selected species, reduce risk of insect or disease epidemic, reduce risk of wildfire, increase risk of debris torrents and mass wasting, begin secondary succession in regeneration cuts
Beaver Ponding and Activity	Natural	Create pools, favor species adapted/dependent on high water tables, favor riparian hardwoods
Mass Wasting	Natural	Redistribute nutrients, provide fish spawning material, rapidly alter landform, change channel morphology, create sag ponds

Process	Type	Role in the Environment
Erosion	Natural and Human Caused	Redistribute nutrients, provide fish spawning materials, slowly change landform, change channel morphology
Water Withdrawals	Human Caused	Reduce or eliminate stream flow and aquatic habitat, increase farm production beyond watershed, generate electric power, provide for domestic water use
Fish Stocking	Human Caused	Increase fish populations, decrease populations of prey species, increase angling success, alter composition of fish stocks.

Burning by American Indian was probably common in parts of the watershed. Early records suggest burning at various places on Wacoma Ridge for huckleberry production. The condition of Dee Flat ("burned and barren" yet with good timber in the report on the conditions of the Cascade Range Forest Reserve) also suggests at least some burning to clear trails. In addition, most individuals and groups did not extinguish their campfires; they simply abandoned them. Occasionally these campfires would have flared into larger fires.

Undesirable Effects

All disturbance processes have undesirable effects on the environment in terms of human desires or beliefs on what the ecosystem should produce and how it should function. How long a given undesirable effect lasts depends on the intensity and severity of the disturbance. Some undesirable effects may not appear until the intensity or severity reaches a critical threshold. In many cases, we do not know where this threshold lies.

Process	Undesirable Effects
Fire	Smoke and other emissions, reduced visibility, loss of economically valuable trees, loss of critical wildlife habitat, loss of fire sensitive plant species and/or habitat, increased risk of erosion and debris torrents, increased risk of bark beetle epidemics, possible decrease in site productivity, visually unattractive, create habitat for invasive non-native plants
Insect Epidemic	Loss of economically valuable trees, increased risk of large wildfire
Disease Epidemic	Loss of economically valuable trees, increased risk of large wildfire
Mudflows/Debris Torrents	Damage to infrastructure, increased sediment delivery further downstream, loss of fish habitat, possible loss of rare or sensitive aquatic and riparian species, possible flooding further downstream
Floods	Damage to infrastructure, potential loss of critical aquatic or riparian habitat, bank erosion, sedimentation
Timber Harvest	Loss of critical wildlife habitat, loss of sensitive species and/or habitat, soil compaction on slopes less than 30%, increased risk of debris torrents on slopes greater than 60%, increased forest and wildlife habitat fragmentation, increased erosion associated with roads and improper logging methods, visually unattractive, introduction of non-native plants, create habitat for invasive non-native plants, loss of biodiversity
Beaver Ponding and Activity	Damage to infrastructure, downing of economically desirable trees, plugged water diversion structures
Mass Wasting	Damage to infrastructure, increased sediment delivery, possible loss of aquatic and riparian habitat in path of flow
Erosion	Increased sediment delivery to streams, filling or loss of pools, loss of fish spawning and rearing habitat, potential loss of site productivity, road damage
Water Withdrawals	Decreased or lost water availability downstream of diversion, loss of aquatic and riparian habitat downstream of diversion, reduced water quality downstream of diversion
Fish Stocking	Potential for loss of genetic integrity of native stocks and competition with non-target species.

Risks of Undesirable Effects

The risks of undesirable effects remain relatively unchanged over pre-1900 conditions while some have increased. Where possible, the table below indicates where the greatest damage occurred or the period of most negative effects.

Process	Areas Outside RNC	Causes	Risk Rating
Fire	Possibly Mt. Defiance	Fire exclusion	Moderate to High
Insect Epidemic	Mt. Defiance	Overstocked stands, drought stress	Very High
Disease Epidemic	None identified	N/A	N/A
Debris Torrents	West Fork and Lake Branch subwatersheds	Rate of timber harvesting, some road locations in Lake Branch, removal of downed logs from intermittent streams, reduction in downed log potential in intermittent streams	High
Timber Harvest	Throughout watershed	Multiple entries, 40 acre limitation on National Forest lands, short rotations on private lands, social pressure to provide logs for local and regional economies	Moderate
Erosion	Throughout watershed	Social pressures to provide commodity outputs from National Forest lands that may not be sustainable, inadequate road maintenance, poor road locations, oversteepened slopes	Moderate to High
Water Withdrawals	Green Point subwatershed, West Fork Hood River	Increase crop production, generate hydroelectric power	Moderate
Fish Stocking	A few streams in the West Fork are stocked	Social demands for relatively high levels of catchable game fish, obligations to meet conditions of 1855 treaty with the Middle Tribes of Oregon	Low to Moderate

Role and Risk of Fire in West Fork Hood River Watershed

Role of Fire. Fire serves many roles in the West Fork watershed. Among these are reducing fuels, reducing stocking levels, favoring selected plant species and habitat conditions, recycling nutrients, and "resetting" the successional clock. The role of fire has changed in various parts of the watershed since 1900 due to aggressive wildfire suppression (fire exclusion), timber harvesting, introduction of non-native plants, construction of a major powerline corridor, and changing the typical season of burning (prescribed fire).

Within West Fork, fire may also play a role in controlling certain root diseases. Dickman and Cook (1989 in Agee 1993) suggest that interactions between fire and laminated root rot (*Phellinus weirii*) that depend on the fire return interval. Where the fire return interval is short enough to favor species resistant to laminated root rot, the disease is not widespread. As the fire return interval lengthens, laminated root rot becomes more widespread and a more important factor in stand dynamics. Another interaction arises from a particular fire effect. Burning increases available nitrogen and can increase the rate of nitrogen mineralization by exposing the forest floor to higher temperatures. Species normally susceptible to laminated root rot, such as mountain hemlock, are able to better resist the disease as nitrogen availability improves (Agee 1993).

The combination of fire and climate may have influenced the ecotone between high elevation meadows and parklands and forest. During warming and drying climate cycles, tree establishment may move upslope into meadows and parklands. Subsequent cooling periods primarily affect tree growth rates. If a disturbance, such as fire, kills the mature forest during the cooling period, a new ecotone between forest and meadow may develop (Agee 1993).

Prior to 1900, only the Mt. Defiance area and lower elevations of Green Point subwatershed likely experienced semi-frequent fire that saw a mix of low intensity underburning and high intensity stand replacing fire. Fires occurred just frequently enough to promote a more even mix of these two fire types across the landscape. Most of the remainder of the watershed experienced relatively rare stand replacing fire at the landscape level. These fires also included some underburning, but much of the underburning was probably lethal and the high intensity fire was much more prevalent in a given event. The entire watershed experiences small, low to moderate intensity fires, but these fires are not significant at the landscape level.

Fire frequency varied across the landscape, even in the areas dominated by large stand replacing fires. Around Mt. Defiance, the average fire return interval was around 50-100 years, based on the precipitation and current species compositions. The area of mixed intensity fire is defined by the areas where grand fir is a major stand component. This area generally averages 80 inches or less of annual precipitation.

Areas where western hemlock, Pacific silver fir, or mountain hemlock are the theoretical climax species (climatic climax) usually burned with high intensity fire. Various studies in the Pacific Northwest have shown a wide range of return intervals in the western hemlock zone, 100-300 years on drier Pacific silver fir sites, 300-600 years on moister silver fir sites, and over 500 years in mountain hemlock forests (Agee 1993). In the whitebark pine zone around Mt. Hood, fire probably is not a significant factor at the landscape level. The fire return interval can be quite short in whitebark pine forests and woodlands, but usually only all or part of an individual clump of trees burns. This area has more influence from other disturbance factors.

At present, the only location where human activities probably have had a measurable effect is Mt. Defiance. Excluding fire since the 1930s has probably contributed to the level and duration of the current spruce budworm outbreak. Elsewhere in the watershed, fire exclusion has not had a noticeable effect. It is possible that if we continue to exclude fire, we may begin to see some effects in the western hemlock zone.

Risk of Fire. Wildfire risk and hazard have specific meanings in fire management. **Risk** refers to the probability of fire starts. In this analysis, risk also refers to a qualitative assessment of the probability of escaped fires. **Hazard** refers to the available fuel loading. The areas of high fuel hazard on National Forest lands include:

- Mixed conifer stands on Mt. Defiance: spruce budworm related mortality of true firs
- Visual corridor along Road 13: stand age, overstory dying, new stand developing, extensive ladder fuels
- Lost Lake Butte (unconfirmed): dominated by lodgepole pine, last burned in late 1800's.

All other areas have low fuel hazards. Overall, West Fork and Lake Branch subwatersheds rate out as a low risk due to the low number of annual starts and lack of available surface fuels, particularly in the 0-3 inch diameter size categories. For the most part, the understories of forested stands are dominated by live vegetation, such as beargrass, huckleberries, rhododendrons, and numerous wet-site indicator forb species. Green Point subwatershed rates out as a moderate risk due to the low number of annual starts but the increasing probability of an escaped fire within the high hazard areas.

The weather factors that most often lead to large-scale, stand replacing fires are prolonged drought (generally lasting at least 3 years), prolonged summer drying under stable high pressure systems, followed by strong winds. Past burn patterns and evidence such as tree flagging suggests that the Mt. Defiance area is subject to both strong west and strong east winds. The remainder of the watershed is subject to strong west winds.

Strong westerly winds occur when intense thermal lows develop in the Columbia Basin east of the Deschutes River. Intense thermal lows develop from prolonged surface heating and high temperatures, creating strong connective air currents over a large area. High pressure in the Willamette Valley can also contribute to the development of strong west winds. The Columbia River Gorge can accelerate these winds to over 40 mph at eye-level. The strongest west winds typically occur between mid-July and early September.

Strong easterly winds develop under the opposite conditions as the westerlies. Usually these develop under strong high pressure inland with a strong low pressure system just offshore in the Pacific Ocean. East winds tend to occur in spring and late fall through winter. Large fires typically develop under strong east winds during October and early November. We could find no records of large fires from strong east winds in spring.

One factor related to fire that has proven impossible to discuss coherently is the chemical effects of fire and what long-term impacts may arise from changing the fire frequency and typical season of burn. While not well understood, we do know that fire can alter the amount of total nutrients, available nutrients, and soil pH. Merely altering soil pH potentially has far-reaching effects on subsequent soil chemical reactions and the populations and species compositions of soil microorganisms. Research into this aspect of fire effects is not very advanced, but does suggest that the chemical effects of fire play very important roles in ecosystem functioning. We have not found a method to evaluate the potential ecosystem effects of burning on a more frequent interval that the pre-1900 interval and burning at a different season of year (spring and mid- to late fall versus summer and early fall). This change in fire frequency is one result of managing the forests on a shorter rotation than the "natural" interval. Further, we cannot evaluate the changes in fire intensity and severity between current prescribed burning practices and pre-1900 fires.

Roles and Risks of Insects and Disease

Roles of Insects and Disease. Insects and disease serve to create snags and snag patches, reduce stocking levels, favor non-host species, cycle nutrients, and start secondary succession. In West Fork and Lake Branch subwatersheds epidemic levels of insects and disease are often closely tied to fire. A major outbreak of either or both results in more open canopies and a sudden and dramatic increase in fuel loadings. The fuels dry earlier in the season and fuel moisture levels can drop below critical thresholds earlier in the season. A large fire eventually burns through an area and may involve a larger area than that affected by the insect or disease outbreak. In turn, fire-damaged trees become more susceptible to insect and disease attack.

In Green Point subwatershed, the current levels of spruce budworm may be partly due to fire exclusion. While less certain than in other watersheds east of the Cascades, it does appear that a significant amount of underburning may have occurred before 1900. If true, then the level of host species may have been less in a typical stand before 1900 than is present currently. Therefore, the current outbreak on Mt. Defiance maybe outside the expected range natural conditions.

Research has shown that bark beetles and disease attack both healthy and susceptible trees with equal frequency. The healthy trees are usually able to eliminate the attackers. During an epidemic outbreak, however, high population levels of bark beetles or disease can overwhelm the defenses of even healthy trees. Bark beetles often serve as a vector for stem rots and stains.

Outbreaks of defoliating insects are closely tied to population levels of host species. As long as the foliage levels remain above a critical threshold, the defoliator species population levels will remain high. Defoliators are often subject to viruses once their population levels reach a critical threshold. The viruses work on either the digestive tracts of the larvae, causing them to starve to death, or on the pupae, causing them to rot or fail to mature.

Diseases operate in a similar fashion as insects. During periods of high stress due to lack of moisture or nutrients, diseases are more successful in attacking and killing trees. Some diseases have an affinity for certain species, although most diseases are not as host-specific as insects. Diseases which are more host-specific, such as white pine blister rust, tend to remain at high levels as long as the host species remains at high levels.

Risks of Insects and Disease. Only certain insects and diseases are of concern in West Fork Watershed:

Species	Hosts	Damage
Douglas-fir bark beetle Dendroctonus pseudotsugae	Douglas-fir	Attacks trees over 12" DBH, introduces blue stain fungus
western spruce budworm Choristoneura occidentalis	true firs, Douglas-fir, Engelmann spruce	Larvae mine buds and old needles in spring then consume new needles as they appear. Increases susceptibility to bark beetles and root disease. Widespread mortality on Mt. Defiance, scattered mortality elsewhere
armillaria root rot Armellaria ostoyae	primarily Douglas-fir and grand fir, but all conifers may be attacked	Increases susceptibility to fir engraver beetle, trees less windfirm
laminated root rot Phellinus weirii	Primarily Douglas-fir, grand fir, western hemlock	Mortality and windthrow, increases susceptibility to fir engraver beetle
annosus root rot Fomes annosus	Ponderosa pine, Douglas-fir, true firs, western hemlock	Mortality and windthrow, increases susceptibility to fir engraver beetle
white pine blister rust Cronartium ribicola	western white pine, whitebark pine	Branch and stem cankers that eventually cause top kill or death of most infected trees. Introduced from Eurasia in early 1930s

Role and Risk of Erosion

Role of Erosion. Erosion is caused by a variety of factors, both naturally related and as a result of management practices. Most available literature focuses on the negative effects of erosion resulting from human activities. Yet erosion is also a natural process that has been generally ignored in forest management. Erosion serves to gradually or rapidly change landforms, depending on the forces at work; provide spawning material to streams; alter stream channel morphology; redistribute nutrients, wood, and rock across the landscape; provide seedbeds for various plant species; and create productive flats and floodplains.

Erosion arises from a variety of processes. Surface erosion is the type that most people are familiar with and includes sheet, rill, and gully erosion. Deep erosion includes debris torrents, landslides, rotational slumps, and mudflows. Collectively, these processes are often called mass wasting. Management actions can often control surface erosion but rarely deep erosion. Management activities can exacerbate deep erosion by concentrating water on susceptible soils and hillslopes, removing anchoring vegetation, and cutting the toes of existing slide areas. Management actions probably have little or no effect on some deep erosion events, such as mudflows which originate from glaciers on Mt. Hood.

Risk of Erosion. The risk of erosion depends on which erosional process is involved. In West Fork, only two deep erosional processes are of the main concern due to the general rapid nature of the event and the relative frequency. Rotational slumps can occur at varying rates of speed, but are driven by such deep forces that humans can do little but stand back and watch. The upper part of Lake Branch appears to have at least two relatively slow-moving rotational slumps. These are evidenced by tiny sag ponds and pistol-butted trees. No major landslides have been noted in West Fork in recorded history. Soil types, slope steepness, the presence of fault lines, and the presence of Mt. Hood all suggest that landslides are possible.

Mudflows. Mudflows consist of a mix of soil, rock, and water with very little organic material at the point of origin. Only Ladd Creek, a tributary of West Fork Hood River, is subject to mudflows. The water source is Ladd Glacier. The soil and rock source is ash and other materials from the Mt. Hood volcano. Mudflows result from a sudden outburst of water from the glacier, such as might occur if an ice dam impounding meltwater broke, that scours the poorly consolidated and unvegetated stream channel just below the glacier. Additional solid material may come from slides along the stream channel. As the flow moves into the vegetated portion of the stream, it uproots trees and shrubs, and entrains downed wood and additional rock and soil. It can also include culverts, bridges, and roadbed as well as any other constructed objects. As the mudflow reaches flatter portions of the stream channel, the flow will begin to spread out. lose energy, and depositing some material around the edges. The deposited material can change the main channel location or split the stream flow into more than one channel.

It appears that mudflows once occurred in an unnamed tributary of Ladd Creek just to the west. The water source would have been Glisan Glacier. But, this glacier may have shrunk below a critical size needed to generate enough water to trigger a mudflow.

Mudflows on Ladd Creek are driven by factors beyond management control. The track of potential mudflows is well established between Mt. Hood and West Fork Hood River, including a very large depositional fan in T1S R8E sections 24 and 25. Any infrastructure objects constructed in the mudflow track along Ladd Creek will be at risk of damage or destruction from a mudflow event until Ladd Glacier shrinks below some critical level.

Debris Torrents. West Fork watershed has one of the highest occurrence rates of debris torrents on the Mt. Hood National Forest. Most recent events have occurred in McGee Creek and Lake Branch. Of the 157 debris torrents inventoried, 29 occurred in mature forest or non-forested lands and did not appear to be connected to any management activities. Old lookout panoramas show natural debris torrents in Lake Branch subwatershed. We know little about what actually triggers such an event in an mature forest since the anchoring fine roots are present. Natural debris torrents may be more tied to unusually wet years or high intensity rainstorms on saturated soils.

West Fork watershed currently contains many debris torrents associated with management activities, mostly clearcutting and roads. Some debris torrents in Green Point subwatershed appear to be tied to the Skyhook Fire. In part, these torrents are easy to spot and count since the concealing vegetation is now gone. It is entirely possible that some torrents associated with management might have occurred regardless. We do know that clearcutting in particular results in the loss of fine roots. Further, the energy from past torrents was at least partly absorbed by the downed trees present either in a mature stand or in an unsalvaged burn. We have left little in the way of such energy absorbers, such that debris torrents today may occur more frequently or affect a longer length of channel than before 1900.

Disturbance Regimes in West Fork and Lake Branch Subwatersheds

Lake Branch and West Fork subwatersheds typically experienced stand replacing fire at the landscape level. The majority of both subwatersheds falls into Fire Groups 6 (Cool, Moist Lower Subalpine) and 8 (Warm, Moist Western Hemlock and Pacific Silver Fir). Some Fire Group 10 (Upper Subalpine and Timberline Forests) exists within the Mt. Hood Wilderness and some Fire Group 4 (Moist Grand Fir) or 3 (Dry Grand Fir) lies east of the National Forest boundary near Dee. Typical fire return intervals within Fire Groups 6 and 8 range from 100 to over 300 years. Based on information in past timber sale Environmental Assessments, most of the National Forest lands within these subwatersheds had an average fire return interval of 300-500+ years. With such long intervals, it would seem highly unlikely that human activities have had much of an impact. However, the combination of harvest levels and planned rotations may have affected the potential return interval and have definitely affected the fuel complex, potential fire effects, and potential successional pathways.

Stand replacing fire within these two subwatersheds depends on a prolonged drought sufficient to dry large downed woody material and reduce foliar moisture in conifer needles and certain brush species. The Yellowstone Fires of 1988 demonstrated the importance of large wood in fire spread, particularly when the logs are the only fuel component dry enough to carry the fire at a particular point in time. Concentrations of downed wood are part of the fuel complex needed to generate sufficient intensity to cause a fire to move into the tree crowns. Low foliar moisture , in essence, concentrates volatile chemicals that are a normal part of conifer needles and leaves of species such as ceanothus and rhododendron. These two factors combined with a heavy lichen load and ladder fuels in the form of variously sized conifer trees form the fuel complex needed to allow a fire to "crown out". Maps from 1901 and 1916 suggest that strong west winds drove many large fires. Typical fire size would be several thousand acres. Based on the 1934 lookout panorama photos, most of the forest in Lake Branch subwatershed originated from one event. In contrast, several different events, all covering large areas, can be detected in West Fork subwatershed based on lookout panoramas and information in timber sale EAs.

Fires would have behaved somewhat differently in the riparian areas. Under the extreme weather and fuel conditions typical of large events, the riparian area would not serve as a barrier to fire spread since long-range spotting (up to 1/2 mile) would occur. The riparian area would burn, but how much would burn depended on the size of the riparian area, actual burning conditions, and chance elements. In general, a crown fire would move through the tree crowns ahead of any surface fire within a broad floodplain (e.g. West Fork Hood River or Lake Branch). Surface fire spread would vary tremendously and tend to be much more spotty than the adjacent uplands. The post-fire vegetation mosaic would be much more complex within the riparian area.

Within a narrow floodplain several possible scenarios exist. In general, the crown fire would spot across the floodplain. Surface fire may or may not burn into the riparian zone depending, to a large extent, on how deeply the riparian area is incised and dryness of the surface fuels. Many riparian trees may still die through lethal radiant heating of the crowns generated from fire burning on both hillsides even if the riparian area itself does not burn.

Immediately after the fire, the large expanses of snags and varying levels of exposed soil cover the landscape. Until a vegetative cover reestablishes, the burn area would be prone to erosion from intense rainstorms, rain-on-snow events, hillslope failure, and debris torrents on susceptible slopes. Areas where brush species such as ceanothus and rhododendron dominated before the fire may develop a deep, persistent hydrophobic soil layer. Shallow, short-lived hydrophobic soil layers may form under general forests and around rocky areas.

Available nutrients would generally increase for a short period of time while total nutrients would decrease. Nutrients in the burned duff would either volatize and become lost to the system or translocate into the soil at about the same depth as a hydrophobic soil layer would form. The greater the level of soil heating, the deeper the nutrients would translocate. In an environment as wet as West Fork and Lake Branch, these translocated nutrients would quickly leach out of the soil unless surviving or resprouting plants capture them. Unburned or lightly burned duff would begin to decay rapidly under the warmer post-fire environment, generally persisting only 3-5 years. As the duff decayed, its nutrients would become available for plant uptake. Once the duff is gone, short-term nutrient capital would depend on leaves, twigs, and branches from the replacement plant community. The chemical contents of the various parts of angiosperms differs from gymnosperms, with unknown effects on soil microorganisms. We do not know much about how the soil ecology changes after a fire.

New snags created by the fire would not be hardened, providing many new feeding and nesting sites for cavity excavators. Existing snags would be fire hardened, essentially converting them to perch trees. One unknown is whether burned bark sloughs off a tree at a different rate than unburned bark. Any existing downed logs that remained after the fire would be smaller and fire hardened. These logs would no longer serve as biological substrates for decay organisms and may no longer provide suitable den sites.

Revegetation would begin quickly from propagules stored in the seedbank; propagules carried in by animals, wind, and water; and from surviving plants or plant parts. Brush would initially dominate, but most plant species present before the burn would also be present after the burn. Certain plant species would be much reduced in population levels or area covered. Some species would grow very little after establishment, waiting for other species to ameliorate the environment. The so-called pioneer species, such as brush, certain forbs, and shade intolerant tree species would be most apparent. A brush dominated environment may persist for only a few years on productive sites and many decades on unproductive sites.

Five to ten years after the fire, many snags would fall, generally most trees under 15 inches DBH, regardless of species; and species subject to stringy rots, such as true firs and Engelmann spruce, regardless of size. Species subject to cubical rots, such as Douglas-fir and western redcedar, could persist for many decades as standing snags.

Five to seven years after the fire, deep roots would have decayed below a critical threshold, increasing the risk of debris torrents. If snags have fallen before this threshold is reached, the downed logs would serve to absorb some of the energy created by the debris torrent and lessen the impacts and effects of smaller scale events high in the subwatershed and larger events lower in the subwatershed.

Reburn potential begins building as the snags fall. In most cases, the highest reburn potential is reached 25-50 years after the fire. A reburn typically starts within the original burn but rarely covers all of it. Some previously unburned forest may be affected by the reburn. Within West Fork and Lake Branch, the highest reburn potential is probably closer to 25 years after the first fire. These subwatersheds are productive enough that relatively "fire proof" forest appears before age 50.

Deep root strength sufficient to "reanchor" the hillsides appears 30-50 years after the fire. The most productive sites could reanchor within 30 years. The least productive sites or areas that reburned could take as long as 50 years to recover. Once the deep roots are reestablished, the frequency of smaller debris torrents should decrease.

Between major fires, smaller scale disturbance events create landscape diversity. These events consist of large, but relatively short-lived insect outbreaks; low and moderate intensity fires similar to the 1993 Benson Fire in the Columbia Wilderness; smaller high intensity fires on drier, exposed ridgetops; and root rot pockets in remnant old-growth stands. After several hundred years, major fires would burn again, essentially "ignoring" much of the diversity created by the other events.

Insect outbreaks may have played a larger role in the terrestrial disturbance regime than disease, but we lack enough evidence to know for certain. Based on data from 1980-1994, it appears that defoliator insect outbreaks are tied to drought stress. Large areas of West Fork, and to a lesser extent Lake Branch, experienced a spruce budworm outbreak in 1986 and 1987. The outbreak declined dramatically in 1988 and has not reappeared. The mid-1980s were low moisture years. Overall moisture conditions improved after 1987. Interestingly, no outbreak occurred in connection with the severe drought in 1992. Bark beetles may be a significant disturbance factor only in connection with large fires or extreme droughts. We have no evidence of significant bark beetle activity since 1980.

The riparian areas in West Fork and Lake Branch were subject to more frequent major disturbances than the adjacent uplands. For example, if 100-year flood events occur approximately once every 100 years, then the streams in these two subwatersheds would experience 3-5 such flood events, on average, for every major fire event. A more frequent disturbance regime suggests more diverse and complex riparian and aquatic habitat conditions relative to the terrestrial conditions.

Landslides have been and continue to be a major force in determining riparian and aquatic habitat conditions and complexity. Landslides consist of several types of events. The most common events in West Fork and Lake Branch are debris torrents, debris flows, sidewall failures, rotational slumps and mudflows in Ladd Creek.

Debris torrents and flows are associated with high precipitation, slopes greater than 50%, loosely consolidated or unconsolidated soils, and perched water tables. Much of the upper portions of West Fork and Lake Branch contain compacted glacial till soils. Most debris torrents and flows originate in hillslope hollows, often below a slope break, that concentrate water. Sidewall failures tend to occur in deeply incised streams with unconsolidated volcanic soils and sideslopes greater than 35%. Sidewall failures are more typical of streams in West Fork subwatershed that originate on Mt. Hood.

Rotational slumps are what they sound like; a portion of the hillside slides and the entire mass rotates somewhat in the process. Rotational slumps may happen very slowly, such that the vegetation adapts and the slump is not readily noticed, or they may happen catastrophically, over a few hours. Hillsides dominated by trees with "pistol butts" indicate a rotational slump moving at moderate speed. A feature called a sag pond often develops at the top of a rotational slump. Several small lakes, or tarns, are found below Indian Mountain and may be sag ponds. Sawtooth Ridge has a tiny sag pond on its north aspect. Most rotational slumps occur in Lake Branch subwatershed.

Ladd Creek is subject to mudflows originating from Ladd Glacier. Material for the mudflow comes from the large deposit below the glacier and from sidewall failures high in the drainage. Water that triggers the mudflow comes from intense rainstorms or rain-on-snow events which also dramatically accelerate glacial melting. The stream undercuts and washes out the debris buildup, creating a mudflow. The last major mudflow in Ladd Creek occurred in the early 1960s. New slides have been noted in Ladd Creek within the Mt. Hood Wilderness, suggesting the possibility of another mudflow event in the near future.

After a major disturbance, such as a flood or debris torrent, species such as alder, willow, cottonwood, and vine maple would dominate the replacement plant community. Hardwood dominated communities in lower gradient reaches would provide suitable conditions for beaver. Beaver would tend to utilize side channels in the mainstem of West Fork and Lake Branch and the mainstems of the tributaries.

Eventually conifers would establish and grow within the hardwood communities. Beaver activity, such as dam and lodge construction and maintenance, felling hardwoods for food, and flooding, would allow the hardwood dominated community to persist. Elsewhere, conifers would establish first on drier portions of the floodplains and gradually "move" into wetter portions. There may be a short period of time in which conifers dominate the riparian stand with only scattered hardwoods in the understory. Eventually, a more cathedral-like conifer stand develops, allowing hardwoods of tree size to grow in the understory. The conifer stand in this case is comprised of widely spaced, very large trees with crowns well above the forest floor. Vine maple and Douglas maple trees generally less than 30 feet tall would be prevalent in the understory.

Larger conifer trees are more resistant to damage from flood events than smaller trees. Susceptibility to flood events increases as conditions become wetter, decreasing the rooting zone. Even very large trees become susceptible to floods if the stand becomes more exposed to wind due to another kind of disturbance (fire or insects), if root disease kills a sufficient number of roots, or channel shifting undermines the tree. Debris torrents in any stream and mudflows in Ladd Creek can cause even well rooted trees to fall or could deposit enough material at the base of the tree to "smother" the roots and kill the tree. The broader floodplain in upper West Fork would likely be more diverse with more side channels than the floodplain of Lake Branch.

Disturbance Regimes in Green Point Subwatershed

Green Point subwatershed typically experienced a mix of stand replacing fire and non-lethal underburning. Fire Groups 3 (Dry Grand Fir), 9 (Dry Western Hemlock and Westside Douglas-fir), and 6 (Cool, Moist Lower Subalpine) comprise the bulk of this subwatershed. Most of the National Forest lands lie within the Pacific silver fir zone, normally in Fire Groups 8 and 6, but available evidence suggests that the fire regime in the lower portions of the zone were more typical of Fire Group 9.

The fire return interval was much more variable in Green Point subwatershed. The average may have ranged from as low as 50-100 years below about 4000 feet elevation to over 200 years above 4000 feet. The combination of Mt. Defiance, Blowdown Ridge, and Wacoma Ridge creates a rainshadow effect within Green Point subwatershed. The various plant communities present indicate much drier conditions in Green Point than in Lake Branch or West Fork.

Below 4000 feet, fire return is driven by a combination of seasonal drought and prolonged drought. Much of the lower portions of the subwatershed would be dry enough to burn by mid-June or July in most years. Before 1900, American Indian burning would have been a significant and frequent ignition source in the lower elevations of Green Point subwatershed. This burning would have occurred in association with maintaining travel routes along Hood River and fishing at Punchbowl Falls. In general, people did not extinguish campfires before the advent of European-style forestry in the United States; they simply abandoned them. One result of burning in lower elevations would be fires sweeping up Green Point subwatershed, particularly during east wind events.

Frequent underburning would maintain more open forests dominated by more fire resistant species, such as Douglas-fir and noble fir. Fires would not have reached the area currently in the National Forest system as frequently as lower in the subwatershed, so the evidence of fire is more mixed and the average return interval longer. It appears that relatively frequent underburns would have occurred for some period of time followed by an extended period without fire. During the fire-free period, fuel loadings would build and the tree canopy would become more dense as fire susceptible species, such as grand fir and Pacific silver fir, established in the stands. If the fire-free period lasted for more than 30 or 40 years, conditions would develop that would support a stand replacing fire. If this scenario is accurate, then below 4000 feet Green Point subwatershed would be characterized by relatively frequent underburning followed by an extended fire free period, followed by a stand replacing fire.

Another potential scenario below 4000 feet is that of frequent underburning prior to 1855. As Euro-American settlers replaced the American Indians in Hood River valley and on Dee Flat, the number of ignitions would decline and the fire frequency change. By 1900, the fire free period would have extended long enough to provide conditions suitable for stand replacing fire to occur. Since we have no good descriptions of the vegetation prior to 1900, either scenario is equally probable. The lower elevation stands were harvested long ago, leaving little evidence of fire history. Major stand replacing events would occur under the same conditions as described for West Fork and Lake branch, although these conditions could develop more frequently under the drier environment of Green Point.

Underburning on Mt. Defiance would be more dependent on early season fire start that creeps and smolders over an extended period of time. Initially, most of the fire behavior would consist of low flame lengths and rates-of-spread. As the season warms and dries, flame lengths and rates-of-spread would increase. Torching and short crown fire runs could occur during the warmest and driest part of the day. Either strong east or west wind events would result in larger crown fire runs. By the time the season-ending moisture event occurred, an individual fire could cover several thousand acres.

Immediately after the fire, many of the same effects described under West Fork and Lake Branch subwatersheds would apply in Green Point subwatershed. Snags would consist of a mix of scattered individuals and patches of varying size. Ceanothus, chinkapin, and vine maple would dominate the brushfields instead of ceanothus and rhododendron. Post fire recovery rates would be slower and brush fields are more likely to persist longer in Green Point. This subwatershed is not as susceptible to debris torrents as Lake Branch and West Fork, so this related disturbance factor may not play as large a role in landscape dynamics.

Insect outbreaks evidently play a major role in landscape dynamics in Green Point subwatershed. A major spruce budworm outbreak began in 1983 and continues in 1995. Unlike West Fork, the outbreak did not lesson in 1988; it continued to grow. Currently, the outbreak affects nearly every stand north of Ottertail Lake and Long Branch Creek. Tree mortality is increasing rapidly on National Forest lands. Other tree pests, such as bark beetles and root disease, are increasing. This outbreak appears to be drought-related. Green Point subwatershed experiences more drought and is more susceptible to decreases in annual precipitation than West Fork and Lake Branch.

Landslides are much less common in Green Point subwatershed. Instead, the major erosion forces are tied to events such as floods, rockfall or rockslides, soil creep, and dry ravel. Debris torrents and flows may still occur but are restricted more to the upper end of the subwatershed. Beaver activity also may have been more limited due to the steeper gradients in much of the subwatershed.

Features That Affect Disturbance Processes

Along with discussing how disturbances affect landscape features, we discussed how certain landscape features affect disturbances. In many cases, there is a feedback loop. A disturbance creates a feature which then affects disturbances which then affect features, and so on. Some examples include:

Feature	Process Affected	Features Affected
Roads and Trails	Runoff, infiltration, peakflow, erosion, wildlife use patterns, spread of weeds	Drainage network
Culverts	Aquatic species migration, stream hydrology, wood movement	Channel morphology
Ditches and above-ground Pipelines	Wildlife movement and distribution, erosion, peakflow, baseflow, spring and seep hydrology	Species composition, drainage network, aquatic habitat, vegetation patterns
Major powerlines	Wildlife movement and distribution, spread of weeds	Vegetation patterns
Water sources (Fill sites)	Stream hydrology	Aquatic habitat
Campgrounds and heavily used dispersed campsites	Runoff, infiltration, erosion, wildlife use patterns	Vegetative communities, aquatic habitat, downed logs
Harvest units	Erosion, debris torrents, infiltration, runoff, wildlife use patterns, peakflow, possibly baseflow, fire	Drainage network, plant communities, stand structures, channel morphology

Appendix B

Species Known or Suspected in West Fork Watershed

APPENDIX B--SPECIES KNOWN OR SUSPECTED IN WEST FORK WATERSHED

Animals

Key to codes:
- C2--Federal candidate for listing as threatened or endangered
- R6--Regional Forester's list of sensitive species
- SE--State Endangered species
- ST--State Threatened species
- SP--State Sensitive - peripheral or naturally rare
- SC--State Sensitive - critical
- SV--State Sensitive - vulnerable
- SU--State Sensitive - undetermined status
- FEMAT--FEMAT species of concern, less than 80% likelihood of achieving Outcome A

Common Name	Species	Comments
	BIRDS	
golden eagle	Aquila chrysaetus	Uncommon
bald eagle	Haliaeetus leucocephalus	Threatened, R6, ST
osprey	Pandion haliaetus	
sharp-shinned hawk	Accipter striatus	
Cooper's hawk	Accipter cooperi	
northern goshawk	Accipter gentilis	C2, SC, declining
northern harrier	Circus cyaneus	
rough-legged hawk	Buteo lagopus	
red-tailed hawk	Buteo jamaicensis	
merlin	Falco columbarius	
American kestrel	Falco sparvenius	Declining
peregrine falcon	Falco peregrinus	
turkey vulture	Cathartes aura	Summer, declining
ring-necked pheasant	Phesianus colchicus	Introduced
blue grouse	Dendragapus obscurus	Uncommon
ruffed grouse	Bonasa umbellus	
California quail	Callipepla califomica	Uncommon
mountain quail	Oreortyx pictus	C2
wild turkey	Meleagris gallopavo	Introduced, uncommon
American coot	Fulica americana	
killdeer	Charadrius vociferus	
common snipe	Gallinago gallinago	Summer
greater yellowlegs	Tringa melanoleuca	Winter
spotted sandpiper	Actitis macularia	Summer
western sandpiper	Calidris mauri	
ring-billed gull	Larus delawarensis	Summer

Common Name	Species	Comments
herring gull	Larus argentatus	
band-tailed pigeon	Columba fasciata	Declining
mourning dove	Zenaida macroura	Declining
barn owl	Tyto alba	
long-eared owl	Asio otus	
great horned owl	Bubo virginianus	
barred owl	Strix varia	
great gray owl	Strix nebulosa	Uncommon, SV
northern spotted owl	Strix occidentalis	Threatened, ST, declining
snowy owl	Nyctea scandiaca	Rare, winter
western screech owl	Otus kennicottii	Uncommon
flammulated owl	Otus flammeolus	SC
northern pygmy owl	Glaucidium gnoma	SU
northern saw-whet owl	Aegolius acadicus	
common nighthawk	Chorodeiles minor	
common poorwill	Phalaenoptilus nutallii	Summer
Vaux's swift	Chaetura vauxi	Rare, summer
calliope hummingbird	Stellula calliope	Summer, declining
rufous hummingbird	Selasphorus rufus	Summer, declining
belted kingfisher	Ceryle alcyon	
northern flicker	Colaptes auratus	Declining
acorn woodpecker	Melnerpes formicivorus	SU
white-headed woodpecker	Picoides albolarvatus	SC
Lewis' woodpecker	Melanerpes lewis	SC, declining
Williamson's sapsucker	Sphyrapicus thyroideus	SU
red-breasted sapsucker	Sphyrapicus ruber	Declining
red-napped sapsucker	Sphyrapicus nuchalis	
downy woodpecker	Picoides pubescens	
hairy woodpecker	Picoides villosus	Declining
three-toed woodpecker	Picoides tridactylus	SC
black-backed woodpecker	Picoides arcticus	SC, FEMAT, declining
pileated woodpecker	Dryocopus pileatus	SV, declining
western kingbird	Tyrannus verticalis	Summer
olive-sided flycatcher	Contopus borealis	Summer, declining
western wood-pewee	Contopus sordidulus	Summer, declining
ash-throated flycatcher	Myiarchus cinerascens	Summer
Say's phoebe	Sayornis saya	Summer
dusky flycatcher	Empidonax oberholseri	Summer

Common Name	Species	Comments
Hammond's flycatcher	Empidonax hammondii	Summer, declining
willow flycatcher	Empidonax traillii	Summer, declining
Pacific slope flycatcher, western flycatcher	Empidonax difficilis	Summer, declining
Cordilleran flycatcher	Empidonax occidentalis (?)	Summer
horned lark	Eremophila alpestris	
tree swallow	Tachycineta bicolor	Summer
violet-green swallow	Tachycineta thalassina	Summer
cliff swallow	Hirundo pyrrhonota	Summer
barn swallow	Hirundo rustica	Summer, declining
scrub jay	Aphelocoma coerulescens	
Steller's jay	Cyanocitta stelleri	
gray jay	Perisoreus canadensis	
Clark's nutcracker	Nucifraga columbiana	
American crow	Corvus brachyrhynchos	
common raven	Corvus corax	
black-capped chickadee	Parus atricapillus	
mountain chickadee	Parus gambeli	
chestnut-backed chickadee	Parus rufescens	Declining
bushtit	Psaltriparus minimus	
brown creeper	Certhia americana	Declining
white-breasted nuthatch	Sitta carolinensis	Declining
red-breasted nuthatch	Sitta canadensis	Declining
house wren	Troglodytes aedon	Summer
winter wren	Troglodytes troglodytes	Declining
Bewick's wren	Thryomanes bewickii	
marsh wren	Cistothorus palustris	Summer,
golden-crowned kinglet	Regulus satrapa	Summer, declining
ruby-crowned kinglet	Regulus calendula	Summer
western bluebird	Scialia mexicana	SV, summer
mountain bluebird	Scialia curricoides	Summer, declining
Townsend's soltaire	Myadestes townsendii	
Swainson's thrush	Catharus ustulatus	Summer, declining
hermit thrush	Catharus guttatus	Declining
varied thrush	Ixoreus naevius	
American robin	Turdus migratorius	
loggerhead shrike	Lanius ludovicianus	C2, SU, declining
northern shrike	Lanius excubitor	
American pipit	Anthus rubescens	

Common Name	Species	Comments
American dipper	Cinclus mexicanus	
Bohemian waxwing	Bombycilla garrulus	Winter
cedar waxwing	Bombycilla cedrorum	
European starling	Sturnus vulgaris	Introduced
solitary vireo	Vireo solitarius	Summer
warbling vireo	Vireo gilvus	Summer, declining
orange-crowned warbler	Vermivora celata	Summer, declining
Nashville warbler	Vermivora ruficapilla	Summer
yellow-rumped warbler	Dendroica coronata	Summer
black-throated gray warbler	Dendroica nigrescens	Summer
Townsend's warbler	Dendroica townsendi	Summer
hermit warbler	Dendroica occidentalis	Summer, declining
yellow warbler	Dendroica petechia	Summer
MacGillivary's warbler	Oporornis tolmiei	Summer, declining
Wilson's warbler	Wilsonia pusilla	Summer
common yellowthroat	Geothlypis trichas	Summer
yellow-breasted chat	Icteria virens	Summer
black-headed grosbeak	Pheucticus melanocephalus	Summer
lazuli bunting	Passerina amoena	Summer
green-tailed towhee	Pipilo chlorurus	Summer
rufous-sided towhee	Pipilo erythrophthalmus	
vesper sparrow	Pooecetes gramineus	Summer
savannah sparrow	Passerculus sandwichensis	Summer
song sparrow	Melospiza melodia	
chipping sparrow	Spizella passerina	Summer, declining
dark-eyed junco	Junco hyemalis	
white-crowned sparrow	Zonotrichia leucophrys	Declining
golden-crowned sparrow	Zonotrichia atricapilla	
fox sparrow	Passerella iliaca	Summer
Lincoln's sparrow	Melospiza lincolnii	Summer
red-winged blackbird	Agelaius phoeniceus	
Brewer's blackbird	Euphagus cyanocephalus	
brown-headed cowbird	Molothrus ater	Increasing
northern oriole	Icterus galbula	Summer, declining
western tanager	Piranga ludoviciana	Summer
house sparrow	Passer domesticus	Introduced
pine siskin	Carduelis pinus	
American goldfinch	Carduelis tristis	Declining

Common Name	Species	Comments
red crossbill	Loxia curvirostra	Declining
pine grosbeak	Pinicola enucleator	
rosy finch	Leucosticte arctoa	
purple finch	Carpodacus purpureus	
Cassin's finch	Carpodacus cassinii	
evening grosbeak	Coccothraustes vespertinus	
common loon	Gavia immer	R6
Clark's grebe	Aechmophorus clarkii	
western grebe	Aechmophorus occidentalis	
horned grebe	Podiceps auritus	SP, summer
pied-billed grebe	Podilymbus podiceps	
double-breasted cormorant	Phalacrocorax auritus	
American bittern	Botaurus lentiginosus	
green-backed heron	Butorides striatus	
great blue heron	Ardea herodias	
sandhill crane	Grus canadensis	R6, SV, Summer
tundra swan	Cygnus columbianus	Winter
Canada goose	Branta canadensis	
mallard	Anas platyrhynchos	
gadwall	Anas strepera	
green-winged teal	Anas crecca	
American widgeon	Anas americana	
northern pintail	Anas acuta	
northern shoveler	Anas clypeata	Summer
blue-winged teal	Anas discors	Summer
cinnamon teal	Anas cyanoptera	Summer
ruddy duck	Oxyura jamaicensis	
wood duck	Aix sponsa	Declining
ring-necked duck	Aythya collaris	
lesser scaup	Aythya affinis	
harlequin duck	Histrionicus histrionicus	C2, R6, SP, declining
Barrow's goldeneye	Bucephala islandica	SP, summer
common goldeneye	Bucephala clangula	Winter
bufflehead	Bucephala albeola	SP, winter, declining
common merganser	Mergus merganser	
hooded merganser	Lophodytes cucullatus	
MAMMALS		
Virginia opossum	Didelphis virginiana	Introduced

Common Name	Species	Comments
vagrant shrew	Sorex vagrans	
dusky shrew	Sorex monticolus	
water shrew	Sorex palustris	
Pacific water shrew	Sorex bendirii	
Trowbridge's shrew	Sorex trowbridgii	
shrew-mole	Neurotrichus gibbsii	
coast mole	Scapanus orarius	
yuma myotis	Myotis yumanensis	
long-eared myotis	Myotis evotis	FEMAT
long-legged myotis	Myotis volans	FEMAT
California myotis	Myotis californicus	
western small-footed myotis	Myotis occidentalis (?)	
silver-haired bat	Lasionycteris noctivagans	FEMAT
big brown bat	Eptesicus fuscus	
hoary bat	Lasiurus cinereus	FEMAT
Townsend's big-eared bat	Plecotus townsendii	C2, R6, SC, declining
pika	Ochotona princeps	
brush rabbit	Sylvilagus bachmani	
snowshoe hare	Lepus americanus	
mountain beaver	Aplodontia rufa	
Townsend's chipmunk	Eutamias townsendii	
yellow-pine chipmunk	Eutamias amoenus	
Townsend's chipmunk	Eutamias townsendii	
yellow-bellied marmot	Marmota flaviventris	
California ground squirrel	Spermophilus beecheyi	
golden-mantled ground squirrel	Spermophilus lateralis	
western gray squirrel	Sciurus griseus	
Douglas' squirrel	Tamiasciurus douglasii	
northern flying squirrel	Glaucomys sabrinus	
northern pocket gopher	Thomomys talpoides	
western pocket gopher	Thomomys mazama	
beaver	Castor canadensis	
deer mouse	Peromyscus maniculatus	
bushy-tailed woodrat	Neotoma cinerea	
western red-backed vole	Clethrionomys rutilus	
heather vole	Phenacomys intermedius	
red tree vole	Phenacomys longicaudus	FEMAT

Common Name	Species	Comments
Townsend's vole	Microtus townsendii	
long-tailed vole	Microtus longicaudus	
creeping vole	Microtus oregoni	
water vole	Arvicola richardsoni	
Norway rat	Rattus norvegicus	Introduced
house mouse	Mus musculus	Introduced
western jumping mouse	Zapus princeps	
Pacific jumping mouse	Zapus trinotatus	
porcupine	Erethizon dorsatum	
coyote	Canis latrans	
red fox	Vulpes vulpes	Introduced(?)
gray fox	Urocyon cinereoargenteus	
black bear	Ursus americanus	
raccoon	Procyon lotor	
pine marten	Martes americana	SC, FEMAT, declining
fisher	Martes pennanti	C2, SC, FEMAT, declining
ermine	Mustela erminea	
long-tailed weasel	Mustela frenata	
mink	Mustela vison	
wolverine	Gulo gulo	C2, R6, ST
western spotted skunk	Spilogale gracilis	
striped skunk	Mephitis mephitis	
river otter	Lutra canadensis	
cougar	Felis concolor	
bobcat	Felis rufus	
elk	Cervus elaphus	
mule deer, black-tailed deer	Odocoileus hemionus	
REPTILES		
painted turtle	Chrysemys picta	R6, SC, declining
western pond turtle	Clemmys marmorata	C2, R6, SC, declining
western fence lizard	Sceloprus occidentalis	
northern alligator lizard	Gerrhonotus coeruleus	
southern alligator lizard	Gerrhonotus multicarinatus	
western skink	Eumeces skiltonianus	
rubber boa	Charina bottae	
racer	Coluber constrictor	
sharp-tailed snake	Contia tennuis	SV, declining

Common Name	Species	Comments
ringneck snake	Diadophis punctatus	
gopher snake	Pituophis melanoleucus	
western terrestrial garter snake	Thamnophis elegans	
western garter snake	Thamnophis ordinoides	
common garter snake	Thamnophis sirtalis	
western rattlesnake	Crotalus viridis	
AMPHIBIANS		
rough-skinned newt	Taricha granulosa	Declining
northwestern salamander	Ambystoma gracile	
long-toed salamander	Ambystoma macrodactylum	
Cascade torrent salamander	Rhyacotriton cascadae (?)	SV, FEMAT, declining
Cope's giant salamander	Dicamptodon copei	R6, SU, FEMAT, declining
Pacific giant salamander	Dicamptodon ensatus	Declining
Oregon slender salamander	Batrachoseps wrighti	SV, FEMAT, declining
ensatina	Ensatina eschscholtzi	
Dunn's salamander	Plethodon dunni	Declining
Larch Mountain salamander	Plethodon larselli	R6, SP, FEMAT
western red-backed salamander	Plethodon vehiculum	
tailed frog	Ascaphus truei	SV, FEMAT, declining
red-legged frog	Rana aurora	C2, R6, SU, declining
Cascades frog	Rana cascadae	C2, SV, declining
bullfrog	Rana catesbeiana	Introduced
spotted frog	Rana pretiosa	C2, SC
western toad	Bufo boreas	SV
Pacific treefrog	Hyla regilla	
FISH		
rainbow trout	Oncorhynchus mykiss	
steelhead trout	Oncorhynchus mykiss	
chinook salmon	Oncorhynchus tshawytscha	
sockeye salmon/kokanee	Oncorhynchus nerka	
cutthroat trout	Oncorhynchus clarkii	
brook trout	Salvelinus fontinalis	Introduced
brown trout	Salmo trutta	Introduced
Pacific lamprey	Entosphenus tridentatus	Extirpated
western brook lamprey	Lampetra richardsonii	Extirpated
sculpins	Cottus spp.	
mountain whitefish	Prosopium williamsoni	

Common Name	Species	Comments
MOLLUSKS		
Malone jumping slug	*Hemphillia malonei*	C-3 Survey strategies 1, 2
	Juga (Oreobasis) n. sp. 2	C-3 Survey strategies 1, 2
	Lyogyrus n. sp. 1	C-3 Survey strategies 1, 2
	Monadenia fidelis minor	C-3 Survey strategies 1, 2
	Cryptomastix devia	C-3 Survey strategies 1, 2
	Cryptomastix hendersoni	C-3 Survey strategies 1, 2
	Deroceras hesperium	C-3 Survey strategies 1, 2
	Hemphillia pantherina	C-3 Survey strategies 1, 2
	Prophysaon coerulum	C-3 Survey strategies 1, 2
	Prophysaon dubium	C-3 Survey strategies 1, 2

C-3 Plants: Occurrence and Potential for Occurrence

CODES USED IN THE ATTACHED TABLE

The attached table format is similar to the ROD Table C-3 on pages 49-61, with the fungi groups listed first, lichen groups second, bryophytes third, and vascular plants last. Additional columns were added to incorporate habitat information and known range and/or geographic extent. Appendix J2, FSEIS on Management of Habitat for Late-Successional and Old-Growth Forest Related Species within the Range of the Northern Spotted Owl, pages 83-247, provided a large percentage of the information available regarding species range and geographic extent. A format key is attached. The key identifies codes used to expedite and condense this table. Species considered not likely to occur in the watershed are not listed.

Survey Strategy

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

Occurrence

D - Documented sites
P - Potential habitat present
? - Unknown, inadequate information

Trees and Shrubs

ABAM - *Abies amabalis* (Pacific silver fir)
ABCO - *Abies concolor* (white fir)
ABGR - *Abies grandis* (grand fir)
ABLA2 - *Abies lasiocarpa* (subalpine fir)
ABMAS - *Abies magnifica* var. *shastensis* (Shasta red fir)
ABPR - *Abies procera* (noble fir)
ACCI - *Acer circinatum* (vine maple)
ACMA - *Acer macrophyllum* (bigleaf maple)
ARsp - *Arctostaphylos* species (manzanita)
CACH - *Castanopsis chrysophylla* (chinkapin)
CHNO - *Chamaecyparis nootkatensis* (Alaska yellow-cedar)
PIAL - *Pinus albicaulis* (whitebark pine)
PIAT - *Pinus attenuata* (knobcone pine)
PICO - *Pinus contorta* (lodgepole pine)
PIEN - *Picea engelmannii* (Engelmann spruce)
PILA - *Pinus lambertiana* (sugar pine)
PIMO - *Pinus monticola* (western white pine)
PISI - *Picea sitchensis* (Sitka spruce)
PIPO - *Pinus ponderosa* (ponderosa pine)
PSME - *Pseudotsuga menziesii* (Douglas-fir)
QUGA - *Quercus garryana* (Oregon white oak)
TABR - *Taxus brevifolia* (Pacific yew)
THPL - *Thuja plicata* (western redcedar)
TSHE - *Tsuga heterophylla* (western hemlock)
TSME - *Tsuga mertensiana* (mountain hemlock)

SPECIES	SURVEY STRATEGY	PRESENCE	HABITAT	KNOWN RANGE OR GEOGR. EXTENT
MYCHORRHIZAL FUNGI:				
BOLETES				
Gastroboletus subalpinus	1, 3	P	above 4500', ectomychorrizal with pines	Endemic OR Cascades and N. Sierras
Gastroboletus turbinatus	3	P	mid-high elevation w/true firs, PIEN/PISI, TSHE/TSME, w/abundant LWD, humus	WA to N. CA, WA/OR Coast Range, Sisk. Mts, Klam. Mts, N ID, MI, Mexico
BOLETES LOW ELEVATION				
Boletus piperatus	3	P	low-mid elev. forests, requires LWD in PSME	Unknown
Tylopilus pseudoscaber	1, 3	?	low elev. moist habitat, often with PISI	PNW coast endemic
RARE BOLETES				
Boletus haemantinus	1, 3	P	high elevation ABAM	CA north to WA
Boletus pulcherrimus	1, 3	P	low-mid elev. conifer	CA to Canada, north to *Olympics*
Gastroboletus imbellus	1, 3	P	upper mid elev. (5000') w/ABAM, ABGR, PSME, TSHE, TSME, possibly ectomychorrizal with pine	locally endemic to Willamette NF (WNF), Ollalie Trail, and Lamb Butte Scenic
Gastroboletus rubur	1, 3	P	upper mid-high elev. w/mature TSME and developed humus layer	endemic to WA N. Cascades south to Willamette Pass, OR
FALSE TRUFFLES				
Nivatogastrium nubigenium	1, 3	P	mid-high elev. in mature forests w/abundant LWD (relies on mammals for dispersal)	Cascade Mts of CA north to Mt. Adams and northern ID
Rhizopogon abietis R. *atroviolaceus* R. truncatus	3	P	high elev. mixed conifer (true firs, pines, PSME, *TSME) in moderate to dry* sites	E. Canada, E. USA, N. Rockies, Strawberry Mts, *OR, Cascade and Klamath* mts.
Thaxterogaster pinque	3	P	only mid-high elev. true firs w/ thick humus, LWD	Cascade mts south of Canadian border to N. Sierras, Sisk. mts, OR, Klam. mts, CA
UNCOMMON FALSE TRUFFLES				
Macowanites chlorinosmus	1, 3	?	low elev. PISI, PSME, TSHE with LWD	endemic OR coast and Coast Ranges
RARE FALSE TRUFFLES				
Alpova alexsmithii	1, 3	P	mid to upper elev. w/true firs, TSHE and possibly pines	endemic to Cascade mts and BC Coast Range
Alpova olivceotinctus	1, 3	?	*a single site known in the* range of n. spotted owl w/ABAMS	*Unknown*

SPECIES	SURVEY STRATEGY	PRESENCE	HABITAT	KNOWN RANGE OR GEOGR. EXTENT
Arcangeliella crassa. A. lactariodes	1, 3	?	mid-high elev. montane forests with true firs and/or TSME	western OR, N. CA mts, Shasta/Lassen
Destuntzia fusca, D. rubra	1, 3	?	low to lower-mid elev. in variously mixed true firs, TSHE, PSME, oaks, pines, redwood	Mendocino County, CA & WNF, Linn City
Gautieria magnicellaris	1, 3	P	high elev. w/TSME and true firs	WNF, Klamath NF (KNF), Mt. Wash. Wild., NE USA, Germany, Czechoslovakia
Gautieria otthii	1, 3	P	mid to upper-mid elev., ectomychorrizal w/Pineceae	N CA, Sisk. mts, OR, central Cascades, Europe, AK
Leucogaster citrinus	1, 3	P	low to high elev. w/PSME, TSHE, CACH, ARsp, tanoak or in stands w/LWD	Mendocino County, CA north ot Linn and Benton counties, OR
Leucogaster microsporus	1, 3	P	mid elev. w/PSME or in stands w/abundant LWD	Slopes of W Cascade mtns, N Cascades and Coast Range, OR to S Cascades, WA
Macowanites lymanensis	1, 3	P	mid elev. old growth TSME/ABPR forest	Lyman Lake, Wenatchee NF
Macowanites mollis	1, 3	P	mid elev. mature to old growth PSME, pines	Mt. Rainier NP, Larch Mt., MHNF
Martellia idahoensis	1, 3	P	mid-upper mid elev. w/true firs and Pineceae	Coast Range SNF, Cascade Range WNF, N ID
Martellia monticola	1, 3	P	mid-high elev, old growth TSME/true fir	central to north OR Cascades
Octavianiana macrospora	1, 3	P	mt. foothills in PSME/TSME old growth forest	former Twin Bridges CG
Octavianiana papyracea	1, 3	?	coastal mixed PSME/TSME/PISI forest in a fog belt	Humbolt County, CA
Rhizopogon brunneiniger	1, 3	?	low-high elev. dry old growth PSME/TSME/fir/pine forest	N OR Cascades & Coast Ranges, N CA
Rhizopogon evadens var. subalpinus	1, 3	?	upper mid elev. TSME/fir/pine forest near timberline	N CA to WA and ID
Rhizopogon exiguus	1, 3	P	moist-dry mature to old growth PSME/TSME low-mid elev. forest	Cascade mts of WA, and OR Coast Range
Rhizopogon flavofibrillosus	1, 3	P	mid-upper mid elev. mature to old growth mixed conifer forest	N CA, Siskiyou Mts, central OR Cascades
Rhizopogon inquinatus	1, 3	P	mid-upper mid elev. mature to old growth PSME forest	S. Santiam River, WNF, ID
Sedecula pulvinata	1, 3	?	mid-high elev. old growth TSME/true fir	Mt. Shasta to Yuba Pass, CA; CO

SPECIES	SURVEY STRATEGY	PRESENCE	HABITAT	KNOWN RANGE OR GEOGR. EXTENT
UNDESCRIBED TAXA, RARE TRUFFLES, & FALSE TRUFFLES				
Alpova sp. nov. Trappe #9730, #1966; Arcangeliella sp. nov. Trappe #12382	1, 3	?	mid-high elev. mature to old growth PSME/PILA/ARsp/PIAT/ ABMAS forest	Siskiyou mtns of SW OR
Arcangeliella sp. nov. Trappe #12359	1, 3	?	mature to old growth PISI/TSME/PSME coastal fog belt forest	Lane, Lincoln, & Tillamook counties, OR
Chamonixia pacifica sp. nov. Trappe #12768	1, 3	?	upper mid elev. old growth PSME/TSME/PISI/ABAM forest	N coastal OR and N Cascades of WA
Elaphomyces sp. nov. Trappe #1038	1, 3	?	mature to old growth PISI/TSME/PSME coastal fog belt forest	Lane, Lincoln, and Tillamook counties, OR
Gastroboletus sp. nov. Trappe #2897	1, 3	?	mid-high elev. mature to old growth PSME/PISI/ARsp/PIAT/ ABMAS	Siskiyou mts of SW OR
Gastrosuillus sp. nov. Trappe #7515	1, 3	P	high elev. old growth TSME forest	Crater Lake NP
+Gastrosuillus sp. nov. Trappe #7516	1, 3	P	high elev. mature to old growth true fir and coniferous forest	KNF, OR
Gymnomyces sp. nov. Trappe #4703, 5576	1, 3	?	upper mid elev. mature ABPR forest	Suislaw NF (SNF) and Coast Range of OR
Gymnomyces sp. nov. Trappe #5052	1, 3	P	high elev. mature to old growth TSME/ABAM forest	Phlox Point, MHNF
Gymnomyces sp. nov. Trappe #1690, 1706, 1710	1, 3	P	upper mid elev. mature to old growth ABGR/ABPR/ABAM/ TSME forest	W OR Cascades, WNF
Gymnomyces sp. nov. Trappe #7545	1, 3	P	upper mid elev. mature to old growth true fir and coniferous forest	KNF, OR
Hydrotrya sp. nov. Trappe #787, 792	1, 3	P	upper mid elev. old growth ABAM/TSME forest	Mt. Jefferson, WNF
Hydrotrya subnix sp. nov. Trappe #1861	1, 3	P	old growth ABAM forest	Gifford Pinchot NF (GPNF)
Martellia sp. nov. Trappe #311, 649	1, 3	P	high elev. mature to old growth TSME/ABAM forest	Phlox Point, MHNF
Martellia sp. nov. Trappe #1700	1, 3	P	upper mid elev. mature to old growth ABGR/ABAM/PSME/ TSME forest	WNF
Martellia sp. nov. Trappe #5903	1, 3	P	upper mid elev. old growth ABAM/TSME forest	Mt. Jefferson, WNF
Octavianina sp. nov. Trappe #7502	1, 3	P	upper mid elev. mature to old growth ABGR/ABAM/PSME/ TSME forest	WNF

SPECIES	SURVEY STRATEGY	PRESENCE	HABITAT	KNOWN RANGE OR GEOGR. EXTENT
Rhizopogon sp. nov. Trappe #9432	1, 3	?	mid-high elev. mature to old growth PSME/PILA/ARsp/PIAT/ Shasta pine forest	Siskiyou mts of SW OR
Rhizopogon sp. nov. Trappe #1692, 1698	1, 3	P	upper mid elev. mature to old growth ABGR/ABAM/PSME/ TSME forest	WNF
Thaxterogaster sp. nov. Trappe #4867, 6242, 7427, 7962, 8520; Tuber sp. nov. Trappe #2302, 12493	1, 3	?	mature to old growth PSIS/TSME/PSME coastal fog belt forest	Lan, Lincoln, and Tillamook counties, OR
RARE TRUFFLES				
Choiromyces alveolatus	1, 3	P	mid-elev. old growth TSME/true fir forest	Mt. Hood, OR to Yuba Pass, CA
Choiromyces venosus	1, 3	P	low elev. w/coniferous, deciduous, or mature PSME forest	Sprinfield, OR and Europe
Elaphomyces anthracinus	1, 3	?	mature PIPO forest	W Europe, E North Am., E OR Cascades
Elaphomyces subviscidus	1, 3	?	mid elev mature to old growth pine forest	central to southern OR Cacades
RARE CHANTRELLES				
Cantharellus formosus	1, 3	P	coniferous and mixed forest	N CA, OR, and WA
Polyozellus multiplex	1, 3	P	intermittent streams of montane fir forest	N Sierras, CA and OR & WA Cascades
Cantharellus cibarius, C. subalbidus, C. tubaeformis	3, 4	P	coniferous and mixed forest late-successional forest	N CA, OR, and WA
CHANTRELLES - GOMPHUS				
Gomphus bonarii G. clavatus G. floccosus G. Kauffmanii	3	P	late-successional western conifer forests	throughout region, esp. N CA
UNCOMMON AND RARE CORAL FUNGI	(Appendix J2, p. 163-164)			
(Ramaria spp.)	1, 3, and 3	P	with TSHE, true firs, spruce, pines, PSME, and TABR	N CA, OR and WA. Overall distribution of individual species unknown
PHAEOCOLLYBIA	(Appendix J2, p. 166)			
(Phaeocollybia spp.)	1, 3	P	low elev. to montane w/conifers, moist habitat, prefers low elev.	Distribution and frequency currently under study

SPECIES	SURVEY STRATEGY	PRESENCE	HABITAT	KNOWN RANGE OR GEOGR. EXTENT
UNCOMMON GILLED MUSHROOMS		(Appendix J2, P. 168)		
(Catathelasma spp. Cortinarius spp. Dermocybe spp. Hebeloma spp. Hygrophorus spp. Russula spp.)	1, 3, and 3	P	ectomychorrizal in low elev. to montane with conifers	Distribution and range of individual species unknown; some may be PNW endemics
RARE GILLED MUSHROOMS				
Chroogomphus loculatus	1, 3	P	upper mid elev. (5000') w/ABAM, ABGR, PSME, TSHE, TSME	local endemic, type locality Ollalie Trail, WNF
Cortinarius canabarba C. rainierensis C. variipes Tricholoma venenatum	1, 3	P	range and elev. of host species unknown. All require diverse coniferous forests w/heavy humus layer and LWD	Overall ecology and distribution not well known
Cortinarius verrucisporus	1, 3	P	high elev. montane w/true firs & and conifers; hypogenous (fruits underground)	CA and OR
Cortinarius weibeae	1, 3	P	same as above	local endemic, MHNF only known site
UNCOMMON ECTO-POLYPORES				
Albatrellus ellsii, A. flettii	3	?	coastal old growth and mixed hardwood forest	WA, OR, N CA, Rocky mts, NE US, and Europe
RARE ECTO-POLYPORES				
Albatrellus avellaneus A. caeruleoporus	1, 3	?	coastal old growth and mixed hardwood forest	WA, OR, N CA, Rocky Mts, NE US, and Europe
TOOTHED FUNGI				
Hydnum repandum H. umbilicatum Phellodon atratum Sarcodon fuscoindicum S, imbriactus	3 see above	P see above	late successional and second growth conifer and hardwood forest see above	widespread in N American and Europe see above
RARE ZYGOMYCETES				
Endogone acrogena	1, 3	P	low elevation mesic old growth PSME/TSME forest	W Cascades from Mt. Rainier to Whitechuck River
Endogone oregonensis	1, 3	?	low elev. old growth PSME/PISI/TSME coastal forest	SNF

SPECIES	SURVEY STRATEGY	PRESENCE	HABITAT	KNOWN RANGE OR GEOGR. EXTENT
Glomus radiatum	1, 3	P	mature to old growth coastal redwood/Alaska yellow-cedar mesic wet forest	OR and WA Cascades, N CA, NE US
SAPROBES (DECOMPOSERS)				
UNCOMMON GILLED MUSHROOMS				
Species are collectively grouped. See Appendix J2, p. 179	1, 3 3	?	low-mid elev. conifer ecosystems; on PISI, recently fallen logs or decomposed logs	N CA, OR, WA
RARE GILLED MUSHROOMS				
Clitocybe subitopoda C. senilis	1, 3	P	low-mid elev. moist late successional forest, large logs in later stages of decay	WA, OR, CA
Neolentinus adherens	1, 3	P	low-mid elev. moist late successional forest, large logs in later stages of decay	Olympic NP
Rhodocybe nitida	1, 3	P	low-mid elev. moist late successional forest, large logs in later stages of decay	WA, OR, CA
Rhodocyte speciosaq	1, 3	P	low-mid elev. moist late successional forest, large logs in later stages of decay	Mt. Rainier NP to Barlow Pass
Tricholomopsis fulvenscens	1, 3	P	low-mid elev. moist late successional forest, large logs in later stages of decay	Mt. Hood area, Mt. Rainier NP, Mt. Baker-Snoqualime NF (MBS)
NOBLE POLYPORE	(rare and endangered)			
Oxyporus nobilissimus	1, 2, 3	P	late successional forest on true firs, esp. ABPR	OR and WA Cascades
BONDARZEWIA POLYPORE				
Bondarzewia montana	1, 2, 3	P	late successional high elev. forest in association with true firs	Pacific NW, W NV, ID
RARE RESUPINATES & POLYPORES				
Aleurodiscus farlowii	1, 3	P	on wood, humus, litter, stumps, and dead roots	WA, OR, N CA
Dichostereum grandulosum	1, 3	P	on wood, humus, litter, stumps, and dead roots	WA, OR, N CA
Cudonia monticola	3	P	duff layer of mature conifer forest	WA, OR, N CA

SPECIES	SURVEY STRATEGY	PRESENCE	HABITAT	KNOWN RANGE OR GEOGR. EXTENT
Gyromitra californica G. esculenta G. infula G. melaleucoides G. montana (G. gigas)	3, 4	P	decaying matter in soil and rotten wood in older forest (G. esculenta prefers second growth)	northwestern N America and Europe
Otidea leporina O. onotica O. smithii	3	P	conifer duff in moist-wet lat successional mid-low elev. conifer forest	Unknown
Plectania melastoma	3	P	late successional to old growth conifer forest duff	NE and NW North America and Europe
Podostoma alutaceum	3	P	mature conifer and mixed conifer/hardwood forest duff	Pacific Northwest
Sarcosoma mexicana	3	P	late successional and old growth high elevation forest	Coastal OR and WA
Sacrosphaera eximia	3	P	conifers and Fagaceae sp om chalky soils	Pacific Northwest, CA, Rockies, NE US, Europe
Spathularia flavida	3	P	duff layers of mature conifer forest	OR, WA, and N CA
RARE CUP FUNGI				
+Aleuria rhenana	1, 3	P	late successional forest litter	San Francisco to Mt. Rainier
+Bryoglossum gracile		P	mossy, wet alpine/subalpine montane conifer forest	artic and alpine N America and Europe
Gelatinodiscus flavidus	1, 3	P	needles, cones, and twigs of high elev. CHNO	BC, Olympic Pennisula, OR and WA Cascades, central OR
Helvella compressa H. crassitunicata H. elastica H. maculata	1, 3	P	low-mid elev. riparian and wet late successional forest	temperate forested areas of N America
Neournula pouchetii	1, 3	P	late successional THPL and Tsuga forest	N OR, WA
Pithya vulgaris	1, 3	P	high elev. true fir forest	BC, WA, ID, OR
Plectania latahensis	1, 3	P	upper montane, subalpine conifer forest	BC, WA, ID, OR
Plectania milleri	1, 3	P	montane, subalpine conifer forest	BC, WA, ID, OR
Pseudaleuria quinaultiana	1, 3	P	low elev. wet late successional conifer forest on wood or soil	Olympic Pennisula, coastal OR and WA

SPECIES	SURVEY STRATEGY	PRESENCE	HABITAT	KNOWN RANGE OR GEOGR. EXTENT
CLUB CORAL FUNGI				
Clavariadelphus ligula C. psitilaris *C. truncatus* C. borealis C. lovejoyae C. sachalinensis *C. subfastigiatus*	3, 4	P	cool/cold moist late successional hardwood or conifer forest, increases in frequency with increasing latitude and elevation, needs well developed litter layer	Pacific Northwets, BC, AK, Midwest and eastern N. America
JELLY MUSHROOM				
Phlogoistis helvelloides	3, 4	P	riparian zones, upper headwater seeps, intermittent streams w/LWD	Pacific Northwest. Midwest, Rockies
BRANCHED CORAL FUNGI				
Clavulina cinerea C. cristata C. omatipes	3, 4	P	late successional forest with well developed litter layer	Pacific Northwest and elsewhere
MUSHROOM LICHEN				
Phytoconis ericetorum	3, 4	P	LWD in well lit forest with alternating high/low moisture, increases northward	CA to arctic, coast to subalpine elevation
PARASITIC FUNGI	(Appendix J2, p. 212)			
Species are collectively grouped. See Appendix J2	3	P	late successional forest on a host fungus	Pacific Northwest, distribution and ecology unknown
CAULIFLOWER MUSHROOM				
Sparassis crispa	3	P	low-mid elev. old growth conifer forest on large roots, esp. PSME	Pacific Northwest and N CA
MOSS DWELLING MUSHROOM	(Appendix J2, P. 216)			
Species are collectively grouped. See Appendix J2	3	P	late successional moist forest, closely associated with and dependent on mosses	Pacific Northwest and Olympic Pennisula
CORAL FUNGI				
Clavicorona avellanea	3	P	low-mid elev. moist late successional forest on large roots	Pacific Northwest
LICHENS				
RARE FORAGE LICHENS				
Bryoria tortuosa	1, 3	?	low-mid elev., coastally on conifers, inland on pine-oak wet regimes	Central CA to BC, Cascades

SPECIES	SURVEY STRATEGY	PRESENCE	HABITAT	KNOWN RANGE OR GEOGR. EXTENT
RARE LEAFY LICHENS				
Hypogymnia duplicata	1, 2, 3	?	low elev. wet, foggy, windy coast and maritime sites on conifers	OR to AK
Tholuma dissimilis	1, 3	P	subalpine fog zone on stunted TSME, canopy of old growth PSME	Montane areas of OR and WA
RARE NITROGEN-FIXING LICHENS				
Dendriscocaulon intricatulum	1, 3	P	low-mid elev. wet, boreal, riaprian, late successional forest	southern WA to SE AK
Lobaria hallii	1, 3	P	low-mid elev. wet, foggy forest on large diameter hardwoods and on shrubs	central coastal CA to N AK
Lobaria linita	1, 3	P	old growth PSME and moist fir forest	N OR to SE AK, ID
Nephroma occultum	1, 3	P	pristine old growth approx. 400 years old	WNF to BC
Pannaria rubiginosa	1, 3	P	bases of trees in mature forest	Salem, OR and Mt. Rainier
Pseudocyphellaria rainierensis	1, 3	P	old growth forest on trunks of PSME	Cascades of OR and WA
NITROGEN-FIXING LICHENS				
Lobaria oregana	4	P	open 200 yr-old old growth & coastal forests on conifers	PNW Cascades
Lobaria pulmonaria	4	P	moist hardwood old growth forest and swamps	PNW Cascades
Nephroma bellum	4	P	open old growth and along roadsides	PNW Cascades
Nephroma helveticum	4	P	N. coastal, montane forests & foothills woodlands and valleys	PNW Cascades
Nephroma larvigatum	4	P	low eelv. coastal and old growth forest	PNW Cascades
Nephroma parile	4	P	moist coniferous & deciduous old growth forests	PNW Cascades
Nephroma resupinatum	4	P	low-mid elev. coastal and montane coniferous shady forest	PNW Cascades
Pannaria leucostictoides	4	P	low elev. open coastal and old growth forest	PNW Cascades
Pannaria mediterranea	4	P	old growth forest 140-200 yr old	PNW Cascades
Pannaria saubinetii	4	P	old growth forest 140-200 yr old	PNW Cascades
Peltigera collina	4	P	low-mid elev. coastal, montane, and old growth forests	PNW Cascades
Peltigera neckeri	4	P	old growth forest 140-200 yr old	PNW Cascades

SPECIES	SURVEY STRATEGY	PRESENCE	HABITAT	KNOWN RANGE OR GEOGR. EXTENT
Peltigera pacifica	4	P	old growth forest 140-200 yr old	PNW Cascades
Pseudocyphellaria anomala	4	P	low-mid elev. coastal, montane, and old growth forest	PNW Cascades
Pseudocyphellaria anthrapsis	4	P	low-mid elev. open coniferous old growth forest	PNW Cascades
Pseudocyphellaria crocata	4	P	old growth forest 140-200 yr old	PNW Cascades
Stricta beasuvoisii	4	P	old growth forest 140-200 yr old	PNW Cascades
Stricta fuliginosa	4	P	low elev. coastal and moist coniferous old growth forests	PNW Cascades
Stricta limbata	4	P	low-mid elev. coastal and old growth forests	PNW Cascades
PIN LICHENS	(See Appendix J2 p. 234-235)			
Species grouped collectively; all have potential to occur in MHNF watersheds. Three species listed below have special information				
Calicium adaequatum C. viride Stenocybe clavata	4	P	sheltered microsites w/high atmospheric humidity provided by old growth forest conditions; substrate and texture specific	PNW and N Europe; endemic to PNW
RARE ROCK LICHENS				
Pilophorus nigricaulis	1, 3	P	talus rock patches within old growth forest with low fire frequency	coastal OR, WA, BC
Stricta arctica	1, 3	?	rock outcrops in foggy wet coastal forest	coast range of OR
RIPARIAN LICHENS				
Centrelia cetrarioides	4	P	mid-low elev. foggy riparian forest on older hardwood trees	coastal OR to AK
Leptogium burnetiae var. hirsutum	4	P	low-mid elev. foggy riparian forest on older hardwood trees	PNW and N Europe
Leptogium cyanescens	4	P	low-mid elev. foggy riparian forest on older hardwood trees	Equador to AK, including OR
Leptogium saturnium	4	P	low-mid elev. boreal riparian forest on older hardwood trees	PNW, mostly Canada
Leptogium teretiusculum	4	P	low-mid elev. foggy riparian forest on older hardwood trees	PNW and MT
Platismatia lacunosa	4	P	low-mid elev. moist forest on decidous and hardwood trees	central OR to south central AK

SPECIES	SURVEY STRATEGY	PRESENCE	HABITAT	KNOWN RANGE OR GEOGR. EXTENT
Ramalina thrausta	4	P	low-mid elev. boreal forest on hardwood and conifer trees	OR, WA, ID, MT, CA, BC
Usnea longissima	4	P	low-mid elev. wet coniferous/hardwood forest and swamps	northwest CA to AK
AQUATIC LICHENS				
Dermtocarpon luridum	1, 3	P	low-mid elev. streams	OR, CO, VA, BC
Hydrothyria venosa	1, 3	P	mid-high elev. clear, cold streams in pristine old growth	central CA to central BC
Leptogium rivale	1, 3	P	low-mid elev. streams	OR and MT
RARE OCEANIC INFLUENCED LICHENS				
Hypogymnia oceanica	1, 3	P	coast and maritime climates in old growth forest	Inland and coastal OR
Teloschistes flavicans	1, 3	?	dry uplands and prairies, on coastal shrubs	Equador to OR coasts
ADDITIONAL LICHENS	(added after Appendix J2)			
Cladonia norvegica	3	?	unknown	unknown
Heterodermia sitchensis	3	?	unknown	unknown
Hygomnia vittiata	3	?	unknown	unknown
Hypotrachyna revoluta	3	P	high elevation open forest	N CA, W OR, W WA
Nephroma isidiosum	3	?	unknown	unknown
BRYOPHYTES				
Antitrichia curtipendula	4	P	low-mid elev. old growth forest canopies	N CA to N OR west of Cascades
Bartramiopsis lescurii X*	1, 3	P	old growth forest	PNW, esp. WA
Brotherella roellii X	1, 3	P	low-mid elev. old growth forest on rotting logs	WA Casacdes
Douinia ovata	4	P	low-mid elev. foggy old growth forest w/ridges and rock outcrops	PNW Cascades and coast
Encalypta brevicolla var. crumiana X	1, 3	P	foggy rock outcrops shaded by old growth forest	mountains of OR and WA
Herbertus aduncus X	1, 3	P	high elevation old growth forest	OR and WA Cascades and coast
Herbertus sakurali X	1, 3	?	foggy rocky faces in old growth forests	N OR coast range
Iwatsukella leucotricha X	1, 3	?	bark in old growth forest	N OR coast range
Kurzia makinoana	1, 2	P	low elev. old growth forest	OR and WA
Marsupella emarginata var. aquatica	1, 2	P	mid-high elev. stream splash zones	OR Cascades
Plagiochila satol X	1, 3	P	old growth forest on cliffs, rocks, and bark	PNW

SPECIES	SURVEY STRATEGY	PRESENCE	HABITAT	KNOWN RANGE OR GEOGR. EXTENT
Plagiochila semidecurrens var. *crumniana* X	1, 3	?	foggy cliffs and shaded rocks	OR coast range
Pleurosiopsis ruthenica X	1, 3	P	low elev. shrub thickets, old growth swamps, stream edges	WA
Ptilidium californicum	1, 2	P	conifers in old growth forest	N CA to WA
Racomitrium aquaticum X	1, 3	P	shaded moist rocks & streambanks of old growth forest	unknown
Radula brunnea X	1, 3	?	foggy rock walls in old growth forest	north coast range of OR
Scouleria marginata	4	P	splash zones of streams	PNW endemic
Tetraphis genicula X	1, 3	P	low-mid elev. old growth forest on shaded moist wood	N CA to W WA
Tritomaria excestiformis	1, 2	P	old growth forest on moist shaded rocks	OR and WA
Tritomaria quinquedentata	1, 3	P	old growth forest on moist shaded rocks	OR and WA
* X = added after Appendix J2				
VASCULAR PLANTS				
Allotropa virgata	1, 2	D	1500-5000' elev. under closed canopy ABAM, ABGR, PICO, PSME; requires association w/fungus and vasc. plants (saprophytic)	east slopes Casacdes to coast, BC to CA; disjunct in ID and MT
Arceuthodium tsugense	1, 2	P	parasitic primarily in TSHE older than 600 years and on shore pine	rare from AK south to CA and S OR
Botrychium minganese	1, 2	P	variable elev. with THPL and/or ACCI, ACMA habitats	endemic to N America
Botrychium montanum	1, 2	P	3200-4100' (MHNF) in deep shade old growth THPL, seeps	endemic to western N America
Coptis asplenifolia	1, 2	?	360-3600' w/ABAM, TSHE, THPL in cool, wet, shady habitats	OR coast range, WA Cascades, Olympic Pennisula
Coptis trifolia	1, 2	P	perimeters of small wetlands and swamps w/PSME	Disjunct in OR (MHNF); eastern OR
Cypripedium fasciculatum	1, 2	?	1300-5300' in 60-100% shade by numerous plant communities	western US
Cypripedium montanum	1, 2	?	broad range of habitats, presence of specific symbiotic fungi	All Cascades provinces (Hood River and Wasco counties)
Galium kamtschaticum	1, 2	P	seeps w/conifers and west Cascades riparian associated species	circumboreal Olympic and W WA Cascades provinces

SPECIES	SURVEY STRATEGY	PRESENCE	HABITAT	KNOWN RANGE OR GEOGR. EXTENT
Habenaria orbiculata	1, 2	?	mesic-dry forest w/deep litter in TSHE and lower ABAM zones	uncommon, widespread W WA Cascade provinces

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Other Plants

Common Name	Species	Comments
TREES		
Pacific silver fir	Abies amabalis	
grand fir	Abies grandis	
subalpine fir	Abies lasiocarpa	
noble fir	Abies procera	
Alaska yellow-cedar	Chamaecyparis nootkatensis	Uncommon
common juniper	Juniperus communis montana	
western larch	Larix occidentalis	
Engelmann spruce	Picea engelmannii	
whitebark pine	Pinus albicaulis	
lodgepole pine	Pinus contorta latifolia	
western white pine	Pinus monticola	
ponderosa pine	Pinus ponderosa	
Douglas-fir	Pseudotsuga menziesii	
Pacific yew	Taxus brevifolia	
western redcedar	Thuja plicata	
western hemlock	Tsuga heterophylla	
mountain hemlock	Tsuga mertensiana	
vine maple	Acer circinatum	
Douglas maple	Acer glabrum douglasii	
bigleaf maple	Acer macrophyllum	
mountain alder	Alnus incana occidentalis	
white alder	Alnus rhombifolia	
red alder	Alnus rubra	
Sitka alder	Alnus sinuata	
Pacific dogwood	Cornus nuttallii	
Oregon ash	Fraxinus latifolia	
English holly	Ilex aquifolium	Introduced, planted
quaking aspen	Populus tremuloides	
black cottonwood	Populus tricocarpa	
bittercherry	Prunus emarginata	
chokecherry	Prunus virginiana	
pear	Pyrus communis	Introduced, cultivated
apple	Pyrus malus	Introduced, cultivated
western crabapple	Pyrus fusca	
Oregon white oak	Quercus garryana	

Common Name	Species	Comments
cascara buckthorn	Rhamnus purshiana	
variable willow	Salix communtata	
Geyer willow	Salix geyeriana meliana	
Pacific willow	Salix lasiandra lasiandra	
bog willow	Salix pedicellaris	
tea-leaved willow	Salix phylicfolia pennata	
Scouler's willow	Salix scouleriana	
Sitka willow	Salix sitchensis	
SHRUBS		
serviceberry	Amelanchier alnifolia	
bristly manzanita	Arctostaphylos columbiana	
pinemat mazanita	Arctostaphylos nevadensis	
greenleaf manzanita	Arctostaphylos patula	
kinnickkinnick	Arctostaphylos uva-ursi	
tall Oregongrape	Berberis aquilifolium	
Cascades Oregongrape	Berberis nervosa	
dwarf Oregongrape	Berberis repens	
Hall's birch	Betula glandulosa hallii	
Merten's mountain heather	Cassiope mertensiana	
golden chinkapin	Castanopsis chrysophylla	
deerbrush ceanothus	Ceanothus intergerrimus	
mahala mat	Ceanothus prostratus	
redstem ceanothus	Ceanothus sanguineus	
snowbrush ceanothus	Ceanothus velutinus	
western clematis	Clematis ligusticifolia	
dogwood bunchberry	Cornus canadensis	
red osier dogwood	Cornus stolonifera occidentalis	
California hazel	Corylus cornuta californica	
scotch broom	Cytisus scorparius	Introduced, noxious weed
black hawthorn	Crataegus douglasii	
alpine wintergreen	Gaultheria humifusa	
slender wintergreen	Gaultheria ovatifolia	
salal	Gaultheria shallon	
oceanspray	Holodiscus discolor	
western swamp laurel	Kalmia occidentalis	
orange honeysuckle	Lonicera ciliosa	
black twinberry	Lonicera involucrata	
fool's huckleberry	Menziesia ferruginea	

Common Name	Species	Comments
wax myrtle	Myrica gale	
devil's club	Oplopanax horridum	
Oregon boxwood	Pachistima myrsinites	
syringa	Philadelphus lewisii	
red mountain-heather	Phyllodoce empetriformis	
yellow mountain-heather	Phyllodoce glanduliflora	
Pacific ninebark	Physocarpus capitatus	
Cascade's azalea	Rhododendron albiflorum	
rhododendron	Rhododendron macrophyllum	
poison oak	Rhus diversiloba	
blue currant	Ribes bracteosum	
straggly gooseberry	Ribes divaricatum	
mapleleaf currant	Ribes howellii	
black currant	Ribes hudsonianum petiolare	
prickly currant	Ribes lacustre	
Lobb's gooseberry	Ribes lobbii	
red currant	Ribes sanguineum	
sticky currant	Ribes viscosissimum hallii	
spiny gooseberry	Ribes watsonianum	
dog rose	Rosa canina	Introduced
baldhip rose	Rosa gymnocarpa	
Nootka rose	Rosa nootkana	
clustered wild rose	Rosa pisocarpa	
pearhip rose	Rosa woodsii ultramontana	
Himalayan blackberry	Rubus discolor	Introduced
evergreen blackberry	Rubus laciniatus	Introduced
dwarf bramble	Rubus lasiococcus	
blackcap	Rubus leucodermis	
snow bramble	Rubus nivalis	
thimbleberry	Rubus parviflorus	
fiveleaved bramble	Rubus pedatus	
salmonberry	Rubus spectabilis	
Pacific blackberry	Rubus ursinus macropetalus	
blue elderberry	Sambucus cerulea	
black elderberry	Sambucus racemosa arborescens	
European mountain-ash	Sorbus aucuparia	Introduced
Cascade mountain-ash	Sorbus scopulina	
Sitka mountain-ash	Sorbus sitchensis	

Common Name	Species	Comments
shiny-leaf spirea	Spirea betulifolia lucida	
subalpine spirea	Spirea densiflora densiflora	
Douglas' spirea	Spirea douglasii *douglasii*	
pyramid spirea	Spirea pyramidata	
common snowberry	Symphoricarpos albus laevigatus	
creeping snowberry	Symphoricarpos mollis hesperius	
mountain snowberry	Symphoricarpos oreophilus utahensis	
gorse	Ulex europaeus	Introduced
Alaska huckleberry	Vaccinium alaskaense	
dwarf huckleberry	Vaccinium caespitosum	
Cascades huckleberry	Vaccinium deliciosum	
big huckleberry	Vaccinium membranaceum	
western huckleberry	Vaccinium occidentale	
oval-leaf huckleberry	Vaccinium ovalifolium	
wild cranberry	Vaccinium oxycoccos *intermedium*	
red huckleberry	Vaccinium parvifolium	
grouse whortleberry	Vaccinium scoparium	
high-bush cranberry	Viburnum edule	
Oregon viburnum	Viburnum ellipticum	
	GRASSES AND GRAMINOIDS	
bearded wheatgrass	Agropryon caninum majus	
downy wheatgrass	Agropryon dasystachyum	
intermediate wheatgrass	Agropryon intermedium	Introduced
quack grass	Agropryon repens	Introduced
bluebunch wheatgrass	Agropryon spicatum	
red top bentgrass	Agrostis alba	Introduced
thin bentgrass	Agrostis diegoensis	
spike bentgrass	Agrostis exarata	
Howell's bentgrass	Agrostis howellii	State candidate
alpine bentgrass	Agrostis humilis	
Idaho bentgrass	Agrostis idahoensis	
interrupted bentgrass	Agrostis interrupta	Introduced
winter bentgrass	Agrostis scabra	
colonial bentgrass	Agrostis tenuis	Introduced
Thurber bentgrass	Agrostis thurberiana	

Common Name	Species	Comments
varient bentgrass	Agrostis variabilis	
silver hairgrass	Aira caryophyllea	Introduced
early hairgrass	Aira praecox	Introduced
shortawn foxtail	Alopercurus aequalis	
water foxtail	Alopercurus geniculatus	
meadow foxtail	Alopecurus pratensis	Introduced
sweet vernalgrass	Anthoxanthum odoratum	Introduced
tall oatgrass	Arrhenatherum thaliana	Introduced
false-brome	Brachypodium distachyon	Introduced
California brome	Bromus carinatus	
hairy brome	Bromus commutatus	Introduced
smooth brome	Bromus inermis inermis	Introduced
soft brome	Bromus mollis	Introduced
Pacific brome	Bromus pacificus	
ripgut	Bromus rigidus	Introduced
Alaska brome	Bromus sitchensis sitchensis	
barren brome	Bromus sterilis	Introduced
cheatgrass	Bromus tectorum	Introduced
Columbia brome	Bromus vulgaris vulgaris	
shorthair reedgrass	Calamagrostis breweri	R6 Sensitive
bluejoint reedgrass	Calamagrostis canadensis	
Howell's reedgrass	Calamagrostis howellii	
purple reedgrass	Calamagrostis purpurascens	
one-and-a-half-flowered reedgrass	Calamagrostis sesquiflora	
Columbia sedge	Carex aperta	
water sedge	Carex aquatilis	
slender beaked sedge	Carex athrostachya	
Brewer's sedge	Carex brewerii brewerii	
brown sedge	Carex brunnescens	
California sedge	Carex californica	
gray sedge	Carex canescens	
Dewey's sedge	Carex deweyana	
elk sedge	Carex geyeri	
Hall's sedge	Carex halliana	
Henderson's sedge	Carex hendersonii	
Hood's sedge	Carex hoodii	
porcupine sedge	Carex hystricina	
sharp sedge	Carex illota	

Common Name	Species	Comments
inland sedge	Carex interior	
Jones' sedge	Carex jonesii	
smooth stoloned sedge	Carex laeviculmis	
	Carex lenticularis lenticularis	
Sierra-hare sedge	Carex leporina	
bristle-stalked sedge	Carex leptalea	
pond sedge	Carex limnophila	
pale sedge	Carex livida	R6 sensitive
woodrush sedge	Carex luzulina	
large-awn sedge	Carex macrochaeta	R6 sensitive
Merten's sedge	Carex mertensii	
small-winged sedge	Carex microptera	
muricate sedge	Carex muricata	
black alpine sedge	Carex nigricans	
slough sedge	Carex obnupta	
thick-headed sedge	Carex pachystachya	
long stoloned sedge	Carex pensylvanica vespertina	
dunhead sedge	Carex phaeocephala	
Ross sedge	Carex rossii	
beaked sedge	Carex rostrata	
pointed broom sedge	Carex scoparia	
Holm's Rocky Mountain sedge	Carex scopulorum	
Sitka sedge	Carex sitchensis	
showy sedge	Carex spectabilis	
sawbeak sedge	Carex stipata	
inflated sedge	Carex vesicaria vesicaria	
fox sedge	Carex vulpinoidea	
wood reed	Cinna latifolia	
crested dogtail	Cynosurus cristatus	Introduced
hedgehog dogtail	Cynosurus echinatus	Introduced
orchardgrass	Dactylis glomerata	Introduced
timber oatgrass	Danthonia intermedia	
poverty danthonia	Danthonia spicata pinetorum	
mountain hairgrass	Deschampsia atropurpurea	
tufted hairgrass	Deschampsia cespitosa cespitosa	
annual hairgrass	Deschampsia danthonioides	
slender hairgrass	Deschampsia elongata	

Common Name	Species	Comments
hairy crabgrass	Digitaria sanguinalis	Introduced
watergrass	Echinochloa crusgalli	Introduced
ovoid spike-rush	Eleocharis ovata	
common spike-rush	Eleocharis palustris	
few-flowered spike-rush	Eleocharis pauciflora	
blue wild rye	Elymus glaucus	
slender cottongrass	Eriophorum gracile	
many-spiked cottongrass	Eriophorum polystachion	
red fescue	Festuca arundinacea	Introduced
Idaho fescue	Festuca idahoensis	
foxtail fescue	Festuca megalura	
small fescue	Festuca microstachys	
rat-tail fescue	Festuca myuros	Introduced
western fescue	Festuca occidentalis	
slender fescue	Festuca octoflora	
alpine fescue	Festuca ovina brevifolia	
sheep fescue	Festuca ovina ovina	Introduced
red fescue	Festuca rubra rubra	
rough fescue	Festuca scabrella	
bearded fescue	Festuca subulata	
crinkle awn fescue	Festuca subuliflora	
green fescue	Festuca viridula	
tall mannagrass	Glyceria elata	
slender-spike mannagrass	Glyceria leptostachya	
fowl mannagrass	Glyceria striata striata	
Seneca grass	Hierochloe odorata	
common velvet-grass	Holcus lanatus	Introduced
prairie Junegrass	Koeleria cristata	
tapered rush	Juncus acuminatus	
Baltic rush	Juncus balticus balticus	
toad rush	Juncus bufonius	
Colville's rush	Juncus colvillei	
Drummond's rush	Juncus drummondii subtriflorus	
common rush	Juncus effusus	
dagger-leaf rush	Juncus ensifolius ensifolius	
thread rush	Juncus filiformis	
Merten's rush	Juncus mertensianus	
straight-leaved rush	Juncus orthophyllus	

Common Name	Species	Comments
Parry's rush	Juncus parryi	
spreading rush	*Juncus supiniformis*	
slender rush	Juncus tenuis tenuis	
soland	Leersia oryzoides	
Italian ryegrass	Lolium multiflorum	Introduced
English ryegrass	Lolium perenne	Introduced
field rush	Luzula campestris	
spreading woodrush	Luzula divaricata	
Hitchcock's woodrush	Luzula hitchcockii	
smallflowered woodrush	Luzula parviflora	
Harford's melic	Melica harfordii	
Smith's melic	Melica smithii	
Alaska oniongrass	*Melica subulata*	
pullup muhly	Muhlenbergia filiformis	
western panicgrass	Panicum occidentale	
Scribner witchgrass	Panicum scribnerianum	
alpine timothy	Phleum alpinum	
timothy	Phleum pratense	Introduced
nodding semaphoregrass	Pleuropogon refractus	
annual bluegrass	Poa annua	Introduced
bulbous bluegrass	Poa bulbosa	Introduced
Canadian bluegrass	Poa compressa	
Cusick's bluegrass	Poa cusickii purpurascens	
Pacific bluegrass	Poa gracillima	
Gray's bluegrass	Poa grayana	
Howell's bluegrass	Poa howellii	
big bluegrass	Poa juncifolia	
withered bluegrass	Poa marcida	
Wheeler's bluegrass	Poa nervosa nervosa	
fowl bluegrass	Poa palustris	
Kentucky bluegrass	Poa pratensis	Introduced
Sandberg's bluegrass	Poa sandbergii	
roughstalk bluegrass	Poa trivialis	Introduced
annual beard-grass	Polypogon monspeliensis	Introduced
weak alkaligrass	Puccinellia pauciflora	
white beakrush	Rhynchospora alba	
tufted clubrush	Scirpus cespitosus	
small-flowered bulrush	Scirpus microcarpus	

Common Name	Species	Comments
bottlebrush squirreltail	Sitanion hystrix	
Lemon's needlegrass	Stipa lemmonii lemmonii	
small needlegrass	Stipa occidentalis minor	
western needlegrass	Stipa occidentalis occidentalis	
tall trisetum	Trisetum canescens	
nodding trisetum	Trisetum cernuum	
downy trisetum	Trisetum spicatum	
HERBS		
yarrow	Achillea millefolium	
vanillaleaf	Achlys triphylla	
baneberry	Actaea rubra	
pathfinder	Adenocaulon bicolor	
orange agroseris	Agroseris aurantiaca aurantiaca	
pale agroseris	Agroseris glauca monticola	
large-flowered agroseris	Agroseris grandiflora	
annual agroseris	Agroseris heterophylla	
tapertip onion	Allium acuminatum	
nodding onion	Allium cernuum	
Powell's amarantha	Amaranthus powellii	
Menzie's tarweed	Amsinckia menziesii	
rigid tarweed	Amsinckia retrorsa	
pearly-everlasting	Anaphalis margaritacea	
slender-stemmed fairy-candelabra	Androsace filiformis	
threeleaf anemone	Anemone deltoidea	
Drummond's anemone	Anemone drummondii drummondii	
Lyall's anemone	Anemone lyallii	
western pasqueflower	Anemone occidentalis	
Oregon anemone	Anemone oregana oregana	
sharptooth angelica	Angelica arguta	
kneeling angelica	Angelica genuflexa	
alpine pussytoes	Antennaria alpina	
woodrush pussytoes	Antennaria luzuloides	
rosy pussytoes	Antennaria microphylla	
field pussytoes	Antennaria neglecta	
showy pussytoes	Antennaria pulcherrima	
raceme pussytoes	Antennaria racemosa	

Common Name	Species	Comments
umber pussytoes	Antennaria umbrinella	
mayweed chamomile	Anthemis cotula	Introduced
chervil	Anthriscus scandicina	Introduced
apargidium	Apargidium boreale	
bitterroot/dogbane	Apocynum androsaemifolium pumilum	
red columbine	Aquilegia formosa	
common wallcress	Arabidopsis thaliana	Introduced
Cascade rockcress	Arabis furcata	
tower mustard	Arabis glabra	
hairy rockcress	Arabis hirsuta glabrata	
littleleaf rockcress	Arabis microphylla microphylla	
sicklepod rockcress	Arabis sparsiflora atrorubens	R6 sensitive
Douglas dwarf mistletoe	Arceuthobium douglasii	
common burdock	Arctium minus	Introduced
mountain sandwort	Arenaria capillaris americana	
bigleaf sandwort	Arenaria macrophylla	
arctic sandwort	Arenaria obtusiloba	
reddish sandwort	Arenaria rubella	
thyme-leaf sandwort	Arenaria serpyllifolia	Introduced
clasping arnica	Arnica amplexicaulis	
meadow arnica	Arnica chamissonis	
heartleaf arnica	Arnica cordifolia cordifolia	
rayless arnica	Arnica discoidea eradiata	
mountain arnica	Arnica latifolia latifolia	
hairy arnica	Arnica mollis	
Douglas' sagewort	Artemisia douglasiana	
western mugowrt	Artemisia ludoviciana	
Suksdorf's sagewort	Artemisia suksdorfii	
mountain mugwort	Artemisia tilesii unalaschcensis	
goatsbeard	Aruncus sylvester	
wild ginger	Asarum caudatum	
alpine aster	Aster alpigenus alpigenus	
leafy aster	Aster foliaceus parryi	
Cascade's aster	Aster ledophyllus ledophyllus	
few-flowered aster	Aster modestus	
rough-leaved aster	Aster radulinus	
Douglas' aster	Aster subspicatus	

Common Name	Species	Comments
sandweed	Athysanus pusillus	
Cary's balsamroot	Balsamorhiza careyana intermedia	
arrowleaf balsamroot	Balsamorhiza sagittata	
American wintercress	Barbarea orthoceras	
early wintercress	Barbarea verna	Introduced
yellow rocket	Barbarea vulgaris	Introduced
nodding beggers-tick	Bidens cernua	
leafy beggers-tick	Bidens frondosa	
bolandra	Bolandra oregana	State candidate
slender boykinia	Boykinia elata	
mountain boykinia	Boykinia *major major*	
field mustard	Brassica campestris	Introduced
large-flowered brickellia	Brickellia grandiflora	
northern saitas	Brodiaea congesta	
Howell's brodiaea	Brodiaea howellii	
hyacinth brodiaea	Brodiaea hyacinthina	
sagebrush mariposa	Calochortus macrocarpus	
mountain mariposa	Calochortus subalpinus	
white marshmarigold	Caltha biflora biflora	
calypso orchid	Calypso bulbosa	
camas	Camassia quamash quamash	
Scotch bellflower	Campanula rotundifolia	
Scouler's harebell	Campanula scouleri	
shepard's purse	Capsella bursa-pastoris	Introduced
angled bittercress	Cardamine angulata	
Brewer's bittercress	Cardamine breweri orbicularis	
milk maids	Cardamine integrifolia sinuata	
little western bittercress	Cardamine oligosperma oligosperma	
Pennsylvannia bittercress	Cardamine pensylvanica	
slender toothwort	Cardamine pulcherrima	
hoary pepperwort	Cardaria draba	Introduced
harsh paintbrush	Castilleja hispida hispida	
scarlet paintbrush	Castilleja miniata miniata	
magenta paintbrush	Castilleja parviflora oreopola	
cliff paintbrush	Castilleja rupicola	
Suksdorf's paintbrush	Castilleja suksdorfii	

Common Name	Species	Comments
California hedge-parsley	Caucalis microcarpa	
bachelor's button	Centaurea cyanus	Introduced
diffuse knapweed	Centaurea diffusa	Introduced, noxious weed
spotted knapweed	Centaurea maculosa	Introduced, noxious weed
brown knapweed	Centaurea nigra jacea	Introduced, noxious weed
common centaury	Centaurium umbellatum	Introduced
field chickweed	Cerastium arvense	
sticky chickweed	Cerastium viscosum	Introduced
common chickweed	Cerastium vulgatum	Introduced
hoary chaenactis	Chaenactis douglasii achilleaefolia	
lambsquarter	Chenopodium album	Introduced
little pipsissewa	Chimaphila menziesii	
prince's-pine	Chimaphila umbellata occidentalis	
oxeye daisy	Chrysanthemum leucanthemum	Introduced
wild succory	Cichorium intybus	Introduced
western water-hemlock	Cicuta douglasii	
cut-leaved bugbane	Cimicifuga laciniata	
nightshade	Circaea alpina	
Canada thistle	Cirsium arvense horridum	Introduced, noxious weed
bull thistle	Cirsium vulgare	Introduced, noxious weed
farewell-to-spring	Clarkia amoena caurina	
elkhorns clarkia	Clarkia pulchella	
western springbeauty	Claytonia lanceolata lanceolata	
queencup beadlily	Clintonia uniflora	
large-flowered blue-eyed mary	Collinsia grandiflora	
small-flowered blue-eyed mary	Collinsia parviflora	
large-flowered collomia	Collomia grandiflora	
varied-leaf collomia	Collomia heterophylla	
narrow-leaf collomia	Collomia linearis	
pale bastard toadflax	Comandra umbellata californica	
poison hemlock	Conium maculatum	Noxious weed
lady's-nightcap	Convolvulus sepium	Introduced
horseweed	Conyza canadensis glabrata	
cutleaf goldenthread	Coptis laciniata	

Common Name	Species	Comments
Pacific coral-root	Corallorhiza maculata	
western coral-root	Corallorhiza mertensiana	
hood coral-root	Corallorhiza striata	
early coral-root	Corallorhiza trifida	
Yakima birdbeak	Cordylanthus capitatus	
Scouler's corydalis	Corydalis scouleri	
bearded hawkweed	Crepis capillaris	
spring-gold	Crocidium multicaule	
slender cryptantha	Cryptantha ambigua	
common cryptantha	Cryptantha intermedia	
Pacific hounds-tongue	Cynoglossum grande	
hounds-tongue	Cynoglossum officinale	Introduced, noxious weed
Queen Anne's lace	Daucus carota	Introduced
rattlesnake weed	Daucus pusillus	
Menzie's larkspur	Delphinium menziesii pyramidale	
upland larkspur	Delphinium nuttallianum nuttallianum	
Nutall's larkspur	Delphinium nuttallii	
poison larkspur	Delphinium trolliifolium	
mountain tansy	Descurainia richardsonii	
grass pink	*Dianthus armeria*	Introduced
Pacific bleedingheart	Dicentra formosa	
foxglove	Digitalis purpurea	Introduced
Hooker's fairybells	Disporum hookeri oreganum	
fairy lantern	Disporum smithii	
alpine shooting star	Dodecatheon alpinum	
white shooting star	Dodecatheon dentatum	
Jeffrey's shooting star	Dodecatheon jefferyii	
few-flowered shooting star	Dodecatheon pulchellum	
smooth douglasia	Douglasia laevigata	
spring Whitlow-grass	Draba verna boerhaavii	
great sundew	Drosera angilca	
sundew	Drosera rotundifolia	
snow-orchid	Eburophyton austiniae	
alpine willow-herb	Epilobium alpinum	
fireweed	Epilobium angustifolium	
common willow-herb	Epilobium glandulosum	

Common Name	Species	Comments
small-flowered willow-herb	Epilobium minutum	
autumn willow-herb	Epilobium paniculatum paniculatum	
Watson's willow-herb	Epilobium watsonii	
annual fleabane	Erigeron annuus	
diffuse fleabane	Erigeron divergens	
Howell's daisy	Erigeron howellii	Federal candidate
gorge daisy	Erigeron oreganus	State candidate
subalpine daisy	Erigeron peregrinus callianthemus	
daisy fleabane	Erigeron strigosus strigosus	
northern buckwheat	Eriogonum compositum compositum	
tall buckwheat	Eriogonum elatum	
cushion buckwheat	Eriogonum ovalifolium	
alpine buckwheat	Eriogonum pyrolifolium coryphaeum	
strict buckwheat	Eriogonum strictum anserinum	
sulfur buckwheat	Eriogonum umbellatum	
eriophyllum	Eriophyllum lanatum lanatum	
crane's-billl	Erodium cicutarium	Introduced
prairie rocket	Erysimum asperum	
yellow fawn-lily	Erythronium grandiflorum grandiflorum	
avalanche lily	Erythronium montanum	
western boneset	Eupatorium occidentale	
false-mermaid	Floerkea proserpinacoides	
woods strawberry	Fragaria vesca bracteata	
broadpetal strawberry	Fragaria virginiana platypetela	
Columbia frasera	Frasera albicaulis columbiana	
Indian rice	Fritillaria camschatcensis	R6 sensitive
checker lily	Fritillaria lanceolata	
yellow bell	Fritillaria pudica	
cleavers	Galium aparine echinospermum	
northern bedstraw	Galium boreale	
Oregon bedstraw	Galium oreganum	
small bedstraw	Galium trifidum pacificum	
sweetscented bedstraw	Galium triflorum	
Fremont silk-tassel	Garrya fremontii	

Common Name	Species	Comments
spreading groundsmoke	Gayophytum diffusum	
explorer's gentian	Gentiana calycosa	
staff gentian	Gentiana sceptrum	
Bicknell's geranium	Geranium bicknellii	
Carolina geranium	Geranium carolinianum	Introduced
long-stalked geranium	Geranium columbinum	Introduced
cut-leaf geranium	Geranium dissectum	Introduced
dovefoot geranium	Geranium molle	Introduced
Robert geranium	Geranium robertianum	Introduced
Oregon avens	Geum macrophyllum macrophyllum	
skyrocket	Gilia aggregata	
bluefield gilia	Gilia capitata capitata	
Gill-over-the-ground	Glecoma hederacea	Introduced
cotton-batting plant	Gnaphalium chilense	
marsh cutweed	Gnaphalium uliginosum	Introduced
slender cudweed	Gnaphalium microcephalum	
lowland cutweed	Gnaphalium palustre	
purple cutweed	Gnaphalium purpureum purpureum	
sticky cudweed	Gnaphalium viscosum	
rattlesnake plantain	Goodyera oblongifolia	
American hedge-hyssop	Gratiola neglecta	
low gumweed	Grindelia nana integrifolia	
white bog-orchid	Habenaria dilatata	
elegant rein-orchid	Habenaria elegans	
slender bog-orchid	Habenaria saccata	
canyon bog-orchid	Habenaria sparsiflora	
Alaska rein-orchid	Habenaria unalascensis	
diffuse stickseed	Hackelia diffusa cottonii	
diffuse stickseed	Hackelia diffusa diffusa	State candidate
Green's goldenweed	Haplopappus greenei	
Hall's goldenweed	Haplopappus hallii	
English ivy	Hedera helix	Introduced
Rocky Mountain helianthella	Helianthella uniflora douglasii	
gnome-plant	Hemitomes congestum	
cow-parsnip	Heracleum lanatum	
heterocodon	Heterocodon rariflorum	
smooth alumroot	Heuchera glabra	

Common Name	Species	Comments
small flower alumroot	Heuchera micrantha	
yellow hairy hawkweed	Hieracium albertinum	
white hairy hawkweed	Hieracium albiflorum	
houndstongue hawkweed	Hieracium cynoglossoides	
alpine hawkweed	Hieracium gracile	
long-beaked hawkweed	Hieracium longiberbe	
woolly-weed	Hieracium scouleri	
common hawkweed	Hieracium vulgatum	Introduced
tawny horkelia	Horkelia fusca fusca	
ballhead waterleaf	Hydrophyllum capitatum	
Fendler's waterleaf	Hydrophyllum fendleri albifrons	
slender-stem waterleaf	Hydrophyllum tenuipes	
bog St. Johnswort	Hypericum anagalloides	
western St. Johnswort	Hypericum formosum scouleri	
St. Johnswort	Hypericum perforatum	Introduced, noxious weed
spotted cats-ear	Hypochaeris radicata	Introduced
pinesap	Hypopitys monotropa	
streambank globemallow	Iliamna rivularis rivularis	
Oregon iris	Iris tenax	
Hall's isopyrum	Isopyrum hallii	
tall blue lettuce	Lactuca biennis	
wall lettuce	Lactuca muralis	Introduced
blue lettuce	Lactuca pulchella	
prickly lettuce	Lactuca serriola	Introduced
red henbit	Lamium purpureum	Introduced
nipplewort	Lapsana communis	Introduced
thick-leaved peavine	Lathyrus lanswertii lanswertii	
everlasting peavine	Lathyrus latifolius	Introduced
Nuttall's peavine	Lathyrus nevadensis lanceolata pilosellus	
few-flowered peavine	Lathyrus pauciflorus pauciflorus	
leafy peavine	Lathyrus polyphyllus	
water lentil	Lemna minor	
fall dandelion	Leontodon autumnalis	Introduced
hairy hawkbit	Leontodon nudicaulis	Introduced
Columbia lewisia	Lewisia columbiana columbiana	R6 sensitive

Common Name	Species	Comments
celery-leaved licorice-root	Ligusticum apiifolium	
Gray's licorice-root	Ligustricum grayi	
Oregon lily	Lilium columbianum	
Washington lily	Lilium washingtonianum	
Harkness' linanthus	Linanthus harknessii	
northern *linanthus*	Linanthus septentrionalis	
butter-and-eggs	Linaria vulgaris	Introduced, noxious weed
twinflower	Linnaea borealis *longiflora*	
western twayblade	Listera caurina	
broad-leaved listeria	Listera convallarioides	
heart-leaf listeria	Listera cordata	
rocket-star	Lithophragma bulbifera	
smooth prairiestar	Lithophragma glabra	
small flower prairiestar	Lithophragma parviflora	
stoneseed gromwell	Lithospermum ruderale	
Columbia lomatium	Lomatium columbianum	
fern-leaved desert-parsley	Lomatium dissectum dissectum	
Martindale's lomatium	*Lomatium martindalei*	
barestem lomatium	Lomatium nudicaule	
nine-leaf lomatium	Lomatium triternatum triternatum	
Watson's desert-parsley	Lomatium watsonii	R6 *sensitive*
birdsfoot-trefoil	Lotus corniculatus	Introduced
big deervetch	Lotus crassifolius subglaber	
small-flowered deervetch	Lotus micranthus	
Nevada deervetch	Lotus nevadensis douglasii	
meadow deervetch	Lotus pinnatus	
Spanish-clover	Lotus purshiana	
water-purslane	Ludwigia *palustris* pacifica	
partridgefoot	Luetkea pectinata	
silvercrown luina	Luina nardosmia glabrata	
tingue-leaf luina	Luina stricta	
honesty	Lunaria annua	Introduced
two-color lupine	Lupinus bicolor	
broadleaf lupine	Lupinus latifolius	
spurred lupine	Lupinus laxiflorus laxiflorus	
prairie lupine	Lupinus lepidus	

Common Name	Species	Comments
small-flowered lupine	Lupinus micranthus	
bigleaf lupine	Lupinus polyphyllus polyphyllus	
white campion	Lychnis alba	Introduced
rose campion	Lychnis coronaria	Introduced
red campion	Lychnis dioica	Introduced
northern bugleweed	Lycopus uniflorus	
skunk cabbage	Lysichitum americanum	
lemon-scented tarweed	Madia citriodora	
little tarweed	Madia exigua	
cluster tarweed	Madia glomerata	
slender tarweed	Madia gracilis	
small-head tarweed	Madia minima	
Chile tarweed	Madia sativa	
false lily-of-the-valley	Maianthemum dilatatum	
Oregon bigroot	Marah oreganus	
pineapple weed	Matricaria matricarioides	
white sweet-clover	Melilotus alba	Introduced
common yellow sweet-clover	Melilotus officinalis	Introduced
field mint	Mentha arvensis glabrata	
buckbean	Menyanthes trifoliata	
tall bluebells	Mertensia paniculata borealis	
alpine lake microseris	Microseris alpestris	
cut-leaved microseris	Microseris laciniata	
nodding microseris	Microseris nutans	
false-agroseris	Microseris troximoides	
pink microsteris	Microsteris gracilis	
chickweed monkeyflower	Mimulus alsinoides	
purple-stem monkeyflower	Mimulus floribundus	
yellow monkeyflower	Mimulus guttatus guttatus	
Lewis' monkeyflower	Mimulus lewisii	
musk-flower	Mimulus moschatus moschatus	
large mountain monkeyflower	Mimulus tilingii	
Brewer's mitrewort	Mitella breweri	
leafy mitrewort	Mitella caulescens	
oval-leaved mitrewort	Mitella ovalis	
alpine mitrewort	Mitella pentandra	

Common Name	Species	Comments
three-tooth mitrewort	Mitella trifida	
monardella	Monardella odoratissima odoratissima	
Indian pipe	Monotropa uniflora	
water montia	Montia chamissoi	
broadleaved montia	Montia cordifolia	
dwarf montia	Montia dichotoma	
branching montia	Montia diffusa	
narrow leaved montia	Montia linearis	
littleleaf montia	Montia parvifolia parvifolia	
miner's lettuce	Montia perfoliata	
candyflower	Montia sibirica	
comon montia	Montia spathulata	
yellow and blue forget-me-not	Myosotis discolor	Introduced
small flowered forget-me-not	Myosotis laxa	
blue scorpion-grass	Myosotis micrantha	Introduced
wood forget-me-not	Myosotis sylvatica	
mountain navarretia	Navarretia divaricata	
needle-leaf navarretia	Navarretia intertexta intertexta	
skunkwood	Navarretia squarrosa	
small-flowered nemophila	Nemophila parviflora	
woodland beard-tongue	Nothochelone nemorosa	
Indian pond-lily	Nuphar polysepalum	
Indian plum	Oemleria cerasiformis	
water-parsley	Oenanthe sarmentosa	
Hooker's evening primrose	Oenothera hookeri	
naked broomrape	Orobanche uniflora	
sweet-cicely	Osmorhiza chilensis	
western sweet-cicely	Osmorhiza occidentalis	
purple sweet-cicely	Osmorhiza purpurea	
Oregon oxalis	Oxalis oregana	
great oxalis	Oxalis trilliifolia	
mountain sorrel	Oxyria digyna	
fringed grass-of-parnassus	Parnassia fimbriata hoodiana	
bracted lousewort	Pedicularis bracteosa	
elephant's head	Pedicularis groenlandica	
leafy lousewort	Pedicularis racemosa racemosa	
Cardwell's penstemon	Penstemon cardwellii	

Common Name	Species	Comments
Davidson's penstemon	Penstemon davidsonii davidosnii	
glaucous penstemon	Penstemon euglaucus	
shrubby penstemon	Penstemon fruticosus fritocosus	
glandular penstemon	Penstemon glandulosum	
broad-leaved penstemon	Penstemon ovatus	
small-flowered penstemon	Penstemon procerus	
Richardson's penstemon	Penstemon richardsonii richardsonii	
rock penstemon	Penstemon rupicola	
Cascades penstemon	Penstemon serrulatus	
fine-toothed penstemon	Penstemon subserratus	
Gairdner's yampah	Perideridia gairdneri	
Oregon yampah	Perideridia oregana	
alpine butterbur	Petasites frigidus	
whiteleaf phacelia	Phacelia hastata compacta	
varileaf phacelia	Phacelia heterophylla heterophylla	
threadleaf phacelia	Phacelia linearis	
woodland phacelia	Phacelia nemoralis	
tall phacelia	Phacelia procera	
spreading phlox	Phlox diffusa longistylis	
Henderson's phlox	Phlox hendersonii	R6 sensitive
daggerpod	Phoenicaulis cheiranthoides	
slender popcorn-flower	Plagiobothrys tenellus	
English plantain	Plantago lanceolata	Introduced
common plantain	Plantago major	
rosy plectritis	Plectritis congesta	
long horn plectritis	Plectritis macrocera	
finged pinesap	Pleuricospora fimbriolata	
salmon polemonium	Polemonium carneum	
western polemonium	Polemonium occidentale	
skunk-leaved polemonium	Polemonium pulcherrimum	
doorweed	Polygonum aviculare	Introduced
snakeweed	Polygonum bistortoides	
California knotweed	Polygonum californicum	
water smartweed	Polygonum coccineum	
dull seed	Polygonum convolvulus	Introduced
Japanese knotweed	Polygonum cuspidatum	Introduced

Common Name	Species	Comments
mountain knotweed	Polygonum douglasii latifolium	
marshpepper smartweed	Polygonum hydropiper	Introduced
waterpepper	Polygonum hydropiperoides	
willow weed	Polygonum lapathifolium	Introduced
leafy dwarf knotweed	Polygonum minimum	
Newberry's fleeceflower	Polygonum newberryi newberryi	
Nuttall's knotweed	Polygonum nuttallii	
heartweed	Polygonum persicaria	
ribbon-leaf pondweed	Potamogeton epihydrus	
broadleaved pondweed	Potamogeton natans	
Drummond's cinquefoil	Potentilla drummondii	
fan-leaf cinquefoil	Potentilla flabellifolia	
sticky cinquefoil	Potentilla glandulosa	
slender cinquefoil	Potentilla gracilis	
Norwegian cinquefoil	Potentilla norvegica	
erect cinquefoil	Potentilla recta	Introduced
brook cinquefoil	Potentilla rivalis	
villous cinquefoil	Potentilla villosa parviflora	R6 sensitive
western rattlesnake-root	Prenanthes alata	
self-heal	Prunella vulgaris vulgaris	Introduced
California-tea	Psoralea physodes	
pinedrops	Pterospora andromedea	
leafless pyrola	Pyrola aphylla	
alpine pyrola	Pyrola asarifolia	
green wintergreen	Pyrola chlorantha	
lesser wintergreen	Pyrola minor	
white vein pyrola	Pyrola picta	
sidebells pyrolaq	Pyrola secunda secunda	
wax-flower pyrola	Pyrola uniflora	
water-plantain buttercup	Ranunculus alismaefolius alismaefolius	
white water-buttercup	Ranunculus aquatilis	
shore buttercup	Ranunculus cymbalaria	
subalpine buttercup	Ranunculus eschscholtzii eschscholtzii	
creeping buttercup	Ranunculus flammula	
sagebrush buttercup	Ranunculus glaberrimus glaberrimus	

Common Name	Species	Comments
western buttercup	Ranunculus occidentalis occidentalis	
creeping buttercup	Ranunculus repens	Introduced
blister buttercup	Ranunculus sceleratus	
little buttercup	Ranunculus uncinatus	
Sitka mistmaiden	Romanzoffia sitchensis	
blackhead	Rudbeckia occidentalis occidentalis	
sheep sorrel	Rumex acetosella	Introduced
sour dock/curly dock	Rumex crispus	Introduced
golden dock	Rumex maritimus	Introduced
bitterdock	Rumex obtusifolius	Introduced
western dock	Rumex occidentalis	
willow dock	Rumex salicifolius	
alpine pearlwort	Sagina saginoides	
garden burnet	Sanguisorba officinalis	
Pacific sanicle	Sanicula crassicaulis	
Sierra sanicle	Sanicula graveolens	
yerba buena	Satureja douglasii	
American sawwort	Saussurea americana	
brook saxifrage	Saxifraga arguta	
matted saxifrage	Saxifraga bronchialis vespertina	
tufted saxifrage	Saxifraga caespitosa	
rusty saxifrage	Saxifraga ferruginea macounii	
swamp saxifrage	Saxifraga integrifolia	
wood saxifrage	Saxifraga mertensiana	
western saxifrage	Saxifraga occidentalis	
Oregon saxifrage	Saxifraga oregana oregana	
dotted saxifrage	Saxifraga punctata cascadensis	
alpine saxifrage	Saxifraga tolmiei tolmiei	
lance-leaf figwort	Scrophularia lanceolata	
Oregon stonecrop	Sedum oreganum	
creamy stonecrop	Sedum oreganense	
spatula-leaf stonecrop	Sedum spathulifolium	
wormleaf stonecrop	Sedum stenopetalum	
Bolander's groundsel	Senecio bolanderi harfordii	
alpine meadow butterweed	Senecio cymbalarioides	

Common Name	Species	Comments
western groundsel	Senecio integerrimus	
tansy ragwort	Senecio jacobaea	Introduced, noxious weed
streambank butterweed	Senecio pseudaureus	
wood groundsel	Senecio sylvaticus	Introduced
arrowleaf groundsel	Senecio triangularis triangularis	
common groundsel	Senecio vulgaris	Introduced
Mediterranean weed	Sherardia arvensis	Introduced
creeping sibbaldia	Sibbaldia procumbens	
sleepycat	Silene antirrhina	
bladder campion	Silene cucubalus	Introduced
Douglas' silene	Silene douglasii	
windmill pink	Silene gallica	Introduced
Oregon silene	Silene oregana	
Suksdorf's silene	Silene suksdorfii	
tumblemustard	Sisymbrium altissimum	Introduced
hedge mustard	Sisymbrium officinale	Introduced
blue-eyed grass	Sisyrinchium idahoense idahoense	
hemlock water-parsnip	Sium suave	
false solomon's seal	Smilacina racemosa	
starry false Solomon-plume	Smilacina stellata	
Canadian goldenrod	Solidago canadensis salebrosa	
western goldenrod	Solidago occidentalis	
dune goldenrod	Solidago spathulata	
prickly sow-thistle	Sonchus asper	Introduced
simplestem burweed	Sparganium emersum multipedunculatum	
stickwort	Spergula arvensis	Introduced
red sandspurry	Spergularia rubra	Introduced
ladies-tresses	Spiranthes romanzoffiana	
pussypaws	Spraguea umbellata caudicifera	
great betony	Stachys cooleyae	
northern starwort	Stellaria calycantha	
crisped starwort	Stellaria crispa	
sticky starwort	Stellaria jamesiana	
long-leaved starwort	Stellaria longifolia	

Common Name	Species	Comments
chickweed	Stellaria media	Introduced
shining chickweed	Stellaria nitens	
Simcoe Mountain starwort	Stellaria sincoei	
western stenanthium	Stenanthium occidentale	
clasping leaved twisted-stalk	Streptopus amplexifolius	
sessile-leaved twisted-stalk	Streptopus roseus curvipes	
rosy trwisted-stalk	Streptopus streptopoides brevipes	R6 sensitive
violet suksdorfia	Suksdorfia violacea	R6 sensitive
sullivantia	Sullivantia oregana	Federal candidate
snow-queen	Synthris reniformis	
mountain kittentails	Synthris stellata	
common tansy	Tanacetum vulgare	Introduced
dandelion	Taraxacum officinale	Introduced
Strickland's tauschia	Tauschia stricklandii	R6 sensitive
shepherd's cress	Teesdalia nudicaulis	Introduced
fringecup	Tellima grandiflora	
western meadowrue	Thalictrum occidentale	
common mountain thermopsis	Thermopsis montana ovata	
Fendler's pennycress	Thlaspi fendleri glaucum	
sand fringepod	Thysanocarpus curvipes	
coolwort foamflower	Tiarella trifoliata unifoliata	
tofieldia	Tofieldia glutinosa brevistyla	
youth-on-age	Tolmiea menziesii	
small-flowered tonella	Tonella tenella	
	Torilis arvensis	Introduced
yellow salsify	Tragopogon dubius	Introduced
false bugbane	Trautvetteria caroliniensis occidentalis	
northern starflower	Trientalis arctica	
western starflower	Trientalis latifolia	
hare's-foot	Trifolium arvense	Introduced
cup clover	Trifolium cyathiferum	
suckling clover	Trifolium dubium	Introduced
woolly-head clover	Trifolium eriocephalum eriocephalum	
long-stalked clover	Trifolium longipes	
big-head clover	Trifolium macrocephalum	

Common Name	Species	Comments
small-head clover	Trifolium microcephalum	
red clover	Trifolium pratense	Introduced
hop clover	Trifolium procumbens	Introduced
white clover	Trifolium repens	Introduced
subterranean clover	Trifolium subterraneum	Introduced
sand clover	Trifolium tridentatum	
white-tip clover	Trifolium variegatum	
white trillium	Trillium ovatum	
cattail	Typha latifolia	
stinging nettle	Urtica dioica lyallii	
lesser bladderwort	Utricularia minor	R6 sensitive
Scouler's valerian	Valeriana scouleri	
Sitka valerian	Valeriana sitchensis	
lamb's lettuce	Valerianella locusta	Introduced
ventenata	Ventenata dubia	Introduced
inside-out flower	Vancouveria hexandra	
false hellebore	Veratrum californicum caudatum	
green false hellebore	Veratrum viride	
moth mullein	Verbascum blattaria	Introduced
woolly mullein	Verbascum thapsus	Introduced
American brooklime	Veronica americana	
water pimpernel	Veronica anagallis-aquatica	Introduced
common speedwell	Veronica arvensis	Introduced
Paul's betony	Veronica officinalis	Introduced
purslane speedwell	Veronica peregrina xalapensis	
marsh speedwell	Veronica scutellata	
thyme-leaved speedwell	Veronica serpyllifolia	Introduced
American alpine speedwell	Veronica wormskjoldii	
bird vetch	Vicia cracca	Introduced
giant vetch	Vicia gigantea	
hairy vetch	Vicia hirsuta	Introduced
common vetch	Vicia sativa	Introduced
slender vetch	Vicia tetrasperma	Introduced
periwinkle	Vinca major	Introduced
early blue violet	Viola adunca	
pioneer violet	Viola glabella	
small white violet	Viola macloskeyi	

Common Name	Species	Comments
round-leaved violet	Viola orbiculata	
marsh violet	Viola palustris	
redwoods violet	Viola sempervirens	
beargrass	Xerophyllum tenax	
FERNS AND FERN-ALLIES		
maidenhair fern	Adiantum pedatum	
pod fern	Aspidotes densa	
maidenhair spleenwort	Asplenium trichomanes	
lady fern	Athyrium filix-femina	
deer-fern	Blechnum spicant	
leathery grapefern	Botrychium multifidum	
little grapefern	Botrychium simplex	
Virginia grapefern	Botrychium virginianum	
lace lip-fern	Cheilanthes gracillima	
rock-brake	Cryptogramma crispa acrostichnoides	
brittle bladder fern	Cystopteris fragilis	
mountain wood fern	Dryopteris austriaca	
common horsetail	Equisetum arvense	
marsh horsetail	Equisetum plaustre	
giant horsetail	Equisetum telmateia braunii	
oak fern	Gynmocarpium dryopteris	
Nuttall's quillwort	Isoetes nuttallii	
Howell's quillwort	Isoetes howellii	
Bolander's quillwort	Isoetes bolanderi	
bristle-like quillwort	Isoetes echinospora	
lake quillwort	Isoetes lacustris	
stiff clubmoss	Lycopodium annotinum	
stag's horn moss	Lycopodium clavatum	
fir clubmoss	Lycopodium selago	R6 sensitive
Alaska clubmoss	Lycopodium sitchensis	
gold-fern	Pityrogramma triangularis triangularis	
	Polypodium amorphum	
licorice-fern	Polypodium glycyrrhiza	
licorice polypody	Polypodium hesperium	
Anderson's sword fern	Polystichum andersonii	
sword fern	Polystichum munitum	

Common Name	Species	Comments
bracken fern	Pteridium aquilinum	
Douglas' selaginella	Selaginella douglasii	
Wallace's selaginella	Selaginella wallacei	
Sierra wood fern	Thelypteris nevadensis	
Rocky Mountain woodsia	Woodsia scopulina	
CRYPTOGAMS		
	Anastrophyllum minutum	State sensitive
	Conostomum tetragonum	State sensitive
	Gymnomitrion cocinnatum	State sensitive
	Marsupella condensata	State sensitive
	Nardia japonica	State sensitive
	Polytrichum spaerothecium	State sensitive

Appendix C

<u>Specialists Reports</u>

FISHERIES REPORT

West Fork Hood River Watershed Analysis

by Chuti Ridgley, Fisheries Biologist

- Introduction: The Hood River and its West Fork, historic pre-1900.
- Activities within West Fork that have affected distribution of fish stocks, 1900 to present.
- Present known fish distribution
- Miscellaneous
    - Possible causes for decline of lamprey
    - West Fork as potential habitat for bull trout

The Hood River and its West Fork

The Hood River historically supported indigenous anadromous runs of steelhead (Summer and Winter), chinook (Spring and Fall), coho, sea-run cutthroat trout, and Pacific lamprey. Resident fish include rainbow, cutthroat, mountain whitefish, sculpins, and suckers. Sockeye, brown trout, and brook trout have been introduced into the basin, with brown trout and brook trout still persisting within the basin. Historical occurrence of Western brook lamprey are suspected in the Hood River subbasin but records were not available to document their presence in the upper watershed. West Fork of the Hood River likely contained mainly resident fish, such as rainbow, cutthroat and sculpins, in the pre-1900 era. A natural fish barrier is present at rivermile 0.2, where the West Fork has deeply incised itself into some lava flows composed of columnar basalt and created a 15-20 foot falls, named Punchbowl Falls. It's possible that some steelhead and possibly a few salmon may have naturally made it over the falls during higher flows, but historically the upperdrainage may have been dominated by resident fish. Several reports by early pioneers repeatedly mention the West Fork, specifically Lost Lake, Lake Branch, and West Fork mainstem, as great trout streams (Coons 1987, FS interviews 1991, Winans 1991). Two different exploration parties in 1880 and 1887 both mention the abundance of trout within Lake Branch and Lost Lake, with one party documenting lengths between 8-12", and the other saying "each were about the length of a case knife, handle and all". Both parties, as well as other early pioneers, caught all they could eat from one pool or location, hinting at the historic abundance of trout within the West Fork drainage. Pre-1900 and present fish distribution within the various subdrainages of the West Fork is presented in Table 1.

ACTIVITIES THAT HAVE AFFECTED THE DISTRIBUTION OF FISH STOCKS

1. Widespread Habitat Alteration

European and Asian emigrants arrived in the Hood River valley around 1846. The upper valley and the West Fork Hood River was not generally ventured into until around 1880. The country at that time was often described as majestic expanses of timber as far as the eye could see (Pope 1992, Winans 1991). Logging began near the mouth of the Hood River, but moved quickly up the valley. Sawmills were built near streams, harnessing the power of the rivers to not only transport logs but to power their mills. The first log drives in the mainstem began around 1889. The first splash dam was built on the West Fork in 1901, which was 97 feet wide and had 800 feet of backwater. These logs were destined for a mill built near the present town of Hood River. Smaller mills that weren't near water used draft animals or steam donkeys to "skid" logs to their mills. Later, the building of the railroad system up the West Fork allowed harvest of timber all the way to headwater streams of McGee and Elk Creeks. Stumps are still present on streamsides of these areas, attesting to the size and density of these trees historically. Stream side vegetation was harvested along with upland areas. What little was left along the stream was later removed around the 1950's by "stream clean-out" projects. The majority of West Fork streams are in second-growth stands that will take several centuries before being able to provide wood large enough to create habitat that existed around the turn of the century.

MISCELLANEOUS

* **Lamprey and possible factors for decline**

  In the case of lampreys, very little was studied or recorded on needs of these species in the past. Pacific Lamprey were likely found everywhere anadromous fish were able to pass and possibly even higher due to their unique climbing ability. Lampreys may be more susceptible to environmental degradation than salmonids due to several factors such as, long freshwater residence, and sedentary filter-feeding habits during their juvenile phase. Juveniles are not able to move from degraded habitats, nor avoid fluxes in water quality such as toxic spills or sedimentation. Another factor in their decline may be fish ladders and diversions designed mainly for salmonid passage. Recent studies by the Intertribal Fish Commission noted a sharp decline in abundance and distribution of lampreys from historic areas in the Columbia River basin (Blaine Parker, personal communication). A 1963 Oregon Game Commission report on the Hood River noted lamprey as "throughout the basin". Recent fish surveys by various agencies have not located lampreys in the upper Hood River, and they are likely extirpated from the West Fork watershed.

* **Potential habitat and bull trout**

  West Fork of the Hood River contains good potential habitat for bull trout. Other than one fish passing through Punchbowl Falls trap in 1963, no other reports document bull trout within the West Fork drainage. The biggest factor in colonization of bull trout in the West Fork will likely be water temperature related. West Fork was heavily logged by railroad from 1920 to 1940, including most riparian areas. Water temperatures taken from a 1963 report showed that mainstem West Fork may have been warmer than it is now. Lack of older riparian vegetation at the time would support this data. Table 3 lists current stream temperatures by subwatersheds. At the bottom of the table are temperatures currently used by Hood River bull trout for passage or spawning. Given this information, it seems possible for bull trout to colonize West Fork Hood River. The West Fork subwatershed of the West Fork Hood River has the best chance of successful bull trout rearing and spawning. There are currently low enough temperatures to support passage and spawning of bull trout in this subwatershed. Lake Branch and Green Point subwatersheds have temperatures that may be too high for bull trout. Both of these subwatersheds also contain brook trout that can hybridize and/or compete with bull trout, while West Fork (subwatershed) does not. Riparian buffers within West Fork Watershed will be key components to maintaining low stream temperatures. Electroshocking has not turned up any bull trout within the West Fork. Day and night snorkeling surveys will be done in 1996 to continue surveying for possible populations within West Fork tributaries.

Table 1: WEST FORK OF THE HOOD RIVER: Fish Distribution

	Historic (Pre-1900/ early 1900) (Pioneer records & inference)	Present
Green Point Subwatershed		
Ottertail Lake	suspected fishless	Brk
Black Lake	"	Brk
Rainy Lake	"	Brk
Rainy Creek	"	Brk
Gate Creek	"	Brk
Cabin Creek	"	Brk, RB
N. Fork Green Point	RB/redband	RB/redband
Long Branch	fishless?	
Green Point Creek	RB, StW, Lamp?, Cott	RB, StW, Cott
Dead Point Creek	? (vertical falls @ mouth)	RB, Brk
Lake Branch Subwatershed		
Lost Lake	RB	RB, K, Sockeye, Br, Brk
Scout Lake	suspected fishless	Brk
No Name Creek	RB, Cott (lower 0.2 mile)	RB, Cott (lower)
Indian Creek	RB, Cott (lower)	RB, Cott (lower)
Laurel Creek	RB?	RB
Divers Creek	RB, Cott, StS (low)	RB, Cott, StS (low)
Lake Branch	RB, StS, Cott, Lamp?, ChS?	RB, Brn, Brk, StS, Cott
West Fork Subwatershed		
McGee Creek	RB	RB, ChS
Elk Creek	RB	RB, ChS (rearing)
Jones Creek	RB	RB
Ladd Creek/Stump Creek	?up higher on stump	?
Red Hill Creek	RB	RB
Marco Creek	RB	RB
Dry Run Creek	?	?
Deer Creek	?	?
West Fork mainstem	*RB, StS, ChS, Wh, Cott, Lamp?, Bull?	RB, StS, ChS, Cott, Wh
* anadromous/migratory fish may be mostly below PB falls. - Possible Cutthroat trout in upper tributaries (McGee, elk, Jones), *fishing comments.*		Latest revision 2/20/96
RB = rainbow trout, Brk = brook trout, Brn = brown trout, StW = winter steelhead, StS = summer steelhead, ChS = spring chinook, Lamp = Pacific Lamprey, Cott = sculpins, Wh = mountain whitefish , K = kokanee		

Sources: 1963 OR. Game Commission Subbasin report, USFS/ODFW fish surveys.
Farmer's Irrigation District Personal Comm.

Historical reports: History of Hood River County Vol. I and II, History of Early Pioneer Families of Hood River Oregon (Mulitiple authors, compiled by Coon), Hood River...as I have known It (Winans), US Forest Service Interviews: Compiling and Reseraching Local History 1991 (on file at HRRD).

Table 2: WEST FORK OF THE HOOD RIVER: Documented fish stockings

Streams within West Fork watershed have not been stocked with trout since 1957. The lakes continue to be stocked with mainly brook trout (rainbows in Lost Lake) on an annual or biennual basis. Anadromous fish, such as Spring chinook and Summer Steelhead continue to be stocked in the West Fork mainstem.

	SPECIES STOCKED (with release year and broodstock used in parenthesis)	PRESENT
Green Point subwatershed		
Rainy Lake	Brk (1960 to present)	Brk
Black Lake	Brk (1960 to present)	Brk
Ottertail Lake	Brk (1960 to present)	Brk
Rainy Creek		
Gate Creek		
Cabin Creek		
N. Fork Green Point		
Long Branch		
Dead Point Creek		
Green Point Creek mainstem	RB (1955 and 1956 ONLY, Hood River and Oak Springs)	
Lake Branch subwatershed		
Lost lake	1950/60's: Brk, Brn, K, (Sockeye mid 50's only), coho (1958), stocks unknown. RB (Hood River, unknowns, Oak Springs, Williamette River, Roaring) 1980's: RB (williamette River, Deschutes River)	RB
Scout Lake	Brk (1950's to present)	Brk
No Name Creek		
Indian Creek		
Laurel Creek		
Divers Creek		
Lake Branch mainstem	StS (1962-1974 Hood River, unknowns, Washougal) (1975 to 1985 Skamania) RB (1954 to 1956 ONLY, Hood River, unknown, and Oak Springs)	
West Fork subwatershed		
McGee Creek		
Elk Creek		
Jones Creek		
Ladd Creek / Stump Creek		
Red Hill Creek		
Marco Creek		
Dry Run creek		
Deer Creek		
West Fork Mainstem	ChS (Carson, Clackamas, Deschutes, 1984 to 1991) (Deschutes, 1992-present) StS (1961 - 1978 Hood River, Cascade, unknowns, Washougal) (1975-present, Skamania) StW (1962 ONLY, unknown stock) RB (1950-56 ONLY, Hood River, unknowns, Oak Springs)	ChS, StS
RB = rainbow trout, Brk = Eastern Brook trout, Brn = German Brown trout, StS = Summer steelhead, ChS = Spring chinook, StW = Winter Steelhead		

Fish may have been stocked in other streams by private parties and interests, that are not documented.

SOURCES: 1963 Oregon Game Commission report, 1965 Summary Report of Hood River Steelhead Project, 1990 Hood River Subbasin Salmon and Steelhead Production Plan, 1995 draft report of Hood River Production Plan report.

Table 3: WEST FORK OF THE HOOD RIVER: Stream temperatures and bull trout potential

Note: Areas with known spawning (Clear Branch) and travel corridors (Middle Fork Hood River) are displayed on bottom, to show temperatures currently used by bull trout within the Hood River Subbasin.

	Water Temperatures Maximum and (daily range)					1963 temp (if avail.)	Potential Now?
	June	July	Aug	Sept	Oct		
Green Point subwatershed						Low potential due to high temperatures	
Rainy Creek			15.7				No
Gate Creek		10.5					No
Cabin Creek		8.5					No
N.Fork Green Point		15.0	13.5				No
Long Branch		12.5					No, B
Green Point Creek	**12.5 (2.5)**	**16.8 (2.8)**	**15.7 (2.2)**	**12.6 (2.0)**			No
Dead Point Creek		10.0					No, B
Lake Branch subwatershed						Possible, if can pass through Lake Branch	
No Name Creek		14.0		13.3			No
Indian Creek		12.5		12.3			No
Laurel Creek		14.0		7.8			Spawn
Divers Creek		10.0		10.5			Spawn
Lake Branch	13.6 (2.9)	17.7 (3.9)	16.9 (3.3)	13.4 (2.1)	9.7 (2.2)	15.0, 16.7, 14.5, 13.7	Passage?
West Fork subwatershed						Good Potential	
McGee Creek	9.1 (2.0)	11.6 (1.8)	11.2 (1.7)*		5.5		Spawn
Elk Creek		11.5					Spawn
Jones Creek		16.0					?
Ladd / Stump Creek	**10.0 (4.5)**	**11.6 (4.0)**	**12.2 (4.5)***				?, silt
Red Hill Creek		9.0					Spawn
Marco Creek		9.0					No, B
Dry Run creek							No, B
Deer Creek		12.0					No, silt
West Fk mainstem	11.4 (2.2)	14.1 (3.3)	13.4 (2.5)	11.4 (1.8)	9.5	16.2, 15.6, 16.7, 15.0	Passage
Clear Branch	**9.1 (2.3)**	**12.0 (2.7)**	**11.1 (2.1)**	**9.1 (1.5)**	**6.2 (1.2)**		Spawn
Middle Fork Hood River	14.5 (4.4)	14.2 (5.1)	14.1 (5.0)	13.6 (3.5)	10.0 (2.5)		Passage

B = natural barrier at mouth. Silt = high surface silt.

<u>SOURCES</u>: 1994 and 1995 (*only to Aug 10, '95) **data from Onset "Hobotemp" thermographs in BOLD.**
1963 OR game Commission Subbasin report (<u>in 1963 column</u>, showing June, July, August, Sept.)
1972 - 1994 Mt. Hood National Forest stream survey reports (hand-held thermometers @ midday)
1995 Pebble counts Hood River Ranger District. (hand-held thermometers @ mid-day)

Table 4: WEST FORK OF THE HOOD RIVER: CTWS / ODFW Run Size Goals and Adult Returns

CTWS / ODFW run size goals and anticipated adult returns from hatchery releases of spring chinook, and summer and winter steel head in the Hood River Subbasin.

RUN SIZE GOAL[a]				ADULT RETURNS			
SPECIES	NATURAL	HATCHERY	TOTAL	EXISTING	5 YEAR[b]	10 YEAR	15 YEAR
ChS	400	1,300	1,700	<100[c]	1,400	1,700	1,700
StS	1,200	6,800	8,000	<5,000	8,000	8,000	8,000
StW	1,200	3,800	5,000	<800	2,000	4,000	5,000
ChF[d]	1,200	N/A	1,200	<300	600	600	600
Co	600	N/A	600	<300	600	600	600
Total	4,600	11,900	16,500	6,500	12,600	14,900	15,900

[a] Hatchery and wild adult returns to Hood River.

[b] Number of years after the anticipated completion of the Hood River facility.

[c] Adult returns from Carson smolt releases.

[d] Goals as established in system planning. Increases are assumed from the anticipated screening and habitat improvements

Table 5: WEST FOR OF THE HOOD RIVER: Amphibian Sightings (1991-1995)

STREAMS / YEAR	LOCATION / RM	COMMON NAME	NO	PHASE
Green Point Creek - 94	RM 7.2	**Cope's Giant Salamander**	1	neotene
		Tailed frog	1	adult
Gate Creek - 7/95	RM 0.72	*Dicamptodon	6	larva
Long Branch - 7/95	RM 0.4	*Dicamptodon	>9	neo/larv
		Tailed frog	1	adult
Camp Creek- 7/95	RM 0.16	*Dicamptodon	1	larva
Camp Creek - 8/95	T01N,R09E,SW of SE	Pacific Tree Frog	>8	larvae
Indian Creek - 7/93	RM 1	**Cope's Giant Salamander**	1	larva
Indian Creek - 7/95	RM 0.12	**Cope's Giant Salamander**	1	neotene
No name Creek - 7/95	RM 0.12	*Dicamptodon	2	neotene
		*Dicamptodon	4	larva
Lake Branch - 7/94	RM 0.5	*Dicamptodon	1	neotene
		Pacific Giant Salamander	1	adult
Lake Branch - 7/95	RM 11	**Cascade Frog**	>2	adult
Laurel Creek - 7/95	RM 0.1	**Tailed frog**	1	adult
Laurel Creek - 7/95	RM 3	**Cascade Frog**	2	adult
Laurel Creek - 8/95	RM 3	Pacific Giant Salamander	2	neotene
Marco Creek - 7/95	RM .6	**Cascade Frog**	2	adult
		Cascade Torrent Salamand	1	adult
Jones Creek - 8/95	RM 0.16	Pacific Giant Salamander	1	neotene
Lost Lake Pond - 7/95	T01S,R08E, SW of SE	Northwestern Salamander	n/a	eggs
		Pacific Tree Frog		larvae
		Cascade Frog	>1	adult
		Rough Skinned Newt	>1	adult
		Rough Skinned Newt		larvae
West Fork - 7/93	RM 13.5	**Cascade Frog**	3	adult
McGee Creek - 7/91	RM 2.0	Pacific Giant Salamander	1	adult
		Tailed Frog	1	tadpole

* Salamanders indentified to Genus Dicamptodon only, can be Pacific Giant or Cope's.
Bold - Sensitive species on state, or Federal list.

Table 6: WEST FORK HOOD RIVER: Subbasin Instream Surface Fine Sediment

1995 West Fork Subbasin instream surface fine sediment, using Wolman pebble count methodology

Stream Name	Location	River mile	% Surface Fines 1mm or less	% Surface Fines 6mm or less	D50 Particle Size
Elk creek	At mouth, 18 road	0.12	0.68	2.05	78.32
McGee Creek	At mouth, 18 road	0.12	8.55	9.21	61.82
Jones Creek	At mouth	0.16	3.14	4.40	54.48
Red Hill Creek	Above 18 road	0.96	10.43	11.04	97.23
Lake Branch #1	Headwaters, below Lost	11.0	9.16	13.74	44.00
Lake Branch #2	Mouth	0.04	1.64	2.46	228.0
No Name Creek	Mouth, below 13 road	0.12	0.68	2.04	56.52
Indian Creek	Mouth, below 13 road	0.12	5.71	5.71	98.00
Diver's Creek	Mouth, below 13 road	0.08	2.54	4.24	86.15
Camp Creek	Mouth	0.16	0.79	0.79	93.60
Deer Creek	Mouth, above 13 road	0.2	11.54	20.77	25.00
Laurel Creek	Below 1330 road	3.0	14.29	15.79	48.44
Green Point Creek #1	DS of lake, above 2810	7.2	3.50	8.39	72.89
Green Point Creek #2	2810 rd, US of bridge	4.0	0.56	3.93	110.55
Green Point Creek #3	Mouth	0.2	0.0	1.13	150.15
Long Branch	Above bridge	0.4	0.0	0.0	119.65
North Fork Green Pt #1	DS of Black lake	5.2	14.29	31.09	30.67
North Fork Green Pt #2	Below diversion	0.04	0.0	0.85	152,89
Gate Creek	2820/630 US diversion	0.72	27.21	36.05	14.83
Cabin Creek	2820/630 US diversion	1.0	11.72	15.17	39.33
DeadPoint Creek	2820 road	0.8	2.84	3.55	57.78
West Fork mainstem	Mouth	0.08	0.68	2.03	215.27
West Fk 1993 project:	Between Jones & Ladd	13.2	Average of 15 permanent transects		
1993 Pre-project			10.79	15.11	41.65
1994 Post-Porject			20.67	26.00	26.86
1995 Post Project			3.95	9.32	113.90

The Last four lines are from Monitoring and Evaluation data from the 1993 large wood input project. Fifteen permanent transects are set up for monitoring of channel morphology and substrate.

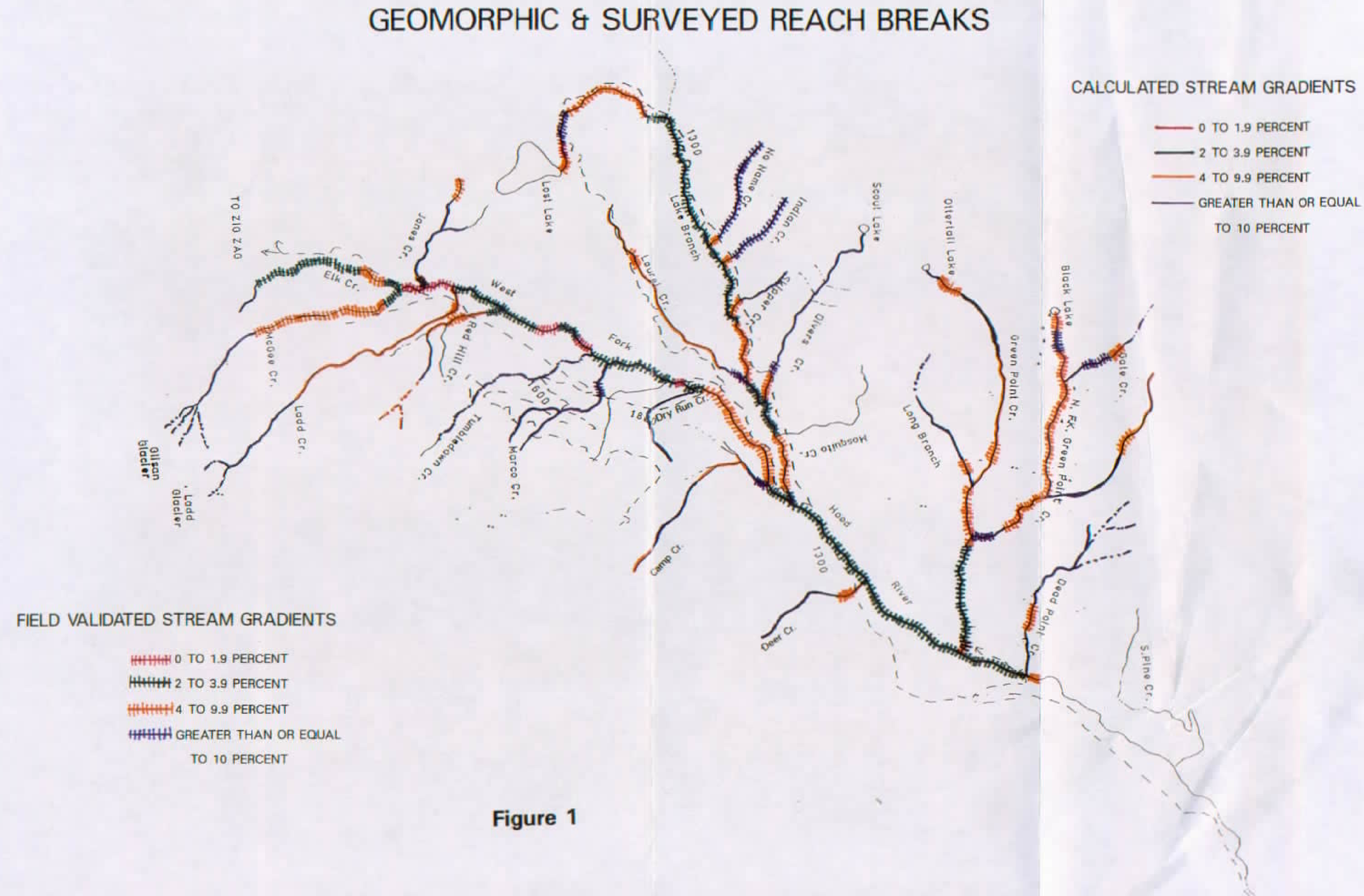

GEOMORPHIC & SURVEYED REACH BREAKS
CALCULATED STREAM GRADIENTS
0 TO 1.9 PERCENT
2 TO 3.9 PERCENT
4 TO 9.9 PERCENT
GREATER THAN OR EQUAL TO 10 PERCENT
FIELD VALIDATED STREAM GRADIENTS
0 TO 1.9 PERCENT
2 TO 3.9 PERCENT
4 TO 9.9 PERCENT
GREATER THAN OR EQUAL TO 10 PERCENT
TO ZIG ZAG
Elk Cr.
Jones Cr.
McGee Cr.
Ladd Cr.
Gilsan Glacier
Ladd Glacier
Red Hill Cr.
Tumbledown Cr.
Marco Cr.
West
Fork
1600
Dry Run Cr.
Lost Lake
Laurel Cr.
Lake Branch
1300
No Name Cr.
Indian Cr.
Skipper Cr.
Olivers Cr.
Scout Lake
Mosquito Cr.
Camp Cr.
Hood
River
Deer Cr.
Long Branch
Otterlail Lake
Green Point Cr.
Black Lake
N. FK. Green Point Cr.
Dale Cr.
Dead Point Cr.
S.Pine Cr.

Figure 1

ROSGEN STREAM CHANNEL TYPE FIELD VALIDATION

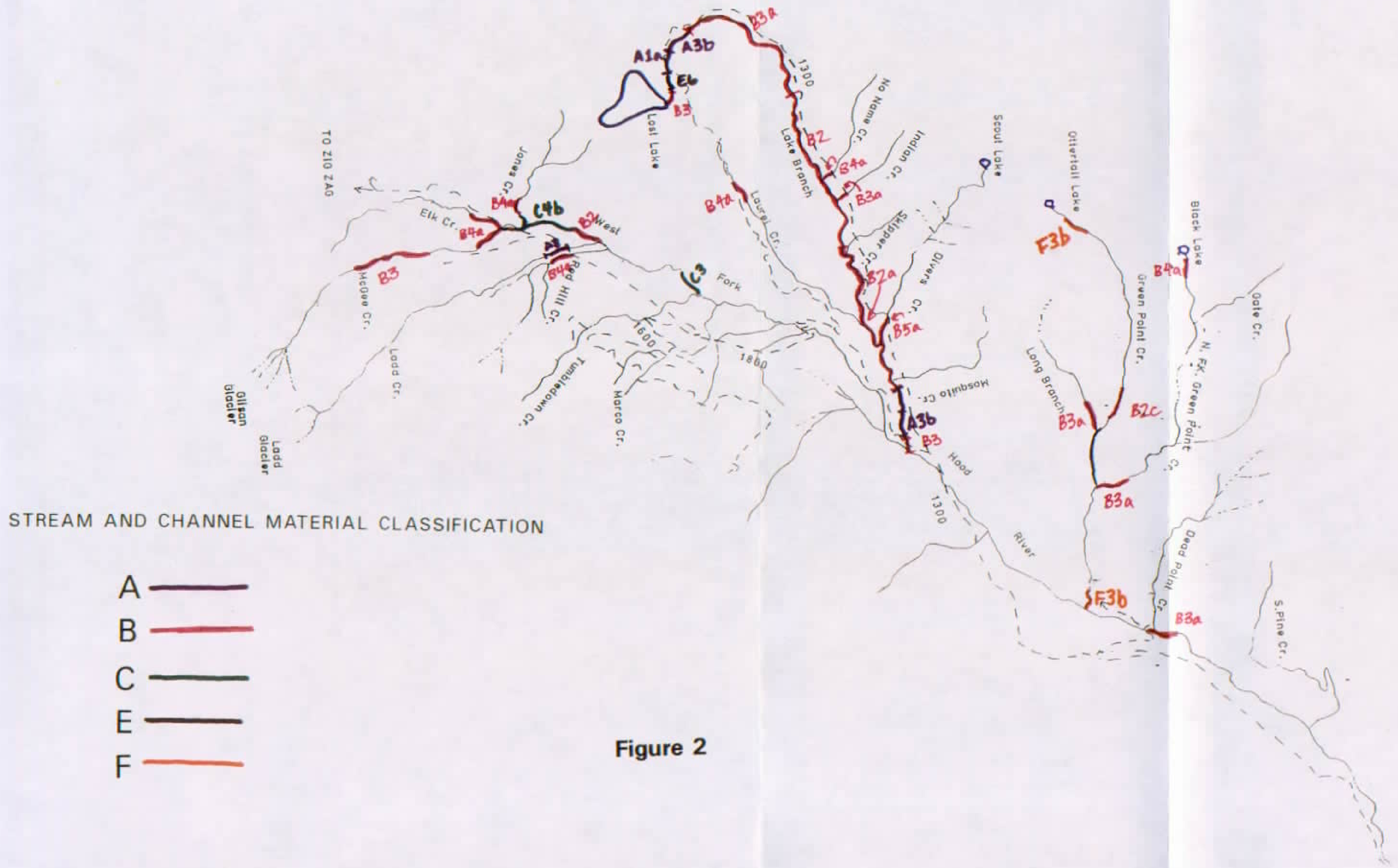
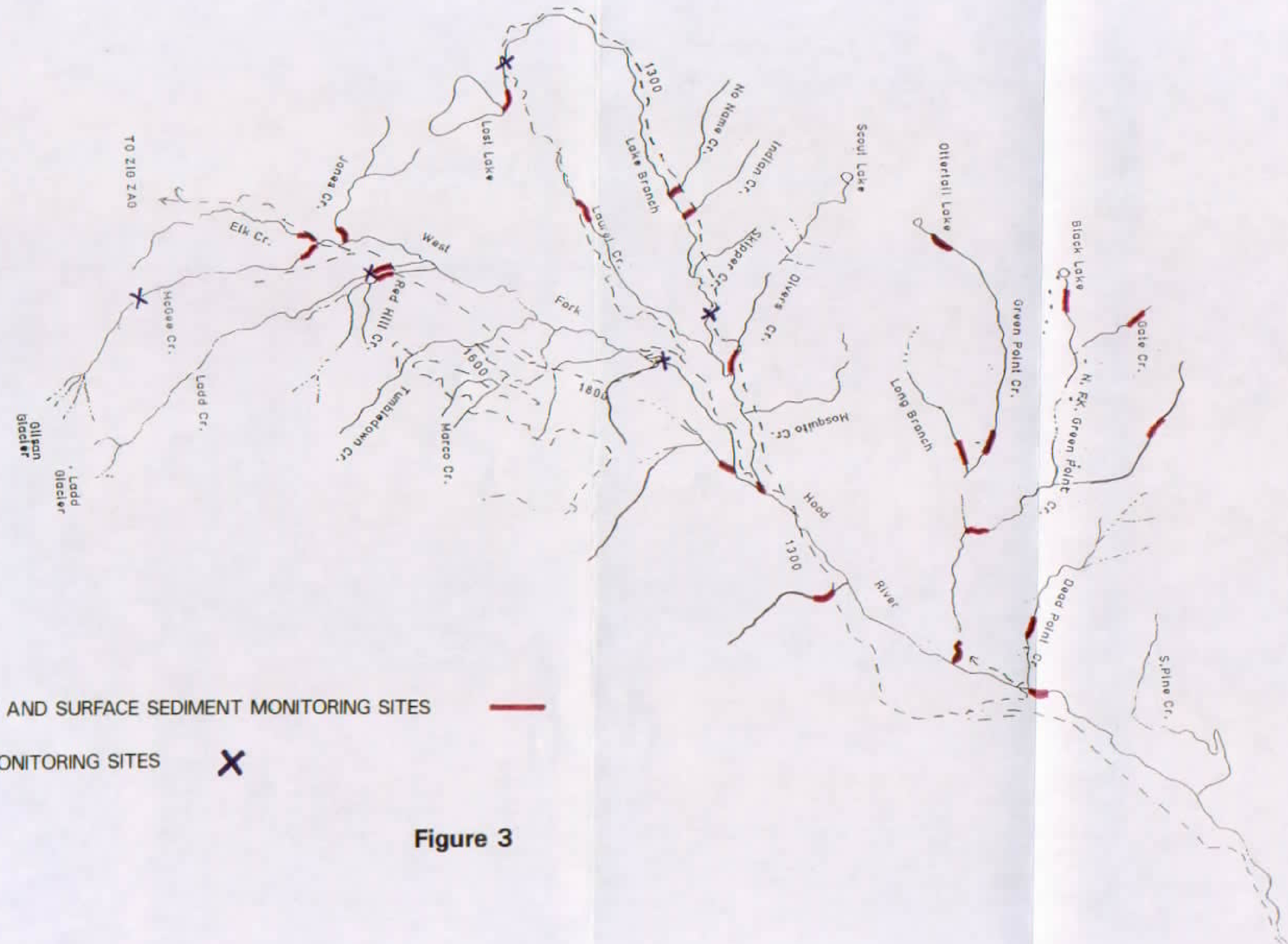


Figure 2

WEST FORK HOOD RIVER MONITORING SITES



CHANNEL MORPHOLOGY AND SURFACE SEDIMENT MONITORING SITES

WATER TEMPERATURE MONITORING SITES ✕

Figure 3

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HYDROLOGY REPORT

West Fork Hood River Watershed Analysis

by Daniel Newberry, Hydrologist

1.0. Introduction

The West Fork of the Hood River (WFHR) is a fifth-order stream that joins the East Fork of the Hood River to form the Hood River at river mile (RM) 12.1. The watershed of the WFHR occupies 65,457 acres (102.3 square miles) and has an average elevation of 3124 ft with its headwaters in the glaciers of Mt. Hood. The western watershed boundary is the Cascade crest. Though on the east side of the crest, the precipitation regime of the WFHR watershed more closely resembles one the Cascade westside than it does an eastside regime. The average annual precipitation in the WFHR watershed varies from 195 inches/yr at the crest near Mt. Hood to 35 in/yr on the eastern slopes of Mt. Defiance. The soil parent material is primarily composed of volcanic and volcaniclastic rocks (basalt, andesite, tuff, tuff breccia, pyroclastic flows) with scattered deposits of glacial till.

The mainstem of the WFHR is formed by the confluence of Elk and McGee Creeks and flows for 13.9 miles in a northeasterly direction before joining the Hood River. The valley from of the WFHR mainstem varies from a very wide flat-bottom "V" to a very narrow bedrock gorge. Many tributaries originate in steep headwall canyons that are often the source of debris flows and other mass movements.

2.0. Peak Flow

Analysis of peak streamflows is important for several reasons. Ecologically, the most significant acute impacts from flowing water happen during infrequent, high volume flows. Streambanks and beds are scoured, massive quantities of sediment are moved, and riparian vegetation may be altered. More significant from year to year is the impact of the bankfull flow. Bankfull flow is often described as the high flow during two out of three years, or as a stream discharge having a recurrence interval of 1.5 years (Dunne and Leopold, 1978). The shape of the channel more closely reflects the bankfull width and height than it does the less frequent floods. If the bankfull flow is raised above the range of natural conditions, excess scouring and headcutting can occur. If lower, the stream may not have the power to move its natural sediment load and cause sediment deposition within the watershed. From a human perspective, increased peakflows may place life and property at risk from flooding.

2.1 Methods

Peakflow was analyzed for the WFHR watershed both by a qualitative examination of current and historical processes in the drainage, and quantitatively through the examination of flow records at the USGS gaging station on the WFHR at Punch Bowl Falls, and through the use of the Aggregate Recovery Percentage (ARP) model. The ARP model was used to compare the state of hydrologic recovery of existing (1991 data) watershed vegetation with that of the reference condition (1900 A.D. estimate). The results of the ARP model were then combined with precipitation, basin relief, slope data, and existing road density to construct a relative hazard/risk rating for likely damage from peak flow and/or peak precipitation for the 6th field subwatersheds and analysis units within the WFHR watershed.

2.2 Processes Affecting Peakflows in the West Fork Hood River Watershed

Historically, the most common disturbances likely to significantly affect peakflows in the WFHR watershed were debris flows and large, high temperature fires. Mass wasting on hillslopes in this watershed did and do occur most frequently during or after winter rain-on-snow events. These events often cause significant melting of the snowpack which supersaturates the underlying soil, reducing soil strength to the point that mass failure occurs. Large amounts of water, soil, rock, and large woody debris reach the stream channel where the resulting debris torrent scours the streambed, banks, and riparian vegetation. The erosive power of a debris torrent is far higher than a "water" flood of the same volume. The scouring action of debris flows removes large instream wood, which causes a decrease of channel roughness, which in turn leads to increased peakflows.

The historic fire regime in the WFHR watershed was likely a large, hot, infrequent one. Mortality would cause a large decrease in evapotranspiration and a increase in large openings in the forest canopy. Both of these phenomena tend to cause an increase in peakflows in the streams draining the affected areas. The loss of root strength in severely burned areas may increase the risk of mass failures, thus leading to higher peakflows.

The literature is full of studies documenting the impact of road-building and clearcutting on hillslope failure (Swanson and Dyrness, 1975; Wolfe and Williams, 1986). By intercepting groundwater and channeling surface flow, road building decreases the transit time of stormwater in a watershed, leading to higher peakflows. A recent study documented the increase in effective stream density due to the incidence of roads in forested watersheds (Wemple, 1994). Historically, large natural openings in forested areas in this basin were created by fire. Because of fire suppression, this pattern has been changed. In the past few decades, gaps in the forest canopy have been created by clearcutting. Clearcutting causes a local accumulation of the snowpack which changes the amount and timing of snowmelt and causes an increase in available snow water equivalent available for melt in rain-on-snow events. A fire-caused canopy opening typically has a high snag density, which retards the development of a large snowpack which in turn leads to a smaller contribution to peakflows than would be experienced by a clearcut of equivalent size.

Historically, there were much higher levels of large wood in the streams in this basin. Wood has been removed in salvage logging, splash damming, and stream "cleaning" operations. One physical effect of large wood in stream channels is to slow down moving water, which tends to desynchronize the timing of peak inflow and outflow of water, reducing the peakflows. This difference is most noticeable in smaller events and decreases as the size of the flow increases.

Based on the processes examined here, it is safe to say that the effect of management in this watershed, especially road building and the removal of large wood from stream channels, has increased peakflows over what would have occurred without that management. Because no pre-management flow records exist, no quantitative proof of these postulates is possible

2.3 Streamflow Records

There is one gaging station operating in the WFHR watershed, located on the WFHR at river mile 0.4, 0.3 miles above Dead Point Creek. The station has been in continuous operation since 1932. Originally a USGS station, it was assumed by the office of the Water Master for Hood River County in 1992. Data for this analysis was taken from published USGS flow records (Moffatt and others, 1990), water years 1932-1987, and Sep, 1913-Feb, 1916 (incomplete). The maximum recorded streamflow for the period of record is 15,000 cfs (maximum daily discharge) on 12/23/64. The instantaneous maximum occurred during the 1964 flood but was too great to be captured.

For an estimate of bankfull discharge, the published 2-year, 7-day flood has been used. Table 1 compares the bankfull flows of the WFHR with those of nearby basins. Precipitation estimates stored in the Mt. Hood NF GIS database indicates that the mean annual precipitation in the WFHR varies from a low 35 in/yr in the Dead Point Creek subwatershed on the east slope of Mt. Defiance to 195 in/yr in the headwaters of the Ladd Creek subwatershed on the Ladd Glacier on Mt. Hood, with a weighted mean annual amount of 105 in/yr. Most precipitation in the watershed falls as snow. Peak snowmelt occurs, on average, in April. Peak annual flows, however, occur, on average, between December and February, as the result of winter rain-on-snow storms. Low flow typically occurs in September or early October. Graph 1 shows the average monthly streamflow on the WFHR at the gaging station. The largest flow events are the result of infrequent winter rain storms, which occur with well-developed snowpacks. The comparisons of water yields in Table 1 confirms that the peak flow patterns of the WFHR watershed more closely resemble those of westside Cascade watersheds than those on the eastside. Of the watersheds compared in Table 1, the WFHR watershed peak flow regime most closely resembles the Salmon River near Welches, in watershed area, gage elevation, and flow. The WFHR, though, has higher peak flow water yields, even though it lies on the east side of the Cascade crest.

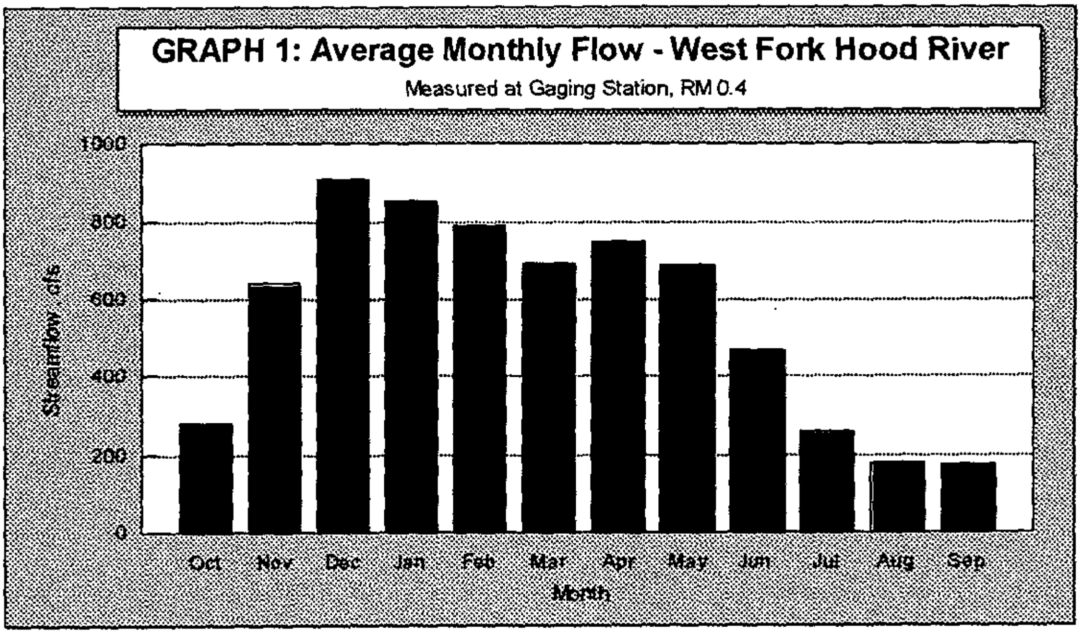


TABLE 1: Peak Flow and Water Yield at West Fork Hood River and Nearby Watersheds

			7-day, 2yr	Yield	Instantaneous	Yield
Location	Area, sqmi	Elev, ft	Flow, cfs	cfs/sqmi	2-yr Flow,cfs	cfs,sqmi
West Fork Hood River	95.6	802	2530	26.5	6790	71.0
Hood River at Tucker Bridge	279.0	383	4510	16.2	11110	39.8
Bull Run River nr Multnomah Falls	47.9	1080	2310	48.2	5870	122.5
Salmon River at Welches	100.0	1350	2060	20.6	5360	53.6
White River below Tygh Valley	417.0	870	1720	4.1	3040	7.3

2.4 Aggregate Recovery Percentage (ARP) Model Results

The ARP model is a risk prediction model, intended to predict the susceptibility of a watershed to sustain damage from winter rain-on-snow events. The theoretical basis for the model is described fully in a paper by Jere Christner (1981). This model predicts this risk solely on the basis of the state of hydrologic recovery of the vegetation and does not account for variations in climatic, geographic, or other environmental factors. The Mt. Hood NF Land and Resource Management Plan (LRMP) (1990) uses a minimum desired threshold for ARP of 65% for a watershed. Thus the watershed impact area's "threshold of concern" (TOC) should not exceed 35%. The LRMP lists the TOC for the Lake Branch subwatershed as 18%. This reflects the high incidence of mass failures experienced in that subwatershed. On the Hood River Ranger District, a TOC of 25% has been used as a more site-appropriate figure (maximum ARP of 75%).

The ARP values in the WFHR watershed were calculated using vegetation data digitized from 1991 satellite data-- the ISAT database. Thus this analysis considers the state of the basin in 1991. Elevation and slope data was derived from USGS Digital Elevation Model (DEM) data. Watershed boundaries and soil and isohyetal (precipitation estimates) data, were taken from the Mt. Hood NF GIS database (MOSS). Analysis was performed using Paradox v4.0, UTOOLS v1.1, and Lotus 1-2-3, v4.0. By comparing recent district ARP analyses that used field-checked and calibrated data derived from aerial photos, it was determined that the ISAT data consistently overestimated the ARP values by 5-7%. Consequently, 5.5% has been subtracted from the calculated ARP values to give a more realistic figure. The likely reason for this discrepancy is that the finer differences in canopy cover for stands approaching maturity (70% canopy) are probably not as easily distinguished on the higher-altitude satellite photos. It is in the nearly mature stands where the hydrologic recovery percentage varies the most. The criterion for level of concern is: "OK" for ARP>75%, "Concern" for ARP 65-75%, and "At Risk" for ARP<65%. The exception is Lake Branch (indicated by an asterisk), for which the concern threshold is about 85% and the At Risk threshold is about 80%.

TABLE 2: Aggregate Recovery Percentage Results for the West Fork Hood River Watershed

HUCCode		Name	Acres	ARP	Concern
1707010512	A	DeadPt Crk	4320	74.3%	Concern
1707010512	B	GreenPt Crk	6192	71.0%	Concern
1707010512	C	NFk GreenPt Crk	4806	76.6%	OK
1707010512	D	Long Branch	2158	62.4%	At Risk
1707010512	E	Lake Branch	12055	66.1%	At Risk *
1707010512	F	Lost Lake	1582	85.9%	OK
1707010512	G	Divers Crk	2848	56.0%	At Risk
1707010512	H	Laurel Crk	2003	66.9%	Concern
1707010512	I	Camp Crk	1845	75.5%	OK
1707010512	J	Marco Crk	1280	69.7%	Concern
1707010512	K	Tumbledown Crk	1211	74.9%	Concern
1707010512	L	Red Hill Crk	1873	70.5%	Concern
1707010512	M	Ladd Crk	4110	82.0%	OK
1707010512	N	Jones Crk	2272	80.5%	OK
1707010512	O	McGee Crk	3444	78.1%	OK
1707010512	P	Elk Crk	2049	79.6%	OK
1707010512	Z	West Fk Main	11408	69.0%	Concern
EAU #1		GreenPoint	17476	72.3%	Concern
EAU #2		LakeBranch	18488	66.3%	At Risk *
EAU #3		West Fork Main	29492	74.3%	Concern
		Entire Basin	65456	71.5%	Concern

* The minimum ARP based on the Mt. Hood LMRP for Lake Branch is 82%

The results of this ARP model suggest that the risk of increased peak flows due to the current state of hydrologic recovery of watershed vegetation is a real concern throughout the West Fork Hood River watershed. The highest risk is in the Lake Branch EAU, and locally in the Divers Creek subwatershed. In the other two EAUs, Long Branch is considered At Risk. Of the 17 subwatersheds in the WFHR watershed, the ARP values on 12 are low enough to be of concern by the standards of the District Hydrology program.

3.0. Sediment

No data or studies on sediment in the WFHR are known at this time. A recent document issued by the Oregon Dept. of Environmental Quality (ORDEQ) described the WFHR as having a sediment problem, but it is not known on what information this statement was based. Summer and fall turbidity in the WFHR are the result of the melting Ladd Glacier on Mt. Hood. Glacial meltwater contributes colloidal sized sediment to Ladd Creek and eventually to the WFHR. This sediment source is natural and the concentration and load are largely dependent on the melting rate of the previous year's snow on Ladd Glacier. In general, this process is not significant until the previous year's snow has melted. At that point, the glacier begins to melt, delivering fine sediment to Ladd Creek. Thus, the air temperature, cloud cover, and the previous winter's snowpack all affect the amount of sediment delivered to the WFHR by Ladd Glacier.

Quantification of both summer and winter sediment loads is a clear data need/information gap on the WFHR system. Measuring the sediment load, especially during dormant season storms would be helpful in assessing watershed impacts due to management activities, especially road building and maintenance. An inexpensive first step would be to install an ISCO sampler at the existing gaging station above Punchbowl Falls. Because flow is already measured at that location, sediment loads could be easily calculated with periodic suspended sediment sampling.

4.0. Baseflow and Water Withdrawal/Diversion

ORWRD maintains a database of water allocation on many streams throughout the state to determine if a stream is overallocated. The criteria for overallocation is that water currently allocated (according to a formula derived from outstanding water rights, including instream rights) be in excess of the mean monthly flow that is exceeded 80% of the time from the natural streamflow. The analysis period is 1958-1987 where possible. More recent data has been not been used to exclude the influence of the last drought cycle. Table 3 shows the calculated natural streamflow (80% exceedance value), the consumptive uses, the instream water rights, and the remaining water available for allocation. Irrigation, domestic, commercial, industrial, municipal, and any other use that causes a net removal from the system are considered consumptive. Instream rights include those held by public agencies for fisheries and scenic waterways. Power generation water rights are excluded from this table. All values are in cubic feet per second (cfs). The instream right on the WFHR is held by ORWRD for 100 cfs with a priority date of 30-Mar-1966. A larger instream water right is being processed by ORWRD. Because the net water available for allocation in August and September is very small, it is unlikely that any additional water rights applications will be approved in this watershed (Rick Cooper, ORWRD, personal communication).

TABLE 3: Water Allocation on the West Fork Hood River, in cfs

	80%Natural	Consumptive	Instream	Net Avail
Month	Streamflow	Use&Storage	Rights	for Allocation
Jan	358	23	100	235
Feb	414	23	100	291
Mar	442	27	100	315
Apr	491	33	100	358
May	475	42	100	333
Jun	297	53	100	144
Jul	204	57	100	47
Aug	160	55	100	5
Sep	148	46	100	2
Oct	151	34	100	17
Nov	259	24	100	135
Dec	374	23	100	251

Most of the consumptive water uses in the WFHR are for irrigation, and most irrigation rights are owned by the Farmers Irrigation District (FID). Stream Surveys and field observations reveal that Cabin, Gate, and Rainy Creeks often are 100% dewatered by these diversions during the low flow season. Additionally, it has been reported that the diversion on North Fork Green Point Creek near its mouth dewaters the stream by as much as 90%.

The City of Hood River has water supply water rights on Laurel Creek and on four springs (Cold Spring, Stone Springs 1, 2, and 3) in the Lake Branch drainage. The combined water rights amount to 30.5 cfs, though only about 7 cfs are currently being used (metered as 4-5 million gallons per day). The largest of the City's five water rights in the WFHR watershed is for 20 cfs on Cold Spring (City of Hood River, 1993). This water source is classified as groundwater and does not appear in ORWRD's water rights database. If the city ever utilizes its full water rights it would likely impact low flows on lower Lake Branch.

5.0. Water Temperature

There are very few water temperature records available in the WFHR basin. Historical records include thermograph measurements from the late 1940s to early 1960s taken by the USGS on Green Point and Dead Point Creeks, and on the WFHR (Moore, 1964). The District has thermograph records in the Lake Branch subwatershed from the 1980s and thermograph records throughout the WFHR watershed since 1994.

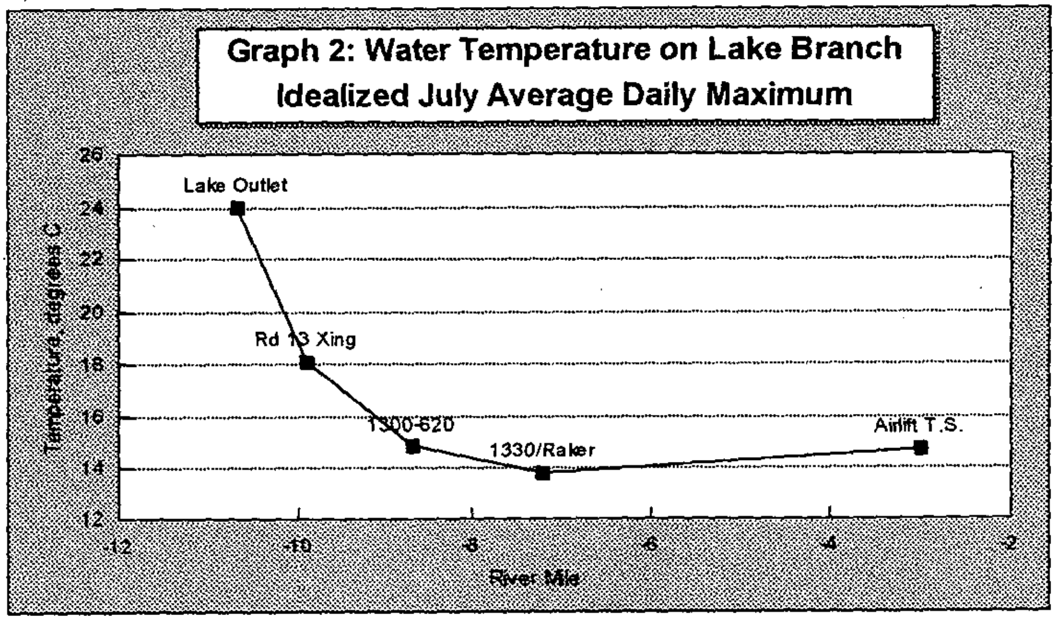
Because the temperature monitoring location on Green Point Creek in the 1950s is the same as the current location (maintained by Farmers Irrigation District) we may compare historical with current water temperature on that stream. Both are thermograph records, listed here in degrees C:

TABLE 4: Green Point Creek Maximum Water Temperatures: Historical vs. Current, in degrees C

	1950-54	1994
Jun Max	13.3	14.4
Jul Max	15.0	17.6
Aug Max	15.6	16.6
Sep Max	13.9	13.9

Because of the limited amount of data, the trends should not be treated as statistically significant. It appears, though, that the water temperature is slightly warmer now than in the 1950s. This is not unexpected, as the current state of hydrologic recovery is lower than it was forty years ago as the result of timber harvest and the Skyhook burn. The five years measured in the 1950s include both warm and cool years. By comparison, 1994 was a warm year.

The summer water temperature regime on Lake Branch is unique in the WFHR watershed. Warm surface water draining Lost Lake forms the headwaters of Lake Branch. Unlike most streams that increase in temperature as they drop in elevation, Lake Branch cools for about 3.4 miles before it begins to warm. Through a comparison of several water temperature monitoring stations on Lake Branch in the 1980s and 1990s, an idealized temperature profile has been constructed for the maximum water temperature for a typical July day. These results are presented in Graph 2.

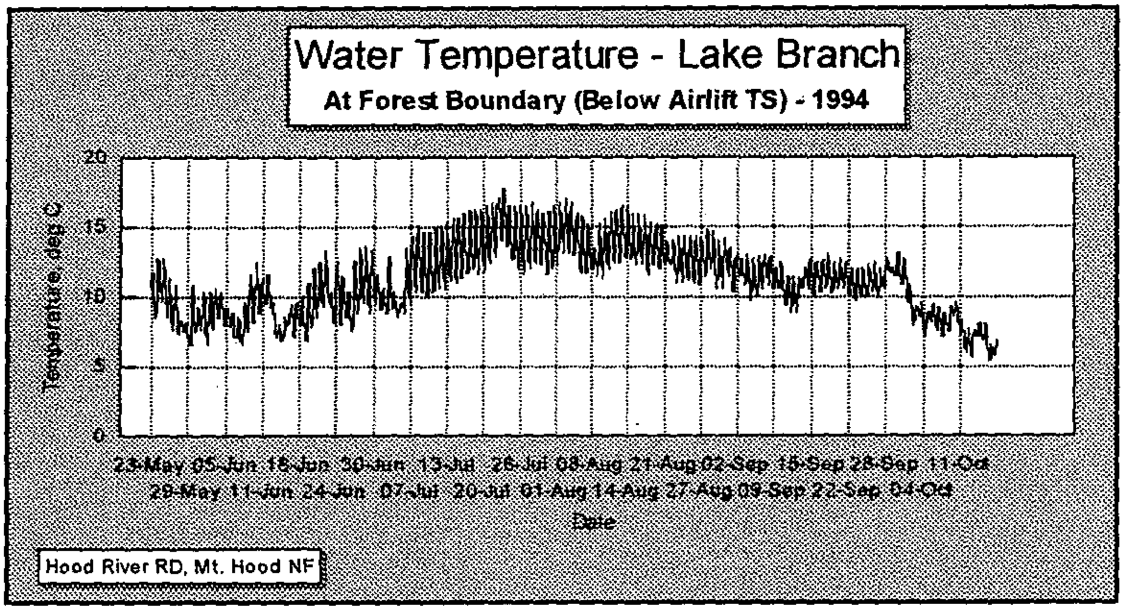


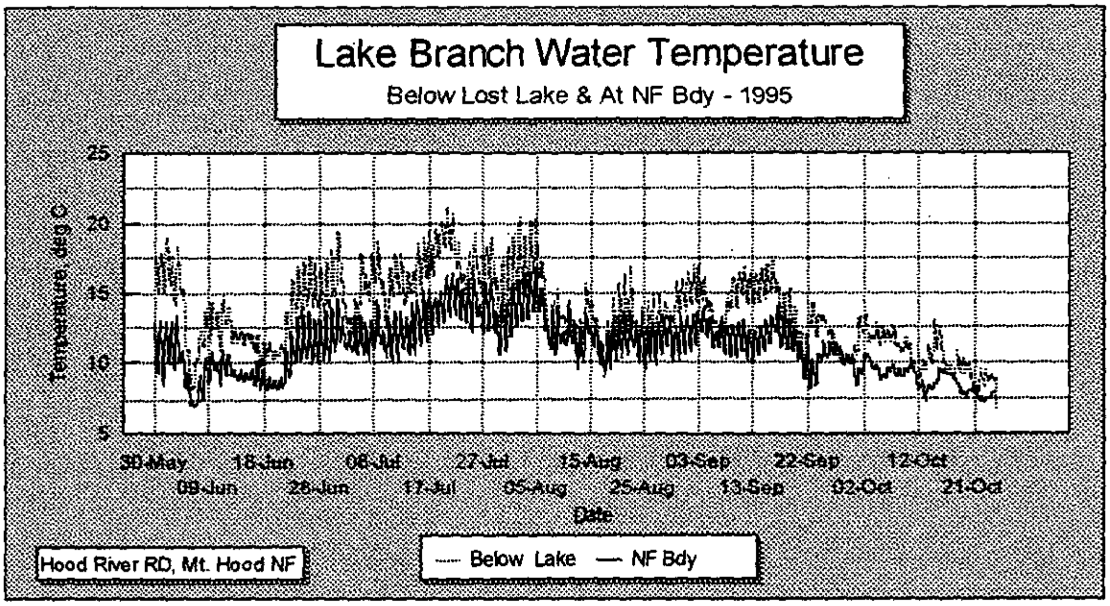
The point at which water temperature begins to rise is about at the 1330 road crossing. For several miles below this point are several timber harvest units with little or no riparian buffer. What data does exist suggests that water temperature on Lake Branch would be lower if the basin had a higher level of hydrologic recovery, and specifically in the riparian corridor on both Lake Branch below RM 7.2 and on Indian Creek. Weekly max-min temperatures for 1963 on Lake Branch and other Hood Basin streams were reported by the Oregon State Game Commission (1963), but this data is insufficient for determining warming or cooling trends on Lake Branch since 1963.

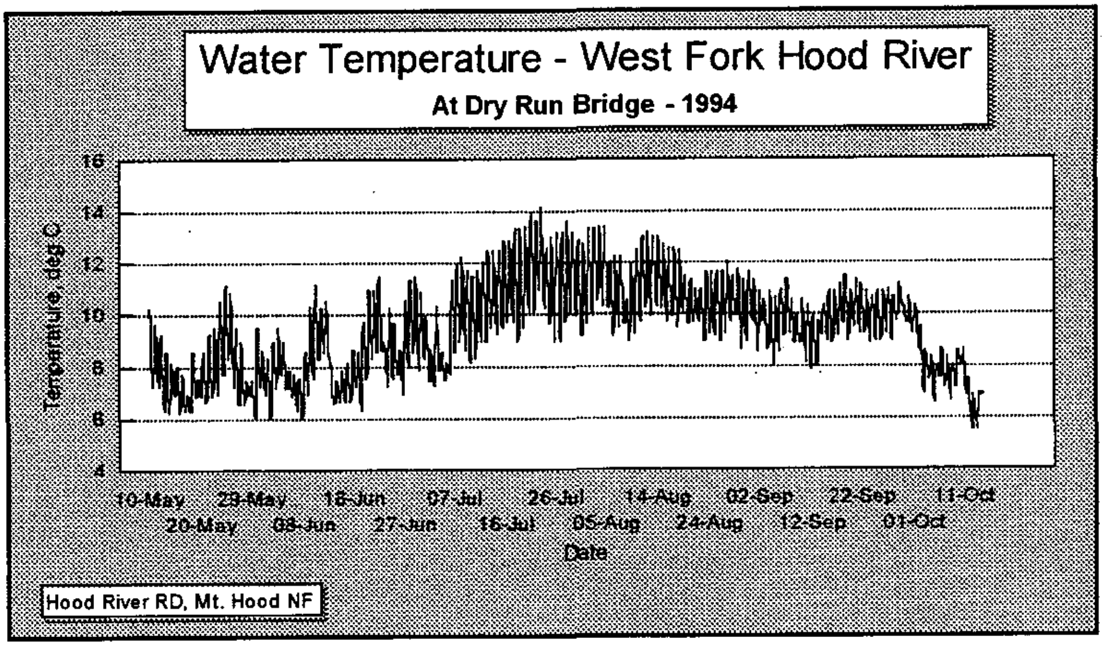
Analysis of temperature records on the mainstem of the WFHR from three different records (Moore, 1964; OSGC, 1963; District records 1994,95) indicate that current average summer temperatures are about 1.5 degrees C ***cooler*** than in the 1950s, though because of the small dataset and different sampling locations, this figure is only approximate and open to debate. An explanation for this cooling trend is that the large scale clearcuts logged in the 1920s and 1930s in the West Fork mainstem system during height of the railroad logging era were still recovering when the stream temperatures analyzed here (USGS, 1964, OSGC, 1963) were recorded.

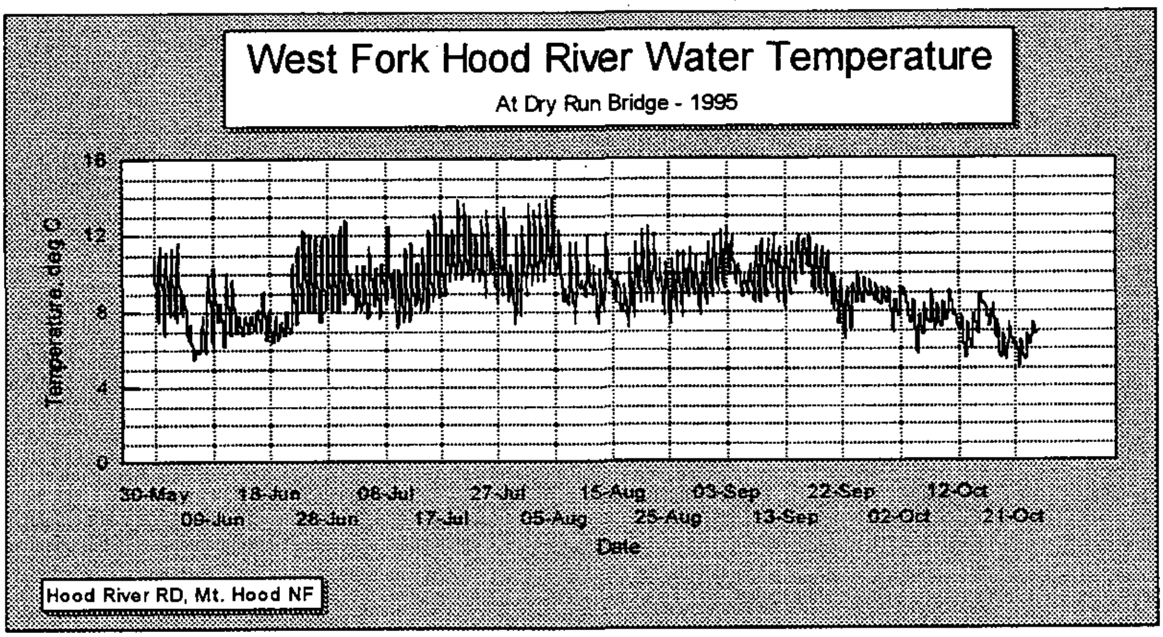
In 1994, summer maximum daily temperatures on the West Fork measured at Dry Run Bridge (RM 8.2, below the NF Bdy) were below the Mt. Hood NF Forest Plan Standard of 14.4 degrees C at all times (FW-110: "Forest management activities shall not cause water temperatures to: (1) exceed 58 degrees F on any day, or (2) increase more than 2 degrees F).

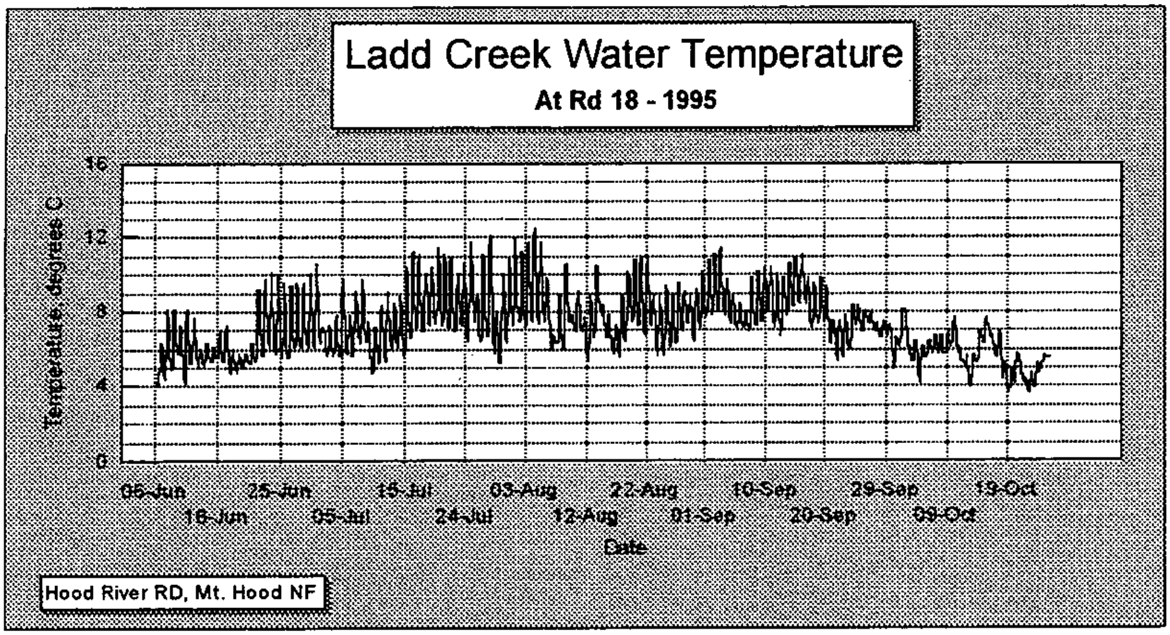
Temperature records for 1995 in the WFHR mainstem system (through August 6) reveal that both Ladd and McGee Creeks had cool maximum daily temperatures at 12.5 and 11.7 degrees C, respectively. Ladd Creek had a far higher diurnal range than did McGee Creek. This is expected because a large percentage of the stream network is above treeline and thus receive a high degree of direct solar radiation, and because nighttime stream cooling is significant because a large percentage of the drainage is covered by snow/glacier for the entire year. The WFHR watershed is in the orographic zone of Mt. Hood and thus, on average, has a deep snowpack. We would thus expect the persistence of this snowpack during the summer to have a cooling influence on the groundwater and eventually the surface water. This is undoubtedly a factor responsible for the relatively cool water temperatures in the WFHR watershed. Water temperatures in the East Fork Hood River (EFHR) watershed are several degrees higher at higher elevations compared with the measuring locations in the WFHR.

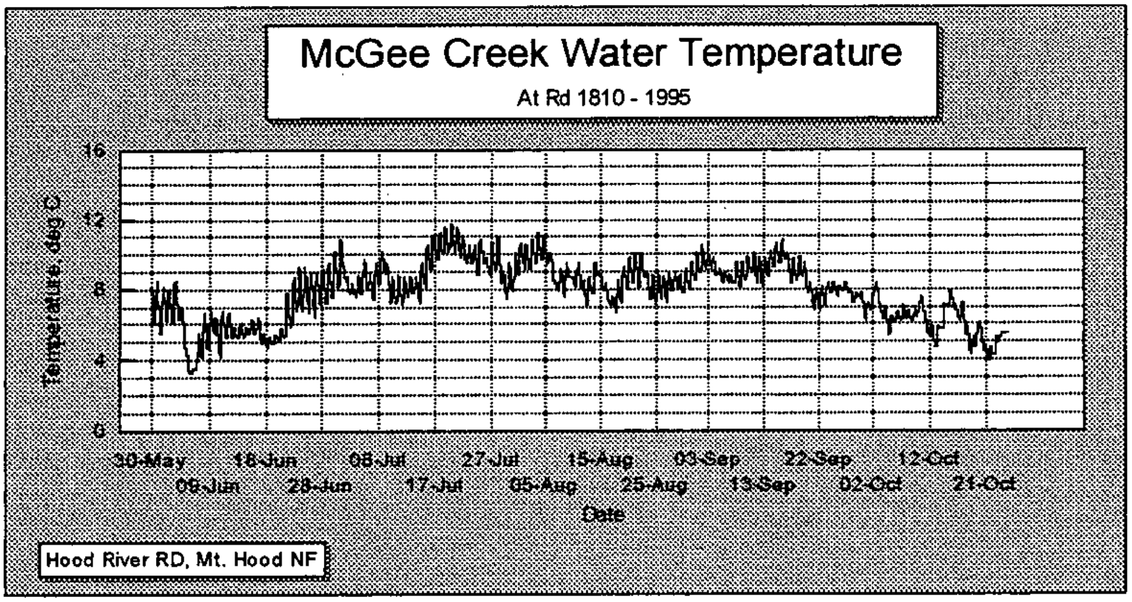

Water Temperature - Lake Branch
At Forest Boundary (Below Airlift TS) - 1994
Temperature, deg C
0
5
10
15
20
23-May 05-Jun 18-Jun 30-Jun 13-Jul 26-Jul 08-Aug 21-Aug 02-Sep 15-Sep 28-Sep 11-Oct
29-May 11-Jun 24-Jun 07-Jul 20-Jul 01-Aug 14-Aug 27-Aug 09-Sep 22-Sep 04-Oct
Date
Hood River RD, Mt. Hood NF

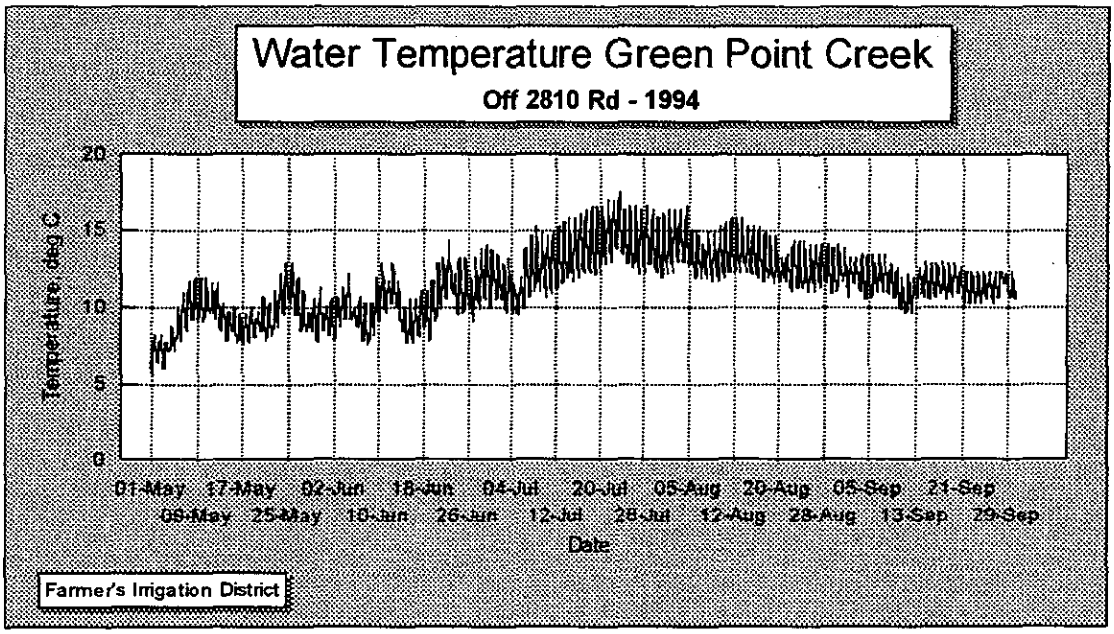

Lake Branch Water Temperature
Below Lost Lake & At NF Bdy - 1995
Temperature, deg C
5
10
15
20
25
30-May 18-Jun 08-Jul 27-Jul 15-Aug 03-Sep 22-Sep 12-Oct
09-Jun 28-Jun 17-Jul 05-Aug 25-Aug 13-Sep 02-Oct 21-Oct
Date
Hood River RD, Mt. Hood NF
Below Lake
NF Bdy


Water Temperature - West Fork Hood River
At Dry Run Bridge - 1994
Temperature, deg C
16
14
12
10
8
6
4
10-May
20-May
29-May
08-Jun
18-Jun
27-Jun
07-Jul
16-Jul
26-Jul
05-Aug
14-Aug
24-Aug
02-Sep
12-Sep
22-Sep
01-Oct
11-Oct
Date
Hood River RD, Mt. Hood NF


West Fork Hood River Water Temperature
At Dry Run Bridge - 1995
Temperature, deg C
16
12
8
4
0
30-May
09-Jun
18-Jun
28-Jun
08-Jul
17-Jul
27-Jul
05-Aug
15-Aug
25-Aug
03-Sep
13-Sep
22-Sep
02-Oct
12-Oct
21-Oct
Date
Hood River RD, Mt. Hood NF


Ladd Creek Water Temperature
At Rd 18 - 1995
Temperature, degrees C
16
12
8
4
0
05-Jun
25-Jun
15-Jul
03-Aug
22-Aug
10-Sep
29-Sep
19-Oct
15-Jun
05-Jul
24-Jul
12-Aug
01-Sep
20-Sep
09-Oct
Date
Hood River RD, Mt. Hood NF


McGee Creek Water Temperature
At Rd 1810 - 1995
Temperature, deg C
16
12
8
4
0
30-May
18-Jun
08-Jul
27-Jul
15-Aug
03-Sep
22-Sep
12-Oct
09-Jun
28-Jun
17-Jul
05-Aug
25-Aug
13-Sep
02-Oct
21-Oct
Date
Hood River RD, Mt. Hood NF



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GEOLOGY REPORT

West fork Hood River Watershed Analysis

by Rob Piehl, Geotechnical Engineer

Road Sediment Delivery Potential*

Delivery Potential	Erosion Potential			
		SRI Erosion Hazard		
	Road Surface	High	Medium	Low
Within 400' of Stream Crossing	Native	0.50[1] (2.5 miles)	0.90 (4.4 miles)	0.02 (0.1 mile)
	Other	2.00 (9.6 miles)	5.60 (26.1 miles)	0.60 (2.9 miles)
Within 200' of Stream	Native	0.08 (0.4 mile)	0.02 (0.1 mile)	0.02 (0.1 mile)
	Other	0.30 (1.5 miles)	1.00 (4.9 miles)	0.60 (0.3 mile)

[1] Percent of total miles of road in each category. Percent does not include rating for roads outside National Forest boundary. (Values in parentheses are miles of road)

* Miles of road by 12 risk categories based on:

A) Road Erosion Potential

1) the soil erosion potential from the surface of the road prism (i.e., cutslopes, ditches, traveled way, and fillslopes) according to the Mt. Hood National Forest Soil Resource Inventory and adjusted by a group of soil scientists, hydrologists, geologists, and engineers

2) the road surface type which strongly influences the erosion potential on the traveled way (i.e., native / soil surfaced vs. Aggregate and / or asphalt type surfaces)

B) *Road Sediment Delivery Potential*

1) the physical proximity to streams, which indicates relatively high potential for sediment transport and delivery to streams (i.e., portion of road within 400 feet of road-stream crossings or within 200 feet of a stream in cases when the road is not near a crossing)

Appendix D

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