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Pacific Northwest Region

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Salmon River Watershed Analysis

Mt. Hood National Forest
USDA - Forest Service

First Iteration

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Chapter 1 - Introduction

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Watershed Analysis

The purpose of watershed analysis is to develop and document a scientifically-based understanding of the ecological structures, functions, processes and interactions occurring within a watershed, and to identify desired trends, conditions, and restoration opportunities. Watershed analysis is the mechanism to support broad ecosystem management objectives at the watershed scale, as described in the Northwest Forest Plan (The Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl).

Watershed Analysis is one of the four elements of the Aquatic Conservation Strategy, as described in the Northwest Forest Plan. These four elements are designed to operate together to maintain and restore the productivity and resiliency of riparian and aquatic ecosystems. Salmon River is a Tier 1 watershed, a critical refugia for at-risk fish species.

The information contained in this report is to assist in making sound resource management decisions within the watershed. The analysis also develops restoration and monitoring priorities that will move landscape units from existing to desired conditions, identify opportunities for commodity outputs, and recommend Riparian Reserve widths.

Watershed analysis is an ongoing, iterative process. This report is a dynamic document, and is intended to be revised and updated as new information becomes available.

MT. HOOD NATIONAL FOREST LOCATION MAP

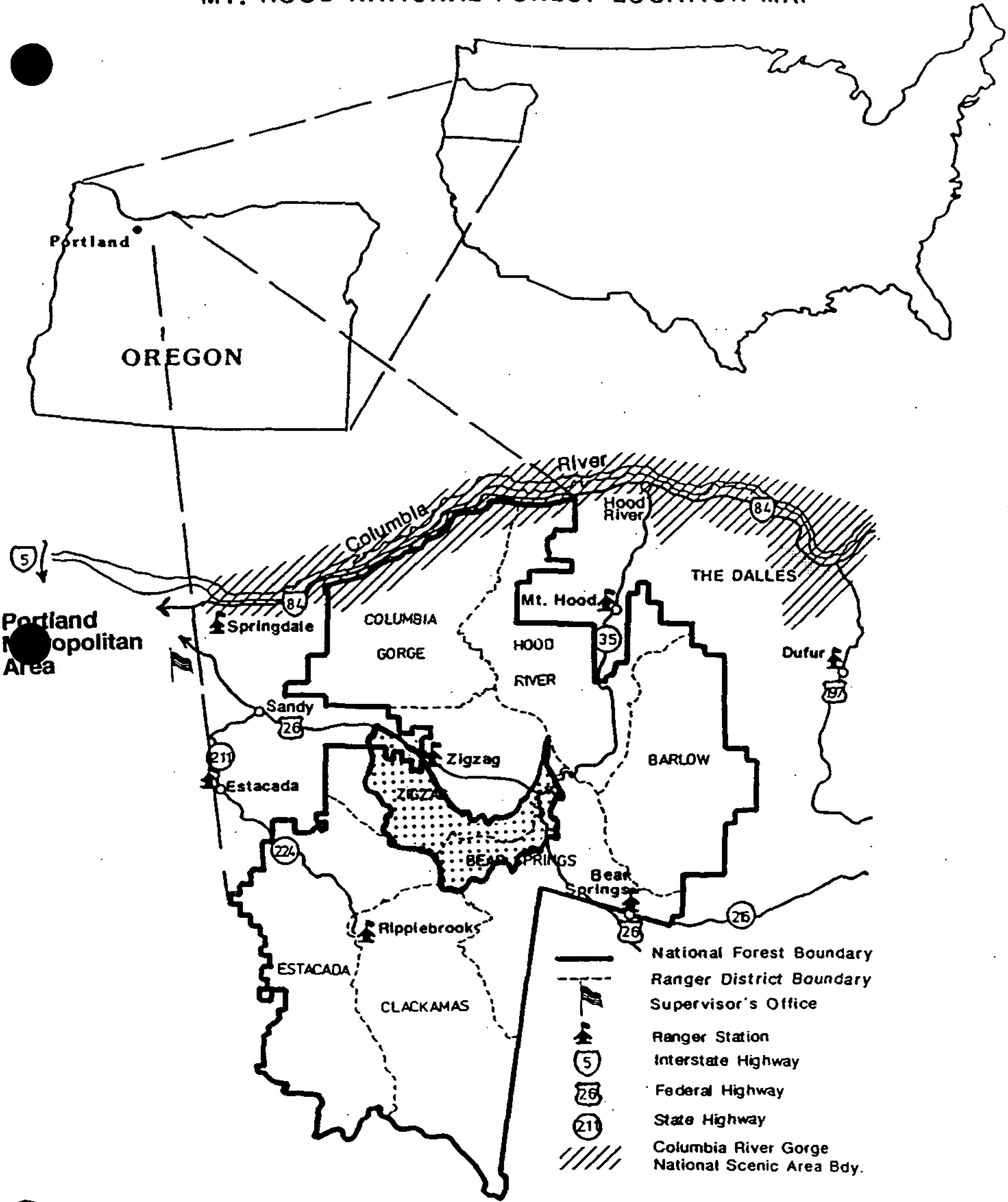
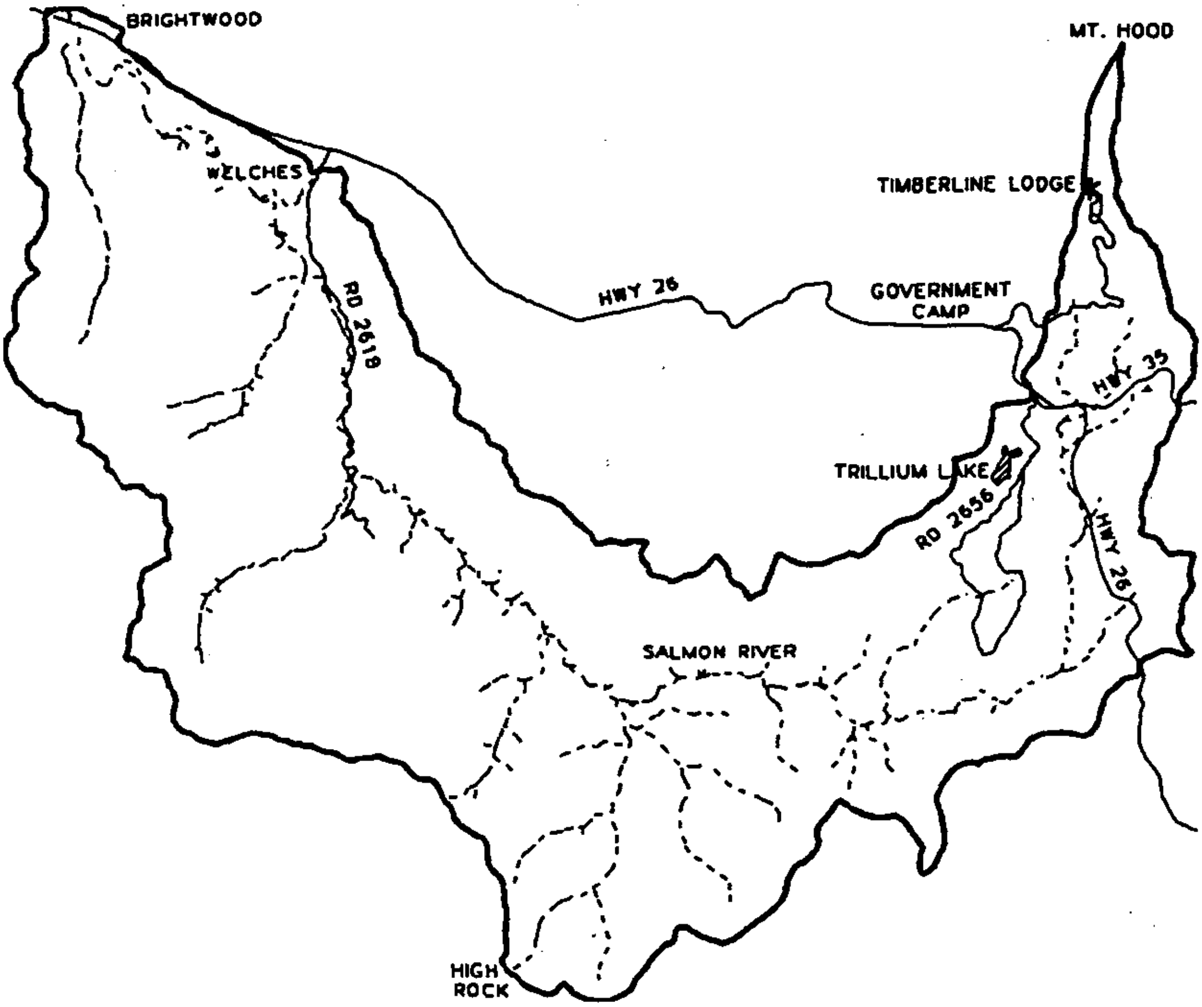


Figure 1-1 Salmon River Watershed



Watershed Setting

Terrestrial

The Salmon River Watershed is located to the west of the Cascade Range and to the south of the Columbia River in north central Oregon. The watershed incorporates portions of two major physiographic zones, the Cascade Mountain Range and the Columbia Basin, with elevations ranging from 1,100 to 10,000 feet. It encompasses approximately 116 square miles or 74,240 acres.

From its headwaters on Mt. Hood, the Palmer Snowfield, the river flows for 33 miles, through the Salmon-Huckleberry Wilderness and through eight miles of mixed BLM, Clackamas County and private lands, to its confluence with the Sandy River at Brightwood. The entire river was designated as a Federal Wild and Scenic River in 1988 with the Management Plan completed in 1993.

Major tributaries to the Salmon River include the West and South Forks of the Salmon River, Mud Creek, Linney Creek, Cheeney Creek, Mack Hall and Boulder Creek. The Salmon River is free-flowing throughout its length.

The watershed contains great faunal, floral and topographic diversity with alpine environments, narrow basalt canyons, wide floodplains with associated wetlands, and old growth Douglas-fir forests. The headwaters of the Salmon receive ample rainfall and snow with over 100 inches of precipitation per year.

The watershed includes the Red Top/Salmon River Meadows complex which are large complexes in comparison to other meadows in the region, and are considered quite unique at their elevation. These meadows contain tremendous ecological diversity including sensitive plants such as scheuchzeria, and unusual plants such as wild cranberry. Two key wildlife species found within the meadows include Roosevelt elk and sandhill crane.

Other threatened and sensitive species are located within the watershed such as coldwater corydalis, an endemic sensitive plant found in cold water near the mouth of Linney Creek and the lower mainstem of the river. Sensitive aquatic species are found along the entire length of the river including the red-legged frog which has been found in the wetlands of the Wildwood Recreation Site on the lower reaches of the river. Remnant old growth stands provide important habitat to species such as the northern spotted owl and pine marten.

Aquatic

Aquatic habitat, channel stability and riparian conditions are judged to be among the best on the Forest based upon observations by agency hydrologists. Varying geology and topography in the Salmon River drainage has produced hydrologic features such as waterfalls, wetland meadows and oxbow river channels in places along the steam course. The headwaters are within the special use permit area boundary for Timberline Lodge, a developed recreation area. In the lower river area, near the confluence with the Sandy River, the Salmon flows through private lands that have been dramatically altered and managed, directly impacting the natural channel and tributary flow. A major flood event in 1964 caused major channel scouring and alteration of flow patterns.

Salmon River provides exceptional quality and diversity of fish habitat. Both anadromous and resident species of salmonids are supported in the system. Issues of stream degradation by human-caused and natural flooding are more evident in the lower watershed areas and recreational use along the lower river has impacted streambanks and riparian vegetation at several sites. Fish habitat improvement projects have been implemented in the South Fork tributary. The river is nationally renowned for its summer steelhead fishery and anglers come from outside Oregon to fish the river. In addition to summer steelhead, the river contains winter steelhead, coho salmon, spring chinook salmon, native cutthroat trout and native and hatchery rainbow trout. The upper river supports brook trout and native cutthroat trout.

Social

Historically, the Salmon River watershed has been used by American Indians as a major huckleberry picking area specifically in the Sherar Burn, Mud Creek and High Rock areas. The area was also used seasonally for fishing and hunting. Pioneers traversed across the Barlow Road and Oak Grove wagon roads on their way to the Willamette Valley during the mid to late 1800's. Sheep grazing was common in the watershed around the turn of the century. Recreationists have used the area for climbing, hunting, fishing and camping since the 1880's. In 1936, Timberline Lodge was built on the south slope of Mt. Hood, allowing skiing to become a major recreation activity.

The Salmon River and its adjacent area provide a wide variety of recreational opportunities throughout its length. These activities range from more primitive types of recreation such as hiking, fishing and backpacking, to those that take place at highly developed resort facilities, such as skiing and golfing. The river flows through the Salmon-Huckleberry Wilderness, which provides high quality primitive recreation opportunities, while Timberline Lodge, The Resort at the Mountain in Welches, and the Mt. Hood RV Park provide more urban, developed recreation opportunities. Dispersed camping sites, popular hiking trails and well known fishing areas increase the visitor use throughout the year.
Within the Wild and Scenic River Corridor, the lower eight miles of the Salmon River is administered by the Bureau of Land Management (BLM). This portion of the Salmon River, within the heavily visited Mt. Hood Corridor, offers recreational opportunities ranging from the semi-primitive non-motorized to the roaded natural and developed. The majority of recreation activities are day use in nature and include bank fishing, picnicking, swimming, nature study, kayaking, golfing, biking and hiking.

Economic

Timber harvesting began in the lower drainage in the late 1940's and within the Mud Creek area in 1959. Timber stand composition consists of sub-alpine fir/mountain hemlock in the higher elevations, moving through mixed conifer stands of Douglas-fir, noble fir, and pacific silver fir in the middle elevations, to western hemlock/Douglas fir along the lower elevations. Other forest products harvested include beargrass, boughs, Christmas trees, and mushrooms

Land ownership in the Salmon River watershed is 92.6% Forest Service, 0.8% BLM, 1.0% Clackamas County, 0.1% State of Oregon, and 4.5% private.

The economic environment within the watershed is increasingly dependent upon tourism. Industries include ski areas, retail shops, professional and related services, manufacturing and service based businesses plus vacation/resort related companies.

Forestwide "PULSE"

In January and February of 1994, the Mt. Hood National Forest undertook what has been termed the forest-wide "PULSE" effort. Participants mobilized from all over the forest to assemble, analyze, and synthesize information. The purpose was to develop larger-scale (Forest level) information and analysis in preparation for watershed analysis. PULSE now provides information about the context, both ecological and human, of watersheds within the overall Forest. Until additional larger scale planning is completed, PULSE will also provide larger scale information about processes, patterns and uses that will meet at least some of the objectives of provincial level planning.

In the analysis, sixteen key questions were addressed in the PULSE synthesis stage, pulling together all of the information that had been gathered (for more information, see the PULSE synthesis report). The following is a brief synopsis of risks/areas of concern within the Salmon River drainage that were identified in the synthesis step:

- There are a variety of risks to riparian reserves, including timber harvest, grazing, roads, dispersed and developed recreation, low potential for large wood recruitment, potential mass wasting, rain on snow events, windthrow and catastrophic fire.

- Early and late seral forest in much of the watershed is at the low end or below the range of natural conditions. Fire in the early part of the century accounts for the large areas of mid-seral stage forests.

- Some vistas are at risk due to created openings and possible spruce budworm activity in the watershed.

- Hydrologic regimes may have been altered by high harvest levels and road densities in the Mud and Linney Creek drainages.

- Timber harvest has been identified as the dominant human process affecting landscape patterns. This takes place within the Mud and Linney Creek area, west of Frying Pan Lake, and to the north of Highway 26 & 35 interchange. The landscape in these areas is categorized as perforated, fragmented, or aggregated due to timber harvest.

- Landscape patterns resulting from timber harvest may impact several natural processes such as windthrow (increased size of openings), fire regime, increased mass wasting and landslides on geologically unstable areas.

- The natural landscape pattern has been retained in the Salmon-Huckleberry / Roaring River area in the lower watershed.

- The watershed is highly valued for a wide variety of recreational and scenic values. Recreation use is typically tourist-oriented around developed sites such as Timberline Lodge, sno-parks, campgrounds and private recreational developments.

- Trillium Lake was identified as an area for potential conflicts between ecological values and high public use.

- There is a potential reduction in special forest product utilization in the upper watershed and late successional reserve, such as huckleberries, boughs, and poles, due to decreased disturbance.

- The Mud Creek subwatershed was identified as an area of high sediment production potential.

Many of the identified areas of risk/issues from PULSE were carried forward for more detailed evaluation in the watershed analysis.

Chapter 2 - Desired Conditions

Chapter 2 - Desired Conditions

The desired conditions for National Forest lands in the watershed are taken from existing management plans. These are derived from merging the land allocations from the Record of Decision of the Northwest Forest Plan (ROD), the Mt. Hood Forest Land and Resource Management Plan (LRMP), including amendments made to it by the Salmon Wild and Scenic River Management Plan.

The ROD amends existing plans with additional land allocations and standards and guidelines. For acreage and display purposes, the following land allocation hierarchy is used: 1) Congressionally Reserved Areas, 2) Late Successional Reserves, 3) Riparian Reserves, 4) Administratively Withdrawn Areas, and 5) Matrix.

The standards and guidelines of the LRMP still apply where they are more restrictive or provide greater benefits to late-successional forest-related species. In matrix lands, management direction from the LRMP will generally apply, as well as the direction from the ROD that applies to all land allocations.

On Bureau of Land Management (BLM) lands, the NW Forest Plan and Resource Management Plan (RMP) for the Salem BLM District apply. On non-federal lands, state and county land management regulations apply.

Table 2-1 below summarizes acres by land allocation on National Forest lands based on the hierarchy above.

Table 2-1 Acres by National Forest Land Allocation

LAND ALLOCATIONS	ACRES IN ALLOCATION
Wilderness (A2)	36,320
Wild and Scenic River (A1)	6,724
Late Successional Reserves (LSR)	7,386
Riparian Reserves	3,247
Winter Recreation (A11)	1,488
Key Site Riparian (A9)	136
Unroaded Recreation (A5)	499
Special Interest Area (A4)	64
Scenic Viewshed (B2)	8,162
Roaded Recreation (B3)	363
Deer and Elk Winter Range (B10)	195
Backcountry Lakes (B12)	37
Timber Emphasis (C1)	3,158
Private Land	442
Total acres - National Forest Land Allocation	68,221

Figures 2-1 and 2-2 on the following pages show Congressionally Reserved Areas, Late Successional Reserves and Riparian Reserves on the National Forest Lands and National Forest Land Allocations respectively. Mapping is based on the above mapping hierarchy.

The pages following the maps summarize the key aspects of the desired conditions by land allocation: Further detail is described in the existing plans.

Figure 2-1 Congressionally Reserved Areas, Late Successional Reserves and Riparian Reserves on National Forest Lands

(Note, there are smaller private inholdings within the National Forest boundary which are not depicted on the map below and total approximately 442 acres. Although mapped within the National Forest, these areas are regulated by State and local laws.)

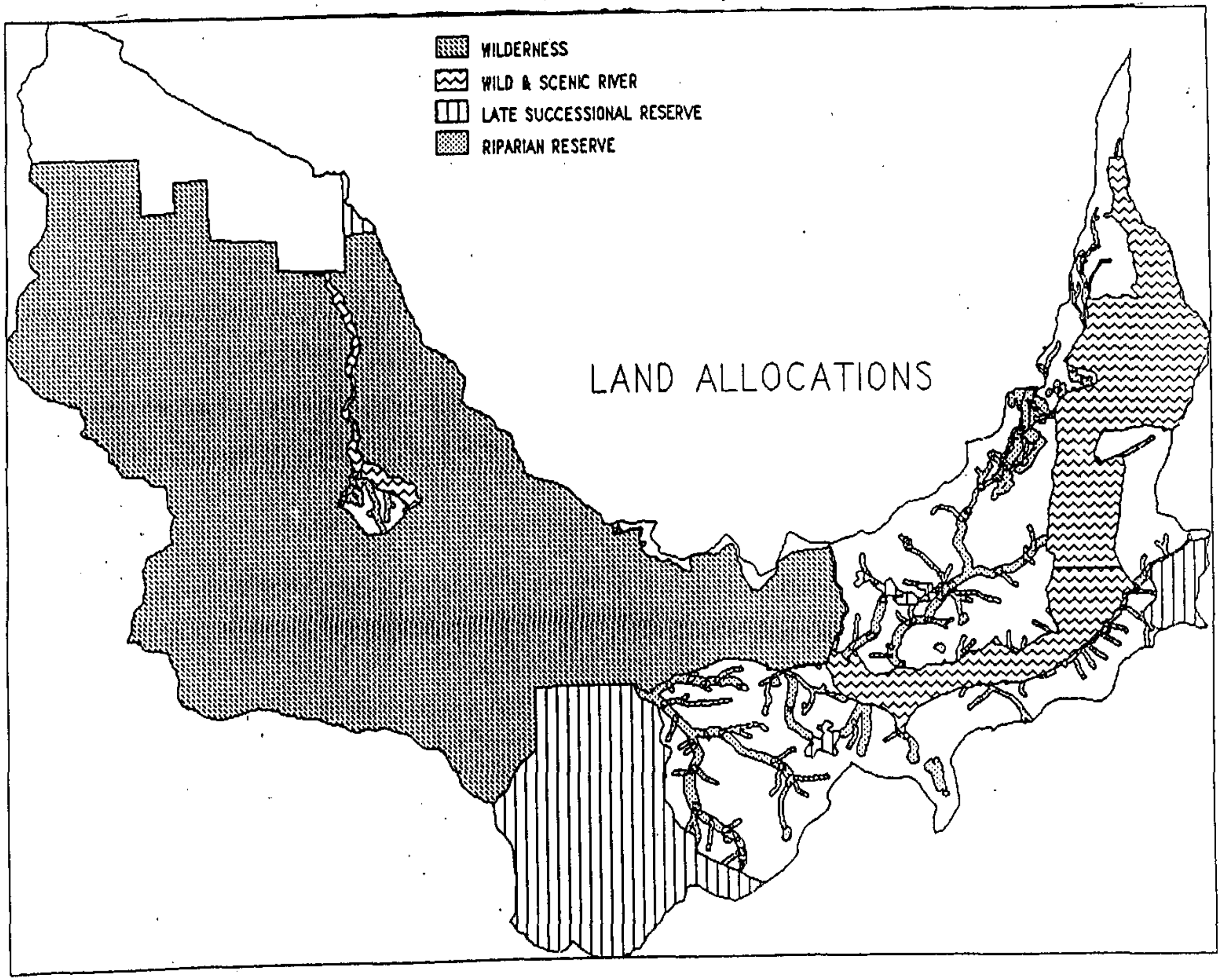
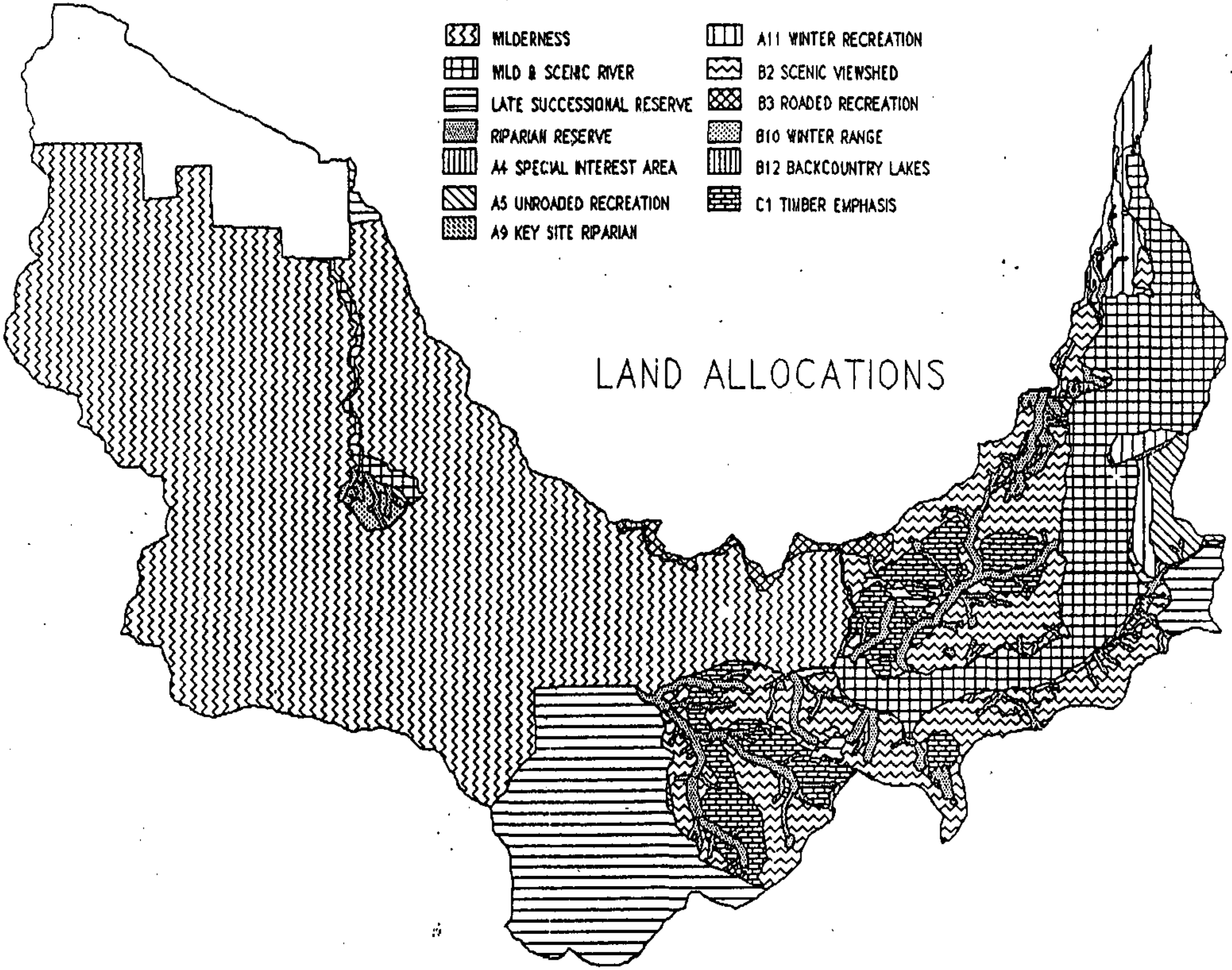


Figure 2-2 National Forest Land Allocations

(Note, there are smaller private inholdings within the National Forest boundary which are not depicted on the map below and total approximately 442 acres. Although mapped within National Forest land allocations, these areas are regulated by State and local laws.)



Land Allocations

Congressionally Reserved Areas

These lands have been reserved by act of Congress for specific land allocation purposes. For the Salmon River watershed this includes the Salmon-Huckleberry Wilderness and the Salmon Wild and Scenic River.

Salmon-Huckleberry Wilderness (A2)

The goal of Wilderness areas are to 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. Motorized or mechanical equipment is not allowed within Wilderness boundaries.

Salmon Wild and Scenic River (A1)

For the Salmon River, the desired condition is to protect and enhance the identified outstandingly remarkable values of the river and to maintain its free-flowing character. The identified outstanding values to be protected and enhanced are:

- Diverse scenery, primarily in the upper river corridor
- Wide variety of recreation opportunities
- High water quality and six waterfalls in the middle of the river
- Unique botanical, ecological and wildlife values in the Red Top/Salmon River Meadows complex
- Anadromous habitat for spawning and rearing.

Late Successional Reserves (LSR)

The desired condition for these reserves, in combination with the other allocations and standards and guidelines, is to:

- Maintain a functional, interacting, late-successional and old-growth forest ecosystem.
- Serve as habitat for late-successional and old-growth related species including the northern spotted owl.
- Maintain natural ecosystem processes and functions (ROD B-1 and B-4).

In addition to the mapped LSRs (shown on Alt. 9 map with the Final SEIS), 100 acre LSRs are to be designated around each known spotted owl activity center not already protected by another reserve. One hundred acres of the best northern spotted owl habitat will be retained as close to the nest site or owl activity center as possible in the matrix. This is intended to preserve an intensively used portion of the breeding season home range. Because these areas are considered important to meeting objectives for species other than spotted owls, they are to be maintained even if they are vacated by spotted owls.

Management assessments are to be prepared for each large Late-Successional Reserve before habitat manipulation activities are designed or implemented. The Salmon River watershed contains pieces of two larger Late Successional Reserves: Roaring River to the south and north, and White River to the east. The watershed analysis provides information that will be important for the overall LSR assessment.

Riparian Reserves

As a key element of the Aquatic Conservation Strategy, the Riparian Reserves provide an area along all streams, wetlands, ponds, lakes, and unstable and potentially unstable areas where riparian-dependent resources receive primary emphasis. Riparian Reserves are important to the terrestrial ecosystem as well. Desired conditions for Riparian Reserves are to:

- Attain a fully functional aquatic and riparian habitat area that meet the needs of riparian-dependent species.
- Serve as dispersal corridors for many terrestrial animals and plants.
- Enhance habitat for species that depend on the transition zone between upslope and riparian areas.
- Maintain and restore riparian structure and function of intermittent streams.
- Provide greater connectivity within the watershed and among LSRs.

Direction for designating Riparian Reserve widths is stated in the ROD (Standards and Guidelines, pages C-30 and C-31). For the Salmon River Watershed Analysis, measured site-potential tree heights within major vegetative zone were used to delineate the interim Riparian Reserve widths. Below is a summary of the interim riparian reserve widths that were used in this analysis. See Chapter 7 for more detailed information on the assumptions used for developing the interim riparian reserve widths. For the purpose of mapping, horizontal distances were used. On most lands (except steep slopes), the difference between slope and horizontal distance is small.

The major vegetative zones and their measured site-potential tree heights are:

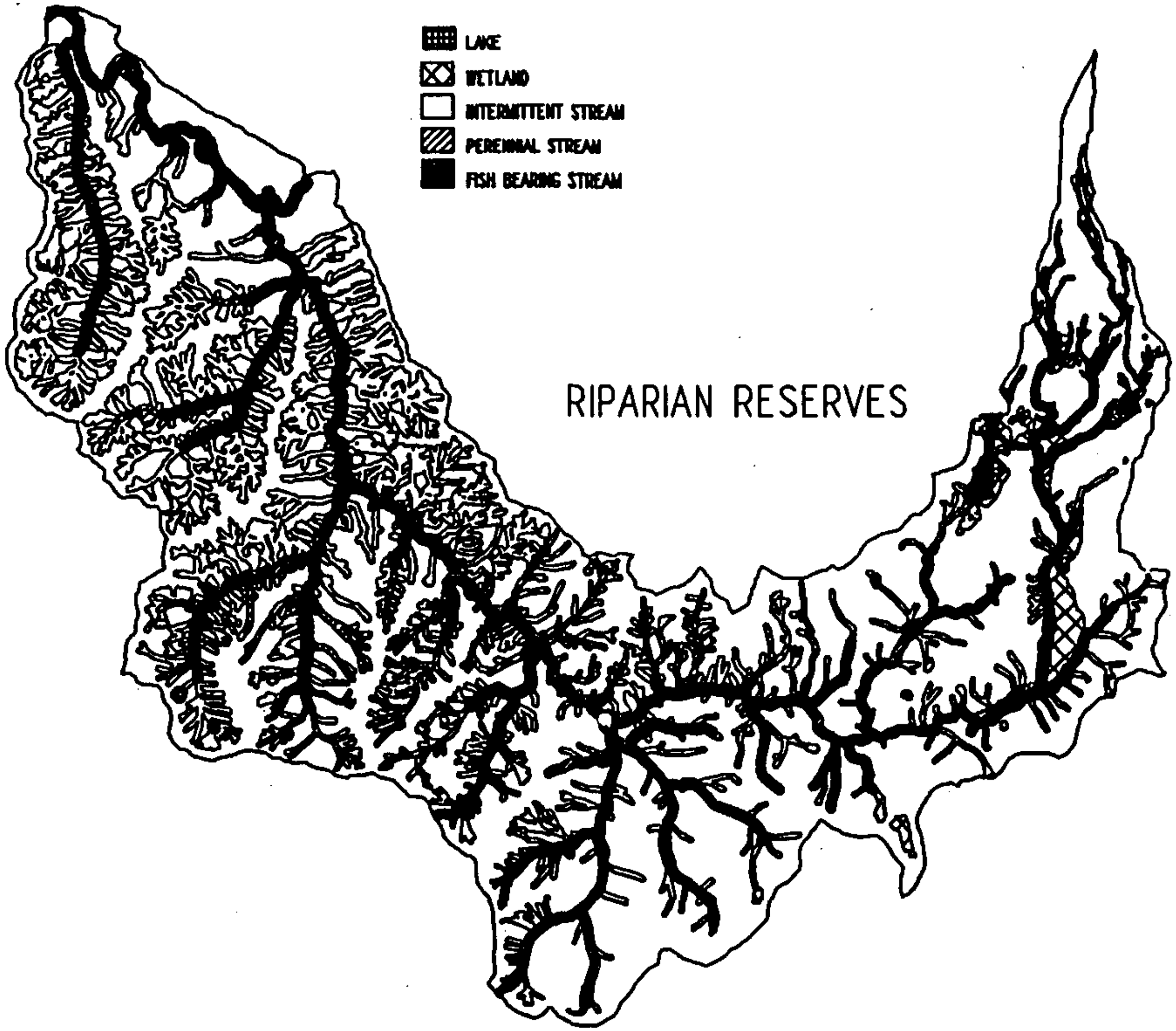
- Western Hemlock Zone - Douglas-fir measured tree height 210'
- Pacific Silver Fir Zone - Douglas-fir measured tree height 170'
- Mountain Hemlock Zone - Use defaults from the ROD.

Unstable and potentially unstable areas should be field verified during project planning and delineated by a soil scientist or geologist. Final location of all riparian reserves will be based on site specific analysis.

Table 2-2 Interim Riparian Reserve Widths

STREAM/RIPARIAN ZONE TYPE	WESTERN HEMLOCK ZONE	PACIFIC SILVER FIR ZONE	MOUNTAIN HEMLOCK ZONE
Fish bearing streams (uses 2 site-potential tree heights)	420'/side 840' total	340'/side 680' total	300'/side 600' total
Non-fish bearing, permanently flowing streams (uses 1 site-potential tree height)	210'/side 420' total	170'/side 340' total	150'/side 300' total
Seasonally flowing or intermittent streams (uses 1 site potential tree height)	210'/side 420' total	170'/side 340' total	100'/side 200' total
Lakes and natural ponds (uses 2 site potential tree heights)	420' surrounding	340' surrounding	300' surrounding
Wetlands (uses 1 site-potential tree height)	210' surrounding	170' surrounding	150' surrounding
Unstable and potentially unstable areas (uses 1 site-potential tree height)	210' surrounding	170' surrounding	100' surrounding

Figure 2-3 Riparian Reserves within the watershed



Administratively Withdrawn Areas

Administratively Withdrawn Areas are identified from the LRMP. These include recreation and visual areas, back country, and other areas where management emphasis precludes scheduled timber harvest.

A9 Key Site Riparian

The desired condition is to maintain or enhance the habitat and condition of these areas which are notable for their exceptional diversity, high quality and for the key role they play in meeting the needs of riparian dependent species. These areas are managed very similarly to riparian reserves. In most regions of the watershed, Riparian Reserves override the Key Site Riparian designations of the LRMP. However, there are 136 acres of Key Site Riparian within the watershed outside the Riparian Reserves which are wider and contain more upland forest.

A11 Winter Recreation Areas

The desired condition is to provide high quality winter recreation (and associated summer) opportunities including: downhill skiing, Nordic skiing, snowmobiling, and snowplay within a naturally-appearing forest environment.

The upper portion of the watershed, including the Timberline ski area, provides important developed alpine winter recreation opportunities. Other areas of the watershed as well provide important Nordic skiing and snowmobiling opportunities.

A5 Unroaded Recreation

These areas provide a variety of year-round unroaded recreation opportunities in a semi-primitive, non-motorized setting and undeveloped environment. They are generally accessed by trails suitable for foot or horseback use.

A4 Special Interest Area

Special Interest Areas protect, and where appropriate, foster public recreational use and enjoyment of important historic, cultural, and natural aspects of our national heritage. The Barlow Road Historical Travel Route is located within this allocation and includes all known traces of the wagon road and associated features.

Matrix

The matrix consists of those federal lands outside the categories of designated areas listed above. Therefore, in matrix lands, management direction from the LRMP will generally apply, as well as directions from the ROD that apply to all land allocations. The following land allocations are within the matrix:

B2 Scenic Viewshed

Scenic viewsheds are to provide attractive, visually appealing forest scenery with a wide variety of natural-appearing landscape features. Vegetation management activities are used to create and maintain desired landscape character. The visual character of the landscape results from prescribed visual quality objectives within distance zones from selected viewer points.

Much of the watershed is within a designated viewshed. The primary viewer positions are: Timberline Lodge, Timberline Road, US Highway 26, State Highway 35, the Salmon Wild and Scenic River, and developed recreation sites such as Trillium Lake Campground.

B3 Roaded Recreation

This land allocation applies to the portion of the watershed along Sherar Burn Rd. 2613. The desired condition is to provide a variety of year-round recreation opportunities in natural-appearing roaded settings and, secondarily, to maintain a healthy forest condition through a variety of timber management practices.

B10 Deer and Elk Winter Range

A small area of this land allocation is located at the end of Salmon River Road 2618. The desired condition is to provide high quality deer and elk habitat for use during most winters. Since the adjoining land allocation is Wilderness, which can provide hiding and thermal cover, the emphasis is on providing forage.

B12 Backcountry Lakes

This allocation is used to 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. Two lakes in the watershed are included in this allocation, Kinzel Lake and Frying Pan Lake.

C1 Timber Emphasis

The desired condition of this allocation is to 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 harvest.

Aquatic Conservation Strategy

In addition to land allocations, the Aquatic Conservation Strategy (ACS) focuses on maintaining and restoring ecosystem health at watershed and landscape scales to protect fish habitat and other riparian-dependent resources. The strategy consists of four components: key watersheds, riparian reserves, watershed restoration, and watershed analysis. These components provide the land management agencies with the tools to maintain and restore the productivity and resiliency of riparian and aquatic ecosystems. The objectives of the Aquatic Conservation Strategy are listed in ROD B-11.

Key Watersheds

Key Watersheds overlay the land allocations of designated areas and matrix, and place additional management requirements or emphasis on activities in those areas. Key Watersheds serve as refugia for maintaining and recovering habitat for at-risk stocks of anadromous salmonids and resident fish species. These refugia include high quality habitat as well as degraded habitat that have a high potential for restoration.

Salmon River is a Tier 1 Key Watershed, and as such, is to contribute directly to conservation of at-risk anadromous salmonids, bull trout and other resident fish species. The emphasis within Key Watershed is to reduce existing system and non-system road mileage and receive priority for restoration (ROD B-19). Watershed analysis is required prior to management activities, including timber harvest.

BLM Allocations

The following allocations apply to BLM lands in the northwest portion of the watershed. These are matrix lands according to the Northwest Forest Plan and therefore are managed according to the land allocations from the Salem District Resource Management Plan. All BLM lands within the viewshed of State Highway 26 and/or within the Salmon Wild and Scenic River corridor are within the Mt. Hood Corridor Recreation Special Management Area and are to be managed for recreation and scenic purposes. These include Wildwood Developed Recreation site and Visual Resource management Class I areas below.

Wildwood Developed Recreation Site

Overall recreation objectives are to provide a wide range of developed and dispersed recreation opportunities that contribute to meeting projected recreation demand within the planning area. Developed sites are to be managed in a manner consistent with BLM 2000: A Strategic Plan and the Oregon-Washington public lands recreation initiative.

Connectivity/Diversity Blocks

This allocation includes most of the section adjacent to the Wilderness near Boulder Creek. The desired condition is to provide connectivity (along with other allocations such as Riparian Reserves) between Late-Successional Reserves. 25 to 30% of each block will be maintained in late-successional forest at any point in time. Available forest land is managed on a 150-year rotation and regeneration harvest areas will retain 12 to 18 green trees per acre.

Visual Resource Management Class I

The remaining BLM lands within the watershed are managed to preserve the existing character of landscapes. Some very limited management activities may occur in these areas.

Chapter 3 - Key Question Development

Chapter 3 - Key Question Development

One of the first steps in the watershed analysis process is to focus on the key attributes of the watershed that are most relevant to management questions, human values, or resource conditions in the watershed. The identified attributes are then formulated into questions. These key questions are answered in the analysis, based on indicators most commonly used to measure or interpret processes and conditions for ecosystem elements. To facilitate synthesis, processes and conditions are analyzed and presented under the same key question.

A key attribute was identified as:

- Having a stature in the watershed that we cannot ignore
- An item of administrative or legislative significance (i.e. species addressed under the Endangered Species Act)
- Tied to the Record of Decision for Amendments to Forest Service and Bureau of Land Management Documents Within the Range of the Northern Spotted Owl (ROD)
- Distinct or unique at the watershed, basin or provincial scale

Key Questions and Rationale

Once the key attributes were identified, they were re-structured into question format and are listed below. The rationale for selection accompanies each key question.

Consideration of the past, present and future temporal scales is implied in the word "conditions".

Key Question #1: How do conditions of the watershed contribute to habitat needs for species of concern associated with terrestrial habitat?

Note: Species were separated into habitat type since the processes and therefore the analysis approach, will differ by habitat.

RATIONALE: The Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl (ROD) states, as one of the goals (page B1), to maintain late successional and old growth habitat and ecosystems on federal land. Also, finer scale attention was deemed necessary in the FSEIS for some species and ecosystem issues. Species which were outside the scope of the FSEIS and deemed to be at risk were also considered.

Species of concern are tied to the Endangered Species Act, NFMA regulations, and FS policy.

Key Question #2: How do conditions of the watershed contribute to habitat needs for species of concern associated with riparian and aquatic habitats?

RATIONALE: The Aquatic Conservation Strategy Objectives from the ROD (1, 2, 8, 9) address species in riparian and aquatic habitats. Finer scale attention was also deemed necessary in the FSEIS for some species and ecosystem issues.

Species of concern are tied to the Endangered Species Act, NFMA regulations, and FS policy.

Key Question #3: How do conditions of the watershed contribute to habitat needs for species associated with special habitats?

RATIONALE: The ROD gives direction to provide habitat for species of concern associated with late successional forests. Finer scale attention was deemed necessary in the FSEIS for some species and ecosystem issues. Species of concern are tied to the Endangered Species Act, NFMA regulations, and Forest Service policy.

Key Question #4: How do conditions of the watershed affect historic features including Timberline Lodge, Silcox Hut, Barlow Road Historic District, Devil's Peak Lookout and Summit Meadows?

RATIONALE: Timberline Lodge is a National Historic Landmark. Silcox Hut and Barlow Road Historic District are on the National Register of Historic Places, and Devil's

Peak lookout is eligible for the National Register. Summit Meadows area is within the Barlow Road District, and exhibits other features that may make this area eligible for the National Register. These factors give the features and areas high historical significance and special protection under the National Historic Preservation Act.

Key Question #5: How do conditions of the watershed affect the availability of natural resources, primarily huckleberries, for American Indian traditional use?

RATIONALE: The ROD (E9) references American Indian trust resources of religious and cultural heritage, forest species, resources, and places important for subsistence and cultural or economic reasons. A stated goal of the Mt. Hood Forest Plan is to 'Protect and preserve American Indian ceded rights and privileges to access and use of the Forest for traditional and religious values'. The Sherar Burn/Wolf Camp Butte/High Rocks areas have long been traditional sites for huckleberry harvesting by members of the Confederated Tribes of Warm Springs. The watershed also provides resources that are important for other traditional uses.

Key Question #6: How do conditions of the watershed affect the amount and wide diversity of recreational/educational opportunities in the watershed?

RATIONALE: The Salmon River watershed is unique in that it provides a variety of year-round recreational opportunities across the spectrum, from highly developed recreation to primitive experiences; across vegetative zones, from alpine to low elevation coniferous forest; and across land ownerships, such as the Forest Service property, Bureau of Land Management areas, and private land. It is an area easily accessible by a large metropolitan area and public use, and demand for recreational opportunities is very high. Recreational activities include alpine and Nordic skiing, camping, hiking, climbing, fishing, and a wide range of services provided by privately owned recreational facilities.

Key Question #7: How do conditions of the watershed affect opportunities for production and extraction of commodities including livestock grazing, timber, special forest products, water, and mineral resources?

RATIONALE: The ROD (E9) requires that predictable levels of timber and non timber resources be available and produced including: timber, livestock grazing, special forest products, and mineral extraction.

The following key questions are based on objectives from the Record of Decision for Amendments to the Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl, and are broader scale, synthesis questions.

Key Question #8 How do conditions of the watershed affect the ability to meet the Aquatic Conservation Strategy objectives?

Key Question #9: How do conditions of the watershed affect the ability to maintain late successional and old growth species habitat and ecosystems?

Key Question #10: How do conditions of the watershed affect the ability to maintain biological diversity associated with native species and ecosystems?

Chapter 4 - Current Conditions and Trends

Chapter 4 - Current Conditions and Trends

Introduction

Chapter 4 describes the condition of the watershed in terms of processes and functions that are critical to addressing the key questions. Included is a description of the existing condition, the range of natural variation and trends based on current management direction. Also documented is how conditions have changed over time as a result of human influence and natural disturbances.

Results of the analysis were often complex and lengthy. Additional information is presented in the appendices of this document and in the analysis file. Other important products of the watershed analysis include maps, spatial data summaries, and databases used for the analysis. Most of the maps displayed within this document are available at 2 inches per mile or 2.64 inches per mile and the data layers reside in electronic format in MOSS. Hand-drawn maps summarize additional information. The materials provide a foundation for future management in the Salmon River watershed.

Geology

The Salmon river watershed can be divided based on geology and slope into eastern and western halves. The western half of the watershed is located within the Western Cascades geologic province. It is largely comprised of older, uplifted andesite tuff breccia that originated mainly as pyroclastic flows and lahars. On the ridgetops, more resistant andesite caps the weaker tuff breccia. These older, weathered slopes in the western portion of the watershed are extremely steep and deeply dissected. The eastern half of the watershed primarily consists of younger, glaciated hillslopes of the High Cascades Province. The hillslopes in the eastern half of the watershed are generally moderately sloping deposits of basalts, andesites and pyroclastic flows. Over steepened, unconsolidated materials comprise the upper limits of the watershed below Palmer snowfield.

Landforms

The geologic units within the watershed have been grouped into twelve landform types based primarily on slope angle, drainage density and susceptibility to landsliding. The predominant landform unit in the watershed is weak rock steep slopes (WRSS). The gently sloping eastern half of the watershed is comprised largely of landform units RIRGS (resistant and intermediate rocks, gentle slopes) and VBT (alluvial valley bottoms and terraces). Figure 4-1shows the location of landform units. Table 4-1 provides a key to the landform units and their characteristics in the watershed.

Figure 4-1 - Landforms Map

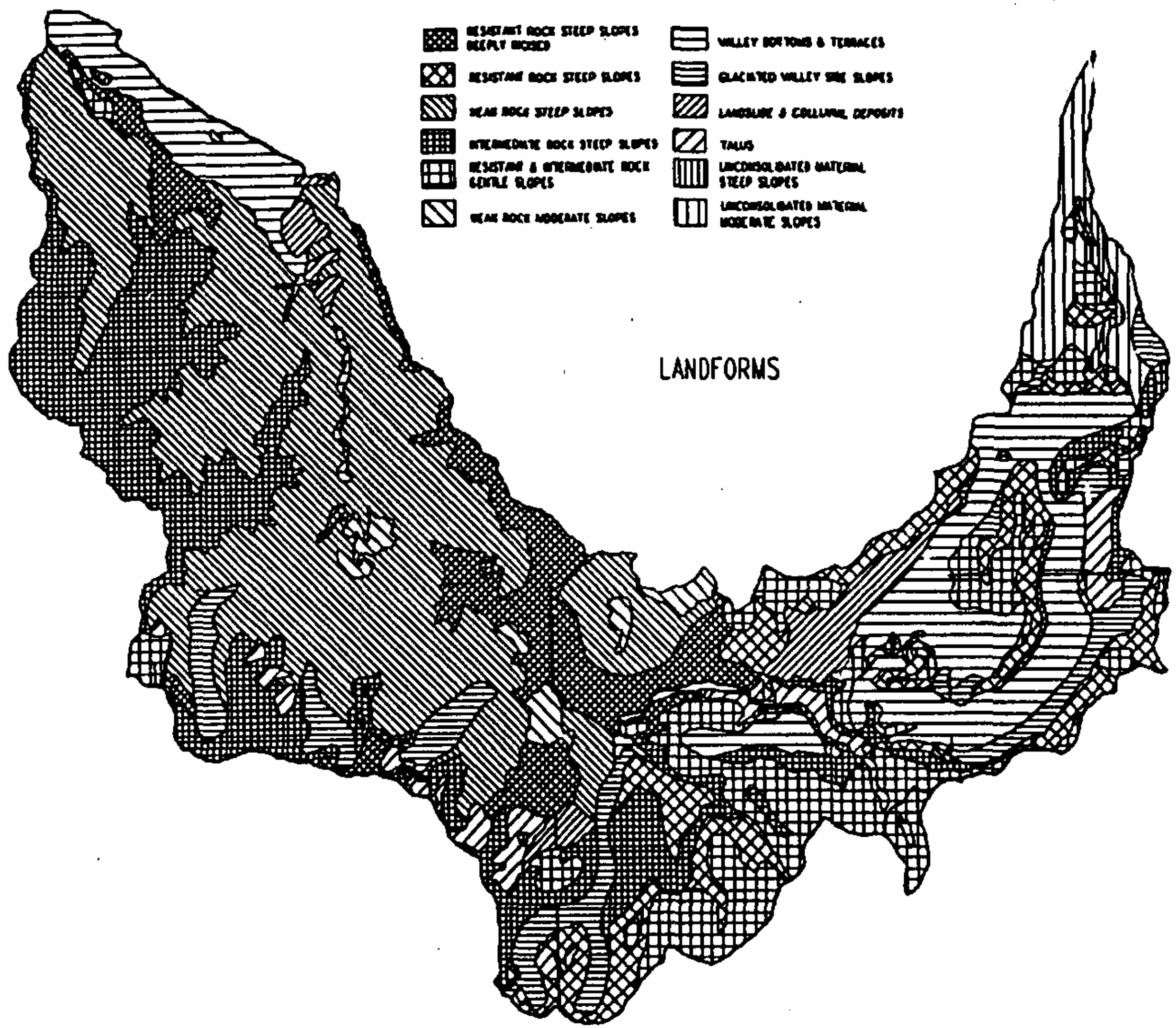


Table 4-1 - Landform Characteristics

LANDFORM UNIT	GEOLOGIC TYPE	PHYSICAL CHARACTERISTICS	SLOPE FORMING PROCESSES	SEDIMENT DELIVERY MECHANISMS
Resistant rock, steep slopes, deeply incised (RRSSDI)	Basalt, andesite, porphyritic lava, dioritic intrusions	Slope angles typically exceed 50%. Occurs in western and central part of watershed	Lava flows, regional uplift, debris flows and slides, surface erosion and creep	Streambank failures, debris flows and slides, creep
Resistant rock, steep slopes (RRSS)	Basalt, andesite, porphyritic lava, dioritic intrusions	Slope angles typically exceed 50%. Occurs in western and central part of watershed	Lava flows, regional uplift, debris flows and slides, surface erosion.	Streambank failures, debris flows and slides, creep
Weak rock, steep slopes (WRSS)	Andesite, breccia, fluvial volcaniclastic sandstone	Slopes typically exceed 70%. Resistant rock hydrothermically altered	Pyroclastic and laharic deposits, minor lava flows, regional uplift.	Streambank failures, debris flows and slides, slump, creep
Intermediate rock, steep slopes (IRSS)	Andesitic lava flows with volcaniclastic interbeds	Slopes typically exceed 50%. Forms steep valleys and narrow ridges	Regional uplift, fluvial and glacial erosion, debris flows and slides	Streambank failures, debris flows and slides, earthflows
Resistant and intermediate rock, gentle slopes (RIRGS)	Basalt, andesite, porphyritic lava, volcaniclastic interbeds, laharic deposits	Slopes range form 10-40%. *Comprises much land* around Frying Pan Quarry, Abbott Burn	Surface erosion, creep, slumps, regional uplift, fluvial and glacial erosion, debris flows.	Streambank failures, debris flows and slides, earthflows
Weak rock, moderate slopes (WRMS)	Andesite, fluvial volcaniclastic sandstone, siltstone, hydrothermically altered andesite	Slope angles do not typically exceed 30%. Ridgetops, possible quaternary landslide deposits	Pyroclastic and laharic deposits, minor lava flows, regional uplift, fluvial and glacial erosion.	Streambank failures, debris flows and slides, slump, creep, erosion, earthflows
Alluvial valley bottoms, terraces (AVBT)	Generally sorted deposits of sand, gravel, and reworked ash	Slopes do not typically exceed 30%. Occurs in eastern part of watershed	Peak flow deposits, stream-bank failures, surface erosion.	Streambank failures, surface erosion
Glaciated valley side slopes (GVSS)	Generally unsorted compacted deposits of detritus, from silt to boulder	Slopes typically range from 20-50%. Mantles in valley walls, narrow valley floors	Glaciation, debris slides and flows, surface erosion, creep.	Streambank failures, debris slides and flows, erosion, creep
Landslide and colluvial deposits (LCD)	Unsorted deposits of weathered detritus	Slopes typically less than 30%, but may exceed 70%	Slumps, debris slides, possibly high magnitude earthquakes.	Streambank failures, debris slides, surface erosion
Talus (T)	Unsorted deposits of basaltic and andesitic boulders, cobbles	Slopes typically less than 30%, but may exceed 70%	Glaciation, frost heave, debris slides, creep.	Debris slides, subsurface erosion, rockfall
Unconsolidated material, steep slopes (UMSS)	Dacite pebbles and cobbles, boulders in sand matrix	Slopes typically 50%, may exceed 70%. Found on south slopes of Mt. Hood	Air-fall, stream bank failures, debris flow deposits, surface erosion.	Streambank failures, debris slides and flows, dry gravel, surface erosion
Unconsolidated material, moderate slopes (UMMS)	Dacite pebbles and cobbles, boulders in sand matrix	Slopes typically 30%, seldom exceed 50%. Found on south slopes of Mt. Hood	Air-fall, stream bank failures, debris flow deposits, surface erosion.	Streambank failures, debris slides and flows, dry gravel, surface erosion

Landslides

As can be seen from the Landform map and the summary table, the area most sensitive to landsliding is the western half of the watershed in the Salmon-Huckleberry Wilderness. Here, the Salmon River and its tributaries have cut steep, narrow valleys out of weak pyroclasitc rock (WRSS), making them susceptible to debris slides. Where the valley walls have been incised by smaller tributaries, the potential for debris flows is high. Moreover, the presence of resistant rock (RRSS and IRSS) may not eliminate the landslide risk, particularly of debris flows. It is often at the contacts of these landform types that landslides originate. High drainage densities combine with the susceptibility to mass wasting to result in landforms capable of delivering large amounts of debris.

In contrast, the eastern half of the watershed tends to be less sensitive to mass wasting, primarily because it contains more flat ground. Slope angles in this area seldom exceed 50 percent and are usually less than 30 percent. Exceptions with steeper slope angles include Eureka Peak and the watershed divide near Salmon River Meadows. Much of the land in the eastern half of the watershed also tends to have low drainage densities, further reducing the likelihood of sediment delivery. Stream bank failures, however, are probably the most common type of landslide in this area and, because of their position, are highly effective in delivery of sediment to streams.

The steep, upper slopes of Mt. Hood (UMSS) are unvegetated, consist of unconsolidated pyroclastic and debris flow deposits and recent glacial deposits, and may receive an excess of 100 inches of precipitation each year. They are therefore highly susceptible to landsliding, particularly during times of heavy rainfall or rapid snowmelt when debris flows are easily triggered. Furthermore, since this landform borders the headwaters of the Salmon River, sediment delivery is virtually assured.

Table 4-2 summarizes the landslide potential and sediment delivery for the landforms within the watershed.

Table 4-2 - Relative Landslide Potential and Sediment Delivery Ratings by Landform Unit

LANDFORM UNIT	LANDSLIDE POTENTIAL	SEDIMENT DELIVERY	PERCENT OF WATERSHED	ACREAGE IN WATERSHED
RRSSDI	HIGH	HIGH	8%	6,005
RRSS	HIGH	HIGH	7%	5,352
WRSS	HIGH	HIGH	30%	21,662
IRSS	HIGH	HIGH	17%	12,157
RRIRGS	LOW	LOW	10%	7,489
WRMS	MEDIUM	MEDIUM	1%	973
AVBT	LOW	LOW	10%	7,170
GVSS	MEDIUM	MEDIUM	6%	4,298
LCD	MEDIUM	MEDIUM	3%	1,944
TALUS	MEDIUM	LOW	3%	1,875
UMSS	HIGH	HIGH	less than 1%	272
UMMS	MEDIUM	MEDIUM	5%	4,026

Table 4-3 summarizes the landslide potential by subwatershed. It is important to note that the subwatersheds within the Western Cascades province (Boulder, Cheeney, South Fork/Mac Hall, Lower Salmon) are highly susceptible to landslides. In the subwatersheds in the High Cascades province(Mud Creek, West and East Forks, Upper Salmon) the landslide potential is less.

Table 4-3 - Landslide Potential by Subwatershed

SUBWATERSHED	TOTAL ACRES	HIGH LANDSLIDE (ACRES)	% HIGH LANDSLIDE
BOULDER	5076	5004	99
SALMON	5,582	2,968	53
CHEENEY	6,118	6,086	99
LOWER SALMON	3,742	3,483	93
SO.FORK /MAC HALL	8,057	6,484	80
MIDDLE SALMON	13,234	11,367	86
LINNEY/DRAW	10,189	5,207	51
UPPER SALMON	11,770	3,062	26
MUD CREEK	4,394	924	21
WEST & EAST FORKS	5,098	963	19

Management activities which can affect slope stability are those which disturb hydrologic or vegetative conditions or lands within unstable areas. In order to assess the increase in landslides over the reference condition, a landslide inventory was completed. Methods for the landslide inventory are described in the appendix. Results of the inventory indicate that of the 105 landslides tallied within the watershed, 12 were associated with roads, 9 with clearcuts, 5 with roads and clearcuts, 5 with old clearcuts or possibly fire, 2 with non-forested land and 72 with mature forest. These results suggest that while the natural rate of landslides is high in a large portion of the watershed, management activities such as road construction and harvest can increase this rate. The high natural rates of landslide are generally found in the unmanaged lands in the lower watershed, while the managed lands have a lower landslide potential, (Table 4-3). Unstable lands are to be located during project level field investigations and included in Riparian Reserves. A detailed geology report can be found in appendix A. It includes additional tools to identify areas or conditions within the watershed that would trigger additional field investigation.

Soils

Soils in the watershed are influenced in part by the geologic conditions described previously. In addition, climate, vegetation and organic matter , topography and time combine to shape the soils and their development in the watershed. In the western portion of the watershed where slopes are steep and subject to downslope movement, soils are shallow, poorly developed and contain a significant fraction of gravel and cobble. In the eastern and upper elevations of the watershed, soils have been influenced by alpine glaciation. Moderate slopes in the eastern portion of the watershed have allowed for soil development in place. General soil conditions for the watershed are summarized in Table 4-4.

Fire has played a role in soil development in the Salmon watershed. At the turn of the century, most of the lands in what is now the Salmon-Huckleberry Wilderness had burned over in wildfires. In 1915, 10,000 acres in the Sherar Burn area were consumed following a lightning caused wildfire. In 1933/34 many of the lands in the Sherar Burn/Wolf Camp Butte area burned again. Panoramic photos from 1933 and 1934 show complete consumption of down woody material, soil litter and duff. Loss of soil organic material is thought to have negatively affected soil nutrition on these sites. In addition, soil nutrition is thought to have been affected by loss of mineral soils through surface erosion following the intense fires.

Trends

The reference conditions for soil productivity are found in the LRMP standards and guidelines FW-022 through FW-038. A review of existing soil monitoring results in the watershed was inconclusive in determining any trends associated with management impacts to soil resources. Monitoring results were not well distributed through the managed lands within the watershed and monitoring sites were limited in number. Trends in soil productivity monitoring forest wide suggest a concern for detrimental soil conditions on lands where ground based equipment has been used for 2 or more entries or activities on one site.

Conditions that influence the maintenance of soil productivity include activities which can alter soil physical or biological conditions. Soil capabilities that may in turn pose limits to management include organic matter, soil depth, rock content and at the higher elevations, mean annual summer moisture and temperature. The Soil Resource Inventory can be used as a preliminary investigative tool to identify potential site limitations, however field investigations are recommended at the project level.

Table 4-4 - General Soil Types of the Salmon River Watershed

SUBWATERSHED	GENERAL SOIL TYPES
BOULDER	shallow, very gravely soils forming in colluvium from pyroclastic rock formations, soil complexes with felsenmeers, talus, pyroclastic rock outcrops.
SALMON	deep, poorly drained to excessively drained soils that formed in mixed alluvium.
CHEENEY	shallow, very gravely soils forming in colluvium from pyroclastic rock formations, soil complexes with felsenmeers, wet talus, pyroclastic rock outcrops.
LOWER SALMON	shallow, very gravely loams and silt loams, soil complexes with talus and pyroclastic rock outcrop.
SO. FORK/MAC HALL	shallow, very gravely and cobbly soils forming in colluvium from pyroclastic rock formations, moderately deep, very gravely and cobbly soils forming in glacial till, soil complexes with felsenmeers, pyroclastic rock outcrops.
MIDDLE SALMON	shallow, very gravely and cobbly soils forming in colluvium from pyroclastic rock formations, soil complexes with felsenmeers, wet talus, pyroclastic rock outcrops.
LINNEY/DRAW	moderately deep, loamy, very gravely and very cobbly soils forming in glacial deposits, felsenmeer and talus.
UPPER SALMON	moderately deep, gravely and cobbly loams. Deep, sandy loams and silt loams. Shallow, gravely sandy loams and silt loams. Wet meadows and bottomlands, soil complexes with talus and igneous rock outcrop, felsenmeers.
MUD CREEK	moderately deep, gravely soils forming in glacial till. Shallow, very gravely soils forming in colluvium from glacial till. Wet meadows and bottomlands, unvegetated talus and igneous rock outcrop.
WEST & EAST FORKS	moderately deep, gravely soils forming in glaciated till and ash. Wet meadows and bottomlands, fresh sands and gravels, perpetual snow and ice.

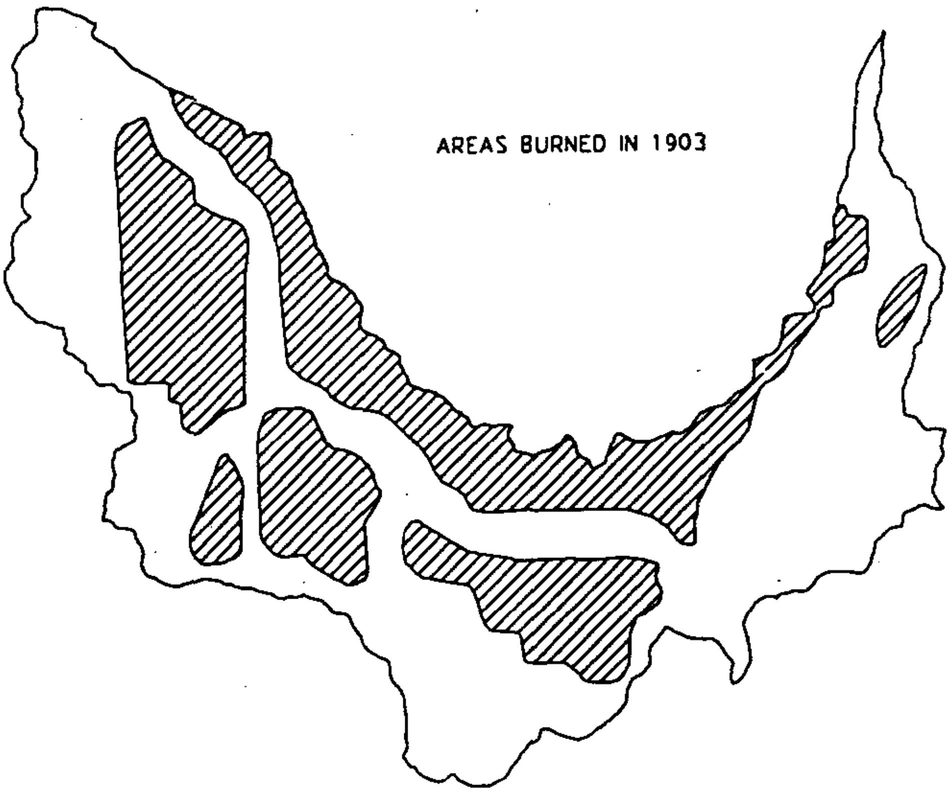
Fire

Historical fire occurrence records for the Mt. Hood National Forest consist of documented fires from 1960 - 1994. Fire occurrence records prior to 1960 consist of a survey of the Cascade Range Forest Reserve conducted in 1901 - 1903, fire lookout records circa 1920, and fire lookout panoramic shots taken in 1933 - 1934. It is apparent by studying the available historic information that fire occurrence in the Salmon River

Watershed and the surrounding watersheds (Eagle, Roaring River, and Zigzag) has burned much of the area. These fire occurrences are broadly sketched on the maps included in this section.

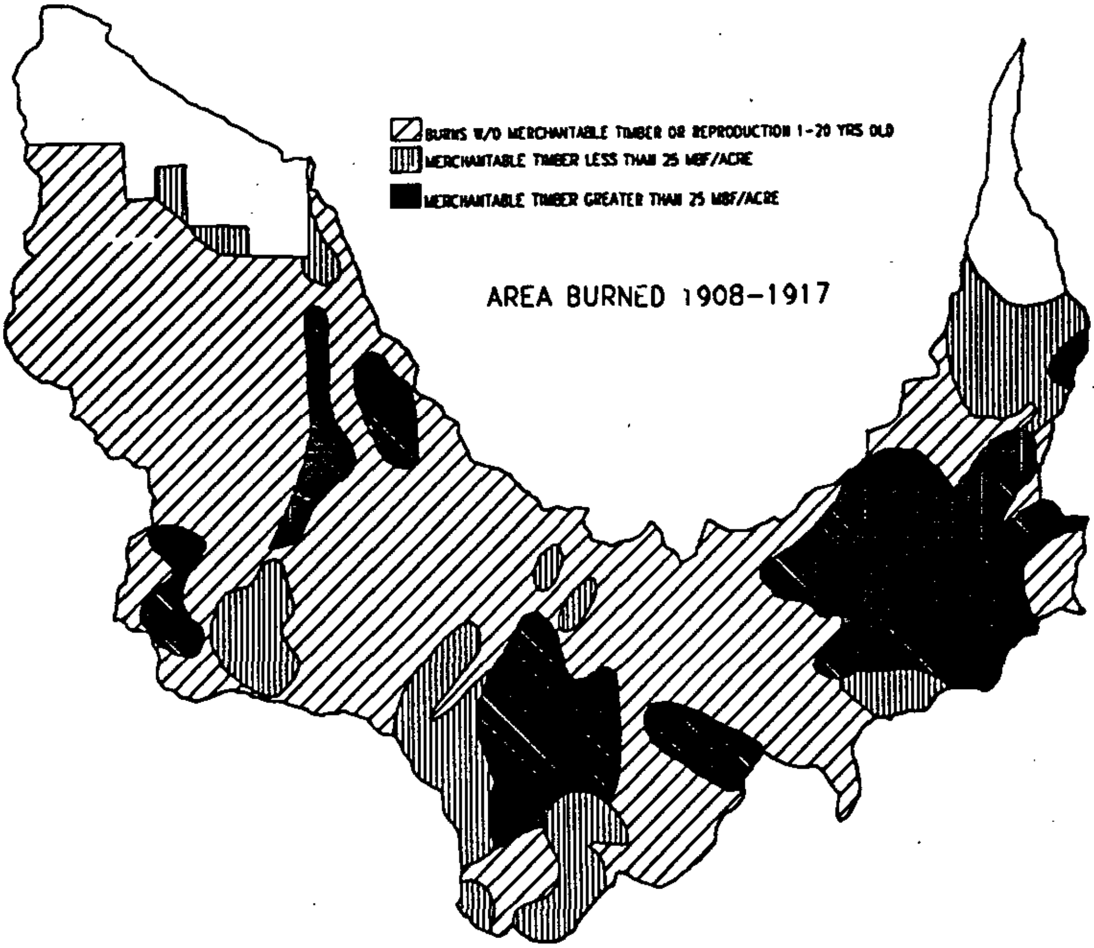
As documented in the survey of the Cascade Range Forest Reserve in 1901, as much as 60 percent of the land base of some townships was burned over by wildfires. According to the survey, the earliest documented forest fires were believed to have occurred around 1852, which burned over the area near Government camp and the headwaters of Mud Creek.

Figure 4-2 - Burned over areas, 1903



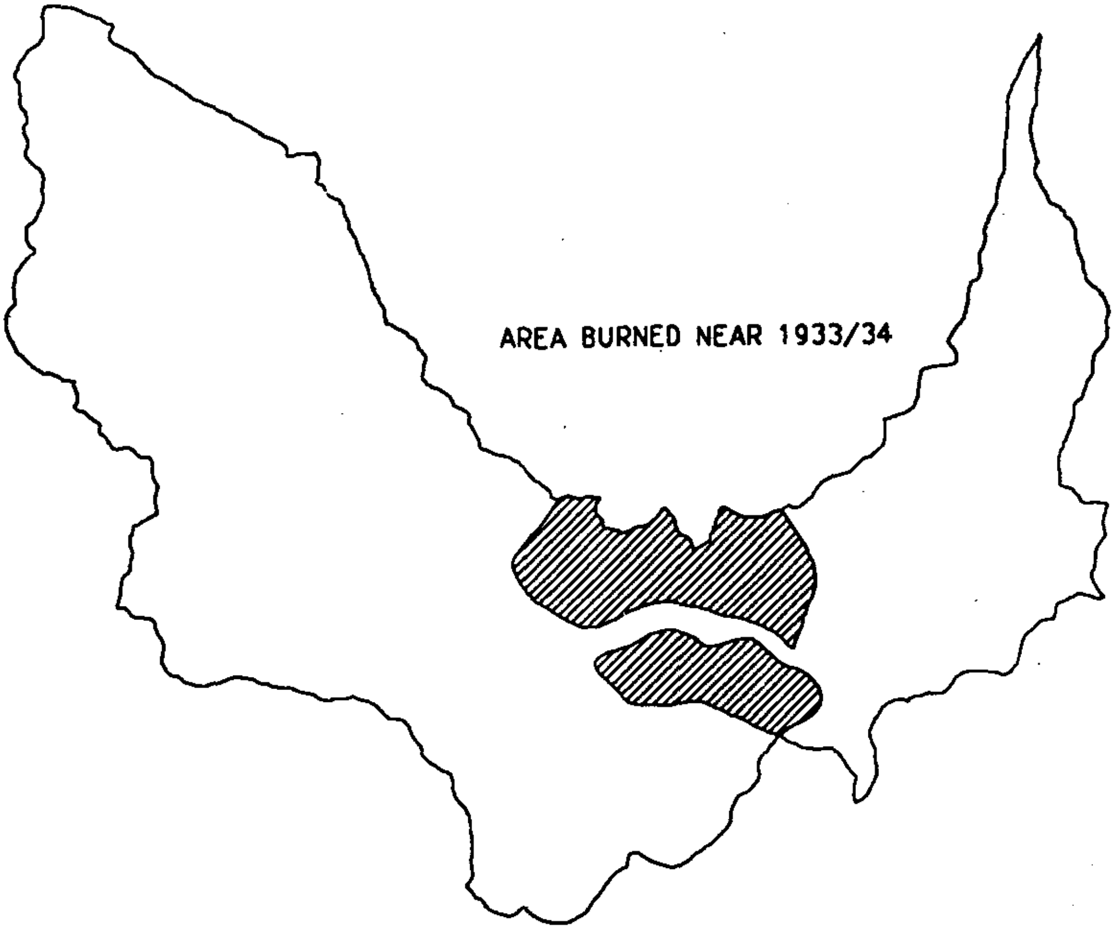
Fifteen fires occurred from 1908 through 1917 within the Salmon River watershed. The largest fire documented was in the Sherar burn area (10,000 acres) which occurred in 1915. Lightning was listed as the causal factor for this fire. The second largest fire (3,700 acres) originated within the Eagle Creek Watershed and burned into the western portion of the Salmon River Watershed. Ignition source for this fire was unknown. The Abbott Burn burned approximately 2,000 acres around 1900 and burned another 3,000 acres around 1920. Most likely this was a human caused fire.

Figure 4-3- Areas burned, 1908-1917



The panoramic photos, taken from fire lookouts in 1933-1934, show heavily burned areas throughout much of the watershed. Also evident in the photos is evidence of more recent fires burning in the Wolf Camp Butte/Sherar Burn area. It is apparent that additional fires have burned within this area as evidenced by the lack of old downed woody material and snags in the photos.

Figure 4-4 - Areas burned just prior to 1933-1934



Since 1960 there have been approximately 142 statistical fires within the Salmon River Watershed. These fires range in size from class A (less than .25 acre) to class C (10 - 99 acres). Of the 142 fires, 60% were human caused (campfires/smoking), 15% were lightning, 8% were debris burning, 5% were equipment fires, and 12% were miscellaneous or of unknown origin.

In reviewing the locations of the recorded fires for the 1970 - 1979 period, approximately 80% of all human caused fires were abandoned campfires or smoking fires in or near Trillium Lake Campground. Most of the remaining human caused fires could be associated with dispersed campsites or existing road/trail systems.

The fire occurrence rate from 1960 to present for the Salmon River Watershed is .062 fires/1,000 acres/year. This occurrence rate translates into approximately 4 fires per year. In comparison, the fire occurrence rate for the Salmon River Watershed for the period 1908-1917 was .022 fires/1,000 acres/year, or approximately 1.5 fires per year. Although the rate of fire occurrence has increased, the size of fires has decreased. This is due in part to fire suppression and pre-suppression activities and partly attributed to current reporting conventions.

Table 4-5 Fire Occurrence by Size Class

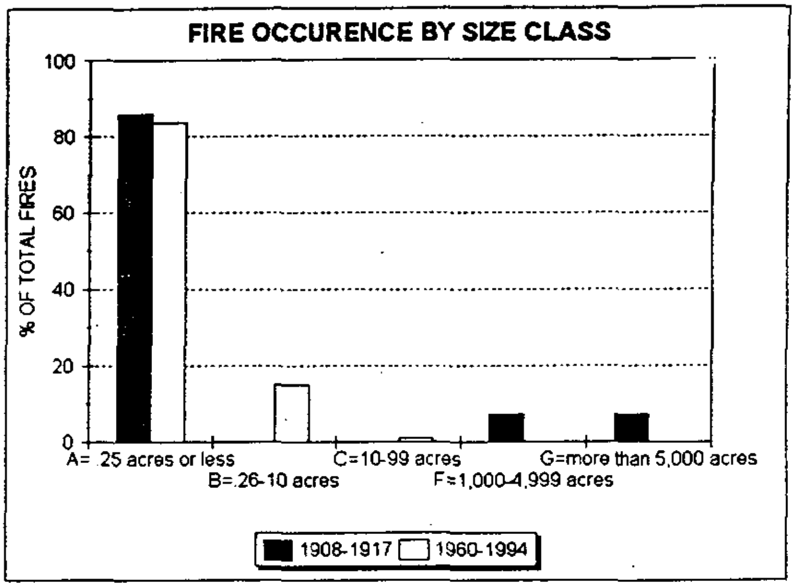
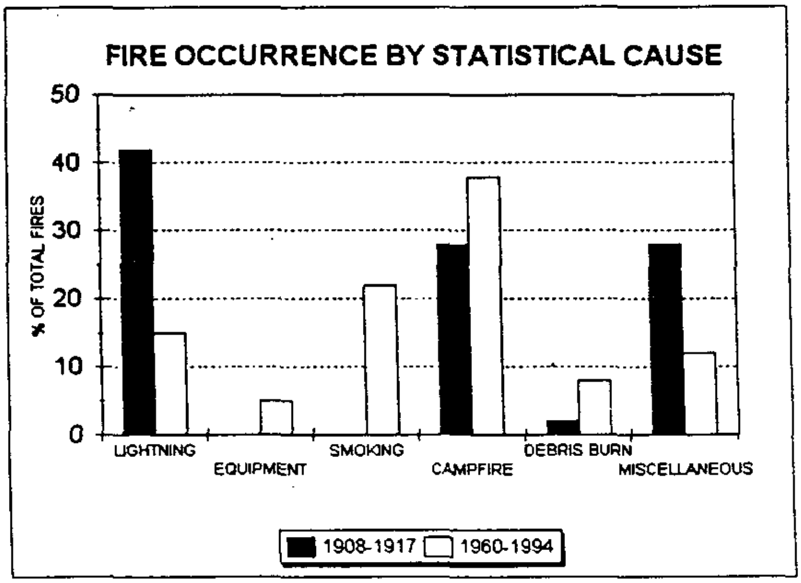


Table 4-6 Fire Occurrence by Statistical Cause



Fuel Treatment

Beginning in 1960, broadcast burning and pile burning were the preferred fuel treatment methods within the watershed analysis area. Other fuel treatment prescriptions utilized have been machine piling (dozer, excavator, and SuperHoe), Yarding Unutilizable Material (YUM), burning, and no treatment.

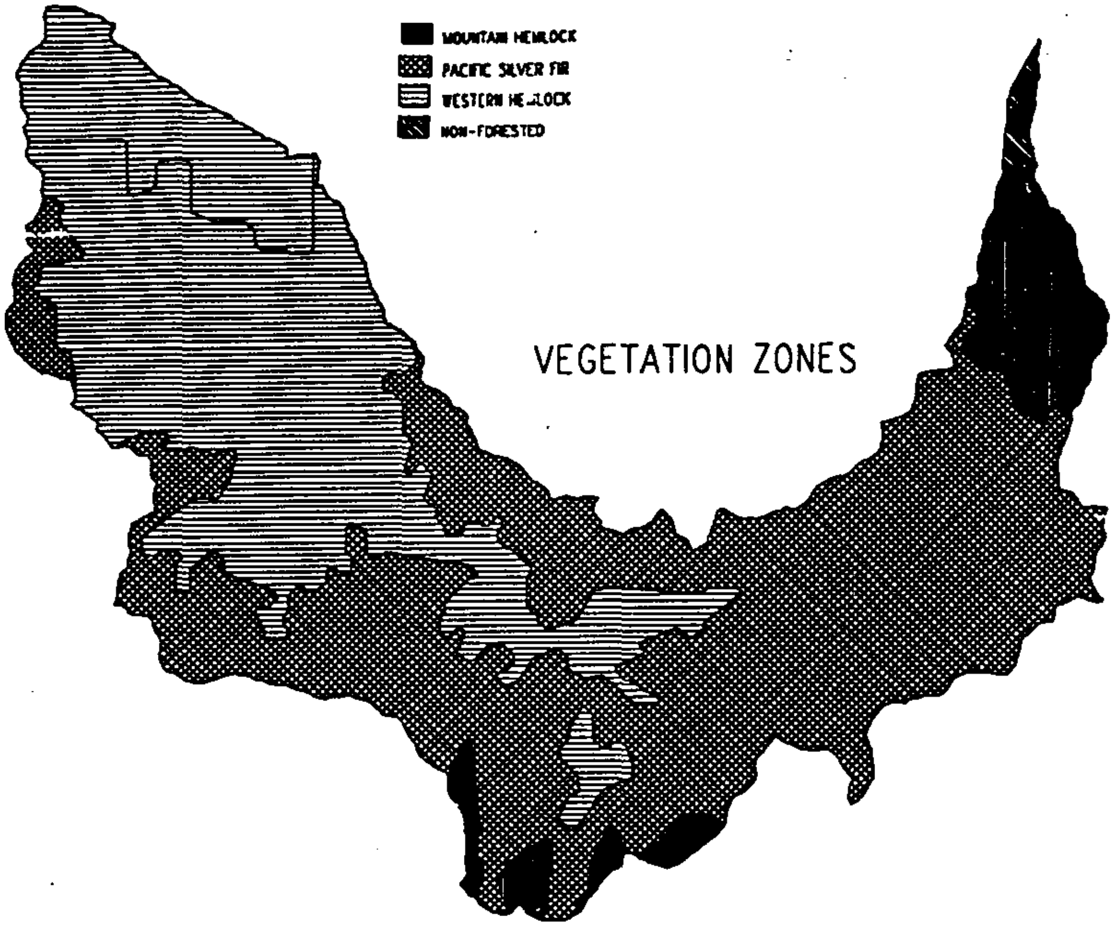
Present fuel treatment methods emphasize hand and machine piling, sometimes in conjunction with burning, or natural fuel decomposition. Natural fuel decomposition includes no treatment or mechanical abatement involving crushing, grinding or mulching. Mechanical abatement breaks the slash into smaller pieces exposing more surface area in order to speed decomposition processes. It also compresses fuels to reduce possible fire intensities.

Vegetation

Ecological Vegetation Zones

There are three main vegetation zones within the watershed: Western Hemlock , Pacific Silver Fir, and Mountain Hemlock. Near timberline, there are small acreages of Subalpine and Alpine Zones. These zones represent ecological factors that shape the type of forest projected to dominate in a particular area.

Figure 4-5 - Vegetation Zones



The Western Hemlock zone occurs at lower to mid elevations up to about 3400 feet. This zone reflects moderate sites without season-long snowpacks and abundant moisture. Western hemlock is the dominant species in climax stands, which are rarely found due to fire. Douglas-fir is dominant in early successional stands and co-dominant with hemlock in late successional stands. These are high biomass, diverse, productive forests. Approximately 34% of the watershed is within this zone.

Approximately 54% of the watershed is within the Pacific Silver Fir Zone which is found at moderate elevations, 3,000 to 4,000 feet. This zone is characterized by a high diversity of tree species, including western hemlock, Douglas-fir, true firs, western red cedar, and western larch in the transition zone of the Cascades. Pacific silver fir is the climax dominant, but this condition rarely occurs. Cool, moist conditions are representative with season long snowpacks only at the upper elevations. Growing season frost is likely.

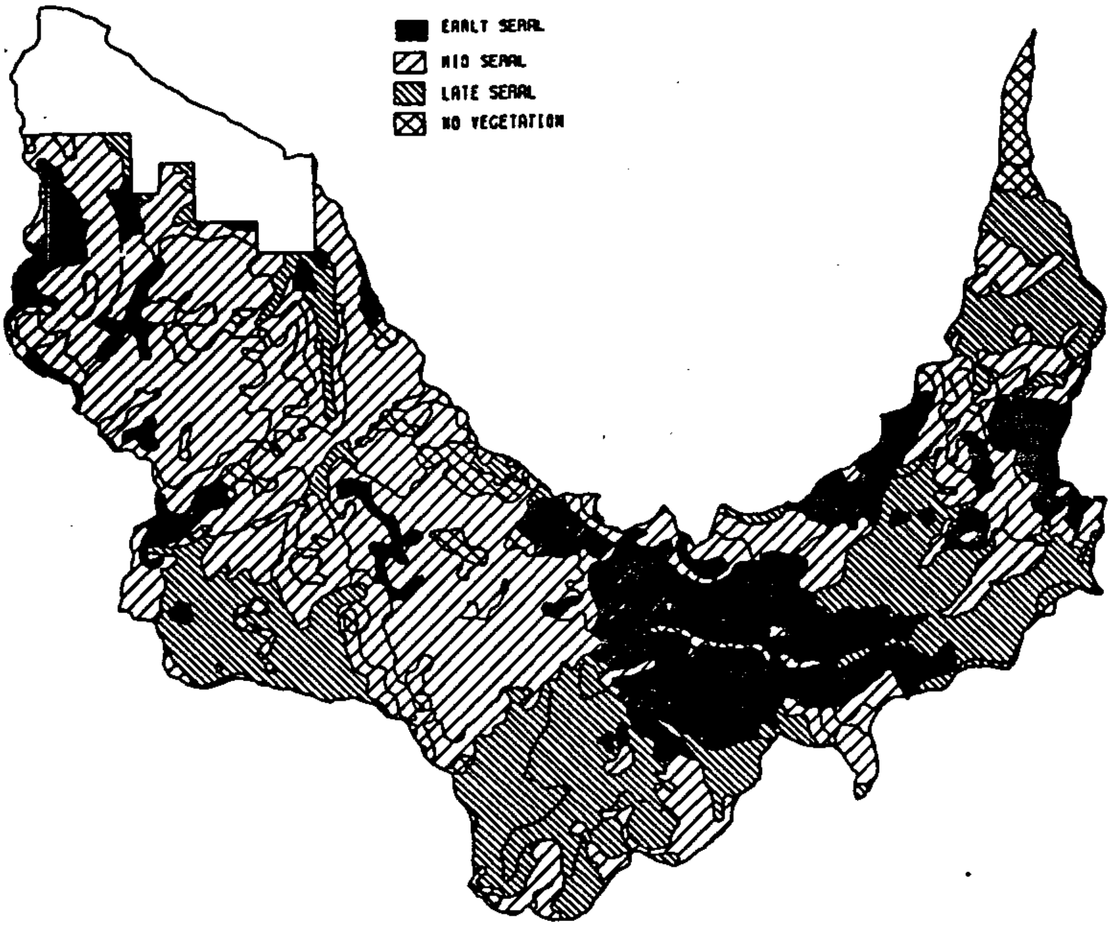
The Mountain Hemlock Zone represents approximately 7% of the watershed in the higher elevations near timberline and High Rock. Mountain hemlock dominates mid and late successional stands, but western hemlock, true firs, western white pine and Douglas-fir are also common. After fire, lodgepole pine is a common pioneer, due to its tolerance of growing season frost. These are cold, moist environments with deep winter snowpacks and short summers.

Less than 1% of the watershed is within the Alpine Zone and this is at the highest elevations just below timberline. Mountain hemlock and subalpine fir predominate, white bark pine may be present in small amounts. Even harsher than the Mountain Hemlock Zone, these environments are cold and moist with deep winter snowpacks.

Vegetation Size and Structure

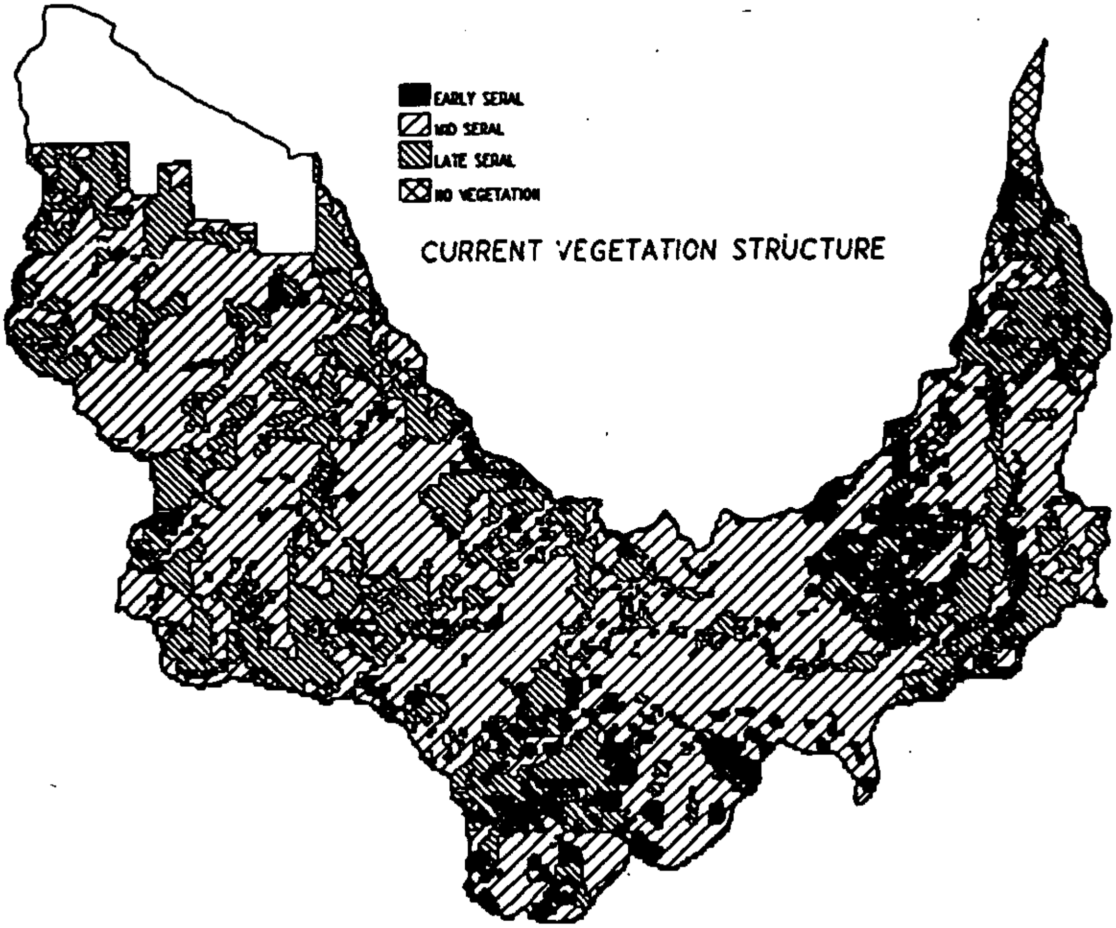
Along with the ecological factors described above, the nature of the forests in the Salmon River Watershed were largely determined by the frequency, intensity and extent of the past fires in this area. The following map, produced from the 1944 county survey historical database,(PNW 1944 database), displays the size and structure of vegetation that followed the stand replacing fire events. This database portrays the watershed prior to most timber harvest.

Figure 4-6 - 1944 Historic Vegetation Size and Structure



In 1944, the majority of the Salmon-Huckleberry Wilderness was closed, small conifer with remnant old growth in the stream bottoms and in a few concave draws. Other areas of the watershed have large patches of closed, small conifer as well resulting from burns at the turn of the century. Those areas that were not burned, matured into closed, large conifer forests. The Sherar Burn and Abbott Burn areas, with more recent fire history, are in earlier seral stages.

Figure 4-7 - Current Vegetation Size and Structure



The current vegetative condition of the Salmon-Huckleberry Wilderness is mainly of even aged, moderately dense stocked stands of 80 to 100 year old Douglas-fir. Many stands on shallow soils or on south and east aspects show stunted and chlorotic growth. Most likely this is due to loss of the duff and litter layer and loss of mineral soil from the severe fire intensity. These stand conditions may contribute to forest health problems in the future. Remnant old growth remains in most of the stream bottoms and on some concave slopes, however these stand conditions change to mid-seral conditions a few hundred feet upslope. There are several special habitats within the Wilderness including small stands of old-growth noble fir and oak balds.

Other burned areas of the watershed display similar stand conditions as the Wilderness. The forest health problem of the Sherar Burn area was compounded, not only by dense stocking, but by offsite plantings, which are less resilient to climatic and insect stresses. Small stands of lodgepole pine have come in after fire in mid to higher elevations. The

Mud Creek area has been noted for its species diversity in both trees and understory vegetation, due to its location in the transition zone of the Cascades.

The portion of the White River LSR, east of Salmon River Meadows, contains stands mainly of closed large conifer and closed small conifer with remnants. However, the portion of the Roaring River LSR in Linney/Draw Creek, has been heavily managed. Although large patches of closed large conifer remain, many of the stands are in early seral stages of seedlings, saplings or poles.

Trends

Overall there has been a decrease in early seral stands since 1944 as these stands have grown into sapling/pole/small conifer stands. There has been a slight decrease in closed large conifer stands, a larger decrease in closed small conifer stands, and an increase in open large conifer stands. The above descriptions consider change due to harvest and stand maturation.

Table 4-7 - Vegetation Structure Comparison, Historic (1944) vs. Current

SIZE STRUCTURE	ACRES IN 1944	ACRES IN 1995
Closed large conifer	17,784	17,000
Closed small conifer	34,607	27,000
Closed sapling pole	14	5,500
Open small conifer	not included	4,300
Open sapling pole	not included	2,090
Grass forb shrub (includes meadow, alpine)	13,526	6,000
Open large conifer	30	2,300
Rock, water, non-veg	1,976	1,150
Hardwood	121	not separated
TOTAL	68,058	68,215

Comparing broad species composition of current stands to 1944 stands, shows some change. It appears that Douglas-fir dominated stands have increased in the Linney/Draw Creek and Mud Creek areas, although overall acres of Douglas-fir are similar. This is most likely due to artificial regeneration favoring Douglas-fir. There have been increased acreages of pacific silver fir and lodgepole pine. Comparing species maps from the two time periods also shows a discrepancy between stands of western hemlock and mountain hemlock. Errors in stand typing may be the cause of this discrepancy.

Table 4-8 - Vegetation Species Comparison, Historic (1944) vs. Current

SPECIES	ACRES IN 1944	ACRES IN 1995
Pacific silver fir	47	2,723
Lodgepole pine	459	1,092
Douglas-fir	39,500	39,800
Western red cedar	103	331
Western hemlock	7,230	16,731
Mountain hemlock, Noble fir, Mixed silver fir	17,248	4,558
Engelmann spruce	not included	136
Hardwood, alpine, rock, water, meadow	3,469	2,900
TOTAL	68,056	68,271

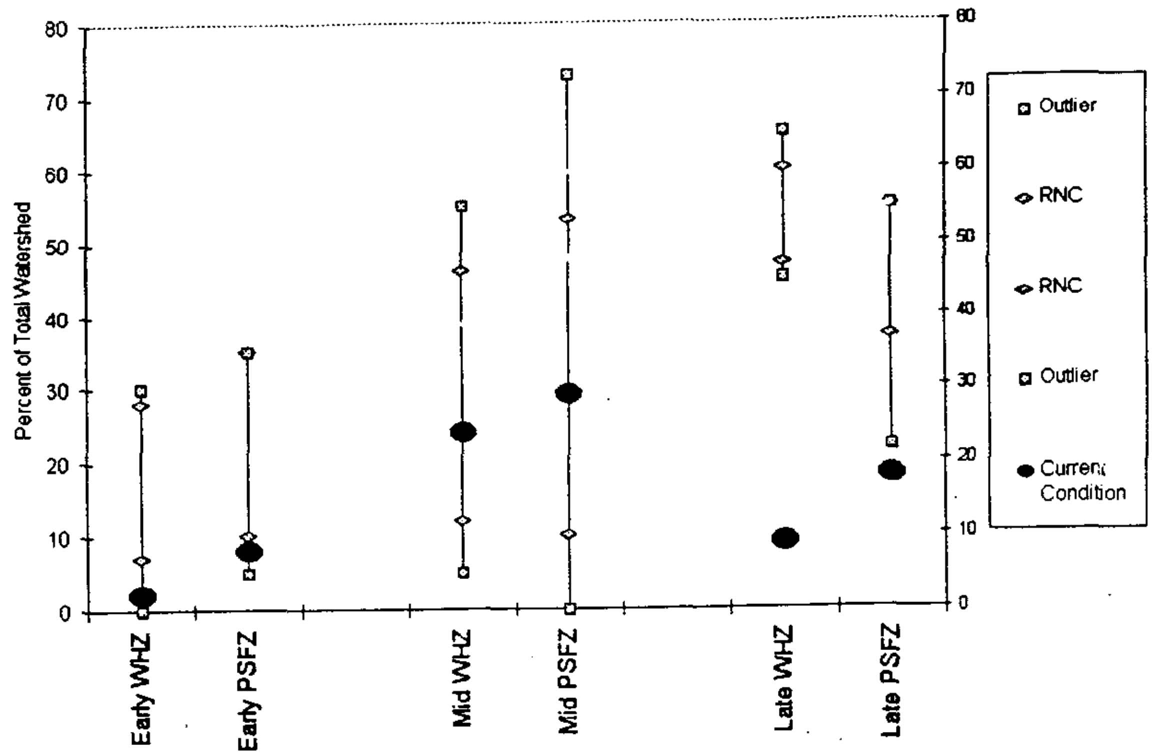
Seral Stage

Seral stage affects a variety of ecosystem functions, including: wildlife species use and migration, hydrologic function, production of snags and coarse woody debris, nutrient cycling, and disturbance processes such as fire, insects and disease. The Range of Natural Conditions, (RNC), for seral stages is based on the Regional Ecosystem Assessment Project, (REAP), scaled down to the watershed level. REAP determined pre-European management conditions at a landscape level and determined a RNC for the time period of 1750-1900. Current conditions are based on corrected 1995 vegetation data.

The following table compares current seral stages, by vegetative zone, against the RNC. Outlying data is displayed as well, but has a lower confidence level. Early seral reflects an intent to portray acres of forest that function as openings. Late seral is based on large size class and more than one layer. Mid seral generally includes small conifer stands and closed sapling/pole stands. Overall, 30% of the watershed is in late-seral, 55% in mid-seral and 11% in early-seral.

In watersheds with less than 15% late seral forest, all late seral patches should be retained, regardless of land allocations (ROD C-44). Protection of these stands could be modified when reserved areas have reached late successional conditions. Although, Salmon River Watershed currently has more than 15% late seral forest, this standard and guideline should be considered during project planning. Also refer to LSR summary in Chapter 7, Recommendations.

Figure 4-8 - Comparison of seral stage, by vegetation zone, with Range of Natural Conditions



Early and late seral forest, for both the Western Hemlock, (WHZ), and Pacific Silver Fir Zones, (PSFZ), are below the RNC. Most notable is late seral forest in the Western Hemlock Zone which is well below RNC. Other comments in regards to RNC are:

- Large fires in early part of this century decreased the late seral stage and account for the higher mid seral stage.
- Wilderness and roadless areas limit timber harvest, thus little early seral.
- Logging in the middle and upper watershed explains part of the decreased late seral.

Landscape Pattern

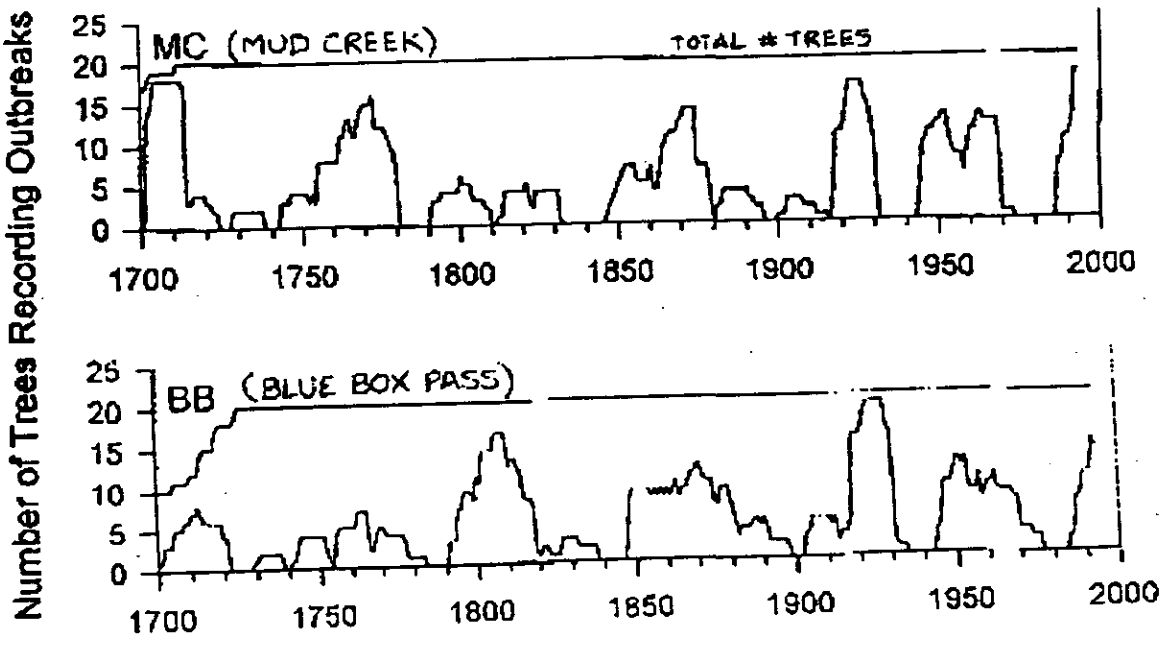
In the historic landscape, large patches dominated. These large patches were either late or early seral patches at any given point in time as dictated primarily by fire occurrence. The shapes of the forested patches were irregular with edges of low contrast and boundaries following topography and landform. In the current landscape this same pattern holds true for a large portion of the watershed in Wilderness and roadless areas. However, the intensively managed areas of Mud Creek, Linney/Draw Creek, the Salmon timber sale area, and the area above the Highway 26-35 interchange, are highly fragmented. These patches are generally small to mid size openings, with high contrast edges and mainly geometrically shaped boundaries. The northwest corner of the watershed is also highly developed from residential and recreational use. The patterns of these managed landscapes are very different from the historic landscapes.

Disturbance from Insects

Western spruce budworm has been the major defoliator in recent decades. Budworm larvae feed predominantly in buds and on foliage of the current year. Sustained heavy attack causes nearly complete defoliation in 4 to 5 years. Epidemics cause decreased growth, tree deformity, top killing, and sometimes mortality, often over extensive areas. Bark beetles often invade a stand after defoliation or stress from budworm attacked trees and cause additional mortality.

Recent dendrochronology studies have documented the occurrence of numerous western spruce budworm outbreaks over the past three centuries. These long term reconstructions provide historical reference on the range of natural variability. Data from the Mud Creek area of the watershed is displayed below as well as data from Blue Box pass, just east of the watershed (from Swetnam and Wickman et al, 1994).

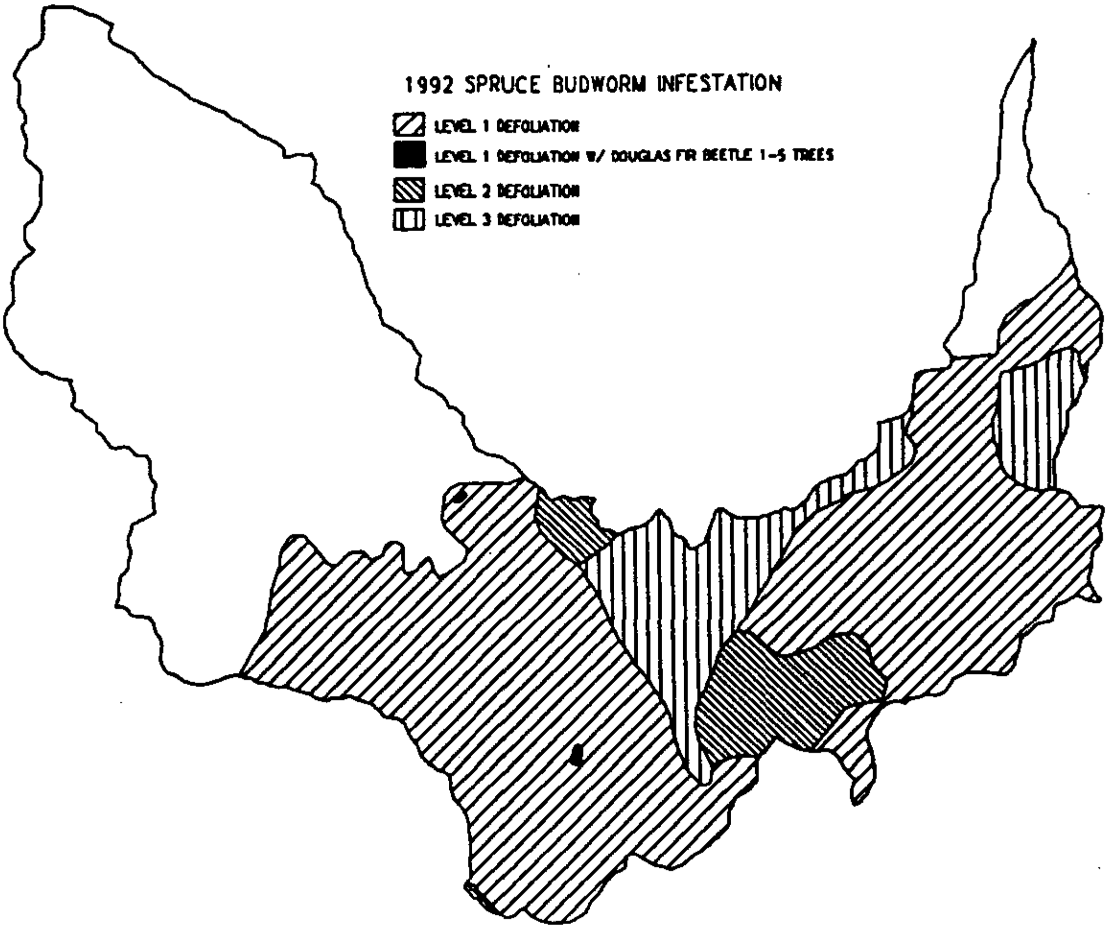
Figure 4-9 - Historic Spruce Budworm Outbreaks



Compilations of the numbers of trees recording outbreaks within Mt. Hood National Forest reveal a strong pattern of repeated outbreaks over the past several centuries. Many of the peaks span 20 to 30 years or more. Average budworm outbreak duration recorded within individual trees was about 12 to 14 years and average periodic growth reduction during these periods was approximately 20 to 30 percent of expected growth (Swetnam and Wickman et al, 1994).

1992 mapping of spruce budworm infestation showed affected areas throughout most of the central and eastern portions of the watershed. The infestation extended as far west as Mack Hall subwatershed in the Wilderness, and northeast near the Timberline Road. These areas had previously been sprayed in 1988 with Bt (*Bacillus thuringiensis*), a biological control agent.

Figure 4-10 - 1992 Spruce Budworm Infestation



Defoliation Intensity:

Level 1 = current year's defoliation is visible from the air
Level 2 = some bare tops (very little gray)
Level 3 = many bare tops visible (some gray with some foliage)
Level 4 = bare crowns (very gray, no visible green foliage in tree)

The 1994 Aerial Insect Infestation Map which displays new infestation only, showed light intensity budworm defoliation in the Red Top Meadow/Buzzard Point area only. This is a good indicator that the current outbreak is near the end of its cycle. The length of infestation has been approximately 14 years, starting in 1980, peaking at defoliation threshold around 1992, and presently declining.

The aerial mapping also showed the Sherar Burn area as having a small infestation of fir engraver. Bark beetle attack, known in this area, would be difficult to aerially detect since these are usually identified by red dying foliage. Therefore, new bark beetle infestation would not be aerially detected if foliage was dead or absent from budworm feeding.

Although this most recent outbreak was within the range of historic conditions, the effects of the spruce budworm population had greater impacts due to off-site plantings in the Sherar Burn area and dense stand structure of single species. Both of these factors cause stressed and less resilient stands.

Huckleberry Fields

There are several historic huckleberry field areas within the watershed including north of the Sherar Burn road and the High Rock area. Narratives from 1903 also describe abundant huckleberries in the southwest portion of the Wilderness and further south. Historic wildfires frequently created open, tree-free environments above 3,000 feet that were suitable for the growth and development of wild huckleberries. With fire suppression, trees eventually encroach, crowding and shading the shrubs, eventually eliminating huckleberry production. To maintain historic fields, in the absence of fire, some form of overstory control is necessary.

Several field plots were installed in the Wolf Camp Butte area in 1972 as part of a huckleberry ecology and management research project (Minore, Smart and Dubrasich, 1979). It was described that berry production can be very high and huckleberry fields are culturally, recreationally and economically important. The project concluded with several management recommendations that still warrant consideration today. Included in these recommendations are overstory control by individual tree girdling, and nitrogen fertilization of berry plants.

Botany

A detailed and comprehensive botany analysis is included in the appendix. It includes the following documents:

- Botanical recommendations and restoration opportunities.
- Discussion on fungi, lichens, bryophytes, and vascular plants with survey and manage status that occur within the watershed.
- Discussion on sensitive plants that occur within the watershed.
- Noxious weeds and other invasive non-native species.
- Riparian Reserve species.
- A modified Survey and Manage Table, (C-3 Table from the ROD), that includes occurrence status, habitat information, and geographical extent.

In this chapter, the botanical highlights are summarized.

Biological Diversity

There are potentially 910 different plants in the watershed as determined by the Species Conservation and Community Analysis (SCCA). Of these, 80, or about 10% are introduced.

Survey and Manage Species

There are many species of concern that are to be protected through survey and management standards and guidelines (ROD C4 - C6). These are listed in Table C-3 of the appendix to this document. There are four survey strategy ratings which apply to C-3 species:

1. Manage known sites (beginning in 1995).
2. Survey prior to ground-disturbing activities and manage newly discovered sites (for 1999 project implementation and beyond).
3. Conduct extensive surveys for the species to find high priority sites for species management.
4. Conduct general regional surveys to acquire additional information and to determine necessary levels of protection.

Species with survey strategy ratings 1 and 2 demand the most immediate attention. Survey and Management Guidelines for species with 1,2 ratings are due from the Regional Executive Office, (REO), in June 1995. Recommendations for fungi, lichens, bryophytes and vascular plants documented in the Salmon River watershed could change based on these guidelines.

Fungi

Martellia #649, rare endemic false truffle (1,3): This truffle is located at Phlox Point picnic area. Generally it grows at 5,000 - 6,000 ft. elevation in mature mountain hemlock and silver fir stands under the humus/debris layer. Protection is required from ground disturbing activities, including recreational use. Winter recreational use is compatible.

Oxyporus nobilissmus, noble polypore (1,2,3): This noble polypore is a NW Oregon / SW Washington endemic (only 8 sites are known locally and it is not found elsewhere in the world). Its habitat is large diameter noble fir stumps, snags, and less commonly, live trees. A small conk was recently located off road 220. This site and others discovered in the future require protection from logging activities with a one square mile buffer with fungus in center. Potential habitat should be surveyed.

Lichens and Bryophytes (1,2,3,4)

26 species of C-3 lichens, and one moss, have been documented in the Salmon River watershed. Location information will be received from the REO early this summer. Of the lichens, 3 species have 1,3 ratings: *Hydrothyria veriosa, Hypogymnia oceanica, and Pseudocephallaria rainerensis*. The others have 4 ratings. The one moss, *Scouleria marginata*, has a 4 rating.

For documented occurrences, current, general habitat recommendations are as follows:

- Nitrogen-fixing arboreal lichen species - maintain 10-40 acre patches of old growth trees for microclimate and dispersal. 200+ year old trees with large lateral branches and emergent crowns are important.
- Riparian species - maintain a diversity of hardwoods in stands, especially large big leaf maple.
- Aquatic species - maintain clear, clean water.
- Rock species - maintain shading and microclimate.
- All species - control harvest of mosses and lichens as special forest products.

Hypogymnia oceanica, rare oceanic-influenced lichen (1,3): this lichen grows on Salmon-Huckleberry Trail #793a. Wilderness designation should adequately protect this site from impacts to the microclimate.

More location information is needed for the other lichen and moss species listed above.

Vascular Plants

Allotropa virgata, sugar stick (1,2): Sites are known near Salmon River Meadows and Summit Meadows. Its habitat is mesic forest with well drained soils, well developed humus layer and coarse woody debris in an undisturbed forest floor. Logging/thinning and fire suppression may affect the species. More surveys of potential habitat are needed to determine locations.

Botrychium minganese and *B. montanum*, grapeferns (1,2): Mt. Hood NF Sensitive Plants. Though not documented in the watershed, good habitat is present. These grapeferns commonly grow in wet cedar areas such as those near Mud Creek.

Corydalis aquae-gelidae, coldwater corydalis (1,2): A NW Oregon / SW Washington endemic (found nowhere else in the world); Mt. Hood NF Sensitive Plant and candidate for federal listing. Habitat includes cold water (10 degrees C), >50% gravel with coarse sand, usually perennial flow, shallow water, and high streamside canopy.

A large population exists in the Linney Creek/Draw Creek area growing along the stream bank/water's edge. A few plants were reported on a gravel bar in Salmon River upstream of Green Canyon Campground. The Wild and Scenic River Plan recommended evaluation of habitat and potential restoration. Management guidelines due from the REO this summer may require special buffers for these sites.

Coptis trifolia, threeleaf goldthread (1,2): Mt. Hood NF Sensitive Plant. Threeleaf goldthread grows at the brushy, shaded edges of wet meadows. One site is known from Jackpot Meadows. Potential habitat exists in unnamed meadows in Mud Creek drainage, Redtop Meadow, and Salmon River Meadow, therefore further surveys of potential habitat should be conducted. A Botanical Special Interest Area designation for Jackpot Meadows is suggested along with the exclusion of grazing.

Other Plant Species of Concern

The wet meadows in the Salmon River Watershed serve as special botanical habitat. Several sensitive or unusual plant species that grow in these wet meadows include: Buxbaum's sedge, cotton grass, scheuchzeria, pale blue-eyed grass (an iris relative), lesser bladderwort and wild cranberry. Pale sedge has not been located in Salmon River Meadows since 1987. The Salmon National Wild and Scenic River Management Plan (1993) recommends evaluating Salmon River/Redtop Meadows for Botanical Special Interest Area designation in 1996.

Carex buxbaumii, Buxbaum's sedge is located in Pepper Meadows, Peeled Cedar Meadow and Jackpot Meadow. No other sites are known on the Mt. Hood NF. Loss of wet meadow and bog habitat has threatened this species. Grazing may be impacting this sedge. Recreation has been a threat at some sites in Oregon.

Eriophorum polystachion, cotton grass, is found in Salmon River Meadows. The many cold, wet meadows in the watershed provide good potential habitat.

Scheuchzeria palustris var. americana, scheuchzeria: A Mt. Hood NF Sensitive Plant which grows in boggy meadows, often with Sphagnum spp. Salmon National Wild and Scenic River Management Plan (1993) recommends designing methodology and location of partial grazing exclosure in Salmon River Meadows to monitor impacts on scheuchzeria.

Sisyrinchium sarmentosum, pale blue eyed grass, is a sensitive species, with only a few sites on the Mt. Hood NF. This member of the iris family lives in wet meadows and openings along streams and lakes. Riparian reserves should adequately protect its habitat within the watershed.

Utricularia minor, lesser bladderwort is a sensitive species found in Redtop Meadows. It is a carnivorous, floating aquatic plant that grows in quiet, shallow waters that are often acid and draw down in the summer. No impacts are currently occurring to its habitat in Redtop Meadows and riparian reserve guidelines should adequately protect these plants.

Vaccinium oxycoccus, wild cranberry grows in sphagnum bogs and on the Mt. Hood National Forest is found in cold boggy meadows in the Bull Run, Salmon and Zigzag watersheds. It is locally abundant but uncommon in Oregon. Impacts from grazing in Salmon River and Jackpot Meadows have not been investigated.

Huperzia occidentale, fir clubmoss is a sensitive species found in Draw Creek. Fir clubmoss favors mature riparian forest and prefers an undisturbed forest floor/streamside with well developed humus layer and woody debris. Historically, it may have been more abundant but past logging practices have altered riparian forest that might have been good habitat. Riparian reserve guidelines should help improve habitat. The populations in Draw Creek are significant in that they are the only sites in the Salmon River Watershed.

Riparian Reserves

A list of species that are known or could potentially occur in riparian areas within the Salmon River Watershed is included in the appendix. Very little is known about the ecology of most species of bryophytes, lichens and fungi. Therefore recommended riparian reserve widths should be maintained. Some vascular plant species, such as the grapeferns are strongly associated with the riparian reserve areas of the watershed.

The Mud Creek area is an area of high vegetative diversity and as an ecotone between west Cascades and east Cascades vegetation. Enhancement of the connectivity between the wet meadows and creek, would restore vegetation and functions of riparian areas in the Mud Creek drainage.

Noxious Weeds

Based on a roadside weed survey of the district in 1992 and personal observations, the following new invaders and established infestations occur in the Salmon River Watershed:

- *Centaurea diffusa*, diffuse knapweed
- *Centaurea maculosa*, spotted knapweed
- *Cirsium arvense*, Canada thistle
- *Cytisus scoparius*, Scotch broom
- *Hypericum perforatum*, St. Johnswort
- *Senecio jacobaea*, tansy ragwort

Generally noxious weeds in the Salmon River Watershed grow in high traffic areas along roadsides and on disturbed ground, especially in the intensively managed areas. Except for an infestation of tansy ragwort in the middle of the watershed, noxious weeds are concentrated in the upper and lower sections. Occurrences tend to be light and patchy rather than dense. Though specific noxious weed surveys have not been done in the Salmon/Huckleberry Wilderness, noxious weeds do not appear to be a problem. Information on the known species in the watershed is given in the appendix.

Potential Invaders

Of the potential invaders, *Lythrum salicaria*, purple loosestrife is the most threatening. This aggressive wetland weed can completely dominate a wetland within a couple of years and is a known problem in the Willamette Valley. Habitat and forage are lost for waterfowl and other wildlife, as well as displacement of native and sensitive plants. The wet meadow complexes in this watershed should be continually monitored for purple loosestrife invasion.

Invasive Non-Native Species

Below are five species found in the watershed that are aggressive in displacing native plants. Plants such as these do not get listed on the state or federal noxious weed lists because they are not usually associated with economic losses. However, these species have the potential to cause much more damage to the watershed than some of the noxious weeds listed in the section above.

- *Geranium robertianum*, herb robert
- *Hedera helix*, English ivy
- *Polygonum cuspidatum*, Japanese knotweed
- *Rubus discolor*, Himalayan blackberry

- *Rubus laciniatus*, evergreen blackberry

Monitoring and control is recommended for all noxious weeds and invasive, non-native species.

Wildlife

Decisions made in the Northwest Forest Plan affecting the terrestrial ecosystem are relatively complex. Late Successional Reserves and Riparian Reserves were designated with the objective of providing both for aquatic habitat conditions and for terrestrial species that inhabit the riparian habitats. Despite this extensive reserve system, future outcomes were considered uncertain for over 300 terrestrial plant and animal species. As a result, the agencies are to survey and manage for these species on sites where they are located. Additional standards and guidelines were prescribed for matrix lands as well, to provide for needs of some terrestrial species. This assembly of reserves and standards and guidelines creates a terrestrial ecosystem management strategy analogous to the objectives of the Aquatic Conservation Strategy (R6 - Terrestrial Module, 1995).

The approach for wildlife discussions in this analysis is to look at species of concern where finer scale attention was deemed necessary in the FSEIS. These include C-3 species, threatened or endangered species, and protection buffer species in the matrix. Furthermore, species which were outside the scope of the FSEIS and which are deemed to be at risk, or sensitive, are considered. Species with potential habitat within the Salmon River Watershed are also identified for use as indicators of biodiversity.

The Key Questions address conditions of the watershed and how they contribute to habitat needs for species of concern in terrestrial, aquatic, riparian and special habitats. Therefore this chapter focuses on general information.

Biological Diversity

Currently, 236 wildlife species have potential habitat within the watershed. Of these, 31 are listed as threatened, endangered or sensitive, 12 are FEMAT species of concern, 46 are snag dependent species and 8 are introduced species. These species are listed in the appendix by guild.

Life History Guilds

Wildlife species have been grouped into life history guilds based on how species are expected to respond to different amounts and distributions of habitat across the landscape, (Mellen, Huff, and Hagestedt, 1995). Home range size, patch configuration use, and structural stage use were used to group terrestrial species. Riparian associated species were grouped by water body, aquatic association, and structural stage. Species that require special habitats such as caves or cliffs were not grouped into guilds. The objective of the guilding approach is to predict terrestrial and amphibian occurrence relative to landscape patterns.

The following tables display the criteria used to group species by life history into guilds, and the amount of habitat within the watershed for each guild. The amount of habitat is displayed by acres and percent of watershed, as well as the potential number of species in each guild.

Table 4-9 - Criteria Used to Group Species by Life History into Guilds

TERRESTRIAL: Terrestrial habitat users (may use riparian or special habitats as well, but do not require them).

HOME RANGE:

SMALL: Home ranges less than 60 acres
MEDIUM: Home ranges 60 - 1000 acres
LARGE: Home ranges more than 1000 acres

PATCH CONFIGURATION:

PATCH: Species requiring one homogeneous patch (one structural stage) during life cycle (or breeding period for migrants).
MOSAIC: Species capable of aggregating patches of like structural stages that are dispersed in a mosaic pattern across the landscape.
CONTRAST: Species using two different major structural stages in close proximity, usually large tree and open.
GENERALIST: Species whose primary habitat is not restricted to one major structural stage.

STRUCTURAL STAGE:

OPEN: Includes grass/forb, shrub, leave tree/shelterwood, and open sapling/pole.
SMALL TREE: Includes closed sapling/pole, open small conifer (less than 21")
LARGE TREE: Includes large conifer (more than 21") and old growth.

RIPARIAN: Species that require aquatic or riparian habitats (may use terrestrial habitat if riparian habitat is nearby. May use special habitats, but do not require them).

WATER BODY:

LAKE: Aquatic/riparian obligate using only lakes.
LAKE/RIVER: Aquatic/riparian obligate using lakes or rivers or streams.
RIVER: Aquatic/riparian obligate using only rivers or streams.

AQUATIC ASSOCIATION:

A: Species use only the aquatic portion of the watershed.
AR: Species use both the aquatic and the riparian (edge or shoreline) portion of the habitat.
R: Species use only the riparian portion of the habitat.

STRUCTURAL STAGE:

OPEN: Grass/forb/shrub.
FORESTED: Hardwood sap/pole, hardwood small tree/large tree, conifer sap/pole, and conifer small tree/large tree.

SPECIAL: Species requiring special and unique habitats such as caves, cliffs, bridges, buildings, and wetlands for breeding and/or feeding.

Table 4-10 Amount of Habitat Available Within the Watershed for Terrestrial Guild Groups

GUILD CODE	PATCH CONFIGURATION	HOME RANGE	STRUCTURE STAGE	# OF SPECIES	TOTAL ACRES	% OF WATERSHED
TSPO	Patch	Small	Open	23	4,579	6%
TPSPT	Patch	Small	Small Tree	0	14,279	19%
TSPLT	Patch	Small	Large Tree	5	18,767	25%
TSMO	Mosaic	Small	Open	5	872	1%
TSMST	Mosaic	Small	Small Tree	0	0	0%
TSGOS	Generalist	Small	Open/Small Tree	7	45,830	62%
TSGSL	Generalist	Small	Small/Large Tree	5	60,054	81%
TSGG	Generalist	Small	All	82	67,817	92%
TMPO	Patch	Medium	Open	0	0	0%
TMMO	Mosaic	Medium	Open	2	2,704	4%
TMMLT	Mosaic	Medium	Large Tree	2	13,519	18%
TMGG	Generalist	Medium	All	16	67,817	92%
TLMO	Mosaic	Large	Open	2	228	less than 1%
TLMLT	Mosaic	Large	Large Tree	7	17,021	23%
TLGG	Generalist	Large	All	7	67,817	92%
TSC	Contrast	Small	Contrast	2	3,232	4%
TMC	Contrast	Mosaic	Contrast	6	4,579	3%
TLC	Contrast	Large	Contrast	6	14,279	8%

Table 4-11 - Amount of Habitat Available Within the Watershed for the Aquatic/Riparian Guild Groups

GUILD CODE	WATER BODY	AQUATIC ASSOCIATION	STRUCTURE STAGE	# OF SPECIES	TOTAL ACRES	% OF WATERSHED
LAKEA	Lake	Aquatic		4	81	less than 1%
LAKEARO	Lake	Aquatic, riparian	Open	1	44	less than 1%
LAKERO	Lake	Riparian	Open	6	24	less than 1%
LKRVA	Lakes/Rivers	Aquatic		8	8,956	12%
LKRVARO	Lakes/Rivers	Aquatic, riparian	Open	0	0	0%
LKRVARF	Lakes/Rivers	Aquatic, riparian	Forested	7	8,024	11%
LKRVARG	Lakes/Rivers	Aquatic, riparian	All	8	8,848	12%
LKRVRO	Lakes/Rivers	Riparian	Open	5	805	1%
LKRVRG	Lakes/Rivers	Riparian	All	0	0	0%
RIVA	Riverine	Aquatic		1	8,012	11%
RIVARF	Riverine	Aquatic, riparian	Forested	3	8,012	11%
RIVARG	Riverine	Aquatic, riparian	All	0	8,836	12%
RIVRO	Riverine	Riparian	Open	1	383	less than 1%
RIVRF	Riverine	Riparian	Forested	1	8,012	11%

Table 4-12 - Amount of Habitat Available Within the Watershed for the Aquatic/Riparian Guilds

GUILD CODE	WATER BODY	AQUATIC ASSOCIATION	STRUCTURE STAGE	# OF SPECIES	TOTAL ACRES	% OF WATERSHED
LAKEA	Lake	Aquatic		4	81	less than 1%
LAKEARO	Lake	Aquatic, riparian	Open	1	44	less than 1%
LAKERO	Lake	Riparian	Open	6	24	less than 1%
LKRVA	Lakes/Rivers	Aquatic		8	8,956	12%
LKRVARO	Lakes/Rivers	Aquatic, riparian	Open	0	0	0%
LKRVARF	Lakes/Rivers	Aquatic, riparian	Forested	7	8,024	11%
LKRVARG	Lakes/Rivers	Aquatic, riparian	All	8	8,848	12%
LKRVRO	Lakes/Rivers	Riparian	Open	5	805	1%
LKRVRG	Lakes/Rivers	Riparian	All	0	0	0%
RIVA	Riverine	Aquatic		1	8,012	11%
RIVARF	Riverine	Aquatic, riparian	Forested	3	8,012	11%
RIVARG	Riverine	Aquatic, riparian	All	0	8,836	12%
RIVRO	Riverine	Riparian	Open	1	383	less than 1%
RIVRF	Riverine	Riparian	Forested	1	8,012	11%

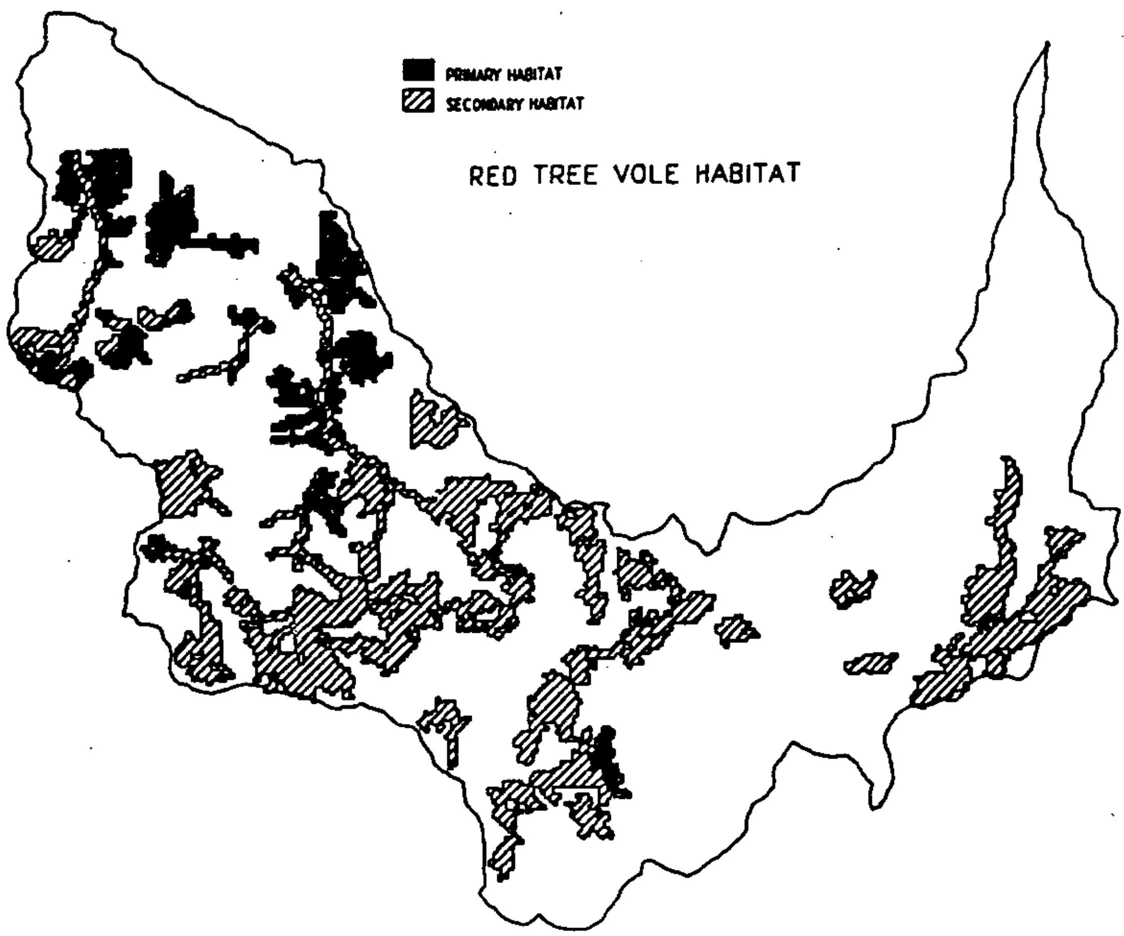
The amount of acres of habitat for each guild will aid in determining relative amounts of habitats for different groups of species. As an example, habitat is most abundant for generalist species of any home range size, since by definition generalists can use all seral stages and are not restricted by landscape pattern. Generalist species include the pine siskin and mountain beaver, among many others. As another example, there is very little habitat for species such as the red fox, which require a large home range in open structural stages (TLMO). For those guilds with very little habitat in the watershed, a closer look at the species may be warranted. Maps of each guild are available at the forestwide scale and were used as a tool in answering the Key Questions.

Individual Species of Concern

Using available databases, the landscape level analysis can be run for individual species of concern with species specific information on habitat use and home range size and composition. This was done for the red tree vole, a C-3 species potentially occurring in Salmon River Watershed below 3,000 feet. This map displays primary and secondary habitat for the red tree vole and may be a useful tool for identifying survey sites.

Primary habitat consists of large tree patches more than 100 acres in size in the western hemlock zone. Secondary habitat consists of large tree patches less than 100 acres in the western hemlock zone; or any habitats in the Pacific silver fir zone; or closed sapling/pole and closed small conifers stands of any size in the western hemlock zone (reference Huff, Holthausen, and Aubry 1992).

Figure 4-11 Primary and Secondary Habitat for the Red Tree Vole



Special habitat associates

The Salmon River Watershed includes almost 5,000 acres of special habitats including wetlands, rock outcrops, talus slopes, cliffs and waterfalls. A list of species associated with special and unique habitats, that are potentially found in Salmon River Watershed is located in the appendix. Obligate users of special habitats is discussed in the Key Questions.

Pileated Woodpecker and Pine Marten Areas (B-5)

C-3 of the ROD states that: "Administratively Withdrawn Areas that are specified in current Forest Plans to benefit American martens, Pileated woodpeckers, and other late-successional species are returned to the matrix unless local knowledge indicates that other allocations and these standard and guidelines will not meet the objectives for these species".

This spring, a forestwide analysis was drafted that assessed the relative importance of individual B-5 areas based on their contribution to late seral forest conditions at the watershed level. Salmon River Watershed has several areas of B-5 designation that were assessed during this process for their relative value as habitat for late seral species.

The first "screen" considered whether or not the watershed is more than 75% withdrawn from intensive silvicultural treatments (includes Congressionally Reserved, LSRs, and Administratively Withdrawn). Salmon River was approximately 70% reserved so the next "screen" of dispersal habitat and late seral levels was considered. A threshold of concern was raised for any watershed that provided less than 60% dispersal habitat and less than 30% late seral habitat. The Salmon River Watershed contains adequate dispersal habitat at 70%, and meets the 30% late seral criteria.

In conclusion, none of the B-5 areas in the watershed are recommended for retention. District wildlife biologists concurred with this recommendation.

Road density

Road density is important since use of roads may inhibit deer and elk use of quality foraging, rearing, or wintering areas. Species sensitive to human presence, such as the wolverine, may also be impacted by road densities. Road density by subwatershed is displayed in Table 4-1, included in the discussion on sedimentation.

Forest Plan standards state: "by year 2000, roads open to motorized vehicle traffic should be reduced to not exceed 2.0 MI/sq mile within inventoried deer and elk winter range, and 2.5 MI/sq mile within deer and elk summer range (FW-208)". Three subwatersheds exceed these standards: Mud Creek, West and East Fork Salmon, and Salmon River subwatersheds. The Linney/Draw Creek subwatershed is only slightly below the maximum density. Allocated B-10 deer and elk winter range, in the keyhole area, is within the standards of not exceeding 1.5 MI of road/sq mile (B10-037).

Road density is one component of habitat effectiveness for deer and elk. Sizing and spacing of forage and cover, density of roads open to motorized vehicles, cover quality and forage quality together form the overall habitat effectiveness. The Habitat

Effectiveness Model can be run on scales smaller than the watershed for project planning. Normally areas between 1,000 and 6,000 acres can be analyzed, but the largest analysis area should be chosen on the basis of evaluation of cumulative effects (USDA FS, 1986, pg. 23).

Snags and Coarse Woody Debris

Forty six wildlife species potentially occur within the watershed that are dependent on snags. Most of the primary cavity nesters are generalists and can make use of available snags in any seral condition; however, three species (black-backed woodpecker, Pileated woodpecker, and three-toed woodpecker) require snag habitat in a late seral forest condition. Most of the secondary cavity nesters are also generalists; however two species (mountain bluebird and western bluebird) require snags in early seral conditions and four species (barred owl, marten, northern flying squirrel, and northern spotted owl) use snags in late seral conditions.

For the watershed overall, snag density is depauperate, largely due to high intensity or repeated burns, and past management activities. Large snags are most abundant within unmanaged large conifer stands, such as in the Upper Salmon River subwatershed, and remnant stands in stream bottoms and other areas that were not burned at the turn of the century. Forestwide inventories conducted in 1986 and 1992 generally indicate low snag densities in managed plantations as compared to unmanaged stands.

The LRMP and ROD each tie snag retention levels to a certain percentage of the biological potential (carrying capacity) of cavity nesting birds in the landscape. Minimum levels across the landscape are set at 40%, while the minimum level in new harvest units is 60%. Ecology plot information was reviewed for the Salmon-Huckleberry Wilderness which showed snag levels at 10-20% of biological potential (Bill Otani, Forest Wildlife Biologist, personal communication). This percentage was for trees in the large size class, found predominantly in the unburned stream bottoms. As the mid seral stands age and undergo self-thinning, the density of medium sized snags should increase.

Boulder Creek, Salmon River, Mud Creek, and Linney/Draw subwatersheds have decreased snag levels due to past management practices in plantations, and due to development outside the national forest. The Mud Creek area does have some areas of larger snags including western red cedar. In the West and East Fork subwatershed, more snags were left in the managed stands. Islands of vegetation with both smaller and larger trees were left in the Snowshoe timber sale units, whereas Passline timber sale units were small openings with snags left in adjacent uncut areas. Repeated routes of pine marten tracks have been found in this subwatershed.

The Wolf Camp Butte and Sherar Burn areas had repeated fires which destroyed most snags. Furthermore, "snagging", or falling of snags to prevent re-burning of areas, was done by the Civilian Conservation Corps during the mid 1930s and probably occurred in this area. Mortality from the western spruce budworm has left standing, dead trees, but most of these are less than 16 inches in diameter, which is smaller than required for most species. Douglas-fir bark beetles in this area can serve as prey for pileated woodpeckers. Wet meadows in the watershed have snags around the edges and in forested pockets. The forested meadows provide varied sizes of snag habitat.

Coarse woody debris is important for denning areas, invertebrate prey sources for birds and salamanders, and habitat for voles, shrews and various fungi which are utilized by the northern flying squirrel and other small mammals. Coarse woody debris levels follow a similar pattern as the snag levels due to fire history, past management practices, and development.

The trend for coarse woody debris and snag levels are increasing due to reserve allocations, standards and guidelines, and maturation of stands, however increase in levels will take time.

Hydrology

Introduction

Originating from Palmer glacier on the south face of Mount Hood (elevation 11,345) the river carves a 35-mile arc, flowing south from Mount Hood turnig west and eventually north and entering the Sandy River near the town of Brightwood. Major tributaries to the Salmon River include the West Fork Salmon River, Mud Creek, Linney Creek, South Fork Salmon River, Cheeney Creek, and Boulder Creek. The Salmon River has no water impoundments and is considered free flowing throughout its length.

Figure 4-12 - Stream Network and Subwatersheds

Varying geology and topography in the Salmon River watershed has produced hydraulic features such as waterfalls, wetland meadows, and oxbow river channels. A complex of wetland meadows located in the Upper Salmon Subwatershed, downstream from the Highway 26 river crossing appear to have a substantial affect on the water quality and flow in the upper portion of the Salmon River. The stream and several tributaries meander slowly through these meadows, allowing sediments to settle out of the water. An intricate cycling of organic matter adds nutrients to the stream influencing stream productivity. The meadows may also act as a "sink" where water is detained and slowly released to the stream as baseflow. The lower section of Middle Salmon Subwatershed contains a series of six waterfalls ranging in height from 15 to 75 feet occurring within a 3-mile stretch of river. A widening of the river valley and lower stream gradients in the lower watershed have allowed the river to meander over many years forming bends and eventually cutting them off to form oxbows. These segments also contain several small adjacent wetland areas. Some stretches of river below the Forest Service boundary have been channelized and straightened for flood control, limiting further meandering.

Annual precipitation in the Salmon River Watershed ranges from about 130 inches at the source to about 35 inches on the east end of the watershed, with the greatest precipitation occurring in the period between November and January, and the least occurring in July and August (Figures 4-13 and 4-14). Mount Hood sustains a snowpack year round in its highest elevations, which directly affects stream discharge in the Salmon River by providing water storage over the winter and supplementing flows in the summer. Figures 4-15 and 4-16 detail the average daily discharges in the upper and lower watershed. The data illustrate that average discharges are influenced substantially by rates of snow accumulation and snowmelt within the watershed.

Figure 4-13 Precipitation at Government Camp

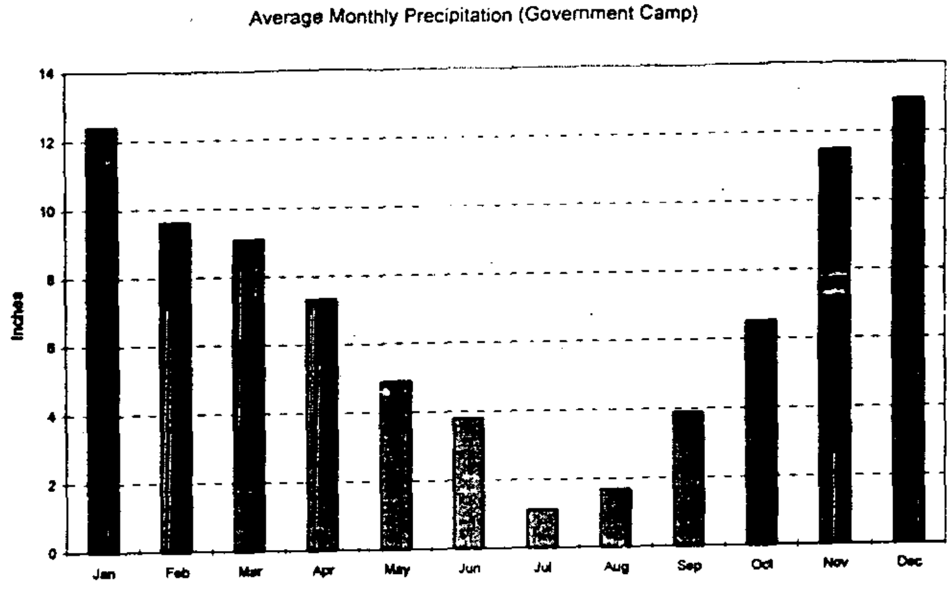


Figure 4-14 Annual Precipitation in Inches

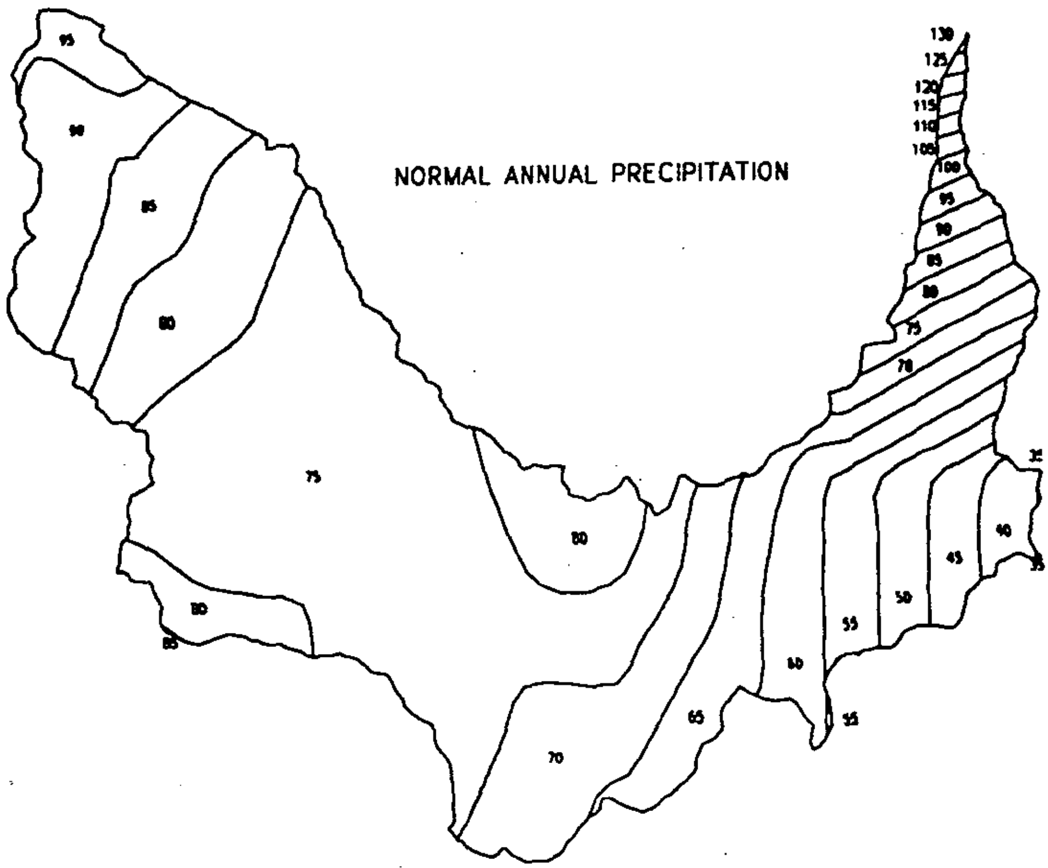


Figure 4-15 - Flow Regime Upper Salmon River

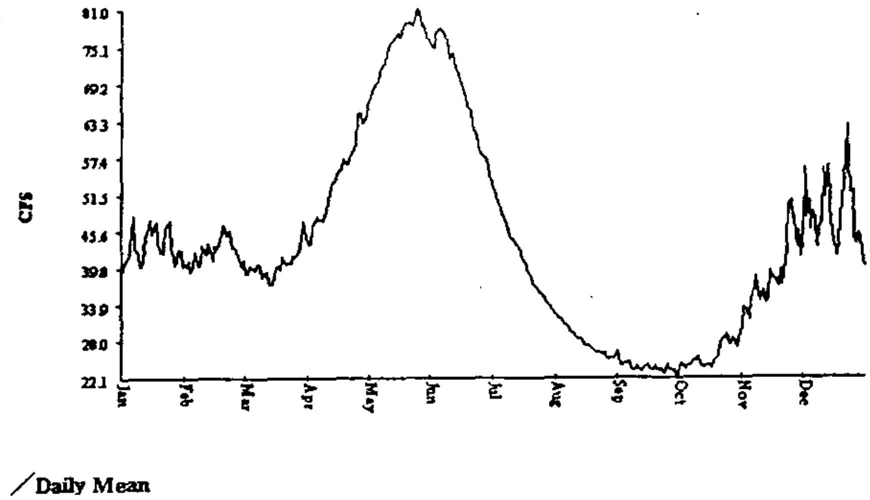
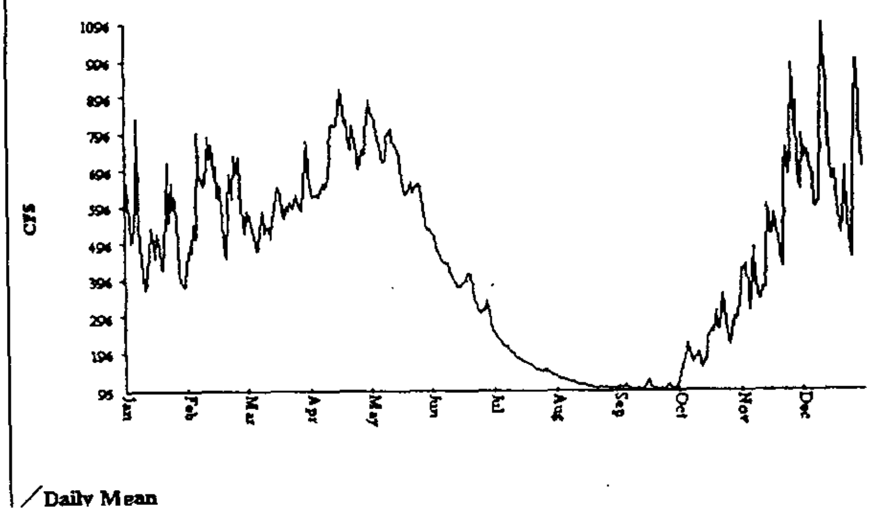


Figure 4-16 - Flow Regime Lower Salmon River



Peakflows

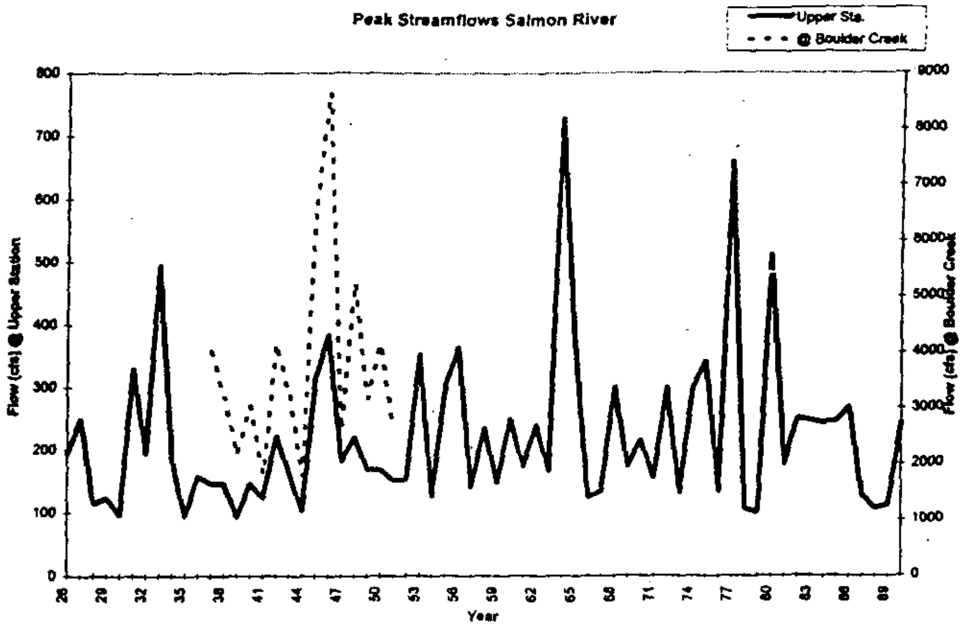
Peak streamflows have important effects on stream channel morphology, sediment transport and bed material size. Peak streamflows effect channel morphology through bank erosion, channel migration, riparian vegetation alteration, bank building and deposition of material on floodplains. The vast majority of sediment transport occurs during peakflows, as sediment transport capacity increases logarithmically with discharge (Ritter 1978; Garde and Rangu Raju, 1985). The ability of the stream to transport incoming sediment will determine whether there is deposition or erosion within the active stream channel. The relationship between sediment load and sediment transport capacity will affect the distribution of habitat types, channel morphology, and bed material size. (EPA 1991). Increased size of peakflows due to urbanization have been shown to cause rapid channel incision and severe decline in fish habitat quality (Booth, 1990).

Another important consideration is the impact of 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 can occur. If lower, the stream may not have the power to move its natural sediment load and cause sediment deposition within the watershed.

The Aquatic Conservation Strategy gives clear direction that "the distribution of land use activities, such as timber harvest or roads, must minimize increases in peak streamflows" (B-9) in order to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing.

Peak streamflows of large magnitude in the Salmon River Watershed are generated by rain-on snow events as is demonstrated in Figure 4-17which details peakflows in the upper watershed and near the confluence with the Sandy. The peakflow event on December 12, 1946 is the highest on record from the gage on the Salmon River near Boulder Creek and occurred within the same timeframe at the upper and lower stations which would indicate that the event was caused from rain on snow throughout the watershed.

Figure 4-17 - Peak Streamflows Salmon River Watershed (based on daily means)



Peakflows will be assesssed by:

1. Examing trends based on the historical record from the USGS gauging station in the upper watershed

2. Assessing changes in peakflows from rain on snow events

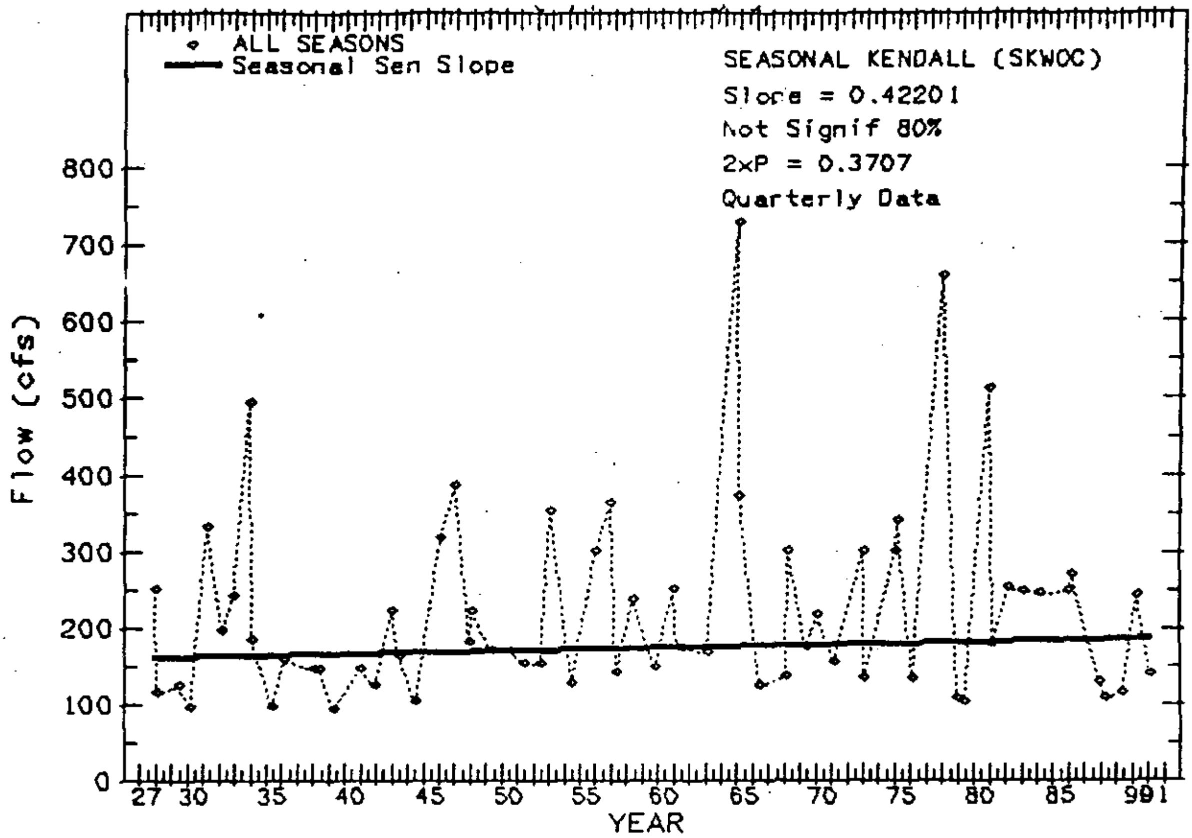
3. Assessing changes in peak flows associated with increases in the stream drainage network

Assessing changes in peakflows from channel network expansion

Trends

Trend analysis using the Season Kendall Test Without Correction For Correlation (SKWOC) was completed for the upper watershed. The upper watershed was the only area analyzed because the period of record at the other gauging stations stopped in the 1950's.

Figure 4-18 Peak Streamflow Trends



The analysis concluded that there was a slight increasing trend in peakflows(+0.42201), however this trend is not statistically significant at the 80% level

Assessment Of Changes Due To Increased Peakflows From Rain On Snow Events

This assessment was completed using methodolgy from the Washington DNR Standard Methodolgy For Completing Watershed Analysis (DNR 1993). This method assumes that the greatest likelihood for causing significant, long-term cumulative effects on forest hydrologic processes is through the influence of created openings from timber harvest and roads on snow accumulation and melt. The effect of vegetation change on peakflows during rain-on snow events is the focus of the assessment.

The primary mechanism by which forest practices affect peak streamflows is alteration of snow accumulation and melt in response to forest canopy density.

Peakflows are calculated for 2, 5, 10, 25, 50, and 100 year recurrence interval peak streamflow events and two storm intensities (average and unusual) and three vegetative cover conditions (existing, 1944 and hydrologically recovered). The vegetative cover conditions from 1944 were modeled as a "snapshot" of historical condition and to reflect the influence of the fires between the turn of the century and 1944. The average storm represents a typical rain on snow event using average values for precipitation, storm temperature, wind speed and snow accumulation. The unusual storm uses the average value plus one standard deviation for precipitation, storm temperature, wind speed and snow accumulation. Hydrologically recovered conditions for vegetative cover were assumed to be 70% canopy closure of trees over 8 inches dbh in coniferous stands. Figure 4-19, Figure 4-20, and Figure 4-21 detail canopy closure under the three scenarios modeled.

Figure 4-19 Canopy Closure Current Condition

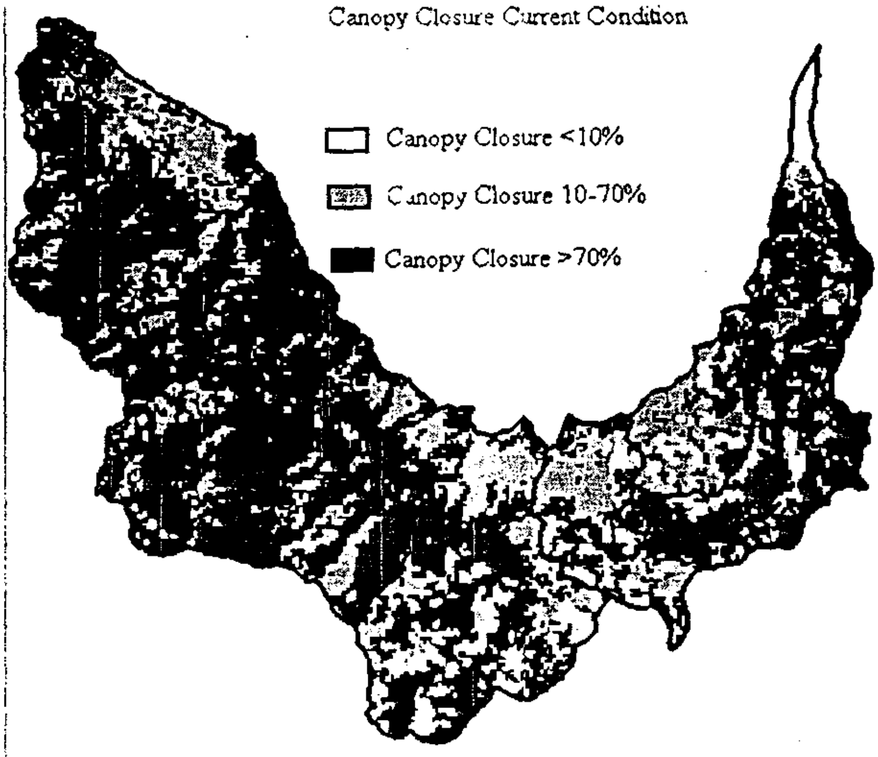


Figure 4-20 Canopy Closure 1944

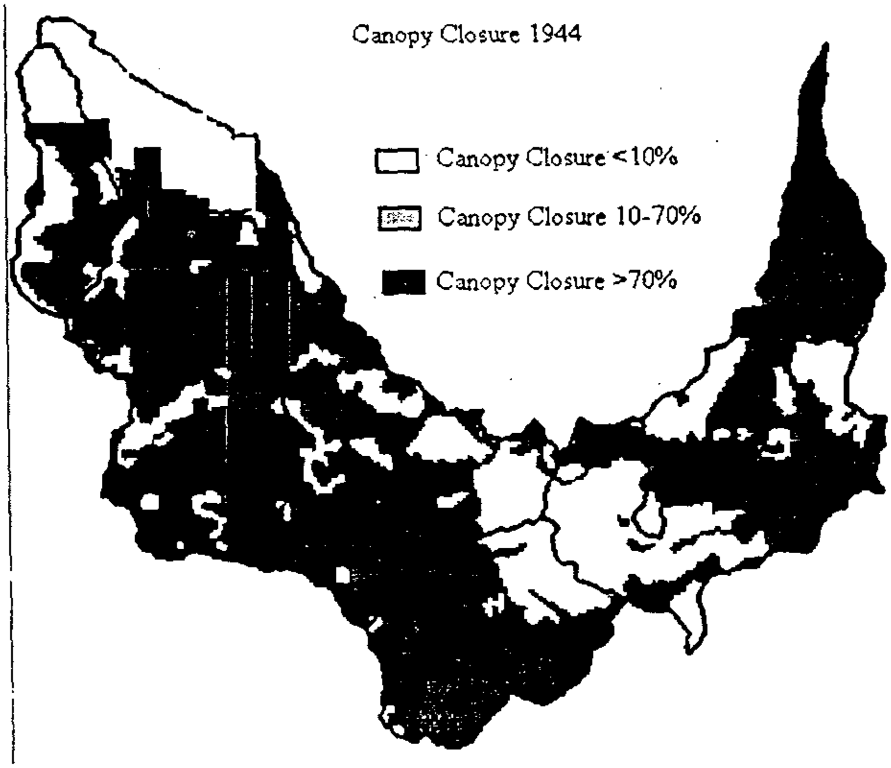


Figure 4-21 Canopy Closure Hydrologically Recovered Condition

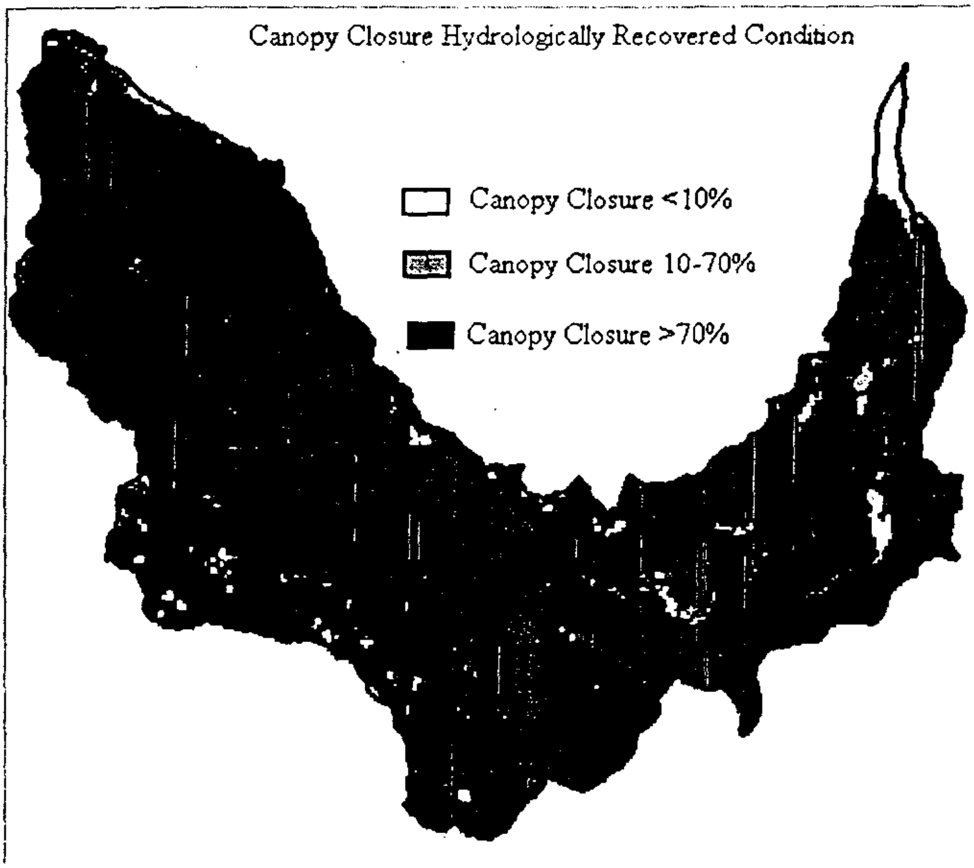


Figure 4-22, and Figure 4-23 detail changes in peakflows from a hydrologically mature condition.

Figure 4-22 - Peak Streamflows (Current Condition)

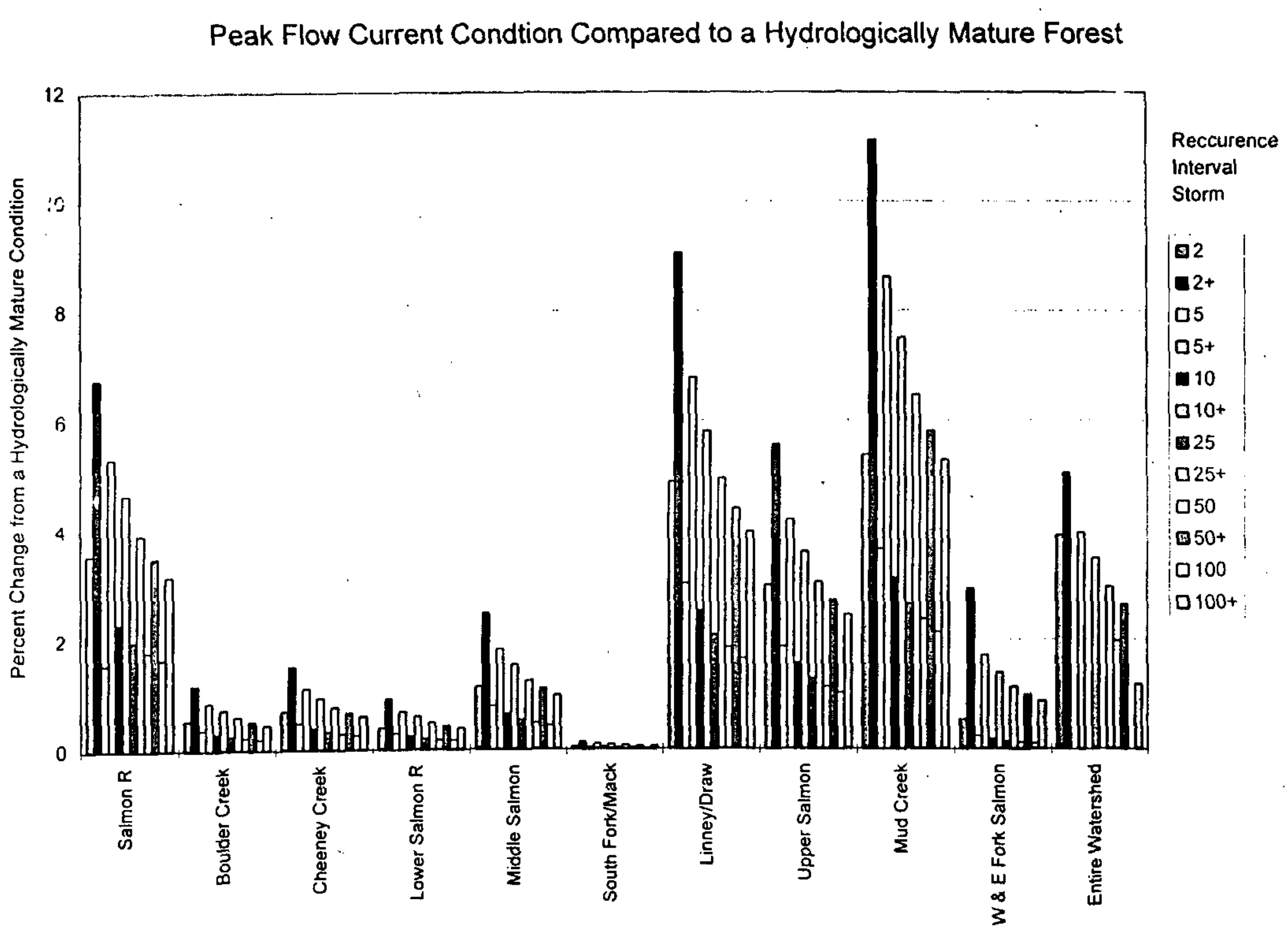
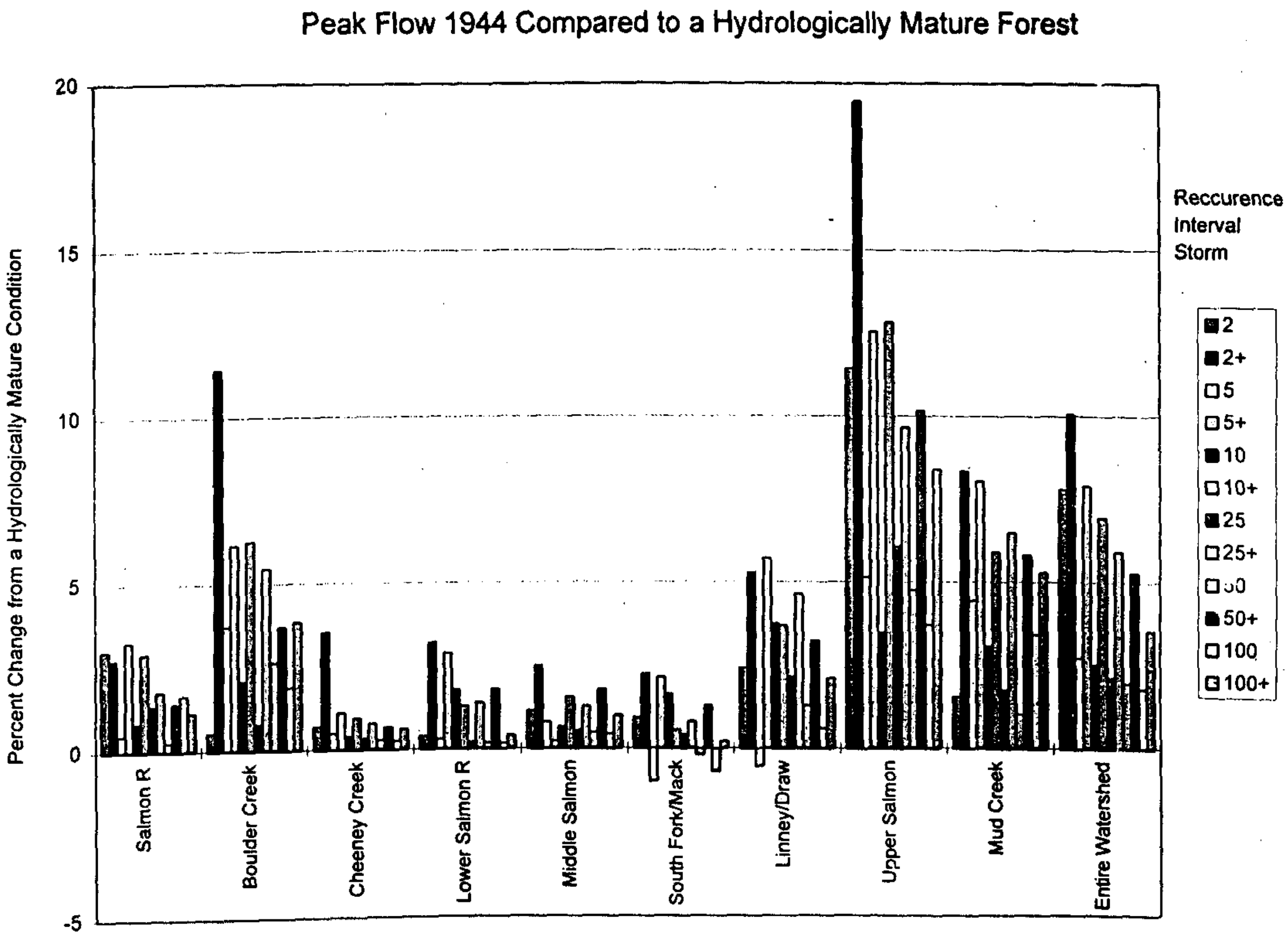


Figure 4-23 - Peak Streamflows 1944



Results

Figure 4-22, and Figure 4-23 detail increases for different recurrence interval peak streamflows. The largest increases are predicted for the 2+ storm. This is the storm with a two year recurrence interval and "unusual" weather conditions.

The threshold of concern for increases in peakflows based on this methodology is 10% , given the inherent error in the peak flow prediction method and that changes in peakflows of up to 10% are usually below detection limits using standard stream gauging methods. Based on this threshold of concern and current vegetative conditions Mud Creek is the only subwatershed with the potential for adverse effects from increased peak flows due to rain on snow events. There is an 11% increase in peakflows predicted for the 2+ storm in the Mud Creek subwatershed.

Of concern in the Salmon River is the effect of increased peakflows on the mobilization and scour of stream bed sediments and the resulting disruption of the egg incubation environment (redds). Salmonids generally bury most of their eggs at depths exceeding the mobile stream bed layer for the 2-year flood. Evolutionary strategy would suggest advantage to burying eggs at depths below the 2-year storm mobile bed layer, since scour frequency at shallower depths could affect populations on a nearly annual basis. Larger floods with greater volumes and duration of flow may cause deeper than "normal" scour of the gravel, however, these storms occur less frequently, they have a lower probability of affecting the entire population, but could have significant effects on the brood in the years they do occur (DNR 1993).

The increased mobilization and stream bed scour due to altered peakflows has the potential to degrade *Corydalis aqua-gelida* habitat by removing or altering gravel substrates necessary for germination and establishment of this species.

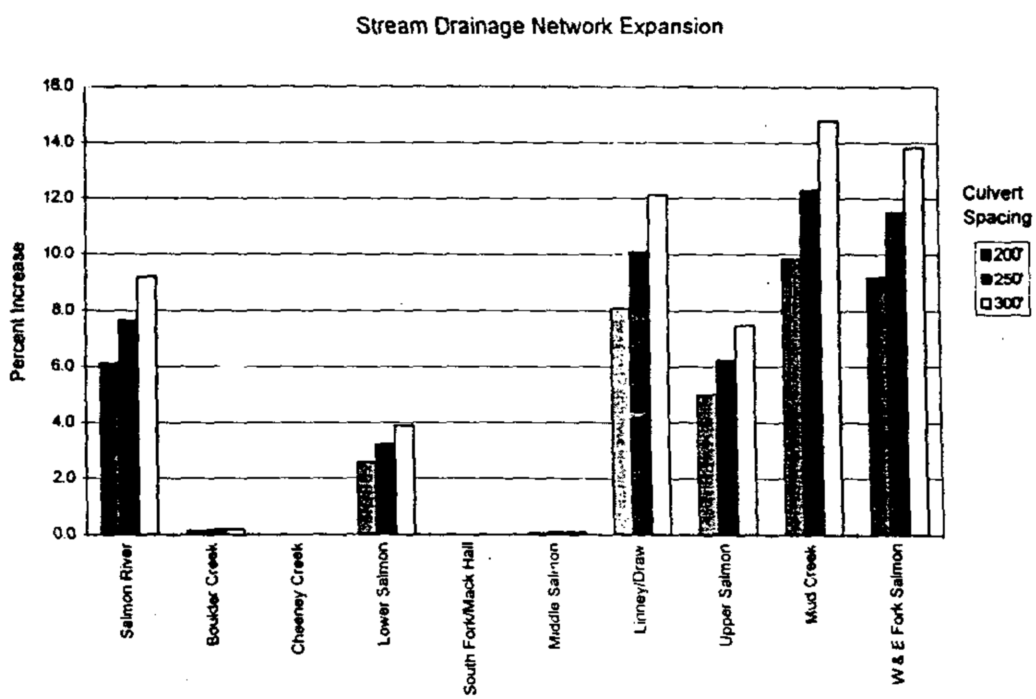
Currently, only Mud Creek is above the threshold of concern so resident fisheries may be affected, however based on the conditions of the watershed in 1944 and the distribution of unstable stream channel throughout the watershed increased peakflows may be affecting anadromous fish habitat. The most prevalent Rosgen channel type (see fish habitat section for a more complete description of channel types)in the anadromous section of the watershed is A3. These channels have a very high sensitivity to disturbance from changes in streamflow magnitude, a very poor natural recovery potential, very high sediment supply, and high streambank erosion potential. The channels within the anadromous section of the watershed may still be recovering from increased peakflows in the 1940's with sediment yields above background levels because of the unstable nature of the channels.

Stream Drainage Network Expansion

Current research has suggested that roads function hydrologically to modify streamflow generation in forested watersheds by altering the spatial distribution of surface and subsurface flowpaths. Observations suggest that roadside ditches and gullies function as effective surface flowpaths which substantially increase drainage density during storm events (B. Wemple, 1994). This increase in drainage density may effect the timing, duration and frequency of peak streamflows. An assessment of the increase in the channel network due to inboard ditches along roads has been completed using methodology that was developed on the Siskiyou National Forest (Elk River WA 1994).

Channel network expansion is calculated by counting the number of stream crossings within a watershed, multiplying that number by the distance to the first culvert up from the stream crossing and adding that distance to the stream network. This procedure adds the ditchlines from the stream crossing up to the first ditch relief culvert to the stream system. For this analysis it was assumed that the ditchlines on both sides of the stream crossing contributed to the increase in the stream network. Channel network expansion was calculated for 200', 250', and 300' culvert spacing since the exact culvert spacing for the subwatersheds could not be determined.

Figure 4-24 Stream Drainage Network Expansion



The analysis points out that there have been significant (greater than 10%) increases in the stream drainage network in Linney Creek, Mud Creek and West and East Fork subwatersheds.

Conclusions Peakflows

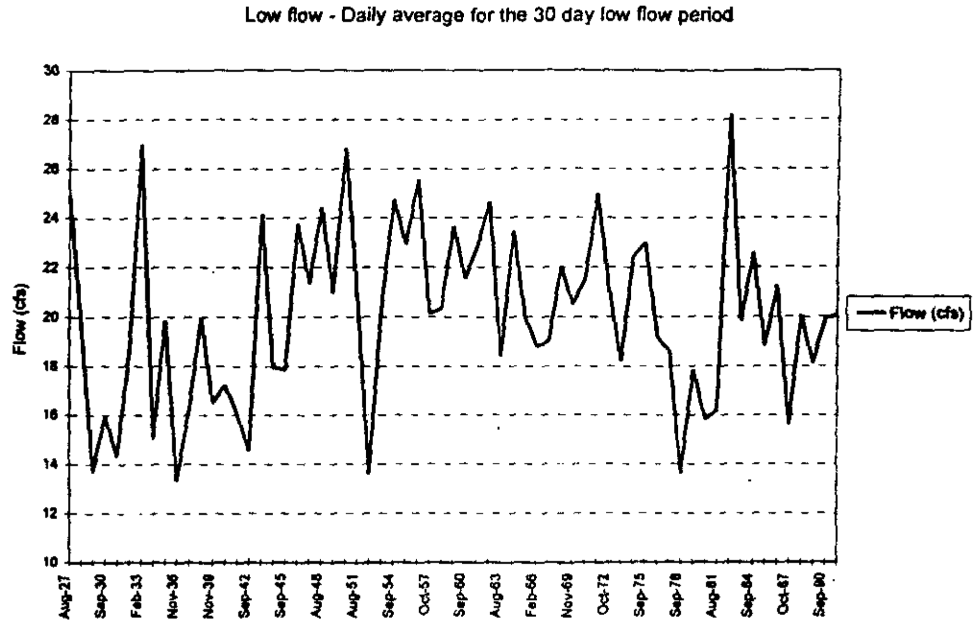
Mud Creek and Linney Creek subwatersheds are at or above the threshold of concern for increased peakflows from rain on snow events and/or increased stream drainage network. The link between increased peakflows from rain on snow events and road drainage network expansion has not been documented, however since these subwatersheds are at or above the threshold of concern for one or both of these processes they are of special concern with respect to increased magnitude of peak streamflows.

Baseflows

Baseflows are a critical component in maintaining aquatic habitat and wetlands in the Salmon River Watershed. The Aquatic Conservation Strategy requires that lands be managed to maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in wetlands and meadows.

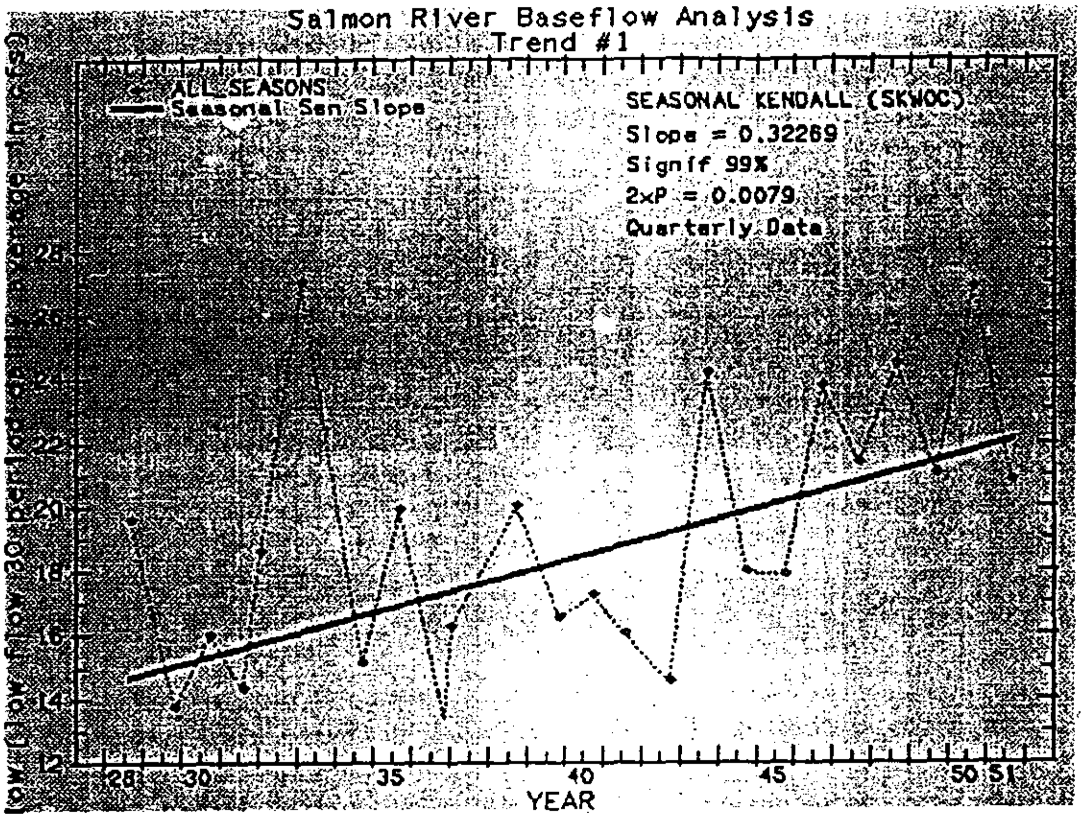
Baseflows in the upper watershed were felt to be very important in maintaining the Red-Top and Salmon River Meadows complex. With these areas in mind the trend in baseflows for the upper watershed was analyzed. This was accomplished by determining the average lowflow in cubic feet per second for a 30 day duration at the USGS gauging station above Salmon River Meadows. A 30 day duration was used because it was felt to reflect the influence of baseflows on maintaining inundation and water table elevation in wetlands and meadows. Figure 4-25 details the baseflows from 1926-1991.

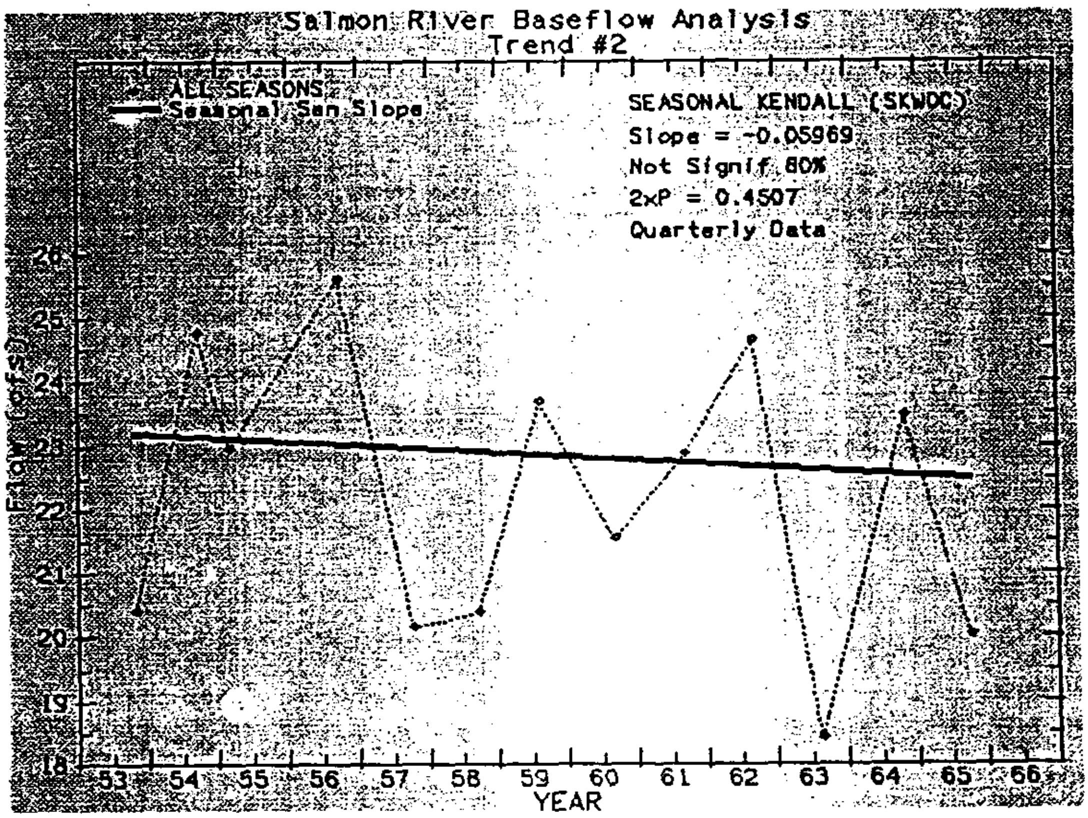
Figure 4-25 - Baseflow Upper Salmon River

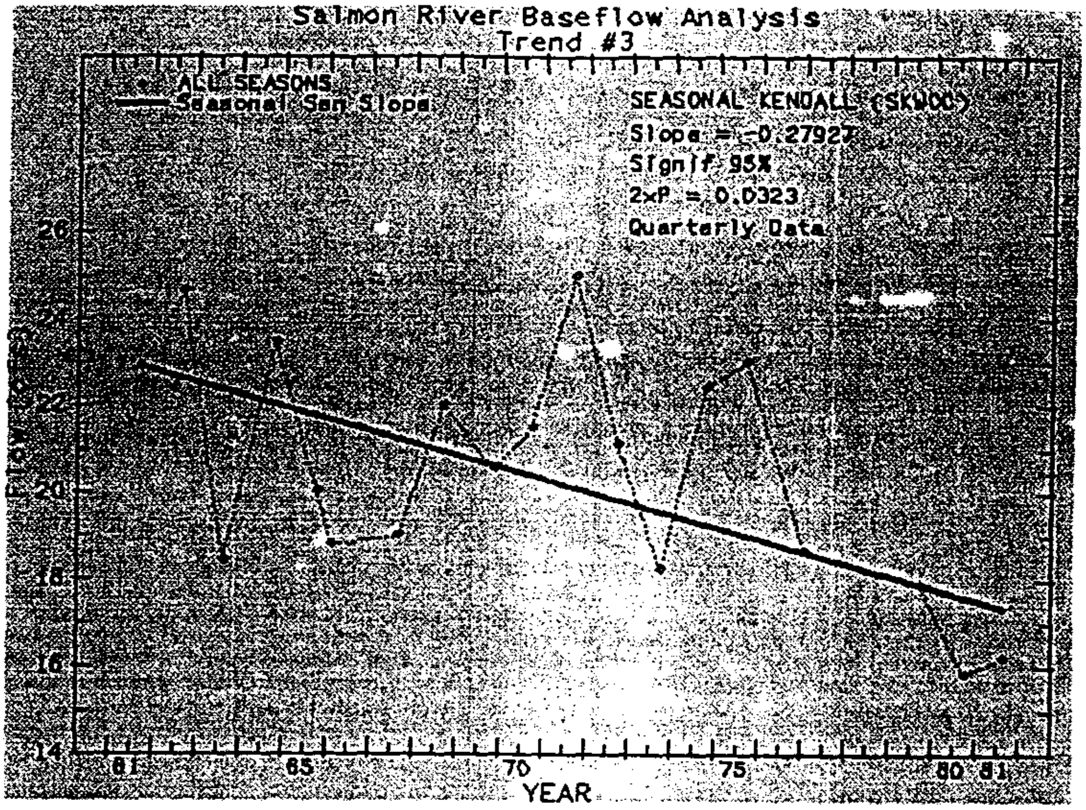


In order to assess a trend in the baseflow regime the Season Kendall Test Without Correction For Correlation (SKWOC) was completed for the upper watershed. This test compares only those data points within the same season (3 months) and the final test statistic is composed of a linear combination of individual statistics from different blocks. The results are displayed in figure 4-26.

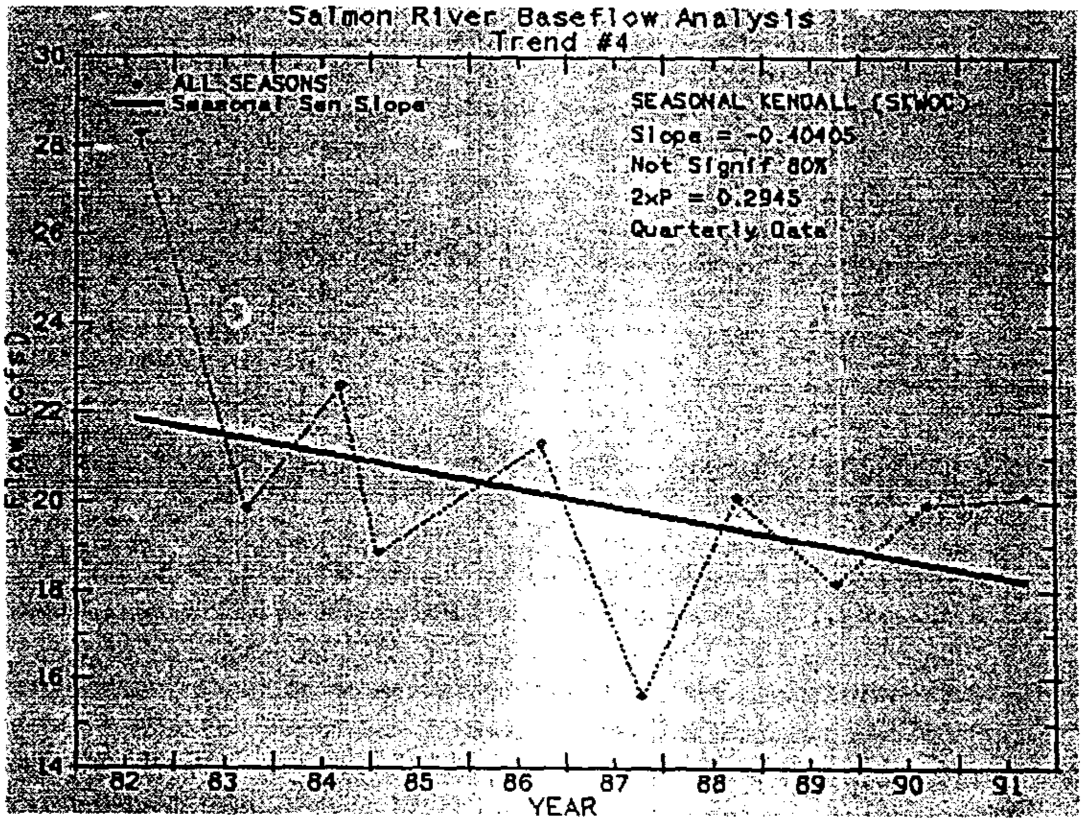
Figure 4-26 Baseflow Trends







Salmon River Baseflow Analysis
Trend #3
ALL SEASONS
Seasonal Sen Slope
SEASONAL KENDALL (SKWOC)
Slope = -0.27927
Signif 95%
2xP = 0.0323
Quarterly Data
Flow (cfs)
YEAR
61
65
70
75
80 81
14
16
18
20
22
24
26



Salmon River Baseflow Analysis
Trend #4
ALL SEASONS
Seasonal Sen Slope
SEASONAL KENDALL (SKWOC)
Slope = -0.40405
Not Signif 80%
2xP = 0.2945
Quarterly Data
Flow (cfs)
YEAR
82
83
84
85
86
87
88
89
90
91
14
16
18
20
22
24
26
28
30

Based on this analysis there are two significant trends. An increasing trend in baseflows from 1927 to 1951 and a decreasing trend from 1961 to 1981. To determine if there was a relationship between snowpack and baseflows, April snowpack in snow water equivalent and baseflows were compared using linear regression analysis and there was not a good correlation between the two variables (r^2 =.22).

After climatic influence due to snowpack was eliminated as the causal factor for the reduction in baseflows management activities in the upper watershed in the period around 1950 were examined. The only major activity during this period was the construction of the Timberline road which was completed in the early 1950's. Examination of aerial photos shows that a drainage in the vicinity of the parking lot at Timberline Lodge may have been diverted from the East Fork to the West Fork of the Salmon River. However, no clear relationship between either climatic or management activities and baseflow could be established.

Sediment Production

Surface erosion occurs when the mineral soil surface is exposed to water from rainfall, snowmelt or runoff. Compacted surfaces increase runoff velocity and susceptibility to erosion. In forested ecosystems, trees, understory vegetation and litter and duff combine to effectively protect most soil surfaces from surface erosion. Surface erosion can result in reduced soil productivity. In addition, transport of eroded materials to water resources such as stream channels can reduce water quality and diminish aquatic habitat. Soil erodibility is influenced by soil characteristics that affect infiltration, permeability, water holding capacity, and aggregate stability. The transport of eroded materials to a water body is influenced by a number of site specific factors: slope gradient, slope length and shape, surface roughness, vegetation cover, texture of the eroded material, delivery distance and concentration of the water flow (USEPA-USDA Forest Service, 1980).

Mass Wasting

Mass wasting is the primary source of sediment in the lower watershed (Salmon, Boulder, Cheeney, Lower Salmon, South Fork/Mac Hall, and Middle Salmon subwatersheds). Sediment supply in the lower portion of the watershed is tied to high intensity, low frequency rainfall events which are thought to initiate debris slides and debris flows in the colluvial headwalls. There is evidence for a large number of debris flows associated with the high intensity rain-on -snow event in 1964. Additionally, small debris flows were observed contributing sediment to the Salmon river near Wildwood following the high intensity rainfall events in October/November 1994. Debris flows transporting sediment to the mainstem would likely occur during coincident high flows. The occurrence of major sediment pulses tied to infrequent storm events is estimated to result in short term effects to aquatic organisms.

Surface Erosion

Surface erosion in the lower watershed is tied to processes which disturb soil litter and duff cover. The high intensity fire recorded at the turn of the century in the Salmon watershed would have generated a large pulse of sediment the first winter following the disturbance. Surface erosion is expected to have continued at decreasing rates until recovery to undisturbed levels an estimated 5-10 years following fire disturbance. Surface erosion from forest management activities on national forest lands in the lower watershed is mainly tied to recreation activities and roads with a high delivery potential to streams. The average annual rate of surface erosion is predicted to be much lower than that for mass wasting in the lower watershed. However, surface erosion supplies a chronic background rate of sediment above undisturbed conditions as compared to the infrequent, large pulses of mass wasting events.

In the High Cascades province of the upper watershed, surface erosion processes dominate on the moderate slopes. Natural rates of surface erosion in forested watersheds is measured to be quite low (Swanson, F. and G.Grant, 1982; USEPA-USDA Forest Service, 1980). Activities within the Salmon watershed that commonly increase the susceptibility of a site to surface erosion through the exposure of bare soil include timber harvest and site preparation, road construction, recreational uses, and grazing. In addition to sediment production from surface erosion, sand applications to snow-covered highway surfaces are a source of sediment in the watershed. In the upper watershed, mass wasting is less important in the natural sediment regime and it is here that the majority of management related surface erosion is produced. Only those sediment sources with high potential for delivery were considered in this process. The process used to evaluate the sediment regime in the watershed is described fully in the appendix.

Results

Modeling results suggest existing roads and highway sanding are the largest contributors to potential sediment in the watershed. Total road miles as well as landform and proximity to water resources were factors that most influenced predicted sediment levels from existing roads by subwatershed. Table 4-8 summarizes road related sediment information. The West and East Forks Salmon subwatershed had the highest sediment contribution for an individual subwatershed and on a per area basis (it is one of the smaller subwatersheds). The high stream density in the West and East Forks results in a high number of road crossings and delivery potential. The Salmon river subwatershed also has a high sediment contribution on a per area basis. Of the 6.73 miles of roads with high sediment delivery potential in this subwatershed, 90 percent (approximately 6 miles) are on private lands. Model results for individual sediment sources within the watershed are presented in Appendix A.

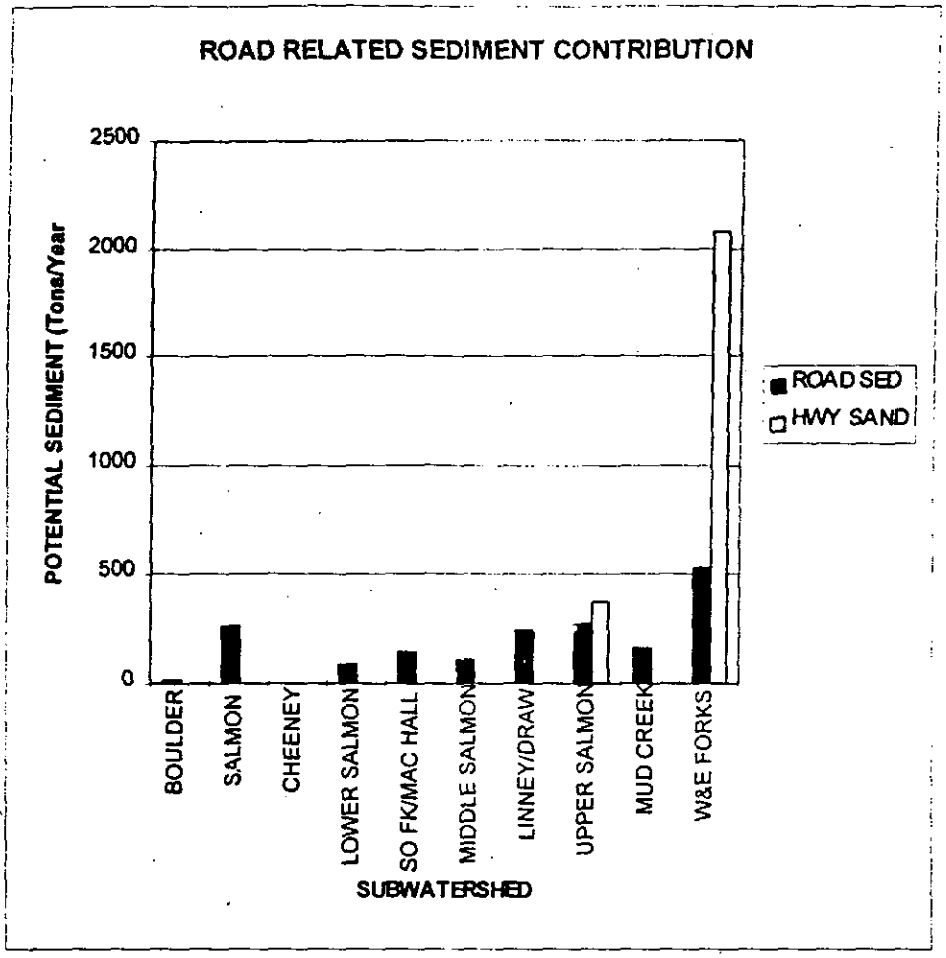
Potential sediment from highway sanding was computed given actual application rates obtained from Oregon Department of Transportation. Highway sanding contributes direct sediment input into the West and East Fork Salmon and Upper Salmon subwatersheds. Total sand application was then reduced to account for end of season sand removal by the Department of Transportation. The effectiveness of mitigation measures to reduce runoff of sand directly from the highway to the river and its tributaries was not quantified for this analysis. Field observations confirm the sediment barriers along highway 26 south of the 26/35 junction are somewhat effective in reducing sand input to the Salmon river. Mitigation measures in the West and East Fork drainage were observed to be less effective. Per mile sanding rates are greatest along highway 35 from the junction with highway 26 to the watershed boundary.

Road sand has been observed to flow across the forest floor for up to 50 feet. While this material fails to be delivered to the stream in the current year, it can form deposits several inches thick. In small areas, existing ground vegetation has been covered and replaced by species adapted to higher moisture regimes.

Table 4-8 - Road Related Sediment Contribution by Subwatershed

SUBWATERSHED	TOTAL ROAD MILES	ROAD DENSITY	MILES WITHIN 300 FEET OF STREAMS	ESTIMATED ROAD SEDIMENT (Tons/Year)	HIGHWAY SANDING SEDIMENT (Tons/Year)
Boulder	.60	.08	.44	18.12	
Salmon	24.79	2.84	6.73	262.05	
Cheeney	.02	0.00	.04	1.57	
Lower Salmon	3.96	.68	4.01	88.06	
South Fork/Mac Hall	2.87	.23	2.52	143.15	
Middle Salmon	3.82	.18	.73	106.18	
Linney/Draw	33.33	2.16	4.53	248.63	
Upper Salmon	27.08	1.42	7.50	270.30	376.97
Mud Creek	24.82	3.61	3.43	160.46	
West & East Forks	28.72	3.60	8.51	533.62	2082.57

Figure 4-27 Road Related Sediment Contribution by Subwatershed



There is a high potential for sediment from the forest roads evaluated to contribute to reduced water quality and habitat degradation within the watershed.

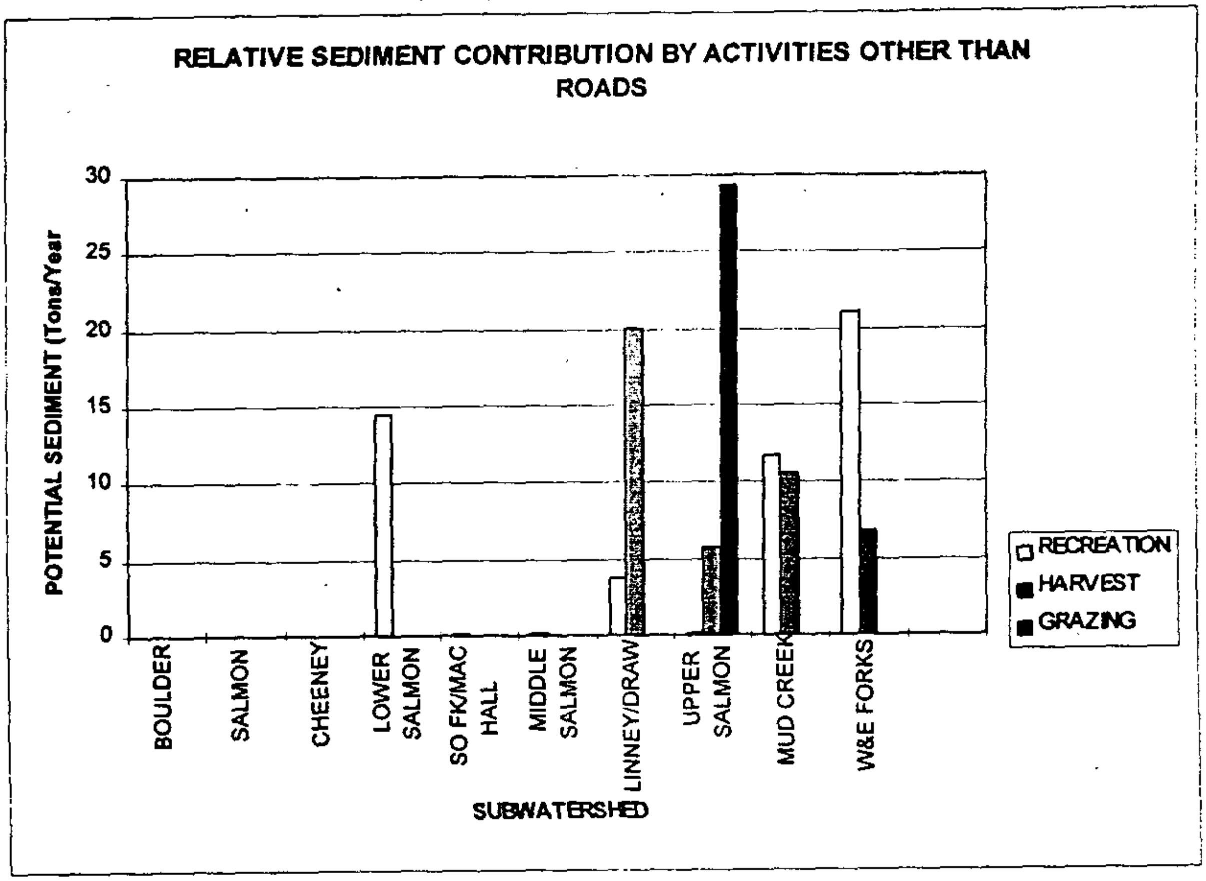
Figure 4-28 summarizes the relative sediment contribution among other ground disturbing activities within the watershed. When compared with levels of potential sediment from roads and highway sanding, these activities contribute a much lower level of potential sediment. Harvest related sediment was highest overall in the Linney/Draw subwatersheds. However, when considered on a unit area basis over the subwatershed, the West and East Forks have the highest overall impact followed by Linney/Draw and Mud Creek. No information was available on site preparation activities.

Recreation related sediment was highest overall in the West and East Fork drainage when developed and dispersed campgrounds and the airstrip are tallied. Unit area impacts are highest in Mud Creek, followed by Lower Salmon and the West and East Fork.

Grazing impacts in the watershed are confined to the Upper Salmon in Jackpot and Dry Meadows. While grazing has been observed to result in only a small amount of effective ground cover loss in this area, the erosion factor of this area is relatively high.

Potential sediment contribution from all sources was greatest overall for the West and East Forks subwatershed followed by Upper Salmon. Restoration activities and mitigation measures to reduce erosion would be efficacious in these drainages.

Figure 4-28 Relative Sediment Contribution by Activities Other Than Roads



Sediment Delivery

The consideration of sediment production at the subwatershed level can assist in the identification of priorities for mitigation and restoration. In order to assess the potential impact on in-channel habitat, low gradient reaches which provide habitat for aquatic species of concern were identified. As the following map displays, depositional reaches are often associated with stream junctions.

Key depositional reaches were identified to simiplify the analysis. The key reaches are Salmon Meadows (Ghost creek/Salmon river confluence), the confluence of Mud Creek with the mainstem of the Salmon, the confluence of Linney and Draw creeks and the Fly Fishing Bridge along road 2618. For these key reaches, potential sediment delivery and deposition to those points was calculated. Fine sediment delivery to stream channels and transport to depositional reaches within the watershed can alter substrate competition important to aquatic species (invertebrates, amphibians, fish and plants). Cumulative sediment delivery to these sites is displayed in Table 4-9

Figure 4-29 Key Depositional Reaches within the Watershed

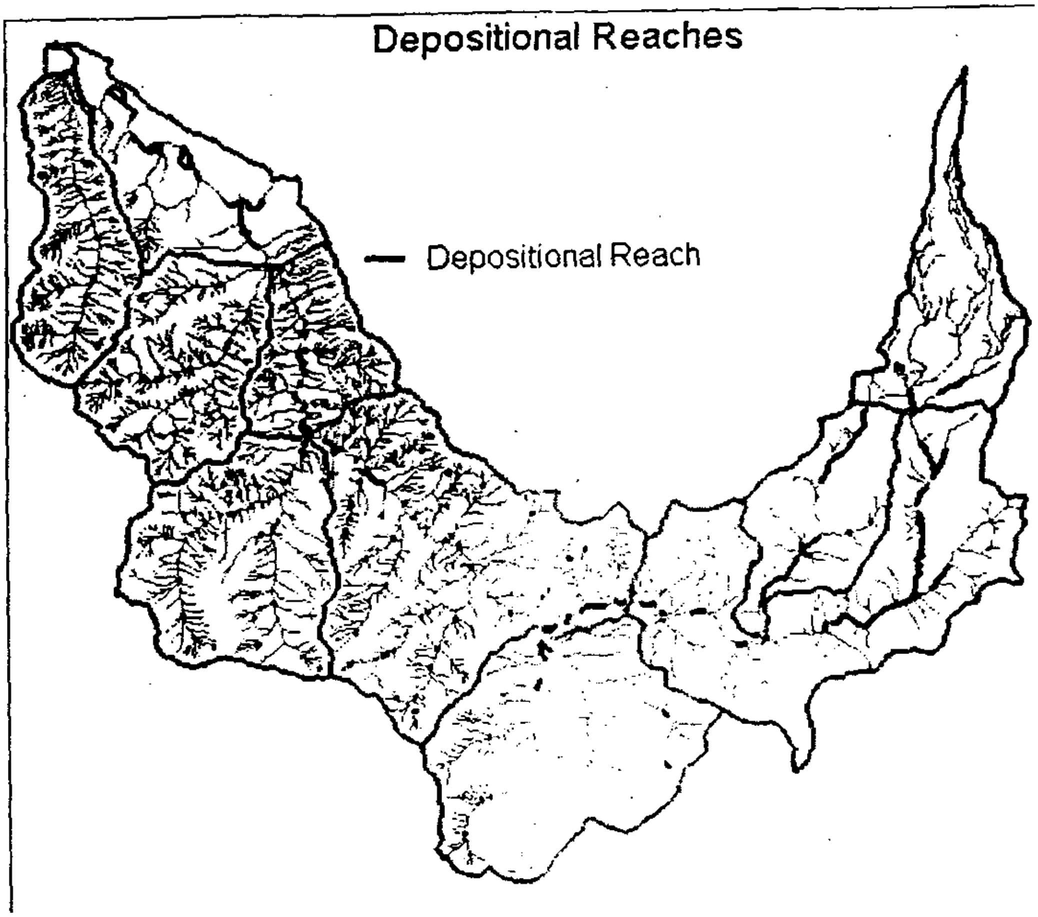


Table 4-9 Cumulative Sediment Delivery at Key Reaches

KEY DEPOSITIONAL REACH	ESTIMATED SEDIMENT DELIVERY (Tons/Year)
SALMON MEADOWS	3,081
MUD CREEK	183
LINNEY/DRAW	273
FLY FISHING BRIDGE	2,892

Sediment delivery from modeled surface erosion rates are of concern to all of these reaches as they have been identified as providing habitat for known aquatic species of concern. While field observations have confirmed that erosion and transport to streams from roads and highway sanding is occuring, actual erosion and deposition rates have not been measured (see Chapter 7, Monitoring). Restoration activities that reduce potential erosion and deposition may be prioritized when impacts are considered on a per area basis.

Of greatest concern on a per area basis is the potential sediment deposition in the Salmon Meadows reach. There are numerous terrestrial and aquatic species that could be affected by sediment deposition and habitat alteration within the wetland complex.

The reach with the second highest concern for per area potential depositional is the Mud creek confluence. Potential sediment yield and deposition within this reach could affect resident fish and amphibian populations.

Potential impacts in the Linney/Draw key reach include alteration of a known population of *Corydalis aqua-gelidae*. On a per area basis, Linney/Draw would have a lessor concern for depositional impacts than Salmon Meadows and Mud creek.

While the reach above the Fly Fishing Bridge has the highest overall sediment delivery, surface erosion from management activities within this reach is considered to be negligible when geologic rates of erosion are considered. The geologic erosion in this reach is greatly influenced by mass wasting and surface erosion inputs. Erosion from mass wasting in this area would be associated with infrequent, high intensity storms. Mass wasting would produce large, episodic pulses of sediment. In contrast, surface erosion in this reach would be characterized by much smaller inputs associated principally with first flush rainfall events.

Conclusions

Restoration priorities to reduce sediment within the watershed should focus on the greatest potential sources identified above: highway sanding and roads. Reducing sediment from roads can be further prioritized by proximity to stream, surfacing type, cut and fill slope vegetation and landform. Erosion from grazing can be effectively reduced through grazing exclosures in riparian reserves. While modeled erosion rates for sediment supply from recreation sites were low, revegetation and site hardening would assist in the reduction of erosion and improve aesthetics. Further recommendations for restoration priorities can be found in Chapter 7.

Water Quality

Water quality was assessed by examining existing data for violations of state water quality or Forest Plan standards and assessing management activities for their effect on water quality. The initial data source examined was *The Summary of the Water Quality Mapping* from *DEQ Oregon Statewide Assessment of Nonpoint Sources of Water Pollution* with respect to Salmon River watershed.

Table 4-10 - Water Quality Information

	TURBIDITY	NUTRIENTS	SEDIMENT	EROSION	STRUCTURE
410 Salmon River	M2	M2	M2	M2	M2
411 So. Fork Salmon	-	M2	-	M2	-
412 Linney Creek	-	M1	-	M1	-
413 Boulder Creek	-	-	-	-	-
420 Ghost Creek	-	-	-	-	-

M1=Moderate problem with data
M2=Moderate problem observation

As table 2 details most of the water quality impacts listed are based on observations and not data, so there is no way to determine the extent of the impact.

The Salmon river is a candidate to be listed as and Outstanding Resource Waters under the State-Wide Water Quality Management Plan (Oregon Administrative Rules, Chapter 340, Division 41). The priority for waterbodies to be nominated is:

1. National Parks
2. National Wild and Scenic Rivers
3. National Wildlife Refuges
4. State Parks
5. State Scenic Waterways

In designating Outstanding Resource Waters water quality values to be protected will be designated and allowable activities that will not affect outstanding resource values are identified. This has not been completed for Salmon River.

Based on recommendations from the Wild and Scenic River plan, water quality monitoring was implemented in September of 1991 at five stations throughout the watershed for the variables listed in table 2. Grab samples were collected once a month from September 1991 until the present.

Table 4-11 - Variables Monitored with Wild and Scenic River Plan Monitoring

VARIABLE	CONCERN
Enterococci	Fecal contamination
Fecal coliforms	Fecal contamination
Total coliforms	Fecal contamination
Alkalinity	Rock mineral dissolution
Dissolved nitrogen	Nutrient inputs
Kjeldahl nitrogen	Nutrient inputs
Phosphorous	Nutrient inputs
Potassium	Nutrient inputs
Sodium	Salt inputs
Sulfide	Quantify groundwater inputs/Wastewater
Suspended solids	Sediment inputs
Ethylene	Hazmat spills or contamination
Benzene	Hazmat spills or contamination
Toluene	Hazmat spills or contamination
Xylene	Hazmat spills or contamination
Air temperature	To be used in conjunction with water temperature
Water temperature	Altered stand or channel structure
Conductivity	Salt inputs
pH	Salt inputs
Turbidity	Sediment inputs
Flow	Altered flow regime
Dissolved oxygen	point sources or introduction of organic material

Figure 4-30 Water Quality Monitoring Stations

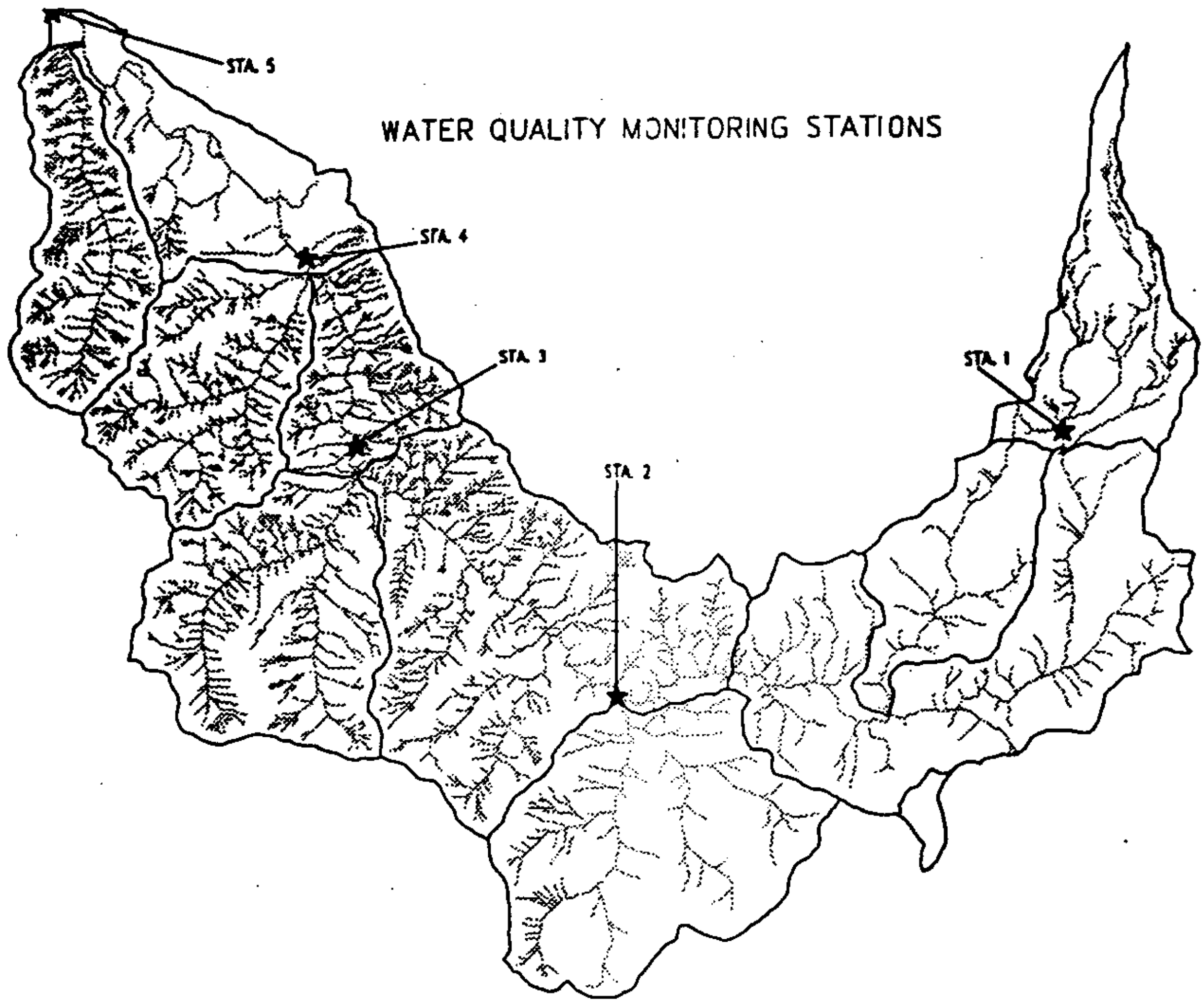


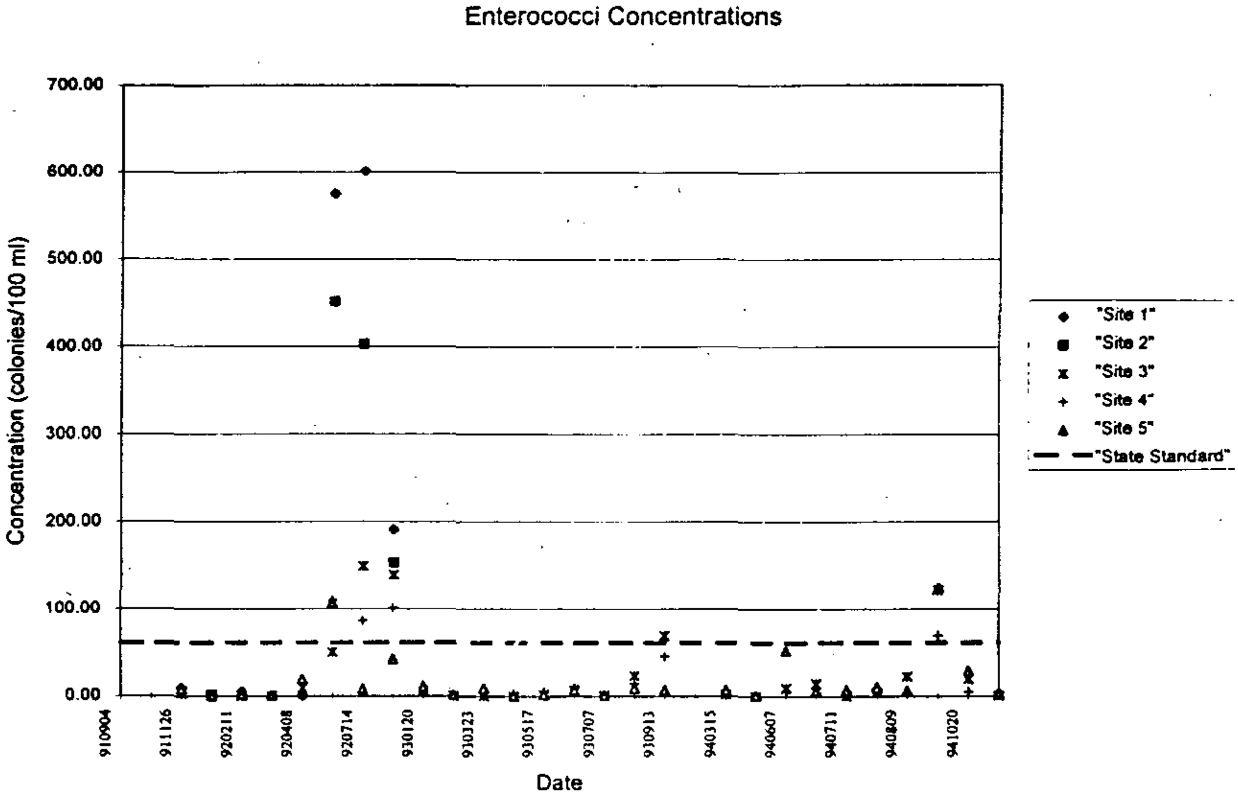
Table 4-12 Current and past managment activities with the potential to alter water quality

MANAGEMENT ACTIVITY	ASSOCIATED VARIABLE
Palmer snowfield salting	Conductivity and sodium
Timber harvest and associated roading	Stream temperature, turbidity and suspended solids, dissolved oxygen, dissolved nitrogen
Road sanding	Turbidity and suspended solids
Timberline lodge and developed recreational sites	Enderococci, turbididty and suspended solids

Enterococcus

Enterococcus is part of the larger fecal streptococci group which is found in the intestines of warm blooded animals. The enterococcus group of bacteria is a useful monitoring variable because it is a good indicator of the risk of gastrointestinal illness in recreational waters (Vasconcelos and Anthony, 1985). The water quality standard for the Sandy basin for bacteria of the entrococcus group is no single sample shall exceed 61 enterococci per 100 ml.

Figure 4-31 - Enteroccocus Levels



In addition to the water quality monitoring completed in association with the Wild and Scenic River Plan macroinvertebrates were sampled on June 29, 1992. Analysis of the macroinvertebrate community indicated high levels of simuliid larvae (black flys) at stations 1 and 2. Simuliid larve are associated with organic loading and a generally found attached to rocks in riffles.

Monitoring results indicate that enteroccocus bacteria levels have been above the state standard in 1992, 1993 and 1994. Highest levels were recorded at sites 1 and 2 (where levels of the simuliid larvae were highest) which would indicate the source of the bacteria is in the upper watershed. The high level of enteroccocus bacteria at the upper station is suspected to be related to the failure of the drainfield for secondary sewage treatment at Timberline Lodge. A 3000 gallon holding tank was installed to take the place of the drainfield by chlorinating the effluent. Monitoring results indicated that the holding tank was effective in treating the effluent. The new drainfield was completed in August of 1995 and is currently being used.

Problems with sewage treatment facilities have also been documented on private land within the Wapintia area. This may account for the high levels of bacteria and simuliid larvae at station 2.

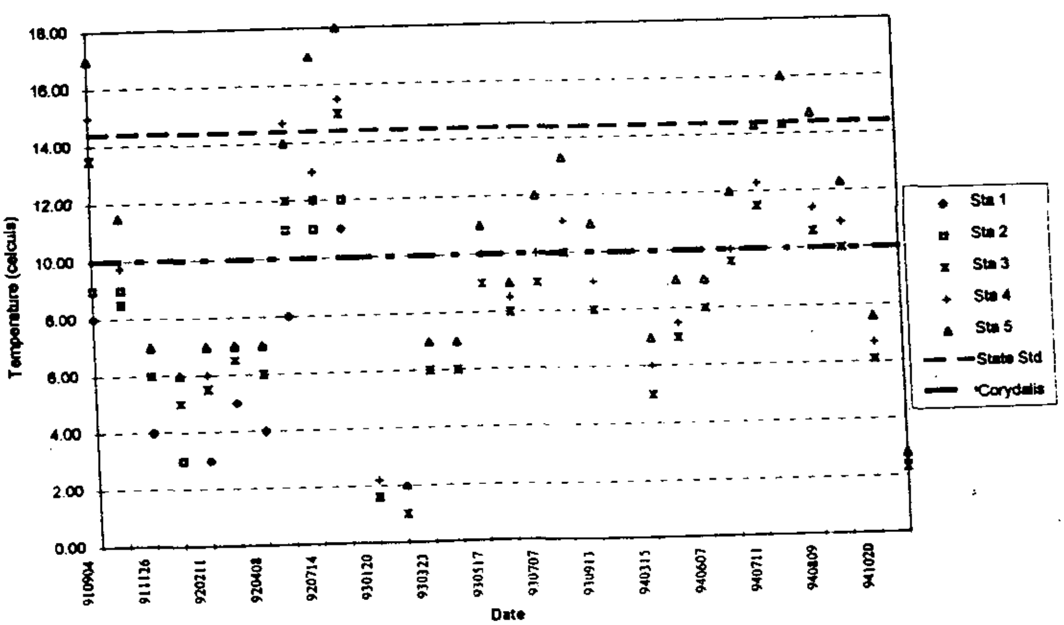
Temperature

Increased water temperatures have the potential to increase biological activity. A rise in summertime water temperature may increase the growth rate and productivity of many aquatic organisms (Beschta et al., 1987). The state standard for water temperature in the Sandy subbasin states that no measurable increases in stream temperature shall be allowed when stream temperatures exceed 14.4^0 C (58^0F).

The optimal temperature range for most salmonid species is approximately 12-14^0C. Lethal levels for salmonids are generally in the range of 20-25^0C. Spawning coho and steelhead may be intolerant of temperatures above 10^0C (Beschta et al., 1987).

Of special concern in the Salmon River watershed is *Corydalis aquae-gelidae* which is a Mt. Hood sensitive plant and a candidate for federal listing. Substrate temperatures at *Corydalis aquae-gelidae* sites on the Mt. Hood N.F. average 10^0C. *Corydalis aquae-gelidae* has been documented in Linney Creek and Draw Creek and near the confluence with the Salmon River and the mainstem of the Salmon River near Green Canyon campground.

Water Temperature

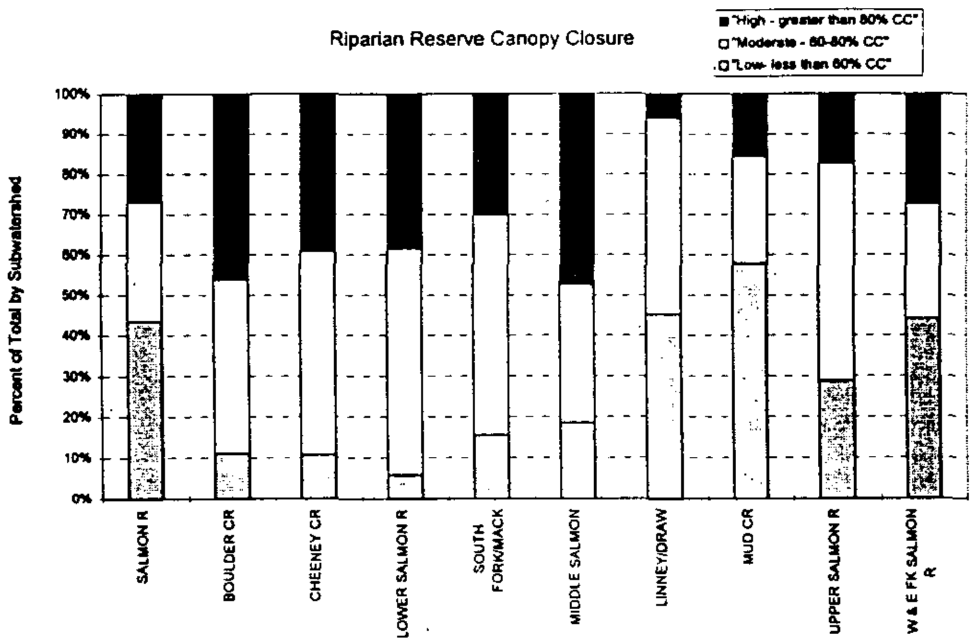


Stations 4 and 5 were above the state standard in 1992 and 1994 with a maximum temperature of 18^{0}C at station 5 on August 11, 1992. While stations 3, 4 and 5 were above 10^{0}C , only station 3 is of concern because of the *Corydalis aquae-gelidae* population below that site.

Stream Shade

Direct solar radiation intercepting the stream surface is the principle factor in raising stream temperature in forested watersheds (Brown, 1969). Management activities have the potential to alter the amount of solar radiation intercepted by the stream surface by altering riparian vegetation and channel form. In order to assess the effects of management on stream shade, and the associated increase in solar radiation intercepted by the stream surface, canopy closure within the riparian reserves was calculated by subwatershed.

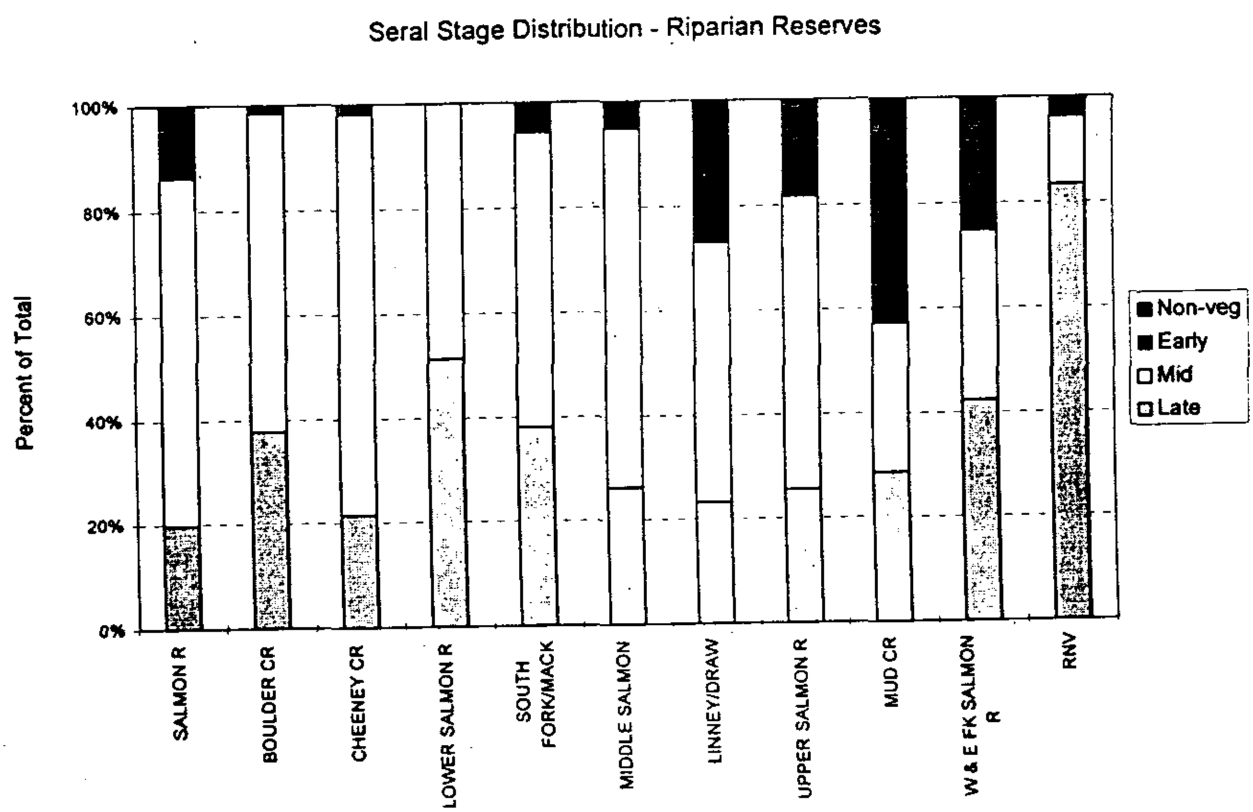
Figure 4-32-Riparian Reserve Canopy Closure by Subwatershed



Subwatersheds in the wilderness (Boulder Creek, Cheeney Creek, Lower Salmon River, South Fork/Mack Hall and Middle Salmon) were felt to indicate the undisturbed condition for riparian shade in the Salmon River watershed (10 to 20% of the area in the low shade category). Linney/Draw, Mud Creek and W & E Fork Salmon subwatersheds have considerably lower levels of shade (over 40% in the low shade category) which indicates management activities have had some impact on stream shade levels. The exception maybe W & E Fork Salmon which is in the alpine area and may have naturally lower levels of riparian shade.

A comparison of riparian seral stage distribution to the range of natural variation in the Sandy subbasin was completed. The entire Salmon watershed has less late seral stands in the riparian area than the range of natural variation. This is attributed to recent fire history in the watershed. The subwatersheds in the wilderness have approximately 95% of the area within the riparian reserves in mid and late seral conditions. There is considerably more early seral stand structure in Mud and Linney Creeks (37% and 27%) than within the range of natural variation (4%) or subwatersheds within the wilderness.

Figure 4-33 Seral Stage Distribution



The following figure shows that the percent of early seral structure within Mud and Linney Creek corresponds very well with the amount of regeneration harvest in these watersheds.

Figure 4-34 Harvest Within Riparian Reserves

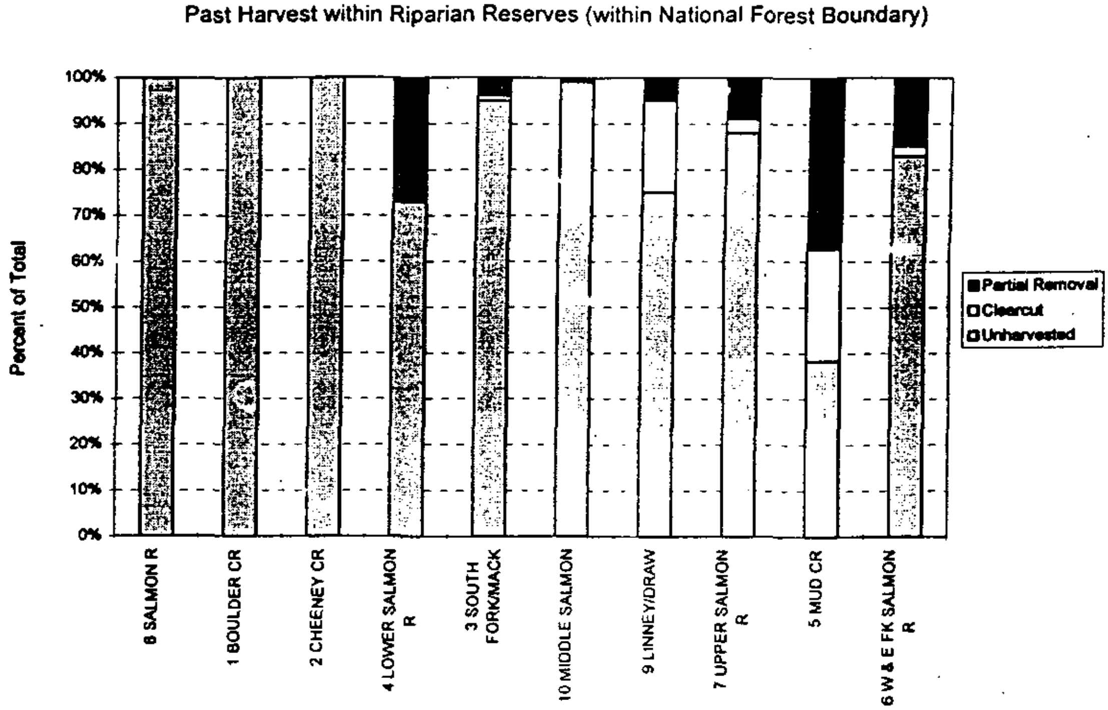
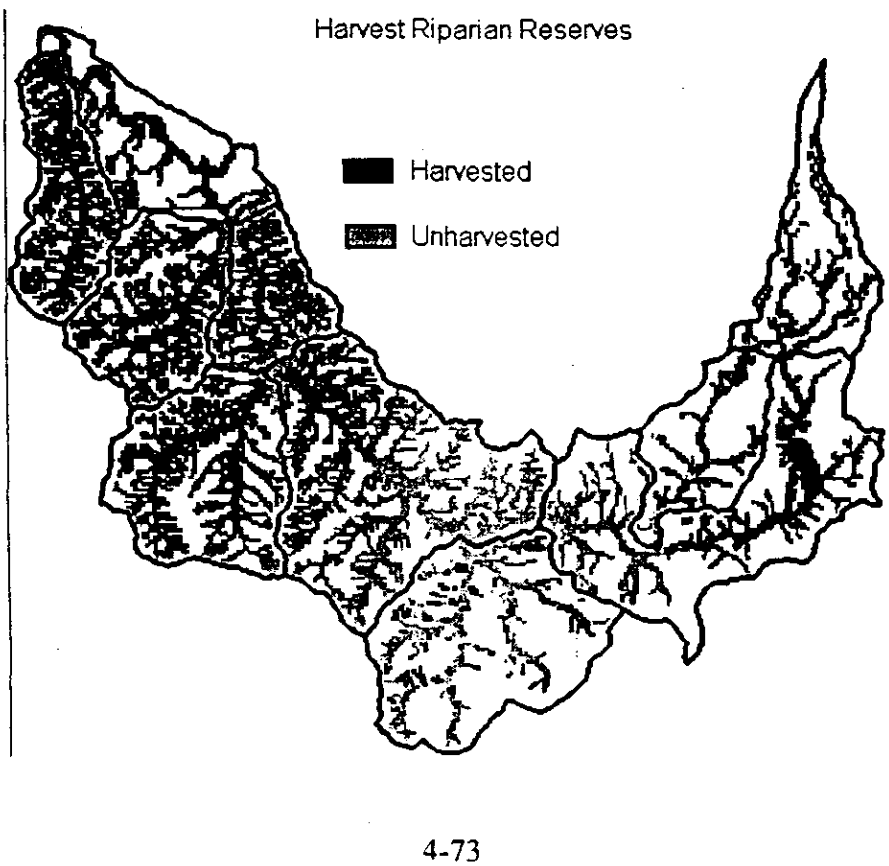


Figure 4-34 does not account for historical harvest in Boulder and Chenney Creeks.

Figure 4-35 Riparian Reserve Harvest Levels



Based on the stream shade analysis stream temperatures records for Mud and Linney Creek were examined. The only stream temperature data available for Linney Creek was from the SMART database. Temperatures ranged from 42 to 49^{0}F (during survey years 1989-1994), which is below state water quality standards. This also indicates good conditions for *Corydalis aquae-gelidae* since it is below average temperature for this aquatic species. Mud Creek data from continuous stream temperature monitoring for 1990 and 1991 is displayed in Figure 4-36 and Figure 4-37. The data for 1990 was collected below Trillium lake where Mud Creek crosses road 2656903. The data for 1991 was collected at the bridge on road 2656309 on a tributary to Mud Creek just above the confluence with Mud Creek.

Figure 4-36 Mud Creek 1990

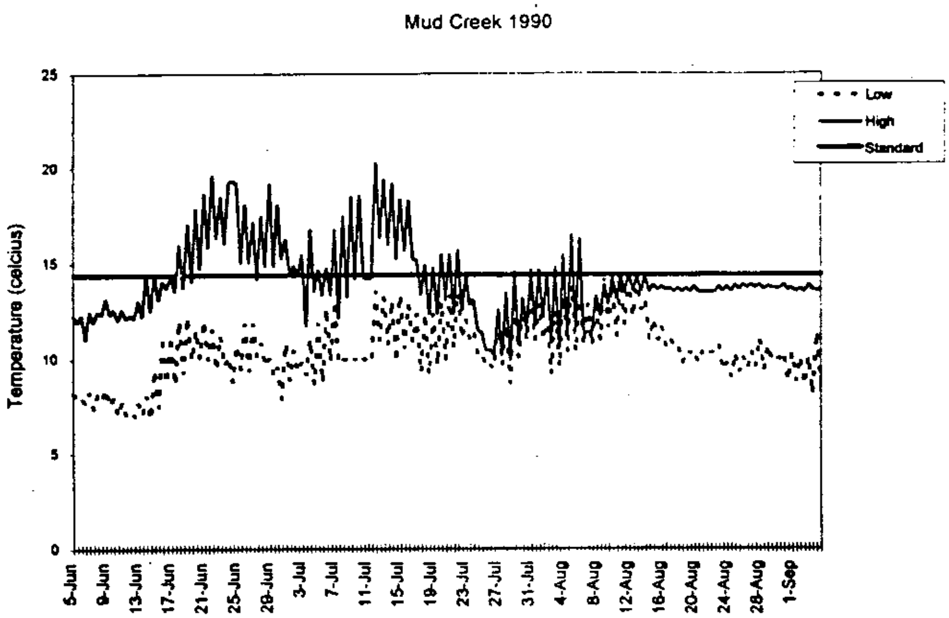
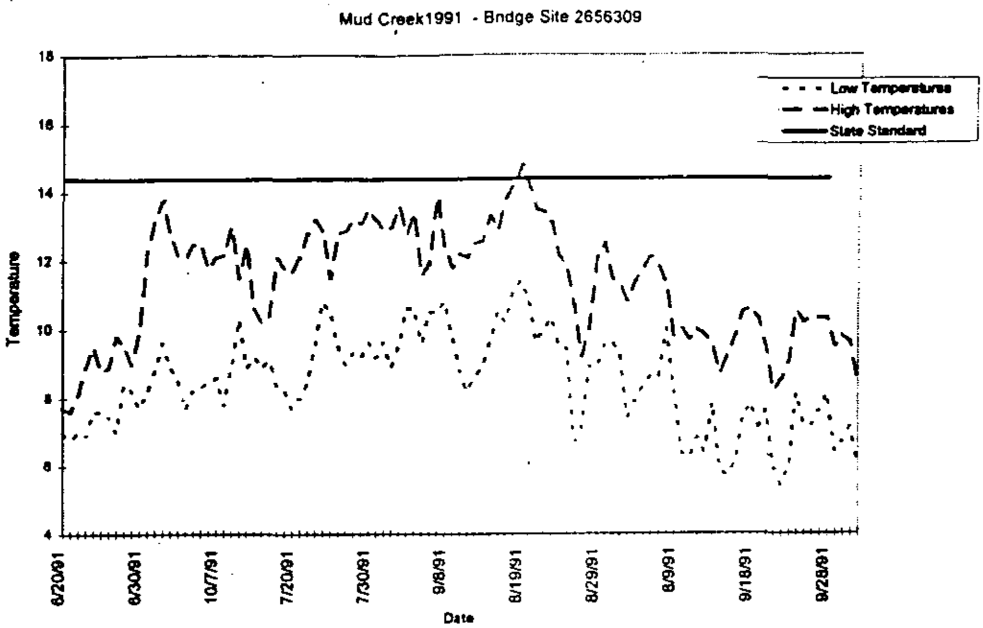


Figure 4-37 Mud Creek 1991



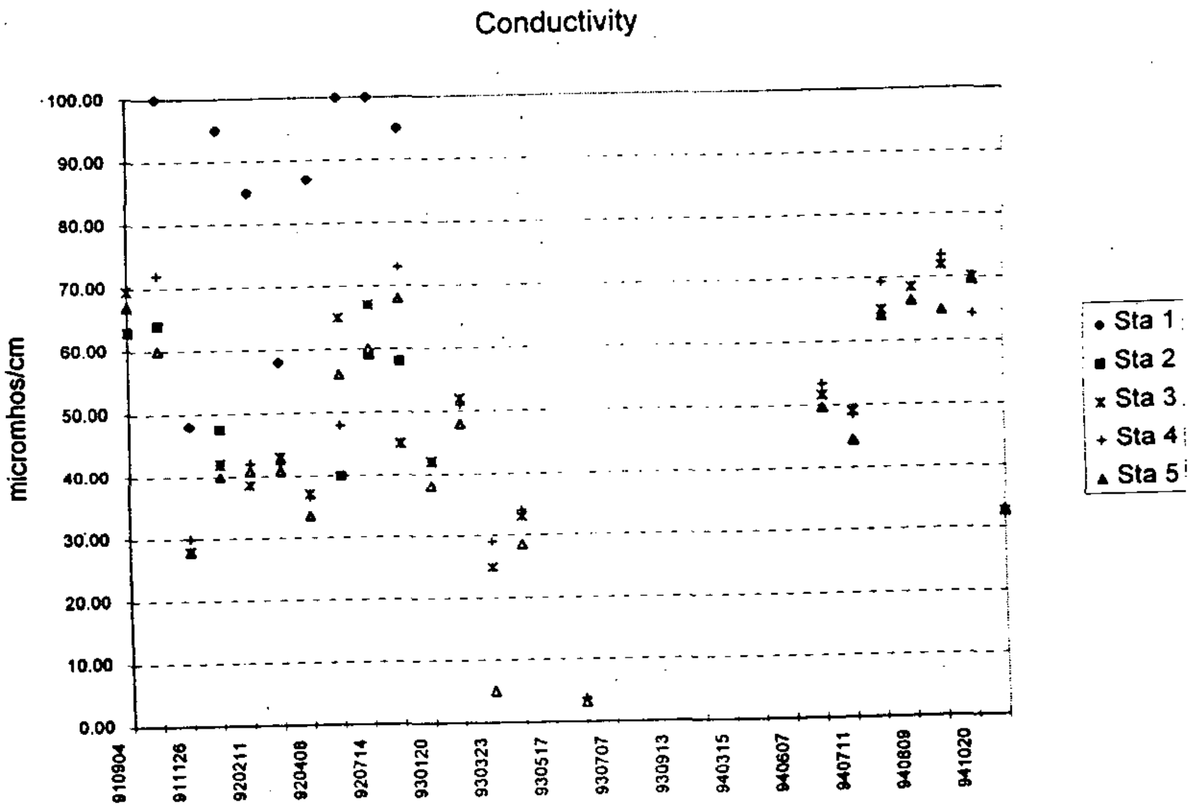
From late June to late July in 1990 stream temperatures were above 14.4^{0}C and with the exception of a short period in 1991 stream temperatures were below 14.4^{0}C. This is attributed to the location of the sample sites. It appears that the sample site in 1990 was located on Mud Creek and the site in 1991 was located on a tributary to Mud Creek. The site in 1990 was located below a large clearcut area on private land and Trillium lake. Increased temperatures were attributed to increased solar radiation intercepted by the lake and streams on private land. The 1991 data shows stream temperatures below 14.4^{0}C except for one short period in the middle of August indicating stream shade conditions on this tributary were acceptable. Based on this data and the level of stream shading in Mud Creek stream temperatures are of concern in this subwatershed because they are above state standards and this is attributed in part to management activities..

Conductivity, Sodium and Chloride Concentrations

Conductivity refers to the ability of a substance to carry an electrical current. The conductivity of water is a function of water temperature and the concentration of dissolved ions. Conductivity is very useful for quickly assessing water quality and often a linear relationship can be established between conductivity and the major ionic species (EPA, 1991). Melted snow in the western US has a conductivity of 2 to 42 micromhos/cm (Hem,1970). Usually there is an inverse relationship between conductivity and discharge (Keller et al., 1986, Aumen et al., 1989). Water that is slowly transmitted to the stream (baseflow) has more opportunity to pick up dissolved ions through weathering and other chemical reactions. Water that is quickly transformed from precipitation to runoff tends to have fewer dissolved ions, thus causing a corresponding decline in conductivity at high discharges. This relationship between conductivity and discharge means that simultaneous discharge measurements are needed to properly interpret conductivity data (EPA, 1991).

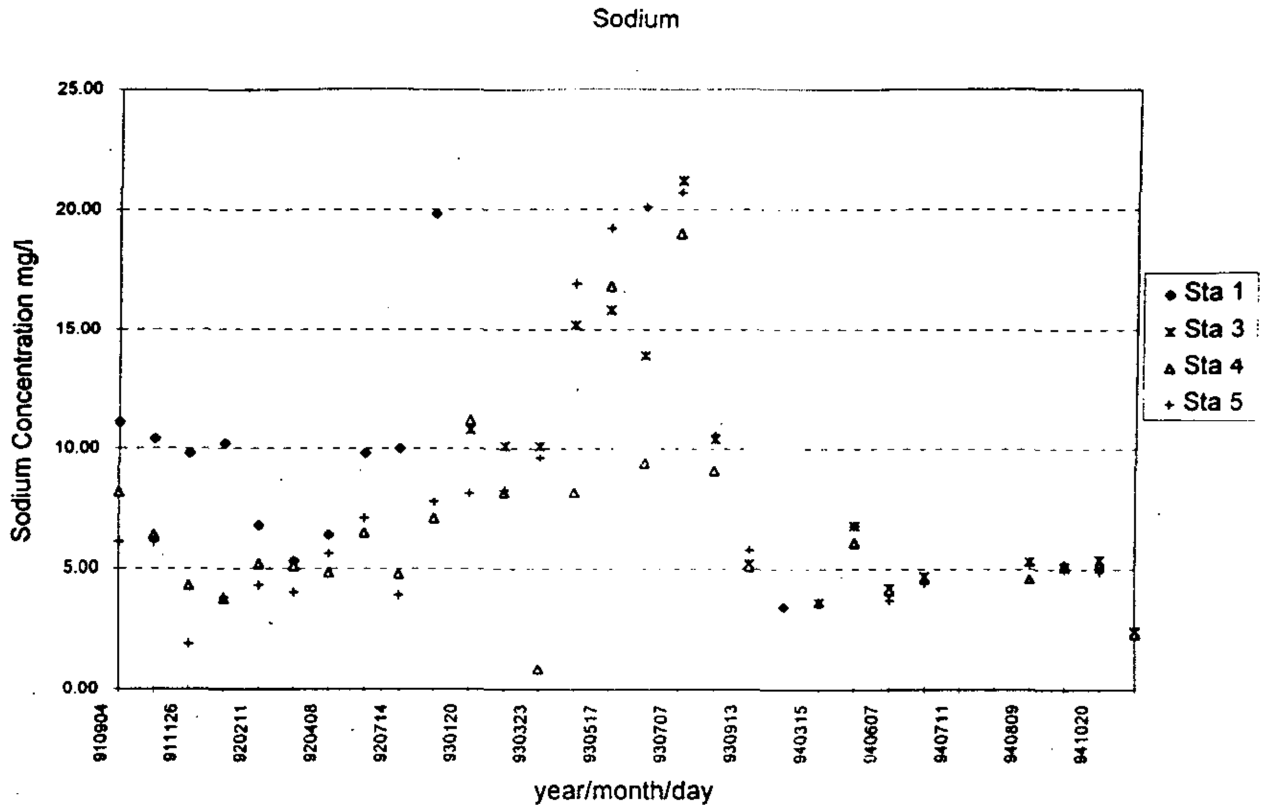
Of particular concern in the Salmon River watershed is conductivity in the upper watershed that could indicate effects from the salting of the Palmer Snowfield. Sodium chloride is applied at the rate of 600,000 to 700,000 pounds per year to maintain skiing conditions in the spring and summer (pers comm Steve Kruse).

Figure 4-38 Conductivity



Conductivity readings from station 1 are often in the range of 80-100 micromhos/cm and are higher than any of the other monitoring sites. This could indicate effects from the snowfield salting on Palmer Snowfield or it could be related to the lower discharge at the upper station. Water quality data from the Bull Run Watershed (USFS 1994) detail specific conductance levels in the range of 15 to 40 micromhos/cm and preliminary data from meltwater from Eliot Glacier indicate conductivity's that range from 10 to 30 micromhos/cm (Lundstrom 1988). Conductivity levels at station 1 are above those from snowmelt within the western US, levels in the Bull Run, and snowmelt from Eliot Glacier. Sodium levels were also graphed in an effort to determine if the snowfield salting was having an effect on water quality.

Figure 4-39 Sodium



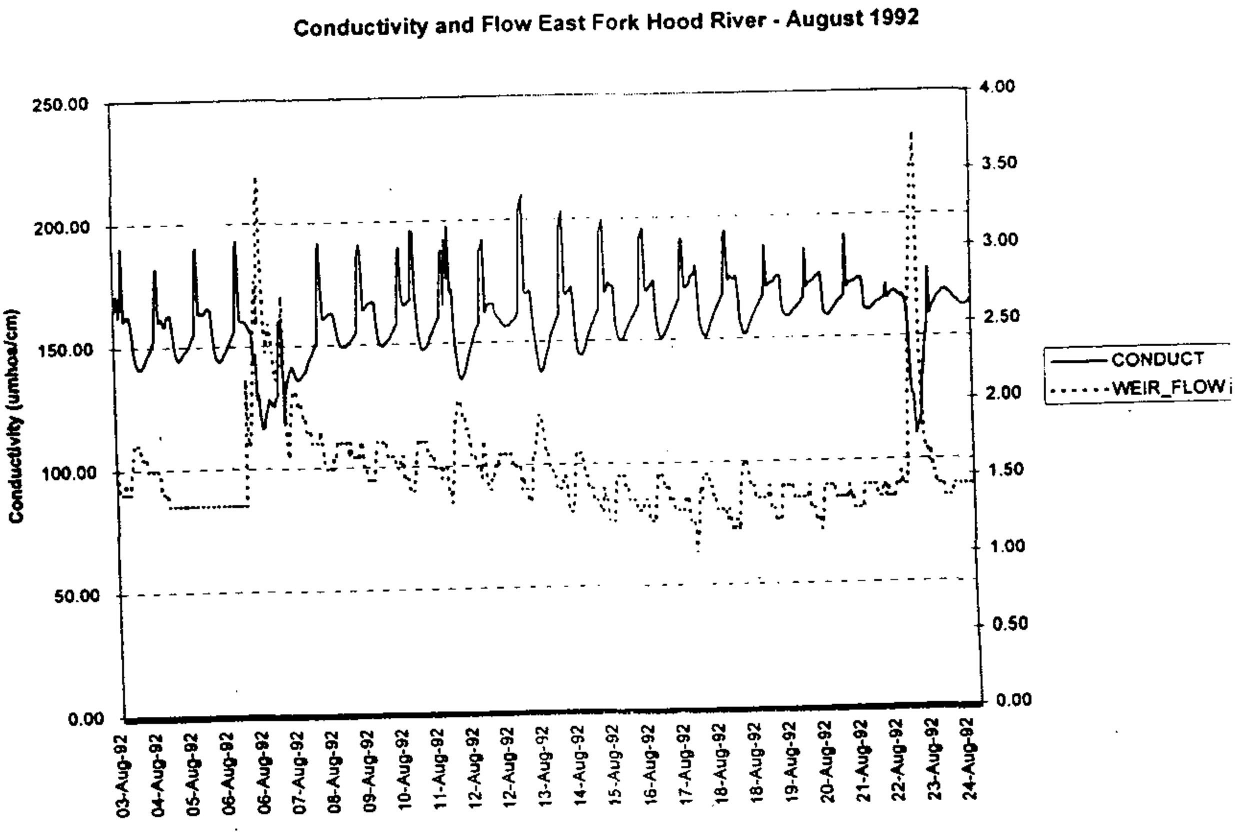
Sodium concentrations are the highest at the upper station. The greatest difference between the upper and lower stations was recorded on August 11, 1992 and the least difference was on March 16, 1992 which would indicate a correlation with application of salt (which is applied for summer skiing) and increased levels of sodium in the Salmon River. Concentrations of sodium within the Bull Run Watershed for the period between 1979 and 1986 average 1.6 mg/L (Bureau of Water Works 1988). Sodium concentrations at station 1 range from 4 to 20 mg/L.

Ongoing monitoring of surface streams draining the Palmer snowfield, suggest chloride concentrations rise from a base or background level of 5 mg/L to 20 mg/L during the summer ski season with occasional spikes as high as 44 mg/L. Concentrations of chloride within the Bull Run Watershed for the period between 1979 and 1986 average 0.30 mg/L (Bureau of Water Works 1988).

Conductivity, sodium and chloride levels are below any documented threshold of concern. The EPA National Water Quality Criteria for salt sensitive biota state that a four-day average of not more than 230 mg/L Cl and a one-hour average of not more than 860 mg/L Cl, at an average frequency of once every 3 years, will not "unacceptably affect" aquatic biota. The maximum level recorded below Palmer snowfield was 44 mg/L Cl. However, conductivity levels and sodium and chloride concentrations are well above those for melted snow in the western US and the Bull Run Watershed. These levels appear to be above base or background levels and outside the range that species, populations and communities are uniquely adapted.

Monitoring has been in effect to assess the effects of Palmer snowfield salting since 1988. In order to quantify sodium and chloride concentrations associated with diurnal fluctuations and rain on snow events additional elements have been added to the monitoring program. The following figure details conductivity levels on the East Fork of the Hood River below Mt. Hood Meadows ski area and demonstrates the inverse relationship between discharge and conductivity. This graph illustrates the large diurnal fluctuations in conductivity from snowmelt that are tied to changes in flow.

Figure 4-40 Conductivity East Fork Hood River



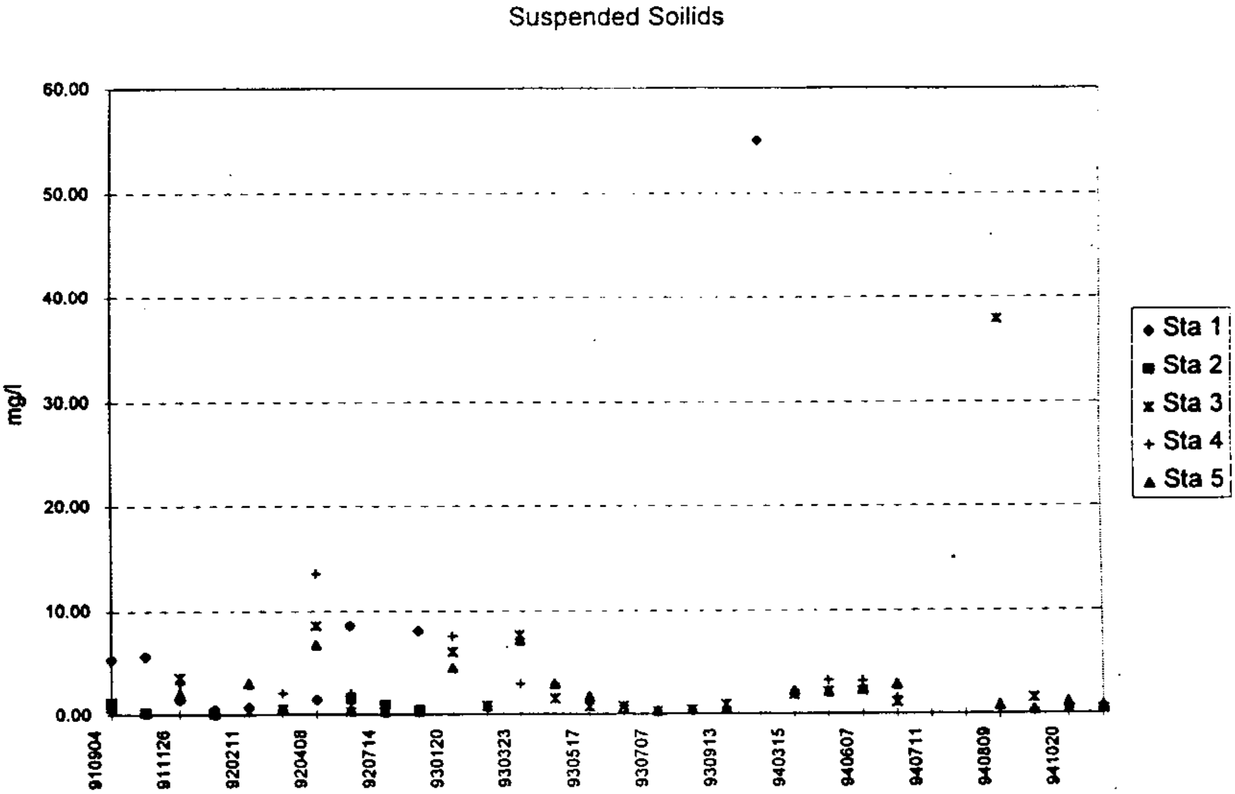
Sediment

An increase in sediment load is often the most important adverse effect of forest management activities on streams. Large increases in the amount of sediment delivered to the stream channel can greatly impair, or eliminate, fish and aquatic invertebrate habitat, alter the structure and width of the streambanks and adjacent riparian zone. (EPA 1991).

The physical effects of increased fine sediment load can be equally far-reaching. The amount of sediment can effect channel shape, sinuosity, and the relative balance between pools and riffles. Changes in sediment load will effect the bed material size, and in turn can alter the both the quality and quantity of the habitat for fish and benthic invertebrates (EPA 1991).

Of particular concern in the Salmon River watershed is the degradation of pool habitat in the anadromous section of the watershed through introduction of fine sediment.

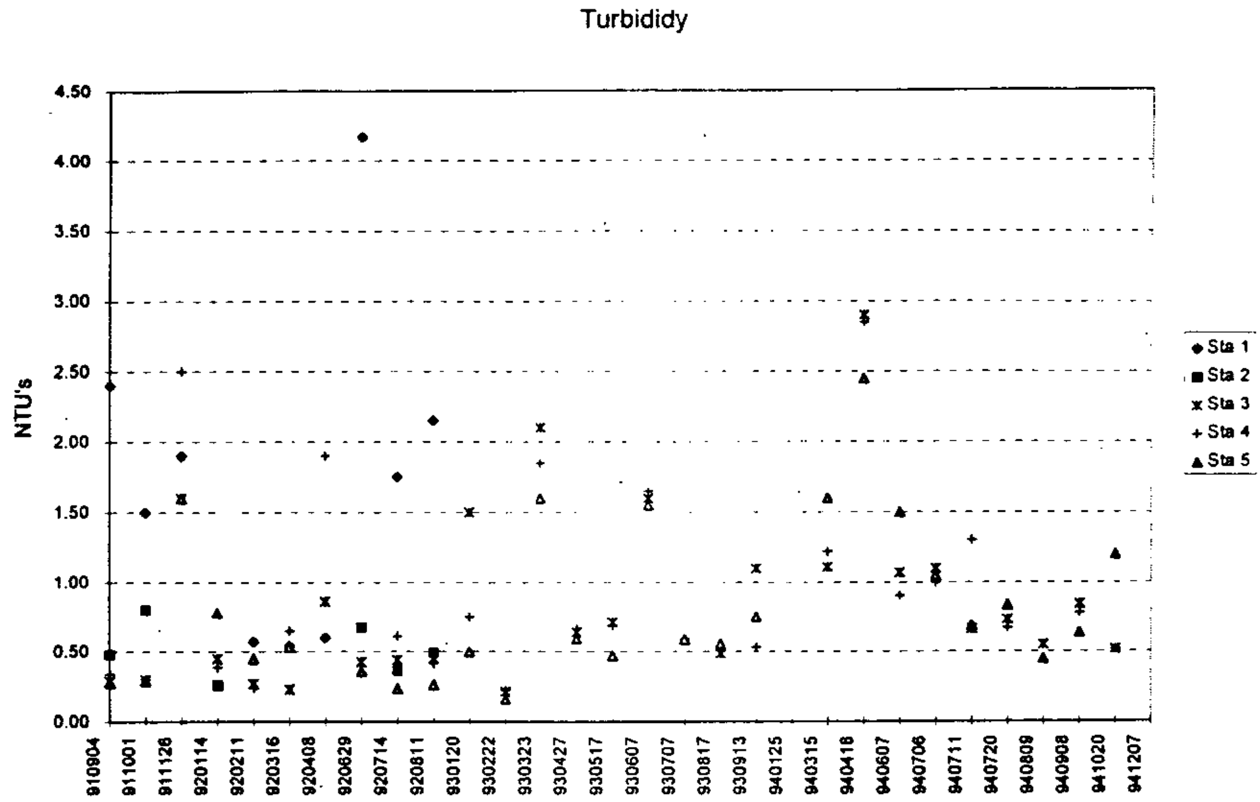
Figure 4-41 Suspended Solids



In all but one case the highest suspended sediment readings were at station 1. This station had the highest recorded level of suspended solids 55mg/L on January 25, 1994. This would agree with the sediment production analysis which concludes that the greatest sediment input is from roadside sanding in the upper watershed.

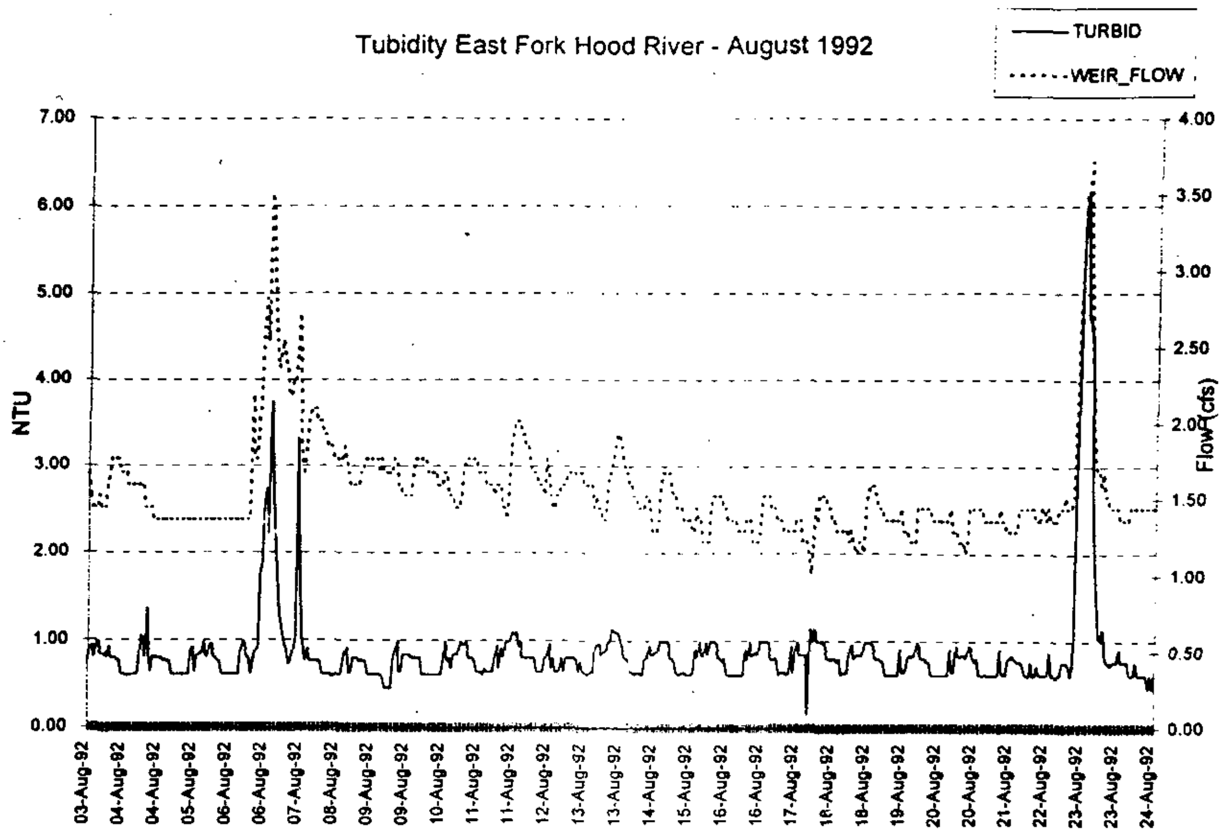
Turbidity is often used as a surrogate for suspended solids because it much easier to measure than suspended solids and water quality standards are tied to turbidity rather than suspended solids. However, turbidity can be caused by finely divided organic matter, colored organic compounds, plankton and microorganisms, so a correlation of turbidity and a weight concentration of suspended solids cannot be assumed.

Figure 4-42 Turbidity



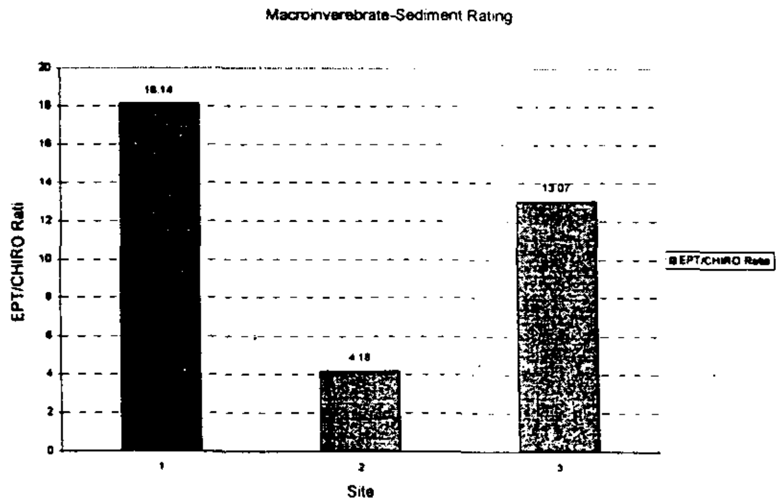
Turbidity levels are highest at the upper station with the other stations being clustered together within a range of 1 NTU. The monitoring regime that is implemented in association with the wild and scenic river plan is not adequate to capture and characterize fluctuations in suspended sediment or turbidity. Monitoring results from the Bull Run Watershed have shown that the 90 percent of the time streamflows have turbidities less than 1 NTU. Stream turbidity greater than 1 NTU was found to occur rapidly when rainfall intensities exceed 0.25 inches in 3 hours. This rapid rise is consistent with the erosion of sediment at sources close to stream channels (LaHusen, 1994). To adequately characterize the sediment regime monitoring needs to occur during periods when rainfall exceeds 0.25 inches in 3 hours and periods of rapid snowmelt. Figure 4-43 demonstrates the relationship between turbidity and streamflows on the East Fork of Hood River below Mt. Hood Meadows ski area.

Figure 4-43 Turbidity East Fork Hood River



Analysis was completed on the macroinverebrate community within the Salmon River from samples collected on June 29, 1992. A EPT/CHIRO ratio was calculated to assess sediment levels. The higher the ratio the greater the level of fine sediment.

Figure 4-44 EPT/CHIRO Ratio



This analysis concurs with the sediment production analysis which predicts the highest sediment production from management activities in the upper watershed from road sanding. This material is expected to be deposited in Salmon River Meadows. The second highest levels of sediment deposition within the watershed were predicted for the Fly Fishing Bridge which is sampling site #3. This site has the second highest EPT/CHIRO ratio and the sediment at this site is attributed to natural processes and the roads within 300' of streams within Middle Salmon and South Fork/Mack Hall subwatersheds.

Conclusions: Water Quality

Within the upper watershed (W & E Fork, Mud Creek, Linney Creek, and Upper Salmon subwatersheds) variables of concern and associated managment activities tied to monitoring results include:

VARIABLE	MANAGEMENT ACTIVITY
Enterococcus bacteria	Sewage treatment
Water temperature	Timber harvest and riparian shade, Trillium lake
Sodium	Snowfield salting
Suspended solids	Road sanding

There are no variables of concern in the middle watershed (the wilderness). In the lower watershed the only variable of concern based on monitoring data is stream temperature.

There are no variables of concern within the middle watershed (the wilderness). In the lower watershed the only variable of concern based on monitoring data is stream temperature.

Fisheries

The Mt. Hood National Forest uses salmonids (salmon, steelhead, trout, and char) as management indicator species for aquatic habitats. Because of their value as game fish, and their sensitivity to habitat changes and water quality degradation, they have been selected to monitor trends in the streams and lakes of the Mt. Hood National Forest. Although there are other fish species present in the river (sculpins and dace, for example), population trends are unknown. Much more information exists on salmonids, making this group a better choice for monitoring aquatic environments.

The Salmon River supports both anadromous (sea-run forms) and resident species of salmonids. Within these species are distinct stocks, some native to the upper Sandy basin and some introduced. The native stocks are unique in that they have adapted to the special conditions found in the Salmon River and the upper Sandy River basin. In general, the populations of native stocks of salmonids are much reduced from historical levels due to habitat degradation, hydroelectric dam operation, overfishing and ocean rearing conditions. The Oregon Department of Fish and Wildlife (ODFW) has developed a Wild Fish Policy and anglimg regulations to protect these stocks, which include winter steelhead, spring chinook, coho salmon, and cutthroat trout. High quality habitat is critical for maintaining these stocks; the Salmon River is exceptional in the quality and diversity of fish habitat present.

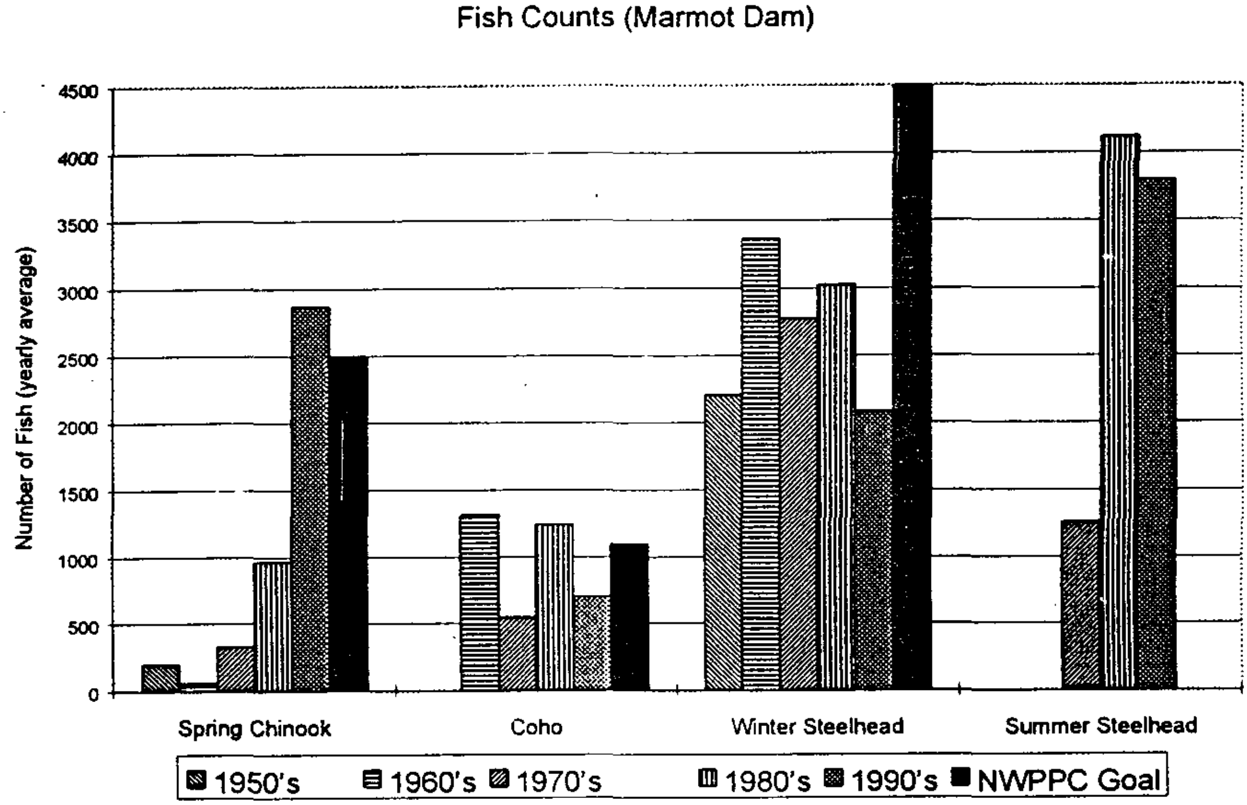
Fish Stocks

The Salmon River and its tributaries below the falls are very important for its anadromous fishery values. The river is nationally renowned for its summer steelhead fishery and anglers come from outside Oregon to fish along the river. This section of the river also contains winter steelhead, coho salmon, spring chinook salmon, cutthroat and rainbow trout as well as other non-game fish. Above the falls, the river contains cutthroat, rainbow and brook trout (sculpin are the dominant non-game species). Some of these salmonid stocks are native to the upper Sandy River, while others have been introduced and are naturally sustaining through wild reproduction. Still other stocks are regularly supplemented with hatchery-reared stock released by the ODFW to improve recreational fisheries on the Salmon and Sandy Rivers.

Salmon and steelhead counts passing Marmot Dam are presented to give a point of reference; little information is available on actual fish numbers in the Salmon drainage. Historical information derived from hatchery records is included to give an indication of former production from the drainage (Note: Historical data is extrapolated, and should be viewed with caution. Also, it should be noted that the information is from the 1890's, following the peak of the commercial fishing on the Columbia River. Fisheries were already reported to be in decline at that point).

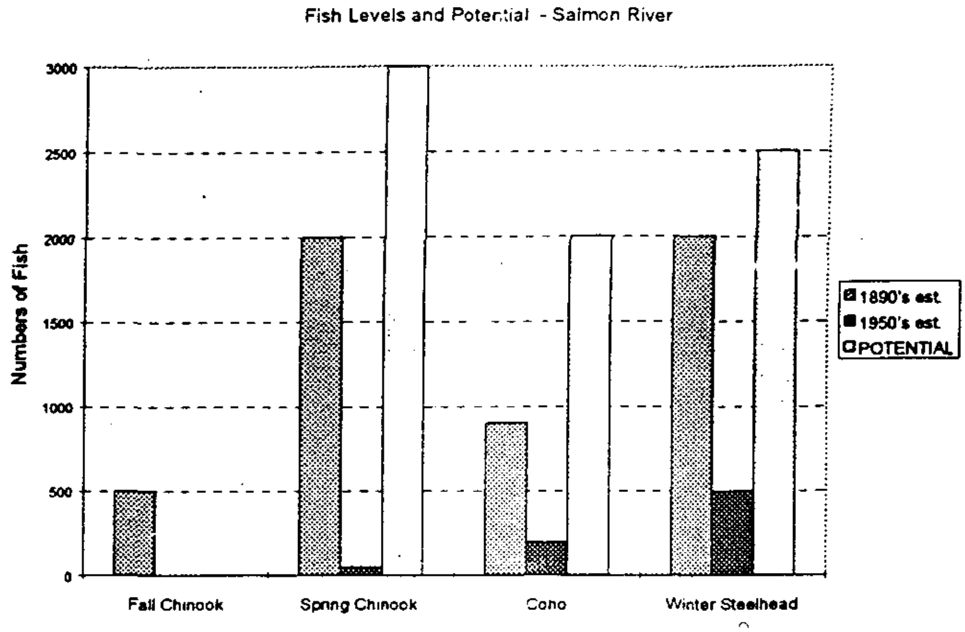
Information is also presented from ODFW's Sandy River Subbasin Salmon and Steelhead Plan, 1990; and PGE's Hydroelectric Development and Fisheries Resources on the Clackamas, Sandy and Deschutes Rivers, 1995. It is assumed that most of the returning summer steelhead and spring chinook counted at Marmot Dam are bound for the Salmon River, and that a significant portion of the other anadromous runs also originate there.

Figure 4-45 Fish Counts and Existing Escapement Goals, Upper Sandy River



NWPPC-Northwest Power Planning Council

Figure 4-46 Estimated Population and Potential, Salmon River (Mattson, 1955)



Summer Steelhead

Summer steelhead were introduced to the Sandy basin in 1975. The Foster/Slamania stock is the hatchery stock presently used. This stock was developed at the the South Santiam hatchery from eggs obtained from the Skamania hatchery on the Washougal River. Average adult return to the upper Sandy has averaged nearly 3,500 fish for return years 1978-1979 through 1993-1993, with a peak in 1985 of 7,598 fish. Most of these fish return to the Salmon River.

The stock was introduced to the basin with the assumption that there would be little to no success in natural reproduction and no negative interactions with the native winter steelhead. The run has been maintained with annual smolt outplanting in the Salmon and other upper Sandy tributaries (averaging 70,000 for the upper Sandy). A low level of natural reproduction is occurring, but competitive effects with native salmonids are unknown.

There is some information indicating a native summer steelhead stock may have existed in the Sandy River subbasin. It is a late summer/fall returning stock; and if genetically distinct, remaining numbers are very low. Evaluation of this stock is an information need.

Winter Steelhead

The existing stock of winter steelhead of the Salmon River and upper Sandy basin is primarily a native upper Sandy late-run stock. Prior to 1964, early-run Big Creek stock were released throughout the upper Sandy basin. More recently, stocking was limited to below Sleepy Hollow bridge (below the confluence of the Salmon and Sandy Rivers.) Since 1989, no hatchery stocking of winter steelhead has occurred above Marmot Dam. The native stock returns to the river from December to March, and spawns from March through May. Due to later spawning periods, fry of this stock emerge later than summer run and hatchery winter stocks, and may be at a disadvantage because of the age/size difference between the three stocks. Adult returns to the upper basin have been fairly stable averaging around 3,000 fish for the past 30 years, although returns have decreased recently. Native winter steelhead are protected by angling regulations and contribute significantly to one of the most popular and successful steelhead fisheries in the state of Oregon.

Spring Chinook

The spring chinook salmon population of the upper Sandy basin is composed of two stocks, a native early-run and the later-run Willamette stock, which has been planted in the Sandy since the mid-70's. The native run, historically abundant, in both the Sandy and Salmon Rivers, has been decimated by a number of factors: early hatchery egg-taking operations (one of the first hatcheries in Oregon was located near the mouth of the Salmon River, operating from 1898-1912); high harvest levels in commercial and recreational fisheries; poor ocean rearing conditions; and most significantly by early operations at Marmot Dam. Water withdrawal from the Sandy River, starting in 1912, dewatered long reaches of the river until 1974. The diversion canal was unscreened until 1951, and much of the smolt production was diverted into and killed by the operation of the Bull Run power generating facilities during this period.

The native run is presently very small. The stock is listed as possibly extinct in the recent evaluation of the Pacific coast salmon and steelhead stocks published by the American Fisheries Society (Nehlsen, Williams, and Lichatowich, March 1991). Less than 100 fish a year returned over Marmot Dam during most of the period from 1955-1970.

Hatchery stock returns have gradually increased with returns over Marmot Dam ranging from 700-6984 fish since 1986. The Salmon River run was annually supplemented with smolt introductions. It appears that natural production from derived hatchery stocks is increasing and contributing significantly to the increased run size. What effect the increased production of the hatchery derived stock has on any remnant native run is unknown, although the potential for interbreeding and hybridization is possible due to overlap of spawning periods in September. ODFW is presently releasing all hatchery spring chinook smolts below Marmot dam.

Coho

The coho salmon run is also composed of two stocks: a native late-spawning stock (November-March) and an early spawning stock (September-November) derived from mid-basin Sandy River fish (Cedar Creek hatchery). The late-run stock is listed by the state of Oregon and Forest Service as a sensitive species. It is listed in high risk of extinction in the AFS stock evaluation. It appears that habitat degradation, overfishing in a mixed stock fishery with the more numerous hatchery stocks, poor ocean rearing conditions, and competition/hybridization with outplanted hatchery stocks have contributed to coho decline. This stock is at critically low levels, with very few counted at Marmot Dam in recent years. (ODFW average index spawning counts, made in selected tributaries of the Salmon River, for this stock have declined from 22.8 fish/mile in the 1960's to about 3 fish/mile in the 1980's).

The early spawning stock was outplanted from Sandy Hatchery on Cedar Creek (Sandy River basin) in the 1980's as adults, pre-smolts and smolts in the upper Sandy basin to supplement declining native coho stocks. Although it appears that coho pre-smolt supplementation has been largely ineffective, there seems to have been some success in increasing escapement to the upper basin with this stock. Counts at the dam have increased from 283 in 1977 to about 1,500 in 1985-87. Virtually all stocking of coho has been limited to below Marmot Dam since 1990.

Cutthroat Trout

The cutthroat trout population in the Salmon River drainage is composed of at least two native stocks: an anadromous (sea-run) form that is likely present in the lower 14 miles of mainstem and associated tributaries (below impassible barriers); and a resident stock that is present throughout the drainage, particularly above barriers such as Final Falls or the falls on the South Fork of the Salmon.

The sea-run stock is currently listed as a sensitive species by the Forest Service and the state of Oregon. It is classified as coastal cutthroat by the ODFW, and populations have been in severe decline throughout its range. The AFS report lists the stock as in moderate danger of extinction. Most of the sea-run production has been in the lower Sandy basin, but there has been a run of these fish into the upper basin. High quality cutthroat habitat present in the Salmon River and its tributaries indicates the drainage may have been one of the more important production areas for this fish. Historically the sea-run stock appears to have been present in the Salmon drainage in significant numbers; there are numerous reports by anglers of large cutthroat caught in the Salmon River until recently. However, adult fish returns at Marmot Dam have plummeted; very few are counted passing the dam. Whether these fish spawn in the Salmon River is unknown. Cutthroat smolts continue to be observed in the fish trap at Marmot Dam in diminishing numbers. The fish are relatively easy to catch, and the adult fish are prized by anglers. It appears that overfishing, poor ocean rearing conditions, and degradation of habitat have contributed to this stock's decline.

The resident form is well-distributed throughout the drainage, but several factors may be limiting its numbers in some areas. It, too, is easily caught, and areas near roads and development may literally be "fished out" in a short period of time (for ceratian ages of fish). It does not compete well for food and space with some other salmonid stocks and may be displaced from its habitat; this appears to be the case with introduced Eastern brook trout in Mud Creek and in the mainstem in the Salmon River meadows area. Cutthroat also readily hybridize with rainbow trout; this probably happened in areas accessible to anadromous fish where both species were naturally present. The introduction of hatchery strains of rainbow trout to Trillium Lake (along with brook trout) allowed their spread into Mud Creek, Salmon River mainstem and other tributaries. Where they rainbow trout are present, hybridization with cutthroat may have occurred. For these reasons, the "refuge" habitat provided in remote drainages, above migration barriers, is especially important for sustaining this stock of fish.

Rainbow Trout

Rainbow trout are also present above and below Final Falls. Rainbow were present historically below the falls in both resident and anadromous (steelhead) forms. They may have been present above the falls prior to stocking programs. Rainbow trout from several sources have been used by hatcheries to develop stock for outplanting into the upper Sandy basin. Due to excellent access, attractive environment, nearby campgrounds, and excellent fishing, the lower Salmon River and Trillium Lake have attracted heavy use by anglers. Resident trout populations were likely heavily impacted by intensive fishing decades ago. For this reason, the ODFW has supplemented trout populations with catchable-size fish at several points on the river and at Trillium Lake. However, ODFW discontinued the stocking of legal sized rainbow in 1995 within the Salmon River. It appears that if these stocked fish are not quickly harvested, they do not usually survive through the following winter. However, some of these fish, plus some of hte stocked summer steelhead smolts, may successfully overwinter. These fish compete with resident and juvenile anadromous fish for food and space, and potentially interbreed with native stocks, changing the genetic make-up of the populations.

Redband Trout

A stock of inland rainbow trout suspected to be redband trout exist above the falls in South Fork Salmon River and Mack Hall Creek and possibly elsewhere in the drainage (pers. comm. J.Uebel). Redband trout are currently a candidate for listing under the Endangered Species Act.

Other Stocks of Interest

The bull trout is a proposed for Federal Threatened or Endangered Species listing and is listed as a sensitive species by the State of Oregon and the Forest Service. There are historic reports of bull trout in the Salmon River drainage, but its presence has not been confirmed. Suitable habitat and isolation exists to support this species in the upper watershed and in Salmon River tributaries such as Mack Hall Creek, South Fork, Cheeney, Copper and Wolf Creeks.

Lower Columbia River fall chinook salmon are listed as state sensitive species and are identified at high risk of extinction by the AFS report. This stock was apparently present in the Salmon River until Marmot Dam was constructed. The fish were not able to adapt to pressures from egg-take for hatcheries, intensive fisheries, and the extended periods of low mainstem flows, poor upstream passage conditions and high smolt mortality that were imposed by dam operations from 1912-1951 and later. The fish are now found only in the lower reaches of the Sandy River, although spawning adults were documented in the Salmon River in the fall of 1994. The Sandy Basin Plan (in progress) is defining 2 and possibly 3 stocks of fall chinook: tule stock (September to mid-October)' lower river wild stockl (late October through December), and late "bright" stock (December through February). The stock referred to in the AFS text is hte late component of the lower river wild stock.

Brook trout are present in the upper Salmon River drainage in Mud Creek and upstream through the Salmon River meadows complex. This introduced char is likely descended from hatchery stocks used for supplementing the fishery in Trillium Lake. Habitat in the streams of this area is optimum for this species, with cool stream temperatures, braided low-gradient meandering channels and high levels of cover provided by overhanging and emergent vegetation. These fish are successful competitors for food and space, and may compete with native trout stocks.

Table 4-13 -Summary of Fish Stocks - Lower Salmon River

Species/Stock	Origin	Trend
Spring Chinook	Wild Spawning (Naturalized) Hatchery	Stable/Decrease Stable/Increase
Fall Chinook	Native	Extirpated
Coho	Wild Spawning (Naturalized) Native	Decrease Decrease
Winter Steelhead	Native Hatchery/Wild Spawning (Naturalized)	Decrease Decrease (since 1991)
Summer Steelhead	Hatchery/Wild Spawning (Naturalized) Native	Stable Unknown
Rainbow Trout	Native Hatchery	Decrease No longer stocked
Cutthroat Trout -Anadromous -Resident	 Native Native	 Extinct ? Decrease
Brook Trout (lakes)	Hatchery/Wild Spawning (Naturalized)	Stable
Mountain Whitefish	Native	Unknown
Dace (Longnose) (2)	Native	Unknown
Sculpin -Torrent (?) (2) -Shortnose (?)	 Native Native	 Unknown Unknown
Pacific Lamprey	Native	Unknown

Table 4-14 - Summary of Fish Stocks in the Upper Salmon River

Species/Stock	Origin	Status
Cutthroat Trout	Native	Unknown
Rainbow Trout	Hatchery/Wild Spawning (Naturalized) Native(redband possibly present)	Stable Unknown
Brook Trout	Hatchery/Wild Spawning (Naturalized)	Stable
Sculpin -Torrent -Shortnose	 Native Native	 Unknown Unknown

Index of Biological Integrity

Biological intergrity for the Lower and Upper Salmon River was completed using Indices of Biological Integrity for California Department of Wildlife and Fisheries ((Moyle and Brown 1986). Indices for the Lahonton drainage of Northern California were used for comparision and evaluation. Factors leading to competition of interbreeding are rated on a scale of one to five and then summed to give and overall rating of integrity.

Table 4-15 - Biological Integrity, Lower River

Metric	Index ratings for: Wild & Native species	Index ratings for: True Native Spp (No Hatchery Influence)
% Native Fish (#)	5	3
% Native Species	5	3
Total Fish Abundance	3	3
Total Fish Species	5	5
# of Salmonid spp	5	5
Juvenile Salmonid Abundance	4	4
Catchable Wild Trout	3	1
Sculpin Abundance	4	4
Total	34 (Good-Excellent)	28 (Fair-Good)

This analysis indicates biological integrity is good overall and that wild spawning stocks are in good condition. Limiting factors that are operating on biological integrity in the anandromous portion of Salmon River are:

- Introduced species; competition/interbreeding - Trout/Salmon
- Habitat quality balance for species (pools, LWD, Side channels) - Salmon
- Harvest/harassment: mortality - Trout

Table 4-16 - Biological Integrity, Upper River

Metric	Score
% Native Fish	5
% Native Species	3
Total Fish Abundance	4
Total Fish Species	3
# of Salmonid spp.	5
Juvenile Salmonid Abundance	3
Catchable Wild Trout	3
Sculpin Abundance	3
Total	29 (Fair-Good)

Limiting factors to biological integrity in the resident portion of Salmon River:

- Introduced Species

Stock Management

Anadromous fish stocks in the Salmon River are managed under guidelines established in the ODFW Sandy River Subbasin Salmon and Steelhead Plan (1990). A new subbasin plan is in progress. The plan outlines a strategy for protection of native populations of salmon and steelhead, while continuing to provide for a high level of consumptive recreational fishing that has been present on the Sandy. As a result of public comment and analysis for the plan, stocking of coho and winter steelhead has been eliminated from the upper Sandy basin. Stocking of summer steelhead still occurs in the Salmon drainage. Hatchery spring chinnok chinnok smolts are released below Marmot dam and the stocking of legal sized rainbow trout was discontinued in 1995. Several fishing regulations have also been introduced for the Sandy and Salmon Rivers to encourage natural reproduction and protect emigrating smolts, including: fly fishing only on the mainstem reach from the Forest Service Road 2618 bridge upstream to Final Falls; a late opening date for trout season; 8" minimum size restriction; catch and release of wild unmarked adult steelhead (barbless hook regulations), and seasonal closures for protection of native salmon and steelhead returning adults.

Current objectives of the subbasin plan for spawning escapement in the upper Sandy basin (above Marmot Dam) are:

Species	Existing Escapement	Future Escapement Goal
Coho (early+late)	1,400 fish (1987)	1,300 fish
Winter steelhead	3,000 fish (1990)	4,500 fish
Summer steelhead	0	0
Spring chinook	1,500 fish (1987)	2,500 fish

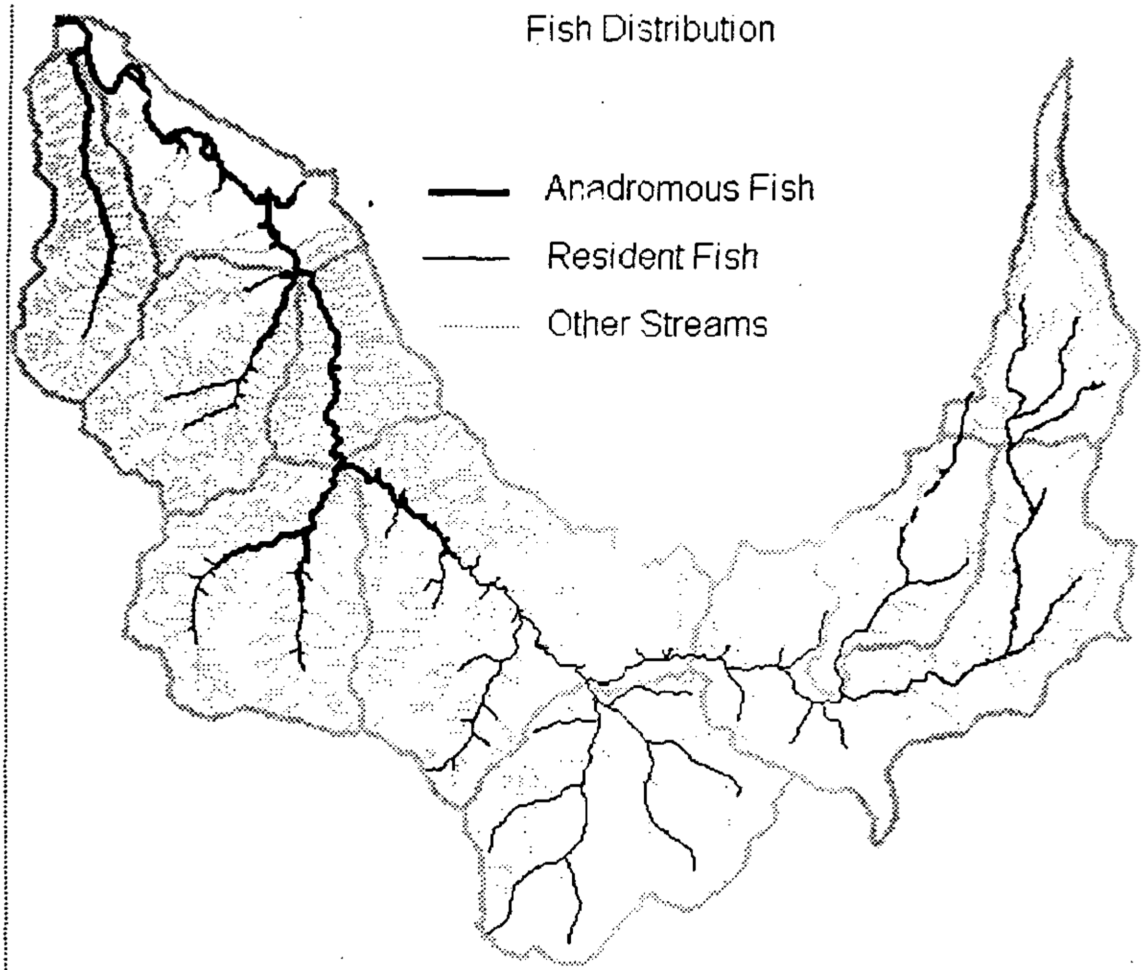
Strategies proposed in the plan to achieve increases in escapement include improved juvenile bypass facilities at Marmot Dam, habitat improvement in the upper Sandy basin, and changing hatchery practices and releases.

Usual methods for population management of resident gamefish include stocking programs coupled with fishing regulations (and in some cases, public access management.) Besides the stocking practices and fishing regulations mentioned previously, an 8-inch minimum size limit and a five fish daily limit are currently in effect for trout on streams in the Salmon River drainage. Resident populations appear stable under current conditions of access and stocking, although anecdotal evidence suggests that cutthroat populations have diminished in some areas due to overfishing and species competition. Increasing public access to remote stream reaches without special regulations for protecting native populations may exacerbate this trend. Currently there are no regulations in effect specifically for the protection of sea-run cutthroat, which is probably harvested indiscriminately in the resident trout fishery in both juvenile and adult forms.

Habitat

The drainage can be divided into two major sections: the lower 14 miles, which is inhabited by anadromous salmonids (salmon, steelhead and sea-run cutthroat), and the upper 20 miles, which is inhabited by resident salmonids (trout and char). Final Falls, at river mile (RM) 14, prevents upstream migration of anadromous fish.

Figure 4-47-Fish Distribution



Habitat conditions for salmonids in the drainage are generally good. Water quality is excellent for the production of salmonids, being usually clear and cool in the summer. This is a contrast to some of the other large tributaries of the Sandy system which contain large amounts of glacial flour in the summer. Habitat surveys of the mainstem and tributaries have identified a great diversity of habitat types, ranging from low-gradient, wide, meandering river channels to small, high-gradient glacier-fed creeks. The "typical" habitat for the basin is a moderate-sized stream with boulder and rubble substrate, riffle dominated, with frequent large pools present due to the presence of bedrock outcrops, large boulders or old growth trees that have fallen into the stream. This habitat type favors the production of trout and steelhead. Small meandering alpine meadow streams (resident cutthroat and brook trout), large mainstem glides and pools (chinook salmon) and small low-gradient tributaries, wetlands and backwaters (coho salmon) are also well distributed in the drainage.

Fish habitat has been degraded in some areas. Large floods in 1964 and the 1970's scoured the channel and swept much of the large woody material out of the system. Following these floods, the U.S. Army Corps of Engineers, the Forest Service and other public agencies and private individuals removed any remaining large logs and boulders from the mainstem channel from the mouth above to the confluence with the South Fork of the Salmon. The channel was deepened and straightened throughout this area, cutting off meanders, oxbows and side channels. Substantial habitat was lost, and the diversity and quality of habitat in the lower river was reduced. Interviews with long term residents cite specific locations of large debris jams and pools at Tawny Rock (confluence of Salmon River and Cheeney Creek), below and above the confluence of the South Fork Salmon and Salmon rivers, and on the South Fork Salmon River. These log jams are no longer present.

On private lands, many small low gradient tributaries and wetlands that were prime habitat for coho salmon have been channelized, drained and filled over the years. There are few remaining examples of the large wetland complexes that used to exist in the Welches area. One prime example of this excellent coho habitat is in the Wildwood Recreation Site. Large logs have been removed from the channel and floodplain of the lower mile of Cheeney Creek, and road construction has triggered landslides in some areas. This has also happened to a lesser extent on lower Boulder Creek.

Only one diversion, Marmot Dam (operated by Portland General Electric), is located between the Salmon River and the Pacific Ocean. This dam is equipped with a fish ladder for returning adults and with screens to aid the downstream migration of smolts. These facilities were improved in 1983 and in the late 1980's the dam was removed and reconstructed. Both downstream and upstream passage conditions are considered good at this time. PGE conducts surveys of fish runs to the upper Sandy basin by using a system that photographs each fish entering the fishway.

Stream Geomorphology

Channel morphology and condition reflect the input of sediment, water, and wood to the channel, relative of the ability of the channel to either transport or store these inputs (Sullivan et al., 1987). Systematic and local differences in transport capacity and the nature and magnitude of inputs through a channel network result in a distribution of different channel types throughout a channel network, reflecting spatial differences in channel slope, flow depth, sediment supply and the availability of large woody debris. Because of these differences, certain channels are more or less sensitive to similar changes in these inputs factors (DNR 1993).

Rosgen stream types for the Salmon River Watershed were delineated by generating stream gradients with a digital elevation model and using information from stream surveys on bankfull width, bankfull depth and dominant substrate. Figure 4-48 details the Rosgen stream types by subwatershed. By understanding these types, we can identify habitat hot spots and futures restoration opportunities. An understanding of sensitivity of stream types to management can influence the width of riparian reserves.

Figure 4-48-Rosgen Stream Types

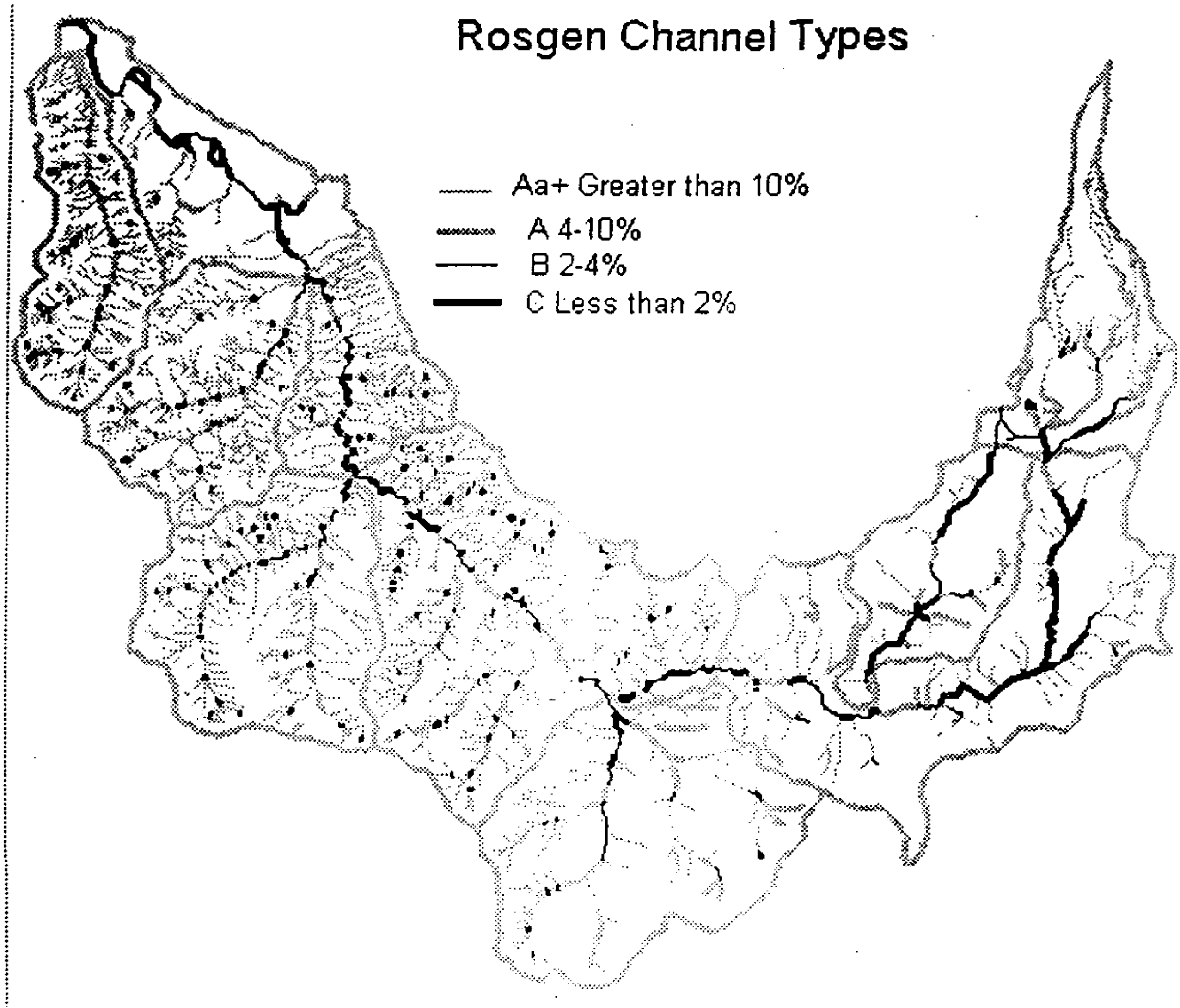
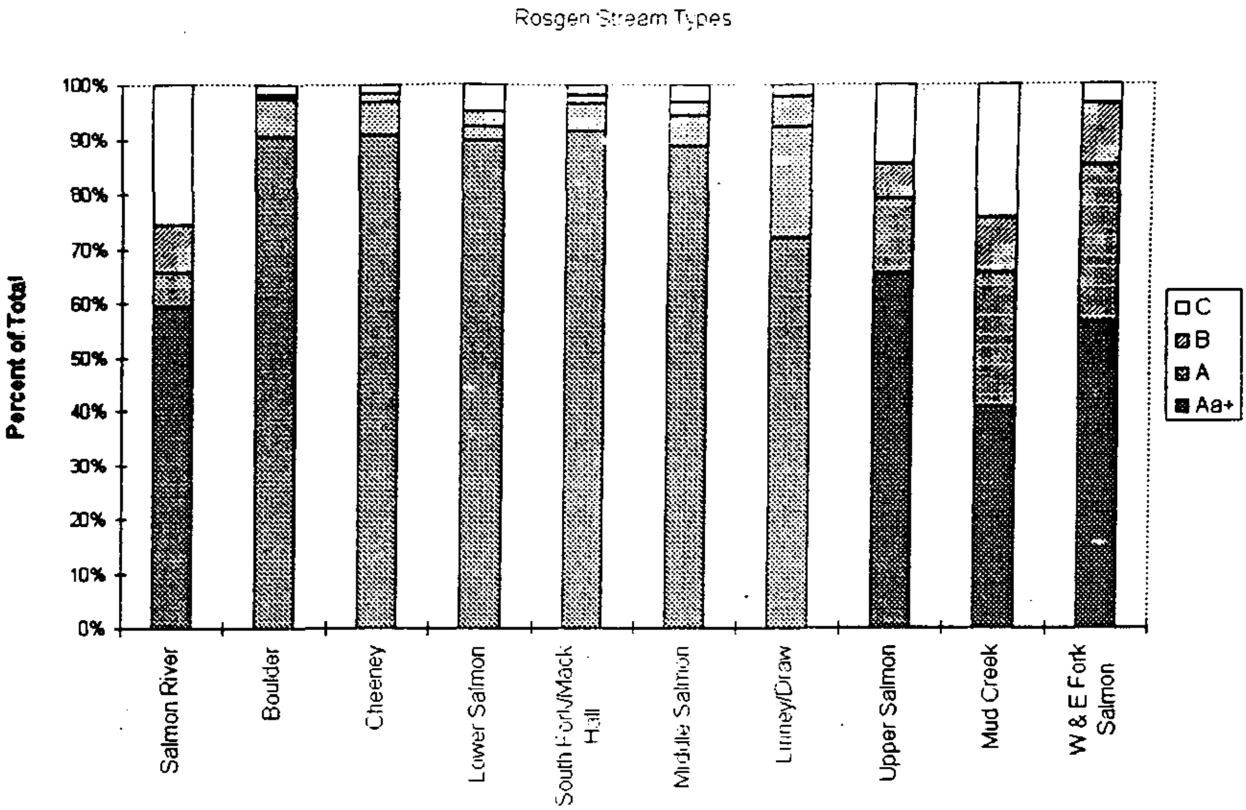


Figure 4-49 - Rosgen Stream Types



General definitions of stream types

- Aa+ - very steep deeply entrenched debris transport streams
- A - Steep, entrenched, cascading, step/pool streams. High energy/debris transport associated with depositional soils. Very stable if bedrock or boulder dominated channel
- B - Moderately entrenched, moderate gradient, riffle dominated channel, with frequently spaced pools. Very stable plan and profile. Stable banks
- C - Low gradient, meandering, point-bar, riffle dominated channels with broad well defined floodplains

We stratified the watershed into three strata based upon anadromous habitat, resident trout habitat, and landforms.

- Lower watershed (anadromous and alluvial landform)- Salmon River (river mile 0-7.2)
- Middle watershed (anadromous and western cascades landform) - Boulder Creek, Cheeney Creek, Salmon River (river mile 7.2-18.2), and South Fork/Mack Hall

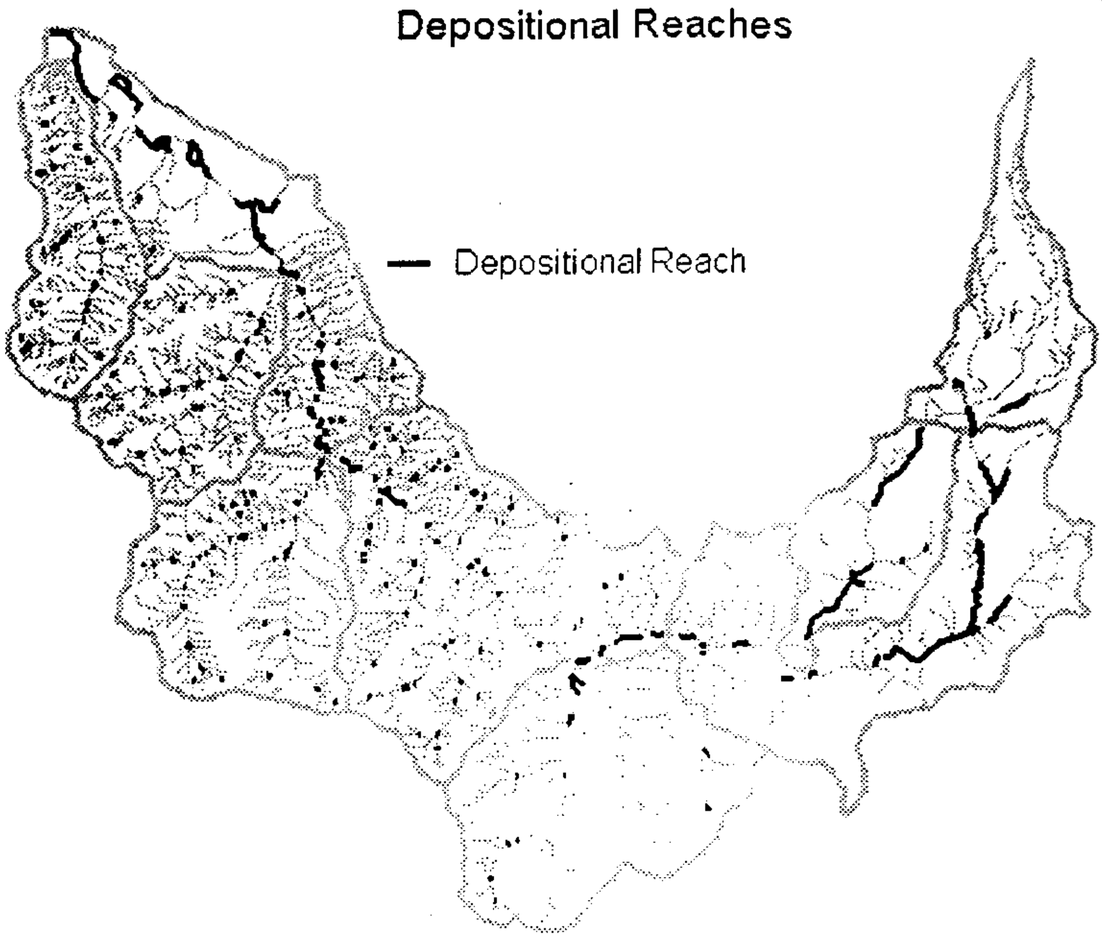
- Upper Watershed (resident trout and high cascades landform) - Linney Creek, Draw Creek, Inch Creek, String Creek, Mud Creek and Salmon River (river mile 18.2-26.9)

The lower watershed is in an area of alluvial deposits and is a mix of A, B, and C stream types. A stream types occur in the first order channels and the B and C stream types characterize the mainstem Salmon River. B and C streams types are generally stable where the sediment that is moved by the A and Aa+ channels will be deposited. C channels within this area have been identified as high quality habitat for anadromous fisheries (especially coho and chinook salmon).

The streams in the middle watershed are 90% Aa+ stream types which are characterized as debris transport streams and would be expected in this area based on the landform description (see Geology current condition). This landform is characterized by debris slides and these stream types would be efficient in mobilizing the sediments from these debris slides into debris flows.

In the upper watershed the streams are a mix of A, B and C types with the A channels characterizing 65 to 92% of the channels. Mud Creek and Upper Salmon have 15 to 25% C stream types which are depositional reaches and have the potential to capture any sediment generated in the upper basin. The Red Top Meadow and Salmon River Meadow complexes are large depositional areas which would capture sediment generated in the upper basin.

Figure 4-50 - Depositional Reaches



It is notable that there are depositional reaches at many of the tributary junctions in the middle watershed. Depositional reaches tend to have very diverse habitat mixes and are frequently key habitats for fish production.

Based on stream gradient and channel substrate the channels in the subwatersheds were stratified for management interpretations. Channel substrate was used to classify channels into there respective secondary stream types.

1=Bedrock substrate
2=Boulder substrate
3=Cobble substrate
4=Gravel substrate

Table 4-17 Percent of Stream Type by Subwatershed

Subwatershed	A2	A3	A4	B2	B3	B4	C2	C3	C4
Salmon		65			9		26		
Boulder Creek	97			1			2		
Cheeney Creek		97			2		3		
Lower Salmon	92			3			5		
South Fork/Mack Hall		96			1		2		
Middle Salmon		94			2		3		
Linney/Draw		92			5		2		
Upper Salmon		79			6		15		
Mud Creek			66			10			25
W & E Fork Salmon		84			11		4		

Table 4-18 Management Interpretations of Stream Types

Stream Type	Sensitivity to Disturbance	Sediment Supply	Streambank Erosion Potential
A2	very low	very low	very low
A3	very high	very high	high
A4	extreme	very high	very high
B2	very low	very low	very low
B3	low	low	low
B4	moderate	moderate	low
C2	low	low	low
C3	moderate	moderate	moderate
C4	very high	high	very high

The distribution of stream types vary with the landform. Potential effects become more or less important based on the beneficial use in the area. Stream types such as A3 that are sensitive to disturbance, have a high sediment supply and have high streambank erosion potential would be of concern if the area is located above a depositional reach that is critical habitat for anadromous species.

The lower watershed is characterized by a cobble substrate with A3, B3 and C3 stream types. The A3 stream types are characterized by a very high sensitivity to disturbance, a very high sediment supply and high streambank erosion potential so any disturbance (with respect to increased peakflows or sediment inputs) in the uplands in this watershed has the potential to generate sediment that will be deposited in the low gradient reaches of the mainstem of the Salmon River.

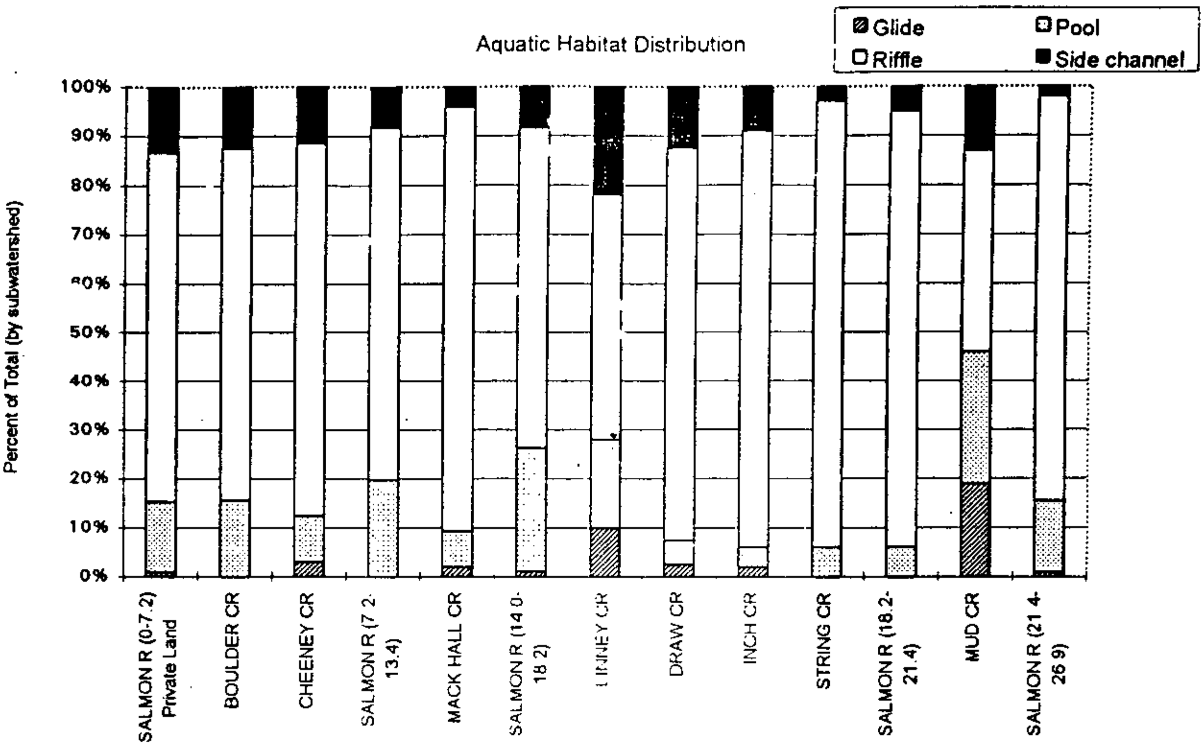
The middle section of the watershed is characterized by A2 and A3 channels. A2 channels area very stable and not sensitive to disturbance. However, the A3 channels are very unstable so any disturbances with respect to peakflow regime or sediment inputs will generate sediment within the channel. Sediment will be routed to the depositional reaches along the mainstem of the Salmon River in the lower watershed.

The upper watershed is a mix of A, B and C channels. The majority of the stream types are A (66-92%). Mud Creek has the most unstable stream types of A4, B4 and C4. The A4 and C4 stream types are very sensitive to disturbance with high sediment supply and streambank erosion potential. Based on the distribution of C steam types and wetlands in the upper watershed it appears that most of the sediment that is generated will be captured in this area and not routed downstream to the anadromous habitat in the lower watershed. Management activities which have the potential to alter the peakflow regime or generate sediment in the upper watershed need to receive attention with respect to sediment generation and routing when assessing effects in the upper watershed.

Aquatic Habitat Types

Pool, riffle, glide and side channel habitat types provide critical habitat for salmonid species. Different habitat types are preferred by different species at different stages of their life cycle. Fast water habitats such as riffles and glides favor trout and steelhead. Large mainstem glides and pools favor chinook salmon. Side channel habitat favor coho salmon. Small meandering alpine meadow streams with glides and pools favor resident cutthroat and brook trout. Habitat types for the Salmon River were evaluated to assess habitat quality for different anadromous and resident fish. This analysis was completed by using the habitat type from the Stream Management, Analysis, Reporting and Tracking (SMART) database.

Figure 4-51 - Aquatic Habitat Types



Riffle habitat is the dominant habitat type in the Salmon River Watershed. A large portion of the habitat is in fast water type which would be expected based on the channel gradient. To determine if the habitat types for the anadromous sections of Salmon River were within the range of natural variation habitat types from the Salmon River Watershed were compared to the South Fork of the McKenzie River (located on the Willamette national Forest)(OSU 1991). Riffles and pools were in the same range for the two basins, but side channel frequency was lower on the lower Salmon River. Historically, the lower Salmon River was characterized by old meander channels and beaver activity. After the 1964 and 1974 floods, debris removal and channelization altered the habitat types along the lower Salmon River up to the confluence with the South Fork of the Salmon.

A limiting factors analysis for coho salmon was completed and concluded that side channels are important to coho production in the basin; the potential summer population calculated for all coho-bearing tributary streams in the watershed was less than the number that could be supported in the mainstem side channels alone. However, few side channels in the mainstem provided good juvenile coho habitat. Of the twenty side channels in the mainstem Salmon River, only four had more than 100 coho observed. High quality side channel habitat was the exception rather than the rule, and side channels that contained large woody debris correlated well with coho observed. Side channel habitat has been significantly reduced in the last 40-50 years; at least 4 large reaches were removed by channelization from 1950-1980.

Based on observations of historical conditions the mix of habitat types has moved from slow water side channels and pools and glides to more fast water habitat along the lower mainstem of the Salmon River. This change has altered that habitat in the watershed to favor steelhead over coho and chinook salmon.

For the part of the watershed that supports resident fish there is a mix of habitat types providing adequate habitat for existing species(riffles and glides for resident rainbow trout and glides and pools for cutthroat and brook trout).

Pool Levels

Pools provide resting habitat for adult salmonids on their spawning migrations, baseflow thermal refugia, protective cover, and slow water rearing and overwintering habitat for juvenile steelhead and salmon, resident fishes, and amphibians. The habitat capability of individual pools increases with depth, volume, substrate complexity, and large woody debris for cover and habitat partitioning.

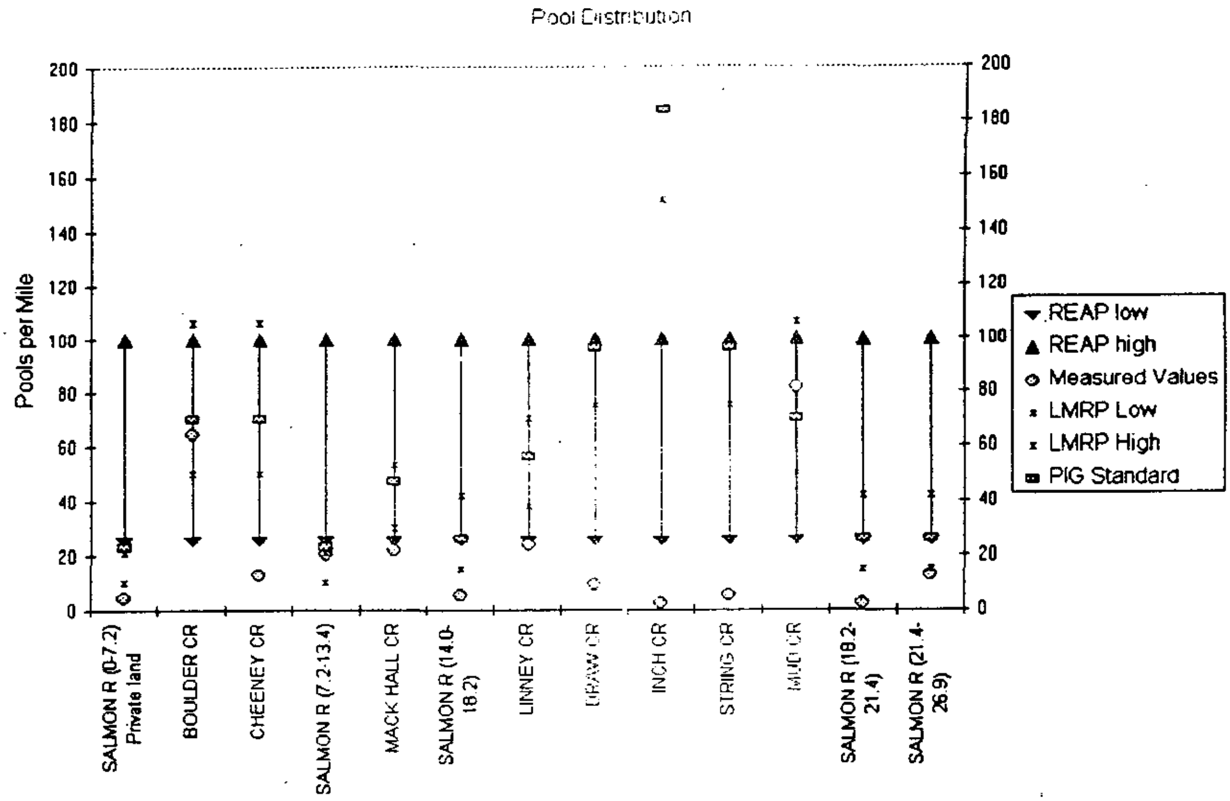
The natural range of pool frequencies is highly variable and dependent on gradient, confinement, and stream width. Habitat complexity and the number of pools per mile increases with decreasing stream order and width.

In low gradient, depositional C reaches, the lateral scour pools on the outside of meander bends are the primary pool form (Rosgen, in prep.; Montgomery and Buffington 1993). Channel straightening and entrenchment in the lower watershed has decreased the natural meander pattern of C reaches. Large log jams in C reaches tend to create high amounts of pools and cover and therefore are key habitats for fish production. Virtually all log jams have been removed from the lower Salmon River.

Pool levels were calculated for major tributaries and the mainstem of the Salmon River from queries of the SMART database. The assessment was completed to compare pool quantity to the range of natural variation, Forest Plan, and Columbia River Policy Implementation Guide/Salmon Summit (PIG) standards.

The range of natural conditions was approximated from data on the Lewis River located on the Gifford Pinchot National Forest. Of all the watersheds that the range of natural variation was established as part of REAP the Lewis River was felt to best approximate conditions within the Salmon River.

Figure 4-52 Pool Levels



Stratifying the watershed based on anadromous habitat and landform there are three major strata

- Lower watershed (anadromous and alluvial landform)- Salmon River (river mile 0-7.2)
- Middle watershed (anadromous and western cascades landform) - Boulder Creek, Cheeney Creek, Salmon River (river mile 7.2-18.2), and South Fork/Mack Hall
- Upper Watershed (resident and high cascades landform) - Linney Creek, Draw Creek, Inch Creek, String Creek, Mud Creek and Salmon River (river mile 18.2-26.9)

In the lower watershed pool levels are outside the range of natural conditions and below Forest Plan and PIG standards. This is attributed to channel straightening and stream cleanout prior to and after the 1964 and 1974 floods.

In the middle watershed, for the most part, pools are outside the range of natural conditions and below Forest Plan and PIG standards. The notable exception is Boulder Creek which meets or is very near Forest Plan and PIG standards. To some degree this condition can be attributed to historical stream cleanout and channel straightening along the mainstem of the Salmon River up to the confluence of the South Fork. However, pool levels are below standards in the South Fork of the Salmon River and Mack Hall Creek which are in the wilderness and have not been cleaned out or straightened. This may be attributed to the steep gradient channels with cobble substrates (90% of the channels in this area are over 10% gradient) or past fire history in the area which effects (increased peakflows and assocaited channel scour, increased sediment delivey, and decreased in-channel large woody debris) may be manifested in the channel. The lower South Fork of the Salmon River was also cleaned of large woody debris from 1965-1980. It is notable that standards for pools are being meet in Boulder Creek which has been heavily managed near the turn of the century with logging and splash damming and the standards are not being met in historically unmanaged sections of the wilderness. Also, the pool levels in Mack Hall/South Fork Salmon may have been biased by changes in pool definition over the past several years (surveys in these areas were completed in 1990).

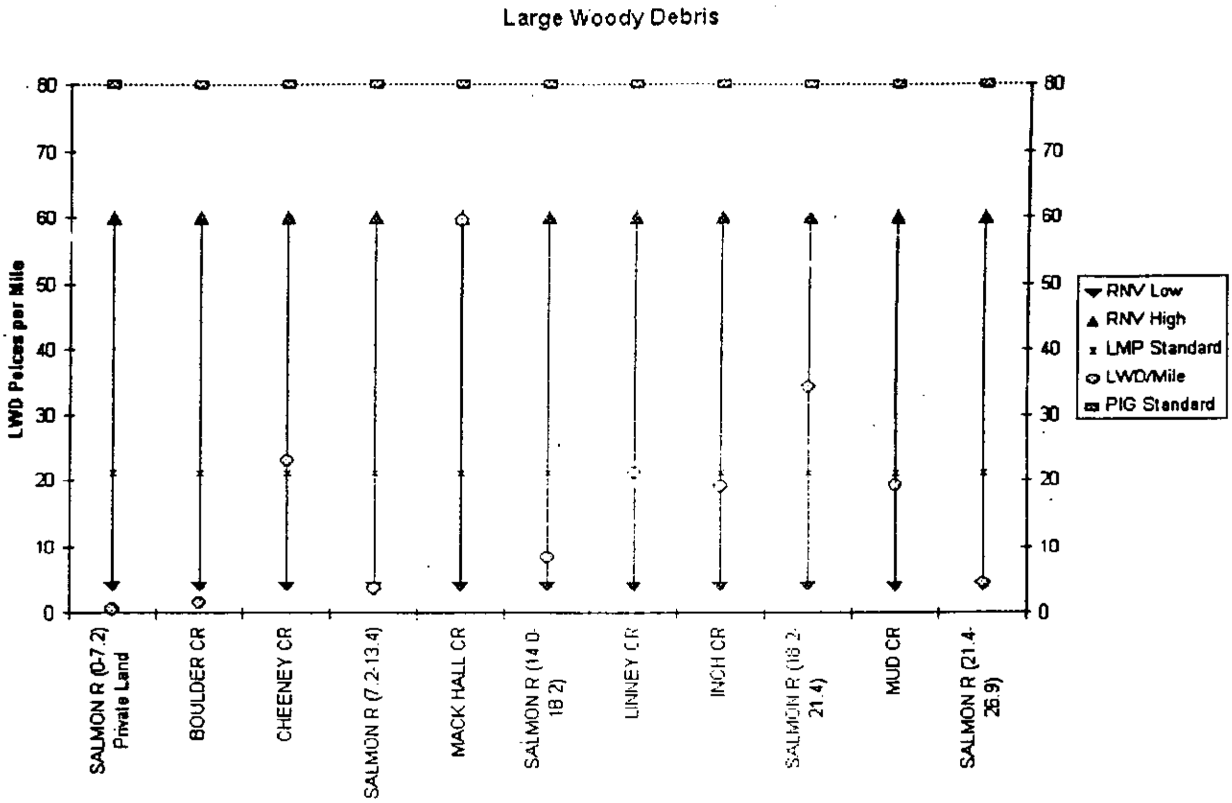
In the upper watershed, with the exception of Mud Creek, pool levels are outside the range of natural conditions and below Forest Plan and PIG standards. Mud Creek meets all the applicable standards. Again it is notable that the subwatershed with the greatest amount of management activities (roading and timber harvest) meets the standards for pools while less intensively managed subwatersheds do not. Again, the pool levels may have been biased by changing survey protocal for the various streams.

Large Woody Debris

Large woody debris provides pool structure, sediment storage, substrate, partitioning of space, cover, nutrients, channel roughness, and velocity refuge for aquatic plants, fish, macroinvertebrates, and amphibians. Large floods in 1964 and the 1970's scoured the channel and swept much of the large woody material out of the system. Following these floods, the U.S. Army Corps of Engineers, the Forest Service and other public agencies and private individuals removed any remaining large logs and boulders from the mainstem channel from the mouth up to the confluence with the South Fork of the Salmon.

The current levels of large wood were queried from SMART database. The range of natural variation was established for the Sandy basin by examining levels of large woody debris in unmanaged stream reaches in the Salmon River and Bull Run watersheds.

Figure 4-53 - Large Woody Debris Levels



Using the stratum that were developed based on landform and anadromous habitat. The levels of large woody debris per mile in the lower watershed are outside the range of natural variation and below Forest Plan and PIG Standards. This condition can be attributed to channel clean out activities after the 1964 and 1974 floods. The lower 10 miles of the mainstem Salmon River and Cheeney Creek are particulary low in large woody debris.

Levels of large woody debris in the middle section of the watershed are within the range of natural variation and at or near Forest Plan standards, however, they are well below PIG standards. This would be expected based on the large portion of this area that is in the wilderness and has not been managed. It is a concern that PIG standards may not be achievable because even in historically unmanaged portions of the wilderness (Mack Hall Creek and Salmon River mile 14.0-18.2) levels of large woody debris are below PIG standards.

In the upper watershed all the tributaries assessed were within the range of natural variation. However, with the exception of Salmon River (18.2-21.4), all the tributaries are at the lower end of the range of natural variation and just at or below Forest Plan and below PIG standards. Upper Salmon River has the lowest level of LWD and this may be atributed to being in the alpine area where there is a limited supply of large woody debris.

Mud and Inch Creek are below Forest Plan and PIG standards. These areas have had extensive timber harvest which may account for this condition.

Even though it was outside the scope of this analysis it is of concern that there may be low levels of large woody debris in intermittent streams that are an ecologically important link between aquatic and terrestrial ecosystems. Riparian zones associated with intermittent streams function as habitat for amphibians, travel corridors, microclimate refugia, water and food sources for terrestrial wildlife. At the same time, intermittent streams convey terrestrial inputs of large woody debris, nutrients and sediment downstream to fish-bearing streams (Reid and Ziemer unpub.).

Large Woody Debris Recruitment Potential

In order to assess the trend in in-channel large woody debris the large woody debris recruitment potential of the riparian reserves was assessed using the methodology from the DNR Standard Methodolgy for Watershed Analysis Large woody debris recruitment potential was rated as high, moderate, or low based on the following matrix:

Dominant Tree Type	Young/ Sparse	Young/Dense	Mature/ Sparse	Mature/ Dense	Old/Sparse	Old/Dense
Conifer	Low	Moderate	Moderate	High	Moderate	High
Deciduous	Low	Low	Low	Moderate	Low	Moderate

Young is defined as seedlings, saplings and poles, mature is small and large sawtimber and old is old growth. Sparse is less than 60% canopy closure.

Figure 4-54 - Large Woody Debris Recruitment Potential

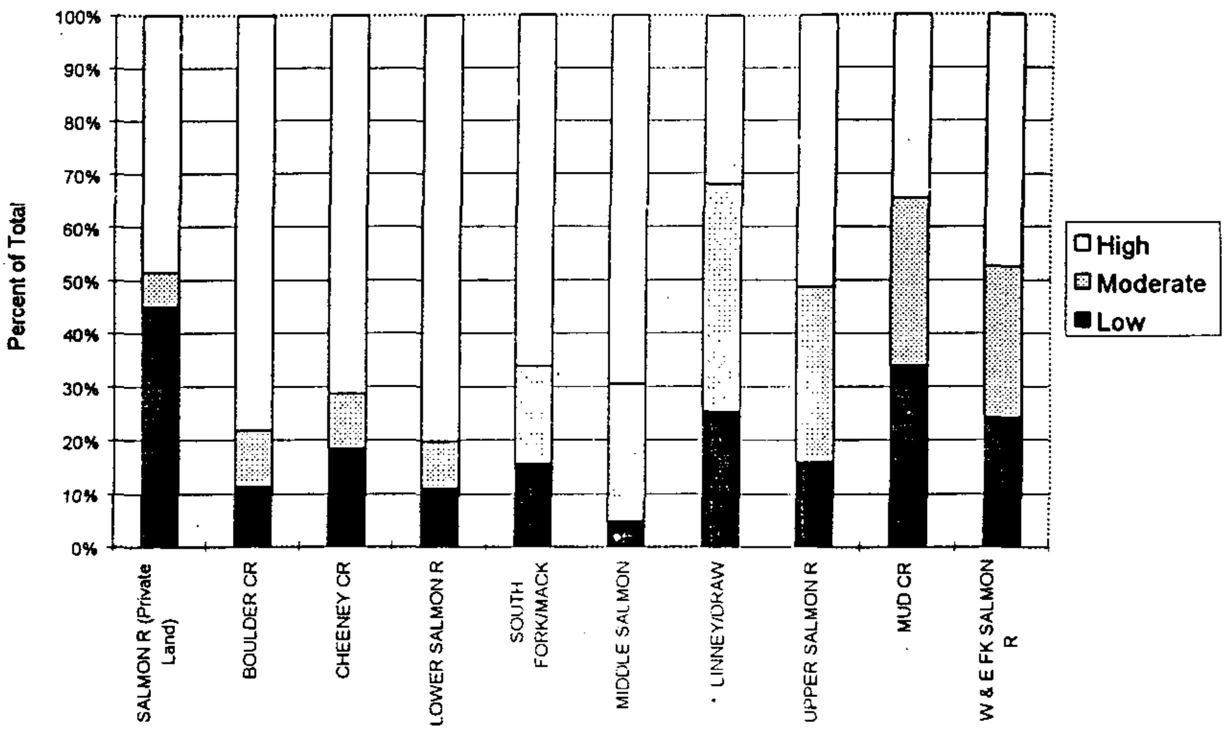
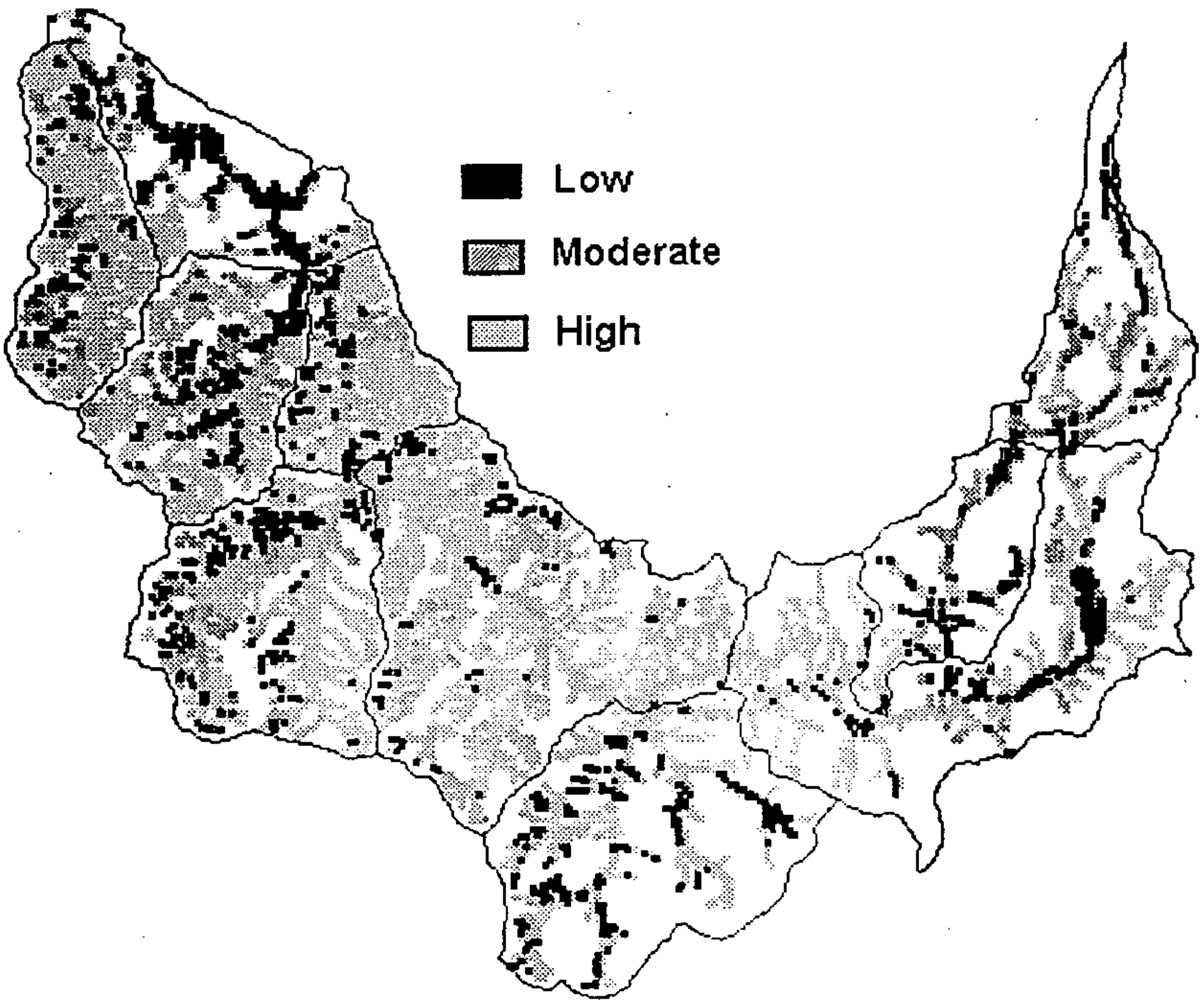
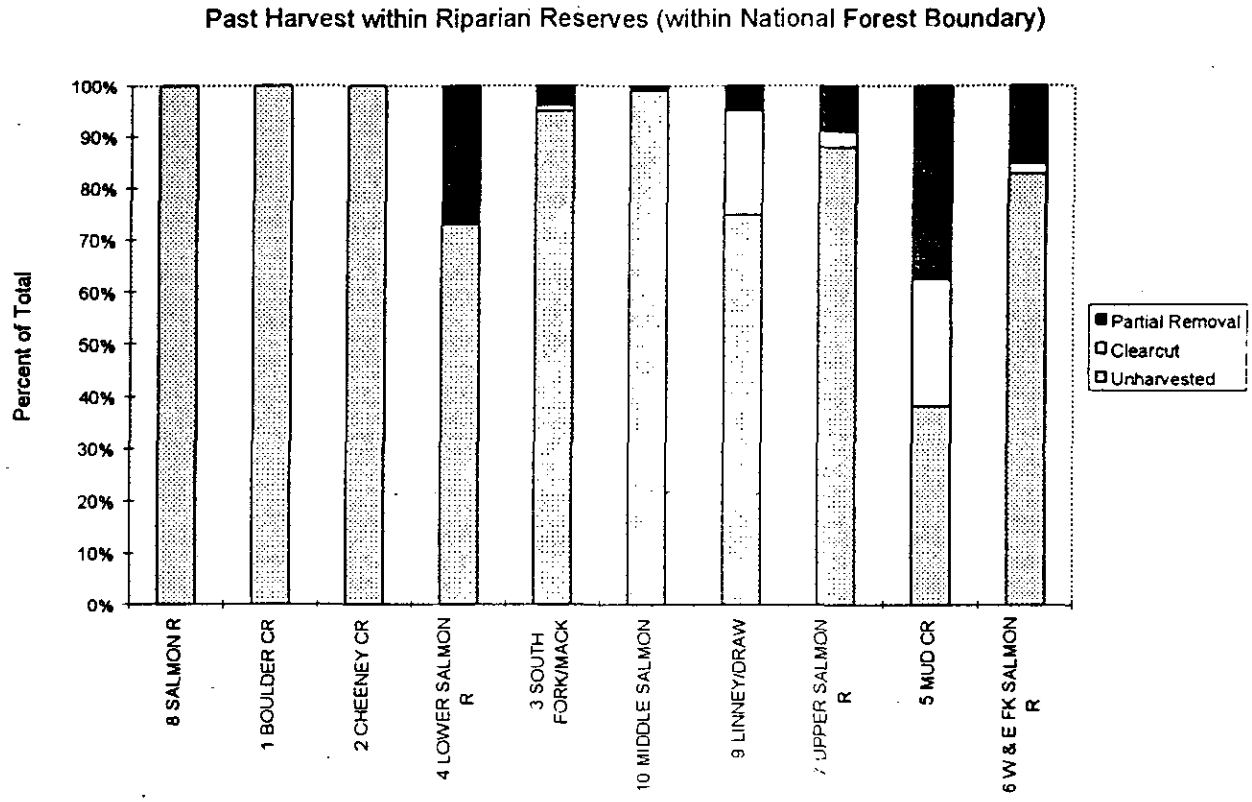


Figure 4-55 Large Woody Debris Recruitment Potential



Historical Harvest

Figure 4-56 - Harvest Activity within the Riparian Reserves



Historical harvest within the wilderness portions of Cheeny and Boulder Creeks is not captured in Figure 4-56 because this harvest occurred prior to Forest Service ownership of these lands.

Stratifying the watershed based on historical management regime and anadromous habitat there are three strata.

- Lower watershed (private land and anadromous habitat)- Salmon River
- Middle watershed (wilderness and anadromous habitat)- Boulder Creek, Cheeney Creek, South Fork/Mack Hall and Middle Salmon
- Upper Watershed (multiple use and resident habitat)- Linney/Draw, Upper Salmon, Mud Creek and West and East Fork Salmon River

In the lower watershed 50% of area is in the low and moderate large woody debris recruitment potential categories. This may be attributed to management on existing and former private lands including developments in the riparian reserves and timber harvest. This is of concern because current levels of in-channel large woody debris are low in this area and large wood has been identified as important in developing high quality pools and side channels which are important habitat for coho and chinook salmon.

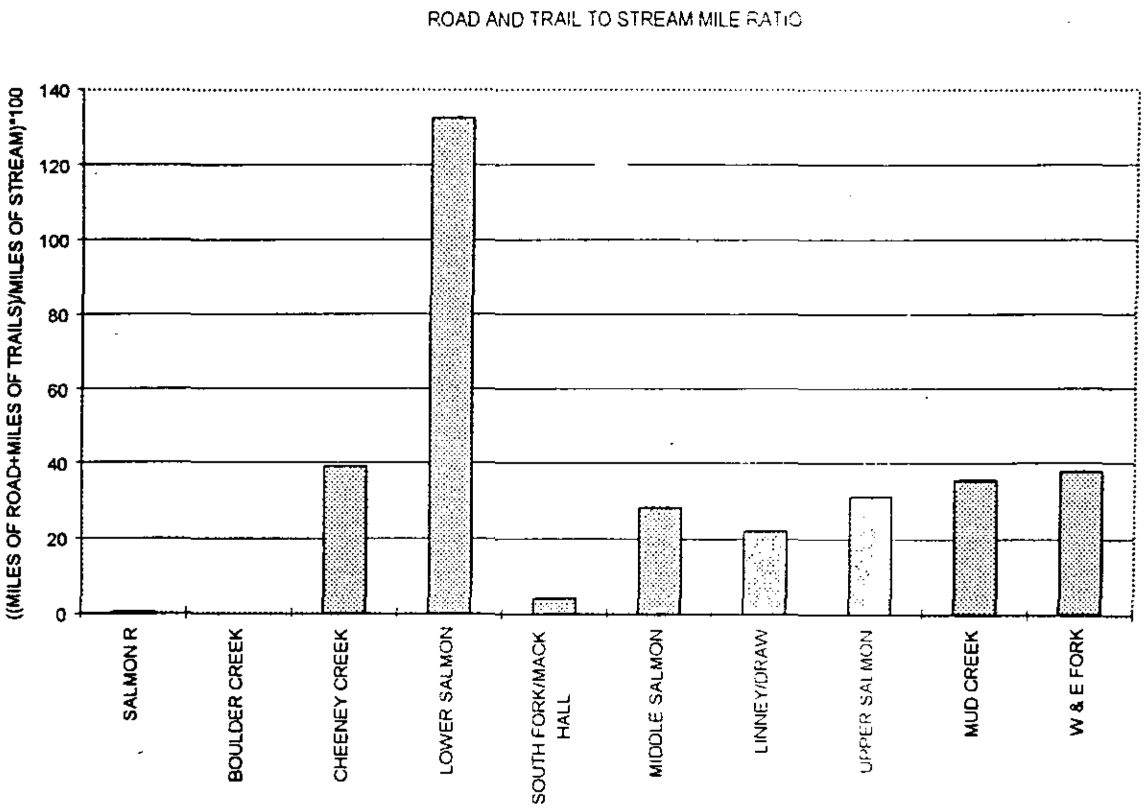
In the middle watershed at least 70% of the area is in the high large woody debris recruitment potential class. This area is at or near the Forest Plan Standard for in-channel large woody debris so in this area large woody debris recruitment is not as much as a concern as the lower watershed. This area may still be recovering form the fires between (1900-1950) and that may account for why there is not more area in the high large woody debris recruitment category.

In the upper watershed 50-70% of the area is in the low and moderate large woody debris recruitment potential classes and currently most of this area is outside the range of natural variation and just at or below Forest Plan and PIG standards for in-channel large woody debris. This is a concern because current low levels of in-channel large woody debris and the unlikely recovery of these areas in the near future due to the low rating for large woody debris recruitment potential.

Habitat Effectiveness Anadromous Species

Habitat effectiveness, especially in the anadromous habitat, has been heavily influenced by the easy access provided by bankside roads and trails along the mainstem and major tributary reaches. Figure 4-57 details the miles of roads and trails compared to the miles of stream in each subwatershed.

Figure 4-57 Road and Trail to Stream Length Ratio



Very high use and fishing activity are present in over 90% of the high quality anadromous fish habitat (Rosgen C type channels). Snorkel surveys indicate that virtually all legal sized trout (greater than 8 inches) are removed from the lower mainstem. There is likely incidental mortality from catch and release of resident trout, smolts and adult steelhead and spring chinook salmon from handling stress in this area. High levels of activity may affect the distribution of both juvenile and adult salmonids in the watershed.

Designation as a tier one key watershed was intended to recognize the high quality habitat remaining in this watershed, and its ability to function as a refuge and basis for production and restoration of anadromous fish populations. Although the protection and management of fish populations is the responsibility of the Oregon Department of Fish and Wildlife, the Forest Service should recognize that harvest pressure and population status are to some degree a function of accessibility for anglers. Since a very high percentage of the anadromous habitat is currently easily accessible, the importance of the remaining areas of limited accessibility should be recognized.

Areas of limited access include the Salmon River from Chenney Creek upstream for one mile and one mile below final falls, the central portion of Cheeney Creek, Boulder Creek and the mid to upper portions of the South Fork.

Conclusions

Lower Watershed

Within the lower watershed side channel habitat, pool levels and levels of large woody debris are outside the range of natural conditions. This area is also in the low range for large woody debris recruitment potential. This has resulted in degraded habitat for coho and chinook salmon and a shift in habitat types that favors steelhead. Access and fishing pressure is high in this area, lowering habitat effectiveness.

Middle Watershed

The middle watershed is outside the range of natural conditions for pools and at the low end of the range of natural conditions for large woody debris. This majority of this area is within the Salmon-Huckleberry wilderness and for the most part has not been managed. Levels of pools and large woody debris are attributed to the recent fire history in this area.

Upper Watershed

The upper watershed is outside the range of natural conditions for pools and at the low end of the range of natural condtions for large woody debris. Large woody debris recruitment potential in this area is in the low to moderate class. Habitat conditions in this area are atttributed to harvest activities where up to 62% of the riparian reserves within a subwatershed have been harvested (either clearcut or partial cut).

Commodities

Timber

Timber harvest began in the lower watershed in the 1940's and the upper watershed in the 1950's. Since the 1950's harvest levels have risen steadily, with a peak in the 1980's. Figure 4-58 illustrates the trend in timber harvest by decade within the watershed. On National Forest lands in the watershed, a total of 2927 acres have been clear-cut harvested to date. Of the 68,000 acres of National Forest lands in the watershed, 5% or 3294 acres are in the Timber Emphasis (C1) land allocation. Table 4-19 displays the harvest by land allocation to date. Figure 4-59 illustrates the location of existing clear-cut harvest by decade in the watershed.

Table 4-19 Summary of Harvest to Date

Land Allocation	Total Acres	Harvest Acres	Percent of Total
A Lands		1628	
B2	8261	2911	35
B3	363	5	1
B10	195	62	32
B12	37	17	47
C1	3158	1048	33
Riparian Reserve	3294	1030	31
Late Successional Reserve	7386	1512	21

Figure 4-58 Clear-cut harvest by decade, Salmon Watershed

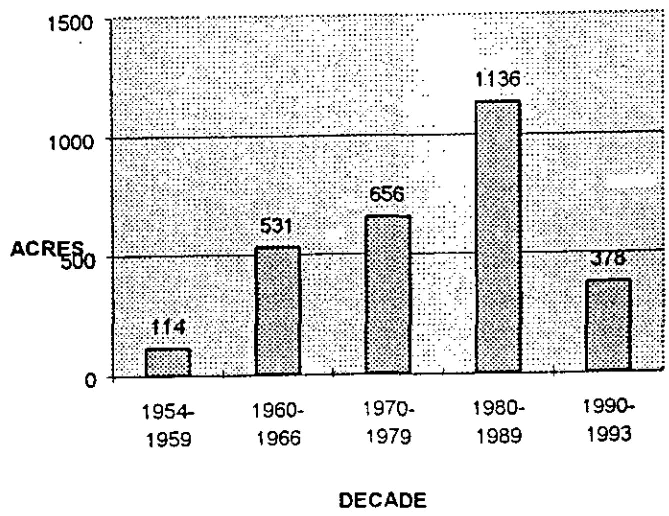
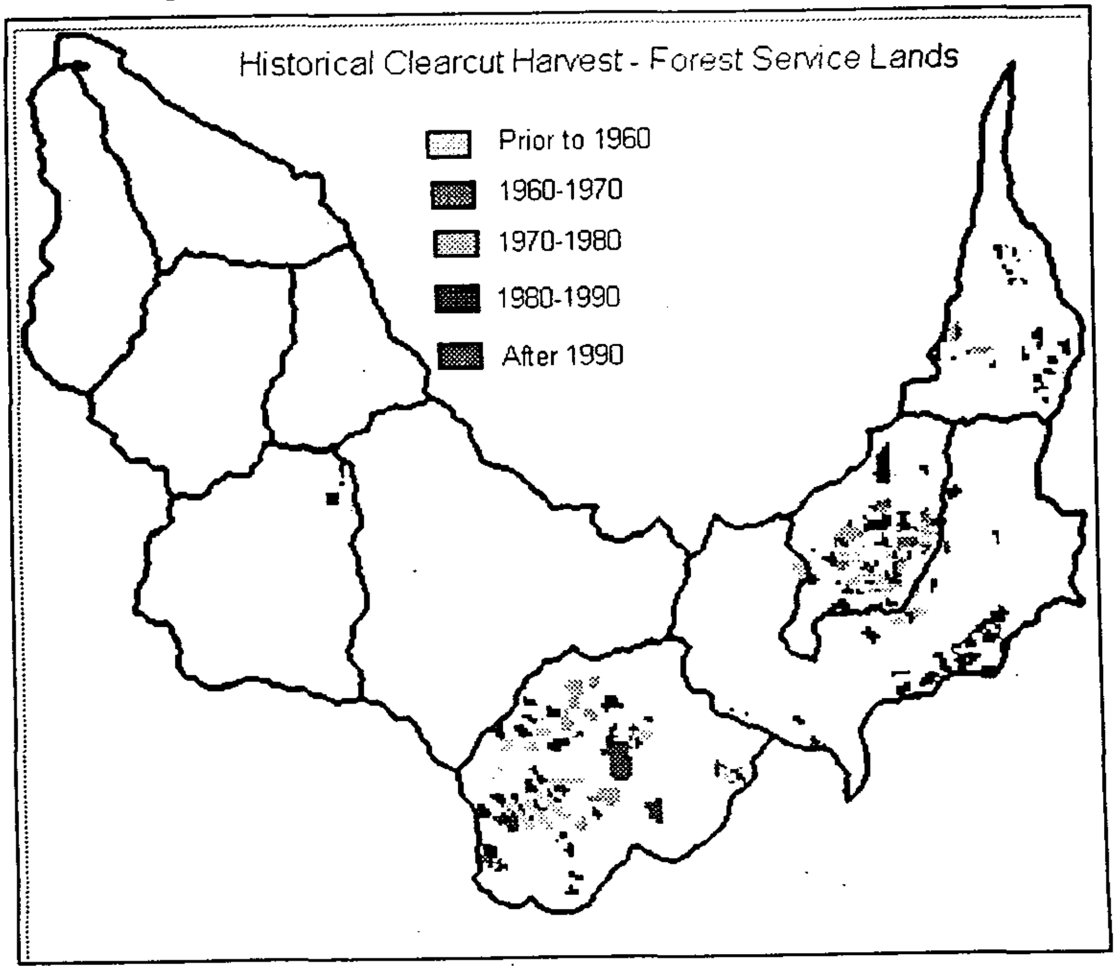


Figure 4-59 Clear-cut harvest by decade, Salmon River Watershed



Although acres of harvest data for the current decade are incomplete, it is expected that there will be a decline over harvest rates in the previous decade.

Grazing

The Wapinitia grazing allotment contains approximately 6581 acres of transitory range (early seral forest), and 526 acres of mountain meadows and natural openings. The remaining 19,217 acres in the range allotment are forested. The allotment encompasses parts of the White River, Oak Grove Fork of the Clackamas River and Salmon River watersheds. Roughly 25 percent of the allotment is within the Salmon watershed. The permittee is currently allowed to graze 390 AUM (animal unit months) or 130 head of livestock annually, during the season 7/1 to 9/30. An Environmental Assessment completed for the allotment in 1993 reduced the AUM to 300 until mitigation measures such as meadow exclosures could be implemented.

A review of the allotment for consistency with the Aquatic Conservation Strategy Objectives (appendix I) was completed in June 1995. The allotment was found to be consistent in most areas with the ACS objectives. Concentrated grazing in Jackpot and Dry meadow does not currently meet the ACS objectives and these areas have been prioritized for restoration (grazing exclosures) and monitoring.

Cattle grazing within the Wapinitia allotment is expected to remain at or about current levels for the next decade. As transitory range (early seral vegetation) decreases, available range will decrease in the allotment.

Special Forest Products

A variety of forest products are harvested from within the watershed. The following table summarizes the principle resources gathered in the watershed. Availability of these products are dependent upon forest seral stage and vegetation community. In most cases future product supplies are expected to meet demand. The availability of firewood, post and poles may be limited in the future as timber harvest levels decline. These materials are generally available as secondary by-products of timber harvest. Additionally, demand for firewood continues to grow.

Table 4-20 - Miscellaneous Products - Current Demand and Supply Trend

FOREST PRODUCT	CURRENT DEMAND	TREND
HUCKLEBERRIES	Moderate to High by both American Indians and the general public.	Continued moderate to high demand. Availability expected to meet demand.
MUSHROOMS	Moderate to High personal use and commercial demand	Continued moderate demand. Availability expected to meet demand.
BOUGHS AND CONES	Moderate commercial demand	Continued moderate demand. Supply limited to mid seral stands. Availability expected to meet demand.
BEARGRASS	Moderate to High commercial demand	Continued moderate to high demand. Availability expected to meet demand.
FIREWOOD POST AND POLES	Moderate to High demand	Continued moderate to high levels of demand. Availability limited by timber harvest levels. Demand may exceed supply.
CHRISTMAS TREES	Moderate demand for personal use.	Continued moderate demand. Availability expected to meet demand.
TRANSPLANTS	Low demand for personal use.	Continued low demand. Availability expected to meet demand.

Mineral Resources

There are two active quarries on National Forest lands in the Salmon watershed. Mud Creek quarry is a 24 acre site containing in excess of 500,000 cubic yards of high quality andesite rock. The expected lifespan of Mud Creek quarry is 50 years. Frying Pan quarry is a 7 acre site containing an estimated 140,000 cubic yards of high quality andesite and basalt. This quarry is considered inactive for the foreseeable future given economic conditions.

Miller quarry is a 16 acre site directly adjacent to the Salmon river below Wildwood Recreation Area. A private construction company owns the land and mineral rights for aproximately 10 acres of the 16 acre site. There are no remaining mineral resources within the privately held section of the quarry. The State of Oregon retains mineral rights on the remaining rock resources on the BLM lands. This portion of the quarry is currently inactive, and there is an unknown quantity of rock remaining. There are currently no known reclamation plans for either the privately or public held areas within the quarry.

There are currently no active locatable mineral claims or geothermal leases within the watershed.

Recreation

The Salmon River watershed is a key area for providing recreational opportunities on the Mt. Hood National Forest and within the Portland metropolitan region. The upper watershed, especially Mt. Hood itself, has been a popular destination since the 1800's. As roads were constructed and access to the watershed increased, use of the area has also risen, especially in popular areas like Timberline Lodge, Trillium Lake area, and the lower river area, an area especially popular for its sportfishery. With the increasing population of the State, especially in the Portland metropolitan area, recreation demand has been increasing. This demand is at rates higher than the population growth rate for the metropolitan area.

The watershed has a number of highly used, federally managed, recreation areas within areas of low to moderate use. The highest use areas on the National Forest are the Timberline Lodge area, Trillium Lake area, and the area along the lower river, including Green Canyon Campground and the Wildwood Recreation site managed by the Bureau of Land Management.

The Timberline area is popular for climbing, skiing, sightseeing, and hiking, and receives over 1,000,000 visitors annually. Since the 1960's use has been increasing steadily, to where today, Timberline Lodge is one of the most visited recreation sites in Oregon. The Palmer snowfield, at the headwaters of the Salmon River, is unique that it provides one of the only summer skiing opportunities available in the United States and is used extensively for skier training and racing programs including the training for the Olympics. The area is used by approximately 60,000 skiers during the summer and approximately 200,000 skiers during the winter.

The watershed provides a wide variety of dispersed recreational activities. Some of these, such as camping, fishing, and hiking, are activities which generally take place in or adjacent to riparian reserve areas that are easily accessed by roads and trails. The lower river is extremely well known for its summer steelhead sportfishery and receives very heavy fishing pressure in the summer and fall. The highest use trails within the watershed are the Old Salmon River Trail #742B and the lower two miles of the Salmon River Trail #742. Associated with these trails and the river are a number of very popular dispersed camping sites. The high levels of use along the trail and at the dispersed sites have created areas with resource impacts such as vegetation and soil disturbance, as well as sanitation concerns from human waste and garbage.

Popular dispersed recreational activities, including snowmobiling, Nordic skiing, mountain bicycling, driving for pleasure, and picking huckleberries and some hunting, are not as dependent upon water-based recreation and are less likely to impact riparian reserves values.

Non-Federal Lands

Off the National Forest, the Welches, Wemme, Brightwood areas provide a wide variety of recreation facilities and services. In addition to Resort at the Mountain and Mt. Hood RV Village, there are smaller bed and breakfast facilities, and a couple of residential youth camps. There is also a wide variety of stores, restaurants and other support facilities that meet the needs of residents and visitors to the area. Many of the business in the Welches, Wemme, and Brightwood areas are dependent upon this demand. A study conducted in 1988 revealed that nearly one third of the businesses in the Mt. Hood Corridor indicated that over 80% of their business is tourism-related. In 1987, tourism accounted for more than 70% of the gross revenue for business in the Mt. Hood Corridor.

Privately owned homes are increasing in number in the lower watershed, both for permanent residences and for vacation homes and this trend is expected to continue. Many of the full-time residents live and work in the area but many also commute to the Portland metropolitan area for work.

Future Recreation Trends

The most important factor influencing the trends in recreation use in the Salmon River watershed is population growth, especially in the Portland metropolitan area. As an urban forest within 1-2 hours drive from the Portland metropolitan area, population growth affects both demand for recreation resources as well as the condition of those resources. Oregon's state population grew 8% in the 1980 to 1989 with the majority of growth occurring in metropolitan areas while rural populations declined. Information from the State Comprehensive Outdoor Recreation Plan (SCORP) shows a projected increase in Recreational Visitor Day demand for the Mt. Hood National Forest of 57% from 1987 to 2000. No studies are available to show how much of this increase would take place within the Salmon River drainage but it is assumed that the demand would be similar to the increase in demand for the Forest.

The following SCORP information summarizes potential growth projections for the 1987-2000 period for activities which take place within the watershed. This information is for the Portland Metropolitan Region which includes Clackamas, Columbia, Multnomah, and Washington Countries. While many of the activities may take place in other areas on the Forest or around the State, those activities dependent upon consistent snow conditions, such as downhill skiing, sledding, and snowplay also have increased significance within the watershed since those opportunities are limited to very few areas within the state. This increased significance also applies to climbing and mountaineering which are tied to the presence of Mt. Hood itself.

Table 4-21 Recreational Activity Projected Growth from 1986-2000

Recreational Activity	Percent projected growth 1986-2000
Bicycling on roads	105%
Bicycling on designated trails	93%
Non-motorized fishing on lakes	77%
Day hiking	67%
Recreational vehicle camping	55%
Nature/wildlife observation	52%
Sledding/snowplay/snowboarding	51%
Off-highway vehicle use	42%
ATV riding over snow	41%
Off-road bicycling	38%
Downhill skiing	37%
Tent camping with a motorized vehicle	35%
Picnicking	35%
Big-game hunting	34%
Overnight hiking on trails	29%
Climbing/mountaineering	23%
Freshwater fishing from banks	21%
Non-motorized river boating	20%
Snowmobiling	8%

In addition to user demand, the SCORP study also indicated a shortage of the semi-primitive Recreational Opportunity Spectrum setting regionally and on the Forest. These settings are found within the wild segment of the Wild and Scenic River corridor and in the Salmon-Huckleberry Wilderness. Their presence in the watershed helps to meet some of the demand for that type of recreation setting. Management actions which could further limit access to dispersed camping sites could further limit supply. The figure below shows the ROS classes on National Forest lands within the watershed.

Figure 4-60 Recreation Opportunity Spectrum classes on National Forest lands within the watershed

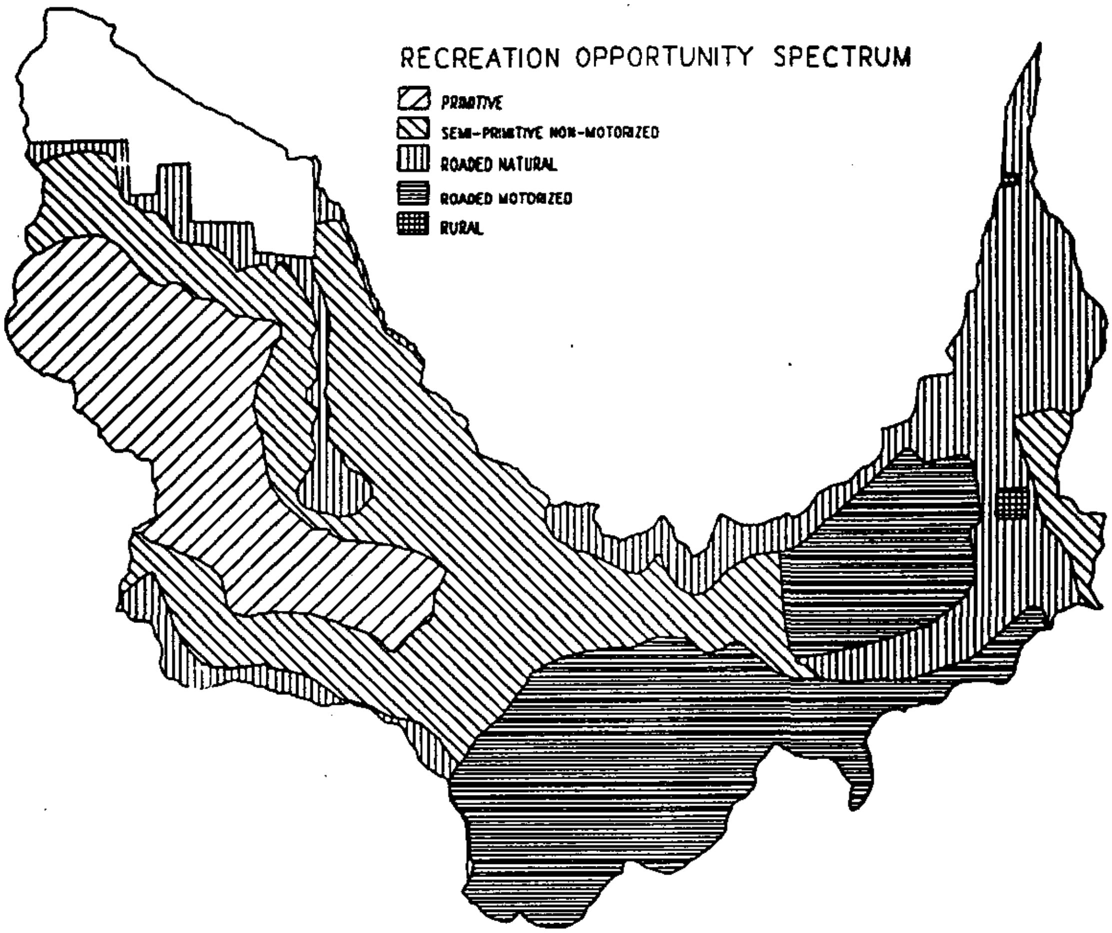


Table 4-22 Acres by ROS class within watershed

ROS Class	Acres by ROS Class	Percent of Watershed
Primitive	11,290	17%
Semi-Primitive Non-Motorized	22,050	32%
Roaded Natural	15,410	23%
Roaded Motorized	18,650	27%
Rural	200	1%

In the Salmon River watershed, the preferred settings for recreation are the Riparian Reserves along rivers or creeks, primarily Salmon River itself, Trillium Lake campground, resort type facilities such as Timberline Lodge, Resort at the Mountain, and Mt. Hood RV Village. These areas can be expected to be under even greater demand as the Portland

Metropolitan Area grows in the future. The existing landscape features, (the river, lakes, and vistas) are in limited supply so recreational use at the limited number of these areas can only be expected to increase. As population increases, the perception of how close the forest is to the metropolitan area may also change. Activities like mountain biking that currently receive relatively low use in the watershed because of driving distances from Portland, may increase at even greater rates as people drive even further to recreate in their preferred setting.

Additional residential development is also expected, with residences being developed for both vacation homes and for primary residences for individuals who are seeking less crowded conditions than what would be found within Portland itself. Associated with this additional development is the additional infrastructure such as roads, stores, and other services necessary to meet the increased local population. These individuals will be relying heavily on within and adjacent to the watershed to meet many of their recreational desires.

Increased use in the watershed can also increase the number of social encounters and user conflicts which can also increase the need for additional law enforcement personnel as violence and crimes increase. In summary, the increased population growth of the metropolitan area can be expected to lead to an increased concentration of use within the existing pattern of recreation use.

Barring any large-scale changes in the forest cover from natural events such as fires and insect epidemics, changes in scenic quality will primarily be a function of tree growth and future timber harvest. The progression of early-seral stands, especially those created by timber harvest, to mid-seral would serve to improve scenic quality over time as the forest canopy closes and blends in with adjoining stands.

Historic Features

This section will discuss the past and current conditions of Timberline Lodge, Silcox Hut, Barlow Road Historic District, Devils Peak Lookout, and Summit Meadows area. The reason for focusing specifically on these features is to provide background information for the answer to key question # 7 which discusses these features. Further information on these and other historic features in the watershed can be found in Appendix E of the watershed analysis.

Timberline Lodge

This building was constructed by the Works Progress Administration as part of Depression-Era work relief program and was completed in 1938. The building was listed on the National Register of Historic Places in November of 1973, and designated a National Historic Landmark in 1977. The building is one of only two buildings in the

National Forest system that is a National Historic landmark. The Lodge historical significance is its unique "Cascadian" architecture and its many arts and crafts displayed in its interior. The Eastleg and Westleg roads were constructed to provide access to Mt. Hood and the timberline area, even before the idea of Timberline Lodge was conceived. These roads provided the primary access until the construction of the current Timberline Road which started in 1949. The popularity of the Lodge has grown over the years, not only for skiers, but for many other visitors who come to enjoy the setting and view from the Lodge and the beauty of the Lodge itself. Over 1,000,000 visitors visit the lodge each year, making it one of the most visited sites in the state of Oregon.

The Lodge and its associated facilities, including Silcox Hut, obtain potable water from a series of springs that were developed in 1937-1938. The springs were developed to supplement the primary source taking water directly from Salmon River. This primary source was found to be inadequate and the springs were then fully developed. The spring source does not meet newer water quality standards and plans are being made to modify the springs to convert them to a ground water source that will meet the newer standards. Attempts to drill wells in 1994 for potable water were unsuccessful to meet the needs of the facilities.

Silcox Hut

This building was constructed in 1939 to serve as the upper terminal for the Magic Mile chairlift. The building also had a small snackbar associated with the terminal. This chairlift was the second chairlift built in the United States. The original lift was replaced in 1962. Over time, the building fell into disrepair, but because of the efforts of a group, "The Friends of Silcox Hut", the building was placed on the National Register of Historic Places in 1983. This group completed rehabilitation of the hut in 1993. The rehabilitation included modifications of the building to include sleeping quarters, food service facilities, installation of a sewage drain field and hook-up to Timberline Lodge's water system to accommodate visitors to the Hut.

Barlow Road Historic District

This area contains the route of the Barlow Road, which dates back to 1845 and was an overland route of the Oregon Trail. The Historic District is listed on the National Register of Historic Places, and contains many unique including visible ruts of the trail, and graves of individuals that died while emigrating to the Oregon Territory. Individuals wanting to learn more about the trail still come to view portions of the trail in the watershed. The District includes all the known traces of the Barlow Road on the Forest as well as other associated features.

Summit Meadows Area

This area has a number of historically significant features associated with it. Summit Meadows was a landmark for the immigrants on the Oregon Trail. The original Summit Guard Station was located in the meadows before it was located in its present location near Government Camp. An airstrip was constructed at the southern end of the meadow by the Forest Service prior to the 1930's. A CCC camp was established in the meadows which evolved into a highly developed camp to house WPA workers constructing Timberline Lodge. In addition, a traditional American Indian campsite has been reported in the meadows but has yet to be found. Currently, the area along the edge of the meadow, especially the airstrip area and the site of some of the old CCC camp facilities are receiving heavy dispersed camping use, impacting these sites and degrading their heritage values.

Devils Peak Lookout

The original lookout was a log structure that was constructed in 1924 and was replaced in 1933. That structure was reconstructed in 1952. The building is not actively managed by the Forest Service at this time, but it is regularly visited by recreationists. Its current condition is poor and it may present a public hazard if allowed to deteriorate further. The Forest Service is considering rehabilitating the structure and renting it out to the public which would make the building safe for public use and help to preserve its historical character.

Trends

Active management actions will need to take place in order to preserve the value of these features. To ignore them will result in deterioration over time. Increasing public use in the watershed, especially dispersed camping in the Summit Meadows area and at Devils Peak Lookout, and to some extent, visitation along the Barlow Road will cause increasing impacts to the historic character of the features by increasing disturbance of the sites, potentially degrading their values. The National Historic Preservation Act, as well as Forest Plan standards require that historic features and artifacts be protected, at least until they can be adequately studied and recorded for their historic values.

Chapter 5 - Landscape Analysis and Design

Chapter 5 - Landscape Analysis and Design

Introduction

The Landscape Analysis and Design process (LAD), (Diaz and Apostol, 1992), unites forest planning with the principles of landscape ecology and emphasizes the conscious design of patterns in the landscape. The objective for using LAD, in conjunction with watershed analysis, is to synthesize current management direction with information gained from the watershed analysis into a spatial plan of vegetation patterns and forest structures. More specifically, LAD assists in synthesizing information about physical, biological, and social processes and functions with management direction, recommendations, and expectations.

Understanding the watershed was facilitated by answering a series of spatial questions. What are the elements present in the landscape i.e. patches, corridors, matrix? Where do flow phenomena like wildlife, people, and water occur? What has been the historic disturbance pattern from fire, insects, floods, and windthrow? What is current management direction for lands throughout the watershed?

The initial step of LAD was completed in which long-term, conceptual landscape vegetative patterns were identified. This conceptual landscape design was an integral and essential step in answering the key questions, especially in regards to future trends.

After completion of watershed analysis, additional Landscape Analysis and Design work should be completed:

1. To develop an interim landscape design for the watershed and identify the infrastructure in terms of roads and other facilities necessary to manage the developed areas and desired vegetative patterns.

2. To graphically display where future management activities can occur in the watershed to serve as a bridge between analysis and site specific project development.

3. To evaluate how different management actions will affect the growth and structure of forest over time by using SNAP or another modeling system.

Landscape Analysis and Design Mapping Process

Using the LAD design process, a **Conceptual Landscape Pattern Map** was developed for the Salmon River Watershed. This map depicts what the landscape will look like at some point in the future, 50 - 200+ years. The design was based on direction from the Northwest Forest Plan, the Mt. Hood Forest Plan, and information gained during the watershed analysis about the physical and biotic characteristics of the landscape and social desires. Design elements were developed which provide the desired landscape structure to meet management goals for the area. The terms used attempt to describe how these landscapes would appear in their future condition when viewed by the public. See Figure 5-1 for the Conceptual Landscape Pattern.

Figure 5-1 - Conceptual Landscape Pattern

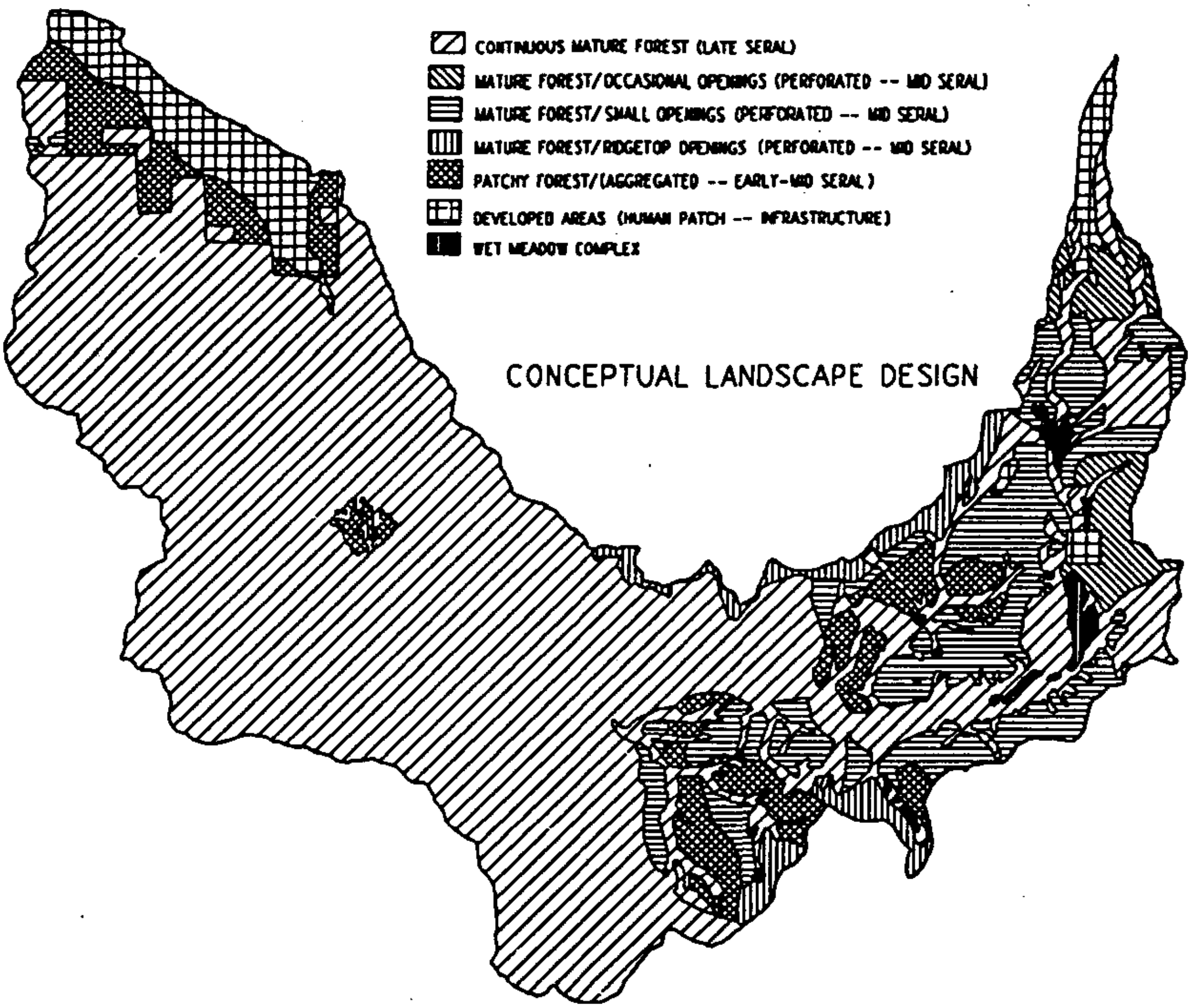


Table 5-1 Acres by Design Cell

Design Element	Acres	Percent of watershed
Continuous Mature Forest	52,239	71%
Mature Forest / Occasional Openings	1,956	3%
Mature Forest / Small Openings	7,792	10%
Mature Forest / Ridgetop Openings	2,016	3%
Open Immature Forest	5,459	7%
Developed Areas	3,544	5%
Wet Meadows Complex	646	1%

The **Continuous Mature Forest** (Late Seral) design element includes all areas that in the future would be considered terrestrial and riparian reserves. This pattern covers approximately 71% of the watershed and contains 52,239 acres.
The assumptions which guided the development of this element were as follows:

1. The Salmon/Huckleberry Wilderness will function as late seral habitat,

2. Riparian reserves will provide late seral structure as well as connectivity corridors for terrestrial species;

3. The Key Site Riparian allocation will be managed as late seral;

4. The riparian reserves in the alpine zone will be managed to protect hydrological values downstream;

5. 100 acre owl centers will be managed for late-seral structure;

6. The wild segment of the Salmon's Wild & Scenic River allocation will be managed as late seral structure,

7. The C-3 fungi, noble polypore (*Oxyporus nobilissimus*), site south of Timberline Lodge will be managed as late seral based on C-3 survey and manage guidelines. Its square map form will not appear as such on the ground as it will visually blend into neighboring elements, and,

8. Most BLM parcels within the lower watershed are managed to preserve the existing character of the landscape. Exceptions include the developed Wildwood Recreation Site and the southern 1/3 of Section 35, T2S, R6E. This section is managed for connectivity between Late Successional Reserves but limited timber harvest may take place..

The **Mature Forest / Occasional Openings** (Mid to Late Seral) design element is located east of Trillium Lake and the upper elevation forest just south of Timberline Lodge. It provides the type of structure described in LRMP allocations of: unroaded recreation, winter recreation, scenic viewshed, and the upper recreational segment of the wild and scenic river corridor. This pattern covers approximately 3% of the watershed and contains 1,956 acres. The structure suggested would be mostly late seral, but with occasional small openings created for big game forage, scenic vistas along the PCT, snowmobile trails, etc. These small openings will also facilitate regeneration where frost pockets are a problem.

The assumptions which guided the development of this element were as follows:

1. The areas above Timberline Lodge Road outside of the ski runs will be managed for mid to late seral structure; and

2. The areas east of Trillium Lake along the east side of Salmon River will be managed for mid to late seral structure as discussed above.

The **Mature Forest / Small Openings** (Mid Seral--Perforated Forest) design element was created to provide a similar structure to that caused by natural disturbance factors (gap dynamics) of lightning strike fires, root diseases, wind, etc. which create small openings in the forest canopy. This pattern covers approximately 10% of the watershed and contains 7,792 acres. This structure allows for the creation of small openings for special silvicultural needs such as: sites with regeneration problems due to frost pockets; scenic viewsheds where created opening size is limited; forage areas within the wild and scenic river corridor, and on BLM land to provide connectivity.

The assumptions which guided the development of this element were as follows:

1. Unstable and potentially unstable lands will be protected by riparian reserves,

2. Open patch size will range from less than one acre up to five acres depending on site limitations and resource objectives; and will be dispersed over approximately 20% of the area at one time; and

3. On BLM land, manage lands on a 150 year rotation of slightly larger patches with 25 to 30% of land in late successional forest at any time. Total acreage on BLM lands within the category, including riparian reserves, is approximately 130 acres. Riparian reserves will separate regeneration blocks into smaller openings.

The **Mature Forest / Ridgetop Openings** (Mid Seral--Perforated Forest) design element was created to provide the structure similar to the gap dynamics discussed above, but allowing a slightly larger open patch size to facilitate huckleberry production. This pattern covers approximately 3% of the watershed and contains 2,016 acres.

The assumptions which guided the development of this element were as follows:

1. Huckleberries will be managed in created openings and under sparse canopy areas;

2. Created openings will be designed to meet Scenic Viewshed and Roaded Recreation objectives; and

3. Open patch size will range from 5-20 acres and will be dispersed over up to 50% of the area at one time.

The **Open Immature Forest** (Early to Mid Seral--Aggregated Forest) design element was developed to provide structure similar to that created by large scale natural disturbance factor such as stand replacement fires or blowdown due to windstorms, but at a smaller open patch size due to social restrictions related to loss of wildlife and fisheries habitat, water quality, recreation opportunity, scenic degradation, etc. This pattern covers approximately 7% of the watershed and contains 5,459 acres. These areas will provide timber products and big game forage from Timber Emphasis, Big Game Winter Range allocations on Forest Service lands and non-federal lands zoned as timberlands.

The assumptions which guided the development of this element were as follows:

1. Open patch size will range from 5-100 acres with 15% leave trees (snags/down wood), dispersed over 50% of the area at one time;

2. Areas with high landslide potential will use 2-5 acre maximum open patch size adjacent to unstable lands,

3. The Big Game Winter Range area at the terminus of the Salmon River Road (keyhole area) will be managed for forage and will use created openings at the lower end of the size range.

The **Developed Areas** (Human Patch/Infrastructure) design element provides the places of human habitat and transportation/utility corridors. This pattern covers approximately 5% of the watershed and contains 3,544 acres. It is found in the following locations:

- Roads and Trails,
- Developed Sites,
- Timberline Lodge,
- Trillium Lake,
- Welches/Wemme/Brightwood Residential Areas,
- Wapinitia Residential Area; and
- Wildwood Recreation Site.

Not all features that would fit into this category were mapped in the Conceptual Landscape Pattern map due to their small size, but will need to be considered in more site specific analysis in the future. These include the roads and trails, as well as some smaller developed sites such as Green Canyon campground, and Alpine campground.

The **Wet Meadows Complex** design element highlights the larger wet meadow complexes within the watershed. These areas are important in meeting special habitat needs, as well as other ecological functions. This pattern covers approximately 646 acres, or slightly less than 1% of the watershed.

Chapter 6 - Key Questions/ Synthesis

Chapter 6 - Key Questions/Synthesis

Introduction

In this chapter, key questions are answered by assessing the effects processes and functions have on the key attributes addressed in each question. This approach synthesizes the analysis by considering the relevant processes and conditions in the answer. It also identifies and documents significant shifts from the range of natural conditions and desired conditions. The result provides a basis for identifying and prioritizing methods to maintain or restore the key attribute.

Future Seral Stage

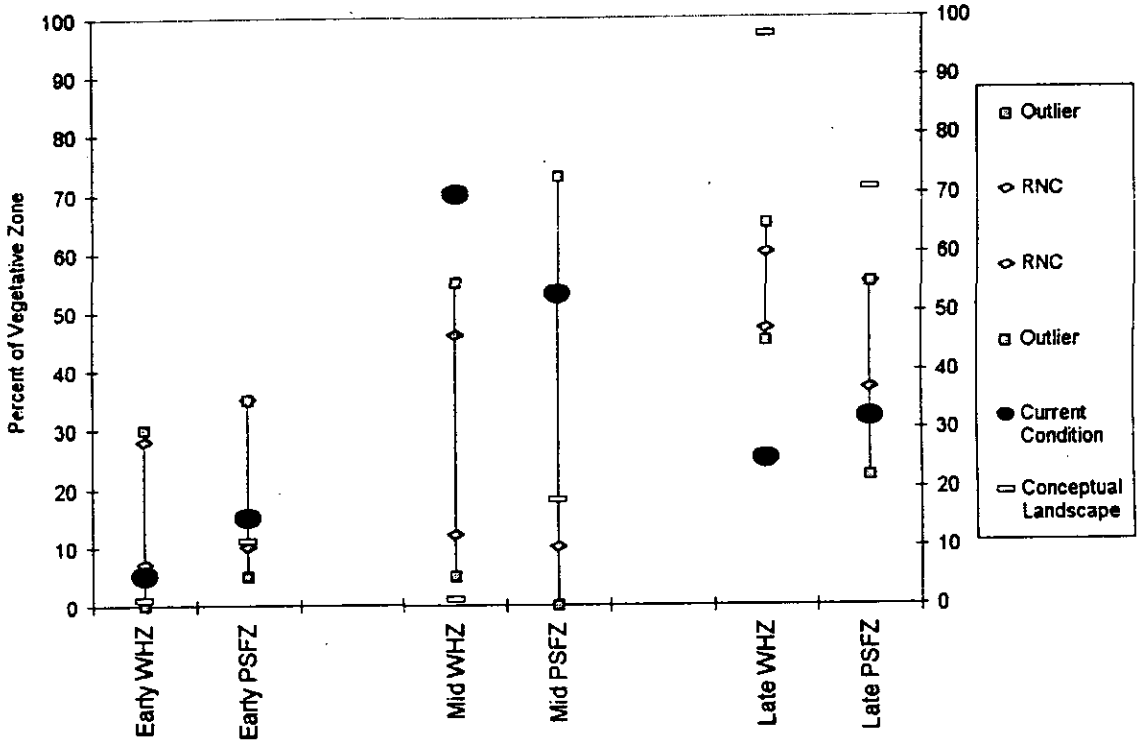
The conceptual future condition for seral stage is described here since it is useful in addressing many key questions and affects a variety of ecosystem functions, including: wildlife species use and migration, hydrologic function, production of snags and coarse woody debris, nutrient cycling, and disturbance processes such as fire, insects and disease. The Range of Natural Conditions, (RNC), for seral stages is based on the Regional Ecosystem Assessment Project, (REAP), scaled down to the watershed level. REAP determined pre-European management conditions at a landscape level and determined a RNC for the time period of 1750-1930. Current conditions are based on corrected 1995 vegetation data.

The forest landscape analysis and design (LAD) process was used to depict what the future watershed landscape will look like in 50-200+ years, based on current management direction and information gained during the watershed analysis about the physical and biotic characteristics of the landscape and social desires.

The following chart compares current seral stages, and conceptual landscapes developed through the LAD process, by vegetative zone, against the RNC.

Outlying data is displayed as well, but has a lower confidence level. Early seral reflects an intent to portray acres of forest that function as openings. Late seral is based on large size class and more than one layer. Mid seral generally includes small conifer stands and closed sapling/pole stands.

Figure 6-1 - Seral Stages: RNC, Current Condition and Conceptual Future Condition



Implementation of the NW Forest Plan results in late seral stand structure that is outside and well above the range of natural conditions in both the Western hemlock zone and the Pacific silver fir zone. Mid and early stand structure is outside the range of natural conditions within the Western hemlock zone and within the range of natural conditions for the Pacific silver fir zone. It should be noted that seral stage for the future is based on the "desired conditions" and actual conditions may not reach that level of late seral stands because of natural disturbance mechanisms such as fire and insect infestations. This is addressed further in key question #9.

Answering Key Questions

Question #1: How do conditions of the watershed contribute to the habitat needs for species of concern in terrestrial habitats?

For ease of discussion, species of concern are grouped and addressed by their life history guild. Guild maps at the forestwide scale were used as a tool in answering this Key Question, as well as vegetation and other resource information, and species specific information.

TLML: (Terrestrial, Large home range, Mosaic patch configuration, Large tree structure)

- Northern spotted owl
- Wolverine
- Northern goshawk
- Pileated woodpecker
- Pine marten
- Fisher

23% of the watershed is within this guild. The range of natural conditions shows historic landscapes with much more late seral forest. Fire and management activities within this century have decreased the amount of late seral.

Currently, the best existing habitat for this guild is located within the Critical Habitat Unit for the northern spotted owl, (CHU), in the West and East Fork Salmon subwatershed. The conceptual landscape pattern shows this area as perforated.

Private lands and developed areas within the watershed are not currently providing habitat for this guild. Furthermore, they are not expected to provide habitat in the future.

Future vegetative conditons of the watershed are moving towards late seral which will provide large amounts of habitat for species in this guild, including snag dependent species. Lowered site potential within the LSR and Wilderness may limit the amount of stands with old-growth characteristics due to stand stagnation and increased risk of disturbance. This is discussed further in Key Question 9.

Wolverine

The California wolverine is managed as a sensitive species by the Forest Service and is a candidate for listing under the Endangered Species Act by the USFWS. Populations in the Cascades are small and scattered. The wolverine is not solely a late seral species and may not, in fact, fit into this guild. Wolverine have large home ranges and have an aversion to human presence. Human disturbance is especially critical at denning sites.

Confirmed wolverine tracks were located above Snowbunny in May of 1990. Repeated annual surveys in this same area have not identified any additional tracks. A Forest-wide conservation strategy is being drafted. In this conservation strategy, refugia blocks have been drafted where large contiguous blocks of habitat already exist or where land management allocations provide for future blocks. These blocks will vary in size from winter to summer as snow melts off the roads and allows human access into these areas.

One refugia block under consideration includes the Salmon-Huckleberry Wilderness and adjacent LSR. This refugia provides quality habitat in terms of low human presence yet has been identified as low in high quality food sources. The major food source of wolverine is deer and elk. Creation of forage openings to enhance deer and elk habitat may in turn provide higher quality wolverine habitat by providing a larger prey base. There is an opportunity to create forage openings in the B-10 allocation at the end of the Salmon River Road, which is adjacent to the Wilderness. This area, commonly referred to as the keyhole, provides opportunities to create forage openings, especially for deer.

Northern goshawk, fisher, pine marten, and pileated woodpecker

These are all species of concern (federal candidate species or Oregon State sensitive - *see appendix for status*) dependent on snags and old growth forest. Overall snag levels in the watershed are low, thereby reducing the amount of quality habitat for these species. However, pileated woodpeckers are frequently seen in the Salmon River riparian areas and habitat conditions are generally considered excellent in this area. Pileated woodpeckers have become fairly common in the watershed. Pileated woodpeckers are a primary excavator that require large acreages of intact forest to forage for their preferred food source, the carpenter ant, and for other insects such as bark beetles.

Pine marten has been documented in the upper Salmon River and there is a known goshawk nest site near Salmon River meadows. Fallen trees and branches are an important component of marten winter habitat. The marten enters the snow-free area beneath the down logs to hunt tree squirrels. Its "shy" behavior makes it a rarely observed animal of the forest.

There are no documented sightings of fisher in the watershed, although sightings have been documented south of the watershed. During the 1920 - 1930s, the fisher declined in population from overtrapping and poisoning aimed at coyotes and wolves. Currently the status of the fisher population on the forest is unknown, yet it is believed to be severely depressed or non existent. The fisher may be extirpated from the watershed, basin, and possibly forest.

Northern spotted owl

Northern spotted owls are discussed here in more detail as an aid to consultation.

The distribution of spotted owls in the watershed is very connected to protected areas and drainage bottoms where good habitats remain as a legacy from fire. There are 17 known owl pairs in the watershed. Thirteen of these pairs are within the Wilderness and adjacent LSR. Management of the wilderness is assumed to be consistent with management and recovery of spotted owls and any management of wilderness needs to be planned with this assumption in mind (Ray Bosch, USFWS, letter 1995).

Four pairs are located within the matrix and are potentially subject to incidental take in the future by disturbance or reducing habitat. Three out of the four pairs are already below incidental take levels due to the amount of suitable habitat around the activity center. Each of these owl centers are currently protected by 100 acre LSR designations. Because these areas are considered important to meeting objectives for species other than spotted owls, they are to be maintained even if they become no longer occupied by spotted owls.

Currently, dispersal habitat is good since 70% of the watershed is in this classification. There is 58% dispersal habitat in the matrix, including those portions of riparian reserve and 100 acre LSRs. Overall dispersal habitat is adequate in the matrix between LSRs. The Salmon Wild and Scenic River designation and riparian reserves will maintain forested conectivity between the Mud Creek area and south.

Critical Habitat Units are a land designation defined by the USFWS. In the watershed, most of the CHUs lie within LSRs except for the keyhole area and the northeast corner of the watershed.

Salmon River watershed contains only portions of two larger LSRs. The LSR adjacent to the Wilderness is part of the Roaring River LSR #R0207. This LSR is 105,000 acres in its entirety and contains 35 owl pairs. The Wilderness pairs are not counted in this tally, but Wilderness is to function largely as late seral habitat. The portion of LSR in the eastern portion of the watershed is part of White River LSR #R0204. This LSR is 34,000 acres and contains 13 pairs, 2 of which are on the border.

TLC: (Terrestrial, Large home range, Contrast)

Great Gray Owl

The Great Gray Owl is a C3 species with survey and manage strategies 1 and 2. It is most common in lodgepole pine forest adjacent to meadows. However, it is also found in other coniferous forest types. Some shelterwood harvesting systems may be beneficial to the species by opening up otherwise closed canopy cover for foraging. Known sites require 300 foot protective buffers.

Protocol for survey is being developed. Initial surveys this spring found none on the forest. This included the meadows near Salmon River.

Only 8% of the watershed currently has habitat for this guild. In the future contrast habitat will decrease further.

TSPL: (Terrestrial, Small home range, Patch, Large Tree)

Red Tree Vole

This species was discussed in the current condition chapter which included an individual species map showing potential habitat in the watershed. Currently there is limited primary habitat and secondary habitat is marginal. Primary habitat is expected to increase in the future as more forest becomes late seral. To date, there have been no sightings within the watershed.

TMGG: (Terrestrial, Medium home range, generalist)

- Long eared myotis
- Long legged myotis
- Hoary bat

92% of the watershed meets the habitat requirements for this guild. As generalists, they can adapt to future vegetation.

These three bat species are C3 species, strategies 1 and 2. These bats breed in cavities in large trees, including cracks and deep fissures of bark. Lack of snags in the watershed may be limiting. Caves are used mainly as secondary habitat for breeding and resting.

TMML: (Terrestrial, Medium home range, Mosaic, Large tree

Black-backed woodpecker

Although 18% of the watershed is in this guild, Salmon River watershed is at the limits of the range for the black-backed woodpecker. Habitat is limited through lack of lodgepole and size of snags within the watershed, but areas such as Inch Creek could provide possible habitat. Although habitat is limited, bark beetles present within mixed conifer stands weakened by spruce budworm would provide an increased food source for this species.

The black-backed woodpecker is a protection buffer species as defined in the ROD (C-45).

TSGG: (Terrestrial, Small home range, Generalist)

- Clouded salamander
- Red-legged frog
- Oregon slender salamander
- Northern pygmy owl

92% of the watershed is within this guild and is anticipated to be at similar levels in the future due to the generalist nature of the species. The clouded and Oregon slender salamanders, and the northern pygmy owl are Oregon State sensitive species whereas the red-legged frog is a candidate for federal listing.

There are currently no surveys for amphibians on Forest Service lands within the watershed. These species, however, are likely to occur within the watershed, as they occur in adjacent watersheds. The red-legged frog has been found on BLM lands within the watershed south of Wildwood. BLM will protect this one known population site and develop a monitoring plan.

The red-legged frog is found throughout western Oregon and Washington at elevations ranging from sea level to 2800 feet. Outside of the breeding season, adult red-legged frogs are highly terrestrial and are frequently encountered in woodlands adjacent to streams. Refer also to Key Question #2 for further discussion.

Clouded and Oregon Slender salamanders are woodland salamanders that live in downed logs. Downed logs may be limited in large areas of the watershed due to fire history and general lack of large woody debris. These conditions should improve in the future.

The Northern pygmy owl is known to occur in the watershed.

TSPE: (Terrestrial, Small home range, Patch, Early seral)

- Western bluebird
- Mountain bluebird

Both of these bluebirds are secondary cavity nesters, dependent on snags and primary cavity nesters. They require patches of early seral forest with snags which currently exists in the eastern half of the watershed. Only 6% of the watershed is currently within this guild and the trend over time seems to be the reduction of early seral habitat. Snags are also at low levels. The western bluebird is listed as Oregon State sensitive.

TMC: (Terrestrial, Mosaic, Contrast)

Silver haired bat

The silver haired bat is a C3 species that breeds in large trees with cavities and uses caves as secondary nesting. There is only 3% of habitat within the watershed for this guild and managing for late seral forest in the future will limit habitat for this contrast species.

Mollusks

Four species of C3 slugs potentially occur within the watershed. In 1948, a type specimen of the Malone jumping slug, *Ortmanni tormentor*, was located near "Tawny's Hotel", which is near Bridge Street in the northwest corner of the watershed. The other three species, (Blue-grey tail dropper, Papillose tail-dropper, and Evening fieldslug) are not known on the Mt. Hood, but surveys may help confirm. As with all of the mollusks, the species range is not well defined, and those additional surveys may yield new information which could change current thought of the species range.

Habitat for the Malone jumping slug is generally in open but uncut forest from 1600 - 3900 feet in elevation. This species may occur with the Larch Mountain Salamander. Blue-grey tail droppers are found solitarily in dark fir woods under damp logs. The Papillose tail-dropper has been found at one site in Oregon at 1873 feet elevation in marginal oak forest. The Evening fieldslug has been found at 26 feet in elevation vegetated with salmonberry, hemlock, black cottonwood and spruce; and at 2000 feet in elevation vegetated with maples, grand fir, hemlock, ferns, mosses and annuals.

Survey and Manage (C3) Plants

The following C3 species are located in terrestrial habitats and are discussed in more detail in the botany section of Chapter 4. These include:

- *Martellia* #649, a rare endemic false truffle in high elevation old growth,
- Noble polypore, a fungus that grows on old growth noble fir stumps and snags,
- Sugar stick, a vascular plant that grows in undisturbed forest floor,
- Lichens and bryophytes including several that are associated with old growth.

The future increase in late seral forest, along with individual protection requirements, should improve the habitat for these species.

Question #2: How do conditions of the watershed contribute to the habitat needs for species of concern in aquatic and riparian habitat?

Table 6-1- Species of Concern within Salmon River Watershed

Species	Concern
Coho salmon	Forest Service and State sensitive species, high risk of extinction
Spring chinook salmon	High risk of extinction
Winter steelhead	Moderate risk of extinction
Sea-run cutthroat trout	Forest Service sensitive species, moderate risk of extinction
Bull trout	Proposed for T & E listing, Forest Service sensitive.
Resident cutthroat trout	Public interest, Mt. Hood National Forest management indicator species
Resident rainbow trout	Public interest, Mt. Hood National Forest management indicator species
Redband trout	T & E petitioned, Forest Service sensitive
Mt. Hood brachycentrid caddisfly *Eobrachycentrus gelidae*	Fish and Wildlife category 2 species, taxa of concern
Mt. Hood farulan caddisfly *Farula jewetti*	Fish and Wildlife category 2 species, Oregon Natural Heritage Program, taxa of concern
Columbia dusky snail	ROD survey and manage species
Red-legged frog	Forest Service sensitive species
Tailed frog	Oregon State sensitive species
Corydalis aqua-gelida Cold water corydalis	Forest Service sensitive species, ROD survey and manage species, Fish and Wildlife category 2
Botrychium minganese, B. montanum	Forest Service sensitive species, ROD survey and manage species
Coptis trifolia, threeleaf goldthread	Forest Service sensitive species, ROD survey and manage species
Harlequin duck	Oregon State and Forest Service sensitive species, USFWS C2 species
Ring necked duck	Oregon Natural Heritage Program Sensitive species
Carex livida, pale sedge	Forest Service sensitive species
Scheuchzeria palustris var. americana, scheuchzeria	Mt. Hood NF Sensitive Plant
Utricularia minor, lesser bladderwort	Forest Service sensitive species
Sisyrinchium sarmentosum, pale blue eyed grass	Forest Service sensitive species
Huperzia occidentale, fir clubmoss	Forest Service sensitive species

Species with similar habitat requirements were grouped in answering this question to avoid redundancy.

Coho and spring chinook salmon

The coho salmon run is composed of two stocks: a native late-spawning stock, and an early spawning hatchery influenced stock. The late run stock is virtually extinct, and both stocks are listed by the State of Oregon and the Forest Service as sensitive species.

The spring chinook salmon run in the upper Sandy basin is also composed of two stocks, a native early-run and a late-run derived from and supplemented with Willamette stock. The native run is presently very small may be extinct. Natural reproduction of the introduced run is increasing over time in the watershed.

Fall chinook appear to have been present historicially, and spawning adults were observed in 1994.

Figure 6-2 - Current Coho distribution

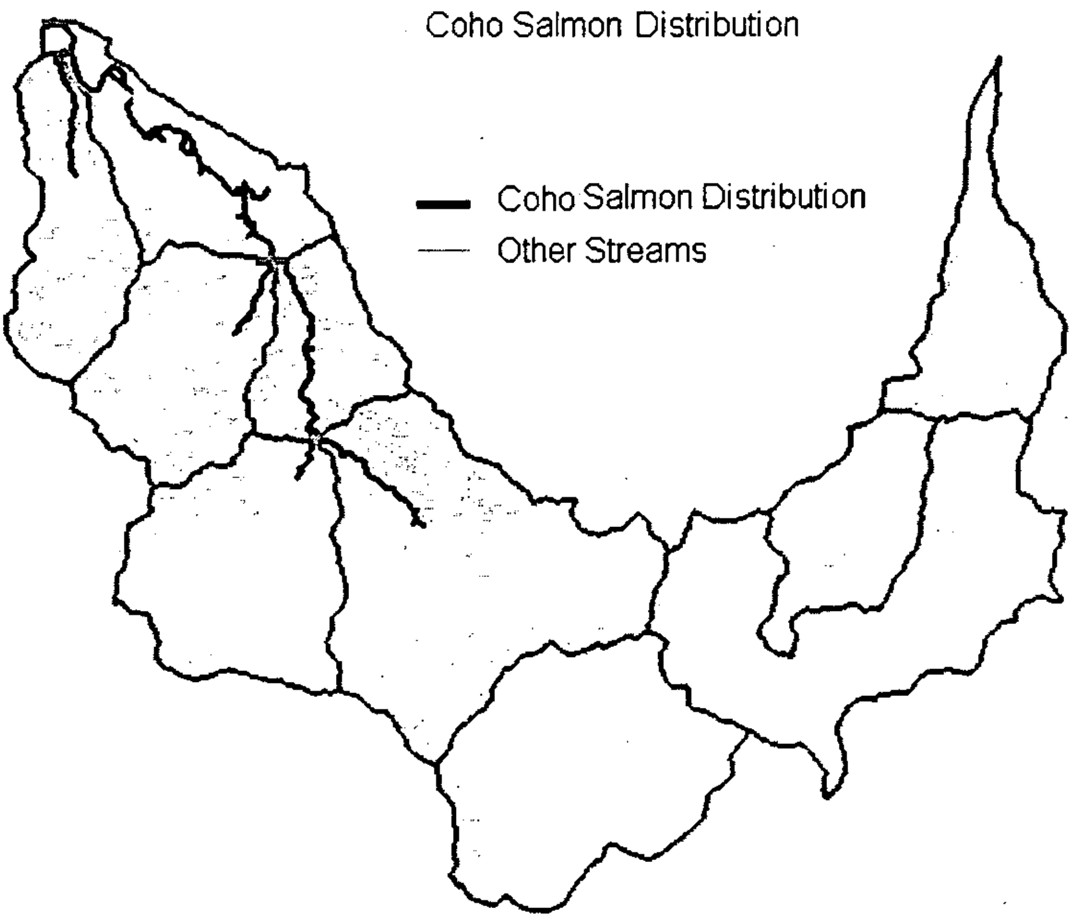
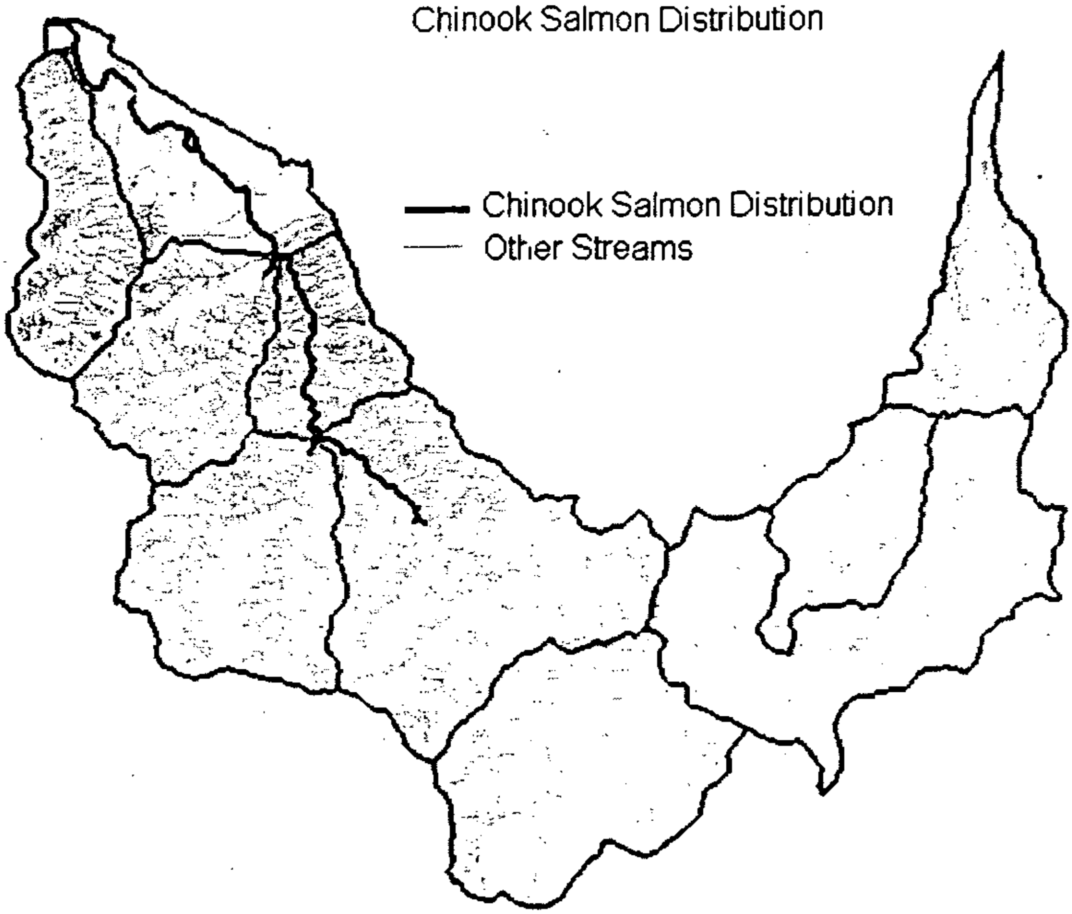


Figure 6-3 - Current Chinook distribution



Coho salmon prefer areas with low water velocities such as low gradient small to medium sized streams, side channels, and the margins of mainstem rivers (Meehan and Born 1991; Grout and Margolis 1991). Large woody debris frequently acts as the roughness element creating the protected low velocity margins of the river that coho prefer to utilize.

Chinook salmon utilize larger streams and river systems. Chinook prefer large pools with large woody debris in low gradient areas along the mainstem and do not venture into tributaries or side channels.

These low gradient areas would be characterized by Rosgen C type channels which are defined as low gradient, meandering, point-bar, riffle dominated channels with broad, well defined floodplains. For the most part this type of channel exists in the Salmon River and Lower Salmon subwatersheds. The Salmon River subwatershed is below the range of natural variation and Forest Plan Standards for pools, large woody debris, and over 50% of the riparian reserves are in the low and moderate large woody debris potential class. Salmon River within the Lower Salmon River subwatershed is outside the range of natural variation for pools, but within Forest Plan and PIG standards, and within the range of natural variation for large woody debris, but below Forest Plan and PIG standards.

Another important consideration in assessing coho habitat is examining the mix of habitat types. Coho salmon prefer slow water pools and side channels. The Salmon River is outside the range of natural variation for both pools and side-channel habitat for the range of coho salmon. This is attributed to channelization and large woody debris removal in the 1960's and 1970's. A limiting factors analysis for coho salmon was completed by Oregon State University and it concluded that side channels are important to coho production in the basin and that to provide good habitat for coho side channels should be restored, incorporating large woody debris into existing and restored side channels.

Habitat effectiveness in this area has also been degraded in the Lower Salmon and Cheeney Creek subwatersheds due to easy access and associated fishing pressure.

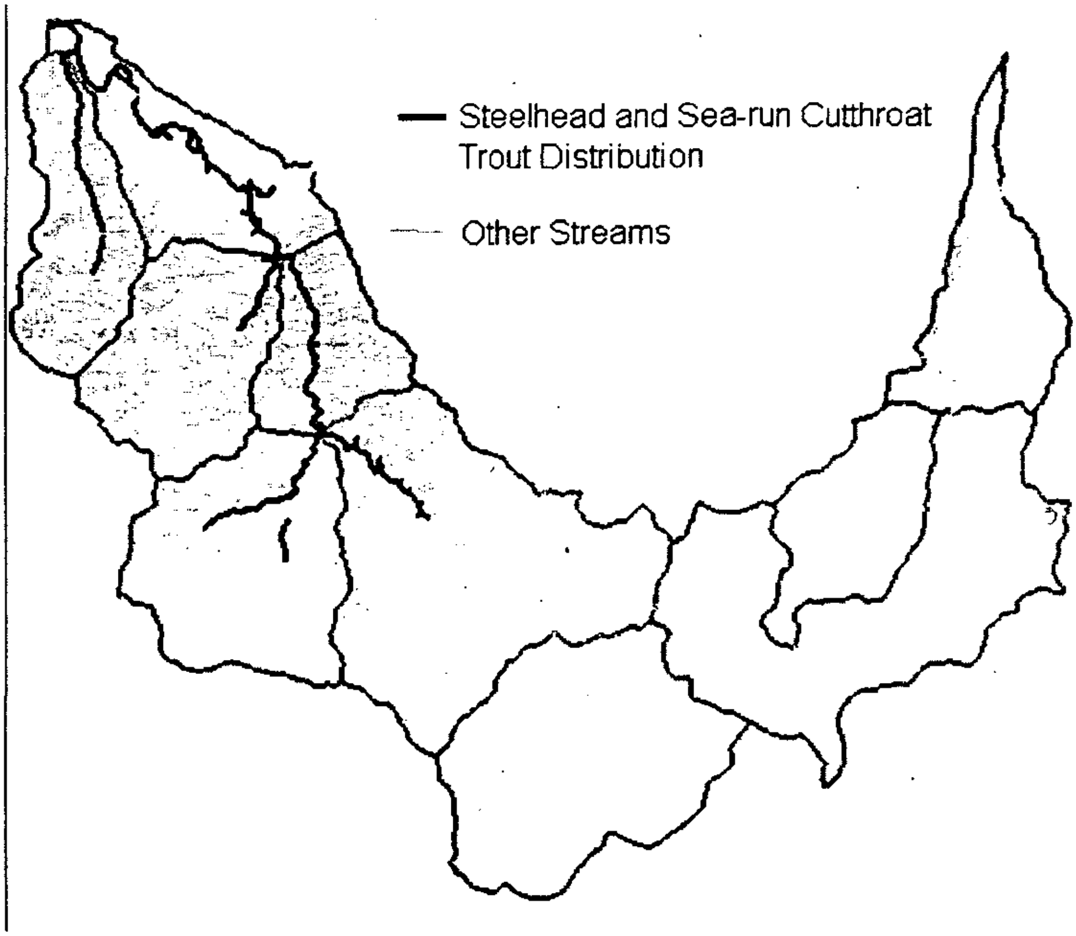
These factors indicate that the habitat for coho and chinook salmon is outside the range of natural variation and is in a degraded condition. With implementation of the NW Forest Plan and the Aquatic Conservation Strategy (ACS) habitat should improve on federal lands.

Winter steelhead and sea-run cutthroat

The existing stock of winter steelhead is composed primarily of late-run upper Sandy stocks. Prior to 1964 early-run stocks were released throughout the upper Sandy basin. Hatchery liberations of early run stocks continue in the Sandy River below Marmot dam. Adult returns to the upper Sandy basin have been fairly stable averaging around 3,000 fish for the past 30 years.

The sea-run cutthroat is a native stock and is possibly present in the lower 14 miles of the mainstem Salmon and associated tributaries. The sea-run cutthroat is listed as a sensitive species by the State of Oregon. The AFS report lists the stock as in moderate danger of extinction; very few are detected passing over Marmot dam.

Figure 6-4 - Steelhead and Sea-Run Cutthroat Distribution



As detailed figure 6-4 steelhead and sea-run cutthroat ranges overlap. Juvenile steelhead trout typically prefer faster water areas than coho or chinook salmon (Groot and Margolis 1991; Meehan 1991). Older steelhead juveniles prefer the heads of pools, and riffles with large boulder substrate and woody cover in the summer. During winter, older steelhead juveniles are found in pools, near streamside cover and under debris, logs or boulders.

The two species utilize habitat in the Salmon River, Boulder, Cheeney, South Fork Salmon, Mack Hall Creek, and other small tribuirtaries below migration barriers. Pool levels in these stream systems are outside the range of natural variation and below Forest Plan Standards and PIG standards, with the exception of Boulder Creek and Salmon River between river mile 7.2 and 13.4. Large woody debris for this area is within the range of natural variation, above the Forest Plan standard, but below PIG standards for all the streams with the exception of the Salmon River from river miles 0-7.2. With the exception of Salmon river subwatershed the entire area is in good condition with respect to large woody debris recruitment(LWD) potential with over 70% of the riparian reserves being in the high LWD recruitment potential category.

Riffle habitat is the dominant habitat type in this area with pools and side channel mixed in. Riffles and pools were determined to be within the range of natural variation for this area, and side channel habitat is outside the range of natural variation. It appears that the side channel habitat within the range of these species has been lost and habitat is now dominated by riffles and pools. This change in the mix of habitat types would favor steelhead and sea-run cutthroat over coho salmon

Habitat effectiveness in this area has also been degraded in the Lower Salmon and Cheeney Creek subwatersheds due to easy access and associated fishing pressure

The habitat for these species has been slightly degraded due to the lack of pools with large woody debris. Recovery is expected with the implementation of the NW Forest Plan and the ACS. Habitat restoration for coho and chinnok salmon will likely have some benefits for steelhead and cutthroat as well, especially in enhancing overwintering habitat.

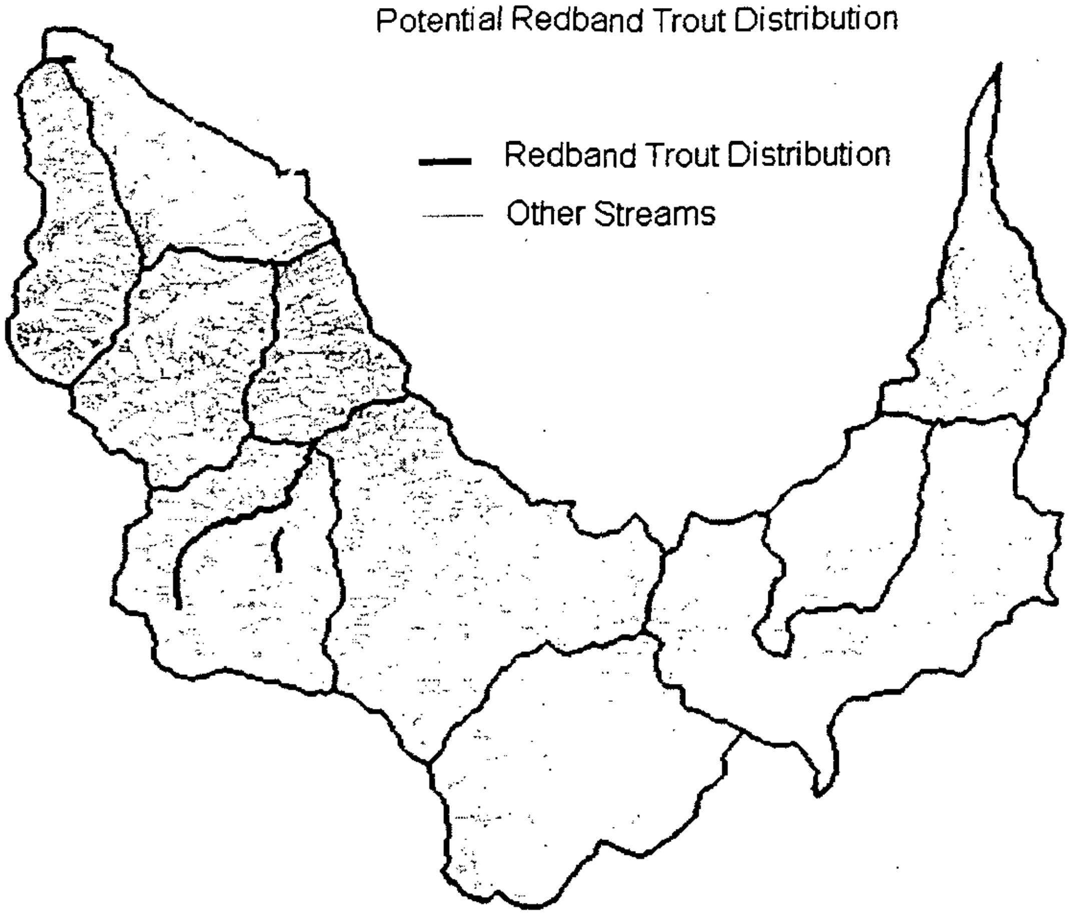
Bull Trout

The bull trout is proposed for listing under the Federal Endangered Species Act and is listed as a sensitive species by the State of Oregon and the Forest Service. There are historic reports of bull trout in the Salmon River watershed, however its presence has not been confirmed. Suitable habitat and isolation exists to support this species in the upper watershed and Salmon River tributaries such as: Mack Hall Creek, South Fork Salmon River, Cheeney, Copper and Wolf Creeks. However, there have been no documented sightings.

Redband Trout

Redband trout are a Forest Service sensitive species and are currently a candidate for listing under the Endangered Species Act. A stock of inland rainbow trout suspected to be redband trout exist above the falls in South Fork Salmon River and Mack Hall Creek and possibly other locations. Figure 5 details the potential range of redband trout within the drainage.

Figure 6-5 - Potential Redband Trout Distribution



Redband trout habitat requirements are similar to those of steelhead trout. The redband prefer fast water areas (riffles) intermixed with pools and large woody debris. 96% of the channels in the South Fork/Mack Hall subwatershed are greater than 4% gradient and approximately 85% of the aquatic habitat is riffles. This indicates a large portion of this area is in fast water habitat types. South Fork Salmon and Mack Hall Creeks are outside the range of natural variation and below Forest Plan Standards for pools, and within the range of natural variation and above Forest Plan standards for large woody debris. Over 80% of the South Fork/Mack Hall subwatershed is in the middle and high large woody debris recruitment classes.

The portion of the watershed occupied by the inland rainblw stock is largely within the Wilderness and historically has not been managed. The low levels of pools in this area could be attributed to the fires that burned in this area between the turn of the century and 1940. The channel types in this area are classified as having a high sensitivity to disturbance from increased peakflows or sediment supply, a high sediment supply when disturbed, a very poor recovery potential, and a very high streambank erosion potential. Increased peakflows from the altered vegetative structure (more created openings from the fires around the turn of the century) may have caused channel destabilization in this area from which the channels are slowly recovering. Large landslides have likely added large volumes of rock and sediment that have filled pools. The lower mile of South Fork was salvage logged and most of the large woody debris was removed in the period between 1965-1980.

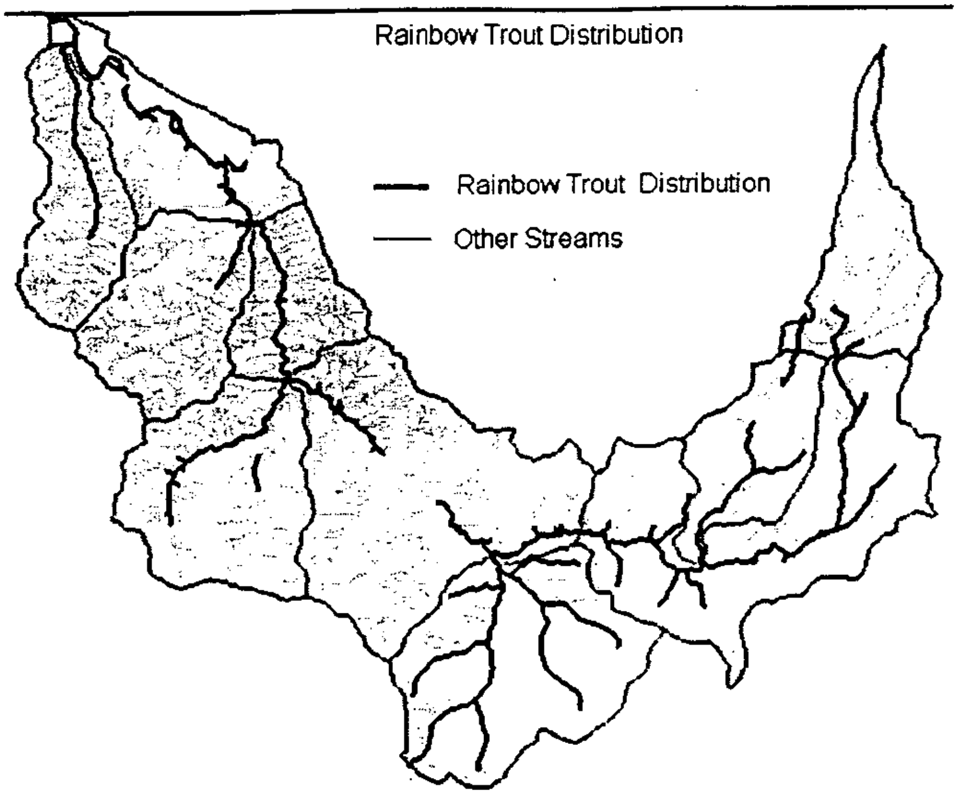
Another concern for the redband trout is competition with brook trout. Brook trout may have been planted in Plaza Lake and spread to habitat occupied by redband trout. Brook trout do not inter-breed with *Oncorhynchus* spp., but they can compete for limited habitat and food resources, and prey on the eggs and larvae of other fishes.

The habitat for redband trout is slightly outside the range of natural variation due to a lack of pools. This habitat appears to be recovering and should continue to do so under the NW Forest Plan and the ACS.

Resident Rainbow Trout

Rainbow trout were present historically below the falls in both resident and anadromous (steelhead) forms. They may have also been present above the falls prior to the stocking programs in the upper watershed. Rainbow trout from several sources have been used by hatcheries for outplanting in the upper Sandy basin. Catchable rainbow trout have been historically released at three sites in the watershed (Trillium lake, Salmon River at Green Canyon Campground and Wildwood Recreation Site). In 1995, catchable rainbows were only released at Trillium lake. It appears that if these fish are not quickly harvested they do not survive the following winter. There have been recent reports of large native resident rainbow trout caught in the lower mainstem.

Figure 6-6 - Resident Rainbow Trout Distribution



Habitat requirements for resident rainbow are similar to those of steelhead. The condition of the habitat for the anadromous section of the watershed had been previously discussed under steelhead, so this discussion will focus on the resident section of the watershed. Within the resident section of the watershed habitat exists in Upper Salmon, Linney Creek and Mud Creek subwatersheds (although native rainbow have not been documented there). Mud Creek is within the range of natural variation and within Forest Plan standards for pools. Linney Creek is outside the range of natural variation below Forest Plan and PIG standards for pools. Large woody debris is within the range of natural variation and at or near Forest Plan standards in Mud and Linney Creek subwatersheds. Large woody debris recruitment potential results show over 50% of the area in the low and moderate recruitment potential classes in Linney and Mud Creek subwatersheds. Upper Salmon watershed is outside the range of natural variation and below Forest Plan and PIG standards for pools and large woody debris. Large woody debris recruitment potential in this area is low with approximately 50% of the riparian reserves in the low and moderate recruitment potential classes.

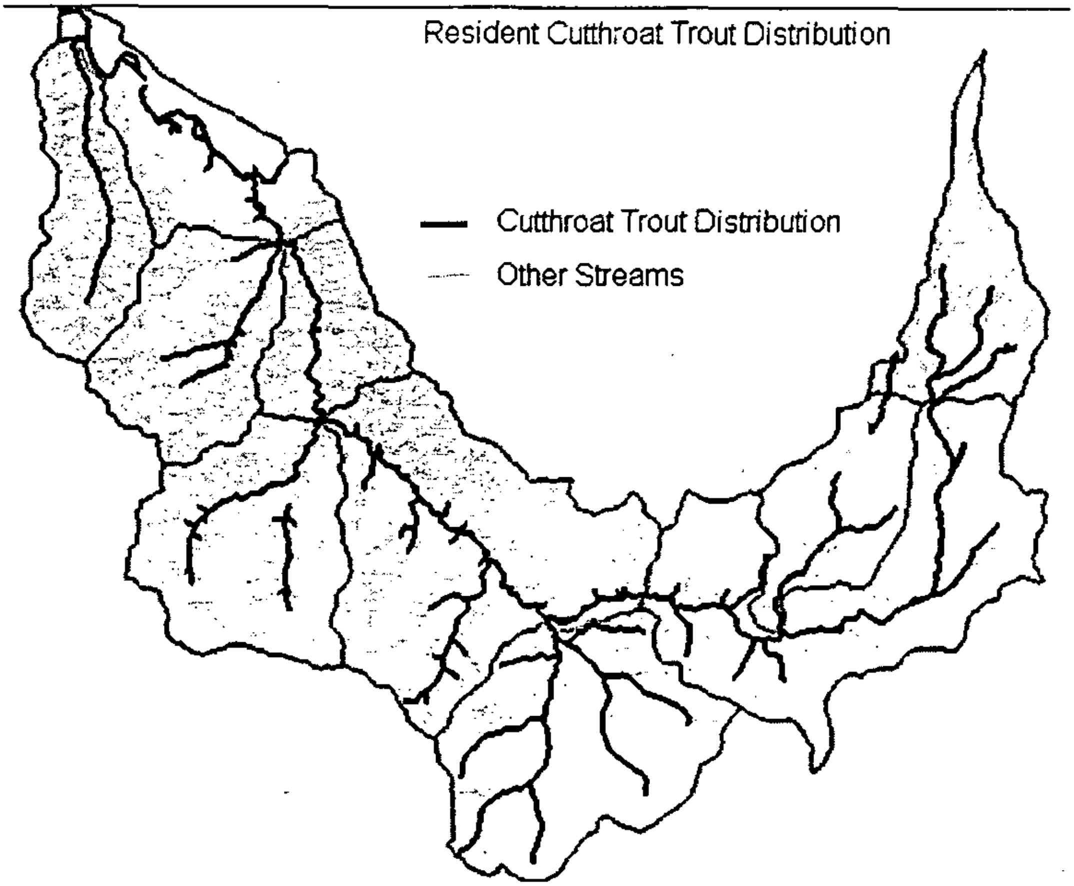
Stream temperatures within the Mud Creek drainage have been recorded as high as 19.3^{0}C which is above the threshold for adverse effects on rainbow trout. Currently, 58% of the riparian reserves within Mud Creek subwatershed have less than 60% canopy closure.

Based on these conditions the habitat for resident rainbow trout in the upper watershed is in a degraded condition due to lack of pools and large woody debris. Within Mud Creek the lack of large woody debris and increased stream temperatures could be attributed to historical harvest (over 62% of the riparian reserves within Mud Creek have received some sort of harvest activity). With implementation of the NW Forest Plan and the ACS pool and large woody debris levels should move toward the range of natural variation.

Resident Cutthroat Trout

The resident population of cutthroat trout is from native stock in both the upper (resident) and lower (anadromous) portions of the watershed. The resident form is well distributed throughout the drainage.

Figure 6-7 - Resident Cutthroat Trout Distribution



The anadromous portion of the watershed has been addressed in assessing the habitat for sea-run cutthroat so only habitat within the upper watershed will be addressed in this section. Within the upper watershed cutthroat trout occupy habitat within Middle Salmon, Upper Salmon, Linney Creek and Mud Creek subwatersheds. Habitat for resident rainbow trout has been addressed within Mud Creek, Linney Creek and Upper Salmon subwatersheds and the same factors would apply to resident cutthroat. Habitat conditions within the Middle Salmon Watershed and South Fork/Mack Hall subwatersheds are characterized by low levels of pools (outside the range of natural conditions and Forest Plan and PIG standards) and moderate to high levels of large woody debris (within the range of natural conditions and above Forest Plan standards). As described in the conditions of the watershed for redband trout the broad extent of fires between the turn of the century and 1940 may have caused increased peakflows which have caused channel alterations resulting in less pool habitat.

Increased sedimentation in the upper watershed from road sanding activities is of concern because of the potential effects of sediment deposition on redds. Because sediment loads from road sanding are greatest during spring runoff this has the greatest negative effect on reproduction of spring-spawning native trout, and favors fall-spawning brook trout.

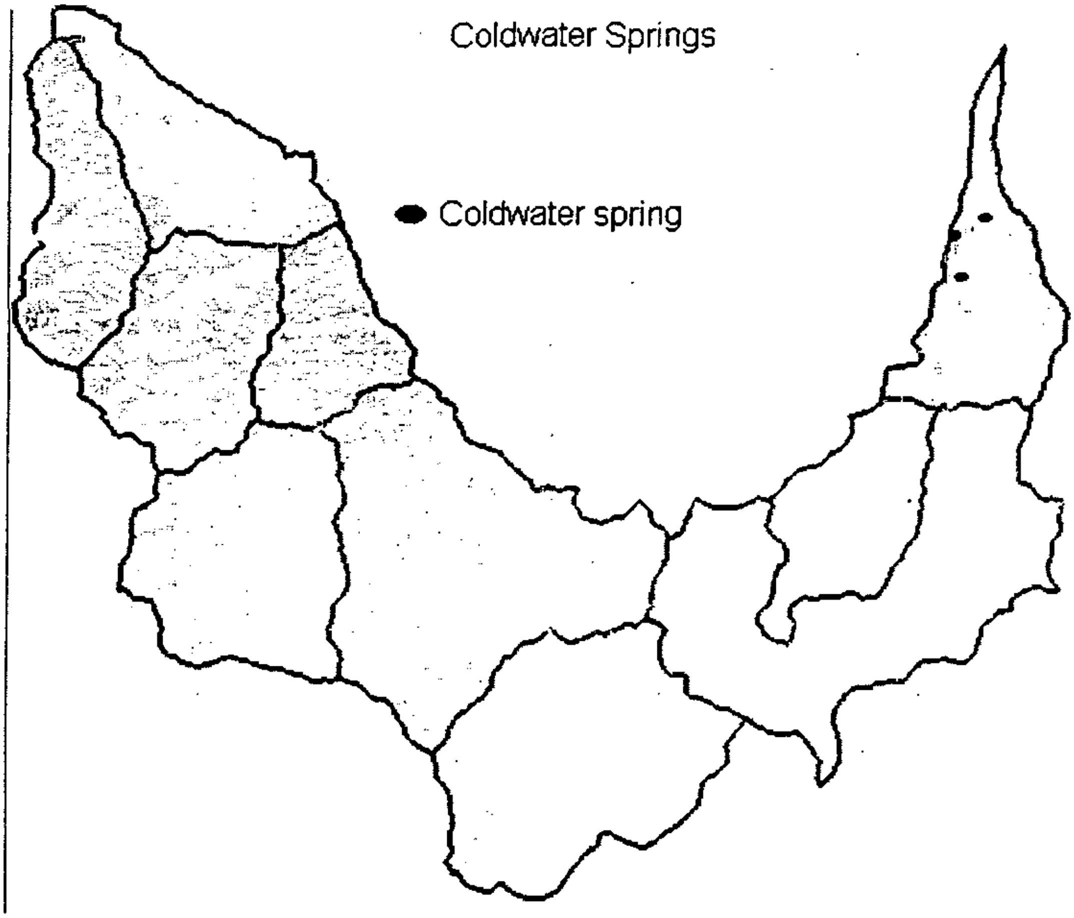
These factors have resulted in degraded habitat in the Mud Creek and Upper Salmon watershed due to low levels of pools, LWD and sediment inputs. Implementation of the NW Forest Plan and the ACS should result in recovery of this habitat.

Competition with brook trout and hybridization with introduced stocks of rainbow trout are also of concern. Brook trout compete for limited habitat and food resources, and prey on the eggs and larvae of other fishes. The introduction of rainbow trout into Trillium lake allowed their spread into Mud Creek, Salmon River and other Mainstem tributaries. Where this occurs hybridization with native rainbow and cutthroat has possibly occurred

Mt. Hood brachycentrid caddisfly, Mt. Hood farulan caddisfly, and Columbia duskysnail

All three of these species have either been documented at cold water springs or require cold water spring habitat. Mt. Hood brachycentrid caddisfly and Mt. Hood farulan caddisfly have been documented at headwater springs at three sites (along Timberline and Westleg Roads) in the West Fork of the Salmon River drainage. The Columbia duskysnail has been documented in the Bull Run Watershed and habitat exists within the Salmon River Watershed, however there have not been any documented occurrences.

Figure 6-8 - Coldwater Springs



Habitat requirements for the Mt. Hood brachycentrid caddisfly include: moderate to high gradient, cold, narrow (1-2 feet wide) perennial spring channels with dense shade by a coniferous and deciduous overstory, elevation range appears to be 4000 to 5000 feet, and larvae appear to be restricted to spring channel which have a significant portion of their bottom substrates consisting of submerged moss. Columbia duskysnail habitat requirements are springs and spring outflows, from low to high elevations, in cold, pure, well oxygenated water. Often found in very small springs or channel margins of larger springs and most common on soft substrates, in shallow, rather slow flows. Prefers oligotrophic(deficient in plant nutrients) pristine water sources with no macrophytes (large plants) (Frest 1993). Habitat requirements for Mt. Hood farulan caddisfly are similar with preferences for woody debris substrates. Based on the similar habitat requirements conditions for all three species they were assessed together.

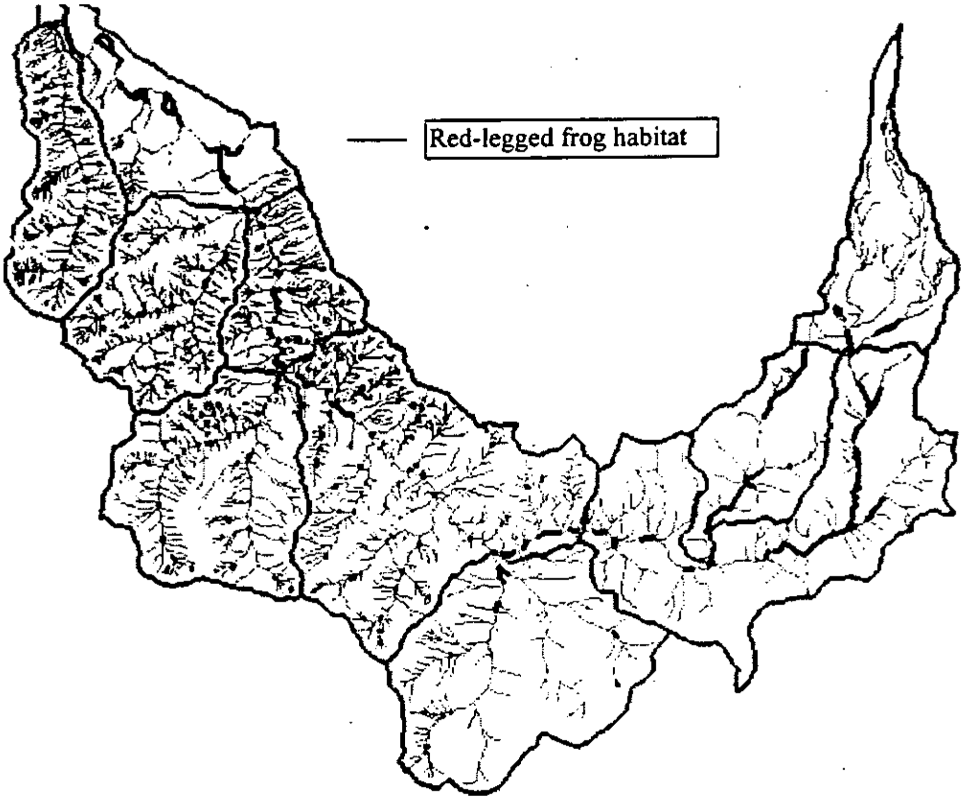
Potential effects to these species come from declining baseflows, increased stream temperatures, decreased stream shading, and sediment inputs. In the West and East Fork of the Salmon River subwatershed baseflows have been on a declining trend since 1951 (based on data from the USGS gaging station). The alteration of the flow regime has the potential to dewater areas where the species live and to increase stream temperatures due to less water available to buffer effects from solar radiation inputs. Water development from spring sources has also affected habitat in the past. Increased stream temperatures and reductions in stream shade have resulted from created openings in the subwatershed. 17% of the riparian reserves in this subwatershed have been harvested and 44% of the riparian reserves have canopy closures of less than 60%. The known habitat for these species is adjacent to the Timberline and Westleg roads and may receive increased sediment inputs from roadside sanding and road maintenance activities.

Based on all the factors listed above the current condition may have resulted in slight degradation of habitat, however, with riparian reserves in place and subject to the aquatic conservation strategy objectives there appears to be little potential for continued adverse impacts to habitat for these species.

Red-legged frog

The red-legged frog inhabits ponds, marshes, rivers and streams in coniferous forests where vegetation at the waters edge provides good cover. The red-legged frog requires low gradient, slow flowing water and sandy/gravely substrates.

Figure 6-9 Red-legged frog habitat



The habitat for this species was assesses by looking at two factors: 1) low gradient stream reaches, and 2) in-channel large woody debris levels.

Low gradient stream reaches are the primary habitat for this species and the greatest identified impact to these reaches are sediment inputs. The sediment production analysis completed in chapter 4 identified cumulative sediment delivery associated with management activities to key depositional reaches.

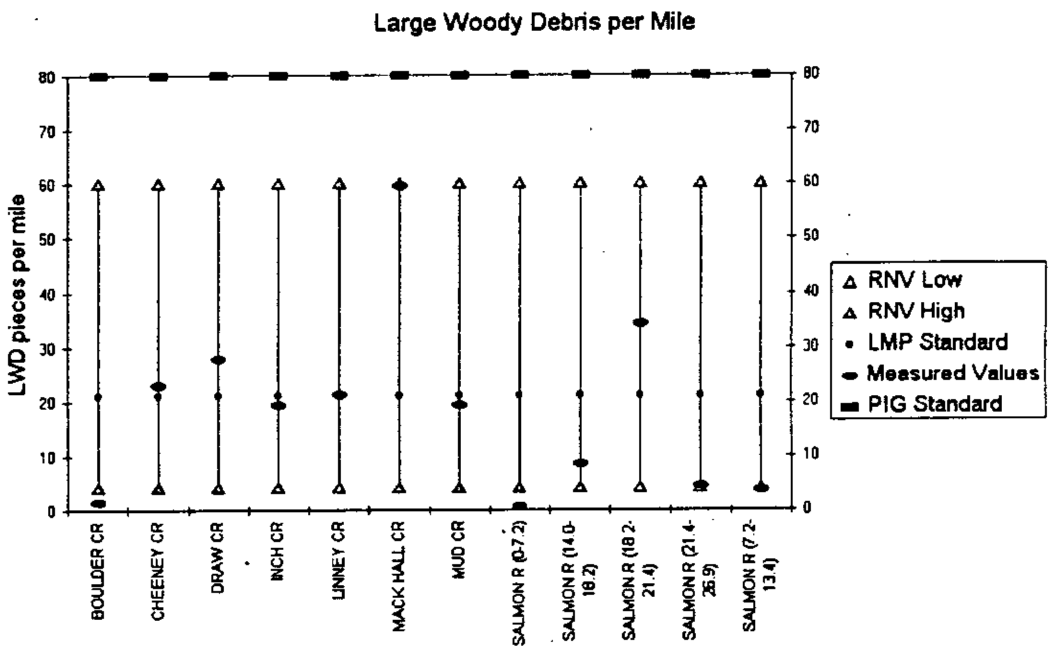
Table 6-2 Sediment Delivery

KEY DEPOSITIONAL REACH	ESTIMATED SEDIMENT DELIVERY (Tons/Year)
SALMON MEADOWS	3,081
MUD CREEK	183
LINNEY/DRAW	273
FLY FISHING BRIDGE	2,892

Sediment delivery from modeled surface erosion rates are of concern to all of these reaches as they have been identified as providing habitat for red-legged frogs. Of greatest concern on a per area basis is the potential sediment deposition in the Salmon Meadows reach. The reach with the second highest concern for per area potential depositional is the Mud creek confluence. On a per area basis, Linney/Draw would have a lessor concern for depositional impacts than Salmon Meadows and Mud creek.

In-channel large woody debris is important in the creation and maintenance of low gradient reaches in the watershed. In-channel large woody debris levels throughout the watershed are detailed in the figure below.

Figure 6-10 - Large Woody Debris Levels



Levels of large woody debris are outside the range of natural variation in Lower Salmon, Upper Salmon and Boulder Creek subwatersheds and are at the mid to low end of the range of natural variation for the subwatersheds within the wilderness and Mud Creek. Low levels of large woody debris in the Lower Salmon are attributed to stream cleanout after the 1964 and 1974 floods, low levels within Mud Creek are attributed to past harvest activities and the reasons for low levels within the upper Salmon watershed may be attributed to this area being in the alpine zone. Lower levels of large woody debris within the wilderness are attributed to the recent fire history in that area.

Habitat for red-legged frogs within the Salmon River watershed is in a degraded condition due to sediment deposition and low levels of in-channel large woody debris. Implementation of riparian reserves and the aquatic conservation strategy objectives will promote recovery of habitat for red-legged frogs.

Tailed frog

Tailed frogs require fast flowing cold water streams. These habitat requirements can be found throughout the watershed so seral stage distribution and riparian reserve canopy closure were used to assess how conditions of the watershed contribute to habitat needs for tailed frogs.

Figure 6-11 - Seral Stage Distribution

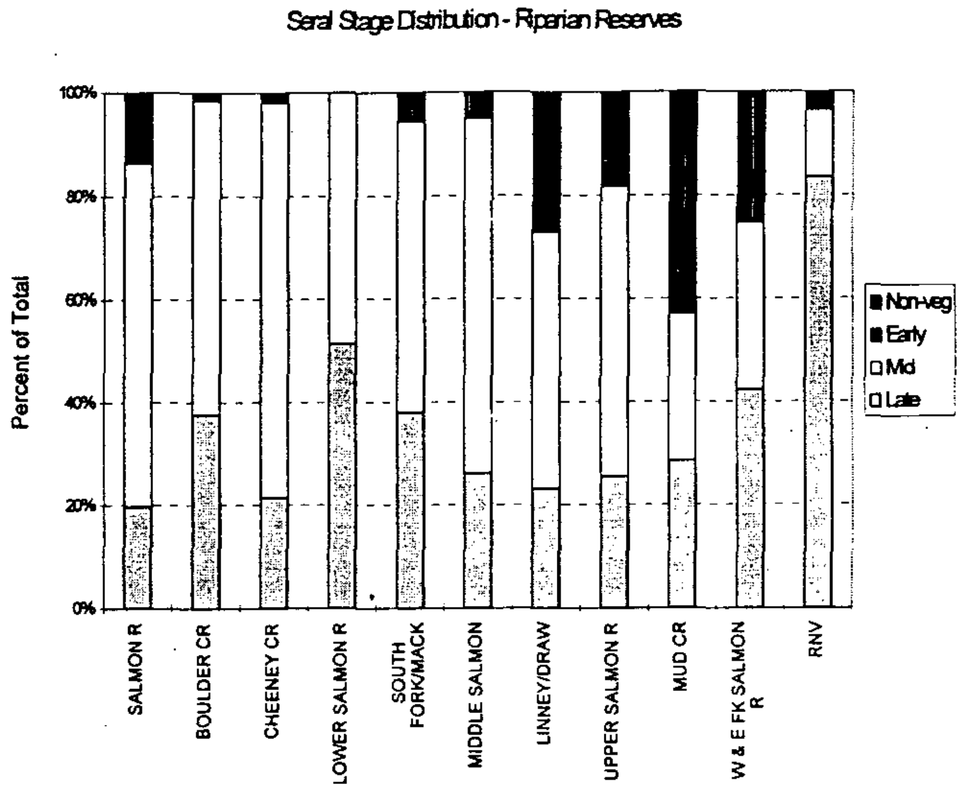
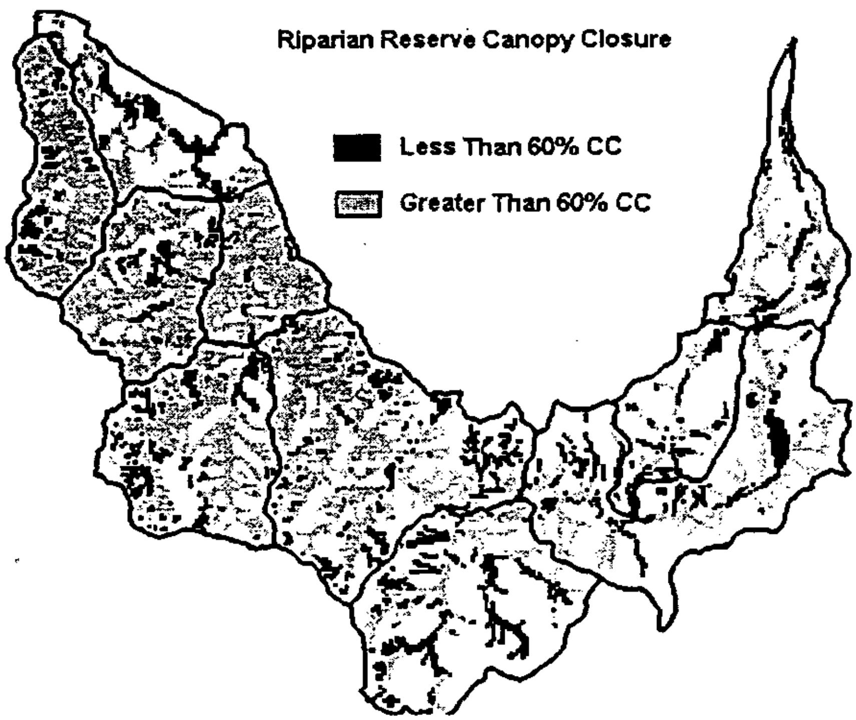


Figure 6-12 - Riparian Reserve Canopy Closure



The entire watershed is well outside the range of natural variation (from PULSE) for late seral stand structure within the riparian reserves. This is attributed to the fires between the turn of the century and the 1940's. Subwatersheds within the Wilderness have approximately 95% of the area in late and mid seral condition (which is within the same range as the range of natural variation) and with respect to the recent fire history in this area this appears a good estimate of the natural condition in this watershed. Mud Creek and Linney Creek are well below the natural condition for the watershed and Salmon River, Upper Salmon and W & E Fork are slightly below the natural condition. The areas of low canopy closure (less than 60%) in the Mud and Linney Creek are for the most part created from timber harvest activities and are used to indicate areas where there would be a lack of vegetative cover at the waters edge.

Based on seral stage distribution and riparian reserve canopy closure there is degraded habitat for tailed frogs in the Mud Creek and Linney Creek subwatersheds. Implementation of riparian reserves and the aquatic conservation strategy objectives should allow recovery of the vegetation adjacent to tailed frog habitat and these areas should recover over time.

Corydalis aquae-gelidae

Corydalis aquae-gelidae, coldwater corydalis; is a Mt. Hood NF Sensitive Plant and candidate for federal listing. Habitat includes cold water (average 10 degrees C), >50% gravel with coarse sand substrate, usually perennial flow, shallow water, and high streamside canopy. There is a large population in the Linney Creek/Draw Creek area growing along stream bank/water's edge. Another reported population sighting on gravel bar in Salmon River upstream of Green Canyon Campground

Coldwater corydalis has been documented in the Linney Creek, and Lower Salmon watersheds so habitat conditions of those subwatersheds, plus Middle Salmon because it is immediately upstream of the Lower Salmon subwatershed, will be assessed. Factors with the potential to influence coldwater corydalis habitat include flow regime, water quality, stream shade, stand structure and sediment inputs.

Linney Creek subwatershed is very near the threshold of concern for increased peakflows due to created openings and above the threshold of concern for increased peakflows due to stream drainage network expansion associated with roads. Middle Salmon and Lower Salmon subwatersheds are well below the threshold of concern for increased peakflows from created openings or stream drainage network expansion. With increased peakflows there is the potential for channel scour and associated deposition of the fine material resulting in degradation of coldwater corydalis habitat.

In the upper Salmon River subwatershed baseflows have been on a declining trend since 1951 (based on data from the USGS gauging station). It is not clear if this trend is occurring throughout the watershed because the only long term stream gauging station is in the upper watershed. Notwithstanding, the alteration of the baseflow regime has the potential to dewater areas where the species live and to increase stream temperatures due to less water available to buffer effects from solar radiation inputs

Low stream temperatures are a critical habitat component for coldwater corydalis and management activities have the greatest potential to affect stream temperatures by altering riparian vegetation. Stream shade is also a concern because cold water corydalis prefers a high canopy which filters direct solar radiation. As discussed earlier with the tailed frog, Linney Creek is outside the natural range for early seral stands and 45% of the riparian reserves have less than 60% canopy closure. Middle Salmon and Lower Salmon are within the natural range for seral stage distribution and only 19% and 6% respectively of these subwatersheds have canopy closures of less than 60%.

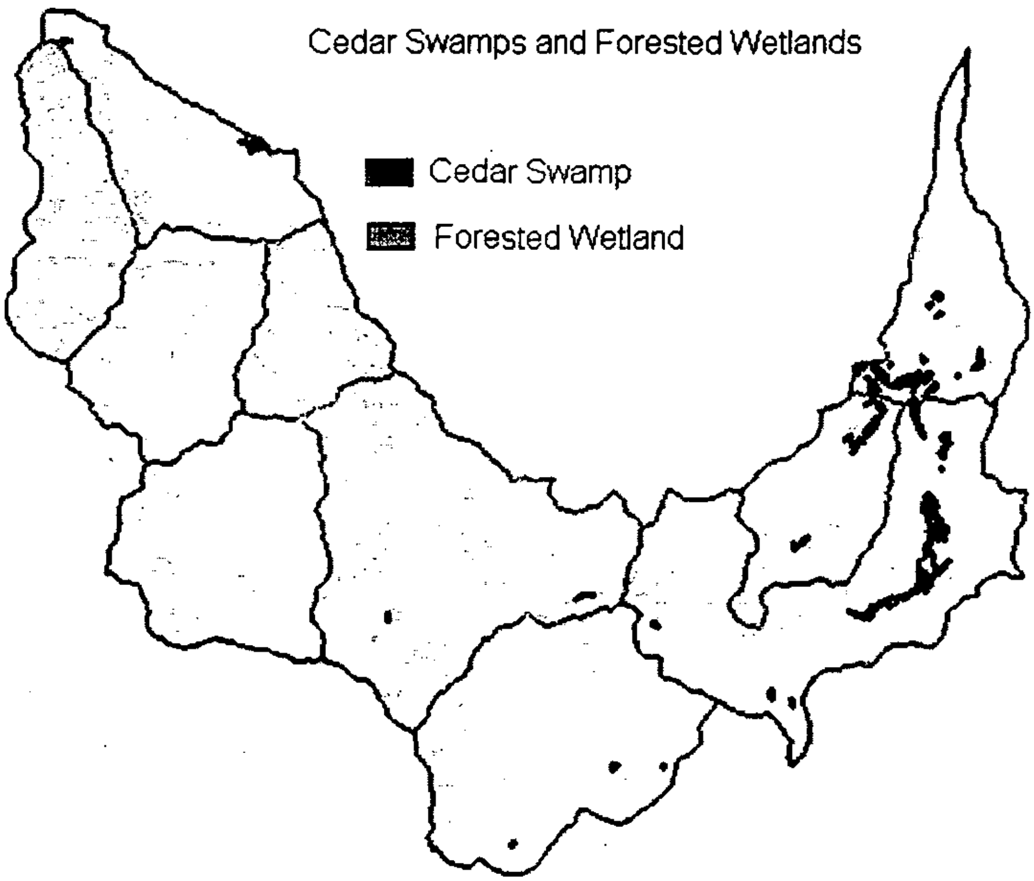
Sediment inputs have the potential to alter the habitat (gravel with coarse sand substrate) that is required by coldwater corydalis by increasing fine sediment deposition in these areas. Sediment inputs from management activities including road sanding, roads, recreation, harvest and grazing were predicted by subwatershed. For Linney Creek subwatershed there was an estimated sediment delivery of 273 tons to a key depositional reach near the confluence with the Salmon River. This sediment was attributed to the 4.53 miles of roads within 300 feet of streams in this area. There was an estimated 2892 tons of sediment delivery to a depositional stream reach near the coldwater corydalis population near Green Canyon Campground. The majority of this sediment is attributed to the 10.75 miles of road within 300 feet of streams above this depositional reach in Upper Salmon, Middle Salmon and South Fork/Mack Hall subwatersheds. The sediment deposition in Linney Creek is of concern due to the potential effects on habitat, however due to the high geologic rates of erosion above the lower site the addition of sediment from management activities is negligible.

Based on the factors discussed above there is potential for habitat degradation in Linney Creek due to altered peakflow and baseflow regimes, increased stream temperatures and sediment deposition. It appears that this potential will lessen over time with as riparian reserves are established and the ACS objectives are implemented.

Botrychium minganese and B. montanum

Botrychium minganese and *B. montanum*, grapeferns are Mt. Hood NF sensitive plants. Habitat requirements are wet cedar areas. These species have not been documented in the watershed but good habitat is present. In many cases the wet cedar areas are associated with wetlands throughout the watershed.

Figure 6-13 - Cedar Swamps and Forested Wetlands



In the lower watershed and the Mud Creek area hydrologic connectivity has been reduced by channel straightening, large woody debris removal, and road locations lowering the water table in these areas and subsequently degrading the habitat for cedar and *Botrychium minganese* and *B. montanum*. Harvest of cedar within the Mud Creek and Salmon River Subwatersheds is also of concern. A large extent of the riparian reserves (62%) within the Mud Creek drainage have been harvested, either clearcut or partial cut. Harvest records are not available for private lands or BLM lands within the lower watershed, but based on levels of canopy closure within the riparian areas it appears that there has been significant harvest in these areas.

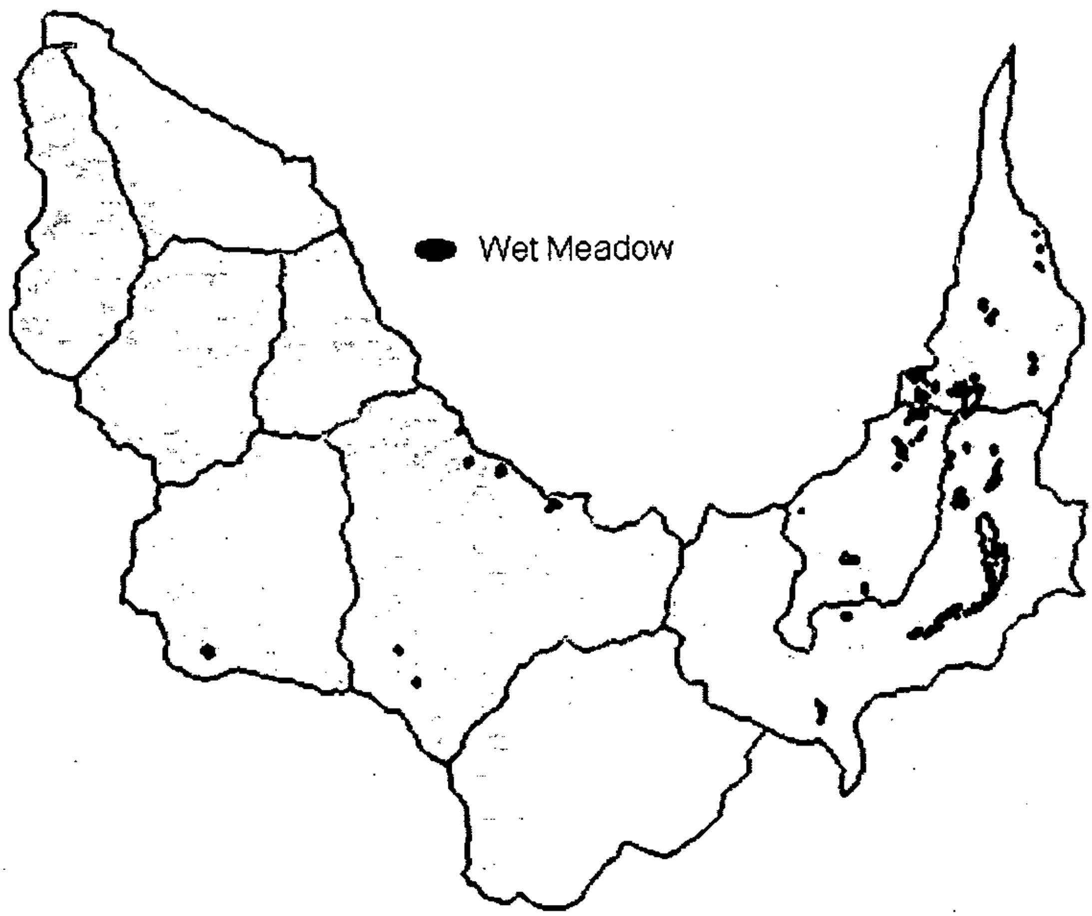
Decreases in baseflows have the potential to alter the timing and magnitude of wetland inundation which will degrade the habitat for *Botrychium minganese* and *B. montanum*.

Habitat for *Botrychium minganese* and *B. montanum* has been degraded in Mud Creek and the Salmon River subwatersheds due to alterations in the flow regime and cedar harvest. With implementation of the riparian reserves and ACS objectives the flow regime should move towards the range of natural variation and riparian vegetation should reestablish on federal lands.

Coptis trifolia

Coptis trifolia, threeleaf goldthread is a Mt. Hood NF sensitive plant. Habitat is brushy, shaded edges of wet meadows. There is a known site in Jackpot Meadow. Potential habitat exists in unnamed meadows in Mud Creek drainage, Redtop Meadow, and Salmon River Meadow.

Figure 6-14 - Wet Meadows



Habitat for this species exists in the Mud Creek and Upper Salmon River subwatersheds. Factors that influence the condition of the habitat in these areas include flow regime, and stand structure. Stand structure adjacent to wetlands within these areas has been altered. A large extent of the riparian reserves (62%) within the Mud Creek drainage have been harvested and 12% of the riparian reserves have been harvested in Upper Salmon subwatershed.

Due to conditions with respect to baseflow regime and stand structure *Coptis trifolia* habitat has been degraded especially in the Mud Creek subwatershed. With implementation of the riparian reserves and ACS objectives these areas should recover over time.

Harlequin Duck

Harlequin ducks are identified as a sensitive species by both the State of Oregon and the Forest Service and a C2 species by the USFWS. This species inhabits turbulent mountain streams in coniferous forests. Adult harlequins are usually found in the riffles and runs of streams several meters wide with large rock substrates and "loafing sites" (large rocks or other debris the ducks can use to get out of the water) at least every 10 meters. The bank vegetation usually consists of shrubs or large timber/shrub combinations (Casurer and Groves, 1989). Preliminary results from studies indicate that harlequin ducks prefer isolated areas with dense shrubs, woody debris and meandering channels for brood rearing (Casurer and Groves, 1989). Harlequin ducks are regulary obserbed in the Wildwood area along the lower reaches of the Salmon River. Surveys for harlequin ducks have not been completed in the Salmon River watershed, however the watershed provides suitable habitat and the ducks likely use the river during migration, and possibly for nesting and brood rearing as well.

Figure 6-15 - Potential Harlequin Duck Habitat

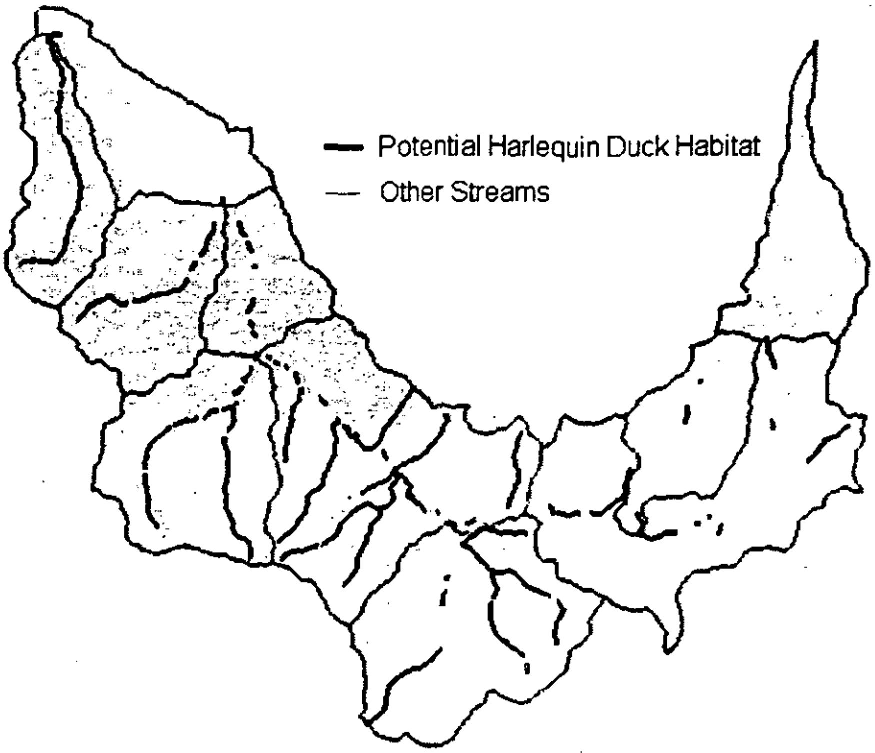
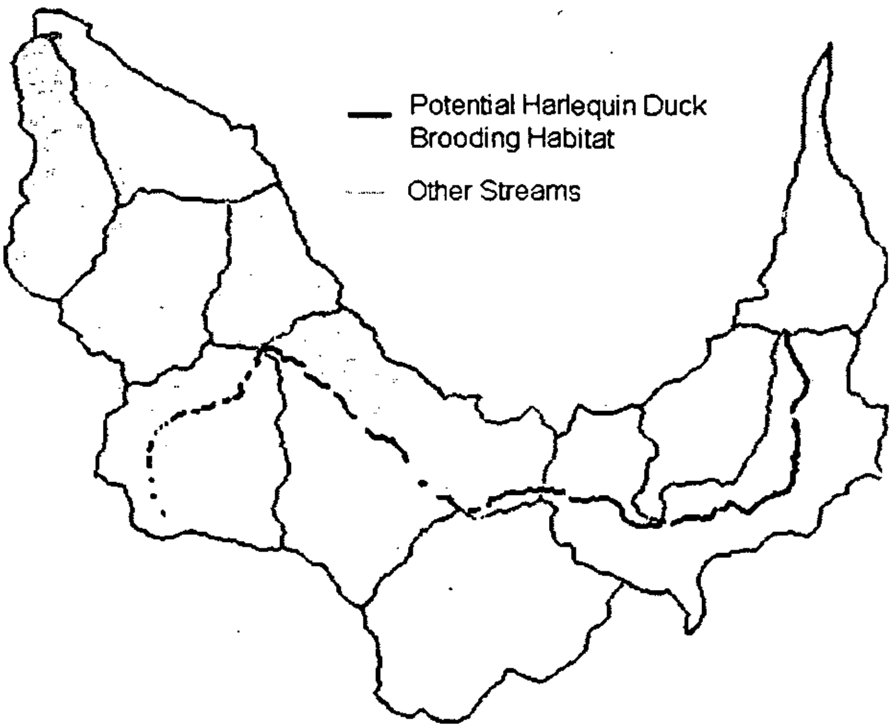


Figure 6-16 - Potential Harlequin Duck Brooding Habitat

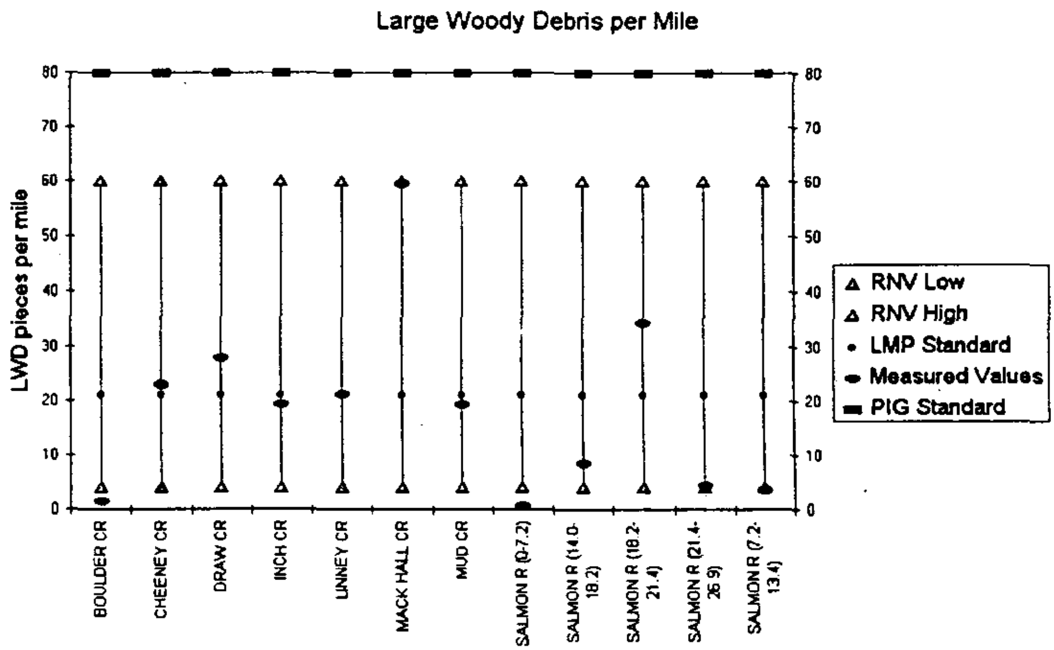


A large portion of the watershed provides turbulent mountain streams within coniferous forests, so quality of the adjacent vegetation and in-channel large woody debris was used to assess this foraging habitat. Isolated areas with dense shrubs, woody debris and meandering channels exists within the Upper Salmon and Middle Salmon subwatersheds and adjacent vegetation and in-channel large woody debris are critical habitat components , so these factors will also be used to assess brooding habitat.

This assessment of the condition of the habitat uses the same components of vegetative structure that were used for tailed frog habitat. Mud Creek and Linney Creek are well below the natural condition for late and mid seral stand structure within the riparian reserves. Salmon River, Upper Salmon and W & E Fork are slightly below the natural condition. The areas of low canopy closure (less than 60%) in the Mud and Linney Creek are for the most part created from timber harvest activities and are used to indicate areas where there would be a lack of vegetative cover at the waters edge.

In-channel large woody debris levels throughout the watershed are detailed in the figure below.

Figure 6-17 - Large Woody Debris Levels



Levels of large woody debris are outside the range of natural variation in Lower Salmon, Upper Salmon and Boulder Creek subwatersheds and are at the mid to low end of the range of natural variation for the subwatersheds within the wilderness and Mud Creek. Low levels of large woody debris in the Lower Salmon are attributed to stream cleanout after the 1964 and 1974 floods, low levels within Mud Creek are attributed to past harvest activities and levels within the upper Salmon watershed are attributed to the subwtershed being in the alpine area. Lower levels of large woody debris within the wilderness are attributed to the recent fire history in that area.

With respect to brooding habitat seral stage distribution for Upper Salmon and Middle Salmon subwatersheds are at or near the natural condition. Large woody debris levels are at the upper end of the range of natural variation in Middle Salmon subwatershed and at the low end of the range of natural variation in Upper Salmon.

Harlequin duck habitat has been degraded in Mud Creek, Linney Creek and lower salmon subwatersheds based on stand composition and in-channel large woody debris levels. Brooding habitat is slightly degraded in Upper Salmon subwatershed. As riparian reserves are implemented and stands move toward late seral conditions, harlequin duck habitat should improve.

Ring-Necked Duck

The ring-necked duck is a Oregon Natural Heritage Program sensitive species and a rare breeder on the National Forests of Oregon and Washington. The only known breeding site in the state has been at Trillium Lake (pers. comm. B. Kott). This site will be managed in the same manner in the future so there appears to be no threat to the ring-necked duck.

Wet Meadow Special Botanical Habitat

The wet meadows in the Salmon River Watershed serve as special botanical habitat. Several sensitive species grow in these wet meadows including

- *Carex livida,* pale sedge
- *Scheuchzeria palustris var. americana*, scheuchzeria
- *Sisyrinchium sarmentosum,* pale blue eyed grass
- *Utricularia minor,* lesser bladderwort
- *Huperzia occidentale*, fir clubmoss

These species are addressed in the botany section in Chapter 4 and Appendix C - Botany.

Key Question #3: How do conditions of the watershed contribute to the habitat needs for species of concern in special habitats?

Peregrine Falcon

The peregrine is managed as an endangered species by both the State of Oregon and the federal government. Suitable nesting habitat is within the watershed in the form of rock cliffs. Waterfowl and migrating songbirds nesting in the Salmon River drainage could be prey for nesting falcons. Historic use within the watershed is likely.

There is high quality, potential recovery habitat in the Wolf Peak/High Rock area. Much of the Zigzag watershed is potential recovery habitat and this extends over into the Devil's Peak area. Peregrine habitat has been verified through a helicopter flight by Forest Service biologists. A map of these sites is included in the analysis files. Field verification is occurring this summer. Rock cliffs within the Wilderness may also serve as recovery habitat, but these areas have not been mapped.

Peregrine falcons were reintroduced on the cliffs above Still Creek and Camp Creek drainages north of Salmon River watershed. Approximately 25 individuals have been released from 1990 to 1994 and populations are stabilizing/increasing. High Rock is suitable habitat for the establishment of a wild aerie. There are no current plans for further hacking projects (release of young), but if an aerie was established at High Rock, seasonal use restrictions would be required on the campground.

Decreases in neotropical migratory bird populations could limit the prey base for the peregrine.

Sandhill Crane

A spring and summer resident in Oregon, the sandhill crane is identified as a sensitive species by the State of Oregon and the Forest Service. Cranes are usually found in prairies, marshes, mountain meadows, and grasslands. Red Top, Dry, Jackpot and Salmon River Meadows provide habitat for sandhill cranes, which nest on the ground from March through September. These large sedge meadows are interspersed with islands of small conifers, huckleberry, willow and alder which provide important cover for nesting. Meadows adjacent to and outside the watershed also provide suitable nesting conditions.

There is a consistent, reproducing pair of sandhill cranes nesting in Salmon River Meadows. Successful nesting has also occurred in Dry Meadow. Fledgling success, however, has been limited on these sites. Reasons are unknown for this lack of success, but could include human disturbance or predators.

Although viability of fledglings is a concern, their habitat appears stable within the watershed. A comparison of 1944-1948 air photos with current photos showed no encroachment to the wet meadows by either trees or shrubs, although tree size and crown widths are increasing in the forested areas. Riparian reserve standards will afford good protection of habitat.

Larch Mountain Salamander

The Larch Mountain salamander is found north of the watershed within talus slopes of the Columbia River Gorge. It is a C-3 species with survey strategies 1 and 2. The Salmon-Huckleberry Wilderness includes some potential habitat based on andesite rock outcrops and talus slopes. The watershed is however, outside the known range of this species.

Townsend's Big-Eared Bat

Townsend's big eared bats are a sensitive species and are of concern to state wildlife agencies in both Washington and Oregon. These bats are strongly associated with caves, primarily for breeding and resting, and secondarily for feeding. The body temperature of obligate cave dwellers varies with the air temperature, and consequently they are extremely dependent on air temperature stability. Townsend's big eared bats are also extremely sensitive to disturbance, especially from recreational cavers.

Potential habitat for Townsend's big eared bat exists within the watershed. There is a site with known bat use, but which species is unknown at this time. The site will be surveyed this summer with an instrument called the Ana-bat which can determine species by sound identification. This site was surveyed once and no bats or sign of bats was found. The ROD requires protection of known sites from disturbance or any activity that could change cave or mine temperatures or drainage patterns.

Howell's Daisy

Howell;s Daisy, *Erigeron howellii*, is a Mt. Hood NF sensitive plant and a C2 candidate for federal listing. Howell's daisy commonly grows in cool, moist, shaded rocky places, (often basalt cliffs), and usually at low elevations in the Columbia River Gorge. The site near Devil's Peak is unusual because of its elevation and distance from the Gorge. Other similar rock outcrops in the watershed are potential habitat. No threats are apparent.

Lichens and bryophytes

Rock outcrops and grassy balds within the watershed serve as habitat for several species of lichens and bryophytes. Maintenance of shading and microclimate is important to maintain these species.

These special habitats and others, such as oak openings, should be surveyed for potential species of concern. Many of these non-forested areas are in the Wilderness and therefore receive high protection. Survey and manage strategies will increase our knowledge of these species.

Key Question #4: How do conditions in the watershed affect historic features, including Timberline Lodge, Silcox Hut, Barlow Road Historic District, Devils Peak Lookout, and Summit Meadows?

Timberline Lodge and Silcox Hut

It has been found that continued use of historic buildings is a very important way of protecting their historical values, since vacant buildings are often allowed to deteriorate. Basic infrastructure for buildings, such as adequate water and sewer facilities are key for continued use to take place. The water system that currently serves Timberline Lodge and Silcox Hut does not meet new Clean Water Act standards. Attempts to drill wells for drinking water in 1994 were unsuccessful to meet the needs of the facilities. Current plans are to drill a deeper well to avoid impacts that would result from upgrading the current water source.

The sewer system at Timberline Lodge is being repaired after problems encountered in 1994. The repaired drainfield is designed to meet current DEQ standards and has an expected life of 10 years. At the end of the 10 years, Timberline will need to find an alternative way of handling the waste effluent. Future feasibility studies will include the option of piping the effluent to Government Camp, if the sanitation district's sewage plant capacity is expanded.

The drainfield system for Silcox Hut is not designed to meet the use that it is currently experiencing. Options to correct the situation at Silcox may include expansion of the existing drainfield, connecting to the Timberline sewer plant or limiting use at the hut. The need for upgrading and repairing these facilities will continue in the future in order to meet existing and future health and safety requirements and to allow continued use of those facilities.

The watershed analysis has identified a trend of decreasing base flows within the upper watershed. At this time, it is not known how significant this trend is and the cause of the decrease has yet to be determined. Until the cause of decreased base flows can be determined, activities that have potential to affect long term base flows in the upper watershed should be limited in their scope.

Barlow Road Historic District

The district contains remnants of the Barlow Road, part of the overland route of the Oregon Trail. The remnants within the watershed include visible ruts and graves of individuals that died while emigrating to the Oregon Territory. Current direction allows protection of the features, including removal of smaller vegetation that may be growing in the ruts.

Devils Peak Lookout

The view historically seen from the lookout is being diminished by trees growing up around the lookout. Wilderness allocation to the south of the lookout where it looks into the watershed and Late Successional Reserve to the north of the lookout prohibit, or severely limit, respectively, removal of trees to restore the view. The District is considering repairing the lookout and renting it out for use by the public. This action would help to preserve the historic character of the building itself, even if the view that could be historically seen from the lookout is not still visible.

Summit Meadows Area

The historic value of this important area is being adversely affected by high levels of dispersed camping. The most popular camping site is in the location of an old CCC camp which is causing loss of historic values of the camp from soil disturbance as well as vandalism to the remnants of the camp's buildings and other facilities. Any additional ground disturbing activities in the area will have the potential to further threaten surface and subsurface historic artifacts. Limiting use at the dispersed camping site will provide a better opportunity to protect historic features at the site and reduce vandalism by recreationists.

Within the meadow area itself, there have been impacts in the past from vehicles driving in the meadow. A recently constructed fence has reduced adverse effects to the natural values of the meadow and reduced the potential to impact historic artifacts that may be within the meadow area.

There is also a historic airstrip adjacent to the meadow which has been affected in the past by storage of road waste materials on the airstrip and recreational vehicle camping. Vegetation is also starting to encroach on the historically cleared area. All of these have changed the original character of the airstrip.

Key Question #5: How do conditions of the watershed affect the availability of natural resources, primarily huckleberries, for American Indian traditional use?

Historical fires in the past and their frequency contributed to the establishment of accustomed berry picking areas. Historic records show that huckleberries were very abundant after past wildfires in the early 1900's into the 1930's within the watershed since they need open areas with direct sunlight to grow well. Greater fire suppression efforts in the past 50+ years has reduced the number of openings caused by natural disturbances. Plant succession has brought about a reduction in acreage of huckleberries from what has historically existed as forest stands have grown up and shaded out older huckleberry fields.

Conceptual landscape design elements 2 (mature forest, occasional openings), 3 (mature forest, small openings), and 5 (open immature forest) allow for secondary huckleberry production through vegetative manipulation. Design element 4 (mature forests, ridgetop openings) provides the opportunity to manage primarily for huckleberry production. The land allocations that provide the basis for the above design cells do allow opening forest stands to some degree that can mimic openings similar to those caused by natural fires that are compatible with huckleberry production.

One of the primary management objectives for the mature forest, ridgetop openings design element is to allow active management for huckleberry production. Within this element there are 2, 017 acres and the design guidelines would allow for openings 5 to 20 acres in size with up to 50% of the area being in an open patch condition at one time. It is the larger openings that favor huckleberry production.

Wilderness and other areas managed for late seral habitat (LSR's and Riparian Reserves), limit the opportunity to manage for huckleberries in those areas, even if the areas have been managed for huckleberry production in the past. High Rock, now located within the LSR, is one of these areas.

Question #6: How do conditions of the watershed affect the amount and wide diversity of recreational/educational opportunities in the watershed?

Overall, recreational use is expected to increase significantly in the future. In the Portland metropolitan region, use between 1987 and the year 2000 is projected to grow 57%. These increases will cause increased use at all popular sites, especially Trillium Lake, Timberline Lodge, and the lower 13 miles of Salmon River on both federal and private lands. With this increasing use will come the demand for additional recreational facilities as well as the potential for additional resource impacts at existing and planned facilities. There will also be the potential for conflicts between different types of recreation use and with other resource management objectives.

Timberline Lodge Ski Area/Alpine Zone

The ski area occasionally proposes expansion of ski runs to address safety concerns or to improve the recreational experience on ski runs. They may also consider future expansion of the ski area which would likely include developing new ski runs. Any newly created openings would need to meet standards and guidelines for the allocation, including key watersheds and riparian reserves. Limitations on creation of additional openings that would not meet ACS objectives may limit further expansion of runs at the ski area. Created openings may benefit other early seral species, such as mountain and western bluebird populations, and big game species.

Applications of salt are made to the Palmer Snowfield to improve snow conditions for summer skiing. There is a concern for off-site impacts to water quality from snowmelt. Water quality monitoring has been in place since 1988. Test results have shown an increase in conductivity and chloride levels during the summer ski/salting season but these levels are below below EPA water quality criteria thresholds established for salt sensitive aquatic species. Additional monitoring elements added during the summer of 1995 will better quantify changes in conductivity resulting from diurnal fluctuations and quick snowmelt from rain-on-snow events to better determine effects to aquatic resources from snowfield salting.

There is a need to develop a water source for the lodge and its facilities. The current source is a surface water system developed in 1938-1939 that, while it has had some improvements, does not meet newer Clean Water Act standards.. Earlier attempts to drill a well to meet the lodge's needs were not successful. The Forest Service is now considering drilling a new, deeper well since other proposals for water source development would affect wetland areas and may not meet riparian reserve standards.

The lodge's drainfield recently failed and repair work done in 1994 and 1995 will be effective for approximately 10 years. The existing drainfield is located immediately adjacent to and partially within the riparian reserve for the mainstem of the river and there is a concern that further failures will degrade water quality of the river. There will be a need to develop a new drainfield or alternate sewage treatment system that will meet current management standards prior to the end of the 10 year life of the current drainfield. Monitoring will also be necessary to insure that the repaired system is working properly and water quality is being protected.

The Boy Scouts have been using a historic cabin at the Phlox point area within the ski area boundary for many years. A rare false truffle, *Martellia*, has been found at the site of the cabin and is known to be sensitive to disturbance. As a result, any ground disturbing activities will need to be minimized around the cabin. Since winter snows provide protection to the site, winter recreation activities would not be restricted by the presence of the fungi.

Public use is very high around the Timberline Lodge area, and there are many user made trails around the lodge in addition to the constructed trails. This has affected fragile native plant populations that provide erosion protection to the landscape. These plants are hard to reestablish because of harsh alpine growing conditions. There is a need to reduce damage to remaining populations and to reestablish these native plant communities where they have been eliminated.

Dispersed Winter Recreation Opportunities

Nordic skiing is a very popular low impact activity that has been found to be generally compatible with current watershed conditions and management direction. The Trillium Lake/Mud Creek area is the most popular Nordic area in the watershed. Lower levels of Nordic use take place behind the Snowbunny sno-park area and along the Pacific Crest trail and adjoining trails starting at the Frog Lake sno-park. Snowmobiling is very popular on the road system that is to the west of the Clear Lake sno-park south of Salmon River. This can also be a low impact activity that is compatible with current conditions, especially when it stays on already developed roads and trails.

Demand for both Nordic skiing and snowmobiling is increasing and development of new trails will have to follow management direction, especially for riparian reserves, Late Successional Reserve management, and to reduce impacts to sensitive wildlife species such as the wolverine. If current snowmobile use or new proposals for snowmobile trails is found to reduce habitat effectiveness within the LSR or for species of concern, mitigation measures would likely be needed.

The only snowplay site within the watershed is one by the Snowbunny sno-park that is operated under special use permit. This existing activity, like Nordic skiing is one which is compatible with conditions within the watershed. There is a high demand for additional safe snowplay areas on the forest, especially locations where recreationists can bring their own snowplay equipment and can play in the snow for minimal costs. One area within the upper watershed near the Highway 26/35 junction has been proposed for development of a new snowplay site. The need to meet ACS objectives will need to be met prior to any proposed expansions or development of any new snowplay sites within the watershed and may limit some development opportunties.

Developed and Dispersed Camping/Picnicing Opportunities

Both Green Canyon and Trillium Campgrounds are very popular campgrounds within the watershed and Wildwood and Trillium are also extremely popular day-use sites. The demand for these types of facilities is increasing. Both campgrounds are largely within the riparian reserve and the riparian reserve is the most desirable location for expansion of existing facilities or development of new facilities. Any imporvements/developments must meet ACS objectives which may limit future development or require modifications to existing facilties. This will have the effect of placing greater demands on the existing facilities.

Dispersed recreational camping is very popular within the lower watershed, especially along the Old Salmon River Trail #742B on national forest lands. Some of the site have relatively large areas of bare ground which are potential sediment sources into the river and almost all these sites are within the riparian reserve. Impacts to water quality from human waste contamination is also a concern at heavier use sites. Opportunities exist to reduce some of the above impacts by eliminating, relocating or hardening suitable sites. This could result in a loss of some dispersed camping opportunities in some popular locations.

Most other popular dispersed camping sites in the watershed are also within the riparian reserve with some also being in the Roaring River LSR. If these sites are found to be in conflict with ACS or LSR objectives, mitigation measures such as site relocation or closure may need to be necessary to reduce the impacts.

Other Recreational Uses Within the Watershed

Hunting for big game species is a popular activity, primarily in the upper portions of the watershed. Deer and elk are primarily early seral and contrast habitat species. The increasing emphasis on managing for late seral habitat may reduce the amount of habitat for these species, potentially reducing their numbers within the watershed.

Hunters, anglers, and other recreationists have historically used many of the current roads for access to the watershed for access to popular areas. Road densities are currently above LRMP standards and guidelines (FW-208) in the Mud Creek, West and East Forks, and Salmon subwatersheds. There has been a significant (greater than 10%) increase in the stream drainage network in Linney Creek, Mud Creek, and the West and East Forks subwatersheds from roading. Roads within riparian reserves are contributing to erosion and sedimentation within the watersheds (see table 4-1). Road closures to mitigate effects to resources will reduce vehicle access for hunters, anglers and other recreationists.

The lower Salmon River is well known for its sportfishery, primarily the summer steelhead, a fish stock that was introduced into the Sandy Basin in 1975. Implementing actions to meet ACS objectives within the riparian reserve will provide long-term benefits for fish habitat through improved water quality, increased large woody debris supply, and providing additional spawning and rearing habitat for native anadromous fish. There is a potential that improved habitat conditions will increase the numbers of fish within the river. The management focus on federal lands will be to provide for the habitat needs of native fish species in accordance with ACS objectives. Forest Service and BLM personnel will also be coordinating with Oregon Department of Fish and Wildlife (ODF&W) in defining future habitat and fish stocking objectives in the watershed. Overall, ODF&W has the responsibility for managing fish populations and stocking practices and the Forest Service and BLM have the responsibility for managing the habitat that is used by fish and wildlife.

With increasing use in the watershed comes an increase in the importance of encouraging group education activities that will teach visitors how to minimize impacts of activities in the watershed. This type of activity not only teaches better land stewardship, but can instill a greater appreciation for the natural resources available within the watershed. Currently, Cascade Streamwatch, located at the BLM Wildwood site, is filling that role to a degree and there is a potential for much more of this type of activity.

Much of the recreational use currently taking place is dependent upon the naturally appearing forested settings that are found in the watershed. Natural disturbances such as wildfire, and insect and disease outbreaks have the potential to alter vegetation patterns at the landscape scale. Depending upon the location and size of any of these events, they have the potential to affect the recreation experience by causing large scale changes to the forest that visitors may be seeking.

Question #7: How do conditions of the watershed affect opportunities for production and extraction of commodities including timber, livestock grazing, special forest products and mineral resources?

The primary factors affecting the availability of commodities within the watershed include the land allocations and the existing vegetative condition. A summary of Northwest Forest Plan standards and guidelines for special forest product collection and harvest is contained in Appendix I. On State of Oregon, Clackamas County, and privately owned lands, state laws and local zoning requirements apply and would be the controlling regulations affecting commodity availability.

The approach for this section was to summarize the availability for commodity production by land allocation and acreage. Table 6-2 below summarizes the availability of commodities within the watershed based on the limitations prescribed by management direction, state laws, land allocation and/or zoning regulations. The definitions for the table are:

- **Excluded**: activities not permitted within the land allocation/zoning
- **Very limited**: activities usually limited only to those that benefit the management objectives of the land allocation/zoning.
- ***Somewhat limited***: *management direction and/or regulations restrict* the availability to a moderate degree. Commodity outputs are generally consistent with the management objectives of the allocation/zoning. Additional resource considerations will apply.
- **Few limits**: the activity is compatible with the land allocation/zoning. Additional resource considerations will apply.

For the commodities described in this section, the following considerations apply:

- **Timber** refers to commercial sawtimber.
- **Grazing** refers to existing allotments on federal lands.
- **Special forest products** describes a broad range of forest materials such as firewood, posts and poles, beargrass, mushrooms and Christmas trees. Special forest products is abbreviated SFP in table 6-2.
- **Mineral** resources in this analysis is limited to rock quarries.

Table 6-3 - Commodity availability based on land allocation/ownership within the Salmon River watershed

LAND ALLOCATION	ACRES IN WATERSHED	PERCENT OF WATERSHED	AVAILABILITY OF COMMODITIES
A2 Wilderness	36,389	49	Excludes all commodities listed.
A1 Wild and Scenic River	6,904	9	Timber: very limited Grazing: somewhat limited SFP: somewhat limited recreational segments, Excluded wild segment. Minerals: new developments very limited rec. segment, excluded wild segment.
Late Successional Reserve	7,386	10	Timber: very limited Grazing: somewhat limited SFP: very limited Minerals: very limited
Riparian Reserve	3,294	4	Timber: very limited Grazing: somewhat limited SFP: very limited Minerals: new developments limited
A9 Key Site Riparian	136	00.18	Timber: very limited Grazing: somewhat limited SFP: very limited Minerals: very limited
A11 Winter Recreation	1,522	2	Timber: very limited Grazing: very limited SFP: somewhat limited Minerals: new developments very limited
A5 Unroaded Recreation	512	00.69	Timber: very limited Grazing: very limited SFP: somewhat limited Minerals: new developments very limited
A4 Special Interest Area	64	00.08	Timber: very limited Grazing: excluded SFP: somewhat limited Minerals: new developments very limited
B2 Scenic Viewshed	8,221	11	Timber: somewhat limited Grazing: few limits SFP: few limits Minerals: somewhat limited
B3 Roaded Recreation	363	00.49	Timber: somewhat limited Grazing: excluded. SFP: somewhat limited Minerals: new developments somewhat limited
B10 Deer and Elk Winter Range	195	00.26	Timber: few limits Grazing: excluded SFP: somewhat limited Minerals: few limits

LAND ALLOCATION	ACRES IN WATERSHED	PERCENT OF WATERSHED	AVAILABILITY OF COMMODITIES
B12 Backcountry Lakes	37	00.05	Timber: somewhat limited Grazing: somewhat limited SFP: somewhat limited Minerals: new developments somewhat limited
C1 Timber Emphasis	3,158	4	Timber: few limits Grazing: few limits SFP: few limits Minerals: few limits
Bureau of Land Management (BLM) Recreation	320	00.43	Timber: very limited Grazing: not applicable SFP: excluded. Minerals: excluded
BLM - VRM 1 Visual Resource	905	1	Timber: very limited Grazing: not applicable SFP: very limited Minerals: new developments very limited
BLM - Connectivity	115	00.16	Timber: somewhat limited Grazing: not applicable SFP: somewhat limited Minerals: new developments very limited
Private Ownership	3,334	5	Timber: few limits on timberland zoning , very limited in residential zoning. Grazing: not applicable SFP: few limits. Minerals: very limited
Clackamas County	723	1	Timber: few limits on timberlands, very limited in residential zoning Grazing: not applicable SFP: somewhat limited Minerals: somewhat limited
State of Oregon	80	00.11	Timber: very limited by location Grazing: not applicable SFP: very limited by location Minerals: very limited by location.

Timber

- Timber production is excluded on the wilderness lands within the watershed. Approximately 49% of the watershed (36,389 acres) is wilderness.
- Timber production is very limited on land allocations that comprise over 26% of the acres within the watershed. Wild and Scenic River, Late Successional Reserve, Riparian Reserves and Winter Recreation are included in the very limited rating for timber.
- The land allocations representing few limits to timber harvest are Timber Emphasis and Deer and Elk Winter Range. Nine percent of the lands within the watershed are within these land allocations. On national forest lands,

approximately 5% or 3353 acres within the watershed have few limits to timber harvest.

- Timber harvest may be limited due to current conditions within the watershed. Since 1950, a total of 2927 acres have previously been clearcut within the watershed. Thirty-three percent of the acres within the Timber Emphasis land allocation have been previously harvested.
- Opportunities for timber harvest are concentrated in mid seral stands within the watershed. There are 2,140 acres of mid seral and 280 acres of late seral stands on C1 lands within the watershed. The mid seral stands comprise 68% of the 3,158 acres in the C1 allocation.
- Mud Creek and Linney/Draw subwatersheds are currently at or near the threshold of concern for increased peakflows due to harvest and road construction limiting timber harvest opportunities which create openings.
- Timber production is somewhat limited on 8621 acres or 11.5 % of the lands within the watershed (Scenic viewshed, Roaded Recreation, Backcountry Lakes and BLM connectivity). In general, timber production from these lands is a byproduct of meeting the standards and guidelines for the land allocation.
- The Conceptual Landscape Pattern for the watershed identifies long term vegetation objectives for the land allocations in the watershed. The Conceptual Landscape Pattern cells with the greatest potential for timber harvest are those identified as Open Immature Forest, Mature Forest/ Ridgetop Openings, and Mature Forest/Small Openings. (see map 5-1).
- Completion of an interim LAD would help to identify the current opportunities for timber harvest within the watershed. Additional site analysis will aid in the identification of actual locations for timber harvest.
- Silvicultural treatments to managed plantations and natural stands less than 80 years of age may be prescribed in the Roaring River LSR to promote and hasten late-successional forest conditions. Without thinning, these densely planted stands may not achieve desired late seral structure. Even aged natural stands may also benefit from silvicultural treatment to hasten development of late seral characteristics. These silvicultural treatments will consist mainly of pre-commercial and commercial thinnings. Commercial thinning may provide short term commodity outputs.
- The Scheduling and Network Analysis Program (SNAP) can be used as a tool to model and schedule future timber harvest based on stand growth rates and land allocation constraints.
- Spruce budworm mortality may yield harvest opportunities within the watershed, both on timber emphasis and non-timber emphasis lands. Harvest in these areas may be limited by existing snag and large woody debris deficits.
- On lands managed for huckleberry production, there would be a short term impact to timber harvest, since retention of openings for huckleberry production would delay re-establishment of timber stands.
- Non-federal lands within the watershed will continue to supply timber products. The level of timber harvest from these lands is unknown.

Livestock Grazing

Currently, livestock grazing within the watershed takes place on the Wapinitia allotment. Exclusion of grazing from Jackpot meadows, Salmon river meadows and Ghost creek has been identified as a high priority restoration opportunity (Chapter 7, Restoration Opportunities). Livestock numbers are expected to remain steady throughout the remainder of the allotment in the known future.

Special Forest Products

- The availability of special forest products is potentially very limited on 63% of the lands within the watershed. Since special forest products is a broad category, consult the appropriate references for each land allocation and product. Wilderness, Late Succesional Reserves and Riparian Reserves account for the majority of the lands with the very limited rating
- Additional site specific analysis is needed to evaluate the availability of special forest products in Riparian and Late Successional Reserves.
- Additional species specific information is needed to address the affect of special forest product harvesting on species of concern.
- Firewood and post and pole products are secondary products of timber harvest and their supply would be indirectly limited by timber harvest levels.
- There is a high potential to produce huckleberries in the watershed, especially in the Mature Forest, Ridgetop Openings design cells from the Conceptual Landscape Pattern.

Minerals

- There are currently no active locatable mining claims or geothermal lease permits within the watershed. Trends for rock quarries within the watershed are described in Chapter 4. All three quarries within the watershed (Mud Creek, Frying Pan and Miller) contain useable rock resources.

Question #8: How do conditions of the watershed affect the ability to meet the Aquatic Conservation Strategy Objectives?

Aquatic Conservation Strategy Objectives:

Objective #1: Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic sustems to which species, populations and communities are uniquely adapted.

The primary watershed and landscape scale feature used to assess this objective will be vegetative structure and composition. This feature was felt to best reflect watershed and landscape-scale conditions under which aquatic species, populations and communities are uniquely adapted.

The current stand structure and composition is altered from the conditions under which species, populations and communities are adapted in the following areas:

- More Douglas-fir dominated stands in Linney and Mud Creek areas
- Decreased late seral stand structure in the Western Hemlock and Pacific Silver Fir Zones.
- Fragmented landscapes in Mud Creek, Linney Creek and Salmon River subwatersheds
- Altered stand structure and composition with potential for greater impacts from spruce budworm infestations

The forest landscape analysis and design(LAD) process was used to depict what the watersheds landscapes should be like in 50-200+ years in the future based on current management direction. This is detailed in figure 5-1.

Implementation of the NW Forest Plan results in late seral acreage that is outside and well above the range of natural conditions in both the Western Hemlock Zone and the Pacific Silver Fir Zone. Mid and early stand acreage is outside the range of natural conditions within the Western Hemlock Zone and within the range of natural conditions for the Pacific Silver Fir Zone.

Landscape patterns generated under the LAD process generate similar patterns to those under natural conditions with large patches dominating.

Objective #2: Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling the life history requirements of aquatic and riparian-dependent species.

The Northwest Forest Plan provides for maintenance of spatial and temporal connectivity, of aquatic and riparian areas on federal lands. Private lands are not likely to contribute to maintenance of spatial connectivity and may eliminate that connectivity or access for aquatic species.

Habitat connectivity for aquatic and riparian dependent species between the channel and floodplain have been eliminated through channel straightening and clean out in the lower watershed. A large wetland south of Wildwood Recreation site no longer retains moisture in the late summer months. Small wetlands in the Mud creek subwatershed have been disturbed by timber harvest and road construction. The vegetative and hydrologic connectivity of these wetlands has been impaired. Re-establishment of these habitats is a priority for restoration.

Historically, beaver dams were probably important components of low gradient reaches in the lower watershed. Beaver dams increase habitat complexity and moderate baseflow and peakflow changes, and provide increased rearing capacity for steelhead. Eradication of beaver from the lower watershed resulted in less vegetative and hydrologic connectivity of wetlands due to channel incision and a lower water table.

Baseflows have been on a declining trend since 1951 in the upper watershed. This has the potential to effect hydrologic connectivity and associated vegetative structure in the Salmon River/Redtop Meadow area.

Current research has suggested that roads function hydrologically to modify streamflow generation in forested watersheds by altering the spatial distribution of surface and subsurface flowpaths. Observations suggest that roadside ditches and gullies function as effective surface flowpaths which substantially increase drainage density during storm events (B. Wemple, 1994). This has the potential to quickly route stormflows off site and not allow for storage and slow release which will maintain hydrologic connectivity to wetlands. This process is of concern in Mud Creek, Linney Creek and W & E Fork subwatersheds.

There is a culvert which is a barrier to resident trout on Salmon River where the river crosses Highway 26.

Objective # 3: Maintain and restore the physical integrity of the aquatic system, including shorelines, banks and bottom configurations.

This objective will be assessed by examining aquatic habitat types, levels of pools and large woody debris, and channel morphology.

Within the lower watershed side channel habitat, and levels of pools and large woody debris are outside the range of natural conditions. This is attributed to channel straightening, cleanout and eradication of beavers in this area.

The middle portion of the Salmon River watershed (the wilderness area) is outside (below) the range of natural conditions for pools and within the range of natural conditions for large woody debris. Low levels of pools are attributed to past fire history in the area which effects (increased peakflows and channel scour, increased sediment delivery and decreased in-channel large woody debris) are manifested in the channel.

In the upper watershed pool levels are outside the range of natural conditions (with the exception of Mud Creek) and large woody debris levels are near the low end of the range of natural variation. Pool and large woody debris levels in this area are attributed to timber harvest activities in the upper watershed. The riparian reserves within Mud Creek and Linney Creek have received some type of harvest activity on 62% and 25% of the area respectively.

A large portion of the streams in the watershed (especially the wilderness area) are characterized as debris transport streams and are unstable and sensitive to disturbances with respect to increased peakflows or sediment inputs. If these channels are disturbed they have a high sediment load and a low recovery potential. This is of special concern in the lower watershed where these channels are located above depositional reaches that are key habitats for anadromous fish.

Objective #4: Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical and chemical integrity of the system and benefits survival, growth, reproduction and migration of individuals composing aquatic and riparian communities.

Enterococcus Bacteria

Enterococcus bacteria (an indicator of fecal contamination) levels were above the state standard in 1992, 1993 and 1994 in the Salmon River. The highest levels were recorded in the upper watershed. There are also much higher levels of macroinvertebrates that are an indicator of organic loading in the upper Salmon River.

Enterococcus bacteria levels are of most concern with respect to risk of gastrointestinal illness in humans. There appear to be other affects from high levels of enterococcus within the Salmon River. There is a shift in the macroinvertebrate community within the Salmon River and water quality is outside the range under which individuals and species composing aquatic and riparian communities are adapted.

The high levels of enterococcus bacteria were thought to be attributed to the failure of the drainfield for secondary sewage treatment at Timberline Lodge and inadequate sewage treatment facilities on private land in the Wapinitia area. These problems have been addressed, so entrococcus bacteria levels are expected to drop. Monitoring associated with the drainfield at Timberline Lodge is planned to assess the effectiveness of the sewage treatment facilities.

Water Temperature

Stream temperatures in the Salmon River within the lower watershed were above the state standard of 14.4^0C in 1992 and 1994 with a maximum temperature of 18^0C at the confluence with the Sandy River on August 11, 1992.

Of special concern in the Salmon River watershed is *Corydalis aquae-gelidae* which is a Mt. Hood sensitive plant and a candidate for federal listing. *Corydalis aquae-gelidae* sites have an average substrate temperature of 10^0C.

Stream temperatures were recorded above 10^0C at the Fly Fishing Bridge which is immediately upstream of a population of *Corydalis aquae-gelidae.* This is attributed to increased stream temperatures in managed areas with reduced levels of riparian shade. There is considerably more early seral stand structure in Mud and Linney Creeks (37% and 27%) than within the range of natural variation (4%) or subwatersheds within the wilderness.

Within the Mud Creek subwatershed, for a good part of the summer of 1990, water temperatures were above 14.4^0C and the threshold of concern for effects to resident trout. The sample site was located below a large clearcut area on private land and Trillium lake. Increased stream temperatures were attributed to increased solar radiation interception. There was no continuous stream temperature data available for Linney Creek. Based on this data and the level of stream shading in Mud Creek and Linney Creek, stream temperatures are of concern because of their effect on habitat for *Corydalis aquae-gelidae.*

Conductivity and Sodium

Conductivity readings are higher at the upper monitoring site on the Salmon River than at any of the other monitoring sites. Conductivity is useful for quickly assessing water quality and often a linear relationship can be established between conductivity and the major ionic species. This could indicate effects from the snowfield salting on Palmer Snowfield or it could be related to the lower discharge at the upper station. Sodium levels were analyzed in an effort to determine if snowfield salting was having an effect on water quality.

Sodium concentrations are the highest at the upper station. The greatest difference between the upper and lower stations was recorded on August 11, 1992 and the least difference was on March 16, 1992 which would indicate a correlation with application of salt (which is applied for summer skiing) and increased levels of sodium in the Salmon River.

Usually there is an inverse relationship between conductivity and discharge (Keller et al., 1986, Aumen et al., 1989). This relationship between conductivity and discharge means that simultaneous discharge measurements are needed to properly interpret conductivity data (EPA, 1991) and to effectively assess the conductivity and/or sodium concentrations within the upper watershed.

Sodium and Chloride concentrations are below any threshold of concern, however these levels appear to be outside the range under which individuals and species composing aquatic and riparian communities are adapted

Suspended Sediment

Highest suspended sediment levels within the Salmon River have been recorded in the upper watershed. These monitoring results correlate well with sediment regime analysis. This analysis predicted 2459 tons per year of sediment delivered to the stream system in the upper watershed from highway sanding.

Increased sedimentation in the upper watershed from road sanding activities is of concern because of the potential effects of sediment deposition on redds of resident cutthroat trout. Because sediment loads from road sanding are greatest during spring runoff this has the greatest negative effect on reproduction of spring-spawning native trout, and favors fall-spawning brook trout.

Objective #5: Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate and character of sediment input, storage and transport.

Timing and Character

Natural rates of sediment production from mass wasting predominates in the lower watershed. Delivery is episodic and occurs in conjunction with intense winter storms. On site and instream recovery rates are rapid. Surface erosion in the lower watershed is primarily associated with areas of human disturbance and soil compaction and supplies a chronic, low level background rate of sediment during first flush, fall rainstorms. Recovery from surface erosion is a function of site revegetation and decompaction.

In the upper watershed, mass wasting is less important in the natural sediment regime and it is here that the majority of management related surface erosion is produced. Natural rates of surface erosion in undisturbed forested watersheds is measured to be quite low (Swanson, F. and G.Grant, 1982). Activities within the Salmon watershed that commonly increase the susceptibility of a site to surface erosion through the exposure of bare soil include timber harvest and site preparation, road construction, recreational uses, and grazing. In addition to sediment production from surface erosion, sand applications to snow-covered highway surfaces are a source of sediment in the watershed The process used to evaluate the sediment regime in the watershed is described fully in the appendix.

Volume and Rate

In the lower watershed, roads have greatest potential impact to the volume and rate of sediment delivery from management activities within the watershed. While other activities with high potential for sediment delivery exist in the lower watershed, background rates of natural sediment (from mass wasting) are proportionally much higher.

Highway sanding contributes the greatest increase in potential sediment within the watershed. The effects of highway sanding are largely confined to the West and East Forks and Upper Salmon subwatersheds. Existing roads account for the the majority of the remaining potential sediment within the watershed. Potential sediment from existing roads is greatest when considered on a per area basis, in the West and East Forks subwatershed, followed by Upper Salmon and Linney/Draw.

Potential sediment contribution from all sources was greatest overall for the West and East Forks subwatershed. Restoration activities and mitigation measures to reduce erosion would be efficacious in this drainage.

Storage and Transport

Fine sediment delivery to stream channels and transport to depositional reaches within the watershed can alter substrate composition important to the survival of aquatic species. Key depositional reaches within the watershed were identified for aquatic species of concern, and potential sediment delivery and deposition to those points were calculated. The key reaches are Salmon Meadows (Ghost creek/Salmon river confluence), the confluence of Mud Creek with the mainstem of the Salmon, the confluence of Linney and Draw creeks and the Fly Fishing Bridge along road 2618. Cumulative potential sediment delivery to these sites is displayed in Table 6-3.

Figure 6-18 - Key Depositional Reaches

Table 6-4 - Cumulative Sediment Delivery at Key Reaches

KEY DEPOSITIONAL REACH	ESTIMATED SEDIMENT DELIVERY (tons/yr)
SALMON MEADOWS	3,081
MUD CREEK	183
LINNEY/DRAW	273
FLY FISHING BRIDGE	2,892

Sediment delivery from modeled surface erosion rates are of concern to all of these reaches as they have been identified as providing habitat for known aquatic species of concern. Restoration activities that reduce potential erosion and deposition may be prioritized when impacts are considered on a per area basis.

Objective #6: Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient and wood routing. The timing, magnitude, duration and spatial distribution of peak, high and low flows must be protected.

Peak Streamflows

The method used for the assessment of changes in peak streamflows assumes that the greatest likelihood for causing significant, long-term cumulative effects on forest hydrologic processes is through the influence of created openings from timber harvest and roads on snow accumulation and melt. The effect of vegetation change on peakflows during rain-on snow events is the focus of the assessment

Currently, only Mud Creek is above the threshold of concern for increased peak flows from rain on snow events. This area is not in the anadromous portion of the watershed so only resident fisheries may be affected, however based on the conditions of the watershed in 1944 and the distribution of unstable stream channels throughout the watershed increased peakflows may be affecting anadromous fish habitat. The most prevalent Rosgen channel type (see fish habitat section for a more complete description of channel types) in the anadromous section of the watershed is A3. These channels have a very high sensitivity to disturbance from changes in streamflow magnitude, a very poor natural recovery potential, very high sediment supply, and high streambank erosion potential. The channels within the anadromous section of the watershed may still be recovering from increased peakflows in the 1940's (due to the fires during that period creating openings) with sediment yields above background levels because of the unstable nature of the channels.

Of most concern in the Salmon River is the effect of increased peakflows on the mobilization and scour of stream bed sediments and the resulting disruption of the egg incubation environment (redds). Salmonids generally bury most of their eggs at depths exceeding the mobile stream bed layer for the 2-year flood. Evolutionary strategy would suggest advantage to burying eggs at depths below the 2-year storm mobile bed layer, since scour frequency at shallower depths could affect populations on a nearly annual basis. Larger floods with greater volumes and duration of flow may cause deeper than "normal" scour of the gravel, however, these storms occur less frequently, they have a lower probability of affecting the entire population, but could have significant effects on the brood in the years they do occur. (DNR 1993).

Current research has suggested that roads function hydrologically to modify streamflow generation in forested watersheds by altering the spatial distribution of surface and subsurface flowpaths. Observations suggest that roadside ditches and gullies function as effective surface flowpaths which substantially increase drainage density during storm events (B. Wemple, 1994). This increase in drainage density may effect the timing, duration and frequency of peak streamflows.

The analysis points out that there have been significant (greater than 10%) increases in the stream drainage network due to roads in Linney Creek, Mud Creek and West and East Fork subwatersheds. This is of special concern in the Mud Creek and Linney Creek subwatersheds because these areas are near or above the threshold of concern for increased peakflows from rain on snow events. The link between increased peakflows from rain on snow events and road drainage network expansion has not been documented, however since these subwatersheds are at or above the threshold of concern for both these processes they are of special concern with respect to increased magnitude of peak streamflows.

Baseflows

Baseflows are a critical component in maintaining aquatic habitat and wetlands in the Salmon River Watershed. Baseflows in the upper watershed were felt to be very important in maintaining the Salmon River/Redtop meadows complex. In order to assess trends in the baseflow regime the Season Kendall Test Without Correction For Correlation (SKWOC) was completed for the upper watershed.

Based on this analysis there are two significant trends. A increasing trend in baseflows from 1927 to 1951 and a decreasing trend from 1961 to 1981. Baseflows have exhibited a decreasing trend since 1951, however, not all these trends have been significant. To determine if there was a relationship between snowpack and baseflows, April snowpack in snow water equivalent and baseflows were compared using linear regression analysis and there was not a significant relationship. After climatic influence due to snowpack was eliminated as the causal factor for the reduction in baseflows management activities in the upper watershed in the period around 1950 were examined. No clear relationship between either climatic or management activities and baseflow could be established.

The decreasing trend in baseflows is of concern because of the potential to reduce riparian, aquatic and wetland habitats especially in the upper watershed.

Objective #7: Maintain and restore the timing, variability and duration of floodplain inundation and water table elevation in meadows and wetlands.

Floodplain inundation and water table elevation have been altered through channel straightening and clean out in the lower watershed. A large wetland south of Wildwood Recreation Site no longer retains moisture in the late summer months. Small wetlands in the Mud Creek subwatershed have been disturbed by timber harvest and road construction.

Historically, beaver dams were probably important components of low gradient reaches in the lower watershed. Beaver dams increase habitat complexity and moderate baseflow and peakflow changes. Eradication of beaver from the lower watershed may have altered floodplain inundation and water table elevation within the low watershed.
Baseflows have been on a declining trend since 1951 in the upper watershed. This has altered the timing, variability and water table elevation in the Salmon River/Redtop Meadows area. It is unclear what has caused this trend.

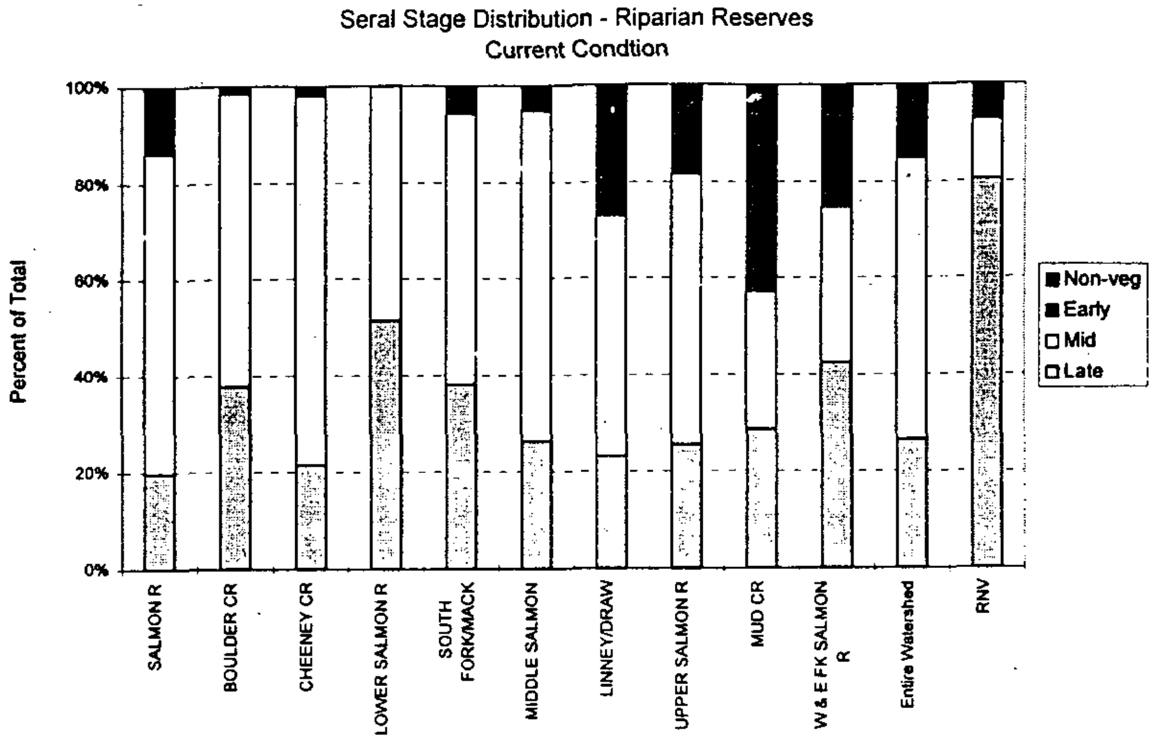
Altered peakflows have the potential to cause channel destabilization including downcutting. As channels downcut the water table is lowered and patterns of floodplain inundation are altered. This process is of concern in the Mud and Linney Creek subwatersheds.

Objective #8: Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability.

Objective #9: Maintain and restore habitat to support well-distributed populations of native plant, invertebrate and vertebrate riparian-dependent species.

Both ACS objectives #8 and #9 above will be assessed by evaluating stand structure and composition within the riparian reserves.

Figure 6-19 - Riparian Reserve Stand Structure

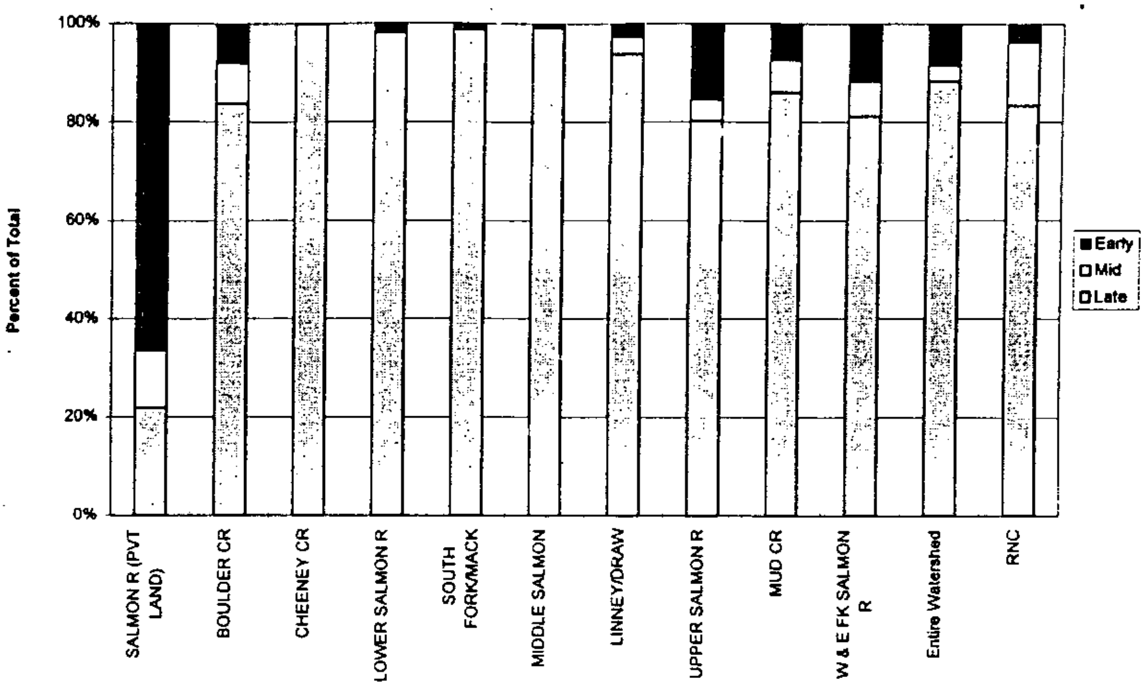


The entire Salmon watershed has less late seral and more mid seral stands than the range of natural variation. This is attributed to recent fire history in the watershed. The subwatersheds in the wilderness have approximately 95% of the area within the riparian reserves in mid and late seral conditions (which is in the same range as the range of natural variation). The stand structure within the wilderness is used to characterize the natural or unmanaged condition with the watershed. There is more early seral stand structure in Mud Creek (37%), Linney Creek (27%), W &E Fork (19) and Upper Salmon (17%) than the natural condition (4%) for the watershed.

Stand structure within the upper watershed (Mud Creek, Linney Creek, W & E Fork, and Upper Salmon subwatersheds) is outside the natural condition for the watershed and of concern with respect to adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, channel migration, coarse woody debris recruitment are of concern in this area. The shift away from mid and late seral structure towards early seral structure in the upper watershed is also of concern in providing habitat to support well-distributed populations of native plant, invertebrate and vertebrate riparian-dependent species.

The forest landscape analysis and design(LAD) process was used to depict what the watershed's landscapes should be like in 50-200+ years in the future. The riparian reserve stand structure was estimated based on design cells from this process.

Figure 6-20 - Riparian Reserve Stand Structure under the Northwest Forest Plan



The early seral stand conditions in Salmon River and Boulder Creek subwatersheds is attributed to private land in those areas. Since the NW Forest Plan does not apply to those areas and they could be developed it was assumed that all these areas would be in an early seral condition. The early seral structure in Upper Salmon and Mud Creek drainages is attributed to the wet meadow complexes. The early seral conditions in W & E Fork are attributed to Palmer snowfield and the development associated with Timberline Lodge.

There is much less mid seral structure and more late seral structure predicted than there was under the range of natural conditions. With respect to adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, channel migration, and coarse woody debris recruitment this is not of concern because late seral structure facilitates these processes as well or better than mid seral structure.

There is a concern for habitat to support well-distributed populations of native plant, invertebrate and vertebrate riparian-dependent species for those species in the upper watershed that utilize mid seral habitat.

Question #9: How do conditions of the watershed affect the ability to maintain late successional and old growth species habitat and ecosystems?

Current Conditions

Currently, late successional and old growth habitat is quite limited within the watershed. Watershed wide, only 30% of the lands are in late seral condition, 55% in mid seral and 11% in early seral. Late seral forest, for both the Western Hemlock and Pacific Silver Fir Zones, is below the range of natural conditions, which is largely due to fires in the early part of this century.

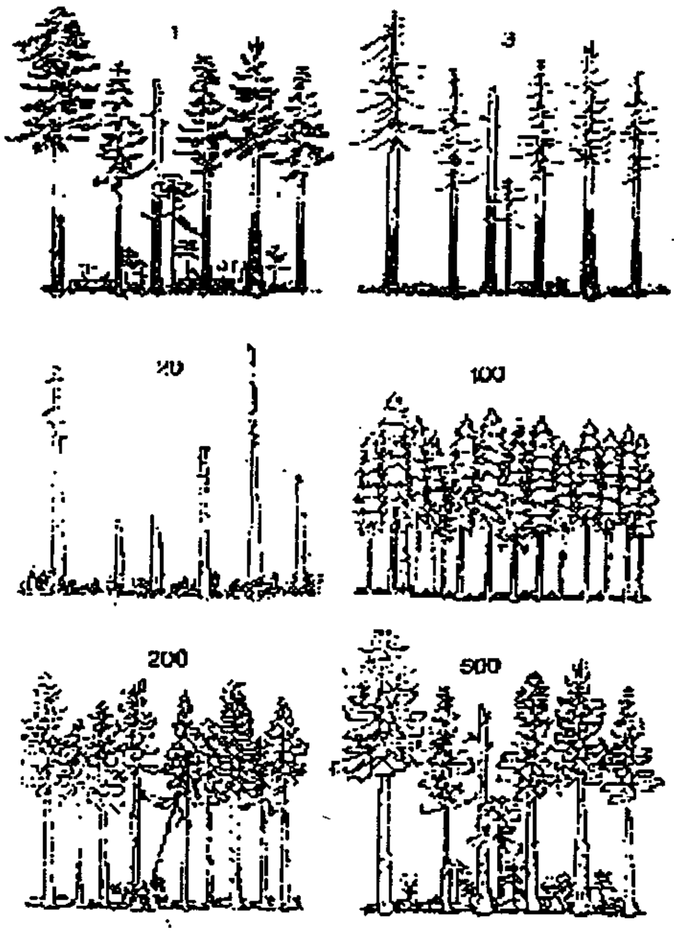
The Salmon-Huckleberry Wilderness, which comprises over half of the acreage within the watershed, contains mostly mid-seral habitat (62%). Late seral habitat, which is found on approximately 33% of the lands within the wilderness, is primarily located along the valley bottoms and stream channels.

In the Roaring River and White River LSRs, there is currently an estimated 33% late seral, 44% mid seral and 23% early seral habitat. The 100 acre LSR in the Sherar Burn area is dominated by (95%) mid seral stand structure. The remaining 100 acre LSRs are dominated (greater than 75%) by late seral conditions.

Intense historical wildfires and reburns, both within the Wilderness and outside in such areas as the Sherar Burn, has limited stand differentiation and habitat. These areas are lacking late seral size and structure. Figure 6-12 illustrates forest development in western hemlock/Douglas-fir forests after stand replacement fire. Each number above the stand refers to the postfire age of the stand. The typical fire regime is a high-severity fire, and is associated with ecosystem instability.

The mid seral structure within the Salmon watershed is well illustrated by the 100 year stand schematic in Figure 6-21. These stands have relatively even crown heights, similar stem size, dense stocking, and narrow crowns. It is estimated that it will take at least an additional 100 years before stand differentiation begins to develop old growth characteristics. Sites with decreased productivity from degraded soils associated with fire may take even longer.

Figure 6-21 - "Chronosequence of forest development after fire



Future Conditions and Maintenance of Ecosystems

There is uncertainty in maintaining both existing and future late successional ecosystems based on 1) the range of natural conditions, 2) historic fire evidence, and 3) current vegetative conditions.

Future vegetative conditions on national forest lands within the watershed are largely defined by land allocations and are illustrated in the Conceptual Landscape Design (see Chapter 5). Calculations from this landscape design show the future Salmon watershed consisting of over 70% late seral forest. These desired late seral conditions are well beyond the range of natural conditions as displayed earlier in figure 6-1. Desired late seral forest is approximately 35% above the RNC in the western hemlock zone and 15% above the RNC for the Pacific silver fir zone. This raises the question as to whether or not late successional forests can be maintained outside of historic levels through time. Consequently, whether or not the intent of the Northwest Forest Plan for old growth associated species in these areas can be met, is uncertain.

Mapping and analysis of historic fires (Ch. 4) displayed several, large, stand replacement fires throughout the watershed within the last century. Some areas had repeated burns. This is strong evidence that large scale fires cannot be ignored in assessing risk to future stands. Furthermore, limited access and remoteness in areas such as the Wilderness, increase the risk of fire spread.

Current vegetative conditions are also contributing to a higher risk of natural disturbance mechanisms such as fire, insects and disease. Within and adjacent to the wilderness, large patches of even-aged post-fire stands show reduced vigor due to low site productivity and off site plantations. Spruce budworm and bark beetle have taken advantage of these conditions further weakening the stands and causing some mortality. In addition, insect defoliation and mortality has increased the availability of crown and ladder fuels. Current stand conditions indicate a moderate risk of large-scale, stand replacing fire.

There are some opportunities however to promote late successional habitat through silvicultural practices, including stand and vegetation management, and prescribed burning. Within LSRs, silvicultural treatments may be applied in stands less than 80 years of age to promote late successional habitat and lessen susceptibility to natural disturbances. Before habitat manipulation may occur, an LSR assessment is required (ROD C11-13). Silvicultural practices in riparian reserves may be applied to control stocking, reestablish and manage stands, and acquire desired vegetation characteristics needed to attain Aquatic Conservation Strategy Objectives (ROD C-32).

Connectivity

Connectivity is also important for the maintanence of old growth associated species. Overall, the watershed has a system of reserves, including LSR's and riparian reserves, that are providing and will continue to provide terrestrial connectivity throughout the watershed. Riparian reserves are especially critical to maintain connectivity where managed lands have fragmented the landscape. With the predominance of late seral habitat, in the future, connectivity should be greatly enhanced through time.

Question #10: How do conditions of the watershed affect the ability to maintain biological diversity with native species and ecosystems?

Terrestrial Species and Ecosystems

The wide variation in physiography in the watershed results in a wide variety of habitats. Landforms include gently sloping alluvial valley bottom terraces, to highly dissected steep rocky slopes, to glacially influenced meadow complexes, alpine terrain and high mountain springs. Currently there is potential habitat for 236 wildlife species and 910 plant species within the watershed.

Currently there is an altered mix of seral stages. Seral stage affects a variety of ecosystem functions, including: wildlife species use and migration, hydrologic function, production of snags and coarse woody debris, and disturbance processes such as fire, insects and disease.

Late seral forest is well below the range of natural conditions, especially for the western hemlock zone. Early seral forest is slightly below the range of natural conditions, whereas mid seral forest is within the range.

Historical landscapes, therefore, would have favored species associated with late successional forests more than they are providing for today. To a lesser extent, this is also true for early successional forests. As displayed in the conceptual landscape design, the watershed is moving towards having large areas of late seral forest, with only small amounts of early seral forest.

Species that require old growth, such as the spotted owl, will have increased habitat, whereas species that require early seral forest, such as the red fox will have decreased habitat. It is further expected that habitat for contrast species, such as elk, will decline.

Roosevelt elk usually inhabit the west side of the Cascades or the coastal forests, whereas Rocky Mountain elk are more an eastside species. The Salmon River watershed provides both summer and winter range for elk and it appears there may be some mixing it up between these two species.

Plant Species

The introduction of competing non-native species and habitat alteration are the two factors which contribute to a reduction of native biodiversity. Ski area development has altered habitat in the alpine and subalpine zones. Throughout the watershed, forage and erosion control seeding has increased the amount of non-native plants. Noxious weed introduction has occurred via transportation corridors, livestock grazing and forest visitors, and most noxious weeds are associated with managed areas. On private lands in the lower watershed, there have been many introduced species and alteration of habitats associated with residential and commercial development.

In comparing historic species to current, there may have be a relatively small scale, short duration change to diversity of tree species. It appears that Douglas-fir dominated stands have increased in the Linney/Draw creek areas. This is most likely due to artificial regeneration favoring Douglas-fir. Many plantations were planted with more than one species, however favored commercially important tree species and excluded non-commercial species. Naturally seeded in species has offset some of this effect. At the genetic level, there has been an increase in diversity in some plantations due to collection of seed from a wide zone.

Extirpated Species

Five wildlife species are believed to have been inhabitants of the west slope of the Oregon Cascade Range and adjacent valleys during the late 19th century that have since been extirpated. These species include: grizzly bear, gray wolf, Columbian white tailed deer, California condor and the yellow-billed cuckoo.

Very little historic population data or life history data are available for these species. The Columbian white-tailed deer, the condor, and the cuckoo may have inhabited the lower portions of the drainage. Grizzly bear and gray wolf are believed to have been prevalent throughout the basin. None of these 5 species are extinct, but opportunities for re-establishing any of these species is minimal at best.

Introduced Species

Eight wildlife species have been introduced to the Salmon River Watershed in the last century or have potential habitat in the watershed. These are: bullfrog, house sparrow, house mouse, norway rat, European starling, wild turkey, Virginia opossum, and ring-necked pheasant. Of these, two are recognized threats to ecosystem processes. The European starling competes with secondary cavity nesting birds for nest sites, and the bullfrog aggressively outcompetes, displaces and preys upon native amphibians.

Introduced plant diseases, such as the Western white pine blister rust, have decreased populations of this tree species in the watershed. However, plant breeding programs have produced genetically resistant stock which will help maintain western white pine in the ecosystem.

Aquatic and Riparian Species - Habitat

The entire Salmon watershed has less late seral and more mid seral stands within the riparian reserves than the range of natural variation. This is attributed to recent fire history in the watershed. Using stand structure within the wilderness to characterize the natural or unmanaged condition with the watershed there is more early seral stand structure in Mud Creek, Linney Creek, W &E Fork, and Upper Salmon subwatersheds than the natural condition for the watershed.

The mid seral stands within the wilderness are moving towards late seral and appear to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, channel migration and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability of the aquatic system in this area.

The shift away from mid and late seral structure towards early seral structure in the upper watershed is of concern in providing habitat including: standing snags, in-channel large woody debris, stream shade and stream cover, to support well-distributed populations of native plant, invertebrate and vertebrate riparian-dependent species. Species of concern in the upper watershed include: resident cutthroat trout, Mt. Hood brachycentrid caddisfly, Mt. Hood farulan caddisfly, Columbia dusky snail, red-legged frog, tailed frog, cold water corydalis, threeleaf goldthread and harlequin duck.

Within the lower watershed side channel habitat, and levels of pools and large woody debris are outside the range of natural conditions. This degrades habitat for native coho and chinook salmon and provides habitat for introduced summer steelhead.

In the upper watershed pool levels are outside the range of natural conditions (with the exception of Mud Creek) and large woody debris levels are near the low end of the range of natural variation. Increased stream temperatures and sedimentation are evident in the upper watershed. This degrades habitat for native species and favors some introduced species such as brook trout.

The forest landscape analysis and design(LAD) process was used to depict what the watershed landscapes should be like in 50-200+ years in the future. The riparian reserve stand structure was estimated based on design cells from this process. There is much less mid seral structure and more late seral structure predicted than there was under the range of natural conditions. There is a concern for habitat to support those species in the upper watershed that utilize mid seral habitat.

Extirpated Species

It is suspected that native summer steelhead, sea-run cutthroat, fall chinook and bull trout are extirpated from the Salmon River watershed.

Introduced Species

Within the anadromous section of the watershed fish stocks from outside the upper Sandy basin have been introduced including: summer steelhead, late-run spring chinook, and rainbow trout. Habitat changes along with introductions of non-native fishes in the anadromous section of the watershed has had detrimental effects on native coho and chinook salmon, summer steelhead and sea-run cutthroat.

Brook trout and non-native rainbow trout have been introduced into the upper watershed. Brook trout do not inter-breed with *Oncorhynchus* spp., but they can compete for limited habitat and food resources, and prey on the eggs and larvae of other fishes. Introduced rainbow trout have been mixing it up with native cutthroat. The introduction of rainbow trout into Trillium Lake allowed their spread into Mud Creek, Salmon River and other mainstem tributaries. Where this occurs hybridization with cutthroat has resulted.

Other effects to biodiversity

Timber management on private and county lands must follow minimum standards for stream protection as directed by the State Forest Practices Act. These standards are less than those required on National Forest and BLM land.

Fishing pressure in the upper watershed on resident native fish species will increase as stocked, non-natives species decrease.

Air quality from nearby urban centers could affect plant species, especially lichens which are very sensitive to air pollutants.

Repeated, high severity fires in some areas of the watershed most likely have impacted the soil biodiversity by decreasing large woody debris, thereby influencing the soil microbial community.

Chapter 7 - Recommendations

Chapter 7 - Recommendations

Introduction

This chapter will focus on guidance and recommendations for project-level planning and overall land management planning based on the findings of the analysis presented and discussed in previous chapters. This chapter will present recommendations for:

- Setting and refining boundaries of Riparian Reserves
- Late Successional Reserves
- Retention of B-5 Pileated and Pine Marten Areas
- PSQ Validation
- General Management
- Restoration Strategy
- Monitoring Strategy
- Addressing Information and Data Gaps

Recommended Riparian Reserves

As a key element of the Aquatic Conservation Strategy, the Riparian Reserves provide an area along all streams, wetlands, ponds, lakes, and unstable and potentially unstable areas where riparian dependent resources receive primary emphasis. Riparian Reserves are important to the terrestrial ecosystem as well, for example, serving as dispersal habitat for certain terrestrial species and connectivity corridors among late successional habitats.

To provide effective habitat connectivity within the watershed, it is recommended that riparian reserve widths are consistent throughout the major vegetation zones. Delineating riparian reserves in this manner will eliminate small scale variations while ensuring larger scale connectivity. Additionally, this method will facilitate administration and analysis.

The Salmon watershed analysis recommends the following reserve widths by vegetation zone. Assumptions for establishing the site potential tree height and supporting documentation from the watershed analysis is presented below. Final Riparian Reserve boundaries are prescribed during site specific analysis and through the NEPA decision making process (ROD B-13).

Table 7-1 Recommended Riparian Reserve Widths

STREAM/RIPARIAN ZONE TYPE	WESTERN HEMLOCK ZONE	PACIFIC SILVER FIR ZONE	MOUNTAIN HEMLOCK ZONE
Fish bearing streams (2 site-potential tree heights)	420'/side 840' total	340'/side 680' total	300'/side 600' total
Non-fish bearing, permanently flowing streams (1 site-potential tree height)	210'/side 420' total	170'/side 340' total	150'/side 300' total
Seasonally flowing or intermittent streams (1 site potential tree height)	210'/side 420' total	170'/side 340' total	100'/side 200' total
Lakes and natural ponds (2 site potential tree heights)	420' surrounding	340' surrounding	300' surrounding
Wetlands (1 site-potential tree height)	210' surrounding	170' surrounding	150' surrounding
Unstable and potentially unstable areas (see note below) (1 site-potential tree height)	210' surrounding	170' surrounding	100' surrounding

Unstable and Potentially Unstable Lands

It is recommended that when unstable and potentially unstable lands are encountered, a geologist or soil scientist field verify the extent of instability. The riparian reserve width will begin at the edge of the instability. Appendix A includes tools to identify unstable conditions within the watershed that will trigger additional field investigation.

Key Site Riparian (A-9)

In most of the watershed, Riparian Reserves override the Key Site Riparian designations of the LRMP. However, there are 136 acres of Key Site Riparian within the watershed which are wider and contain more upland forest. These are managed similar to Riparian Reserves.

Supporting Documentation for Riparian Reserve Recommendations

Analysis of conditions and trends within the Salmon River watershed reveals the processes and existing effects important to riparian habitat within the watershed. The discussion of Key Question 8 details watershed conditions with respect to the Aquatic Conservation Strategy objectives. Additional key questions identify terrestrial processes and functions supported by riparian reserves. Below is a summary of the findings from these analyses that led to the recommendation of riparian reserve widths. For an extensive discussion of the analysis consult the appropriate sections.

Structure and Function

The Salmon river watershed is a Tier 1 Key Watershed. It is expected to provide high quality habitat and serve as refugia for at-risk stocks of anadromous and resident fish species (ROD B-18).

Riparian areas within the watershed provide potential habitat for a number of plant species of concern, including vascular plants, bryophytes, lichens and fungi.

The Salmon watershed is dominated by landforms and stream channels that are very sensitive to disturbance.

Increased magnitude of peakflows are of concern in the Mud Creek and Linney Creek subwatersheds due to created openings and stream drainage network expansion associated with roadside ditches.

Large woody debris recruitment potential is low to moderate along over 50% of stream length in the upper and lower watersheds. Large snags and woody debris are depauperate throughout much of the uplands. The limited large wood and snags within the watershed are most abundant in association with stream channels, providing an important link between riparian and terrestrial systems. Approximately 2500 acres of riparian reserves within the watershed have seen some form of timber harvest.

The lower watershed is outside the range of natural condition and below Forest Plan and PIG standards for pool distribution. In the upper watershed, all the subwatersheds except Mud Creek are outside the range of natural conditions for pools.

The Index of Biologic Diversity rated Salmon watershed condition as "fair to good" for anadromous and resident fisheries.

Channel straightening in the lower watershed has resulted in channel simplification and loss of aquatic habitat. Removal of large logs and boulders, degradation of wetlands and side channels in the lower watershed have contributed to the reduction of aquatic habitat conditions within the watershed.

Connectivity

The lower 8 miles of the Salmon river travel through private lands and are not subject to the Aquatic Conservation Strategy Objectives. Additionally, developments in the upper watershed, (Timberline Lodge and ski area, Wapinitia area inholdings etc.), contribute to reduced connectivity of riparian reserves.

Harvest within riparian reserves exceeds 60% in Mud Creek and 20% in the Linney/Draw subwatersheds.

Over 40% of the total stream length in Salmon river, Linney/Draw, Mud and West and East Fork Salmon have low canopy closure (less than 60%). In 1991, measured stream temperatures in Mud creek were above state water quality standards. Past harvest and low canopy cover within the riparian reserve have led to the increased stream temperatures.

Habitat for terrestrial species is highly fragmented in the Mud Creek, Linney/Draw and East and West Fork subwatersheds and in the area of the Salmon timber sale.

Vegetative and hydrologic connectivity has been reduced in the Salmon and Mud creek subwatersheds.

The wildlife habitat assessment for the watershed analysis assumed that riparian reserves are providing and will continue to provide terrestrial connectivity throughout the watershed. This was assumed knowing that in places current riparian reserves have decreased canopy closure or some level of fragmentation. With implementation of riparian reserve standards and guidelines, these conditions are expected to improve over time. Riparian reserves along the mainstem of the Upper Salmon River are especially important for a connectivity corridor since the subwatersheds north and south of the Upper Salmon River, (Linney/Draw and West and East Fork), are highly fragmented from managed stands.

Site Potential Tree Heights

Direction for designating Riparian Reserve widths is stated in the ROD (Standards and Guidelines, pages C-30 and C-31). Riparian reserve widths are given in terms of site potential tree height or a given slope distance, whichever is greater. A site potential tree is defined as the average maximum height of the tallest dominant trees (200 years or older) for a given site class.

Nancy Diaz, Area Ecologist, compared two approaches to determine average maximum tree heights. The first approach averaged site indices and then determined the maximum height for the average site index. The second approach averaged actual heights of older site-index quality trees measured on plots.

It was found that averaging site indices provided a significantly lower tree height than the trees actually measured on the plots. This may be due to the productivity of the riparian zone. (reference: Riparian Tree Height Information from Ecology Plots, Nancy Diaz, Mt. Hood National Forest).

The measured tree heights yield a better estimate of appropriate buffer width for both the Western Hemlock Zone and the Pacific Silver Fir Zone (with Douglas-fir used as the predominant species). Measured site potential tree height best meets the intent of the ROD for delineation of riparian reserve widths.

For the Mountain Hemlock Zone, the recommendation is to use the given slope distances from the R.O.D. There were too few plots measured in this zone to accurately ascertain average maximum tree height. It is also thought the smaller tree heights of higher elevation species would be best approximated by the ROD distances.

For Salmon River watershed, *measured* site-potential tree heights were used to delineate the recommended widths, since these are the greatest distances.

Based on this process, the measured site potential tree heights are as follows:

Table 7-2 Site Potential Tree Heights

WESTERN HEMLOCK ZONE	Douglas fir measured tree nt. 210'
PACIFIC SILVER FIR ZONE	Douglas fir measured tree ht. 170'
MOUNTAIN HEMLOCK ZONE	Limited measured data Use defaults from ROD

Current Conditions

The standards and guidelines for Riparian Reserves are described on ROD pages C-31 through C38. In general, when current conditions within riparian reserves retard or prevent attainment of the Aquatic Conservation Strategy Objectives (see key question 8), efforts should be taken to modify or mitigate the detrimental conditions.

LSR Summary and Recommendations

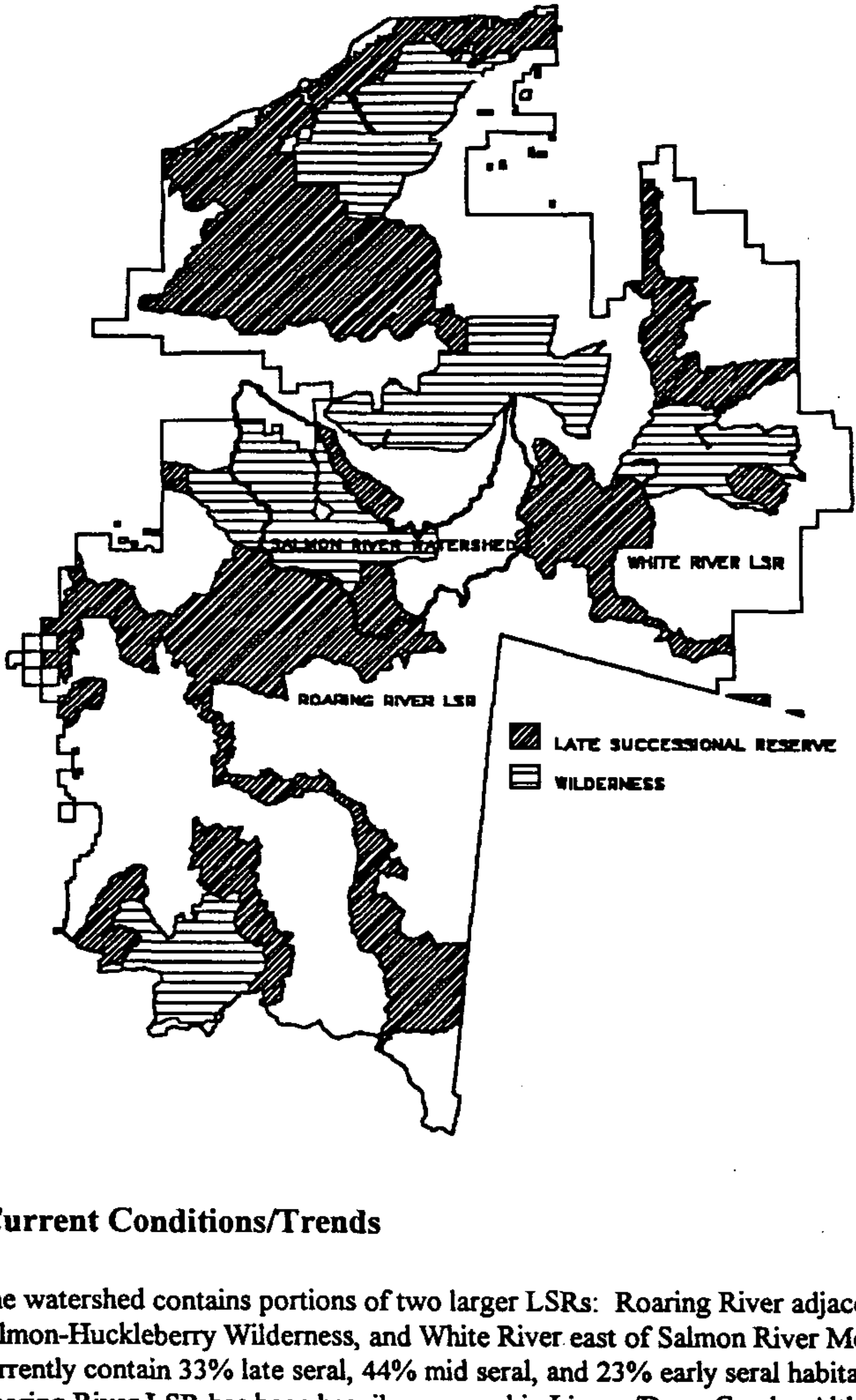
The ROD states that "a management assessment should be prepared for each LSR (or group of smaller LSRs) before habitat manipulation activities are designed and implemented" (ROD C-11). Management assessments for White River LSR #R0204 and

Roaring River LSR #R0207 will be scheduled in the future. It is important that these assessments are not delayed since some stands are nearing 80 years in age and opportunities to use silvicultural treatments to accomplish LSR objectives may be lost.

The information derived from the Salmon River watershed analysis, and summarized in this chapter, is recommended to be carried forward in support of the overall LSR assessments.

Figure 7-1 on the following page shows the locations of all the mapped LSR's and wilderness areas on the Mt. Hood National Forest and the location of the Salmon River watershed.

Figure 7-1 Late Successional Reserves, Mt. Hood National Forest



Current Conditions/Trends

The watershed contains portions of two larger LSRs: Roaring River adjacent to the Salmon-Huckleberry Wilderness, and White River east of Salmon River Meadows. These currently contain 33% late seral, 44% mid seral, and 23% early seral habitat.
Roaring River LSR has been heavily managed in Linney/Draw Creek. Although large patches of closed large conifer remain, many of the stands are plantations of seedling, sapling or pole size. In addition some natural stands are in closed sapling/pole or closed

small conifer stages. Two owl pairs are located within the Salmon River Watershed portion of this LSR. The portion of the White River LSR contains stands mainly of closed large conifer and closed small conifer with remnants. No owl pairs are located within the Salmon River watershed portion of this LSR.

There are four owl centers within matrix land allocation between the larger LSRs to the west and east. Each of these owl centers are protected by 100 acre LSR designations in which one hundred acres of the best northern spotted owl habitat will be retained as close to the nest site or owl activity center as possible. Because these areas are considered important to meeting objectives for species other than spotted owls, they are to be maintained even if they are vacated by spotted owls.

Due to past harvest activities, some of these 100 acre LSRs are narrow and winding versus a more desirable block or circular shape. Three out of the four pairs are already below incidental take levels due to the amount of suitable habitat surrounding the activity center. The 100 acre LSR in Sherar Burn is dominated by 95% mid seral stand structure. The remaining LSRs are dominated by greater than 75% late seral conditions.

Since the Salmon-Huckleberry Wilderness is Congressionally reserved, management is assumed to be consistent with management and recovery of spotted owls (Ray Bosch, USFWS, letter 1995) and provide habitat for other late seral associated species. Currently the Wilderness is mostly mid seral habitat, 62%, and 33% late seral primarily along valley bottoms and stream channels.

Effectiveness of Habitat

The FSEIS (USDA 1994a) referenced the Interagency Scientific Committee (ISC) report model which showed that owl "clusters" of 15-30 owls (numbers varied depending on the assumptions for juvenile dispersal) could be expected to be "self-sustaining" or unlikely to disappear due to random demographic and environmental events. This finding led to the original impetus to draw HCA, and later LSRs, in such a way that they encompass potential territories for 15 to 30 pairs of owls.

The above description is one measure to evaluate a fully functioning LSR. It is also appropriate to evaluate the biological status of other late seral associates inhabiting the LSR, however information such as this is sparse.

Both the Roaring River and White River LSRs are large contiguous blocks of land which provide for large home ranges. Roaring River LSR is 105,000 acres in its entirety and contains 35 owl pairs. The eleven owl pairs in the Wilderness are not counted in this tally, but the Wilderness is to function as late seral habitat and therefore contributes further to the overall effectiveness of the LSR. The Roaring River LSR is believed to be serving a fully functioning role in maintaining population viability of the northern spotted owl.

The White River LSR is 34,000 acres and contains 13 pairs, of which two pairs reside near the LSR border. Although the range of spotted owls on the eastside is most likely similar to pre-settlement conditions, the carrying capacity is likely increased. This increase results from changes in vegetation that have produced a more complex layered forest than the single layer ponderosa pine dominated stands in the past. Multi-layered stands are better for spotted owl foraging. However, due to altered stand structure and composition of these forests, they are also outside the RNC and prone to risk of fire. This raises the question as to the long term effectiveness of this LSR and these considerations should be carried forward in the overall LSR assessment.

Another measure of effectiveness of LSRs is the percentage of late seral habitat. Intuitively, a fully functioning LSR should be largely late seral. As mentioned previously in this summary, the LSRs currently contain more mid seral stands, and in Linney/Draw Creek, early seral stands. It is estimated it will take an additional 100 to 200 years to develop old growth habitat within these stands based on current stand age. Silvicultural treatments for managed plantations and natural stands less than 80 years old, may speed the development of late seral structure. Managed plantations were planted at close spacings with the intent of being thinned in future years. Without thinnings, densely planted stands have a high likelihood of being overstocked, stagnated stands in the future.

Connectivity

In general, large acres of LSR exist in the western half of the watershed and to the east of the watershed with four smaller 100 acre LSRs in between in the matrix, therefore LSRs appear to be well distributed across the landscape. However, in the short term, connectivity may be lacking due to past management activities that have fragmented the landscape.

Riparian reserves, are providing, and will continue to provide terrestrial connectivity throughout the watershed. In some places, riparian reserves may have decreased canopy closure yet these conditions should improve in the future. Riparian reserves for connectivity are especially important along the Upper Salmon River between Linney/Draw and West and East Fork subwatersheds where managed lands have fragmented the landscape. With Wilderness, riparian reserves and other design cells that move the landscape towards late seral habitat, connectivity should be greatly enhanced through time.

Interim Effectiveness/Connectivity

The Sherar Burn 100 acre LSR (#9105) has a long and narrow, almost segmented, shape. Because of this geometry, activities outside the LSR can greatly affect the effectiveness of this LSR. LSR # 2246, near the Salmon timber sale, is also long and narrow and may be affected similarly. The remaining two LSRs, (#9068 near Passline timber sale, and #2016 near Frying Pan Lake), are blockier in shape and therefore not as influenced by outside activities. However, the spotted owl requires large home ranges of old growth forest and it is important to retain connectivity.

For Sherar Burn 100 acre LSR, activities surrounding the LSR should move toward developing late seral habitat to improve connectivity of the stand. Until that occurs, patches of late seral habitat that already exist in the area should be maintained to provide late seral habitat for the species in the short term.

Furthermore, since most of the reserves in the watershed are currently in mid seral stages, late seral habitat is recommended for retention as much as possible until the reserves mature further.

For interim connectivity, it is recommended to actively pursue habitat enhancement projects that do not degrade existing habitat. If short term impacts are unavoidable, disperse active projects across the landscape and through time to minimize impacts to connectivity corridors.

Summary of LSR Recommendations

- use watershed analysis information for overall LSR assessment
- use silvicultural treatments in managed plantations and natural stands up to 80 years to hasten late seral habitat development
- decommission unnecessary roads after silvicultural treatments are completed
- consider late seral habitat needs in Wilderness fire management planning
- consider areas in matrix where existing late seral habitat can be maintained until reserve habitat matures
- develop late seral habitat along narrow 100 acre LSRs to improve their effectiveness
- disperse active projects across the landscape to minimize impacts to connectivity corridors
- pursue habitat enhancement projects to enhance interim connectivity

B5 Pileated Woodpecker and Pine Marten Area Recommendations

No retention is recommended for all of the B-5 areas within the Salmon River watershed (reference Chapter 4 Wildlife and Appendix E).

C-3 of the ROD states that: "Administratively Withdrawn Areas that are specified in current Forest Plans to benefit American martens, pileated woodpeckers, and other late-successional species are returned to the matrix unless local knowledge indicates that other allocations and these standards and guidelines will not meet the objectives for these species."

The watershed analysis concurs with the recommendation contained within the draft process paper "Retention and Analysis Needs for B-5 Pileated Woodpecker and Pine Marten Areas". In this document, the B-5 designations within the watershed were assessed for their relative value as habitat for late seral species. All of the B-5 areas within matrix with the Salmon River watershed were recommended to not be retained because of their proximity to reserved lands (LSRs, congressionally reserved, and administratively reserved).

Implementation of land allocations from the Northwest Forest Plan and the Wild and Scenic River designation resulted in approximately 40 acres of B-5 land remaining within the watershed. The Northwest Forest Plan and Wild and Scenic River allocations offer similar protection to late seral associated species as the original B-5 designation.

Probable Sale Quantity(PSQ) Validation

PSQ was calculated for the Forest in 1994 using the FORPLAN model and assumptions for acres of land management allocations under the Northwest Forest Plan. Acres available for harvest were identified and FORPLAN scheduled harvest against these acres to generate a volume estimate. The disaggregated harvest level for the Salmon River watershed was set at 304 mbf/year for the first decade and PSQ under a regulated forest condition was estimated at 1,238 mbf/year based on these calculations.

Assumptions used to calculate PSQ are applied at the forest scale and are therefore, quite broad. PSQ is difficult to disaggregate to a single watershed. Harvest levels for each watershed change from decade to decade to reflect the distribution and composition of stands across all watersheds on forest.

In order to "validate" PSQ at the watershed scale, several steps are be required. These steps are:

1. Identify lands available for timber harvest through land management allocations, landscape design, current vegetation condition, suitability etc.

2. Using the information above, develop stand level prescriptions and constraints.

3. Schedule stand treatments and harvest over the rotation.

During the Salmon River Watershed Analysis step 1 and part of step 2 was completed.

Acres available for harvest (B and C allocations) were determined to be 11,767 acres which is 7512 acres more than were estimated for the FORPLAN run. This included 3,104 acres of C allocations and 8,663 acres of B allocations. If a linear relationship was assumed between acres available and harvest levels the PSQ under regulated forest conditions would increase from 1,238 mbf/year to 3,232 mbf/year. However, this 276% increase in area available for harvest does not necessarily increase harvest levels by 276%. There is no easy way to account for harvest constraints based on acres impacted by roads, visual adjustments for trails, viewpoints, and "in your face" visual areas.

Based on the concerns with respect to harvest constraints the original estimates (both first decade harvest and PSQ) should be used until areas that should be withdrawn or should receive special management consideration can be identified. This has been identified as an analysis gap and is currently being addressed through the Scheduling and Network Analysis Program (SNAP) program which will be used to generate harvest levels for the watershed based on direction from the NW Forest Plan, the Mt. Hood Forest Plan and current stand structure.

General Management Recommendations

Fire/Fuels Management

In areas with little or no duff and litter layer, natural fuel accumulations and slash from timber management operations should be allowed to decompose naturally. Mechanical site preparation of the residue fuels through the use of chippers, mulchers, or crushing could aid in breaking down the residual fuel bed and speed up the decomposition process.

Consider LSR objectives and the risk of fire from current vegetative structure when designing the Wilderness Fire Plan for the Salmon-Huckleberry Wilderness. Also consider effects to existing levels of snags, coarse woody debris, and soil organic matter. This wilderness fire plan must be completed before prescribed fire or prescribed natural fire can be used in the Wilderness.

Wildlife

Individual species maps are recommended to display potential habitat for species of concern. These may be made from querying the vegetation database in conjunction with the habitat relationships database and mapped with UTOOLS functions. Mapping of potential habitat should be a useful tool in surveying for species of concern.

Survey for species of concern where potential habitat degradation may occur.

Complete quantitative analyses for snags and CWD in project analyses.

Use the Habitat Effectiveness Model for deer and elk in project analyses.

Commodities

Use the Scheduling and Network Analysis Program (SNAP) as an aid in harvest planning, scheduling, and volume determination.

To maintain historic huckleberry fields, implement overstory control. Consider recommendations of field research including overstory control by individual tree girdling, and nitrogen fertilization of berry plants.

Botany (see appendix for additional recommendations)

Minimize non-winter use of the Phlox Point picnic area to protect the rare endemic false truffle, *Martellia* #649.

Protect known site of *Oxyporous nobilissimus* on road 220 from logging activities with one square mile buffer with fungus in center as required by the ROD, Appendix J2.

Consider Botanical Special Interest Area Designation for Jackpot Meadows and exclusion of grazing.

Evaluate Salmon River/Redtop Meadows for Botanical Special Interest Area Designation in 1996 as recommended in the Wild and Scenic River Plan.

Prevent invasion of noxious weeds into restoration areas by removing weeds on site before conducting ground disturbing activities and maintaining or planting native vegetation.

Work with adjacent private landowners to control blackberries and prevent spread onto National Forest land.

Recreation

Complete interim Landscape Analysis and Design steps, identifying infrastructure needs and display where future management activities can occur. Evaluate different management strategies utilizing the SNAP modeling system.

Forest assist Timberline Lodge in developing monitoring plan to better assess salting.

Restrict salt applications to 1990 levels (approximately 600,000 lbs. annually) until more complete monitoring data is collected and analyzed.

Restoration Opportunities

Introduction

Guidance for the assembly of this section was taken from the Aquatic Conservation and Late Successional Reserve strategies in the ROD, the Interagency Watershed Restoration Strategy (Regional Ecosystem Office, October, 1994) and analysis of the current watershed condition and trends. The current vegetative condition and the conceptual landscape design assisted in the development of restoration objectives designed to hasten the attainment of desired vegetative structure. Restoration projects are based on objectives resulting from altered landscape processes. In order to assist with project prioritization, primary restoration needs were selected from those projects that were tied to standards and guidelines for Tier 1 watersheds and Late Successional Reserves, and those that would benefit species of concern identified in the watershed analysis. Secondary restoration needs were selected to move the watershed towards the objectives described by the conceptual landscape design. **Restoration projects that are expected to have the greatest immediate resource benefit are noted in the right hand column of the table with an asterisk *.**

Table 7-3 - Salmon River Watershed Primary Restoration Opportunities

Altered Process	Restoration Objective	Restoration Projects	Emphasis Areas	*
Increased peakflows from rain-on snow events	Restore peakflows to range of natural variation, or minimize increases in peak streamflows due to management activities	Silvicultural activities to move stands to hydrologic maturity	Mud Creek, Linney Creek, and unstable Rosgen stream types	
Increased peakflows from increase in stream drainage network	Restore peakflows to range of natural variation, or minimize increases in peak streamflows due to management activities	Reduce road crossings of streams so the increase in the drainage network is less than 5%	W & E Fork Salmon, Mud Creek, Linney Creek	*

Altered Process	Restoration Objective	Restoration Projects	Emphasis Areas	*
Reduced vegetative and hydrologic connectivity between streams and wetlands	Restore the timing, variability, and duration of floodplain inundation and water table elevation in floodplains and wetlands	Reconnect and restore side channel habitats Rehabilitate disturbed areas Enhance connectivity between disjunct wetlands and streams Riparian plantings and silviculture	Salmon River subwatershed, Mud creek meadows	*
Decreased baseflow trend as measured at USGS gauge	Restore the timing, variability, and duration of floodplain inundation and water table elevation in floodplains and wetlands	Detect and restore conditions contributing to measured baseflow declines Reduce road densities to 2.5 miles per square mile	Upper watershed above Salmon River meadows complex	*
Reduced water quality due to fecal contamination of streams	Maintain water quality to meet State standards	Decrease contamination from human fecal material by improving sewage treatment facilities in the upper watershed Notify DEQ of monitoring results	Timberline Lodge, developed and dispersed camping areas, Wapinitia area inholdings	*
Reduction in pool quality for fish habitat	Increase pool quantity	Increase pool levels through large woody debris placement to move within the RNC	Salmon River (RM 0 - 18.2), Cheeney Creek (lower 1 mile)	
Reduction in side channel habitat for fisheries production	Restore side channel function	Reconnect and restore side channels Increase side channel quality by importing large woody debris	Salmon River subwatershed	
Reduction in in-channel LWD for fish habitat	Increase LWD levels	Move LWD within the RNC by importing LWD	Salmon River (RM 0-7.2)	
Decreased structure and composition of riparian vegetation	Restore structure and composition of riparian vegetation Increase LWD recruitment potential	Riparian plantings Natural regeneration Riparian silviculture	Salmon river, Linney/Draw and Mud Creek subwatersheds	

Altered Process	Restoration Objective	Restoration Projects	Emphasis Areas	*
Decrease in late seral forest habitat	Restore habitat to promote viability of late seral species	Silvicultural and prescribed fire treatments in managed and natural stands to advance late successional structure (multi-storied canopy, snags, and LWD)	Linney/Draw Creek LSR Other Design cells w/ late successional objectives, Riparian reserves	
Poor habitat connectivity in Sherar Burn 100 acre LSR	Promote connectivity of late seral habitat adjacent to LSR	Silvicultural practices to promote late seral structure	Area adjacent to Sherar Burn LSR	
Potential for altered habitat of Corydalis population	Restore and maintain habitat conditions for Corydalis	Minimize increase of peak flow. Reduce sedimentation supply Increase stream shade with riparian plantings.	Linney/Draw creek Salmon River near Green Canyon Campground	
Reduced biodiversity through introduction of noxious weeds and invasive, non-native plants	Secure viability and distribution of native plants; reduce noxious weed populations	Remove noxious weeds Prevent conditions that would encourage establishment of new populations	LSR	*
Increased sediment delivery from highway sanding	Decrease sediment delivery to stream channels	Continue current mitigation and develop additional opportunities to reduce sediment delivery	West and East Fork and Upper Salmon subwatersheds, especially at stream crossings along highways 26 and 35.	*
Disturbance of vegetation and soils in wet meadow habitat	Reduce impacts from grazing	Exclude cows from sensitive riparian habitats	Jackpot, Dry and Salmon River Meadows, Ghost Creek	*

Altered Process	Restoration Objective	Restoration Projects	Emphasis Areas
Increased sediment production and delivery from roads and other ground disturbing activities	Reduce sediment production and delivery	Road obliteration and revegetation Hardening of erosional surfaces Revegetation of road cuts and fills Discourage recreational use at erosive sites; concentrate use at less erosive sites; harden surfaces at areas of concentration Provide effective drainage protection and erosion control at quarry sites and highway sand storage sites	Subwatersheds with high sediment potential, especially those contributing to key depositional reaches Draw creek, Inch creek, Upper Linney creek, 2618 road fill failure, W&E Fork roads and airstrip, sand storage area on Hwy 35, Miller quarry

Table 7-4 Salmon River Watershed Secondary Restoration Opportunities

Altered Process	Restoration Objective	Restoration Projects	Emphasis Areas
Reduced water quality due to increased stream temperature	Maintain water quality to meet State standards	Increase stream shade	Mud Creek, Lower watershed
Reduction in water quality due to in-channel fine sediment levels above forest plan standards	Decrease inputs of fine sediment from management activities	Minimize increases in peakflows and sediment inputs in areas with unstable Rosgen stream types	Mud Creek, W & E Fork Salmon
Reduction in LWD recruitment potential for fish habitat	Increase LWD recruitment potential where current levels of in-channel LWD are below forest plan standards	Riparian Silviculture to move stands from moderate and low LWD recruitment potential to high LWD recruitment potential	Salmon River (RM 0-7.2), Linney and Mud Creek
Introduction of non-native fish species	Reduce competition and negative interaction between native and non-native fish species	Work in cooperation with ODFW to enhance native coho, chinook and cutthroat stocks; control access	Portion of the watershed that supports resident fish

Altered Process	Restoration Objective	Restoration Projects	Emphasis Areas	*
Reduced fisheries habitat effectiveness (migration, human disturbance, species movement	Increase habitat effectiveness	Decrease fishing pressures in key habitat through angler education on conservation needs and goals	Anadromous reaches	
Altered stand structure has increased the risk of catastrophic fire and insect outbreak	Reduce stand susceptibility to fire and insects Restore vigorous stand health by reducing stand densities and off site trees - promote species and age class diversity	Salvage standing dead trees (while leaving some of appropriate size for snags) Thinning to favor species diversity Gradual replacement of offsite plantings with other species Underburning	Mud Creek, Abbott burn, Sherar burn, Other densely stocked stands (see veg structure map)	
Decrease in late seral forest habitat	Restore habitat to promote viability of late seral species	Consider prescribed fire or prescribed natural fire	Wilderness	
Altered forest structure and composition has resulted in loss of snag habitat	Increase in snag levels of appropriate size	Creation of snags by girdling, topping, prescribed fire or other means. Nesting boxes around lakes and other critical areas.	Previously burned areas and adjacent to managed stands with low snag levels. In created openings to provide habitat for mountain bluebird. Adjacent to lake sites where necessary	*
Reduction in aquatic and terrestrial amphibian habitat	Increase LWD, eliminate non-native species	Enhance late seral habitat Import LWD	Managed areas	
Reduced biodiversity through introduction of noxious weeds and invasive, non-native plants	Secure viability and distribution of native plants; reduce noxious weed populations	Remove noxious weeds Prevent conditions that would encourage establishment of new populations Collect native plant materials for restoration plantings	Managed areas, especially Mud Creek, Linney/Draw, and outside NF (see noxious weed map)	*

Altered Process	Restoration Objective	Restoration Projects	Emphasis Areas	*
Reduced wildlife habitat effectiveness (migration, human disturbance, species movement)	Reduce influence of human presence on wildlife sensitive to human disturbance. (deer, elk, wolverine)	Decrease road density	Mud Creek, W & E Fork Salmon, Salmon River sub watersheds	*
Decrease in amount of early seral forest from RNC	Increase early seral to provide feeding areas for wolverine, deer, elk and others.	Create and maintain openings of early seral forest	B-10 allocation in keyhole and other design cells that fit early seral.	
Loss of native wildlife species.	Utilize available habitat	Continue reintroduction of peregrine falcon	High Rock and cliffs in wilderness	
Reduction in traditional areas available for huckleberry production	Increase acreage in huckleberry production in traditional use areas	Create additional openings and manage for huckleberry production	Mature Forest, Ridgetop Openings design cells primarily, also other design cells allowing openings in forest canopy.	
Visual quality objectives are below forest plan standards	Reduce visibility of harvest units from key viewpoints	Modify edges of harvest units to make them more natural in appearance.	Salmon timber sale as viewed from Timberline Lodge	
Degradation of historically significant cultural sites	Protect and preserve historically significant sites	Recreation site management around important areas to reduce impacts, i.e. barriers, closures Site recovery work in areas to preserve information from the site.	Summit Meadows area Barlow Road historic district	*
Disturbance of vegetation and soils in alpine plant community	Reduce erosion, encourage native plant re-establishment	Native plantings	Timberline ski area	

Altered Process	Restoration Objective	Restoration Projects	Emphasis Areas	*
Loss of soil productivity	Reduce impacts to soil productivity	Alleviate compaction from harvest and site preparation; Replace organic materials; Underplant alders to increase nitrogen supply on intensively burned lands	Timber harvest units where ground based logging and/or site preparation has resulted in soil compaction or removal of LWD above Forest Plan standards	

Monitoring

The purpose of this section is to identify monitoring opportunities associated with key processes and functions within the watershed. The processes and functions identified are critical to maintaining or restoring the key attributes. Monitoring within this section falls into two broad categories: 1) baseline monitoring to assesses the current condition prior to implementation of the NW Forest Plan, and 2) implementation and effectiveness monitoring associated with implementation of the NW Forest Plan (which includes restoration projects identified in this document).

Table 7-5 Monitoring Recommendations

PROCESS OR FUNCTION	MONITORING QUESTION	MONITORING OPPORTUNITY	EMPHASIS AREAS
Sensitive plants population viability	What is the impact of grazing on plant species of concern?	Design methodology and location of partial grazing exclosure	Salmon River Meadows. Could also consider other plant species of concern (such as wild cranberry) in other meadows.
Wetland habitat function	Have grazing exclosures been implemented? Are they effective in excluding cattle?	Monitor implementation and effectiveness of fencing.	Jackpot and Dry meadows within the Wapinitia grazing allotment
Livestock grazing	Are conditions within the watershed contributing to the attainment of ACS objectives?	Evaluate quality and function of riparian vegetation	Jackpot and Dry meadows within the Wapinitia grazing allotment

PROCESS OR FUNCTION	MONITORING QUESTION	MONITORING OPPORTUNITY	EMPHASIS AREAS
Native plants and wildlife habitat	Are noxious weeds and invasive non-native species invading the wet meadows?	Monitor for noxious weeds and invasive non-native plants	Wet meadows and managed areas
Plant and wildlife species of concern	What is the status of C-3 and other species of concern in the watershed?	Survey and manage as per protocol.	Potential habitats of individual species.
Riparian reserves	Are riparian reserve widths being implemented according to recommendations in this analysis and site specific circumstances?	Monitor implementation of riparian reserves.	Project areas where disturbance to the riparian reserve may occur.
Native plant communities	What is the impact of high use recreation sites on native plant communities in the alpine/subalpine zones?	Design monitoring plan as recommended by the Wild and Scenic River Plan.	Alpine and subalpine communities including within the Wild and Scenic River zone.
Social Use and Demand	What is the capability of the watershed to meet increasing recreational demand?	Monitor developed and dispersed recreation sites to identify if areas are meeting demand and desired type of recreation use.	Trillium Lake CG area and area along lower river on National Forest and BLM public lands for accessibility.
Soil productivity	Effects of management activities on soil productivity	Monitor soil detrimental conditions	Recently harvested lands
Sediment transport and deposition	What is the impact of road related sediment delivery on aquatic habitat conditions?	Particle size distribution above and below road and hwy. crossings	Key depositional reaches: Salmon meadows, Linney/Draw confluence, Mud creek
Sediment transport and deposition	Effectiveness of current mitigation measures for hwy. sanding	Sediment transport beyond barriers and detention ponds	Hwys. 26 and 35 at stream crossings and parallel to streams
Water Quality: Turbidity	Timing and levels of suspended solids in the stream system associated with management activities	Turbidity and/or suspended solid measurements during storms and "first flush" Continuous turbidity readings	USGS gauging station, Fly Fishing Bridge USGS gauging station
Peak streamflows	Assess peakflows in those subwatersheds with predicted increases	Install crest stage gage to assess peakflows	Linney and Mud Creek

PROCESS OR FUNCTION	MONITORING QUESTION	MONITORING OPPORTUNITY	EMPHASIS AREAS
Baseflows	Assess baseflows in the upper watershed	Obtain data from USGS gauging station on the Salmon River	Above Salmon River/Redtop meadows complex
Water quality: fecal contamination	Assess levels of fecal contamination in the Salmon River	Analyze water samples collected on a monthly basis for enterococcus bacteria	Upper watershed. Below Timberline lodge and Wapinitia development
Water quality: temperature	Assess effects of altered stream shade on stream temperature	Continuous temperature probes during the summer months	Mud Creek, Linney Creek, Salmon River at Fly Fishing Bridge
Water quality: conductivity	Assess effects of Palmer snowfield salting	Continuous conductivity and flow measurements	Upper watershed below Timberline lodge
Fish viability species of concern	Are there viable populations of native anadromous fish?	Survey for presence and distribution of coho salmon, winter steelhead, chinook salmon, and sea-run cutthroat	Anadromous section of the watershed
Fish viability species of concern	Is redband trout present in the watershed?	Survey for presence and distribution of redband trout	South Fork and Mack Hall Creeks
Fish viability species of concern	Is bull trout present in the watershed?	Survey for presence and distribution of bull trout	Bull trout habitat areas

Data and Analysis Gaps

Data and analysis gaps were noted in the analysis when a key process could not be addressed adequately to fully answer the key question. Data gaps were identified as missing or incomplete information needed to assess a process or concern. Analysis gaps were analyses that were not completed due to time, money, resource or data constraints. In the process of implementing ecosystem management it would be appropriate for the districts or forest to address these data and information gaps.

Table 7-6 Data and Analysis Gaps

PROCESS	DATA GAP	ANALYSIS GAP
Lichen population viability	Documented lichen locations - data was due from REO June 1995	
C-3 plant population viability	Documented C-3 locations due from REO in June 1995 may include some new locations.	
Fire processes		Use of fire in Wilderness to promote late seral forest and also to restore natural processes before fire suppression.
Fire processes		Further refinement and field verification of fire regimes
Fire history		Incorporate Mt. Hood Summary of Fire Reports for the years 1924-1930 (information was not available at time of analysis)
Erosional processes	Geologic rates of surface erosion and mass wasting	
Soil productivity	Detrimental soil conditions on managed sites	Consistency of management activities with standards and guidelines for soil productivity
Slope stability	Location and extent of unstable and potentially unstable riparian reserves	
Sediment production	Field validation of erosion potential on disturbed sites	

PROCESS	DATA GAP	ANALYSIS GAP
Late seral habitat	Field validation of managed plantations and natural stands needing silvicultural treatment to promote or hasten late seral structure	
Commodity production		Acres and volume available for timber harvest by decade
Special forest products gathering		Effects to C-3 species and species of concern
Wildlife population viability	Evaluate biological status of other late seral associates other than northern spotted owl	LSRs
Habitat effectiveness over the long term		White River LSR
Population viability for coho salmon, winter steelhead, sea-run cutthroat and spring chinook salmon	Presence, numbers and distribution of coho salmon, winter steelhead, sea-run cutthroat and spring chinook salmon	Quantitative viability modeling for coho salmon, winter steelhead, sea-run cutthroat and spring chinook salmon
Presence and population viability of redband and bull trout	Presence, numbers and distribution of redband and bull trout	Quantitative viability modeling for redband and bull trout
Presence of exotic fish species (brook trout)	Presence, numbers and distribution of brook trout	
Stream geomorphology	Field validation of Rosgen stream types	
Fish habitat: pool levels	Uniform definition of pools from stream surveys	Pool numbers and distribution. Establish range of natural conditions for pools in the Sandy subbasin
Peak streamflows	Current peakflow information for the lower watershed	Peakflow trends analysis
Baseflows	Baseflow information for the mid and lower watershed and baseflow information for upper watershed after 1991 Factors influencing baseflow in the upper watershed.	Trends analysis for mid and lower watershed

PROCESS	DATA GAP	ANALYSIS GAP
Aquatic species habitat: water temperature	Current continuos water temperature data for Mud and Linney Creek subwatersheds	Use stream temperature model such as SHADOW to assess effects of reductions of stream shade in Mud and Linney Creek subwatersheds
Aquatic species habitat: in-channel fine sediment	Particle size distribution for depositional reaches, storm and "first flush": data for turbidity and/or suspended solids	Sediment fluctuations associated with management activities
Landscape Structure		Interim Landscape Analysis and Design steps
Public use and demand	Actual level of public use along the lower river for fishing and other recreational uses.	
Historic human use		Detailed analysis of prehistoric and historic human use.

Chapter 8 - References

Chapter 8 - References

Aumen et al. 1989. Water Quality Monitoring in the Bull Run Watershed, Oregon. Task Force final report to the City of Portland, Oregon, Bureau of Water Works.

Beschta et al. 1987. Stream Temperature and Aquatic Habitat: fisheries and forestry interactions. Institute of Forest Resources, University of Washington, Seattle. E.P.A. report.

Booth. 1990. Stream-Channel Incision Following Drainage-Basin Urbanization. Water Resource bulletin.

Bosch, Ray. 1995. Critical Habitat and Wilderness Areas. U.S. Fish and Wildlife Service memo.

Brown, G.W. 1969. Prediction of Temperature on Small Streams. Water Resources Research 5 (1): 68.75

Bureau of Water Works. 1988. Water Quality in the Bull Run Watershed: A Comparison of Past and Present Conditions. City of Portland Water Bureau report.

DNR. 1993 Washington Department of Natural resources Watershed Analysis Manual, Version 2.0, October 1993

Diaz, Nancy. 1995. Riparian Tree Height Information from Ecology Plots, unpublished report.

Diaz, Nancy and Apostol, Dean. 1993 Forest Landscape Analysis and Design. USDA Forest Service, Pacific Northwest Region.

Dunne and Leopold. 1978. Water in Environmental Planning. W.H. Freeman and Co. San Francisco, CA.

Evers, et al. 1994. Fire Ecology of the Mid-Columbia. Unpublished report on file at the Barlow Ranger District.

Frest, Terrence J. and Johannes, Edward J. 1993. Mollusk Species of Special Concern Within the Range of the Northern Spotted Owl. Final Report prepared for the Forest Ecosystem Management Working Group, USDA Forest Service.

Garde and Rangu Raju. 1985. Mechanics of Sediment Transportation and Alluvial Stream Problems. Wiley Eastern Ltd., New Delhi.

Goldenberg, Doug M. 1990. Draft Species Management Guide for *Corydalis aquae-gelidae* (Peck and Wilson). Unpublished report.

Hem. 1970. Study and Interpretation of the Chemical Characteristics of Natural Water. US Geological Survey Water Supply Paper 1473. Washington D.C.

Huff, Holthausen, and Aubry. 1992. Habitat management for Red Tree Vole in Douglas-fir Forests. PNWGTR - 302. 16 pp.

Ingersoll, Cheryl. 1990. Draft Species Management Guide for *Lycopodium selago L.* Unpublished report.

Keller et al. 1986. Factors Affecting Stream Water Quality: results of a 15-year monitoring study in the Swiss prealps. Monitoring to Detect Changes in Water Quality.

La Husen, R.G. 1994 - Variations in Turbidity in Streams of the Bull Run Watershed, Oregon 1989-90. US Geological Survey Water-Resources Investigations Report 93-4045.

Lundstrom, S. 1988. Institute of Arctic and Alpine Reserach, University of Colorado.

Mattson, C. 1955. Sandy River and its Anadromous Salmonid Population. Oregon Fish Commission.

Mellen, Huff, and Hagestedt. 1995. Interpreting Landscape Patterns: A Vertebrate Habitat Relationships Approach. Unpublished report.

Minore, Smart and Dubrasich. 1979. Huckleberry Ecology and Management Research. General Technical Report.

Moyle, Brown, and Herbold. 1986. Final Report on Development and Preliminary Tests of Indices of Biotic Integrity for California. Environmental Protection Agency, Department of Wildlife and Fisheries Biology Final Report.

Nehlsen, Williams, and Lichatowich. 1991. Pacific Salmon at the Crossroads: Stocks at Risk from California, Oregon, Idaho, and Washington Fisheries.

Oregon Natural Heritage Program. 1993. Rare, Threatened and Endangered Plants and Animals of Oregon. Oregon Natural Heritage Program, Portland, Oregon. 79pp.

State of Oregon Parks and Recreation Department. 1994, Oregon Outdoor Recreation Plan 1994-1999.

Ritter D.F. 1978. Process Geomorphology. Wm. C. Brown, Dubuque, Iowa.

Sullivan et al. 1987. Stream Channels - The Link Between Forests and Fishes. Streamside Management: Forestry and Fishery Interactions. Institute of Forest Resources, University of Washington, Seattle.

Swetnam and Wickman et al. 1994. Tree-ring Evidence of Past Western Spruce Budworm Outbreaks in the Mount Hood and Willamette National Forests, Oregon. USDA Forest Service Report.

USDA Forest Service, Mt. Hood National Forest & USDI Bureau of Land Management, Salem District, 1992. Salmon National Wild and Scenic River Environmental Assessment.

USDA Forest Service, Mt. Hood National Forest & USDI Bureau of Land Management, Salem District, 1993 Salmon National Wild and Scenic River Management Plan,.

USDA Forest Service, 1944 Database, compiled by Region 6 and derived from county vegetation maps originally prepared by Forest Survey, Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

USDA Forest Service, March 1986 A Model to Evaluate Elk Habitat in Western Oregon. Pacific Northwest Region, 35 pages.

USDA Forest Service, Mt. Hood National Forest, July, 1995 Draft Retention and Analysis Needs for B-5 Pileated Woodpecker and Pine Marten Areas.

USEPA-USDA Forest Service. 1980. An approach to Water Resources Evaluation of Non-point Sources-Silviculture. EPA-IAG-D6-0660. Washington, D.C.

USFS. 1994. Bull Run Watershed Management Unit Annual Activity Schedule Water Year 1994. USDA Forest Service Report.

Vasconcelos and Anthony. 1985. Microbiological Quality of recreational Waters in the Pacific Northwest. Water Pollution Control Federation.

Wemple, B. 1994. Hydrologic Interaction of Forest Roads With Stream Networks in Two Basins, Western Cascades, Oregon. Unpublished MS Thesis.

Zika, P. F. 1992. Draft Species Management Guide for rare *Botrychium* species (moonworts and grapeferns) for the Mt. Hood National Forest. Unpublished report.

Chapter 9 - Preparers and Persons Consulted

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For those of you who let us use your computers, thank you, and don't worry, we think we can fix your hard disks!

United States Department of Agriculture

Forest Service

Pacific Northwest Region

1995

Salmon River Watershed Analysis

Mt. Hood National Forest

USDA - Forest Service

First Iteration

Appendices

Appendix A - Soils, Geology

Appendix A

SEDIMENT REGIME

The objectives of evaluating the sediment regime for the Salmon watershed analysis are to:
identify practices which contribute to sediment production and delivery within the watershed.
evaluate and document the relative potential for surface erosion from soil disturbing activities within the watershed and between subwatersheds.
evaluate consistency with the Aquatic Conservation Strategy Objectives for sediment regime.
identify depositional channel reaches and estimate potential impacts to aquatic habitat.
prioritize activities and locations for mitigation, restoration and monitoring.

SEDIMENT PRODUCTION

Surface erosion occurs when the mineral soil surface is exposed to water from rainfall, snowmelt or runoff. Compacted surfaces increase runoff velocity and susceptibility to erosion. In forested ecosystems, trees, understory vegetation and litter and duff combine to effectively protect most soil surfaces from surface erosion. Surface erosion can result in reduced soil productivity. In addition, transport of eroded materials to water resources such as stream channels can reduce water quality and diminish aquatic habitat. Soil erodibility is influenced by soil characteristics that affect infiltration, permeability, water holding capacity, and aggregate stability. The transport of eroded materials to a water body is influenced by a number of site specific factors: slope gradient, slope length and shape, surface roughness, vegetation cover, texture of the eroded material, delivery distance and concentration of the water flow (USEPA-USDA Forest Service, 1980).

Analysis Methods

Methodology for the sediment module closely follows methods for evaluating surface erosion from hillslopes and roads described in the Standard Methodology for Conducting Watershed Analysis (Washington Forest Practices Board, 1993).
At certain steps within the module, data limitations necessitated alternate steps to those described in the methodology. The departures from the methodology retain the logic and assumptions of the original module and contribute to the state analysis objectives. Alternate steps are described in the project folder.
Data utilized for the analysis includes:

- Geology Map
- Landform Map
- Streams, wetlands, lakes and other water bodies
- Roads, harvest, recreation sites, quarries and other soil disturbing activities within 300 feet of lakes, streams and waterbodies.
- Erosion rates by landform
- Rates of sand application on Highways 26 and 35 within the watershed (measured)

TABLE SED.1
RELATIVE SEDIMENT CONTRIBUTION
BY ACTIVITIES OTHER THAN ROADS

SUBWATERSHED	RECREATION	HARVEST	GRAZING	TOTALS
Boulder		NO DATA		
Salmon	0.00			0.00

Cheeney	0.02			0.02
Lower Salmon	14.45			14.45
South Fork/Mac Hall	0.11			0.11
Middle Salmon	0.09			0.09
Linney/Draw	3.83	20.04		3.83
Upper Salmon	0.13	5.77	29.33	35.23
Mud Creek	11.77	10.62		22.39
West & East Forks	21.18	6.74		27.92

Table Sed.2
Potential Sediment From Management Activities
Salmon Watershed

SUBWATERSHED	ACRES	ROAD MILE	RECSED	HARVSED	ROADSED	COW SED	HWY SED	MILLQ SED	TOTAL SED
BOULDER	5076.0	0.4		NO DAT	18.1				18.1
SALMON R	5582.0	6.7	0.0		262.0				262.0
CHEENEY	6118.0	0.0	0.0		1.5				1.5
LOW SALMON	3742.0	4.0	14.4		88.0				102.5
SO FK/MAC HALL	8057.0	2.5	0.1		143.1				143.2
MID SALMON	13234.0	0.7	0.0		106.1				106.2
LINNEY/DRAW	10189.0	4.5	3.8	20.0	248.6				272.5
UP SALMON	11770.0	7.5	0.1	5.7	270.3	29.3	376.9		682.4
MUD CREEK	4394.0	3.4	11.7	10.6	160.4				182.8
W&E FORK	5098.0	8.5	21.1	6.7	533.6		2082.5		2644.1
WATERSHED TOTAL	73260.0		51.5	43.1	1832.1	29.3	2459.5		4415.7

Table Sed.3
Potential Sediment Delivery to Key Depositional Reaches
Salmon Watershed

KEY DEPOSITIONAL REACH	Subwatersheds	ACRES	TOTAL SED	per AREA Index
SALMON MEADOWS	W&E FORK	5098.0	2644.1	
	UP SALMON	4397.0	436.6	
	Reach Total	**9495.0**	**3080.7**	**0.3**
MUD CREEK	**Reach Total**	**4394.0**	**182.8**	**0.0**
LINNEY/DRAW	**Reach Total**	**10189.0**	**272.5**	**0.0**
FLY FISHING BRIDGE	UP SALMON	7376.0	2644.1	
	SO FK/MAC HALL	8057.0	143.2	
	MID SALMON	13234.0	106.2	
	Reach Total	**28667.0**	**2893.6**	**0.1**

GEOLOGY

The Salmon River Watershed is comprised of 35 geologic units which were identified during previous mapping. The units are briefly described below in their approximate order of occurrence, from youngest to oldest.

Qal	ALLUVIUM: Unconsolidated gravel, sand, and silt eroded from debris- and pyroclastic-flow deposits emplaced during the Holocene. Occurs in the area of Salmon River Meadows and to a lessor extent within the Salmon-Huckleberry Wilderness.
Qhtc	PYROCLASTIC AND DEBRIS-FLOW DEPOSITS: Poorly-sorted pebbles, cobbles, and boulders in a reddish-gray sandy matrix. Occurs on the south slopes of Mt. Hood down-slope from the Qhpc unit.
Qhpc	PYROCLASTIC AND DEBRIS-FLOW DEPOSITS: Poorly-sorted boulders, cobbles, and pebbles in a gray sandy matrix. Includes minor debris-flow avalanche deposits of hydrothermally altered material. Occurs at the headwaters of the Salmon on the south slopes of Mt. Hood.
Qls	LANDSLIDE DEPOSITS: Poorly-sorted deposits of slumps and large debris slides. Several such deposits occur throughout the watershed but the largest is found east of Linney Butte.
Qt	TALUS: Blocky to platy, coarse-grained, rock detritus that is found throughout the watershed and forms unvegetated rock slopes (felsenmeers).
Qca	COLLUVIAL AND ALLUVIAL SLOPE DEPOSITS: Poorly-sorted slope and stream deposits that grade into alluvium at valley floors and give way to bedrock at higher elevations. Found along the valley wall to the west of Mud Creek.
Qgnt	TILL OF NEOGLACIAL AGE: Poorly-sorted pebble through boulder size material in a silty-sand matrix. It is found at the extreme headwaters of the watershed and forms moraines in the vicinity of contemporary alpine glaciers.
Qg	GLACIAL DEPOSITS: Very poorly-sorted pebbles, cobbles, and boulders in a fine-grained, silty-sand matrix. Includes alluvium where streams have reworked the deposits. Occurs over a broad area in the eastern half of the watershed and at the upper reaches of tributary streams in the western half of the watershed.

Qget	TILL OF EVANS CREEK AGE: Poorly-sorted pebbles, cobbles, and boulders forming moraines that may mark the maximum extent of glaciers 20,000 years BP. Found only at the extreme eastern edge of the watershed north of Highway 35.
Qha	ANDESITE AND DACITE LAVA: Form three dome-like features on the south slopes of Mt. Hood in the vicinity of Timberline Lodge.
Qaw	ANDESITE OF WAPINITIA PASS: Medium gray, slightly porphyritic lava. Found in a small area in the southeastern corner of the watershed.
Qdf	DACITE OF FROG LAKE BUTTES: Thick, massive lava found in a thin band in the southeastern corner of the watershed.
Qacl	ANDESITE WEST OF CLEAR LAKE: Uncertain exposure of slightly porphyritic andesite in the south Salmon River valley wall.
Qob	OLIVINE BASALT: Slightly porphyritic lava flows and minor breccia in the vicinity of Frying Pan Quarry.
QTtla	ANDESITE: Lava flows of pyroxene andesite. Occurs in two locations south of Trillium Lake.
QTtlb	BASALT: Lava flows of olivine basalt found in a small area east of Trillium Lake.
QTat	ANDESITE OF TOM DICK AND HARRY MOUNTAIN: Slightly to moderately porphyritic pyroxene andesite lava flows. Occurs in one location on the south slopes of Mt. Hood.
QTb	BASALT: Olivine basalt and minor basaltic andesite located in the southern portion of the watershed between High Rock and Frying Pan Lake.
QTbme	BASALTIC ANDESITE OF MIRROR LAKE AND EUREKA PEAK: Lava flows found on Eureka Peak west of Trillium Lake.
Tiba	INTRUSIVE ROCKS OF BASALT AND BASALTIC ANDESITE: Very fine- to medium-grained massive lava forming small plugs in the vicinity of High Rock.
Tbbu	BASALT OF BULL RUN WATERSHED AND OTHER RIDGE-CAPPING BASALT: Lava flows that cap weaker pyroclastic rock at Hunchback Mountain in the northwest corner of the watershed.
Tbao	BASALTIC ANDESITE OF THE OAK GROVE FORK: Lava flows and minor breccia, chiefly basaltic andesite in composition, slightly porphyritic containing clinopyroxene phenocrysts. Found along the southwestern edge of the watershed.
Tbg	BASALT NEAR GHOST CREEK: Very dark gray to black, columnar jointed lava containing phenocrysts up to 4 mm. Occurs in a very

small area near Salmon River Meadows in the eastern portion of the watershed.

Ttla	ANDESITE: Lava flows found in a narrow band west of Salmon River Meadows.
Trbg	ROCKS OF BARROW RIDGE AND GUNSIGHT BUTTE: Chiefly andesite lava flows and minor volcaniclastic strata, but composition ranges from basalt to dacite. Found as a very small exposure immediately north of Trillium Lake.
Ta	ANDESITE: Lava flows of slightly porphyritic pyroxene andesite broadly capping the Rhododendron Formation in the western portion of the watershed.
Tfa	FINE-GRAINED ANDESITE: Nearly aphyric medium-gray andesite forming small plugs or lava flows in the southwestern portion of the watershed.
Tas	ANDESITE OF SALMON BUTTE: Moderately porphyritic lava flows and volcaniclastic rocks occurring along ridgetops in the southwestern portion of the watershed.
Tma	ANDESITE OF MIDDLE AND LATE MIOCENE AGE: Porphyritic pyroxene andesite lava found over a wide area near Linney Creek Campground in the central portion of the watershed.
Tdp	DACITE OF PLAZA LAKE: Light-blueish-gray to light-greenish-gray pyroxene dacite lava found in a small area west of Salmon Butte near the headwaters of South Fork Creek.
Tbam	BASALTIC ANDESITE OF MACK HALL CREEK: Slightly porphyritic lava flows and minor breccia found near Salmon Butte in the southwestern portion of the watershed.
Trh	RHODODENDRON FORMATION: Andesite tuff breccia that originated mainly as pyroclastic flows and lahars. The most common unit in the watershed, it comprises many of the steep valley walls cut by the Salmon River and its tributaries.
Tcwf	FRENCHMAN SPRINGS MEMBER OF THE WANAPUM BASALT: A member of the Columbia River Basalt Group consisting of fine-grained lava flows, and found along the trunk of the Salmon River down-stream from Linney Creek Campground.
Tcgn	GRANDE RONDE BASALT: A member of the Columbia River Basalt Group consisting of very fine-grained lava flows, and found along the trunk of the Salmon River down-stream from Linney Creek Campground.

The geologic units can be grouped into eight general categories:

Resistant Rock: Qha, Qaw, Qdf, Qacl, QTtla, QTtlb, QTb, QTat, QTbme, Tiba, Tbg, Tbbu, Ttla, Tfa, Tma, Tdp, Tcwf, and Tcgn;

Weak Rock: Trh, and Tma where hydrothermal alteration has occurred;

Intermediate Rock: Qob, Ta, Tbao, Trbg, Tas, and Tbam;

Till: Qg and Qget;

Landslide and Colluvial Deposits: Qca and Qls;

Unconsolidated Material: Qgnt, Qhpc, and Qhtc;

Alluvium: Qal;

Talus: Qt.

GEOMORPHOLOGY

The Salmon River originates on the south slope of Mt. Hood and flows several miles to the south before emptying into the Sandy River some fifteen miles west of Mt. Hood. Its crescent-shaped watershed can be justly divided on the basis of slope angle into eastern and western halves. The majority of the eastern portion has been glaciated and is gently-sloping at angles less than 30 percent. Consequently, both road construction and timber harvest have occurred on a broad scale. Exceptions are Mud Creek Ridge and the eastern watershed boundary where local slope angles may exceed 70 percent. The western half of the watershed falls mainly within the Salmon-Huckleberry Wilderness Area. It has been maturely dissected by the Salmon River and many of its tributaries, and is essentially free of roads and timber harvests. Here, slope angles frequently exceed 70 percent, and are seldom less than 30 percent.

The watershed has been divided into twelve landform types based primarily on slope angle, drainage density, and susceptibility to landsliding. These landforms are described below.

RESISTANT ROCK--STEEP SLOPES--DEEPLY INCISED (RRSSDI): Occurs in the central and western portions of the watershed. Slopes typically exceed 50 percent but small inclusions of slopes less than 50 percent have been made.

RESISTANT ROCK--STEEP SLOPES (RRSS): Occurs in the central and eastern portions of the watershed where local relief is slight. Slope angles usually exceed 50 percent.

WEAK ROCK--STEEP SLOPES (WRSS): Found only in the western portion of the watershed where the Rhododendron Formation occurs or where resistant rock has been hydrothermally altered and weakened. It consists of deeply incised valley walls and narrow ridges. Slopes exceed 70 percent regularly and are seldom less than 50 percent.

INTERMEDIATE ROCK--STEEP SLOPES (IRSS): Forms steeply-sloping valley walls and narrow ridges. May be deeply incised by tributary streams, particularly in the western portion of the watershed where it caps the Rhododendron Formation. Slope angles normally exceed 50 percent.

RESISTANT AND INTERMEDIATE ROCK--GENTLE SLOPES (RIRGS): Occurs almost exclusively in the eastern half of the watershed and comprises much of the land around Frying Pan Quarry and the Abbott Burn. Slopes range from approximately 10 to 40 percent.

WEAK ROCK--MODERATE SLOPES (WRMS): Occurs within the western portion of the watershed, primarily within the Salmon-Huckleberry Wilderness Area. It generally represents ridge tops or, possibly, Quaternary landslide deposits. Its slope angles seldom exceed 30 percent.

ALLUVIAL VALLEY BOTTOMS AND TERRACES (AVBT): This landform type includes alluvial deposits and low-gradient glacial deposits, and occurs primarily within the eastern portion of the watershed. Slope angles rarely exceed 30 percent.

GLACIATED VALLEY SIDE SLOPES (GVSS): Occur throughout the watershed at elevations above about 2500 feet. In the eastern half of the watershed, they form portions of the valley walls of the Salmon River. In the western half of the watershed, they mantle valley walls and narrow valley floors containing tributary streams of the Salmon River. Slope angles range from 20 to 50 percent, with inclusions of steeper ground.

LANDSLIDE AND COLLUVIAL DEPOSITS (LCD): Three Quaternary landslides and a large band of colluvium have been mapped within the watershed. Their slope angles are typically less than 30 percent, but may exceed 50 percent in some areas.

TALUS (T): Several large talus slopes occur within the watershed on slopes ranging from less than 30 percent to more than 70 percent.

UNCONSOLIDATED MATERIAL--STEEP SLOPES (UMSS): Found only on the south slopes of Mt. Hood where pyroclastic and debris flow deposits and recent glacial deposits mantle the slopes. Slope angles are usually around 50 percent, but may exceed 70 percent.

UNCONSOLIDATED MATERIAL--MODERATE SLOPES (UMMS): Found only on the south slopes of Mt. Hood where pyroclastic and debris flow deposits mantle the slopes. Slope angles are around 30 percent and seldom exceed 50 percent.

LANDSLIDES

The landslide potential and relative sediment delivery rating for the landform types were determined by examining selected aerial photographs, field-checking landslides in three locations, consulting past project reports, interpreting an existing landslide map, and by consulting Randy Brown and Pat

Petteys. Since the western portion of the watershed has a greater propensity for landsliding, a more detailed landslide inventory was undertaken here. In some cases, as many as five sets of air photos were examined, compared to only two sets for the eastern portion of the watershed.

The results of this work are summarized in the tables below. Table I shows the combined landslide potential for each landform type. Table II shows the types of mass wasting and erosion processes that are likely to occur on a particular landform. Table III lists each landform type and its relative sediment delivery rating for mass wasting. It is important to note that landslide potential and relative sediment delivery are not necessarily equivalent because of variations in delivery capability and proximity to streams. Table IV summarizes the characteristics and processes associated with each landform.

TABLE I. LANDSLIDE POTENTIAL BY LANDFORM TYPE

Resistant Rock--Steep Slopes--Deeply Incised	High
Resistant Rock--Steep Slopes	High
Weak Rock--Steep Slopes	High
Intermediate Rock--Steep Slopes	High
Resistant and Intermediate Rock--Gentle Slopes	Low
Weak Rock--Moderate Slopes	Medium
Alluvial Valley Bottoms and Terraces	Low
Glaciated Valley Side Slopes	Medium
Landslide and Colluvial Deposits	Medium
Talus	Medium
Unconsolidated Material--Steep Slopes	High
Unconsolidated Material--Moderate Slopes	Medium

TABLE II. DOMINANT SEDIMENT TRANSPORT PROCESSES BY LANDFORM TYPE

	Debris Flow	Debris Slide	Earthflow	Slump	Creep	Rock Fall	Surface Erosion	Stream Bank Failures
RRSSDI	H	H	---	L	L	H	M	H
RRSS	M	H	---	L	L	H	M	H
WRSS	H	H	M	M	M	L	M	H
IRSS	H	H	---	L	L	M	M	H
RIRGS	L	L	---	L	---	---	L	L
WRMS	M	M	M	M	M	---	M	M
AVBT	---	---	---	M	---	---	L	H
GVSS	M	M	L	M	M	L	M	M
LCD	L	M	M	M	M	---	M	M
T	---	M	---	---	---	H	---	L
UMSS	H	H	---	---	L	---	H	H
UMMS	M	M	---	---	L	---	H	M

TABLE III. RELATIVE SEDIMENT DELIVERY BY LANDFORM TYPE*

Resistant Rock--Steep Slopes--Deeply Incised	High
Resistant Rock--Steep Slopes	High
Weak Rock--Steep Slopes	High
Intermediate Rock--Steep Slopes	High
Resistant and Intermediate Rock--Gentle Slopes	Low
Weak Rock--Moderate Slopes	Medium
Alluvial Valley Bottoms and Terraces	Low
Glaciated Valley Side Slopes	Medium
Landslide and Colluvial Deposits	Medium
Talus	Low
Unconsolidated Material--Steep Slopes	High
Unconsolidated Material--Moderate Slopes	Medium

*Sediment delivery via stream-bank failures is not considered in this table. Rather, it refers only to sediment delivered by debris flows, debris slides, earthflows, slumps, creep, and rockfall.

TABLE IV. LANDFORM CHARACTERISTICS AND ASSOCIATED PROCESSES

--Associated Rock Types--

Resistant Rock: fine-grained basalt and basaltic andesite flows, slightly porphyritic lava with minor flow breccia, basaltic and andesitic/dioritic intrusions;

Intermediate Rock: andesitic lava flows with volcaniclastic interbeds and minor tuff breccia and laharic deposits; composition ranges from basalt to dacite;

Weak Rock: andesitic tuff breccia, fluvial volcaniclastic sandstone and minor siltstone, hydrothermally altered andesite (propylite);

Alluvium: generally sorted deposits of sand, gravel, and re-worked ash;

Till: generally unsorted and compacted deposits of detritus ranging in size from silt to boulder;

Landslide and Colluvial Deposits: unsorted deposits of weathered detritus from adjacent formations;

Talus: unsorted deposits of basaltic or andesitic boulders and cobbles;

Unconsolidated Deposits: poorly-sorted dacite pebbles, cobbles, and boulders in sand matrix with silt and fine sand interbeds; may include deposits of hydrothermally altered material;

--Slope-Forming Processes--

Resistant Rock: lava flows, regional uplift, fluvial and glacial erosion, debris flows, debris slides, surface erosion, creep;

Intermediate Rock: lava flows, regional uplift, fluvial and glacial erosion, debris flows, debris slides, slumps, surface erosion, creep;

Weak Rock: pyroclastic and laharic deposits, minor lava flows, regional uplift, fluvial and glacial erosion, debris flows, debris slides, slumps, possible earthflow, surface erosion, creep;

Alluvium: peak-flow deposits, stream-bank failures, surface erosion;

Till: glaciation, debris slides, debris flows, surface erosion, creep;

Landslide and Colluvial Deposits: large-scale slumps and debris slides, minor debris slides and surface erosion within the slide mass, possible high-magnitude earthquakes;

Talus: glaciation, frost heave, debris slides, creep;

Unconsolidated Material: air-fall, debris flow, and pyroclastic flow deposits, glacial outwash, stream-bank failures, debris slides, debris flows, surface erosion.

--Sediment Delivery Mechanisms--

Resistant Rock: stream-bank failures, debris flows, debris slides, surface erosion, creep;

Intermediate Rock: stream-bank failures, debris flows, debris slides, surface erosion, slumps, creep;

Weak Rock: stream-bank failures, debris flows, debris slides, slumps, minor earthflows, surface erosion, creep;

Alluvium: stream-bank failures, surface erosion;

Till: stream-bank failures, debris slides, debris flows, surface erosion, creep;

Landslide and Colluvial Deposits: stream-bank failures, debris slides, surface erosion;

Talus: debris slides, subsurface erosion of fines, rockfall;

Unconsolidated Material: stream-bank failures, debris slides, debris flows, surface erosion, dry ravel.

LANDSLIDE DISCUSSION

The Salmon River Watershed is notable for its steep slopes, abundant precipitation, and weak geologic formations, conditions which are highly conducive to landsliding. The area most sensitive to landsliding is the western half of the watershed in the Salmon-Huckleberry Wilderness. Here, the Salmon River and its tributaries have cut steep, narrow valleys out of weak pyroclastic rock (WRSS), making them susceptible to debris slides. Where the valley walls have been incised by smaller tributaries, the potential for debris flows is high. In either case, the likelihood of sediment delivery from landslides occurring on these slopes is high. Moreover, the presence of resistant rock (RRSS and IRSS) may not eliminate the landslide risk, particularly of debris flows. It is often at the contacts of these landform types that landslides originate. The landslide inventory revealed that nearly all first order streams are capable of transporting large amounts of debris, and many showed convincing signs of recent activity. The aerial photos also revealed many small openings on valley walls and adjacent to streams. Many of these are probably felsenmeers or areas of shallow bedrock, but some are thought to have been created by debris slides.

In contrast, the eastern half of the watershed tends to be less sensitive to mass wasting, primarily because it contains more flat ground. Slope angles in this area seldom exceed 50 percent and are usually less than 30 percent. Exceptions with steeper slope angles include Eureka Peak and the watershed divide near Salmon River Meadows. Much of the land in the eastern half of the watershed also tends to have low drainage densities, further reducing the likelihood of sediment delivery. Stream-bank failures, however, are probably the most common type of landslide in this area and, because of their position, tend to deliver prodigious amounts of sediment to streams.

The steep, upper slopes of Mt. Hood (UMSS) are unvegetated, consist of unconsolidated pyroclastic and debris flow deposits and recent glacial deposits, and may receive in excess of 100 inches of precipitation each year. They are, therefore, highly susceptible to landsliding, particularly during times of heavy rainfall or rapid snow-melt when debris flows are easily triggered. Furthermore, since this landform type borders the headwaters of the Salmon River, sediment delivery is virtually assured.

Most of the landslides that occur in the headwaters above timberline are not single, isolated events. Rather, they are sites of continuous activity, regardless of the specific process. This is because the unstable conditions at the site tend to outlive the stabilizing effects of a single event. Indeed, the site itself may be considered a relatively permanent feature on the landscape. For example, a colluvial hollow acts like a receptacle for debris. As it fills, its stability decreases, as does, therefore, the amount of water needed to trigger a landslide. When the landslide occurs and the hollow is flushed, it returns to more stable conditions. However, if the source of debris has not been depleted, the hollow will start to fill again. In most environments, the filling and flushing of colluvial hollows takes some time. But on Mt. Hood and other stratovolcanoes, the process is rapid and landslides occur again and again at the same site. Other sites of recurrent mass wasting include rock outcrops, the distal end of ablating glaciers, and icefalls, where seracs are prone to toppling. Not all such features are necessarily found within the watershed, but they are typical of Mt. Hood.

Tributary channels may act like colluvial hollows and collect debris introduced by headward erosion or deposited by stream-bank failures. Although many tributaries have been scoured to bedrock, their channel floors may periodically be mantled in loose rock and detritus. Episodes of peak flow associated with large storms or rain-on-snow events typically mobilize this debris in either of two ways. If a debris flow is triggered at the headwaters of the tributary, it may collide with and mobilize the channel debris as it passes. Lacking a debris flow, peak flow volumes must be sufficiently large to entrain the channel debris as a hyperconcentrated flood or possibly a debris flow. This alludes to the importance of events such as the 1964 flood, the cause of which is generally regarded to be a 100-year storm.

During the landslide inventory, 117 landslides were identified. Of these, 105 occurred within the period of photo record which dates back to 1946. The 12 remaining landslides are considered to be ancient and are only visible because they are quite large. Of the recent landslides, 67 are debris flows, 21 are debris slides, and 17 are stream-bank failures. Separating these landslides by land use indicates that 12 are associated with roads, 9 with clearcuts, 5 with roads and clearcuts, 5 with old clearcuts or possibly fire, 2 with non-forested land, and 72 with mature forest. In addition, at least 65 appear to be associated with the 100-year storm that occurred in 1964, 88 appear to have delivered sediment to waterways, and at least 11 have failed more than once within the period of photo record.

TABLE V. LANDSLIDE TYPES AND ASSOCIATIONS

117	landslides identified
12	ancient
105	recent
67	debris flows
21	debris slides
17	stream bank failures
105	
12	associated with roads
9	associated with clearcuts
5	associated with roads and clearcuts
5	associated with old clearcuts or fire
2	associated with non-forested land
72	associated with mature forest land
105	

One might be tempted to conclude that natural rates of mass wasting are not significantly altered by road-building and clear-cutting. There are, however, two reasons why this conclusion cannot be reached based on these data alone, each of which reflects a lack of control over one or more important variables. First, the inherent stability of the managed landforms is not the same as that of the unmanaged landforms. For example, both the geologic units and slope angles are notably different. For a valid comparison, variables such as these need to be held constant, and this was not done. In this case, however, even if these variables had been held constant, the unforeseen influence of the 1964 storm would have been sufficient to alter the results since its impact varied locally and was greatest in the lower portion of the watershed near the confluence of the Salmon and Sandy rivers. In other words, irrespective of land use, areas more impacted by the 1964 storm are expected to have elevated rates of mass wasting.

EFFECTS OF THE 1964 FLOOD

Of the 105 recent landslides identified in the inventory, 65 were first visible in the 1967 set of aerial photographs. The similarities between these landslides support their association with the 1964 storm. Although some may be unrelated to the storm, others not identified or lacking the clear association may in fact have been caused by the 100-year storm.

The majority of the landslides associated with the storm are debris flows. Most of these occurred near the confluence of the Salmon and Sandy Rivers, where the effects of the storm were severe (Waananen et al. 1971), possibly due to the orientation of the Sandy River Valley. As mentioned above, debris flows often originate where colluvium and detritus have accumulated in tributary channels during periods of normal flow. The material is then mobilized during peak flow events or when triggered by another landslide. Following the 1964 storm, valley walls were scarred with the fresh tracks of debris flows. In some cases, material was transported more than one mile through tributary channels to trunk streams on the valley floor. The size of the deposits for any particular event is unknown, but rough estimates of the total volume displaced can be made from the channel length and cross-sectional area.

ADDITIONAL COMMENTS AND OBSERVATIONS

Previous geologic and stability investigations for the Green Canyon Timber Sale indicate that there are several major faults in the vicinity with the predominant fault trend in a northwest to southeast direction. These faults contribute to the poor stability of the area by fracturing and altering the associated rock, which in turn facilitates rapid weathering through the affected zone as a result of groundwater movement. Planes of weakness created in this manner can lead to shallow, planar landslides. In addition, the soil - bedrock contact tends to be shallow and abrupt and therefore is the site of abundant groundwater flow. At steeper slope angles, shallow debris slides may be associated with saturated soils formed by shallow groundwater flow.

From the limited amount of field work conducted in the area, stream-bank failures appear to be vastly underrepresented in the landslide inventory. This is of course because stream-bank failures tend to be small and are often concealed by riparian vegetation. They are, therefore, difficult to detect on aerial photographs at a scale of 1:12,000. Rough estimates indicate that stream-bank failures producing in excess of 50 cubic yards of debris can be concealed from air photo observation by the riparian canopy. In addition, while debris flows and debris slides tend to have return intervals of a few years, stream-bank failures occur with great regularity. It seems that stream-bank failures probably account for a majority of the sediment delivered to streams by landslides.

Certain geologic conditions within the watershed are inherently unstable and merit special attention during field investigations. Some of these areas are listed below. The majority of these sites are found in the Salmon-Huckleberry Wilderness Area where geologic formations tend to be weak and slopes tend to be steep.

1. Contacts between weak and resistant rock. Changes in permeability at these contacts often result in springs or shallow groundwater tables. Altering the groundwater conditions in these areas can trigger debris slides and debris flows. Important contacts include the following:

    Contacts between weak rock (WRSS) and resistant rock (RRSS) on steep slopes. Occur throughout the watershed.

    Contacts between the Rhododendron Formation (Tr) and more resistant overlying cap rock (Ta), found in the western portion of the watershed.

    Contacts between lava flows and the area of propylitic alteration, located between Wolf Creek and Goat Creek.

2. Around the edges of intrusions (Tiba). The heat from these intrusions has often altered and weakened the adjacent rock making it more prone to mass wasting. Intrusions are found throughout the watershed, though some are not mapped because of their small size.

3. Along the margins of dikes and sills. Similarly to intrusions, the heat associated with dike and sill emplacement tends to alter and weaken the adjacent rock making it more prone to mass wasting. Dikes and sills are not shown on the maps but may be found throughout the watershed.

4. Along stream banks within the WRSS, UMSS, or UMMS landforms. Slumps, debris slides, and stream-bank failures may occur next to down-cutting or laterally-cutting streams. These failures are not usually visible on aerial photographs.

5. On slopes with gradients in excess of 60 percent where shallow soils overlie less permeable materials. Although these conditions may be met on many landforms, they are most common on landform types RRSS, WRSS, and GVSS. These conditions are prone to shallow failures.

6. Along the margins of ancient landslides or earthflows. Changes in groundwater levels near these margins often trigger debris slides, debris flows, and slumps.

7. On the scarps of ancient landslides. These areas are steep, have shallow soils, and are prone to debris slides and debris flows. The scarps are not designated on the maps.

8. At the headlands of tributaries with steep gradients, usually found within the Salmon-Huckleberry Wilderness. Historically, many such areas have experienced debris flows, and those presently filled or filling with colluvium may fail with the slightest provocation.

9. In the vicinity of fault zones on steep slopes. Increased fracturing and weathering in these areas decreases stability. Faults are not shown on the landform map.

There is some overlap among the geologic conditions listed above. Although the presence of these conditions does not automatically mean that the area is unstable, it does mean that the area needs to be investigated carefully by an experienced geologist, geotechnical engineer, or geomorphologist during project-level planning.

The information provided in this report should be used in conjunction with the landform map as a tool for evaluating the appropriateness of conducting certain management activities on particular landforms. Land-use planners and anyone responsible for planning management activities should consult these documents prior to finalizing their plans.

LIMITATIONS AND ASSUMPTIONS

1. Due to time constraints, only a few of the inventoried landslides were field-checked. Consequently, it is not possible to accurately estimate landslide sediment production.

2. Rates of sediment delivery were not calculated.

3. The connection between the '64 Flood and specific mass wasting events is assumed. Aerial photographs were used to bracket the flood event, but the time they span is 9 years, 1958 to 1967. It is possible that some of the landslides that appear to be associated with the '64 Flood actually occurred earlier or later.

4. Natural rates of landslide occurrence were not determined.

5. A causal relationship between land management practices and landslide occurrence could not be determined due to the nature of the analysis, a lack of field work, and the inability to control for certain factors such as the distribution of landforms, the types and locations of permissible management activities, and the '64 Flood. This causal relationship, however, is well documented in the scientific literature (O'Loughlin 1974; Swanson and Dyrness 1975; Gresswell et al. 1979; Amaranthus et al. 1985; Wolfe and Williams 1986; Neely and Rice 1990; Sidle 1992).

REFERENCES

Amaranthus, M.P., Rice, R.M., Barr, N.R., Ziemer, R.R., 1985: "Logging and Forest Roads related to Increased Debris Slides in Southwestern Oregon," Journal of Forestry, vol. 83, no. 4, p. 229-233.

Gresswell, S., Heller, D., Swanston, D.N., 1979: "Mass-Movement Response to Forest Management in the Central Oregon Coast Ranges," USDA Forest Service, Pacific Northwest Forest and Range Experiment Station, Resource Bulletin, PNW-84, 26 p.

Neely, M.K., Rice, R.M., 1990: "Estimating Risk of Debris Slides after Timber Harvest in Northwestern California," Bulleting of the Association of Engineering Geologists, vol. 27, no. 3, p. 281-289.

Sherrod, D.R., Scott, W.E., 1994: "Preliminary Geologic Map of the Mt. Hood 30-Minute Quadrangle, Northern Cascade Range, Oregon," Advanced Copy of the USGS Open-File Report 94-___, 45 p. and map.

Sidle, R.C., 1992: "A Theoretical Model of the Effects of Timber Harvest on Slope Stability," Water Resources Research, vol. 28, no. 7, p. 1897-1910.

Swanson, F.J., Dyrness, C.T., 1975: "Imapact of Clearcutting and Road Construction on Soil Erosion by Landslides in the Western Cascade Range, Oregon," Geology, Vol. 3, p. 393-396

Waananen, A.O., Harris, D.D., Williams, R.C., 1971: "Floods of December 1964 and January 1965 in the Far Western States: Part 1. Description," Geological Survey Water-Supply Paper 1866-A, U.S. Government Printing Office, Washington D.C., 265 pgs.

Wolfe, M.D., Williams, J.D., 1986: "Rates of Landsliding as Impacted by Timber Management Activities in Northwestern California," Bulletin of the Association of Engineering Geologists, vol. 23, no. 1, p. 53-60.

Appendix B - Historic Fire and Vegetation

The following historical fire and vegetation information is summarized from:

Forest Conditions in the Cascade Range Forest Reserve, US Geological Survey 1903.

On file is the accompanying map of the Cascade Range Forest Reserve for Mt. Hood and Vicinity dated 1901.

1903 HISTORIC INFORMATION
NORTHERN PORTION CASCADE RANGE FOREST RESERVE

STAND OF TIMBER SPECIES (M. feet B.M.)

	WHITE PINE	LODGEPOLE PINE	YELLOW PINE	WHITE-BARK PINE	WHITE FIR	NOBLE FIR	LOVELY FIR	SUBALPINE FIR
T2S;R9E	435	7,833	277	1,937	865	506	11,206	1,296
T3S;R7E	414	-	-	-	-	4,228	11,012	714
T3S;R 81/2E	752	-	-	-	300	2,805	6,432	1,980
T3S;R9E	5,989	4,951	-	582	2,401	88,733	46,046	3,343
T4S;R7E	-	-	-	-	-	1,232	9,907	-
T4S;R8E	2,228	4,120	-	-	-	18,334	14,319	-
T4S;R81/2E	3,522	45	-	-	-	1,759	1,230	-
T4S;R9E	7,510	13,840	-	-	2,356	25,867	5,779	-

	RED FIR	MERTENS HEMLOCK	PATTON HEMLOCK	RED CEDAR	ENGELMANN SPRUCE	TAMARACK	JUNIPER
T2S;R9E	15,848	3,685	25,649	370	8,416	11,957	-
T3S;R7E	31,744	270	-	316	-	-	-
T3S;R8 1/2E	20,555	17,276	6,165	5,140	119	-	-
T3S;R9E	108,771	31,577	46,393	4,184	11,119	3,435	-
T4S;R7E	18,638	14,474	1,539	203	-	-	-
T4S;R8E	93,553	125,038	6,260	7,888	1,626	374	-
T4S;R8 1/2E	87,006	85,019	-	15,596	-	341	1,553
T4S;R9E	170,969	130,386	4,779	11,318	812	9,445	-

CLASSIFICATION OF LAND (acres)

	TIMBERED	BURNED	GRAZING	BARREN	RESTOCKED	GLACIER	CULTIVATED	WATER
T2S;R9E	11,560	1,225	130	7,845	-	2,280	-	-
T3S;R7E	1,455	5,315	-	-	4,728	-	22	-
T3S;R8 1/2E	2,230	3,435	95	-	-	-	-	-
T3S;R9E	14,900	4,255	600	3,285	-	-	-	-
T4S;R7E	6,560	11,880	-	-	2,510	-	-	-
T4S;R8E	11,525	8,115	60	-	2,355	-	-	25
T4S;R8 1/2E	5,880	35	85	-	-	-	-	-
T4S;R9E	18,855	3,015	810	-	-	-	-	360

FOREST CONDITIONS

	AVERAGE HEIGHT, CLEAR TIMBER	AVERAGE %, CLEAR TIMBER	AVERAGE DIAMETER	LITTER	REPRODUCTION	DEPTH OF HUMUS
T2S;R9E	26 feet	-	15 inches	Medium	Fair	2 do
T3S;R7E	-	-	-	-	-	-
T3S;R8 1/2E	47 feet	-	23 inches	Medium	Light	1 1/2 do
T3S;R9E	29 feet	10%	19 inches	Medium	Medium	1 1/2 do
T4S;R7E	-	-	-	-	-	-
T4S;R8E	45 feet	-	21 inches	Medium	Light	1 1/3 do
T4S;R8 1/2E	25 feet	-	20 inches	Medium	Light	1 1/2 do
T4S;R9E	-	-	-	-	-	-

LIST OF TIMBER SPECIES
NORTHERN PORTION CASCADE RANGE FOREST RESERVE

HISTORIC NAME (1903)	CURRENT NAME
Yellow pine, *Pinus ponderosa*	Ponderosa pine, *Pinus ponderosa*
White pine, *Pinus monticola*	Western white pine, *Pinus monticola*
Lodgepole pine, *Pinus murrayana*	Lodgepole pine, *Pinus contorta*
White-bark pine, *Pinus albicaulis*	Whitebark pine, *Pinus albicaulis*
White fir, *Abies grandis*	Grand fir, *Abies grandis*
Noble fir, *Abies nobilis*	Noble fir, *Abies procera*
Lovely fir, *Abies amabilis*	Pacific silver fir, *Abies amabilis*
Subalpine fir, *Abies lasiocarpa*	Subalpine fir, *Abies lasiocarpa*
Red fir, *Pseudotsuga taxifola*	Douglas-fir, *Pseudotsuga menziesii*
Mertens hemlock, *Tsuga mertensiana*	Western hemlock, *Tsuga heterophylla*
Patton hemlock, *Tsuga pattoniana*	Mountain hemlock, *Tsuga mertensiana*
Red Cedar, *Thuja plicata*	Western red cedar, *Thuja plicata*
Alaska cedar, *Chamaecyparis nootkatensis*	Alaska yellow cedar, *Chamaecyparis nootkatensis*
Engelmann spruce, *Picea engelmannii*	Engelmann spruce, *Picea engelmannii*
Tamarack, *Larix occidentalis*	Western larch, *Larix occidentalis*
Incense cedar, *Libocedrus decurrens*	Incense cedar, *Calocedrus decurrens*
Yew, *Taxus brevifolia*	Pacific yew, *Taxus brevifolia*
Pacific oak, *Quercus garryana*	Oregon white oak, *Quercus garryana*
Cottonwood, *Populus trichocarpa*	Black cottonwood, *Populus trichocarpa*
Quaking aspen, *Populus tremuloides*	Quaking aspen, *Populus tremuloides*
Maple, *Acer macrophyllum*	Big-leaf maple, *Acer macrophyllum*
Chinquapin, *Castanopsis chrysophylla*	Chinquapin, *Castanopsis chrysophylla*
Alder, *Alnus oregona*	Red Alder, *Alnus rubra*

1903 HISTORIC INFORMATION
NORTHERN PORTION CASCADE RANGE FOREST RESERVE

TOWNSHIP 2 SOUTH, RANGE 9 EAST

This township contains the summit of Mount Hood and the greater part of the barren slopes around it. A little more than one-half of its area is timbered. Streams radiate in every direction from the glaciers and snowfields of the mountain, forming a succession of canyons, some of which are deep and very precipitous. The wide altitudinal range, extending from 3,500 to 11,000 feet, favors many peculiar conditions of forest growth. Patton hemlock and white-bark pine reach the highest elevations on the mountain. The timber line varies from 6,000 to 6,500 feet, but on the southeastern slope white-bark pines grow at an elevation of 7,400 feet.

Above timber line are areas of vegetation which afford some grazing, and below are wide areas of open woods in which is an excellent growth of grass, but the soil is so light that the trampling of sheep would soon destroy the thin sod.

The soil is either light volcanic ash or glacial deposits of sand, gravel, and rock, and it erodes rapidly under the action of water.

The timber of this township is remote from natural means of transportation, so it is not probable that it will be in demand for some time.

TOWNSHIP 3 SOUTH, RANGE 7 EAST

Only the eastern half of this township is included in the reserve. Across this area, from southeast to northwest, extends a high precipitous ridge dividing Salmon River from Still Creek and Zigzag River. West of Salmon River is a similar range; hence the surface of this township is extremely rough and broken.

Almost the entire area has been burned over. Along the east side of Salmon River, from the reserve line to the bend of the stream, is a narrow strip of timber, mainly second growth, consisting of red fir mixed with maple and alder, averaging 10 inches in diameter. Above the bend, along the narrow river bottom, is the remnant of a once grand forest of red fir and cedar, which in some instances have attained a diameter of 8 or 9 feet. Only three or four trees remain on each acre, being very old trees which have long since reached maturity.

Above the forks of the river, extending through section 34, remains an excellent body of red fir which is estimated to be from 75,000 to 100,000 feet per acre. Many of the trees are dead, and the litter is very heavy as it is all along the stream. Along Still Creek and Zigzag, the conditions are similar to those described in Township 3 south, Range 8 east.

Reforestation is very good in all parts except on the divides above 3,500 feet. The soil is very rocky in all sections.

TOWNSHIP 3 SOUTH, RANGE 8 1/2 EAST

The greater part of this fractional township is burned. Some good timber remains in the wide basin at the head of Mud Lake Creek and along Still Creek. This consists of mainly red fir and hemlock. On the slopes toward Zigzag the timber is Patton hemlock and other Alpine species.

The soil is very rocky sand.

TOWNSHIP 3 SOUTH, RANGE 9 EAST

The township lies southeast of Mount Hood, and includes a part of the barren land above timber line. It is drained by Hood, White, and Salmon rivers. The wide bottom of the canyon of White River is an immense deposit of rocks and sand which is constantly flooding down from the moraine deposits and barren ridges below the glacier.

Evidence of an old forest remain, showing that at one time this canyon was heavily forested, but now nothing of any value remains. The canyon at the headwaters of Hood River is very similar to that of White River, but the movement of debris has long since ceased and the basin is well covered with timber, most of which is lodgepole pine, lovely fir, and Patton hemlock. On the sides of the canyons of these streams there is an abundance of timber of the finest quality, consisting mainly of noble and red fir.

At the head of the basin of Hood River, and on the White River divides, below timber line, are grassy slopes and alpine meadows, through which are scattered clusters of white-bark pine, subalpine fir, and hemlock. South of White River, where the forest has not been devastated by fire, there is generally a good stand of timber.

The soil is volcanic ash, sand, and rock. The timber in the Hood River Basin could be logged down Hood River, but the remainder could only be handled by small portable mills, and the output hauled or flumed to market.

TOWNSHIP 4 SOUTH, RANGE 7 EAST

This township lies on the western side of the reserve and the extremely rough area at the heads of Roaring River, South Fork of Salmon River, and Eagle Creek. The former stream is a tributary of the Clackamas. Terrific forest fires have swept over nearly all of this township, destroying the greater part of its timber. That which is left is along the summit of the high divide between Salmon and Roaring rivers, extending down the basin of the South Fork of Salmon to almost to the township line. Along the summit of the divide the timber is mainly hemlock, lovely fir, and noble fir. Lower is a stand of almost pure red fir, very dense and thrifty, averaging 12 inches in diameter. Along Salmon River the old burns are rapidly restocking with an excellent growth of red fir from 4 to 6 feet in height. Huckleberries are everywhere and there is good sheep range along the divides, but it is difficult of access.

TOWNSHIP 4 SOUTH, RANGE 8 EAST

This township is all drained by Salmon River. A large part of it has been burned clean, and much more has been damaged by creeping fires. The divides on either side of the Salmon River afford excellent grazing for sheep. The high ridge north of the river is also a favorite huckleberry patch, which is visited annually by Indians from the Warm Springs Indian Reservation. Reforestation along the lower slopes is of an excellent character, being a dense, thrifty growth of red fir. The soil is mostly light sand and gravel of volcanic origin.

A flume down Salmon River would be required to transport the timber. The best timber is along the Mud Lake Branch, in the northeastern part of this township.

TOWNSHIP 4 SOUTH, RANGE 8 1/2 EAST

Nearly all of this township contains a heavy stand of timber. On the slopes of the Mud Creek Basin, it is especially good. It consists of mainly red fir and Mertens hemlock, with some excellent red cedar along the creeks. The soil is sandy gravel with much rock along Salmon River.

If logs could be driven down Salmon River this timber could all be logged to that stream very cheaply, but it is questionable whether this could be done with any profit.

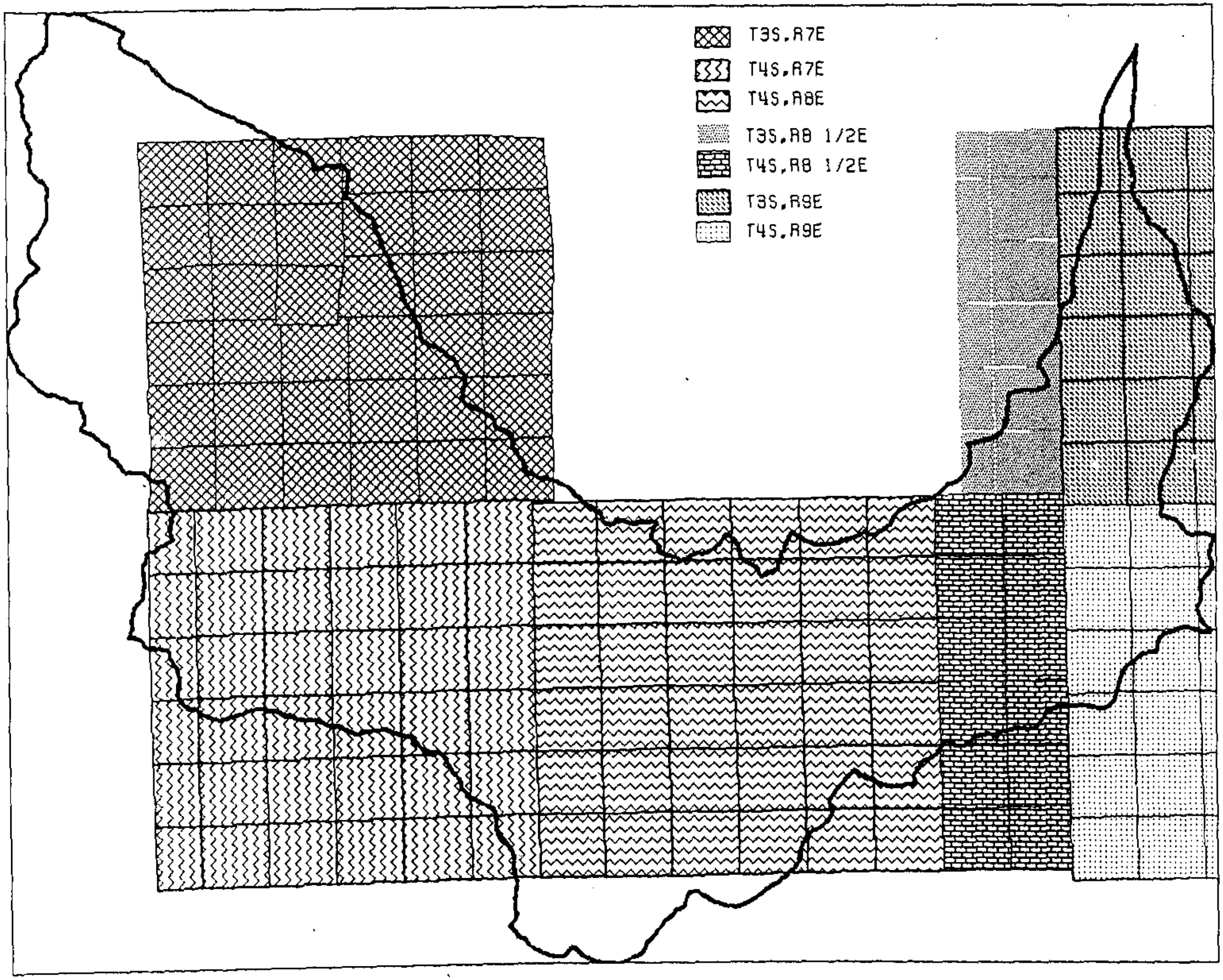
The soil is very rocky on the steep hills, where much rock in place occurs, but along the more gentle slopes and creek bottoms the soil is deep and fertile.

It is very improbable that the timber standing in his township will ever be cut, but it could be logged to Salmon River.

TOWNSHIP 4 SOUTH, RANGE 9 EAST

This township covers the low pass across the main divide of the Cascade Mountains where crossed by the Barlow and Oak Grove roads. It is drained on the western side by Salmon River and on the eastern side by White River and two of its important tributaries - Clear Lake and Frog Lake creeks. The timber is variable and generally of poor quality. Mertens hemlock and red fir are the prevailing species. Throughout the southern half of the township a large percentage of the timber is defective. The original forest was red fir and some of the old trees are still standing, apparently sound and clear, but all are badly decayed. A number of burns have occurred, but these are not extensive. All of this timber could be logged to the streams mentioned, but flumes or other artificial means of transportation would be required to transport it to market.

The soil is mostly a deep gravelly sand.


T3S,R7E
T4S,R7E
T4S,R8E
T3S,R8 1/2E
T4S,R8 1/2E
T3S,R9E
T4S,R9E

Appendix C - Fire

Appendix C - Fire

Fire Occurrence

Historical fire occurrence records for the Mt. Hood National Forest consist of documented fires from 1960 - 1994. Fire records prior to 1960 consist of a survey of the Cascade Range Forest Reserve conducted in 1901 - 1903, fire lookout records circa 1920, and fire lookout panoramic photos taken in 1933 - 1934. It is apparent by studying the available historic information that fire occurrence in the Salmon River Watershed and the surrounding watersheds (Eagle, Roaring River, and Zigzag watersheds) that fire has burned much of the area.

Prior to the establishment of the Cascade Range Forest Reserve, fires raged throughout most of the forest with little or no effort to suppress them. It is believed that many of the fires were intentionally set by sheepmen to increase acreage of range land, as well as hunters, campers, and others who thoughtlessly left unattended campfires to spread. American Indians were also thought to have been responsible for intentionally setting some fires to improve berry picking fields and increase forage for animals.

As documented in the survey of the Cascade Range Forest Reserve, as much as 60% of the land base of some townships was burned over by wildfires. The survey documents that the earliest forest fires were believed to have occurred around 1852 which burned over the area near Government Camp and the headwaters of Mud Creek.

The next documented record of fire activity is the fire lookout records circa 1920. The survey map lists 15 fires that occurred from 1908 through 1917 within the Salmon River watershed. The largest fire documented was in the Sherar Burn area (10,000 acres) which occurred in 1915. Lightning was listed as the causal factor for this fire. The second largest fire (3,700 acres) originated within the Eagle Creek watershed and burned into the western portion of the Salmon River watershed. Ignition source for this fire is unknown. Of the 15 documented fires during this time period, 42% were from lightning; 28% were human-caused; 2% were from brush/debris burning, and for 28%, the ignition source was unknown.

The panoramic photos taken from the fire lookouts in 1933-34 show the devastation throughout much of the watershed. Also evident in the photos is evidence of more recent fires burning in the Wolf Camp Butte/Sherar Burn area. it is apparent that additional fires have burned within this area due to lack of old down woody material and snags in the photos.

Beginning in 1960, the Mt. Hood national Forest started keeping records for statistical fires. This data base is located at the Mt. Hood National Forest Supervisor's Office in Gresham. The records have been transposed and are kept on a PC data base for record keeping and storage. Since 1960 there have been approximately 142 statistical fires within the Salmon River watershed. These fires range in size from class A (less than .25 acre) to class C (10-99 acres). The graphs in Chapter 4 show the fires by statistical cause (lightning, smoking, equipment, etc.) and the fire occurrence by size class for the period form 1960 to 1994. Of the 142 fires, 60% were human-caused (campfires, smoking); 15% were lightning; 8% were debris burning; 5% were equipment fires, and 12% were miscellaneous, of unknown origin.

There are no fire data records or fire lookout photos from 1934-1959. Sometime during this period, at least one other significant fire occurred within the Salmon River watershed, the Abbott Burn. At the present time, I have not been able to locate any documentation for this fire.

When comparing the Size and Structure Veg 1944 map with the circa 1920 lookout photos and 1933-1934 panorama photos, they compare almost identically with the typical vegetation class associated with high fire activity levels.

In 1994, a national airtanker study was conducted to determine the past, present, and proposed most efficient use of airtankers for fire suppression. One of the products of the study was an analysis of the numbers and types of fires for the past 25 years. In comparing the statistical cause of fires for the past 25 years for the Pacific Northwest in general, 75% of all fires were caused by lightning. In contrast, only 15% of the fires in the Salmon River watershed were lightning starts. In reviewing the locations of the fires for the 1970-79 period, approximately 80% of all human-caused statistical fires were abandoned campfires or smoking fires in or near Trillium Lake Campground. Most of the remaining human-caused fires could be associated with dispersed campsites or existing road-trail systems.

Given the fire occurrence from 1960 to present, the Salmon River watershed can expect to have a fire occurrence rate of .062 fires/1,000 acres/year. This occurrence rate translates into approximately 4 fires per year.

Fire Regimes

There are three dominant fire groups within the Salmon River Watershed. They are Fire Groups 8, 9, and 10. These are summarized from the draft document "Fire Ecology of the Mid Columbia" (Evers et al, 1994). These groups are based on plant associations and can be used to describe and predict the influence of fire. However, existing conditions within the Salmon River Watershed do not necessarily fit these descriptions. Therefore, existing conditions must be taken into consideration when using these Fire Groups for predictions or management recommendations.

FIRE GROUP 8 covers approximately 80% of the watershed analysis area and includes most of the western hemlock and Pacific silver fir plant associations. In general, the plant associations reflect a warm, moist climate. 'Classic' old growth stand conditions (closed canopy overstory of large diameter trees over a lush understory) are common in undisturbed areas, indicating infrequent disturbance. Fuel loading s tend to build rapidly once the overstory begins to die from insect and disease attack and the canopy breaks up. Deep duff and large logs are typical of this group. The resulting wildlife hazard is usually low to moderate, depending on weather conditions in a given year and whether extensive canopy gaps have begun to develop. Burning for hazard reduction should occur when duff moisture is relatively high to avoid soil damage and seedbed scarification caused by prolonged smoldering.

FIRE GROUP 9 covers approximately 6% of the watershed analysis area and occurs primarily on south and west aspects in the Salmon River drainage. Typical site characteristics include stony, rocky, gravely, or otherwise well drained soils, steep slopes and generally dry conditions. Fire Group 9 consists of dry western hemlock plant associations where Douglas-fir is the major species with a grassy and brushy understory. Stand-replacing crown fires can develop and do not necessarily depend on the combination of prolonged draught and east wind conditions typical of Group 8. In the absence of east winds, topography and rockiness tend to control fire size and shape.

FIRE GROUP 10 covers approximately 8% of the watershed analysis area and occurs in higher elevations in glacially carved streams and rivers, higher peaks and ridges, and at Timberline on Mt. Hood. Mountain hemlock is the most common tree species in all associations. Group 10 is characterized by relatively sparse fine fuels and moderate to heavy loadings of large diameter woody fuels. Much of the dead and downed woody fuel loadings result from wind and snow breakage, windthrow, insects, and disease. Stands in this fire group are not important timber producing stands. Instead, much of the area covered by this group is managed for wilderness, watersheds, and recreation. Fire is infrequent and tends to do little damage in terms of management objectives. However, fire fighting equipment and tactics can greatly damage these fragile sites; therefore, prescriptions should allow fire to more nearly play its natural role.

Fire Management Direction

Fire management direction within the Salmon River watershed is divided into several different groups requiring different management direction. Included within the Salmon River watershed is State of Oregon protected land, Wildland Urban interface lands, general forest land, and land within the Salmon Huckleberry Wilderness.

Fire management direction for National Forest Lands can be found in the Forest Plan, FSM 5100, and in the Fire Management Action Plan (FMAP). In general, all three documents direct fire and fuels management activities to accomplish three basic objectives:

1. Minimize cost plus net value change (costs and changes to inherent resources values).
2. Use appropriate suppression response for all wildfires, based on Objective #1 above.
3. Fire management activities shall contribute to the most cost-effective fire protection program consistent with Management Area management direction.

Fire management activities include presuppression (such as construction and maintenance of fuelbreaks, helispots, water sources, etc.); prevention; suppression; detection, and treatment of both natural and activity fuels.

Additional direction in various land allocations includes:

KEY SITE RIPARIAN AREAS (A9). Heavy equipment should not be used for fire suppression. Use of chemical fire retardants should be minimized. Prescribed burning should be considered for the purpose of enhancing riparian resource values.

SCENIC VIEWSHEDS (B2). Prescribed burning may occur for wildlife forage enhancement, but broadcast burning should not occur within foreground areas. Use of handpile prescriptions should be emphasized in near-foreground areas. Exceptions to the downed Woody Standards and Guidelines may occur within near-foreground areas with Retention and partial Retention Visual Quality Objectives.

GENERAL RIPARIAN AREAS (B7). Dozer firelines should not be constructed during wildlife suppression activities, although perpendicular crossings are allowed with subsequent rehabilitation. Broadcast burning may be allowed where prescriptions are consistent with riparian management activities.

For all lands within the Salmon River watershed, the most common suppression response will be a control strategy. Confine strategy may be feasible, but it has not been used to date.

In addition to the direction described above, the Northwest Forest Plan created new land allocations and additional Standards and Guidelines related to fire and fuels management. Allocations in the Salmon River watershed include Late-Successional Reserves, Riparian Reserves, and Matrix lands within a Tier 1 Watershed.

LATE SUCCESSIONAL RESERVES. Silvicultural activities are permitted to reduce the risk of large scale catastrophic disturbances. Activities should focus on younger stands and avoid degrading suitable spotted owl habitat and late-successional forest conditions. Activities in older stands are permitted under certain conditions. treatment should be designed to provide effective fuel breaks. Associated fuel treatments should promote the u se of minimum impact suppression tactics during wildfires. The goal of wildfire suppression is to limit the size of all wildfires. Prescribed natural Fire (PNF) may be considered.

RIPARIAN RESERVES. Fire and fuel management activities should meet the Aquatic Conservation Strategy objectives and minimize disturbance of riparian ground cover and vegetation. Management strategy should recognize the role of fire in the ecosystem and identify where fire suppression or fuels management activities could damage long-term ecosystem function. As with Late-Successional Reserves, the goal is to limit the size of all wildfires and PNF may be considered.

MATRIX LANDS. Until specific models are developed, fuel treatments should leave at least 120 linear feet of logs per acre at least 16 inches in diameter and 16 feet long. Retain as many of the existing downed logs as possible. Fuel treatments will need to protect retained green-tree patches in harvest units. Prescribed burning should minimize consumption of community or stand condition. Additional wildfire hazard reduction activities may occur in coordination with local governments, agencies and landowners in the wildland/urban interface.

WILDERNESS. Preference shall be given to those suppression methods and strategies resulting in the least practicable land burned, commensurate with cost-effectiveness, and having the least effect on wilderness values. Currently a fire management plan does not exist for the Salmon Huckleberry Wilderness. When the fire management plan has been completed, naturally occurring ignitions could be managed as a prescribed fire unless declared a wildfire. The use of motorized equipment fore fire suppression unless approval has been obtained from the Forest Supervisor (see FSM 2324.2).

Fire Protection Infrastructure

The fire protection infrastructure in the Salmon River Watershed consists of detection, water sources, helispots, prevention signs, and patrols. Primary fire detection is provided by Clear Lake Butte lookout. Engines and tenders can draw water from numerous streams within the watershed.

No formally designated helispots exist within the Salmon Watershed Analysis area. There are numerous areas suitable for landing, including existing rock pits, large openings in the forest canopy, old spots off Hunchback Trail, and forest road intersections.

Airtankers are available for retardant support from Redmond Air Center with additional support from Troutdale Air Tanker Base. In addition, the Zigzag IHC crew is located at Zigzag District Office and a 100-person fire cache is stationed at Troutdale Tanker Base.

The district maintains a 300 gallon fore prevention patrol, a 1,000 gallon engine, and a 3,000 gallon watertender. Additional support is available from the Columbia Gorge Bull Run Engine and Bear Springs District.

Potentially extreme fire conditions usually occur during late July and August and are exacerbated by east wind events. These are most often confined to the Gorge, but can occur forestwide. When east wind events occur, most, if not all, fire lookouts on the forest report having the same event. Prevailing areas of stronger east winds are not apparent.

STATE PROTECTED LANDS. Oregon Department of Forestry (ODF) Molalla provides fire protection services for State Protected lands. As identified in the Appropriate Suppression Response guide, ODF maintained a 600 gallon and a 1,000 gallon engine fore suppression forces. In addition, the Mt. Hood also has a reciprocal fire fighting agreement (closest forces) that states both units (FS and ODF) will respond to wildfires within these areas.

RURAL FIRE PROTECTED LANDS. Brightwood, Wildwood, and Wemme are included in the Hoodland Rural Fire protection District. The Forest Service provides backup assistance to Hoodland in the event that a fire from a private structure threatens National Forest Lands.

Appendix D - Botany

BOTANICAL RECOMMENDATIONS AND RESTORATION OPPORTUNITIES

Summarized below are points of botanical interest for the Salmon River Watershed. Refer to documents covering Survey and Manage Species, Species of Concern, Riparian Species, and Noxious Weeds/Invasive Plants for more information.

SURVEY AND MANAGE SPECIES/TABLE C3

1. Species in Table C3 with survey strategy ratings 1 (manage known sites beginning in 1995) and 2 (conduct surveys and manage sites for 1999 project implementation and beyond) demand the most immediate attention. Survey and Management Guidelines for species with 1,2 ratings are due from the REO in June 1995. Recommendations listed below for fungi, lichens, bryophytes and vascular plants documented in the Salmon River watershed could change based on these guidelines.

2. *Martiella* #649, rare endemic false truffle (1,3): Minimize non-winter use of Phlox Point Area. Light camping OK. Identify areas of similar habitat.

Murtellia

3. *Oxyporus nobilissmus*, noble polypore (1,2,3): NW Oregon / SW Washington endemic (only 8 sites known, not found elsewhere in world). Protect known site on road 220 from logging activities with one square mile buffer with fungus in center. Survey potential habitat.

4. Lichens and Bryophytes (1,2,3,4): a) Get documented locations for lichens from Mark Boyll. b) For nitrogen-fixing arboreal species - maintain 10-40 acre patches of old growth trees for microclimate and dispersal. 200+ year old trees with large lateral branches and emergent crowns are important (Appendix J2 pg. 228-234). c) For riparian species - maintain a diversity of hardwoods in stands, especially large big leaf maple. Control special forest product harvest of lichens and mosses. (Appendix J2 pg. 240-241). d) For aquatic species - maintain clear, clean water (Appendix J2 pg. 242-243). e) For rock species - maintain shading and microclimate. f) Control harvest of mosses and lichens as special forest products.

5. *Hypogymnia oceanica*, rare oceanic-influenced lichen (1,3): Get exact location on Salmon-Huckleberry Trail #793a from Mark Boyll. Consider special buffer designation for site to protect microclimate from impacts (Appendix J2 pg. 245-246).

6. *Allotropa virgata*, sugar stick (1,2): Need more surveys of potential habitat to determine locations. Create "Wanted" poster for district personnel, public.

7. *Botrychium minganese* and *B. montanum*, grapeferns (1,2): Mt. Hood NF Sensitive Plants. Maintain and enhance wet cedar areas.

8. *Corydalis aquae-gelidae*, coldwater corydalis (1,2): A NW Oregon / SW Washington endemic (found nowhere else in the world); Mt. Hood NF

Sensitive Plant and candidate for federal listing. a) Confirm site on gravel bar in Salmon River upstream of Green Canyon Campground. b) Determine extent of population in Linney Creek/Draw Creek, evaluate habitat and potential for restoration of habitat as recommended in the Salmon National Wild and Scenic River Management Plan (1993). c) If populations are located in riparian reserves with buffer widths of less than 300 ft, increase width to 300 ft around population site (Draft Survey and Management Guidelines for *Corydalis aquae-gelidae*, Stein 1995).

9. Coptis trifolia, threeleaf goldthread (1,2): Mt. Hood NF Sensitive Plant Conduct further surveys of potential habitat. Suggest Botanical Special Interest Area designation for Jackpot Meadows and exclusion of grazing.

OTHER PLANT SPECIES OF CONCERN

10. Unusual plant species grow in the wet meadows of the Salmon River Watershed: Buxbaum's sedge, cotton grass, scheuchzeria, pale blue-eyed grass (an iris relative), lesser bladderwort and wild cranberry. Pale sedge has not been located since 1987. The Salmon National Wild and Scenic River Management Plan (1993) recommends evaluating Salmon River/Redtop Meadows for Botanical Special Interest Area designation in 1996.

11. *Scheuchzeria palustris var. americana*, scheuchzeria: Mt. Hood NF Sensitive Plant. Salmon National Wild and Scenic River Management Plan (1993) recommends designing methodology and location of partial grazing exclosure in Salmon River Meadows to monitor impacts on scheuchzeria. Incorporate direction for protection in grazing allotment plan.

RIPARIAN RESERVES

12. Due to lack of knowledge about bryophytes, lichens and fungi maintain recommended widths.

13. Restore vegetation and functions of riparian areas in Mud Creek drainage. Enhance connectivity between wet meadows and creek. Recognize the Mud Creek area as one of high vegetative diversity and as a transition area between west Cascades and east Cascades vegetation.

NOXIOUS WEEDS

14. Continue aggressive control of knapweeds; use herbicides as needed.

15. Target tansy ragwort population in Linney/Draw Creek area for monitoring and biocontrol.

16. Keep eyes open in wet meadows for purple loosestrife invasion.

17. Work with adjacent private landowners to control blackberries and prevent spread onto USFS land.

18. Develop strategy to control English ivy.

19. Prevent invasion of noxious weeds into restoration areas by removing weeds on site before conducting ground disturbing activities and maintaining/planting native vegetation.

WET MEADOWS

20. Wet Meadows: a) Create species lists for wet meadows. b) Recognize importance of Redtop/Salmon River Meadows complex for plant diversity. c) Evaluate the potential to designate this complex as Botanical Special Interest Area as proposed in Salmon River National Wild and Scenic Management Plan (1993). d) Evaluate potential to designate Jackpot Meadows as Botanical Special Interest Area for Coptis trifolia and associated species. e) Restore vegetation and connectivity of Mud Creek wet meadows and riparian area. f) Assess conditions of wet meadows in Passline/Snowshoe area.

21. Oak Openings: Create species lists for oak openings. Create management scheme for maintaining oak openings in landscape.

22. Grassy Balds/Rocky Outcrops: Create species lists for Salmon River Bluffs and other areas of importance. Buffer rock outcrops from disturbance, especially those north-facing and moist, to maintain microclimate for lichens and bryophytes.

23. Alpine/subalpine: Salmon National Wild and Scenic River Management Plan (1993) recommends designing monitoring plan for plant communities in zone of river and high-use recreation sites.

BOTANY

Molly Sullivan
Spring, 1995

III. CODES USED IN THE ATTATCHED TABLE:

The attached table format is similar to the ROD Table C-3 on pages 49 to 61, with 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, pages 83-247, provided a large percent of the information available regarding species range and geographic extent. A format "key" is also attached. The key identifies codes used to expedite and condense this document. Among the codes is "D" for documented occurrence on the Mt. Hood National Forest. An asterisk (*) preceding a D indicates that there is a specimen of that species in our Forest Herbarium at the Supervisor's Office in Gresham.

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

Watersheds:

S - Salmon
ZZ- Zigzag
SR- Sandy River
BR- Bull Run

Occurrence:

D - Documented sites on MHNF
p - Potential habitat present
n - Not likely to occur
? - Unknown, inadequate info.
S - Seen, but not documented

Trees and Shrubs:

ABAM - Abies amabilis (Pacific silver fir)
ABCO - Abies concolor (White fir)
ABGR - Abies grandis (Grand fir)
ABLA2 - Abies lasiocarpa (Subalpine fir)
ABPR - Abies procera (Noble fir)
ACCI - Acer circinatum (Vine maple)
Arsp .- Arctostaphylos (Manzanita)
CACH - Castanopsis chrisophylla (Chinquapin)
PIAL - Pinus albicaulis (Whitebark pine)
PICO - Pinus contorta (Lodgepole pine)
PIEN - Picea engelmannii (Engelman 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)

IV. C-3 FUNGI

SPECIES	SURVEY STRAT.	MHNF	S	ZZ	SR	BR	HABITAT	RANGE OR EXTENT
MYCORRHIZAL FUNGI-BOLETES								
Gastroboletus subalpinus	#1, 3	D	P	P	P	N	Above 4500', ecto-michorrizal w/ pines.	Endemic OR Casc. & N. Sierras.

Gastroboletus turbinatus	#3	D	P	P	P	N	Mid-high elev. w/true firs, PIEN/PISI, TSHE/ TSME, w/abundant large woody debris, humus.	WA to N. CA, WA/OR Coast Range; Siskiyou Mts.; Klamath Mts.; N. ID; MI; Mexico.
BOLETES LOW ELEVATION								
Boletus piperatus (1)	#3	D	S	S	P	P	Low-mid elev forests, requires coarse woody debris in Douglas fir.	Unknown.
Tylopilus pseudoscaber (2)	#1, 3	S	S	S	S	P	Low elev, moist habitat, often with Sitka spruce.	Endemic to Pacific NW Coast.
RARE BOLETES								
Boletus haematinus	#1, 3	P	P	P	P	P	High elev. silver fir.	CA north to WA.
Boletus pulcherrimus	#1, 3	P	P	P	P	P	Low-mid elev. conifer.	CA to Canada, north to Olympics.
Gastroboletus imbellus	#1, 3	P	P	P	P	P	Upper-mid elev (5000') w/ ABAM, ABGR, PSME, TSHE, TSME, possibly ectomycorrhizal w/ pine.	Locally endemic to Willamette Nat. Forest, Olallie Trail & Lamb Butte specific.
Gastroboletus rubra	#1, 3	D	P	P	D	N	Upper mid-high elev. w/ mature TSME and developed humus layer.	Endemic to northern WA Cascades south to Willamette Pass in OR. **Trail to McNeil Pt.**
FALSE TRUFFLES								
Nivatogastrium nubigenium	#1, 3	P	P	P	P	P	Mid-high elev. in mature forests w/ abundant lg. coarse woody debris. (relies on mammals for dispersal)	Cascade. Mts. of CA, north to Mt. Adams and northern ID.
Rhizopogon abietis *R. atroviolaceus* *R. truncatus*	#3 #3 #3	P P P	P P P	P P P	P P P	? ? ?	High elev. mixed conifers (true firs, pines, PSME, TSME) in moderate to dry sites.	E. Canada, E. USA; northern Rockies; Strawberry Mts.; Cascades and Klamath Mts. in OR/
Thaxterogaster pinque	#3	D	D	P	P	P	Only mid-high elev. true firs w/ thick humus, large coarse woody debris.	Cascade Mts. south of Canadian border, to N. Sierras; Siskiyou Mts. in OR; Klamath Mts. in CA. **Pioneer Woman's Grave.**
(1) Uncommon in S and ZZ **(2) Uncommon in S, ZZ, and SR**								
UNCOMMON FALSE TRUFFLES								

Macowanites chlorinosmus	#1, 3	?	?	?	?	?	Low elev. PISI, PSME, TSHE w/ lg. coarse woody debris.	Endemic OR coast & Coast Ranges
RARE FALSE TRUFFLES								
Alpova alexsmithii	#1, 3	D	P	D	P	P	Mid to upper-mid elev. w/ true firs, TSHE, and possibly pines.	Endemic to Cascade Mts. & British Columbia Coast Range. **Still Creek Campground.**
Alpova olivaceotinctus	#1, 3	?	?	?	?	?	Single site known in range of N. Spotted Owl w/ Shasta fir.	Unknown.
Arcangeliella crassas *A. lactorioides*	#1, 3	?	?	?	?	?	Mid-high elev. montane forests w/ Aibes spp. and/or TSME.	Western OR; northern CA; Mts. Shasta and Lassen.
Destuntzia fusca *D. rubra*	#1, 3	P	P	P	P	P	Low to lower-mid elev. in variously mixed true firs, TSHE, PSME, oaks, pines, redwood.	Mendocino County, CA; Willamette Nat. Forest, Linn County.
Gautieria magnicellaris	#1, 3	P	P	P	P	N	High elev. w/TSME and true firs.	Willamette NF; Klamath NF; Mt. Wash. Wilderness; NE USA; Germany; Czechoslovakia.
Gautieria otthii	#1, 3	P	P	P	P	N	Mid to upper-mid elev., ectomychorrizal w/ Pinaceae.	Northern CA; Siskiyou Mts.; central Cascades in OR; AK; Europe.
Leucogaster citrinus	#1, 3	P	P	P	P	P	Low to high elev. w/ PSME, TSHE, CACH, manzanita, tanoak, or in stands w/ lg. coarse woody debris.	Mendocino County, CA north to Linn & Benton counties.
Leucogaster mocrosporus	#1, 3	D	P	P	P	P	Mid elev. w/ PSME or in stands w/ abundant legacy of coarse woody debris.	Slopes of western Cascade Mts.; northern Cascades & Coastal Range of OR/ southern Cascades of WA.
Macowanites lymanensis	#1, 3	P	P	P	P	P	Mid elev. old-growth TSME/ ABPR forest.	Lyman Lake, Wenatchee, WA.
Macowanites mollis	#1, 3	D	P	P	P	P	Mid elev. mature to old-growth TSME/ Abies spp..	Mt. Rainier NP; Larch Mt.; MHNF.
Martellia fragrans	#1, 3	P	P	P	P	P	Mid-high elev. old-growth TSME/ Abies spp..	Southern OR; northern CA; ID.
Martelllia idahoensis	#1, 3	P	P	P	P	P	Mid-upper mid elev. w/ true firs, Pines.	Coast Range SNF; Casace Range, WNF; northern ID.
Martellia monticola	#1, 3	P	P	P	P	P	Mid-high elev. old-growth TSME/ Abies spp.	Central to north OR Cascades.

Octavianina macrospora	#1, 3	D	P	D	P	P	Mt. foothills in PSME/ TSME old-growth forest.	Former Twin Bridges. Forest Camp **(Kiwanis Camp Rd.)**
Octavianina papyracea	#1, 3	?	?	?	?	?	Coastal mixed PSME/ TSME PISI forest in a fog belt.	Humboldt County, CA.
Rhizopogon brunneiniger	#1, 3	D	P	P	P	P	Low-high elev. dry old-growth PSME/ TSME/fir/pine forest.	Northern OR Cascades & coast ranges; north CA.
Rhizopogon evadens var. subalpinus	#1, 3	D	P	D	P	P	Upper mid elev. TSME/ fir/pine forest near timberline.	Northern CA to WA & ID. **Still Creek Campground.**
Rhizopogon exiguus	#1, 3	P	P	P	P	P	Moist-dry mature to old-growth PSME/ TSME low-mid elev. forest.	Cascade Mts., WA to coast ranges of OR.
Rhizopogon flavofibrillosus	#1, 3	P	P	P	P	P	Mid-upper elev., mature to old-growth PSME forest.	Northern CA; Siskiyou Mts.; central Cascades of OR.
Rhizopogon inquinatus	#1, 3	P	P	P	P	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 PSME forest.	Mt. Shasta to Yuba Pass; CA; CO.
UNDESCRIBED TAXA, RARE TRUFFLES & FALSE TRUFFLES								
Alpova sp. nov. *Trappe # 9730* *Trappe # 1966* *Arcangeliella sp. nov.* *Trappe # 12382*	 #1, 3 #1, 3 #1, 3	 ? ? ?	 ? ? ?	 ? ? ?	 ? ? ?	 ? ? ?	Mid-high elev. mature to old-growth PSME/ PILA/ ARSP/ PIAT/ ABMASH forest.	Siskiyou Mts. of southwestern OR.
Arcangeliella Trappe # 12359	#1, 3	?	?	?	?	?	Mature to old-growth PISI/ TSME/ PSME coast 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.	Northern coastal OR & northern Cascades of WA.
Elaphomyces sp. nov. Trappe # 1038	#1, 3	?	?	?	?	?	Mature to old-growth PISI/ TSME/ PSME coast fog belt forest.	Lane, Lincoln, &Tillamook counties, OR.
Gastroboletus sp. nov. Trappe # 2897	#1, 3	P	N	N	N	N	Mid-high elev. mature to old-growth PSME/ PILA/ ARSP/ PIAT/ Shasta fir.	Siskiyou Mts. of southwestern OR.
Gastroboletus sp. nov. Trappe # 7515	#1, 3	P	P	P	P	P	High elev. old-growth TSME forest.	Crater Lake NP.
Gastrosuillus sp. nov.							High elev. mature to old-growth true fir &	Klamath NF, OR.

Trappe # 7516	#1, 3	P	P	P	P	P	coniferous forest.	
Gastrosuillus sp. nov. Trappe # 9608	#1, 3	P	N	N	N	N	Upper mid elev. mature mixed conifer forest w/ PILA.	Lassen NF, CA
Gymnomyces sp. nov. Trappe # 4703 Trappe # 5576	#1, 3	?	?	?	?	?	Upper mid elev. mature ABPR forest.	Siuslaw NF, OR; Coast Range of OR.
Gymnomyces sp. nov. Trappe # 5052	#1, 3	D	D	D	P	N	High elev. mature to old-growth TSME/ ABAM forest.	**Phlox Pt., Mt.Hood NF, OR.**
Gymnomyces sp. nov. Trappe # 1690 Trappe # 1706 Trappe # 1710	#1, 3	P	P	P	P	P	Upper mid elev. mature to old-growth ABGR/ ABPR/ ABAM/ TSME forest.	Western OR Cascades, Willamette NF.
Gymnomyces sp. nov. Trappe # 7545	#1, 3	P	P	P	P	P	High elev. mature to old-growth true fir & coniferous forest.	Klamath NF, OR
Hydnotrya sp. nov. Trappe # 787 Trappe # 792	#1, 3	D	P	P	P	P	Upper mid elev. old-growth ABAM/ TSME forest.	Mt. Jefferson, Willamette NF.
Hydnotrya subnix sp. nov. Trappe # 1861	#1, 3	P	P	P	P	P	Old-growth ABAM forest.	Gifford Pinchot NF, WA.
Martellia sp. nov. Trappe # 311 Trappe # 649	#1, 3	D	D	P	P	N	High elev. mature to old-growth TSME/ ABAM forest.	**Phlox Pt., Mt.Hood NF, OR.**
Martellia sp. nov. Trappe # 1700	#1, 3	P	P	P	P	P	Upper mid elev. mature to old-growth ABGR/ ABAM/ PSME/ TSME forest.	Willamette NF, OR.
Martellia sp. nov. Trappe # 5903	#1, 3	P	P	P	P	P	Upper mid elev. old-growth ABAM/ TSME forest.	Mt. Jefferson, Willamette NF.
Octavianina sp. nov. Trappe # 7502	#1, 3	P	P	P	P	P	Upper mid elev. mature to old-growth ABGR/ ABAM/ PSME/ TSME forest.	Willamette NF, OR.
Rhizopogon sp. nov. Trappe # 9432	#1, 3	P	N	N	N	N	Mid-high elev. mature to old-growth PSME/ PILA/ Arsp/ PIAT/ Shasta pine forest.	Siskiyou Mts. of southwestern OR.
Rhizopogon sp. nov. Trappe # 1692 Trappe # 1698	#1, 3	P	P	P	P	P	Upper mid elev. mature to old-growth ABGR/ ABAM/ PSME/ TSME forest.	Willamette NF, OR.
Thaxterogaster							Mature to old-growth	Lane, Lincoln, &

sp. nov. *Trappe # 4867* *Trappe # 6242* *Trappe # 7427* *Trappe # 7962* *Trappe # 8520*	#1, 3	?	?	?	?	?	PISI/ TSME/ PSME coastal fog belt forest.	Tillamook counties, OR.
Tuber *sp. nov.* *Trappe # 2302* *Trappe #12493*	#1, 3	?	?	?	?	?	Mature to old-growth PISI/ TSME/ PSME coastal fog belt forest.	Lane, Lincoln, and Tillamook counties, OR.
RARE TRUFFLES								
Balsamia nigra	#1, 3	P	N	N	N	N	Low elev. mature xeric pine/oak forest.	Sierra Nevada Mts, CA to Yamhill Co., OR.
Choiromyces alveolatus	#1, 3	D	P	P	P	P	Mid-high elev. old-growth TSME/ Abies spp. forest.	Mt. Hood, OR to Yuba Pass, CA. High Rock.
Choiromyces venosus	#1, 3	P	P	P	P	P	Low elev. w/coniferous, deciduous, or mature PSME forest.	Springfield, OR; Europe.
Elaphomyces anthracinus	#1, 3	P	N	N	N	N	Mature PIPO forest.	Western Europe; Eastern N. America; Eastern OR Cascades.
Elaphomyces subviscidus	#1, 3	P	N	N	N	N	Mid elev. mature to old-growth pine forest.	Central to Southern OR Cascades.
CHANTERELLES								
Cantharellus cibarius	#3, 4	S	S	S	P	P	Coniferous & mixed forest.	Northern CA; OR; WA.
Cantharellus subalbidus		S	S	S	P	P		Same as above.
Cantharellus tubaeformis		S	S	S	P	P	Late-successional forest.	Same as above.
CHANTERELLES - GOMPHUS								
Gomphus bonarii *G. clavatus*	#3	P S	P S	P S	P P	P P	Northern & montane conifer forest in N. America.	Throughout region, esp. Northern CA.
G. floccosus	#3	S	S	S	S	P	Same as above.	Throughout region, esp. Northern CA.
G. kauffmanii	#3	S	S	S	P	P	Western conifer forests.	Throughout region, esp. Northern CA.
RARE CHANTERELLE								
Cantharellus formosus	#1, 3	P	P	P	P	P	A variety of mixed & conifer forest.	Northern CA; OR; WA.
Polyozellus	#1, 3	S	S	P	P	P	In montane areas	Northern Sierras; OR;

multiplex							alongintermittent streams/seeps with true fir & spruce.	WA Cascades. Rd. 199/169 (Hwy 35).
UNCOMMON & RARE CORAL FUNGI (App. J2, pp 163, 164)								
Ramaria spp. *R. araiospora* *R. botrytis v. aurantiiramosa*	(1, 3) & (3)	P S S	P S S	P S S	P P P	P P P	With TSHE, Abies, Picea, Pinus, Pseudotsuga, & Taxus.	Northern CA, OR, WA. Overall distribution of individual spp., unknown.
PHAEOCOLLYBIA (App. J2, p. 166)								
Phaeocollybia spp *P. olivacea*	(1, 3)	P S	P S	P S	P P	P P	Low elev. to montane, w/ conifers, moist habitat (prefers low elev.)	Distribution, frequency currently under study.
UNCOMMON GILLED MUSHROOMS (App. J2, p. 168)								
Catathelasma sp. *Cortinarius sp.* *Dermocybe sp.* *Hebeloma sp.* *Hygrophorus sp.* *Russula sp.*	(1,3) & (3)	P	P	P	P	P	Ectomycorrhizal in low elev. to montane, w/ conifers.	Distribution and range of individual species is unknown. Some may be Pacific NW endemics.
RARE GILLED MUSHROOMS								
Chroogomphus loculatus	#1, 3	P	P	P	P	P	Upper mid-elev (5000') w/ ABAM, ABGR, PSME, TSHE, TSME.	Local endemic, type locality at Ollalie Trail, Willamette NF.
Cortinarius canabarba *C. rainierensis* *C.variipes* *Tricholoma venenatum*	#1, 3	P	P	P	P	P	The range of elev. and host species are unknown. All require diverse coniferous forests w/ heavy humus layer and coarse woody debris.	Overall ecology and distributions are not well known for these species.
Cortinarius verrucisporus	#1, 3	P	P	P	P	P	High elev. montane, w/ conifers & true firs, hypogeous (fruits underground).	CA; OR.
Cortinarius wiebeae	#1, 3	D	P	P	P	P	(Same as above)	Local endemic/ Mt. Hood NF. only known site.
UNCOMMON ECTO-POLYPORES								
Albatrellus ellsii *A. flettii (1)*	#3	? S	? S	? S	? P	? P	Coastal old-growth & mixed hardwood.	WA; OR; Northern CA; Rocky Mts.; NE USA.
RARE ECTO-POLYPORES								
Albatrellus avellaneus (5)	#1, 3	?	?	?	?	?	Coastal old-growth & mixed hardwood forest.	WA; OR; Northern CA; Rocky Mts.; NE USA;

A. caeruleoporus								Europe.

TOOTH FUNGI (4)

Hydnum repandum (2) *H. umbilicatum (3)* *Phellodon atratum* *Sarcodon fuscoindicum* *S. imbricatus*	#3	S P	S P	S P	P P	P P	Late successional second-growth conifer & hardwood forest.	Widespread in North America & Europe.

(1) Plentiful some years
(2) Common late fall
(3) Less common late fall
(4) Hericium coralloides/H. ramosum common in S and ZZ
(5) Boletopsis subsqyamosa (kurotake), a look-alike, common in SR, less in S and ZZ

RARE ZYGOMYCETES

Endogone acrogena	#1, 3	P	P	P	P	P	Low elev. mesic old-growth PSME/TSME forest.	W. Cascades from Mt. Rainier to Whitechuck Rv.
Endogone oregonensis	#1, 3	?	?	?	?	?	Low elev. old-growth PSME/ PISI/ TSME coastal forest.	Suislaw NF, OR.
Glomus radiatum	#1, 3	P	P	P	P	P	Mature to old-growth Coastal Redwood/ Alaska cedar mesic wet forest.	OR & WA Cascades; Northern CA; NE USA.

SAPROBES (DECOMPOSERS)
UNCOMMON GILLED MUSHROOMS

Species are collectively grouped. See App. J2 p. 179

	(#1, 3) (#3)	P	?	?	?	?	Low-mid elev. conifer ecosystems; on PISI, recently fallen logs, or decomposed logs.	Northern CA; OR; WA.

RARE GILLED MUSHROOMS

Clitocybe subditopoda *C. senilis*	#1, 3	P	P	P	P	P	Low-mid elev. moist late-successional forest, large logs in later stages of decay.	WA; OR;CA.
Neolentinus adherens	#1, 3	P	P	P	P	P	Same as above	Olympic NP
Rhodocybe nitida	#1, 3	P	P	P	P	P	Same as above	WA, OR, & CA.
Rhodocybe speciosa	#1, 3	P	P	P	P	P	Same as above	Mt. Rainier NP to Barlow Pass

Tricholomopsis fulvescens (1)	#1, 3	D	S	S	S	P	Same as above	Mt. Hood area, Mt. Rainier NP, Mt. Baker-Snoq. NF.

NOBLE POLYPORE(rare and endangered)

Oxyporus nobilissimus (2)	#1, 2, 3	D	D	P	P	P	Late-successional forest on Aivies spp. esp. A. procera.	OR & WA Cascades. **Rd. 220 off Hwy 35.**

(1) Very common and plentiful in sandy soil, wet years; up to TLL 5500 ft
(2) Young specimen, verified by DNA analysis

BONDARZEWIA POLYPORE

Bondarzewia montana	#1, 2, 3	P	P	P	P	P	Late-successional high-elev. forest on ass'd w/ Abies.	Pacific NW, Western NV, and ID.

RARE RESUPINATES AND POLYPORES

Aleurodiscus farlowii	#1, 3	P	P	P	P	P	O wood, humus, litter, stumps, & dead roots.	WA, OR, & Northern CA.
Dichostereum granulosum	#1, 3	P	P	P	P	P	Same as above	Same as above
Cudonia monticola	#3	P	P	P	P	P	Duff layer of mature conifer forest.	WA, OR, & Northern CA
Gyromitra californica	#3, 4	P	P	P	P	P	Decaying matter in soil & rotten wood in older forest (except G. esculenta, which prefers second growth).	Northwestern N. America; Europe.
G. esculenta (1)		S	S	S	P	P		
G. infula		S	S	S	P	P		
G. melaleucoides		P	P	P	P	P		
G. montana (syn. G. gigas)(2)		S	P	P	P	P		
Otidea leporina	#3	P	P	P	P	P	Conifer duff in moist wet late successional mid-low elev. conifer forest.	Unknown,
O. onotica								
O. smithii								
Plaectania melastoma	#3	P	P	P	P	P	Late-successional to old-growth conifer forest duff.	NE. & NW. N. America; Europe.
Podostroma alutaceum	#3	P	P	P	P	P	Mature conifer & mixed conifer/hardwood forest duff.	Pacific Northwest.
Sarcosoma mexicana	#3	P	P	P	P	P	Late-successional & old-growth high-elev. forest.	Coastal OR & CA.
Sarcosphaera eximia (3)	#3	S	P	P	P	P	Cnifers & Fagaceae sp on chalky soils.	Pacific Northwest; CA; Rocky Mts.; NE USA; Europe.
Spathularia flavida	#3	P	P	P	P	P	Duff layer of mature conifer forest.	OR, WA, & Northern CA.

(1) Common but in small quantities
(2) Common some years on Bear Springs
(3) Common at McCubbins Gulch, Bear Springs RD

RARE CUP FUNGI

Aleuria rhenana	#1, 3	P	P	P	P	P	Late succesional conifer forest litter.	San Francisco to Mt. Rainier.
Bryoglossum gracile		P	P	P	P	P	Mossy, wet, alpine/ subalpine montane conifer forest.	Arctic & alpine N. America and Europe.
Gelatinodiscus flavidus	#1, 3	P	P	P	N	N	Needles, cones, & twigs of high elev. Alaska Yellow Cedar.	BC; Olympic Penninsula; OR and WA Cascades; Central OR.
Helvella compressa *H. crassitunicata* *H. elastica* *H. maculata*	#1, 3	P	P	P	P	P	Lw-mid elev. riparian & wet late -successional forest.	Tmperate forested areas of N. America.
Neournula pouchetii	#1, 3	P	P	P	P	P	Late-successional Thuja & Tsuga forest.	Northern OR; WA.
Pithya vulgaris	#1, 3	P	P	P	P	P	High elev. Abies forest.	BC; WA; ID; OR.
Plectania latahensis	#1, 3	P	P	P	P	N	Upper montane, sub-alpine conifer forest.	Same as above.
Plectania milleri	#1, 3	P	P	P	P	N	Montane, subalpine conifer forest.	Same as above.
Pseudaleuria quinaultiana	#1, 3	P	P	P	P	P	Low elev. wet late-successional conifer forest on wood or soil.	Olympic Peninsula; coastal WA & OR.

CLUB CORAL FUNGI

Clavariadelphus ligula *C. pistilaris* *C. truncatus* *C. borealis* *C. lovejoyae* *C. sachalinensis* *C. subfastigiatus*	#3, 4	P S P	P S P	P S P	P P P	P P P	Cool/cold moist late-successional hardwood or conifer forest, increases in frequency with increasing latitude & elevation, need well developed litter layer.	Pacific Northwest; B.C.; AK, Midwest, & Eastern N. America.

JELLY MUSHROOM

Phlogoitis (1) helvelloides	#3, 4	P	P	P	P	P	Riparian zones, upper headwater seeps, & intermittent streams with lg woody debris.	Pacific Northwest; northwest; midwest; Rocky Mts.

BRANCHED CORAL FUNGI

Clavulina cinerea(2) *C. cristata (2)* *C. omatipes*	#3, 4	S	S	S	P	P	Late-successional forest with well-developed litter layer.	Pacific Northwest & elsewhere.
(1) Rare **(2) Very common on Forest**								
MUSHROOM LICHEN								
Phytoconis ericetorum	#3, 4	P	P	P	P	P	Large woody debris in well-lit forest with alt. high/low moisture, increases northward.	CA to artic, coast to subalpine elev..
PARASITIC FUNGI (App. J2 p. 212) Species are collectively grouped. See App. J2 pg. 216								
	#3	P	P	P	P	P	Late-successional moist forest on host fungus.	Pacific NW; distribution and ecology unknown.
CAULIFLOWER MUSHROOM								
Sparassis crispa (1)(2)	#3	S	S	S	S	S	Low-mid elev. old-growth conifer forest on lg roots, esp. PSME.	Pacific Northwest; Northern CA.
MOSS DWELLING MUSHROOM (App. J2 p. 216) Species are collectively grouped. See App. J2 p.216								
	#3	P	P	P	P	P	Late successional moist forest, closely associated with and dependent upon mosses.	Pacific NW; Northern CA.
CORAL FUNGI								
Clavicorona avellanea	#3	P	P	P	P	P	Low-mid elev. moist late-successional forest on lg. roots.	Pacific Northwest.
(1) Very common in wet years on Forest **(2) Peziza proteana var. sparassoides is look-alike but very rare; seen at McCubbins Gulch**								

LICHENS

SPECIES	SURVEY STRATEGY	MHNF	S	ZZ	SR	BR	HABITAT	GEOGRAPHICAL EXTENT
RARE FORAGE LICHENS								
Bryoria tortuosa	# 1, 3	P	P	P	P	P	Low-mid elev. coastal conifers, inland, pine/ oa wet regimes.	Central CA to BC Cascades.
RARE LEAFY LICHENS								
Hypogymnia duplicata	# 1, 2, 3	?	?	?	?	?	Low elev. wet foggy, windy coast, maritime sites on conifers.	OR to AK.
Tholurna dissimilis	# 1, 3	P	P	P	P	P	Subalpine foggy zone on stunted TSME, canopy of old-growth PSME.	Montane areas of OR and WA.
RARE NITROGEN FIXING LICHENS								
Dendriscocaulon intricatulum	# 1, 3	P	P	P	P	P	Low-mid elev. wet boreal, riparian, late-successional forest.	Southern WA to southeast AK.
Lobaria hallii	# 1, 3	P	P	P	P	P	Low-mid elev. wet, fogg forest on lg diameter hardwoods, shrubs.	Central coastal CA to northern AK.
L. linita	# 1, 3	P	P	P	P	P	Old-growth PSME moist fir forest.	Norhtern OR to southeast CA, ID.
Nephroma occultum	# 1, 3	P	P	P	P	P	Pristine old-growth, approx. 400 years old.	Willamette NF to B.C.
Pannaria rubiginosa	# 1, 3	P	P	P	P	P	Bases of trees in mature forest.	Salem, OR and Mt. Rainier, WA.
Pseudo-cyphellaria rainierensis	# 1, 3	*D	D	D	D	P	Old-growth forest on trunks of PSME.	Cascades of OR & WA. **Burnt Lake Trail.**
NITROGEN FIXING LICHENS								
Lobaria oregana	# 4	*D	D	D	D	D	Open 200 year old-growth coastal forests, conifers.	Pacific NW Cascades, **Old Maid Flats.**
L. pulmonaria	# 4	*D	D	D	D	D	Moist, hardwood old-growth forests and swamps.	Pacific NW Cascades **Old Maid Flats.**
L. scrobiculata	# 4	*D	D	D	D	D	Old-growth forests, 140-200 years old.	Pacific NW Cascades.

Nephroma bellum	# 4	P	P	P	P	P	Open old-growth & along roadsides.	Pacific NW Cascades.
N. helveticum	# 4	*D	D	D	D	D	Northern coastal & montane forests, foothills & wetlands, valleys.	Pacific NW Cascades.
N. laevigatum	# 4	P	P	P	P	P	Low elev. coastal old-growth forests.	Pacific NW Cascades.
N. parile	# 4	*D	D	D	D	D	Moist coniferous deciduous old-growth forests.	Pacific NW Cascades.
N. resupinatum	# 4	*D	D	D	D	D	Low-mid elev. coast, montane, coniferous and shady forest.	Pacific NW Cascades.
Pannaria ....leucostictoide	# 4	*D	D	D	D	D	Low elev. open coastal old-growth forests.	Pacific NW Cascades.
P. mediterranea	# 4	P	P	P	P	P	Old-growth forests 140-200 years old.	Pacific NW Cascades.
P. saubinetii	# 4	P	P	P	P	P	Same as above.	Same as above.
Peltigera collina	# 4	*D	D	D	D	D	Low elev. coastal, montane & old growth forests.	Same as above.
P. neckeri	# 4	*D	D	D	D	D	Old-growth forests, 140-200 years old.	Same as above.
P. pacifica	# 4	*D	D	D	D	D	Same as above.	Same as above.
Pseudo-cyphellaria anomala	# 4	*D	D	D	D	D	Low-mid elev. coastal montane old-growth forests.	Same as above.
P. anthrapsis	# 4	*D	D	D	D	D	Low-mid elev. open, coniferous, old-growth forests.	Same as above.
P. crocata	# 4	*D	D	D	D	D	Old-growth forests, 140-200 years old.	Pacific NW Cascades. **Old Maid Flats.**
Sticta beauvoisii	# 4	*D	D	D	D	D	Same as above	Pacific NW Cascades
S. fuliginosa	# 4	*D	D	D	D	D	Low elev. coasts, moist coniferous old-growth forest.	Same as above
S. limbata	# 4	*D	D	D	D	D	Low-mid elev. coastal & old-growth forests.	Same as above.

PIN LICHENS

(See App. J2, pp234, 235)

Species grouped collectively; all have potential to occur in MHNF watersheds.
Three species listed below, from the Pin lichen group, have special information.

Calicium ....adaequatum	# 4	*D	D	D	D	D	Sheltered microsites with high atmospheric humidity, provided by old-growth forest	Pacific NW; northern Europe
C. viride	#4	*D	D	D	D	P		

Stenocybe clavata	#4	P	P	P	P	P	conditions. Substrate, texture specific.	Endemic to the Pacific NW
RARE ROCK LICHENS								
Pilophorus ....nigricaulis	# 1, 3	P	P	P	P	P	Talus rock patches within old-growth forest w/ low fire frequency.	Coastal OR, WA, BC.
Sticta arctica	# 1, 3	?	?	?	?	?	Rocky outcrops in foggy wet coastal forest.	Coastal Range of OR.
RIPARIAN LICHENS								
Cetrelia ....cetrarioides	# 4	*D	D	D	D	D	Low-mid elev. foggy riparian forest on older hardwood trees.	Coastal OR and AK.
Collema ....nigrescens	# 4	P	P	?	?	?	Low-mid elev. foggy riparian forest, mostly on QUGA.	Pacific NW to AK. (t Ecuador).
Leptogium burnetiae ....var. hirsutum	# 4	*D	D	D	D	D	Low-mid elev. foggy riparian forest on older hardwood trees.	Pacific NW & northern Europe.
L. cyanescens	# 4	*D	D	D	D	D	Same as above.	Ecuador to AK, including OR.
L. saturnium	# 4	*D	D	D	D	D	Low-mid elev. boreal riparian forest on older hardwood trees.	Pacific NW (mostly Canada).
L. teretiusculum	# 4	P	P	P	P	P	Low-mid elev. foggy riparian forest on older hardwood trees.	Pacific NW & Montana.
Platismatia ....lacunosa	# 4	P	P	P	P	P	Low-mid elev. moist forest on deciduous and hardwood forests.	Central OR to southcentral AK.
Ramalina thrausta	# 4	P	P	P	P	P	Low-mid elev. boreal forest on hardwood and coniferous forests.	OR, WA, ID, CA, B.C., Montana.
Usnea longissima	# 4	*D	D	D	D	D	Low-mid elev. wet coniferous & hardwood forest, swamps.	Northwest CA to AK. **Wildwood Rec. Site.**
AQUATIC LICHENS								
Dermatocarpon luridum	# 1, 3	P	P	P	P	P	Low-mid elev. streams.	OR, VA, B.C., CO, VA.
Hydrothyria venosa	# 1, 3	*D	D	D	D	D	Mid-high elev. cold and clear streams, pristine old-growth.	Central CA to central B.C.

Leptogium rivale	# 1, 3	P	P	P	P	P	Low-mid elev. streams.	Oregon and Montana.
RARE OCEANIC INFLUENCED LICHENS								
Bryoria pseudo-capillaris	# 1, 3	N	N	N	N	N	P..SI forests, open sand dunes on coast.	Oregon coast.
B. spiralifera	# 1, 3	N	N	N	N	N	Pantropical areas on peninsulas and headlands	Northern CA.
B. subcana	# 1, 3	N	N	N	N	N	Coastal bays and streams.	OR, AK, CA.
Buellia oidalea	# 1, 3	?	N	N	N	N	Low elev., dry, coastal oak forest.	Mexico to B.C.
Erioderma sorediatum	# 1, 3	N	N	N	N	N	Stabilized dunes in old PISI, PICO forest.	Oregon coast.
Hypogymnia oceanica	# 1, 3	*D	D	D	D	D	Coast, maritime microclimate in old-growth forest.	Inland, coastal OR. **Salmon-Huck, 793a.**
Leioderma sorediatum	# 1, 3	N	N	N	N	N	Stabilized dunes in old PISI, PICO forest.	Oregon coast.
Leptogium brebissonii	# 1, 3	N	N	N	N	N	Stabilized dunes in old PISI, PICO forest.	Oregon coast.
Niebla cephalota	# 1, 3	N	N	N	N	N	Promontories of land along windswept coast.	Coastal southern CA to maritime northern WA.
Pseudo-cyphellaria mougeotiana	# 1, 3	N	N	N	N	N	Coastal old-growth PISI forest.	Oregon coast.
Teloscistes flavicans	# 1, 3	P	N	N	N	N	Dry uplands and prairies, on coastal shrubs.	Ecuador to OR coasts
Usnea hesperina	# 1, 3	N	N	N	N	N	Broken dune PICO forest	Oregon coast.
OCEANIC INFLUENCED LICHENS								
Cetraria californica	# 1, 3	N	N	N	N	N	Scrubby dune areas on old-growth PICO.	Southern CA to southeast AK coasts.
Heterodermia leucomelos	# 1, 3	N	N	N	N	N	On large PISI in forested headlands.	Southern CA to northern WA coasts.
Loxospora nov. sp. 'corallifera'	# 1, 3	*D	N	N	D	N	Old-growth conifers on immediate coast.	Pacific NW coasts. **Old Maid Flats.**
Pyrrhospora quernea	# 1, 3	N	N	N	N	N	Same as above.	Southern CA to northern WA coasts.
ADDITIONAL LICHENS (Added after Appendix J2)								
Cladonia norvegica	# 3	?	?	?	?	?	Unknown (not listed in unknown Appendix J2)	

Heterodermia sitchensis	# 3	?	?	?	?	?	Unknown (not listed in unknown Appendix J2)	
Hygomnia vittiata	# 3	?	?	?	?	?	Unknown (not listed in unknown Appendix J2)	
Hypotrachyna revoluta	# 3	P	P	P	P	P	High elev. open forest.	Northern CA, western OR, western WA.
Ramalina pollinaria	# 3	?	N	N	N	N	Low elev. northern coastal forest w/ sandstone outcrops.	Western OR, western WA.
Nephroma isidiosum	# 3	?	?	?	?	?	Unknown (not listed in unknown Appendix J2)	

BRYOPHYTES

SPECIES	SURVEY STRATEGY	MHNF	S	ZZ	SR	BR	HABITAT	GEOGRAPHICAL EXTENT
Antitrichia curtipendula	# 4	*D	D	P	P	P	Low-mid elev. old-growth forest canopies.	N. CA to N. OR, west of Cascades.
Bartramiopsis lescurii X	# 1, 3	P	P	P	P	P	Old-growth forest. Low-mid elev. old-growth forest on rotting logs.	Pacific NW, esp. WA. Cascades.
Diplophyllum albicans	# 1, 2	?	?	?	?	?	Coastal old-growth TSME/PISI forest.	Unknown.
D. plicatum	# 1, 2	?	N	N	N	N	Coastal PISI forest.	W. OR and W. WA.
Douinia ovata	# 4	P	P	P	P	P	Low-mid elev. foggy old-growth forest w/ ridges & rock outcrops.	Pacific NW Cascades and coast.
Encalypta brevicolla var. crumiana 'X'	# 1, 3	P	P	P	P	P	Foggy rock outcropping shaded by old-growth forest.	Mountains of OR and WA.
Herbertus aduncus 'X'	# 1, 3	P	P	P	P	P	High-elev. old-growth forest.	Northern coast, Cascade of OR, WA.
H. sakurali	# 1, 3	?	P	P	P	P	Foggy rock faces in old-growth forest.	Northern coast range of OR.
Iwatsukella leucotricha	# 1, 3	?	P	P	P	P	Bark in old-growth forest.	Northern coast range of OR.
Kurzia makinoana	# 1, 2	P	P	P	P	P	Low-elev. old-growth forest.	OR and WA old-growth.
Marsupella emarginata var. aquatica	# 1, 2	P	P	P	P	P	Mid-high elev. stream splash zones.	OR Cascades.
Orthodontlum gracile	# 1, 3	?	N	N	N	N	Old-growth redwood forest.	Northern CA and southwestern OR.
Plagiochila satol 'X'	# 1, 3	P	P	P	P	P	Old-growth forest on cliffs, rocks & bark.	Pacific NW.
P. semidecurrens var. crumniana	# 1, 3	?	P	P	P	P	Foggy cliffs and shaded rocks.	OR Coast Range.
Pleuroziopsis ruthenica 'X'	# 1, 3	P	P	P	P	P	Low elev. shrub thickets, old-growth swamps, stream edges.	WA.
Ptilidum californicum	# 1, 2	P	P	P	P	P	Conifers in old-growth forest.	Northern CA.
Racomitrium aquaticum 'X'	# 1, 3	P	P	P	P	P	Shaded moist rocks & streambanks of old-growth forest.	Unknown.
Radula brunnea 'X'	# 1, 3	?	P	P	P	P	Foggy rock walls in old-growth forest.	Northern coast range of OR.
Scouleria marginata	# 4	D	D	P	P	P	Splash zone of streams.	Pacific NW endemic. **Draw Creek.**
Tetraphis geniculata	# 1, 3	P	P	P	P	P	Low-mid elev old-growth forest on moist, shaded wood.	Northern CA to western WA.

Tritomaria exsectiformis 'X'	# 1, 2	P	P	P	P	P	Old-growth forest on moist, shaded rocks.	OR & WA old-growth.
T. quinquedentata 'X'	# 1, 3	P	P	P	P	P	Old-growth forest on moist shaded rocks.	OR & WA old-growth.
(X = Added after Appendix J2)								

VASCULAR PLANTS

SPECIES	SURVEY STRATEGY	MHNF	S	ZZ	SR	BR	HABITAT	GEOGRAPHICAL EXTENT
Allotropa vigrata	# 1, 2	D	D	D	P	P	1500'-5000' elev under clos. J canopy ABAM ABGR, PICO, PSME requires association w/ fungus & vascular plants (saprophytic).	East slopes of the Cascade range to the coast, Brit. Columbia to Canada, disjunct in Idaho and Missouri.
Arceuthobium tsugense	# 1, 2	S	S	S	P	P	Parasitic primarily on TSHE older than 600 yrs. & on shore pine.	Rare from Alaska south to California, southern Oregon.
Aster vialis	# 1, 2	?	N	N	N	N	Low elev. with mid-successional conifers, thriving in edge hab-itats or in canopy openings.	Endemic to Oregon, Lane, Linn, Douglas counties (Willamette valley).
Bensoniella oregana	# 1, 2	?	N	N	N	N	3000'-5000' elevation with mixed evergreen and white fir, meadow/ stream.	Coast Rng. OR, CA Douglas, Josephine, Curry and Roseburg counties. (Siskiyou)
Botrychium minganese	# 1, 2	D	P	P	P	P	Variable elev w/ THPL and/or ACCI, ACMA variable habitats.	Endemic to North America, difficult taxonomically.
B. montanum	# 1, 2	D	P	P	P	P	Between 3200'-4100' (MHNF) in deep shade of old-growth THPL, seeps.	Endemic to western North America.
Clintonia andrewsiana	# 1, 2	N	N	N	N	N	Coastal redwood forest.	California coast.
Coptis asplenifolia	# 1, 2	P	P	P	P	P	360'-3600' with ABAM, THSE, THPL, in cool, wet, shady habitats.	Oregon coastal range, WA Cascades, Olympic peninsula.
C. trifolia	# 1, 2	D	D	P	N	N	Perimeters of small wetlands/swamps with PSME.	Disjunct in OR (MHNF) eastern Oregon Jackpot Meadow
Corydalis aquae-gelidae	# 1, 2	D	D	P	D	P	1220'-4260' on gravel bars in cold perennial streams with high canopy.	Gifford Pinchot NF, MHNF, Salem BLM. Draw Ck., Linney Ck., **Wildcat Mtn.**
Cypripedium fasciculatum	# 1, 2	?	?	?	?	?	1300' to 5300' in 60 to 100% shade by	Western United States.

							numerous plant communities.	
C. montanum	# 1, 2	D	S	P	P	P	Broad range habitats, presence of specific symbiotic fungi.	All Cascade provinces, (Hood River, Wasco county).
Galium kamschaticum	# 1, 2	P	N	N	N	P	Seeps with conifers and west Cascades riparian associated species.	Circumboreal Olympic and western WA Cascade provinces.
Habenaria orbiculata	# 1, 2	P	N	N	N	P	Mesic - dry mossy forest with deep litter in TSHE and lower ABAM zones.	Uncommon, wide-spread, western WA Cascade Provinces.
Pedicularis howellii	# 1, 2	N/?	N	N	N	N	4200'-6300' in mixed conifer/shrub, edge of openings and damp shade.	Endemic to the Siskiyou mountains.
Scoliopus biglovei	# 1, 2	N/?	N	N	N	N	Low elevation Redwood forest.	Endemic to CA; Siskiyou NF; Six Rivers NF.

FUNGI, LICHENS, BRYOPHYTES AND VASCULAR PLANTS

TERRESTRIAL MODULE - Questions IB

Species for which finer scale attention was deemed necessary in the EIS.

Species which are documented as occurring in the watershed, require survey strategies 1, 2 or 3, and are of special interest are listed below. The management of known sites (strategy 1) is to begin in 1995. Management and survey recommendations for critical species (strategy 1,2) are expected from the REO in June 1995. Strategy 3 surveys are to begin in 1996.

FUNGI

Of the 234 species listed in the ROD, 4 are documented in the Salmon River Watershed: *Thaxterogaster pinque* (common false truffle), *Gymnomyces* sp. nov. #Trappe 5052, *Martellia* sp. nov. #Trappe 311, *649* (rare, endemic false truffles) and *Oxyporus nobilissimus* (rare, endemic polypore). 24 fungi have been seen but not documented. Many of the rest have potential habitat in the watershed.

Dr. Trappe recently (4/10/95) named the false truffles listed above. *Gymnomyces* #5052 and *Martellia* #311 have been determined to be the same species, *Gymnomyces abieties*. This species was previously recorded under other names and is more common than once thought. Dr. Trappe will recommend its removal from the rare list. *Martellia* #649 has been described as *Martellia nondistincta*. The only known location is at Phlox Pt. Collections were made on Sept. 16, 1995.

Gymnomyces sp. nov. #Trappe 5052, rare endemic false truffle *Martellia* sp. nov. #Trappe 311, 649, rare endemic false truffles Appendix J2, pp 148-149
Survey strategies 1,3

Site-specific Distribution of Species and Habitat:
Known Sites: T3S R9E sec 7
Phlox Pt. Picnic area.
Recommended mitigation: Withdraw 160 ACRES containing site from ground disturbing activities (ROD, p C-5)
Minimize recreational impacts, establish buffer around known locations (Appendix J2, p149)
From Dr. Trappe: Minimize use of area. Light camping probably OK. Winter recreation OK. Identify areas of similar habitat (pers. comm. 4/10/95).

Potential Habitat: 5,000 - 6,000 ft elev. in mature to old growth mountain hemlock and silver forest. False truffles are found under the humus/debris layer, sometimes in clumps, often singularily.

Important Habitat Elements and Ecological Functions Needed:
Mycorrhizal partner - may be mountain hemlock and silver fir
Humus layer - level of acceptable disturbance is uncertain

Potentially Threatening Management Activities:
Camping, picnicing - trampling and soil compaction could be detrimental
Cutting trees - loss of hosts, soil compaction, humus disturbance

Interactions with Populations in Adjacent Watersheds:
Not known.

Conditions Limiting Populations Within Watershed:
Not known.

Conditions Limiting Interaction of Populations Between Watersheds:
Not known.

Oxyporus nobilissmus, noble polypore
Appendix J2, pp 185-186
Survey strategies 1,2,3

Site-specific Distribution of Species and Habitat:
Known Sites: T3S R9E sec 20
Past Pioneer Woman's Grave on Rd 220
Base of large noble fir snag

Recommended mitigation: ONE-SQUARE MILE BUFFER WITH POLYPORE NEAR CENTER (Appendix J2, pg. 186).

Potential Habitat: On large diameter noble fir stumps, snags, and less commonly, on live trees. May also occur on large diameter Abies spp and western hemlock. Aspect is usually N/NW/W, gentle slope, and 3,000-4,000 ft elev.

Important Habitat Elements and Ecological Functions Needed:
Big, old Abies - stands with natural distribution of very large Abies procera stumps, snags, and live trees (200+ years?).

Potentially Threatening Management Activities:
Logging - big, old Abies and Tsuga heterophylla are not common.

Interactions with Populations in Adjacent Watersheds:
Closest known existing population is on Larch Mtn in the Multnomah Creek drainage. Extant population documented from Sandy watershed, BLM land, North Mtn. area. Need more information.

Conditions Limiting Populations Within Watershed:
Not known, need more information.

Conditions Limiting Interaction of Populations Between Watersheds:
Not known, need more information.

LICHENS

68 species of lichens are listed in Table C-3; 26 of these have been documented in the Salmon Watershed by Mark Boyll. Mark has not given me all the site

locations at this time. 3 species have 1,3 ratings: *Pseudocephallaria rainierensis, Hydrothyria venosa*, and *Hypogymnia o.ceanica.* The other species have 4 ratings.

Pseudocephallaria rainierensis (rare, endemic, nitrogen-fixing lichen)
Appendix J2, pp 228-232
Survey strategies 1,3

Site-specific Distribution of Species and Habitat:
Known Sites: T, R sec.

Recommended mitigation: Clumps of old growth trees, 10-40 acres in size for microclimate and dispersal. 200 yr+ retention trees with large lateral branches and emergent crowns.

Potential Habitat: Mature to old-growth forest below 4,000 ft.

Important Habitat Elements and Ecological Functions Needed:
200 yr+ conifers/mature forest - provides appropriate bark roughness, microclimate, and dispersal conditions.

Potentially Threatening Management Activities:
Logging - may remove habitat.

Interactions with Populations in Adjacent Watersheds:
Not known, need more information.

Conditions Limiting Populations Within Watershed:
Not known, need more information.

Conditions Limiting Interaction of Populations Between Watersheds:
Not known, need more information.

Hydrothyria venosa (aquatic lichen)
Appendix J2, pp 241-243
Survey strategies 1,3

Site-specific Distribution of Species and Habitat:
Known Sites: T, R sec.

Recommended mitigation: Protect from reductions in water quality and quantity. Lichen "appears to be more sensitive to stream sediment than are salmon". (Appendix J2, pg. 243)

Potential Habitat: Clear, cold streams with stony bottoms from old growth or pristine forest at mid- to high elevations.

Important Habitat Elements and Ecological Functions Needed:
Clear, clean streams - sensitive to sediment and pollution including acid rain.

Potentially Threatening Management Activities:
Logging and road building - sediment generators.

Interactions with Populations in Adjacent Watersheds:
Not known, need more information.

Conditions Limiting Populations Within Watershed:
Not known, need more information.

Conditions Limiting Interaction of Populations Between Watersheds:
Not known, need more information.

Hypogymnia oceanica (rare oceanic-influenced lichen)
Appendix J2, pp 243-246
Survey strategies 1,3

Site-specific Distribution of Species and Habitat:
Known Sites: T, R sec.
Salmon-Huckleberry Wilderness, Trail #793a

Recommended mitigation: Protect, monitor and conduct additional surveys. Other site for this species exists away from the ocean on the Willamette NF.

Potential Habitat: Cool, moist old growth forest.

Important Habitat Elements and Ecological Functions Needed:
Not sure.

Potentially Threatening Management Activities:

Interactions with Populations in Adjacent Watersheds:
Not known, need more information.

Conditions Limiting Populations Within Watershed:
Not known, need more information.

Conditions Limiting Interaction of Populations Between Watersheds:
Not known, need more information.

BRYOPHYTES

23 bryophytes are listed in Table C-3. Only 1 species is documented, *Scouleria marginata*, and it received a 4 rating.

VASCULAR PLANTS

Allotropa virgata, sugar stick
Appendix J2, pp 249-253
Survey strategies 1,2
Site-specific Distribution of Species and Habitat:
Known Sites: In forested areas near Salmon River Meadows and Summit Meadows. Specific locations not known.

Potential Habitat: Mesic forests in the watershed with well-drained soils, well-developed humus layer and coarse woody debris.

Important Habitat Elements and Ecological Functions Needed:

- Undisturbed forest floor - sugar stick is a mycotroph (non-photosynthetic plant with underground fungal connections to other plants)
- Rich humus/coarse woody debris - source of nutrients, home for fungal partners.
- Fire - FEIS panel members noted that known sites have past fire history.
- Long-stand rotations - slow to establish, need to allow for development of habitat.

Potentially Threatening Management Activities:

- Logging/thinning - repeated mechanical disturbance, reduction in coarse woody debris and habitat fragmentation may be detrimental to species.
- Fire suppression - threat noted by FEIS panel members.

Interactions with Populations in Adjacent Watersheds:
Not known, need more information

Conditions Limiting Populations Within Watershed:
Not known, need more information

Conditions Limiting Interaction of Populations Between Watersheds:
Not known, need more information

Corydalis aquae-gelidae, Cold-water corydalis (PNW endemic)
Appendix J2 pp 271-274
Survey Strategies: 1,2

Site Specific Distribution of Species and Habitat:
Known Sites: T4S R8E sec 20,21
Linney Ck/Draw Ck confluence to Linney Ck confluence with Salmon River. First reported in 1988 by Lois Kemp. Documented update by Larry Scofield (BLM) in 1992. Growing along stream banks/water's edge. Actual population size not exactly known, estimated to be in hundreds. Population considered "outlier" by Goldenberg (1990).

T3S R7E sec 21 Salmon River, north of Green Canyon Campground. Reported in 1991 by Matthew Clark, BLM. On gravel bar near bank. Not known if still exists. Report made in August when identity could have been confused with *C. scouleri*. 12 plants.

Potential Habitat: Salmon River and tributaries, cold springs. See Appendix J2 for specific habitat requirements.

Important Habitat Elements and Ecological Functions Needed:

- Cold water - average substrate temp of 10 C
- Gravel/sand substrate - >50% gravel with coarse sand
- Perennial flow - usually

- High canopy - not tolerant of understory competition or dense shade
- cm water - seedlings will not establish if depth is greater
- Bumblebees - pollination

Potentially Threatening Management Activities:

- Fish habitat improvements
- Sediment-producers such as roads, trail crossings, timber sales etc.
- Canopy removal, riparian vegetation removal
- Hydrologic regime alterations from dams, culverts, diversions etc.

Interactions with Populations in Adjacent Watersheds:
Not known at this time, need more information.

Conditions Limiting Populations Within Watershed:
Not known at this time, need more information.

Conditions Limiting Interaction of Populations Between Watersheds:
Not known at this time, need more information.

Coptis trifolia, threeleaf goldthread
Appendix J2, pp 270-271
Survey strategies 1,2

Site-specific Distribution of Species and Habitat:
Known Sites: T4S R8E sec 25, Jackpot Meadow.

Potential Habitat: Brushy, shaded edges of wet meadows. Sites may include unnamed meadows in Mud Ck drainage, Redtop Meadow, Salmon River Meadow.

Important Habitat Elements and Ecological Functions Needed:

- High water table - found in bogs, forest wetland, seeps, wet meadows
- Partial shade - all our sites have partial shade
- More information needed

Potentially Threatening Management Activities:
Grazing - trampling and browsing by stock (deer use a related species, *C. asplenifolia*, as forage).

Interactions with Populations in Adjacent Watersheds:
Not known. The two other sites in Oregon are in the Miles Creek and Clackamas River watersheds. The sites in Oregon represent the disjunct southern edge of this plant's distribution. *Coptis trifolia* is common from Vancouver Island north.

Conditions Limiting Populations Within Watershed:
Not known, need more information.

Conditions Limiting Interaction of Populations Between Watersheds:
Not known, need more information.

Cypripedium montanum, mountain lady's slipper

Appendix J2, pp 280-283
Survey strategies 1,2

Site-specific Distribution of Species and Habitat:
Known Sites: Listed to be in the Salmon River Watershed (SCAA database). Location not known.

Potential Habitat: Multi-story forest with open understory, about 30-60% canopy cover. (Based on observations of Bear Springs sites.)

Important Habitat Elements and Ecological Functions Needed:

- Fungal symbiont - needed for plant establishment, may be more important than habitat conditions.
- Natural fire cycle - suspected to be important for establishment
- Canopy cover - about 30-60%
- Undisturbed forest floor - long establishment time, slow-growing

Potentially Threatening Management Activities:

- Fire suppression
- Hot fires due to unnaturally high fuel levels
- Logging
- Horticultural collection.

Interactions with Populations in Adjacent Watersheds:
Closest known sites are on Bear Springs in White River watershed. Interactions not known.

Conditions Limiting Populations Within Watershed:
In decline on west side of Cascades, perhaps due to fire suppression (see Appendix J2). Good possibility that there are not any sites in the Salmon River watershed at this time.

Conditions Limiting Interaction of Populations Between Watersheds:
Not known, need more information.

OTHER PLANT SPECIES OF CONCERN

TERRESTRIAL MODULE Questions C1 ,2 3.

Species which were outside the scope of the EIS and which are deemed to be at risk.

Listed below are plant species on our sensitive plant list or the Oregon Natural Heritage Program list with documented occurrences in the Salmon River Watershed. Plants on our sensitive plant list that are also C3 species are not listed below. See document entitled "Salmon River Watershed Analysis: Fungi, Lichens, Bryophytes and Vascular Plants" for information on those species.

Of the species listed below, all except fir clubmoss live in wet meadows. Most sites are in the Salmon River Meadows complex. The importance of wet meadows in the Salmon River Watershed as a special botanical habitat needs to be strongly emphasized in the watershed analysis process.

MTH 94 / FWS 93 / ONHP 95 / ODA
Carex buxbaumii, Buxbaum's sedge / inv. / 4
Carex livida, pale sedge / sens. / 2
Eriophorum polystachion, cotton grass / inv. / 4
Huperzia occidentale, fir clubmoss / sens. / 2
Scheuchzeria palustris var. americana, / sens. / 2 /*scheuchzeria*
Sisyrinchium sarmentosum, pale blue-eyed grass / sens. / C2 / 1 / C
Utricularia minor, lesser bladderwort / sens. / 2
Vaccinium oxycoccus, wild cranberry / inv. / 4

The following questions from the Terrestrial Module are addressed below for each species listed in the table above:

- C1. What is the basis for concluding that viability of the species is at risk?
- C2. What are the activities or trends in population or habitat that place the species at risk?
- C3. What is the role of this watershed in the maintenance of the species population?

Carex buxbaumii, Buxbaum's sedge

Pepper Meadows, T3S R8E sec 11
Peeled Cedar Meadow, T3S R8E sec 36
Jackpot Meadow, T4S R8E sec 25

This sedge is known from small wet meadows in the Mud Creek area and from Jackpot Meadow. No other sites are known on the Mt. Hood NF. The species range is circumboreal with southernmost collections from central California on the west coast. Hitchcock states that it is "widespread, but seldom collected". Our sites are the only ones documented from Clackamas Co. Loss of wet meadow and bog habitat may account for placement of this species on the MTH Inventory List and ONHP List 4.

In the Mud Creek area, Buxbaum's sedge grows in a wet meadow associated with Pepper Timber Sale. 2 nearby meadows in the sale area did not have this sedge. These meadows were scheduled for prescribed burning and pothole blasting. The Buxbaum's sedge meadow was dropped from the project. No activities have been proposed at its other location in Mud Creek, Peeled Cedar Meadow below Trillium Lake. At Jackpot Meadow it grows at the opposite end of the meadow from a C3 species, *Coptis trifolia*.

Grazing in Jackpot Meadow may be impacting this sedge. During a visit to this meadow in 1993, we had a hard time locating the sedge as the area was trampled and grazed by cows.

At the most recent ONHP meeting to review their list, a move was made to drop Buxbaum's sedge off the list. It was felt that while uncommon, the population was stable in Oregon. Instead this sedge was moved from List 3 to List 4 due to recreation threats at some locations.

Carex livida, pale sedge

Salmon River Meadows, T4S R9E sec 7

Three sites have been documented for this species on the Forest; one is in Salmon River Meadows, but has not been relocated since the first record by Lois Kemp in 1987. The other two sites are in wet meadows in the Bull Run Watershed.

Hitchcock lists its range as somewhat circumboreal. On the west coast it extends into Washington, with a few sites in Oregon, and into northwest California. Besides the Mt. Hood populations, other sites are located in the Siskiyous.

The reason for the disappearance of pale sedge from Salmon River Meadow is not known. Prescribed fires burned through its location in 1989 and 1992 possibly negatively impacting the population. Not all the wet meadows in the watershed have been surveyed for pale sedge. It would be important to the population distribution in Oregon to relocate pale sedge in the Salmon River Meadows or in other wet meadows in the watershed.

Pale sedge is listed as sensitive due to the few known sites in Oregon.

Eriophorum polystachion, cotton grass

Salmon River Meadows, T4S R9E

Cotton grass is found scattered on the west side of the Oregon Cascades in Clackamas, Lane and Marion Counties. Its larger range is circumboreal in cold wet meadows. Cotton grass is considered stable but uncommon. Its distribution may be limited by the amount of suitable habitat. The Salmon River watershed is important to this species because it contains many cold wet meadows.

Huperzia occidentale, fir clubmoss

Draw Ck, T4S R8E sec 27; T4S R8E sec 34

Huperzia occidentale (formerly Lycopodium selago) is circumboreal in its distribution and nears the southern end of its range on our Forest. It is well . The populations in Draw Ck are significant in that they are the only sites in the Salmon River Watershed. Habitat is not limiting and more sites are expected to be found with further surveys, especially in the Salmon-Huckleberry Wilderness.

Historically, it may have been more abundant. Fir clubmoss favors mature-old growth riparian forest and prefers an undisturbed forest floor/streamside with well developed humus layer and woody debris. Past logging practices have altered riparian forest that might have been good habitat.

Riparian reserve guidelines should protect and help to improve its habitat.

Scheuchzeria palustris var. americana, scheuchzeria

Salmon River Meadows, T4S R8 1/2E sec 13
This variety of scheuchzeria grows from the west to the east coast of northern North America in boggy meadows, often with *Sphagnum spp.* Scheuchzeria is listed as a sensitive species because while more common elsewhere, it is rare in Oregon. Despite its rarity, a population may have hundreds of individuals. Two other sites are known for this species on the Forest, at Dinger Lake and near Little Crater Lake.

In 1992 a prescribed fire burned the shrubby edges of its meadow location but did not come near the scheuchzeria population. Only light grazing occurs now in this and associated meadows. In the past, Salmon River Meadows was heavily grazed. It is not known how grazing has shaped the species composition in these meadows.

As with some of these other species, the species may be limited in its distribution in part by lack of suitable habitat. The Salmon River watershed is important to this species by containing areas of suitable habitat.

Sisyrinchium sarmentosum, pale blue-eyed grass

High Rock, T5S R8E sec 6

Pale blue-eyed grass only has a few sites on our Forest. These sites are in the southern edge of its range. Earlier, its distribution was thought to be confined to Klickitat and Skamania counties in Washington.

This pretty member of the iris family lives in wet meadows and openings along streams and lakes. The largest site on the forest at Little Crater Lake appears stable despite grazing. It has been speculated that light grazing may be beneficial by reducing competition. The status of the High Rock site is not known and should be monitored in the near future.

Pale blue-eyed grass is the only one of the "other species" in this watershed to have a List 1 rating. Therefore maintaining and inventorying for this species in the watershed is important. Riparian reserve guidelines should adequately protect its habitat at High Rock.

Utricularia minor, lesser bladderwort

Redtop Meadows, T3S R9E sec 30
Lesser bladderwort is a carnivorous floating aquatic plant. Besides Redtop Meadows, it grows in Enid Lake in the Zigzag Watershed and also in shallow waters on Bear Springs and Clackamas RD. Its distribution is listed as circumboreal and is not common in Oregon.

This aquatic plant grows in quiet shallow waters that are often acid and draw down in the summer. It flowers infrequently and vegetative propagules are probably dispersed by waterfowl.

No impacts are occurring to its habitat in Redtop Meadows. Riparian reserve guidelines should adequately protect these plants.

Vaccinium oxycoccus, wild cranberry

Salmon River Meadows, T4S R8 1/2E sec 13
Jackpot Meadow, T4S R8E sec 24

Wild cranberry is circumboreal in distribution and grows in sphagnum bogs. On the west coast of North America, its range ends in Oregon. On the Mt. Hood NF it can be found in cold boggy meadows in the Bull Run, Salmon and Zigzag watersheds. Wild cranberry may be locally abundant but is listed as an inventory species because its habitat type is uncommon. The populations in the Bull Run and Zigzag watersheds seem stable and well-protected. Impacts from grazing in Salmon River and Jackpots Meadows have not been investigated.

NOXIOUS WEEDS AND OTHER INVASIVE NON-NATIVE SPECIES

The attached noxious weed lists for Zigzag and Bear Springs Ranger Districts show weeds that are either "New Invaders" or "Established Infestations" or "Potential Invaders". Direction for the control of noxious weeds can be found in several documents: Mt. Hood NF Land and Resource Management Plan, Mt. Hood NF Noxious Weed Management Plan and the Environmental Assessment for the Management of Noxious Weeds on the Mt. Hood NF.

Based on a roadside weed survey of the district in 1992 and personal observations, the following New Invaders and Established Infestations occur in the Salmon River Watershed:

- *Centaurea diffusa*, diffuse knapweed
- *Centaurea maculosa*, spotted knapweed
- *Cirsium arvense*, Canada thistle
- *Cytisus scoparius*, Scotch broom
- *Hypericum perforatum*, St. Johnswort
- *Senecio jacobaea*, tansy ragwort

Generally noxious weeds in the Salmon River Watershed grow in high traffic areas along roadsides and on disturbed ground. Except for an infestation of tansy ragwort in the middle of the watershed, noxious weeds are concentrated in the upper and lower sections. Occurrences tend to be light and patchy rather than dense. Though specific noxious weed surveys have not been done in the Salmon/Huckleberry and Mt. Hood Wilderness areas, noxious weeds do not appear to be a problem. Information on the known species in the watershed is given below.

NEW INVADERS AND ESTABLISHED INFESTATIONS

Centaurea diffusa, diffuse knapweed
Centaurea maculosa, spotted knapweed

The noxious weeds of highest concern in this watershed are the knapweeds due to their New Invader status. If left uncontrolled they have the potential for forming monocultures, displacing native vegetation and forage species in grazing allotments. The largest populations are on the east side of the Cascades with some creeping over to the west. Presently our infestations are limited to roadsides in the Hwy 26/35 corridor. Treatments have included hand-pulling and weed-eaters. These methods are costly and time-consuming because persistent annual treatment is necessary. The biocontrol agent, *Urophora quadrifasciata* (seedhead gall fly), is available for control but like all agents works slowly to control knapweed. For specific locations such as new satellite sites or areas where biodiversity is especially threatened, herbicide applications may be a desirable treatment.

Cirsium arvense, Canada thistle

This weed is dispersed in the upper and lower sections of the watershed. It appears in open disturbed areas such as timber sale units, skid roads and roadsides. Canada thistle will occupy space used by native plants but usually disappears as shade and native species cover increases. It is difficult to control manually as it readily resprouts from root fragments. The biocontrol agents *Urophora carduii* (stem gall fly) and *Ceutorhynchus litura* (crown/root weevil) are available for release on dense populations.

Cytisus scoparius, Scotch broom

Scotch broom is most prevalent in the lower portions of the watershed in open pastures, lots and along roadsides from the Welches area downstream. Originally from the mediterranean, it has been cultivated over time for its attractive flowers, form and hedgerow/erosion control capabilities. Left to its own devices, broom can form a monoculture effectively suppressing native vegetation. It is well established on the west side of the Cascades and is creeping east.

Control measures on federal land has included hand-pulling, cutting, and the biocontrol agent *Apion fuscirostre* (seed weevil). Private landowners may include herbicides in their tool box. Recent studies on control methods have shown cutting when drought stressed and herbicides as being most effective.

Hypericum perforatum, St. Johnswort

St.Johnswort is a widespread invader of disturbed areas in the watershed. Most commonly it grows along sandy, gravelly roadsides. It is not aggressive in displacing native vegetation like knapweed or Scotch broom. St. Johnswort is listed because it contains compounds that are toxic to white-haired animals if eaten and is therefore is a threat to livestock. Like Canada thistle, it will disappear over time with increased shade and ground cover.

Control can be achieved by the biocontrol agent, *Chrysolina quadrigema* (leaf beetle). Hand-pulling may not be effective as St. Johnswort can resprout from rhizomes.

St. Johnswort is a popular medicinal herb with many applications including depression, aches and burns and is harvested as a special forest product in the watershed.

Senecio jacobaea, tansy ragwort

Any livestock owner west of the Cascades can identify tansy ragwort. This weed is toxic to lethal to livestock. It will actively invade pastures and disturbed areas with the potential to form large stands. In the watershed it grows along roadsides and in clearcuts. A conspicuous population exists along the 5850 road in the Linney Creek area of the watershed where no other weeds are mapped. This site is recommended as a high priority for survey and treatment.

Biocontrol of tansy has been highly successful through the use of two agents, the cinnabar moth, *Tyria jacobaeae,* and the flea beetle, *Longitarsus jacobaeae*.

The cinnabar moth has been reported to munch on native Senecios however. Handpulling can be effective if done persistently on at least an annual basis. In some situations where cost and threat of further spread are of concern, herbicides could be considered.

POTENTIAL INVADERS

Of the potential invaders, the scariest one is *Lythrum salicaria*, purple loosestrife. This aggressive wetland weed can completely dominate a wetland within a couple of years. Habitat and forage are lost for waterfowl and other wildlife. Purple loosestrife can easily spread by seeds and root/stem fragments. Mechanical and chemical control methods have not been successful. A biocontrol agent is currently being tested for release.

THE WET MEADOW COMPLEXES IN THIS WATERSHED SHOULD BE CONTINUALLY MONITORED FOR PURPLE LOOSE-STRIFE INVASION.

INVASIVE NON-NATIVE SPECIES

A list of non-native plants is included with the species list for the watershed. Below are 5 species that are aggressive in displacing native plants. Plants such as these do not get listed on the State or Federal noxious weed lists because they are not usually associated with economic losses. However, these species have the potential to cause much more damage to the watershed than some of the noxious weeds listed in the section above.

Geranium robertianum, herb robert

This pretty pink geranium is a perfect weed as it can flower and fruit all year long. It prefers shade and is becoming more and more abundant along forested trails in the lower part of the Salmon River watershed. Herb robert starts along disturbed trail and road edges and spreads outwards crowding out native plants. In the Columbia Gorge, it has spread rapidly on trail systems and through the forest after the Falls Fire.

Hedera helix, English ivy

This high climbing vine is a threat to trees, native epiphytes and surronding ground cover. Forest Park in Portland is horrifying example of how aggressive English ivy can be. In the Salmon River watershed it appears to be confined to the Salmon River road and lower. An effort should be made to prevent its spread further into the watershed.

Polygonum cuspidatum, Japanese knotweed

There are no reports of this giant bamboo-like plant on the Forest yet. In BLM field notes it shows up in the lower watershed on BLM and private land. Like bamboo, Japanese knotweed grows extremely fast and forms monocultures when established. Riparian areas provide ideal habitat.

Rubus discolor, Himalayan blackberry
Rubus laciniatus, evergreen blackberry

Blackberries haven't reached Forest Service land in the watershed yet. Largepatches are growing on adjacent private land and the potential for establishment is great. Unvegetated, disturbed ground invites invasion of these aggressive shrubs. Once established, control and eradication is extremely time consuming and expensive. Forest Service land in the watershed should be continually monitored for infestations. A cooperative effort with private adjacent land owners to control their blackberries is recommended.

RIPARIAN RESERVE SPECIES

Below is a modified version of Appendix 2: Bryophytes, Lichens, Fungi and Vascular Plants which lists the species that are known or could potentially occur in riparian areas within the Salmon River Watershed.

(* = C3 table species; S = Mt. Hood NF sensitive species; + = common and may occur outside riparian reserve)

BRYOPHYTES

Kurzia makinoana *
Marsupella emarginata var. aquatica *
Scouleria marginata *
Tritomaria exsectiformis *

LICHENS

Cetrelia cetrariodes *
Collema nigrescens *
Dermatocarpon luridum *
Hydrothyria venosa *
Leptogium burnetiae var. hirsutum *
Leptogium cyanescens *
Leptogium rivale *
Leptogium saturninum *
Leptogium teretiusculum *
Platismatia lacunosa *
Ramalina thrausta *
Usnea longissima *

FUNGI

Galerina sphagnicola *
Helvella compressa *
Helvella crassitunicata *
Helvella elastica *
Helvella maculata *
Polyozellus multiplex *
Phlogiotis helvelloides
Rickenella setipes *

VASCULAR PLANTS

Adiantum pendatum
Asarum caudatum +
Botrychium minganese *S
Cimicifuga laciniata

*Coptis trifolia *S*
*Corydalis aquae-gelidae *S*
Gymnocarpium dryopteris
Habenaria saccata
Isopyrum hallii
Lysichiton americanum +
Menziesia ferruginea
Mitella breweri
Mitella caulescens
Mitella ovalis
Mitella pentandra
Poa laxiflora
Streptopus amplexifolius
Streptopus roseus
Taxus brevifolia
Tiarella laciniata
Tiarella unifoliata
Vaccinium membranaceum +
Viola glabella +

MODIFICATION OF RIPARIAN RESERVES

BRYOPHYTES, LICHENS AND FUNGI: Very little is known about the ecology of most of these species. Their distribution in the Salmon River Watershed is poorly known and surveys are difficult. It would be wise to maintain the recommended riparian buffers and not reduce widths since there is potential for their occurrence.

VASCULAR PLANTS: The ecology and distribution of the C3 Table species and sensitive species has been discussed in documents for questions B and C in the Terrestrial Module (see -----------). Some of the other species listed above are common and can occur outside riparian reserves (species with a +). Decreases in riparian reserve widths may not be detrimental to these individual species or their population as a whole in the watershed. The other vascular plants either are not that common or seem very strongly associated with riparian reserves in the Salmon River Watershed. Present riparian reserve widths assure adequate habitat for these species.

Appendix E - Wildlife

WILDLIFE GUILDS & ASSOCIATED SPECIES WITHIN SALMON R. WATERSHED

Guild	Species	Common name	Class	TES	Introduced	FEMAT	Snags
LAKEA	ANAAM	AMERICAN WIGEON	B				
LAKEA	CYCO	TUNDRA SWAN	B				
LAKEA	TRME	GREATER YELLOWLEGS	B	NHP2			
LAKEA	PHALO	RED-NECKED PHALAROPE	B				
LAKEARE	RAPR	SPOTTED FROG	A	C1			
LAKERE	BOLE	AMERICAN BITTERN	B				
LAKERE	CALMA	WESTERN SANDPIPER	B				
LAKERE	CAMII	LEAST SANDPIPER	B				
LAKERE	LISC	LONG-BILLED DOWITCHER	B				
LAKERE	PORCA	SORA	B				
LAKERE	RALI	VIRGINIA RAIL	B				
LKRVA	DICO	COPE'S GIANT SALAMANDER	A	RFS		Y	
LKRVA	RACAT	BULLFROG	A		IN		
LKRVA	ANAC	NORTHERN PINTAIL	B				
LKRVA	ANCL	NORTHERN SHOVELER	B				
LKRVA	ANCR	GREEN-WINGED TEAL	B				
LKRVA	ANDI	BLUE-WINGED TEAL	B				
LKRVA	ANST	GADWALL	B				
LKRVA	RFS	COMMON LOON	B	RFS			
LKRVARG	ARHE	GREAT BLUE HERON	B				
LKRVARG	AYCO	RING-NECKED DUCK	B	NHP4			
LKRVARG	BUAL	BUFFLEHEAD	B	ORS			
LKRVARG	HALE	BALD EAGLE	B	T			
LKRVARG	PAHA	OSPREY	B				Y
LKRVARG	POPO	PIED-BILLED GREBE	B				
LKRVARG	CASCA	BEAVER	M				
LKRVARG	LUCA	RIVER OTTER	M				
LKRVARM	DITE	PACIFIC GIANT SALAMANDER	A				
LKRVARM	AISP	WOOD DUCK	B				Y
LKRVARM	BUIS	BARROW'S GOLDENEYE	B	ORS			Y
LKRVARM	CEAL	BELTED KINGFISHER	B				
LKRVARM	MERME	COMMON MERGANSER	B				Y
LKRVARM	SOBE	PACIFIC WATER SHREW	M				
LKRVARM	SOPAL	WATER SHREW	M				
LKRVRE	ACMA	SPOTTED SANDPIPER	B				
LKRVRE	AGPH	RED-WINGED BLACKBIRD	B				
LKRVRE	CHVO	KILLDEER	B				
LKRVRE	GAGA	COMMON SNIPE	B				
LKRVRE	GETR	COMMON YELLOWTHROAT	B				
RIVA	ASTR	TAILED FROG	A	ORS		Y	
RIVARML	RHYCA	CASCADE TORRENT SALAMANDER	A	ORS		Y	
RIVARML	CIME	AMERICAN DIPPER	B				
RIVARML	HIHI	HARLEQUIN DUCK	B	C2			
RIVRE	ICVI	YELLOW-BREASTED CHAT	B				
RIVRML	PLDU	DUNN'S SALAMANDER	A				
SPCL	CICY	NORTHERN HARRIER	B				
SPCL	FAPE	PEREGRINE FALCON	B	E			
SPCL	GRCA	SANDHILL CRANE	B	RFS			
SPCL	HIPY	CLIFF SWALLOW	B				
SPCL	HIRU	BARN SWALLOW	B				
SPCL	PADO	HOUSE SPARROW	B		IN		
SPCL	MUMU	HOUSE MOUSE	M		IN		
SPCL	MYOCI	WESTERN SMALL-FOOTED MYOTIS	M				
SPCL	NECI	BUSHY-TAILED WOODRAT	M				
SPCL	PLTO	TOWNSEND'S BIG-EARED BAT	M	C2			
SPCL	RANO	NORWAY RAT	M		IN		
TLC	AQCH	GOLDEN EAGLE	B				
TLC	BUJA	RED-TAILED HAWK	B				

Guild	Species	Common name	Class	TES	Introduced	FEMAT	Snags
TLC	BUVI	GREAT HORNED OWL	B				
TLC	CATAU	TURKEY VULTURE	B				
TLC	CEEL	ELK	M				
TLC	STRNE	GREAT GRAY OWL	B				
TLGG	COBR	AMERICAN CROW	B				
TLGG	CORCO	COMMON RAVEN	B				
TLGG	CANLA	COYOTE	M				
TLGG	FECO	MOUNTAIN LION	M				
TLGG	FERU	BOBCAT	M				
TLGG	URAM	BLACK BEAR	M				
TLGG	URCI	GRAY FOX	M				
TLME	BULA	ROUGH-LEGGED HAWK	B				
TLME	VUVU	RED FOX	M				
TLML	ACGE	NORTHERN GOSHAWK	B	C2			
TLML	DRPI	PILEATED WOODPECKER	B	ORS			Y
TLML	STOCCA	NORTHERN SPOTTED OWL	B	T			
TLML	STVA	BARRED OWL	B				Y
TLML	GUGU	WOLVERINE	M	C2			
TLML	MAAM	MARTEN	M	ORS		Y	Y
TLML	MAPE	FISHER	M	C2		Y	Y
TMC	FASP	AMERICAN KESTREL	B				Y
TMC	STVU	EUROPEAN STARLING	B		IN		Y
TMC	TYAL	BARN OWL	B				Y
TMC	EPFU	BIG BROWN BAT	M				Y
TMC	LANO	SILVER-HAIRED BAT	M			Y	Y
TMC	MYOCA	CALIFORNIA MYOTIS	M				Y
TMGG	ACCCO	COOPER'S HAWK	B				
TMGG	ACST	SHARP-SHINNED HAWK	B				
TMGG	AEAC	NORTHERN SAW-WHET OWL	B				Y
TMGG	CHMI	COMMON NIGHTHAWK	B				
TMGG	COAU	NORTHERN FLICKER	B				Y
TMGG	MEGA	WILD TURKEY	B		IN		
TMGG	PECA	GRAY JAY	B				
TMGG	DIVI	VIRGINIA OPOSSUM	M		IN		Y
TMGG	ERDO	PORCUPINE	M				
TMGG	LACI	HOARY BAT	M			Y	
TMGG	MUFR	LONG-TAILED WEASEL	M				
TMGG	MUVI	MINK	M				
TMGG	MYEV	LONG-EARED MYOTIS	M			Y	Y
TMGG	MYVO	LONG-LEGGED MYOTIS	M			Y	Y
TMGG	MYYU	YUMA MYOTIS	M				Y
TMGG	ODHE	BLACK-TAILED & MULE DEER	M				
TMME	FACO	MERLIN	B	NHP2			
TMME	SPGR	WESTERN SPOTTED SKUNK	M				
TMML	PIAR	BLACK-BACKED WOODPECKER	B	ORS		Y	Y
TMML	PITR	THREE-TOED WOODPECKER	B	ORS			Y
TSC	CACAS	CASSIN'S FINCH	B				
TSC	COBO	OLIVE-SIDED FLYCATCHER	B				
TSGEM	DEPET	YELLOW WARBLER	B				
TSGEM	EMTR	WILLOW FLYCATCHER	B				
TSGEM	ICGA	NORTHERN ORIOLE	B				
TSGEM	PAAT	BLACK-CAPPED CHICKADEE	B				Y
TSGEM	PAIL	FOX SPARROW	B				
TSGEM	THBE	BEWICK'S WREN	B				
TSGEM	TRAE	HOUSE WREN	B				Y
TSGG	AMGR	NORTHWESTERN SALAMANDER	A				
TSGG	AMMA	LONG-TOED SALAMANDER	A				
TSGG	ANFE	CLOUDED SALAMANDER	A	ORS			
TSGG	BAWR	OREGON SLENDER SALAMANDER	A	ORS		Y	

Guild	Species	Common name	Class	TES	Introduced	FEMAT	Snags
TSGG	BUBO	WESTERN TOAD	A	ORS			
TSGG	ENES	ENSATINA	A				
TSGG	PLVE	WESTERN RED-BACKED SALAMANDE	A				
TSGG	PSRE	PACIFIC TREEFROG	A				
TSGG	RAAU	RED-LEGGED FROG	A	C2			
TSGG	RACAS	CASCADES FROG	A				
TSGG	TAGR	ROUGH-SKINNED NEWT	A				
TSGG	BOCE	CEDAR WAXWING	B				
TSGG	BOUM	RUFFED GROUSE	B				
TSGG	CAGU	HERMIT THRUSH	B				
TSGG	CARPI	PINE SISKIN	B				
TSGG	CARPU	PURPLE FINCH	B				
TSGG	CAUS	SWAINSON'S THRUSH	B				
TSGG	CHVA	VAUX'S SWIFT	B				Y
TSGG	COFA	BAND-TAILED PIGEON	B				
TSGG	COSO	WESTERN WOOD-PEWEE	B				
TSGG	COVE	EVENING GROSBEAK	B				
TSGG	CYST	STELLER'S JAY	B				
TSGG	DENCO	YELLOW-RUMPED WARBLER	B				
TSGG	DENI	BLACK-THROATED GRAY WARBLER	B				
TSGG	DEOB	BLUE GROUSE	B				
TSGG	EMHA	HAMMOND'S FLYCATCHER	B				
TSGG	GLGN	NORTHERN PYGMY-OWL	B	ORS			Y
TSGG	IXNA	VARIED THRUSH	B				
TSGG	JUHY	DARK-EYED JUNCO	B				
TSGG	LOXCU	RED CROSSBILL	B				
TSGG	MELME	SONG SPARROW	B				
TSGG	MOAT	BROWN-HEADED COWBIRD	B				
TSGG	MYTO	TOWNSEND'S SOLITAIRE	B				
TSGG	NUCO	CLARK'S NUTCRACKER	B				
TSGG	OTKE	WESTERN SCREECH-OWL	B				Y
TSGG	PARGA	MOUNTAIN CHICKADEE	B				Y
TSGG	PARU	CHESTNUT-BACKED CHICKADEE	B				Y
TSGG	PHME	BLACK-HEADED GROSBEAK	B				
TSGG	PIEN	PINE GROSBEAK	B	NHP3			
TSGG	PIER	RUFOUS-SIDED TOWHEE	B				
TSGG	PILU	WESTERN TANAGER	B				
TSGG	PIVI	HAIRY WOODPECKER	B				Y
TSGG	RECA	RUBY-CROWNED KINGLET	B				
TSGG	RESA	GOLDEN-CROWNED KINGLET	B				
TSGG	SELRU	RUFOUS HUMMINGBIRD	B				
TSGG	SICAN	RED-BREASTED NUTHATCH	B				Y
TSGG	SICAR	WHITE-BREASTED NUTHATCH	B				Y
TSGG	SIPY	PYGMY NUTHATCH	B	ORS			Y
TSGG	SPNU	RED-NAPED SAPSUCKER	B				Y
TSGG	SPPAS	CHIPPING SPARROW	B				
TSGG	SPRU	RED-BREASTED SAPSUCKER	B				Y
TSGG	TABI	TREE SWALLOW	B				Y
TSGG	TATH	VIOLET-GREEN SWALLOW	B				Y
TSGG	TRTR	WINTER WREN	B				
TSGG	TUMI	AMERICAN ROBIN	B				
TSGG	VERU	NASHVILLE WARBLER	B				
TSGG	VIGI	WARBLING VIREO	B				
TSGG	VIHU	HUTTON'S VIREO	B				
TSGG	VISO	SOLITARY VIREO	B				
TSGG	WIPU	WILSON'S WARBLER	B				
TSGG	ZEMA	MOURNING DOVE	B				
TSGG	APRU	MOUNTAIN BEAVER	M				
TSGG	LEAM	SNOWSHOE HARE	M				

Guild	Species	Common name	Class	TES	Introduced	FEMAT	Snags
TSGG	MIOR	CREEPING VOLE	M				
TSGG	MUER	ERMINE	M				
TSGG	PEMA	DEER MOUSE	M				
TSGG	PRLO	RACCOON	M				Y
TSGG	SCIGR	WESTERN GRAY SQUIRREL	M				Y
TSGG	SCOR	COAST MOLE	M				
TSGG	SOBA	BAIRD'S SHREW	M				
TSGG	SOMO	DUSKY SHREW	M				
TSGG	SOVA	VAGRANT SHREW	M				
TSGG	SPLA	GOLDEN-MANTLED GROUND SQUIRR	M				
TSGG	SYBA	BRUSH RABBIT	M				
TSGG	TADO	DOUGLAS' SQUIRREL	M				Y
TSGG	TATO	TOWNSEND'S CHIPMUNK	M				
TSGG	ZATR	PACIFIC JUMPING MOUSE	M				
TSGG	CHBO	RUBBER BOA	R				
TSGG	DIPU	RINGNECK SNAKE	R				
TSGG	ELCO	NORTHERN ALLIGATOR LIZARD	R				
TSGG	EUSK	WESTERN SKINK	R				
TSGG	SCOC	WESTERN FENCE LIZARD	R				
TSGML	CEAM	BROWN CREEPER	B				Y
TSGML	DEOC	HERMIT WARBLER	B				
TSGML	DETO	TOWNSEND'S WARBLER	B				
TSGML	PIPU	DOWNY WOODPECKER	B				Y
TSGML	CLCA	WESTERN RED-BACKED VOLE	M				
TSME	APCO	SCRUB JAY	B				
TSME	CATR	AMERICAN GOLDFINCH	B				
TSME	EUCY	BREWER'S BLACKBIRD	B				
TSME	PSMI	BUSHTIT	B				
TSME	STCAL	CALLIOPE HUMMINGBIRD	B				
TSPE	ANSPI	AMERICAN PIPIT (WATER PIPIT)	B				
TSPE	ERAL	HORNED LARK	B				
TSPE	MELI	LINCOLN'S SPARROW	B				
TSPE	OPTO	MACGILLIVRAY'S WARBLER	B				
TSPE	PASA	SAVANNAH SPARROW	B				
TSPE	PASAM	LAZULI BUNTING	B				
TSPE	PHCO	RING-NECKED PHEASANT	B		IN		
TSPE	SICU	MOUNTAIN BLUEBIRD	B				Y
TSPE	SIME	WESTERN BLUEBIRD	B	ORS			Y
TSPE	VECE	ORANGE-CROWNED WARBLER	B				
TSPE	ZOAT	GOLDEN-CROWNED SPARROW	B				
TSPE	ZOLE	WHITE-CROWNED SPARROW	B				
TSPE	MAFL	YELLOW-BELLIED MARMOT	M				
TSPE	MILO	LONG-TAILED VOLE	M				
TSPE	MITO	TOWNSEND'S VOLE	M				
TSPE	PHIN	HEATHER VOLE	M				
TSPE	SCTO	TOWNSEND'S MOLE	M				
TSPE	SPBEE	CALIFORNIA GROUND SQUIRREL	M				
TSPE	THMA	WESTERN POCKET GOPHER	M				
TSPE	COLCO	RACER	R				
TSPE	PICA	GOPHER SNAKE	R				
TSPE	THOR	NORTHWESTERN GARTER SNAKE	R				
TSPE	THSI	COMMON GARTER SNAKE	R				
TSPL	EMDI	PACIFIC SLOPE FLYCATCHER	B				
TSPL	GLSA	NORTHERN FLYING SQUIRREL	M				Y
TSPL	NEGI	SHREW-MOLE	M				
TSPL	PHELO	RED TREE VOLE	M	C-3		Y	
TSPL	SOTR	TROWBRIDGE'S SHREW	M				

Class:
- A = amphibian
- B = bird
- M = mammal
- R = reptile

Introduced:
- IN = introduced species

Snags:
- 1 = snag dependent species

FEMAT:
- Y = less than 80% probability of achieving outcome A under Option 9

TES:
- T = Federally threatened species
- E = Federally endangered species
- C2 = Federal candidate species
- RFS = Forest Service sensitive
- NHP1-4 = Oregon Natural Heritage Program listed
- ORS = Oregon State sensitive

ANALYSIS OF MT. HOOD FOREST PLAN ALLOCATIONS FOR PILEATED WOODPECKER AND PINE MARTEN AREAS (AN IMPLEMENTATION STEP OF THE NORTHWEST FOREST PLAN)

To: Forest Plan ID Team
  : Laura Ceperley, Planning Staff

From: Project '95

INTRODUCTION

On page C-3 of the Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl (ROD), under item 2, it is stated:

> "Administratively withdrawn Areas that are specified in current plans and draft plan preferred alternatives to benefit American martens, pileated woodpeckers, and other late-successional species are returned to the matrix unless local knowledge indicates that other allocations and these standards and guidelines will not meet the objectives for these species".

In June 1994, the Mt. Hood N.F. Project 94 group recognized that a forest wide analysis was needed to address the distribution and disposition of the Mt. Hood Forest Plan's B5 pileated woodpecker and pine marten land allocations as they occur in the matrix allocations. This document (with associated maps) represents that analysis.

The purpose of the B5 management areas as stated in the Mt. Hood Forest Plan (p.FOUR-240-1) is to:

> "Provide Forestwide mature or old-growth forest habitat blocks of sufficient quality, quantity and distribution to sustain viable populations of pileated woodpecker an pine marten. A secondary goal is to maintain a healthy forest condition through a variety of timber management practices."

A methodology (screening process) was developed to assess the relative importance of individual B5 areas in the matrix based on their respective contribution to achieving and maintaining a "functional and interconnected old growth ecosystem" (ROD p.5).

This analysis was completed across the Mt. Hood NF portions of the Willamette and Deschutes Provinces. It serves as a basin scale, cursory analysis of providing habitat for these late seral species. Site specific analysis for some watersheds on Forest are available, but are not included within this report. Results for this analysis report are expected to be useful in future Forest planning activities at the Forest scale and in future initiation or iteration of analysis at the watershed scale.

This report should be considered analysis. It is not a series of recommendations or decisions. It is intended to provide data from which a recommendation for a decision can be made.

OBJECTIVES

1) Implement the ROD, provide analysis to help clarify land allocations regarding pileated woodpecker and American marten on the Mt. Hood National Forest.

2) Analyze the contribution of each identified B5 management area to providing a functional and interconnected old-growth forest ecosystem, particularly as it relates to habitat for the pileated woodpecker and the American marten.

3) Identify B5 management areas that are either not warranted or whose retention as a designated management area is warranted.

ASSUMPTIONS

1. Refinement of this analysis will take place during ecosystem analysis.

2. This analysis only addresses terrestrial late-seral associated vertebrates. Riparian dependent species are covered by Riparian Reserves.

4. Focus will be primarily at the watershed landscape scale or greater.

5. Critical Habitat Units as designated by US Fish and Wildlife Service for the northern spotted owl are not counted on to contribute late seral habitat.

6. Wilderness, and other congressionally withdrawn areas, as well as, land allocations administratively withdrawn from programmed timber harvest, will provide late seral habitat (now and in the future) that are well distributed across the land allocations.

7. It is assumed that the contribution of other standards and guidelines will benefit late seral species (eg. riparian reserves, survey and manage strategy, green tree retention).

THE PROCEDURE

This analysis procedure started by "screening out" any B5 area that was in reserved land allocations. The result was map that consisted of B5 areas in the matrix allocation. There are a total of 448 B5 management areas on Forest; 240 are found in the matrix allocation and this analysis focused only on those 240 B5 areas. The 240 B5 areas in the matrix allocation were then taken thorough the three screens described below. The procedure evaluates the respective contributions of the B5 areas to accomplishing the ROD objective of providing for a "functional and interconnected old-growth forest ecosystem." (ROD. p.5)

Screen 1. Relation to the Northwest Forest Plan Land Allocations

The 240 B5 areas were reviewed for their relationship to the Northwest Forest Plan land allocations. B5 areas in the matrix that were immediately adjacent to late successional reserves, congressionally reserved areas and administratively withdrawn areas were screened out due to the desired future conditions afforded by these land allocations. It is assumed that these withdrawn areas regardless of their current condition will progress to a late seral stage in the future. Out of 240 B5 areas in 24 watersheds that entered screen 1, 25 B5 areas in 13 watersheds progress to Screen 2. Refer to Table 1, Screen 1.

Screen 2. Accumulations of Riparian Reserves

B5 areas that entered this screen were assessed for their proximity to riparian reserves, specifically stream orders 3 and 4. It was determined that B5 areas that were within areas of large concentrations of riparian reserves would be dropped from the matrix. This screen also focused on connectivity of the B5 area to each other and other land allocations. Out of 23 B5 areas that entered screen 2, 21 B5 areas in 13 watersheds progress to Screen 3. Refer to Table 1, Screen 2.

Screen 3. Existing Local Knowledge

Screen 3 captured existing local knowledge at the field level. Screen 1 thru 2 were based on province, basin and forest scale mapping and modeling with inherent relative error. Screen 3 used the same concepts as screen 1-2 but took advantage of local data with greater resolution. For example, a given B5 area could be "screened out" by screen 1 based solely on it's juxtaposition to a wilderness area; without regard to existing habitat conditions within the wilderness. Screen 3 provided the opportunity to efficiently gain further clarification of the analysis results by tapping knowledgeable individuals and gleaning from existing field analysis and mapping; i.e. without a further, more detailed analysis process.

One additional criterion was applied in Screen 3, existing knowledge of American marten presence within or near the designated B5 area. Local interdisciplinary discretion was used in applying this criterion.

Results

Based on this analysis, B5 areas were separated into two categories: A) those that should be returned to the matrix. Out of 240 B5 areas, 219 are identified to not be retained with the B5 designation. B) B5 areas which should be retained, at least in the short term, because of their strategic contribution to late seral habitat conditions at the landscape level.

Out of 240 B5 areas in the matrix, 21 are identified for retention. Refer to Table 2 for a listing of individual areas by watershed.

The 21 B5 pileated woodpecker and pine marten management areas (Table 2) should be further analyzed in Ecosystem Analysis (formerly Watershed Analysis). Criteria to consider include:

*amount and distribution of Late Seral (LS) habitat within the watershed (using more refined data).

*quality of LS habitat within the watershed not subject to programmed timber harvest, e.g. interior habitat, standing or down coarse woody debris.

*proximity to riparian reserves and unmapped 100 acre spotted owl late successional reserves.

*projected rate of removal of existing LS habitat.

*presence of high quality LS blocks and potential for relocating the B5.

TABLE 1

ILLUSTRATION OF WATERSHEDS AND B5 MANAGEMENT AREAS PROGRESSING THOUGH SCREENS

WILLAMETTE PROVINCE

# WATERSHED NAME	SCREEN 1	SCREEN 2	SCREEN 3	RETAIN ?
LOWER COLUMBIA RIVER BASIN:				
1 BULL RUN RIVER	7			0
2 SANDY RIVER	4			1
3 ZIGZAG RIVER	3			0
4 SALMON RIVER	15			0
5 COLUMBIA GORGE TRIBS EAST	3			0
6 LITTLE SANDY RIVER	2			0
7 GORDON-THOMPSON CREEK	2			0
WILLAMETTE RIVER BASIN:				
8 LOWER CLACKAMAS R.	12			0
9 SOUTH FORK CLACKAMAS RIVER	1			0
10 OAK GROVE FORK CLACKAMAS RIVER	24			4
11 COLLAWASH RIVER	20	2		1
12 UPPER CLACKAMAS R.	30	2		1
13 FISH CREEK	5			1
14 EAGLE CREEK	4			0
15 NORTH FORK CLACKAMAS RIVER	4			1
16 HOT SPRINGS FORK CLACKAMAS RIVER	7			1
SUBTOTAL OF WATERSHEDS:	9	0	0	7
SUBTOTAL B5 MGT. AREAS "SCREENED OUT":	**143**	**4**	**0**	**10**

NOTE: The numbers in the SCREENS 1-3 reflect the individual B5 areas in the matrix that were screened out. The numbers in the RETAIN? column reflect B5 areas to be retained in the watershed.

DESCHUTES PROVINCE

# WATERSHED NAME	SCREEN 1	SCREEN 2	SCREEN 3	RETAIN ?
MIDDLE COLUMBIA RIVER BASIN:				
17 WEST FORK HOOD R.	12			2
18 EAST FORK HOOD R.	20			0
19 MILL CREEK	2			1
20 MILES CREEKS	2			2
21 MIDDLE FORK HOOD R.	1			2
DESCHUTES RIVER BASIN:				
22 WHITE RIVER	20			3
23 BADGER-TYGH CREEK	8			0
24 ROCK-THREE MILE CR.	7			1
TOTAL WATERSHEDS: (total of 24)	11	0	0	13
TOTAL B5 MGT. AREAS "SCREENED OUT": (total of 240)	215	4	0	21

TABLE 2

B5 AREAS RECOMMENDED FOR RETENTION AND FURTHER ANALYSIS IN ECOSYSTEM ANALYSIS

WILLAMETTE PROVINCE

WATERSHED NAME	PINE MARTEN CODE	WOODPECKER CODE
LOWER COLUMBIA RIVER BASIN:		
SANDY RIVER		9081W
WILLAMETTE RIVER BASIN:		
OAK GROVE FORK/ CLACKAMAS RIVER		3171W, 2041W, 2101W 3111W
COLLAWASH RIVER		5111W
NORTH FORK CLACKAMAS RIVER	5021M	
FISH CREEK	5261M	
UPPER CLACKAMAS RIVER	3281M	
HOT SPRINGS FORK COLLAWASH RIVER		5131W

DESCHUTES PROVINCE

WATERSHED NAME	PINE MARTEN CODE	WOODPECKER CODE
MIDDLE COLUMBIA RIVER BASIN:		
WEST FORK HOOD RIVER	6211M 6161M	
MILL CREEK		6061W
MILE CREEKS	1011M	1081W
MIDDLE FORK HOOD RIVER	6131M	6081W
DESCHUTES RIVER BASIN:		
ROCK-CREEK THREE MILE CREEKS	1031M	
WHITE RIVER		2011W 2061W 2111W
TOTAL B5 AREAS TO RETAIN : (21 areas in 13 watersheds)	8	13

SALMON RIVER WATERSHED — count associated w/ S+H habitat
(all 3 EAU's)

2/16/94

SPECIES ASSOCIATED WITH SPECIAL AND UNIQUE HABITATS

Species	Species_description	EAU	Special_habitat
HIPY	cliff swallow	120	BRIDGES
HIRU	barn swallow	120	BRIDGES
MYVO	long-legged myotis	120	BRIDGES
MYYU	Yuma myotis	120	BRIDGES

Count of Species Associated with BRIDGES : 4

Species	Species_description	EAU	Special_habitat
DIVI	Virginia opossum	114	BUILDINGS
EPFU	big brown bat	114	BUILDINGS
HIPY	cliff swallow	114	BUILDINGS
HIRU	barn swallow	114	BUILDINGS
LANO	silver-haired bat	114	BUILDINGS
MUMU	house mouse	114	BUILDINGS
MYEV	long-eared myotis	114	BUILDINGS
MYOCA	California myotis	114	BUILDINGS
MYVO	long-legged myotis	114	BUILDINGS
MYYU	Yuma myotis	114	BUILDINGS
PADO	house sparrow	114	BUILDINGS
RANO	Norway rat	114	BUILDINGS
STVU	European starling	114	BUILDINGS
TYAL	barn owl	114	BUILDINGS

Count of Species Associated with BUILDINGS : 14

AGPH	red-winged blackbird	114	SHRUB_WETLAND
AISP	wood duck	114	SHRUB_WETLAND
ANAAM	American wigeon	114	SHRUB_WETLAND
ANAC	northern pintail	114	SHRUB_WETLAND
ANCL	northern shoveler	114	SHRUB_WETLAND
ANCR	green-winged teal	114	SHRUB_WETLAND
ANCY	cinnamon teal	114	SHRUB_WETLAND
ANPL	mallard	114	SHRUB_WETLAND
APRU	mountain beaver	114	SHRUB_WETLAND
ARHE	great blue heron	114	SHRUB_WETLAND
BOCE	cedar waxwing	114	SHRUB_WETLAND
BOUM	ruffed grouse	114	SHRUB_WETLAND
BRCA	Canada goose	114	SHRUB_WETLAND
BUBO	western toad	114	SHRUB_WETLAND
BULA	rough-legged hawk	114	SHRUB_WETLAND
CAGU	hermit thrush	114	SHRUB_WETLAND
CALAT	coyote	114	SHRUB_WETLAND
CAPI	pine siskin	114	SHRUB_WETLAND
CASCAN	beaver	114	SHRUB_WETLAND

Species	Species_description	EAU	Special_habitat
CATR	American goldfinch	114	SHRUB_WETLAND
CAUS	Swainson's thrush	114	SHRUB_WETLAND
CEAL	belted kingfisher	114	SHRUB_WETLAND
CEEL	elk	114	SHRUB_WETLAND
CHMI	common nighthawk	114	SHRUB_WETLAND
CHVA	Vaux's swift	114	SHRUB_WETLAND
CICY	northern harrier	114	SHRUB_WETLAND
COBR	American crow	114	SHRUB_WETLAND
COFA	band-tailed pigeon	114	SHRUB_WETLAND
CORCO	common raven	114	SHRUB_WETLAND
COVE	evening grosbeak	114	SHRUB_WETLAND
DENCO	yellow-rumped warbler	114	SHRUB_WETLAND
DENI	black-throated gray warbler	114	SHRUB_WETLAND
DEPE	yellow warbler	114	SHRUB_WETLAND
DIVI	Virginia opossum	114	SHRUB_WETLAND
EMHA	Hammond's flycatcher	114	SHRUB_WETLAND
EMTR	willow flycatcher	114	SHRUB_WETLAND
EPFU	big brown bat	114	SHRUB_WETLAND
ERDO	porcupine	114	SHRUB_WETLAND
EUCY	Brewer's blackbird	114	SHRUB_WETLAND
FACO	merlin	114	SHRUB_WETLAND
FAPE	peregrine falcon	114	SHRUB_WETLAND
FUAM	American coot	114	SHRUB_WETLAND
GETR	common yellowthroat	114	SHRUB_WETLAND
GRCA	sandhill crane	114	SHRUB_WETLAND
HALE	bald eagle	114	SHRUB_WETLAND
HIHI	harlequin duck	114	SHRUB_WETLAND
HIRU	barn swallow	114	SHRUB_WETLAND
ICVI	yellow-breasted chat	114	SHRUB_WETLAND
JUHY	dark-eyed junco	114	SHRUB_WETLAND
LACI	hoary bat	114	SHRUB_WETLAND
LUCA	river otter	114	SHRUB_WETLAND
LYRU	bobcat	114	SHRUB_WETLAND
MELI	Lincoln's sparrow	114	SHRUB_WETLAND
MELME	song sparrow	114	SHRUB_WETLAND
MEMEP	striped skunk	114	SHRUB_WETLAND
MILO	long-tailed vole	114	SHRUB_WETLAND
MIOR	creeping vole	114	SHRUB_WETLAND
MOAT	brown-headed cowbird	114	SHRUB_WETLAND
MUVI	mink	114	SHRUB_WETLAND
MYOCI	western small-footed myotis	114	SHRUB_WETLAND
MYVO	long-legged myotis	114	SHRUB_WETLAND
MYYU	Yuma myotis	114	SHRUB_WETLAND
NECI	bushy-tailed woodrat	114	SHRUB_WETLAND
ODHE	mule deer and black-tailed deer	114	SHRUB_WETLAND
OPTO	MacGillivray's warbler	114	SHRUB_WETLAND

Species	Species_description	EAU	Special_habitat
OTKE	western screech-owl	114	SHRUB_WETLAND
PAAMO	lazuli bunting	114	SHRUB_WETLAND
PAAT	black-capped chickadee	114	SHRUB_WETLAND
PAIL	fox sparrow	114	SHRUB_WETLAND
PECA	gray jay	114	SHRUB_WETLAND
PHME	black-headed grosbeak	114	SHRUB_WETLAND
PIER	rufous-sided towhee	114	SHRUB_WETLAND
PILU	western tanager	114	SHRUB_WETLAND
POPO	pied-billed grebe	114	SHRUB_WETLAND
PRLO	raccoon	114	SHRUB_WETLAND
PSRE	Pacific treefrog	114	SHRUB_WETLAND
RAAU	red-legged frog	114	SHRUB_WETLAND
RANCA	Cascade frog	114	SHRUB_WETLAND
RECA	ruby-crowned kinglet	114	SHRUB_WETLAND
SCOR	coast mole	114	SHRUB_WETLAND
SERUF	rufous hummingbird	114	SHRUB_WETLAND
SIME	western bluebird	114	SHRUB_WETLAND
SOBA	Baird's shrew	114	SHRUB_WETLAND
SOBE	Pacific water shrew	114	SHRUB_WETLAND
SPPA	chipping sparrow	114	SHRUB_WETLAND
SPPU	spotted skunk	114	SHRUB_WETLAND
STVA	barred owl	114	SHRUB_WETLAND
TABI	tree swallow	114	SHRUB_WETLAND
TATH	violet-green swallow	114	SHRUB_WETLAND
THBE	Bewick's wren	114	SHRUB_WETLAND
THSI	common garter snake	114	SHRUB_WETLAND
TUMI	American robin	114	SHRUB_WETLAND
URAM	black bear	114	SHRUB_WETLAND
VECE	orange-crowed warbler	114	SHRUB_WETLAND
VIGI	warbling vireo	114	SHRUB_WETLAND
VIHU	Hutton's vireo	114	SHRUB_WETLAND
WIPU	Wilson's warbler	114	SHRUB_WETLAND
ZATR	Pacific jumping mouse	114	SHRUB_WETLAND
ZOAT	golden-crowned sparrow	114	SHRUB_WETLAND
ZOLE	white-crowned sparrow	114	SHRUB_WETLAND

Count of Species Associated with SHRUB_WETLAND : 100

CHMI	common nighthawk	114	TALUS
EUSK	western skink	114	TALUS
FECO	mountain lion	114	TALUS
LEAR	rosy finch	114	TALUS
LYRU	bobcat	114	TALUS

Species	Species_description	EAU	Special_habitat
MAFL	yellow-bellied marmot	114	TALUS
MAPE	fisher	114	TALUS
MILO	long-tailed vole	114	TALUS
MUER	ermine	114	TALUS
MYOCI	western small-footed myotis	114	TALUS
NECI	bushy-tailed woodrat	114	TALUS
PEMA	deer mouse	114	TALUS
PLDU	Dunn's salamander	114	TALUS
PLVE	western redback salamander	114	TALUS
SCOC	western fence lizard	114	TALUS
SPLA	golden-mantled ground squirrel	114	TALUS
SPPU	spotted skunk	114	TALUS
TATO	Townsend's chipmunk	114	TALUS
THOR	northwestern garter snake	114	TALUS
URAM	black bear	114	TALUS

Count of Species Associated with TALUS : 20

ACMA	spotted sandpiper	114	WET_MEADOW
AEAC	northern saw-whet owl	114	WET_MEADOW
AMGR	northwestern salamander	114	WET_MEADOW
AMMA	long-toed salamander	114	WET_MEADOW
ANAAM	American wigeon	114	WET_MEADOW
ANAC	northern pintail	114	WET_MEADOW
ANCL	northern shoveler	114	WET_MEADOW
ANCR	green-winged teal	114	WET_MEADOW
ANCY	cinnamon teal	114	WET_MEADOW
ANDI	blue-winged teal	114	WET_MEADOW
ANPL	mallard	114	WET_MEADOW
BOLE	American bittern	114	WET_MEADOW
BRCA	Canada goose	114	WET_MEADOW
BUBO	western toad	114	WET_MEADOW
CAAU	turkey vulture	114	WET_MEADOW
CALAT	coyote	114	WET_MEADOW
CAMAU	western sandpiper	114	WET_MEADOW
CAMI	Least sandpiper	114	WET_MEADOW
CAPI	pine siskin	114	WET_MEADOW
CEEL	elk	114	WET_MEADOW
CHMI	common nighthawk	114	WET_MEADOW
CHVA	Vaux's swift	114	WET_MEADOW
CHVO	killdeer	114	WET_MEADOW
CICY	northern harrier	114	WET_MEADOW
COAU	northern flicker	114	WET_MEADOW

Species	Species_description	EAU	Special_habitat
COBR	American crow	114	WET_MEADOW
CORCO	common raven	114	WET_MEADOW
CYCO	tundra (whistling) swan	114	WET_MEADOW
DEOB	blue grouse	114	WET_MEADOW
DIPU	ringneck snake	114	WET_MEADOW
EMHA	Hammond's flycatcher	114	WET_MEADOW
EPFU	big brown bat	114	WET_MEADOW
FACO	merlin	114	WET_MEADOW
FAPE	peregrine falcon	114	WET_MEADOW
FASP	American kestrel	114	WET_MEADOW
FECO	mountain lion	114	WET_MEADOW
FUAM	American coot	114	WET_MEADOW
GAGA	common snipe	114	WET_MEADOW
GRCA	sandhill crane	114	WET_MEADOW
GUGU	wolverine	114	WET_MEADOW
HALE	bald eagle	114	WET_MEADOW
HIRU	barn swallow	114	WET_MEADOW
JUHY	dark-eyed junco	114	WET_MEADOW
LOSC	Long-billed dowitcher	114	WET_MEADOW
LYRU	bobcat	114	WET_MEADOW
MELI	Lincoln's sparrow	114	WET_MEADOW
MILO	long-tailed vole	114	WET_MEADOW
MIOR	creeping vole	114	WET_MEADOW
MIRI	water vole	114	WET_MEADOW
MITO	Townsend's vole	114	WET_MEADOW
MOAT	brown-headed cowbird	114	WET_MEADOW
MUFR	long-tailed weasel	114	WET_MEADOW
MUMU	house mouse	114	WET_MEADOW
MUVI	mink	114	WET_MEADOW
MYEV	long-eared myotis	114	WET_MEADOW
MYOCA	California myotis	114	WET_MEADOW
MYOCI	western small-footed myotis	114	WET_MEADOW
MYVO	long-legged myotis	114	WET_MEADOW
NEGI	shrew-mole	114	WET_MEADOW
ODHE	mule deer and black-tailed deer	114	WET_MEADOW
OTKE	western screech-owl	114	WET_MEADOW
PASA →	savannah sparrow		
PEMA	deer mouse	114	WET_MEADOW
PLTO	Townsend's big-eared bat	114	WET_MEADOW
POCA	Sora	114	WET_MEADOW
PRLO	raccoon	114	WET_MEADOW
PSRE	Pacific treefrog	114	WET_MEADOW
RALI	Virginia rail	114	WET_MEADOW
RANCA	Cascade frog	114	WET_MEADOW
RAPR	spotted frog	114	WET_MEADOW
SCOR	coast mole	114	WET_MEADOW
SCTO	Townsend's mole	114	WET_MEADOW

Species	Species_description	EAU	Special_habitat
SERUF	rufous hummingbird	114	WET_MEADOW
SOBA	Baird's shrew	114	WET_MEADOW
SOBE	Pacific water shrew	114	WET_MEADOW
SOVA	vagrant shrew	114	WET_MEADOW
STELCA	calliope hummingbird		
SYBA	brush rabbit	114	WET_MEADOW
TABI	tree swallow	114	WET_MEADOW
TAGR	roughskin newt	114	WET_MEADOW
TATH	violet-green swallow	114	WET_MEADOW
THSI	common garter snake	114	WET_MEADOW
TRME	greater yellowlegs	114	WET_MEADOW
TUMI	American robin	114	WET_MEADOW
URAM	black bear	114	WET_MEADOW
VUVU	red fox	114	WET_MEADOW
ZATR	Pacific jumping mouse	114	WET_MEADOW

Count of Species Associated with WET_MEADOW : ~~85~~ 87

NOTE: Species listed above do not necessarily occur within these special habitats over the entire EAU. Species may be limited to certain plant communities or counties within the EAU boundary.

MEMO

OPTIONAL FORM 99 (7-90)			
FAX TRANSMITTAL		# of pages ▶ 1	
To ←		From RAY BOSCH	
Dept./Agency		Phone # 231-6179	
Fax #		Fax # 231-6195	
NSN 7540-01-317-7368	5099-101	GENERAL SERVICES ADMINISTRATION	

Date: June 2, 1995

To: Nancy Lankford, Columbia Gorge R.D.
Carol Hughes, Zig Zag R.D.
John Wells, Bear Springs R.D.

From: Ray Bosch, U.S. Fish and Wildlife Service

Subject: Critical Habitat and Wilderness Areas

At the watershed analysis meeting of May 18, the subject of spotted owl critical habitat and wilderness areas, specifically the Salmon-Huckleberry, was brought up. At the time, I was unsure as to the designation of critical habitat included within the wilderness area. I had assumed that the acres of forested habitat that are/were capable of becoming suitable spotted owl habitat within the wilderness were designated as critical habitat. Carol Hughes had, however, provided documentation that this is not the case, and that critical habitat was designated only for lands outside of the wilderness. I agreed to investigate the matter and provide some response.

I discussed the matter with Gary Miller of our office, head of our Endangered Species program. He confirmed that the designation of critical habitat did not generally include the wilderness areas, because of the fact that existing management of these areas is consistent with the management and recovery of the northern spotted owl. The concept is similar to that of LSRs not being designated within Congressionally Reserved Allocations (e.g., wilderness areas) because of existing mandated management. For the Salmon-Huckleberry, then, only the "keyhole" is designated as critical habitat (plus other areas surrounding the wilderness).

However, a major consideration of the designation of the critical habitat outside of the wilderness is the management of the wilderness itself. It is assumed that management of the wilderness is consistent with management of spotted owls. Any decisions to manage wilderness (e.g., prescribed fire plan, including human ignition fires for prescriptive purposes) needs to evaluate the potential impacts to spotted owls, since this changes the environmental baseline under which critical habitat was designated. This does not preclude the use of fire as a tool to manage ecosystem processes within the Salmon-Huckleberry (or any other wilderness); it merely identifies an important component of the wilderness that must be considered in any decision to manage it.

I hope that this provides some help and clarification for this issue. Please call me at 503-231-6179 if you have any additional questions regarding this matter.

Appendix F - Aquatic Conservation Strategy Consistency Review - Wapinitia Grazing Allotment

RECORD OF DECISION (ROD) CONSISTENCY REVIEW FOR THE
WAPINITIA GRAZING ALLOTMENT ENVIRONMENTAL ASSESSMENT (EA)
JUNE 28, 1995

Review conducted & prepared by: Dan Fissell - Range Conservationist
Chris Brun - Fish Biologist
John Wells - Wildlife Biologist

Approved by: /s/Di Ross for
Barbara Kennedy
Acting District Ranger

Date: 6/28/95

Record of Decision (ROD) Consistency Review
for the Wapinitia Grazing Allotment EA

INTRODUCTION

The need for this document arises from a couple of situations that have occurred within the past two years. First the need to update and revise the Wapinitia Grazing Allotment permit through the NEPA process (as identified in the Mt.Hood Forest Plan), and secondly the completion of the Presidents Forest Plan. The process proposed is to:

1) Conduct a consistency review between the Wapinitia EA and The Presidents Forest Plan (ROD), which this document does.
2) Issue the allotment permit for a 3 year term, in order to have all three Watershed Analysis completed that make up this area.
3) At the end of the three year term, make the necessary changes and or amendments to the Wapinitia EA.

TRANSITION STANDARDS and GUIDELINES REVIEW (ROD A-7)

The ROD provides for implementation of the following interim procedures in order to realize the goals and objectives of the management strategy while making project decisions with reasonable promptness that do not preclude long-term options or impair resources sought to be protected:

1. **WATERSHED ANALYSIS** - In the initial years of implementation for interim procedures, the process for watershed analysis is expected to evolve to meet long-term goals described in these standards and guidelines. However, some projects proposed for the first few years of implementation are in areas that require watershed analysis prior to approval of the projects (i.e., Key Watersheds, Riparian Reserves, and inventoried roadless areas). In FYs 1994-96, watershed analysis done for these projects may be less detailed than analyses that are completed in later years. Regardless, analysis done during the initial years (FY 1994-96) will comply with the following guidance:

A. **The goal of this analysis is to determine whether the proposed actions are consistent with the objectives of the Standards and Guidelines (S&Gs).**

To determine consistency, each of the standards and guidelines associated with the land allocations were reviewed and those specific to the planning area were addressed. Those S&Gs follow.

1. STANDARDS AND GUIDELINES COMMON TO ALL LAND ALLOCATIONS (ROD C-2 to C-6)

a. **Current Plans and Draft Plan Preferred Alternatives**- The standards and guidelines from the current Forest & Resource Management Plan applies where they are more restrictive or provide greater benefits to late-successional forest related species than other provisions of these standards and guidelines.
Appropriate existing standards and guidelines of the Mt Hood National Forest Land and Resource Management Plan (1990) were incorporated in the Wapinitia Grazing Allotment Environmental Assessment (1993) during the planning process.

b. **Unmapped Late-Successional Reserves**- Within the matrix, unmapped Late-Successional Reserves are identified for 100 acres around known spotted owl activity centers.
The Wapinitia Grazing Allotment was surveyed to R6 protocol. There are known pairs within the allotment area (refer to the Wapinitia EA Analysis File, Wildlife Biological Evaluation - 5/93, page 3). The Risk Assessment was determined to be a "No Risk" to species or their habitat.

c. **Watershed Analysis**- Watershed analysis is required in all Key Watersheds and all roadless areas prior to resource management. Watershed analysis is required to change Riparian Reserves widths in all watersheds. The Wapinitia Grazing Allotment has portions of both Tier 1 and Tier 2 watersheds within the planning area. The proposed project does address management within riparian reserves. The consistency review will be conducted to ensure consistency between the Wapinitia Grazing Allotment Environmental Assessment and the Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl (ROD) and Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl. This review includes a check for consistency with the transition standards and guidelines (ROD A-7) and with the Aquatic Conservation Strategy (ACS) objectives (ROD B-11) as described in the ROD.

f. **Survey and Manage**- This S & G directs the District to "survey and manage" species listed in Table C-3. Of the species present, two vascular plant species (<u>Corydalis aquae-gelidae</u> and <u>Coptis trifolia</u>) are documented and known to occur in the planning area (refer to Wapinitia EA Analysis file - Botany Biological Evaluation for Wapinitia, 11/93, page 3). Corydalis is in survey strategy 1 and 2. Strategy 1 requires the use of all available information to design or modify activities that are implemented in 1994 to protect these known sites. Activities implemented in 1995 and later must include provisions for these known sites. The Wapinitia EA prescribes protection for the two known areas where this species has been documented to occur. However at this time the livestock do not enter this area because of steepness of terrain, which basically makes the area inaccessible. Monitoring of this species occurs annually, so if data indicates changes in management needed, the EA provides for mitigation measures for protection. Strategy 2 requires surveys for Table C-3 species prior to ground disturbing activities that are implemented in FY 1999 or later. The Coptis species is much in the same situation, in that it occurs in two known and documented areas, however, grazing by livestock at this time seems to not adversely affect this species, and monitoring is conducted annually.

g. **Manage Recreation Areas to Minimize Disturbance to Species**- The S & Gs direct the District to protect known fungi and lichen species within recreation sites. The Wapinitia EA is consistent with this S & G. There are no known sites of fungi and lichens listed in Table C-3, pg C-49 - C-61, Record of Decision within the Campgrounds that are within the Wapinitia Allotment.

B. Existing information will be used to the greatest extent possible, with new information collected, to the maximum extent practicable, to fill crucial data gaps.

The Wapinitia EA identified the existing condition of the planning area prior to implementation of the President's Plan. The Wapinitia EA provided analysis of alternative project implementation using existing and new data collected. No crucial data gaps were identified during the planning process in this intial analysis, however, as a result of the President's Plan, more specifically the Aquatic Conservation Strategy objectives (ASC), additional monitoring specifications will be developed to monitor not "retarding" or "preventing attainment " of these objectives. The data obtained from this monitoring program will be utilized in the next planning period expected in Fiscal Year 1998.

C. Analysis will address the entire watershed, even though some areas may be analyzed at a lower level of precision, and the analysis of issues may be prioritized.

For the purpose of the intial resource analysis of the Wapinitia Allotment EA, it is geographically made up of three watersheds; the White River, the Salmon River and the Oak Grove Fork of the Clackamas River. The White River and Salmon River watershed analysis are expected to be completed in the summer of 1995, however, the Oak Grove Fork of the Clackamas River is not expected to be completed until summer/fall of 1996.

D. Information from the analysis will flow into the NEPA documentation for specific projects, and will be used where practicable to facilitate Endangered Species Act and Clean Water compliance.

The Wapinitia EA identifed future desired conditions, existing conditions, issues, resource opportunities, and some culmulative effects analysis of implementation of these resource opportunities over time and space. The Wapinitia EA has been completed for the Wapinitia Allotment, and all pertinent information has been used to develop alternatives and analyze effects of grazing and its associated proposed resource projects.

E. Restoration opportunities will be identified.

A number of restoration/project opportunities have been identified in the Wapinitia EA, project implementation schedule. These included several projects aimed at improving watershed health and long-term aquatic sustainability, riparian diversity associated with vegetation, by constructing some riparian exclosures in identified key areas. Other opportunities are expected to be identified and addressed on an on-going basis.

2. **GREEN TREE RETENTION REQUIREMENTS** - N/A - does not apply to this project analysis.

3. **ASSESSMENT FOR LATE SUCCESSIONAL RESERVES** - Projects within LSR may proceed in FY 1994-96 using initial LSR assessments done at a level of detail sufficient to assess whether activities are consistent with objectives of LSR. The intial direction comming from the Watershed Analysis team, is that in the short term grazing in LSR's would not be inconsistent with management objectives because of current herbaceous vegetation occurring in

transitory range (clearcuts, and shelterwoods), however, the long term level of use would drop, due to achieving true LSR conditions, and the expected level of timber harvesting to decline.

2. LATE-SUCCESSIONAL RESERVES STANDARD AND GUIDELINES (ROD C-9 to C-21)

The objective of Late-Successional Reserves is 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.

Standards and Guidelines for Multiple-Use Activities Other Than Silviculture

The following standards and guidelines apply to Late-Successional Reserves and Managed Late-Successional Areas.

A. Range Management - Range-related management that does not adversely affect late-successional habitat will be developed in coordination with wildlife and fisheries biologists. Adjust or eliminate grazing practices that retard or prevent attainment of reserve objectives. Evaluate effects of existing and proposed livestock management and handling facilities in reserves to determine if reserve objectives are met. Where objectives cannot be met, relocate livestock management and/or handling facilities.

The Wapinitia Grazing Allotment contains approximately 40-50 acres of designated LSR, so the effects from grazing and/or range-related management does not appear to be significant.

3. RIPARIAN RESERVES STANDARDS AND GUIDELINES (ROD C-30 to C-38)

As a general rule, S&Gs for riparian reserves prohibit or regulate activities in riparian reserves that retard or prevent attainment of the ACS objectives. The following standards and guides apply to the Wapinitia Grazing Allotment.

Grazing Management

GM-1. Adjust grazing practices to eliminate impacts that retard or prevent

attainment of Aquatic Conservation Strategy objectives. If adjusting practices is not effective, eliminate grazing.

The Wapinitia EA identified "Resource Protection" as one of the strategies for each of the key issues. More specifically, "streambank instability and sediment delivery to streams", "accelerated improvement in condition of degraded riparian areas" and "Threatened, Endangered and Sensitive Species/Habitat" protection. In order to acheive these objectives the EA identified certain mitigation measures that would need to be implemented, in order to control the timing, duration, and numbers of livestock within the areas of concern. They are, fencing off of some identified riparian areas and implementing a "deferred rest-rotation" system. However, all the necessary fencing will not get implemented immediately, so in order to lessen the impacts until some of this fencing does occur, the permittee is taking a reduction of 23% or 90 AUM's (30 cow/calf pairs).

GM-2. Locate new livestock handling and/or management facilities outside Riparian Reserves. For existing livestock handling facilities inside the Riparian Reserves, ensure that Aquatic Conservation Strategy objectives are met. Where these objectives cannot be met, require relocation or removal of such facilities.

There were no new livestock handling facilities designated by the Wapinitia EA, however, the existing livestock handling facility was discussed within the EA for possible movement. The current location of this facility is not within the riparian reserve, but the facility does allow access to a riparian reserve, but at this time monitoring studies indicate there is no problem with meeting this objective, since a seasonal restriction is in place for limited livestock access.

GM-3. Limit livestock trailing, bedding, watering, loading, and other handling efforts to those areas and times that will ensure Aquatic Conservation Strategy objectives are met.

The Wapinitia EA does not identify any livestock management such as trailing, bedding, watering, loading, and other livestock handling efforts to occur within the riparian reserves. The livestock handling facility (corrals) are located outside the reserves. However, some livestock trailing, bedding and watering does occur within some of the unfenced reserves.

AQUATIC CONSERVATION STRATEGY OBJECTIVES (ROD B-11)

The ACS was developed to restore and maintain the ecological health of watersheds and aquatic ecosystems contained within them on public lands. The ROD identifies nine ACS objectives that focus on management of the riparian-dependent resources to maintain the existing condition or implement actions to restore conditions.

1. Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted.

2. Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian-dependent species.

3. Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.

4. Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.

5. Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.

6. Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.

7. Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.

8. Maintain and restore the species compostion and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability.

9. Maintain and restore habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species.

AQUATIC CONSERVATION STRATEGY (ROD B-9 to B-11)

The following section describes the Wapinitia Grazing Allotment Environmental Assessment's compliance with the Aquatic Conservation Strategy Objectives described in the Record of Decision for the President's Forest Plan (FEMAT). Due to the urgency of the request and inaccessability to a majority of riparian areas within the allotment due to snow levels an office based review was conducted. The Wapinitia Allotment E.A. and analysis file, stream surveys, aerial photographs, 1:24,000 topographic maps and consultation with Forest Service personnel familiar with the area were used to formulate the following report.

The nine ACS objectives primarily focus on maintaining and restoring functional processes that determine the physical and biological health of the Riparian Reserves. This includes the ecological status of vegetation, geomorphic and hydrologic development as well as structural integrity of both lotic and lentic systems.

The impacts of excessive livestock grazing within riparian areas are well documented (refer to Platts, 1991). In general livestock over-grazing can affect all components of riparian and aquatic systems by changing, reducing or eliminating riparian vegetation and altering physical stream processes. (Meehan,ed.,1991)

METHODOLOGY

Lotic Systems:

Over 35 miles of streams occur within the Wapinitia Allotment. Due to a lack of existing quantifiable information regarding channel condition, stream bank stability and condition of the riparian vegetation bordering the streams we chose to divide the streams into geomorphic reach breaks and assign specific channel types using David L. Rosgen's channel typing methodology (Rosgen, 1994). Other researchers have evaluated livestock grazing effects related to stream stability and sensitivity based upon Rosgen channel types (Swanson and Rosgen, unpublished). We chose to do the same rather than analyzing entire stream lengths as a whole. For a description of Rosgen stream channel types refer to Rosgen, 1994. "E" and "C" channels are highly dependent upon herbaceous and woody riparian vegetation for stream bank stability and very sensitive to disturbance whereas "A" and "B" channels are more stable and influenced by valley confinement and conifers.

We assigned a rating of "meets ACS", "does not meet ACS", or "unknown" based upon the channel type and availability of information. "A" and "B" channels were assumed to be not affected by livestock grazing whereas "C" and "E" channels were assumed to not meet ACS objectives unless they were fenced or there was existing information indicating that livestock were not impacting them. Where there was no information available regarding the condition of the channel an "unknown" determination was made.

STREAM	MEETS ACS	DOES NOT MEET ACS	UNKNOWN
Ghost Cr.	X*		
Salmon R.	X		
Inch Cr.	X		
Draw Cr.	X		
Linney Cr.	X		
Meditation Cr.	X		
Zygote Cr.	X		
Dinger Cr.	X		
Cooper Cr.	RM. 0.6-2.5	RM. 0.0-0.6	
Crater Cr.		RM. 0.0-0.09	
	RM. 0.09-1.8**		
			RM. 1.8-3.07
	RM. 3.07-4.9		
			RM. 4.9-5.4
East Fork Crater	X**		
Clear Cr.			RM. 7.8-11.8
NW Clear Lk. Trib.		RM. 0.0-0.4	
	RM. 0.4-1.0		
Middle Clear Lk. Trib.		RM. 0.0-0.1	
	RM. 0.1-1.0		
NE Clear Lk. Trib.		RM. 0.0-1.0	
	RM. 1.0-1.75		

*-The majority of Ghost Cr. within the allotment is an "E" channel but field reconnaissance by Botany, Range and Fisheries personnel revealed no adverse impacts from livestock grazing.
**-These reaches are either "E" or "C" channels but are excluded from livestock grazing.

Lentic Systems:

Six distinct meadows occur within the allotment. Two of these meadows (Little Crater Meadow complex and Salmon River Meadows) occur within A9 "key-site riparian areas". Excessive livestock grazing in meadows can reduce riparian vegetation that provides root masses which stabilize shorelines, filter fine sediment and provide for terrestrial and aquatic wildlife habitat. In order to determine if management of these meadows, in regards to livestock grazing, is consistent with the ACS we applied a method similar to that used for lotic systems. We assumed that livestock were entering the areas unless they were fenced out or existing information indicated otherwise.

WETLAND	MEETS ACS	DOES NOT MEET ACS	UNKNOWN
Little Crater Mdw.	X		
Salmon River Mdw.	X*		
Stringer Mdw.	X**		
Dry Mdw.		X***	
Jackpot Mdw.		X***	
Frying Pan Mdw.	X		

*- Although the meadow is not fenced it is very wet and boggy. Field reconnaissance by Botany, Range and Fisheries personnel did not reveal any livestock impacts to the meadow.
**- Stringer Meadow is similar to Salmon River Meadows in that it is very wet and boggy. No surveys, to the best of our knowledge for Fisheries have been conducted about its condition, although ocular estimation for utilization levels have been conducted by Range personnel.
***- Ocular estimation with some Condition/Trend monitoring data indicates probably less than 2% of these meadows combined do not meet, especially along the small intermittent streams that occur in each meadow system.

RECOMMENDATIONS:

Because this consistency review was conducted from the office there is an urgent need to evaluate the actual conditions of "C" and "E" stream channels and all wetlands within the Wapinitia Allotment in the field. This will allow us to complete the rating system with a higher degree of certainty. We recommend using the BLM's "Process for Assessing Proper Functioning Condition" for lentic and lotic riparian areas (technical manuals are referred to in the bibliography). This rapid assessment will allow us to identify whether or not the functional processes are present within these areas. If these processes are missing or non-functional we will have to determine if livestock grazing is the causal factor in preventing attainment of the ACS objectives and adjust grazing practices accordingly.

Construction of livestock exclosure fences around certain meadows and creeks where identified as mitigation measures in the Wapinitia Allotment EA. To date only Little Crater Meadows has been adequately fenced. Given budget uncertainties it is unlikely that the remaining exclosure fences will be constructed in the near future. The rationale made by the decision maker for this EA was to select an alternative that reduced livestock numbers by 23% and implemented a grazing strategy that promoted recovery of riparian resources given our current budget and personnel constraints. It was felt that this reduction and strategy is economically feasible in that all the fencing projects may not get completed in order to show an upward trend in recovery of the riparian resources. The combination of reducing livestock numbers and the fencing projects are anticipated to accelerate this recovery process. If field reconnaissance reveals the absence or non-functionality of certain riparian processes such as adequate quality and quantity of riparian vegetation and stable streambanks resulting from over-grazing, alternative grazing strategies should be developed to allow those processes in question to recover and bring these areas into compliance with ACS objectives.

Utilization cages along with Condition/Trend monitoring studies are identified in the Wapinitia Allotment EA, to assess the condition of riparian areas not scheduled for livestock exclusion, such as the tributaries to Clear Lake. Use of these techniques, by themselves, may not be adequate to monitor for compliance with "eliminating impacts that retard or prevent attainment of ACS objectives" or the Mt. Hood LRMP definition of "Satisfactory Range Condition". Additional monitoring parameters to assess stream temperature, channel and streambank stability and riparian vegetation structure need to be implemented in addition to utilization cages and condition/trend studies to determine whether basic resource damage is or is not occurring.

BIBLIOGRAPHY:

Platts, W.S. 1991. Livestock grazing. American Fisheries Society Special Publication. 19:389-423.

Rosgen, D.L. 1994. A classification of natural rivers. Catena. 22:169-199.

Swanson, S. and D.L. Rosgen. Draft. Stream classification interpretations for riparian grazing management.

U.S.D.I. 1993. Riparian area management: process for assessing proper functioning condition. TR1737-9. BLM. Denver, CO. 49pp.

U.S.D.I. 1994. Riparian area management: process for assessing proper functioning condition for lentic riparian-wetland areas. TR1737-11. BLM. Denver, CO. 37pp.

U.S.D.A. 1993. Wapinitia Grazing Allotment Environmental Assessment, and

Decision Notice/Finding of No Significant Impact, 8/30/93. U.S.F.S.

U.S.D.I./U.S.D.A. 1994. Record of Decision for the Forest Ecosystem Management report (FEMAT). Standards and Guidelines, C-33.

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Reply To: 2230

Date: June 28, 1995

Subject: Consistency of Wapinitia Allotment Grazing with Northwest Forest Plan ACS Objectives

To: Dan Fissell, Range Conservationist
Barlow Ranger District

You asked me to provide an evaluation of whether 1995 through 1997 grazing in the Wapinitia allotment is "consistent" and compatible with aquatic conservation strategy (ACS) objectives identified in the Northwest Forest Plan. I am happy to offer my judgement on this matter. However, I must be quick to explain that my conclusions are made without benefit of site-specific field familiarity and with only limited information available on grazing effects in the area. Also, no watershed analysis has been completed on any portion of the Wapinitia allotment, so there are no results available to use in support of a consistency finding.

Complying with ACS objectives means that the Forest Service "must manage the riparian-dependent resources to maintain the existing condition or implement actions to restore conditions (Record of Decision Attachment A, page B-10)." The Plan states that the decision maker, in determining consistency of a management action with the ACS objectives, is to ensure that action implementation "meets" or "does not prevent attainment" of ACS objectives. To assist the decision maker in making a finding, I will provide a thumbnail analysis for evaluating consistency with regard to 1995-1997 grazing and the ACS objectives.

As a place to begin, I include here a very brief description of existing range conditions within the allotment. Most of the range is in forest cover, of varying canopy density, which provides for more or less forage in the understory as fitting to the degree of "openess." Scattered natural meadows, including large named meadows such as Little Crater, Dry, Jackpot and Salmon River, are included within the allotment. These meadows provide a sizeable permanent source of forage. Over the past 40 years or so, forage within meadows and forest has been considerably augmented by "transitory range" made available by timber harvest, especially clearcutting. Transitory range forage is a temporary source which changes in location and time as a result of vegetation growth and cutting of forest stands. Forage from transitory range is anticipated to decline markedly in the future as timber cutting rates are reduced.

From information I have gathered, damage to streamside areas from livestock grazing is evident in the allotment though this degradation is scattered and quite localized. This degradation is typified by streambank sloughing and reduction or loss of plant cover where cattle traditionally congregate each summer. Where this damage has occurred, it is likely disproportionately higher in meadows than elsewhere. General overuse of forage has also occurred in some areas from year to year, but vegetation appears to recover well when rested from grazing.

A recently revised allotment management plan and accompanying environmental study completed in 1994 recognized these "hot spots" of degradation as well as the potential for future declines in forage. As a result, action was taken to reduce the number of animals grazed on the allotment and to protect sensitive areas from future deterioration by livestock. It is implementation of grazing under this new allotment plan which is being considered for consistency with ACS objectives. The term of the permit to be issued would be 3 years and would expire in December 1997.

Wapinitia allotment grazing, begining with the 1995 season, would be permitted at a level of 300 animal unit months (AUM's). The grazing period is scheduled to begin July 1 and would end September 30 of each year. The permittee would graze the same number of cattle throughout the grazing period, so this would mean that 100 cow/calf pairs (or the equivalent number of animals) would be grazed on the 26,324 acre allotment during each month of the 3 month season. The 300 AUM's is down from a 390 AUM level permitted prior to 1995.

Along with a reduced grazing level, the current allotment plan provides for improving riparian areas and meadows by stipulating that fences be built to exclude livestock use in sensitive areas. Although there are no time limits defined, grazing use would not be adjusted upward before completion of fence construction within critical areas.

With regard to the breadth of my judgement regarding consistency of proposed grazing with ACS objectives, I have focused on ACS objectives 1, 2, 8 and 9. The following summary of allotment management changes forms the basis for offering my judgement on consistency. Please keep in mind that my perspective is from a terrestrial system point of view. Here are the positive changes or attributes in grazing management to be implemented with the new allotment plan:

1. The number of animals to be grazed in the allotment is reduced (23 percent) from former levels. Range damage and/or deterioration was being reversed even at the former grazing levels.

2. Sensitive areas ("hot spots") are recognized in the new allotment plan and remedial actions are prescribed in the form of exclusion fencing and rest-rotation grazing.

3. Implemetation of the remedial actions has begun. Exclosure fencing is now (June 1995) being installed at Little Crater Meadows.

4. Range monitoring data collected at 3 locations within the allotment over the past 3 years show a "good" condition (the highest rating) and a stable trend, with one exception. In Dry Meadow, condition was downgraded from "good" to "fair" as a result of changes noticed last year in the ratio of forbs to grasses. This may be an artifact of the sampling methodology and plot location or a real change. In any case, a warning flag is raised that will, as I understand, be addressed with more focused monitoring in Dry Meadow and greater scrutiny of results.

5. The permit is being issued for 3 years rather than the customary 10 years to allow additional monitoring of conditions. This time frame will allow completion of watershed analysis and additional monitoring with which to more thoroughly assess condition trend.

6. Accountability of livestock on the allotment has been vastly improved with implementation of an ear tag monitoring system. Forest Service-issued ear tags are provided for the specific animals permitted on the range, thus allowing for easy identification of over-stocking.

7. The permitted grazing season begins after the nesting season of most birds which use the large meadows in the allotment.

With the above information in mind, it is my conclusion that proposed grazing under the new allotment management plan maintains the existing condition or improves conditions over the long term and thus meets, or at least does not prevent attainment of, ACS objectives 1, 2, 8 and 9. Riparian conditions would appear to be poised for improvement as a result of actions included in the new allotment plan and recent monitoring.

/s/ John T. Wells
JOHN T. WELLS
Wildlife Biologist

Appendix G - Heritage Overview

Salmon Watershed Heritage Overview

Zigzag Ranger District
Jeff Jaqua, District Archeologist

This overview is to be used as a resource in watershed analysis and by the watershed stewards. It is to be used in conjunction with the earlier prepared historic and prehistoric overviews of the District which follow this watershed overview. Generally for this watershed overview, discussion will begin at the headwaters and move downstream. Not all heritage sites are discussed.

SALMON RIVER

Silcox Hut was constructed in 1939 to serve as the upper terminal for the Magic Mile Chairlift. It was dedicated to Ferdinand Silcox, FS Chief from 1933-1939, in 1941. The building was placed on the National Register of Historic Places in 1985. The Friends of Silcox Hut undertook a rehabilitation of the hut which was completed in 1993.

The original Magic Mile Chairlift was constructed in 1939. As stated above, its upper terminal was Silcox Hut. The lower terminus was east of Timberline Lodge. Footings for the lift towers are still evident as is the power generation building for the lift. This original lift was replaced in 1962 with the second Magic Mile which was constructed west of the Lodge.

Joel Palmer, while scouting the route for the Barlow Road, may have crossed the Salmon River high on Mt. Hood. Common interpretations of his journals have him in this area. No physical evidence has been found to support this idea nor are there any sites recorded associated with this trek. Palmer went on to become an important figure in the history of Oregon.

American Indians traditionally harvested the nuts of the white bark pine at timberline. No associated sites or other evidence yet discovered. The white bark pine is not as abundant as it once was.

Timberline Trail was first conceived in the 1920s as an alpine trail for recreationists to access this unique environment. Construction was completed in the 1930s by the CCC though segments of the trail probably preceded that date. The trail was once called the "Round the Mountain Trail". It has been suggested that the trail is eligible for listing on the National Register of Historic Places and a nomination was once prepared . Neither the evaluation for eligibility nor the nomination have been formally submitted.
Timberline Lodge was constructed by the Works Progress Administration in conjunction with the Forest Service as part of the Depression-Era work relief programs of President Franklin D. Roosevelt. Construction of the Lodge was completed in 1938. Timberline

Lodge was listed on the National Register of Historic Places in November of 1973. Areas of significance noted in the nomination were the architecture of the Lodge, and the art and crafts displayed in the interior of the Lodge. In December of 1977 the national significance of the Lodge was recognized and the property was designated a National Historic Landmark.

The Eastleg Road, along with the Westleg Road, first provided access to timberline. It was constructed before Timberline Lodge was even conceived. The highest point on the mountain the road reached was Phlox Point. The road was purposely designed to go no higher in order to protect the fragile alpine environment from overuse. The road was extended in conjunction with the construction of Timberline Lodge. Construction of Timberline Road, which replaced the Eastleg and Westleg Roads as primary access to Timberline Lodge, commenced in 1949.

The historic files for the Phlox Point cabin are slim. It is believed that the cabin dates to 1931 when it was under permit to the Timberline Ski Club which would pre-date the historic Timberline Lodge.

The springs which presently are the domestic water source for Timberline Lodge were first developed in 1937-38 as an auxiliary source to supplement the primary source in Salmon River above timberline. The primary source was basically a diversion of surface water to an underground storage tank. This was soon found to be inadequate and the springs lower on the mountain were developed. These springs still provide domestic water for Timberline Lodge today.

The Barlow Road Historic District is listed on the National Register of Historic Places. It crosses the mainstem and the west fork of the Salmon in the vicinity of the Hwy 26/Hwy 35 intersection. Within the historic District are a number of significant features associated with the Barlow Road.

Salmon River, Still Creek, and Mud Creek all drain Summit Meadows. Summit Meadows was a landmark for the immigrants on the Oregon Trail. There are a number of features within the Salmon watershed portion of the Meadows of historic interest, none of which have been adequately researched or recorded. The Summit airstrip was constructed at the south end of the Meadows prior to 1930 by the Forest Service. The original Summit Guard Station was located in the Meadows before it was re-located in the 1930s to its present location near Government Camp. A CCC Camp was established in the Meadows which evolved into a highly developed camp to house the WPA workers constructing Timberline Lodge. In addition, a traditional American Indian campsite has been reported in the Meadows. The entire Summit Meadows should be carefully examined and recognized for its historic significance. Dispersed camping and other recreational activities in the Meadows continue to impact these sites and their heritage values are being degraded.
The Oak Grove Wagon Road is a historic wagon road joining Summit Meadows with Salmon River/Wapinitia meadow and points east. It was built in the late 1800's but was never finished beyond Summit meadows to the west. Currently there is a powerline and

fiber optic cable buried in the road. The fiber optic cable is a main communication link between eastern Oregon and the Portland metropolitan area.

The Sherar Burn/Wolf Camp Butte area has long been recognized as a traditional American Indian locale for harvesting huckleberries. Sites have been recorded associated with this activity and others have been identified though not yet recorded. The same general area was also popular to sheepherders at the turn of the century. What is believed to be a corral associated with sheep herding was recently discovered and recorded within the watershed. The CCC, under the direction of the Forest Service, implemented timber management projects in the area in the 1930s including replanting, fire control, and snag removal. The intense human manipulation of this landscape over the years has contributed to the forest health issues being addressed today.

The original Devil's Peak Lookout was a log structure constructed in 1924. It sat directly on the ground but had a windowed cupola on the roof peak which provided some elevation for an observer. It was replaced in 1933 with a modified L-4 style lookout. The tower for this 1933 lookout was reconstructed in 1952. The lookout is not actively managed by the Forest Service but is regularly visited and used by recreationists. It has never been evaluated for its historic significance nor its eligibility for inclusion on the National Register of Historic Places. It's condition is poor and may present a public hazard if it is allowed to deteriorate further.

The earliest documented trail up the Salmon River appears to be one constructed prior to 1908 which began at the Forest boundary and went up the drainage a number of miles. This trail was later abandoned. The Forest Service proposed a new trail in 1920. It is unclear when this new trail was constructed but it was well established by 1934. It remains a very popular trail today.

SOUTH FORK SALMON RIVER

The Plaza Guard Station is at the headwaters of the South Fork near the Abbott Road. A cabin was constructed here that dates to at least 1912. A history of the site has not been recorded to my knowledge. It would have been an important administrative site given its location.

CHEENEY CREEK

There was gold mining interest in Cheeney Creek as early as the late 1800s. Bonanza Mine is a result of these interests. Efforts were less than satisfactory.

MUD CREEK

Mud Lake was impounded in 1937-38 to create Trillium Lake. One objective of this work seems to be have been to create a visual focus for visitors at Timberline Lodge. An earthen dam and rock spillway were constructed. Trees from the planned impoundment area were cut for firewood at the Lodge. Cedar from here may have been used to build the benches for the amphitheater at Timberline Lodge. For reasons that are unclear, without further research, the lake was never fully impounded until 1960 when the Oregon State Fish and Game Department reconstructed the earthen dam. This reconstruction enlarged the lake from about 20 acres to 50 acres which is its current condition.

A number of peeled cedar trees have been discovered along Mud Creek downstream of Trillium Lake. These trees were probably peeled by American Indians in association with the berry harvesting done in the Sherar Burn area.

The historic Skyline Trail was located along Mud Creek. The current Jackpot Meadows trail #492 is a segment of this historic trail that ran the length of the Cascades crest from Mt. Hood to Mt. Jefferson and is displayed on a 1916 Forest Service map. This may be the same trail that was identified in an 1884 General Land Office Survey.

PREHISTORIC HERITAGE OVERVIEW
MT. HOOD NATIONAL FOREST
ZIGZAG AND COLUMBIA GORGE DISTRICTS

When considering human beings interaction with the landscape prior to European influences, think of how they may have utilized resources they either sought out or found on the landscape. To think of it another way, which resources would the landscape have provided for human exploitation. The Zigzag and Columbia Gorge Ranger Districts are of course located on the west side of the Cascades in a northwest maritime forest. The maritime forest can be further defined by using vegetative zones (Western Hemlock, Pacific Silver Fir, and Mountain Hemlock). The climatic conditions of a maritime forest provide for a relative environmental stability and the forest tends to achieve and remain in a mature state. The most diverse and productive condition of these forests (from a hunter/gatherer's point of view) would have been in something other than a mature state, where diverse food resources could be found. Ecologic disturbance processes, such as wildfire, floods, windstorms, all maintained meadows and immature stands within the forest which provided this diversity. Another resource potential of the landscape would have been rivers and streams. Generally, the native peoples would have patterned their activities to repeatedly take advantage of deer and elk which they would have found foraging in meadows and sub-alpine parklands. Huckleberries would have been a primary resource which are found in non-mature forests. Anadromous fish bearing streams such as the Sandy, Salmon, Eagle Creek (Clackamas River), and the Bull Run would have been exploited. Cedar bark was important to the northwest cultures and could be found in riparian areas throughout the forest at a range of elevations.

A variety of medicinal plants were harvested in a variety of ecosystems. There are no known or suspected quarry sites for lithic material on the Zigzag or the Columbia Gorge Districts. Though there is evidence of what may be "vision quest" sites on the Hood River District, few sites have been discovered on the Zigzag or Columbia Gorge Districts. Because at any given time much of the forest would have been in a mature state with dense vegetative cover, travel corridors tended to avoid valley floors and bottom lands where travel may have been difficult. Ridgelines tended to be more useful for travel.

Archaeological evidence will more likely be discovered not at the point of exploitation but rather at locations where native peoples came to access the resource. If the hunter's objective is to hunt a meadow, he will not camp in the meadow. To be economically efficient, the gathering of foodstuffs requires processing. Thus, berry camps and fishing camps are established and used repeatedly.

The climate we experience today, and which influences the character of the forest stands, is not necessarily the climate of the recent past. Thus, the forests which the native peoples exploited may have looked much different and thus the use patterns of the human population was also different.

14,500 to 11,500 B.P. was a time when the Mt. Hood glaciers were retreating. This was the end of the Pleistocene ice age. Mass sediment wasting from the retreating glaciers resulted in open parklands in the forest at lower elevations. Elk populations were established and hunters most likely exploited this resource. Human population was small.

Between 11,500 and 9,500 B.P. the forests continued to mature in the humid maritime conditions common to the west side of the Cascades. The forest closed and was probably similar to the forest matrix of today. The ungulates moved up to the upland habitats. The forest would not have been a terribly attractive place for the native people but the population was still relatively small and there was enough scattered meadows and sub-alpine parklands to make it worthwhile for small family groups of foragers to exploit them on a seasonal basis.

The climate became warmer and drier between 9,500 and 4,500 B.P. The forest became more open and less mature. The forests were more susceptible to fire. The resultant early and mid-successional vegetative conditions were attractive to hunter/gatherer exploitation and the regional human population flourished. This is the period when human use patterns became well established and a wide diverse range of resources were identified and developed. A certain dependency on particular resources like huckleberries developed and seasonal exploitation patterns were established. In short, times were good.

Beginning 4,500 years ago the climate changed again to a more humid type and the forest on the west side of the Cascades closed again. This must have been a trying time for the native peoples who had grown dependent upon the resources found in less mature forests. This change coupled with the relatively large human population forced some societal and technological changes. No longer could people depend upon natural events to sustain their resource base but had to develop methodology which mimicked nature to manipulate their environment to their advantage. Thus the burning of the forest to promote huckleberry habitat.

This may have also been the time when the salmon resource was turned to as a means of sustaining a growing population. The development of the salmon resource in the northwest is often equated to the development of agriculture elsewhere in the Americas and growing population is identified as the impetus for both. People became at least semi-sedentary as resource utilization and management became more intensive, technology advanced, specialized skills developed, trading occurred and territories recognized.

By the time Lewis and Clark sailed down the Columbia, the native people and their cultures were decimated. From both direct and indirect contact with European explorers, traders, and finally trappers, the native populations had become exposed to diseases they had no natural immunity to. Population declines have been estimated as high as 75%. The society and culture that developed to support a growing population and reduced resources could no longer be sustained by the remaining population. The cataclysmic decline in population allowed for no opportunity for the people to naturally develop resource utilization patterns which would support their numbers.

HISTORIC HERITAGE OVERVIEW
ZIGZAG AND COLUMBIA GORGE DISTRICTS

The historic period on the Forest can be arbitrarily divided into 4 periods or phases:

1772-1840	Exploration and Fur Trade Phase
1840-1880	Emigrant Phase
1880-1910	Transition Phase
1910-present	Modern Development Phase

The Zigzag and Columbia Gorge Districts probably witnessed little activity from explorers and trappers. Exploration seemed to be limited to the Columbia River. Though trappers were in the country, the Willamette Valley was bountiful and met there requirements. There was probably limited effort made to venture into the Cascades during this period. In 1838 Daniel Lee undertook an overland trip from Wascopam (The Dalles) to his brother's mission in the Willamette Valley crossing Lolo Pass, following an aboriginal trail. On his return trip he herded 14 head of cattle back to Wascopam. This trail was later utilized by emigrants to drive livestock prior to the development of the Barlow Road.

The great immigration to the Oregon territory began in earnest began in 1843. The Barlow Road dates to 1845.

By 1880 the Willamette valley was becoming increasingly settled and people started to look toward the Cascades to provide for some of their needs. The Bridal Veil Logging Company was founded in 1886 and began logging Larch Mountain in response to growing lumber markets. Sheepherders recognized the grazing potential of the parcels of land previously burned by the Indians to enhance huckleberry growth. This "transition phase" was also the time when residents of the Willamette Valley recognized the recreation potential of the Cascades and ventured to the forest to camp, fish, hunt, and climb. President Harrison proclaimed the Bull Run watershed a Forest Reserve in 1892 and the first Bull Run water flowed into the city's water system in 1895.

Ever increasing lumber demands and the depletion of forests in the lowlands led to more logging in the foothills. A logging railroad spur from the Portland-Cazadero line near Barton was constructed which eventually led to Wildcat Mountain. Recreation use increased. The Timberline Cabin was constructed in 1916 at Camp Blossom which was already an established base camp for climbing Mt. Hood. The first permit for a recreation cabin along the Zigzag River was issued in 1915. The Mt. Hood Loop Highway was completed in 1925 and the Mt. Hood Recreation Area was established in 1926. The Oregon National Forest was created in 1907 which later became the Mt. Hood National Forest in 1924. Forest management priorities stressed fire suppression and administration of grazing permits.

The efforts of the CCC and the WPA during the Depression-era of the 1930s had significant impact on the forest landscape. Campgrounds and trails were constructed as well as administrative compounds and lookouts. Fire suppression methods were developed that resembled military actions. Reforestation was done in earnest of both harvested areas and burns.

The exploding housing market following World War II resulted in increased timber harvest and road construction.

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Subject: Contents: 3
Creator: SHELLEY.E.BUTLER:R06F06D09A / CEO
DDT1=RFC-822; DDV1=SHELLEY.E#BUTLER:R06F06D09A@ceo;

Message Id: H000014200364fb6
Priority: Normal   Importance: Normal   Sensitivity: None
Create Date: 12/02/98 11:06:58
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Part 1

TO: DISTRIBUTION

Part 2

ARPA MESSAGE HEADER

Part 3

CEO document contents:

LAD
INTERIM Design Plan
SALMON Watershed
(9/97)

Process

This document is support to and tiered to Salmon Watershed Analysis. During watershed analysis the Conceptual LAD Plan (50-200 yrs. DFC) was developed. In order to reach that 50-200 year landscape design, an Interim LAD plan needed to be developed. The interim design planning team chose the "narrative process" to design each area rather than the "graphic process"(intricately and site specifically designing each area). The watershed was divided into sub-watershed areas with similar problems/opportunities which have distinct geographic boundaries and management needs. These planning areas are referred to as Interim Design Areas (IDA) and are delineated on the Interim Design Map.

The purpose of the Interim Plan is to guide site specific project planning which will begin to move the watershed toward the desired future conditions depicted in the Conceptual Plan (50-200 yrs. in the future depending on existing conditions). The Interim Plan will cover a planning period of 10 years and will be updated each year thus allowing adjustment to changes in management direction, etc. while continuing to look 10 years into the future.

The Interim Plan will include conceptual recommendations which set the framework for "what" is needed in each IDA for the near future. It will also include project recommendations which indicate the "where" and "how" management will proceed. Also included is the project priority list which will indicate the "when" and the relative importance of each project in the projected 10 year workload.

Monitoring

Monitoring and evaluation should be an integral part of all ecosystem management activities. Future funding prospects indicate that all activities will not be intensively monitored; it is more likely that representative projects will be intensively monitored and the remaining projects evaluated at a more basic level. Project monitoring of activities will be initiated during project planning. Intensive monitoring will be identified at the implementation phase of the project in the Interim LAD process, especially where funding is separate from the activity. The watershed steward may qualitatively evaluate project implementation and effectiveness in an annual summary of activities.

Interim LAD Team

IDT: Shelley Butler -- Steward
Gary Loeffler -- Landscape Architect
Carol Hughes -- Wildlife Biologist
John Davis -- Silviculturlist

MDT: Jeff Uebel -- Fisheries Biologist
Bruce Haynes -- Recreation
Molly Sullivan -- Botanist
Carl Exner -- Forester
Sharon Traxler -- Transportation Planner
Jeff Jaqua -- Cultural

Alpine IDA

Conceptual Framework

Vegetation is expected to be in a natural condition; and will be different than that found in lower elevations (low growing shrubby and herbaceous with occassional scattered clumps of conifers).

Potential habitat for listed sensitive aquatic invertebrates is found in this IDA.

Potential habitat for Black-crowned Rosy Finch may be found in this IDA.

Project Recommendations

Survey existing and potential habitats for listed sensitive aquatic invertebrates.

Survey potential habitat for Black-crowned Rosy Finch.

Evaluate and monitor salting at Timberline Ski Area.

Monitor sewage drainfield and associated drainage at Timberline Ski Area.

Timberline Lodge Ski Area IDA

Conceptual Framework

In the alpine areas vegetation is expected to be in a natural condition; and will be different than that found in lower elevations (low growing shrubby and herbaceous with occassional scattered clumps of conifers).

Recreation and Wilderness users are impacting alpine areas: mountain climber sanitation; skier incursion into the Wilderness (unsanctioned salting); and summer hiker off-trail use.

Refer to Timberline Lodge Ski Area Master Plan (1975) and the current Ammended Master Plan (1997-8).

Integration of the human ecology and the biophysical ecology (ie. ski runs and riparian areas) in a comprehensive process including cumulative impacts is much needed. (Mt Hood Meadows Ski Area LAD process should provide a template.)

Potential habitat for Black-crowned Rosy Finch may be found in this IDA.

Project Recommendations

Develop and maintain seed and plant stock for ongoing restoration projects

Review Whitebark Pine studies for management techniques for regeneration etc. (there is tribal concern for the loss of pine nut foraging).

Develop ATM Plan (trails/roads) as part of the Master Plan discussed below

Develop a comprehensive Ski Area Master Plan including: riparian condition restoration; scenic condition (Palmer snow field contrasts); historic compatability evaluation; sewage and water capacity evaluations, etc.

Evaluate future use and maintenance standards for Glade (#661), and Mountaineers (# 788) trails (Proposed District Trail Management Plan would facilitate this).

Evaluate and monitor salting at Timberline Ski Area.

Monitor sewage drainfield and associated drainage at Timberline Ski Area.

Implement sediment/runoff control of Timberline parking lots.

Survey existing and potential habitats for listed sensitive aquatic invertebrates.

Survey potential habitat for Black-crowned Rosy Finch.

Upper Salmon IDA

Conceptual Framework

Late seral structure will mean the same as the NWFP ROD's "late successional" stage of development.

It is estimated that approximately 55% of this IDA is in late seral habitat; 20% is between 80 and 100 years of age; and 25% is < 80 years of age (IDA percentages are based on stand exams and field knowledge).

Huckleberry fields located in the Snowbunny and Passline areas are locally popular and potentially traditional (tribal).

Noble polypore, survey/manage species is located in this IDA and has a one square mile protection area in the general location of the Pioneer Women's Grave.

Timberline Ski Area salt monitoring program has a station located in this IDA.

Potential quality nordic ski trail development (possibly commercial) exists in this IDA.

This area has high quality calving/fawning habitat for deer and elk.

Draft Management Strategy for the California Wolverine (Gulo gulo luteus) does not identify this IDA as a key refugia block (Strategy to be completed in FY 98 by Hughes/Huff).

Potential habitat for listed sensitive aquatic invertebrates exists within this IDA.

A spotted owl critical habitat unit covers this IDA; USFWS must be consulted.

Check on PGE maintenance needs for its utility corridor.

There is a very small piece of the White River LSR in this IDA.

Project Recommendations

Continue to control noxious & non-native plant populations.

Develop and maintain seed and plant stock for ongoing restoration projects

Develop thinning projects to promote both mature and late seral structure and forest health in the IDA.

Evaluate and plan restoration needs (silvicultural) of West Fork riparian areas.

Survey for potential habitat of Noble polypore.

Roads will be obliterated and brought back to near original contours to solve drainage problems. (see attached ATM list).

Roads will be blocked or gated (see attached ATM list).

Evaluate and reconstruct roads and culverts as necessary to accommodate 100 year floods, fish passage and sediment/runoff control.

Survey existing and potential habitats for listed sensitive aquatic invertebrates.

Improve stream crossings (snow bridges) on Yellow Jacket Trail.

Hwy 26/35 Corridor IDA

Conceptual Framework

The Forest Service is a cooperating agency in the planning efforts with the Federal Highway Administration and ODOT concerning various management issues surrounding the corridor (width follows proposed ODOT R/W easement and ranges from 40-100').

Project Recommendations

Work with ODOT to develop a Vegetation Management Plan for Hwy 26/35 Corridor.

Coordinate with ODOT to install, maintain and monitor sand catchment basins; stabilize cut/fill slopes; and control runoff.

Complete Right-of-Way Project in conjunction with ODOT.

Complete Hyw 26 Corridor EIS Project.

Check on utility maintenance within the corridor.

Evaluate connectivity issues for culvert crossings on the East Fork, West Fork, Mainstem and other Salmon River tributaries.

Salmon Meadows IDA

Conceptual Framework

Watershed Analysis (p.4-21) found that within its Western Hemlock Zone it had only 10% in "late seral structure" which is well below the Range of Natural Conditions (50-65%).

Late seral structure will mean the same as the NWFP ROD's "late successional" stage of development.

It is estimated that approximately 50% of this IDA is in late seral habitat; 10% is between 80 and 100 years of age; and 40% is < 80 years of age (IDA percentages are based on stand exams and field knowledge).

Huckleberry fields located along the PCT (tribal and locally popular).

This area is relatively undeveloped and provides high quality habitat for a wide variety of species, both terrestrial and aquatic.

Sensitive animal and plant species such as the sandhill crane and the lesser bladderwort are found in the meadow complex.

The Hyw 26 corridor has the potential to significantly impact the resources in this IDA.

Check on PGE maintenance needs for its utility corridor.

Project Recommendations

Continue to control noxious & non-native plant populations.

Develop and maintain seed and plant stock for ongoing restoration projects

Develop various thinning projects to promote mature and late seral structure and forest health in the eastern portion of the IDA.

Develop thinning project to enhance Huckleberry fields and improve access for tribal members.

Evaluate human impacts to meadow complex (including pre-settlement impacts, fire, beaver and sewage).

Evaluate and plan brook trout control within meadow complex.

Monitor water quality trends for the W&S River (A/US/SM/SHW/LSR/WW).

Implement Ghost Cr channel restoration.

Road 58240? will be obliterated and brought back to near original contours to solve drainage problems (see attached ATM list).

Check land line for Wapinitia (tennis court).

Survey roads, put into ATM and GIS for new district lands (SM, MS and RR).

Check on PGE maintenance on its utility corridor.

Monitor impacts of the Wapinitia Range Allotment.

White River LSR IDA

Refer to White River LSR assessment: T-Twin Landscape Unit.

Project Recommendations

Thin stands to promote late seral structure (insect/disease pockets).

Provide fuel break for LSR protection along Hwy 26.

(see LWD Ghost Cr project, SM IDA).

Mid Salmon IDA

Conceptual Framework

Watershed Analysis (p.4-21) found that within its Western Hemlock Zone it had only 10% in "late seral structure" which is well below the Range of Natural Conditions (50-65%).

Late seral structure will mean the same as the NWFP ROD's "late successional" stage of development.

It is estimated that approximately 5% of this IDA is in late seral habitat; 90% is between 80 and 100 years of age; and 5% is < 80 years of age (IDA percentages are based on stand exams and field knowledge).

Off-site stands and poor soils due to past fires have created the following problems: increased risk of catastrophic events (fire, insect attack); delayed late seral structure development; low quality snag habitat and future snag deficits; and deficient existing and future terrestrial and in-stream large down wood.

Huckleberry fields located within the Abbott burn are both traditional (tribal) and locally popular.

Sandhill cranes are located in Dry and Jackpot Meadows.

Large Cold-water Corydalis population is located in Linney Cr.

Ulota Meglaspora (moss) located in this IDA and in Roaring River IDA.

Rare II roadless area "B" is located in this IDA; projects may require additional analysis.

Project Recommendations

Continue to control noxious & non-native plant populations (tansey ragwort on Rd 5850).

Develop and maintain seed and plant stock for ongoing restoration projects

Begin restoration of off-site stands and poor soils; enhance late seral structure development; low quality snag habitat and future snag deficits; and deficient existing and future in-stream large wood material.

Evaluate and reconstruct roads and culverts as necessary to accommodate 100 year floods and fish passage.

Stabilize eroding cut/fill banks along Rd 5880.

Upgrade Linney Cr Rd (5800-240) to eliminate sedimentation.

Reduce sedimentation on Old Abbott Rd 5800-241; largest problem is at Frying Pan Lk (100 yr flood maint. not analyzed).

Obliterate Rd 5800-242 within riparian area.

Evaluate dispersed site at Dry Meadows for riparian restoration.

Implement channel restoration and fish habitat maintenance projects in Draw and String Cr.

Implement road drainage network reduction projects.

Fence Jackpot Meadows and locate water source out of meadows.

Rehabilitate old clearcuts to meet VQOs from Timberline Lodge.

Develop Basin Pt and Frying Pan Quarry rehabilitation plans (visual).

Survey new roads added to the district from Bear Springs and add to GIS.

Mud Cr IDA

Conceptual Framework

Late seral structure will mean the same as the NWFP ROD's "late successional" stage of development.

It is estimated that approximately 20% of this IDA is in late seral habitat; 20% is between 80 and 100 years of age; and 60% is < 80 years of age (IDA percentages are based on stand exams and field knowledge).

Huckleberry fields located along the ridgeline between Eureka Pk and Devils Pk are locally popular and are potentially traditional (tribal).

This IDA is one of the District's major timber producing areas.

Off-site stands, poor soils and past management (fuels) have created: increased risk of catastrophic events (insect attack); delayed late seral structure development; low quality snag habitat and future snag deficits; and deficient existing and future terrestrial and in-stream LWD.

Varied dispersed cultural sites exist in this IDA including: WPA/CCC air strip; peeled cedar trees; tribal hunting/gathering camps/sites, etc. (see also Mid Still Cr IDA, ZZ WA).

Provide mt. bike trail opportunities in this IDA.

The Mud Cr Quarry is an active and future rock source site.

The Campbell Group private land is on the Aquisition Plan and has potential for wetland habitat.

Check on PGE maintenance needs for its utility corridor.

Buried utility corridors that follow the old Wapanitia Wagon Rd and Trillium Lk Rd should be recognized.

Project Recommendations

Continue to control noxious & non-native plant populations.

Develop and maintain seed and plant stock for ongoing restoration projects

Implement stocking level control in areas of Stand Initiation.

Develop thinning project to enhance huckleberry fields.

Evaluate small wetlands for vegetative encroachment.

Control erosion problems created by drainage of the Mud Cr Quarry.

Evaluate restoration of natural drainage patterns of Rd 903.
[completed 1997]

Evaluate and reconstruct roads and culverts as necessary to accommodate 100 year floods and fish passage.

Roads will be obliterated and brought back to near original contours to slove drainage problems (see attached ATM list).

Obliterate Rd 2656-072 and associated spurs and improve drainage pattern.

Evaluate and plan brook trout control within Mud Cr.

Evaluate reconstruction of Trillium Lk dam to enhance fishing access and reduce sedimentation.

Evaluate Dry Fir Trail location.

Evaluate recreation impacts on WPA/CCC airstrip area including fisheries and hydrology (see District Dispersed Sites Plan [to be completed in '98]).

Develop Vegetation Management Plans for FS developed sites: Trillium CG.

Evaluate future use and maintenance standards for Trillium Lk Xcountry Loop Trail (Proposed District Trail Management Plan would facilitate this).

Roaring River LSR IDA

Refer to the Willamette Province LSR assessment developed by the LSR Assessment Team.

Huckleberry fields located within the Abbott burn are both traditional (tribal) and locally popular.

Boundary ridges between Salmon/Oak Fork has known cultural sites.

Upper reaches of String Cr are good big game habitat.

High Rock is a potential peregrine nest site.

Project Recommendations

Implement stocking level control in Stand Initiation areas to promote late seral structure.

Obliterate all roads except Rd 5880 and 5800-246 (Rds 5880-012 and -340).

Evaluate and plan riparian restoration on Linney and Tumbling Crs.

Evaluate High Rock Rd closure (but keep open for snowmobile winter use).

Salmon/Huckleberry Wilderness IDA

Conceptual Framework

Refer to Salmon/Huckleberry LAC process to direct management of recreation use.

Refer to Wilderness Implementation Schedule.

Vegetation in the uplands is mid seral and is evenaged due to fires with late seral structure in riparian areas; oak openings occur as special habitats.

Draft Management Strategy for the California Wolverine (Gulo gulo luteus) does identify this IDA as part of a key refugia block (Strategy to be completed in FY 98 by Hughes/Huff).

Included in this IDA is a very small A5 area north of the wilderness and west of the Still Cr LSR; management objectives would be very similar to wilderness.

Project Recommendations

Reduce non-native fish stock (brook trout) at Salmon and Plaza Lakes.

Control noxious weeds in Lower Cheeney Creek drainage

Plan and implement restoration of lower Cheeney Cr landslide and skid roads.

Evaluate dispersed campsites above SFork bridge (west bank) (see also District Dispersed Sites Plan).

Evaluate restoration of campsites along Salmon R near Linney Cr crossing and Rolling Riffle areas.

Evaluate campsites around Plaza Lk for restoration.

Evaluate trail location to access Salmon R below the falls.

Implement forthcoming Fire Management Plan including prescribed natural fire.

Key Hole IDA

Conceptual Framework

Manage this IDA for Deer/Elk Winter Range with proper cover/forage ratios.

The Salmon/Huckleberry inventoried Roadless Area is located in this IDA. (Appendix C LRMP FEIS 1990)

Project Recommendations

Continue to control noxious & non-native plant populations.

Develop and maintain seed and plant stock for ongoing restoration projects

Implement stocking level control in various stands.

Evaluate and reconstruct roads and culverts as necessary to accommodate 100 year floods and storm proofing.

Evaluate roads/skid trails for obliteration and restoration.

Create deer/elk forage habitat.

Lower Salmon IDA

Conceptual Framework

The riparian late seral DFC for this IDA is currently being met. However, Doug fir will not be a primary component as time goes on unless it is regenerated as Western Hemlock will eventually dominate.

Late seral structure will mean the same as the NWFP ROD's "late successional" stage of development.

It is estimated that approximately 95% of this IDA is in late seral habitat; and 5% is 80-100 years of age (IDA percentages are based on stand exams and field knowledge).

Inventoried deer/elk winter range occurs in this IDA.

The old Salmon River Trail has heavy dispersed camping, hiking and fishing use.

Dispersed camping is creating significant impacts to riparian areas.

Project Recommendations

Continue to control noxious & non-native plant populations.

Develop and maintain seed and plant stock for ongoing restoration projects

Stabilize eroding cut/fill banks along Rd 2618.

Continue enhancement of instream large wood habitat and monitor and maintain existing structures.

Evaluate and reconstruct roads and culverts as necessary to accommodate 100 year floods, fish passage and riparian restoration.

Separate vehicle and pedestrian traffic along Rd 2618 and mitigate riparian restoration (1/4 mile south and one mile north of Green Canyon).

Improve access to dispersed sites with heavy maintenance of spur trails to Salmon R Trail.

Evaluation and restoration of dispersed camping sites within the Riparian Reserves along Rd 2618 would include closing some sites and revegetating them; and controling vehicles in others (Complete a District Dispersed Sites Management Plan).

Develop Vegetation Management Plans for FS developed sites: Green Canyon CG.

Continue or expand Salmon Watch Education program with Oregon Trout.

Wildwood IDA

Conceptual Framework

Within the Wild & Scenic River boundary riparian restoration projects may be funded on private property (in association with BLM).

Recommended Projects

Continue ongoing riparian restoration and instream projects at The Resort At The Mountain golf cource.

Proposed Metzger property riparian and instream restoration project.

Work with BLM to complete facilities and education program for Cascade Stream Watch.

Establish existing water uses for the area.

Check into Clackamas Co water needs planning process associated with future development.

Work with BLM on restoration of riparian areas (quarry, RV resort exchange property, etc.).

Project Priority List

Priority: H = high; M = Medium; L = Low; P = Plan; I = Implement
Project: V = vegetation; F = fish/roads; R = recreation; W = wildlife; O = other; E = eng/roads.

IDAs:

TLS = Timberline Ski Area	AP = Alpine WR = White R LSR	WW = Wildwood
SHW = Sam/Huck Wilderness	H26 = Hyw 26 Corridor	US = Upper Salmon R
RR = Roaring River LSR	MS = Mid Salmon R	MC = Mud Cr
SM = Salmon Meadows	KH = Key Hole	LS = Lower Salmon R

Project	IDA	Priority	FY 98	FY 99	FY 00	OUT YRS
V1) Noxious weeds/Non-natives	most	H	I	I	I	I
V2) Native seed/plant stock	most	H	I	I	I	I
V3) Stocking level control	most	H	MC	RR	US	I
V4) Survey Noble polypore	US	H	P			
V5) S Mead. human impct. eval.	SM	M	P	I		
V6) Huckleberry fields / restore	MC/US	M	MC		US	

V7) developd sites/veg plans	MC/LS	M				P
V8) Hyw 26 veg mangmt. plan	H26	L				P
V9) Off-site fir restoration	MC	M	P	I	I	I
V10) Eval. sm wetlnd encroach	MC	H	I			
V11) Regen. Whitebark Pine	TLS	L	P	I		
V12) Eval. restr. WFork riparian	US	H	P	P/I		

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Project	IDA	Priority	FY 98	FY 99	FY 00	OUT YRS
E1) Close/reconst/restore roads (see ATM list)	most	H-L	P/I	P/I	P/I	P/I
E2) Reduce rd drain. network	most/MC	H	P	I		
E3) Replace culverts	most	H	I	I	I	I
E4) Hyw 26 sand catch. etc.	H26	H	I	I	I	I
E5) Oblit. Rd 2656-130	MC	H	I			
E6) Oblit. Rd 5800-242 (parts)	MS	H		I		
E7) Oblit. Rd 2656-072 + spurs	MC	H		P/I		
E8) Decom.Rds 5880-012,-240,-340	RR	M		P	I	I
E9) Eval. rds/skid trails oblit	KH	H	I			
E10) Eval. High Rock Rd closure	RR	L				P
E11) Stab. rd banks 2618	LS	H	P/I			
E12) Stab. rd banks 5880	MS	H		I		
E13) Control eros. Linney Cr Rd	MS	H			I	
E14) Control eros. Abbott Rd (small section on ZZ - most on CR)	MS	H			I	
E15) Control eros. Mud Quarry	MC	H	P/I			
E16) Restore fire trails	KH	H	I			

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Project	IDA	Priority	FY 98	99	00	OUT YRS
F1) Channel restoration / fish	most	H	P/I	P/I	P/I	P/I
F2) Chan. rest. Dry/String Cr	MS	H		I		
F3) Survey aquat. inverts.	TLS/US/AP	H	P	P		
F4) Eval. disp. sites/Salmom R	LS/MC/US	M		P		
F5) Eval. disp. site Dry Mead.	MS	M	P			
F6) Non-native fish Salm/Plz Lks	SHW	L				I
F7) Eval. restor Cheeney landsld	SHW	H	P			
F8) Eval. disp.sites SFk bridge	SHW	M		P	-	
F9) Eval. disp.sites LinCr/RolR	SHW	M				P/I
F10) Eval. campsites at Plaza Lk	SHW	L				P
F11) Eval. rip. rest. Lin/Tumb Cr	RR/SHW	M		P		
F12) rip.rest. Res. at Mt golf c.	WW	H	I			
F13) rip.rest. Metzger prop.	WW	H	P			
F14) BLM quarry rest.	WW	H	P	I		
F15) Fence Jackpot Meadows	MS	H		I		
F16) Monitor TLS salting	TLS/AP	H	I			
F17) Mont. TLS drainfield	TLS/AP	H	I			
F18) Eval. brook trout control	SM/MC	M		P		
F19) Mont. water qual. W&SR	most	H	I			
F20) Salmon Watch Ed program	LS	H	I	I	I	I
F21) BLM Cascade Strm Watch	WW	H	I	I	I	I

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Project	IDA	Priority	FY 98	99	00	OUT YRS
R1) TLS Ski Area Master Plan	TLS	H	P	I		
R2) Devel. ATM Plan TLS	TLS	H	P	I		
R3) Salmon/Huck Wild. / LAC	SHW	H	I	I	I	I

R4) Mt. Lake rec. plans (Salmon/Plaza)	SHW	L				P
R5) Dist. Trail Mangmt. Plan (Trillium Lk Xcountry Loop T.)	MC	L	P	I		
R6) Devel. veg plan CGs-Tril.Lk	MC	M		P	I	
R7) Evl. trail access Salm. falls	SHW	L				P/I
R8) Heav. maint. SR Tr. spur trls	LS	M				P/I
R9) Eval. rec impct on WPA/CCC	MC	H	P			
R10) Separate ped/rd traf. R2618	LS	L				P/I
R11) Trillium dam fishing eros.	MC	H	P/I			
R12) Snowbridges-Yellowjacket T.	US	M				P/I
W1) Eval. deer/elk hab. needs	most	H	P			
W2) Create forage hab. D/Elk	KH	M	I			
W3) Survey for Rosy Finch hab.	A/TLS	H			I	

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SM = Salmon Meadows KH = Key Hole LS = Lower Salmon R

Project	IDA	Prio rity	FY 98	99	00	OUT YRS
O1) Hyw 26 Right-of-Way project	H26	H	P			
O2) Hyw 26 Corridor EIS	H26	H	P			
O3) Provide fuel break/Hyw 26	WR	H	P			
O4) Mont. Wapinitia range alt.	SM	H	P			
O5) Check utility maint.	US/H26	M	I			
O6) Check Wapinitia landline	SM	M	I			
O7) Estb. ex. water rights	WW	M	P			
O8) Estb. Wapinitia water rights	WW	L				P
O9) Clack. Co. water futures	WW	M	P			
O10) Survey MBES > MZIG roads	SM/MS/RR	H	I			
O11) Rehab clearcts/frm TLL	MS	H	I			
O12) Devel. quarry rehab plans	MS	M	P/I			

SALMON ILAD PROJECT PRIORITIES

CODE	PROJECT	IDA	PRIORITY	1998	1999	2000	OUTYEAR
V1	Control noxious and non-native plant populations	MOST	H	I	I	I	I
V2	Obtain native seed/plant stock	MOST	H	I	I	I	I
V3	Stocking level control	MOST	H	MC	RR	US	I
V4	Survey for noble polypore	US	H	P	I	I	
V5	Survey Salmon Riv.Meadows/human impacts/Wapinitia	SM	M	P	I		
V6	Huckleberry field enhancement/restoration	MC/US	M	MC		US	
V7	Vegetation plans for developed sites	MC/LS	M				P
V8	Hwy 26 Veg Management plan/ODOT	H26	L				P
V9	Off-site fir restoration/Sherar Burn area	MC	M	P	I	I	I
V10	Eval. small wetland encroachments	MC	H	I			
V11	Regen Whitebark Pine	TLS	L	P	I		
V12	Eval. Restoration/West Fork riparian area	US	M	P	P/I		
E1	Close and reconstruct/restore roads	MOST	H-L	P/I	P/I	P/I	P/I
E2	Road obliteration/recontoured to solve drainage problem	MOST/MC	H	P	I		
E3	Replace culverts	MOST	H	I	I	I	I
E4	HWY 26 Sand catchments/ODOT	H26	H	I	I	I	I
E5	Oblit. Rd 2656-130	MC	H	I			
E6	Oblit. Rd 5800-242 (parts)	MS	H		I		
E7	Oblit. Rd. 2656-072 + spurs	MC	H		P/I		
E8	Oblit. Rds. 5880-012, 340	RR	M		P	I	I
E9	Evaluate road and skid trail obliteration	KH	H	I			
E10	Evaluate High Rock rd closure	RR	L				P
E11	Stabilize road banks 2618	LS	H	P/I			
E12	Stabilize road banks 5880	MS	H		I		
E13	Control erosion Linney Creek Road	MS	H			I	
E14	Control erosion Abbott Road	MS	H			I	
E15	Control erosion at Mud Creek quarry	MC	H	P/I			
E16	Restore fire trails	KH	H	I			

SALMON ILAD PROJECT PRIORITIES

CODE	PROJECT	IDA	PRIORITY	1998	1999	2000	OUTYEAR
F1	Channel restoration for fish	MOST	H	P\I	P/I	P/I	P\I
F2	Channel restoration Dry/String Creek	MS	H		I		
F3	Survey for aquatic invertebrates	TLS/US/AP	H	P	P		
F4	Evaluate dispersed sites/Salmon River	LS/MC/US	M		P		
F5	Evaluate dispersed sites/ Dry Meadows	MS	M	P			
F6	Evaluate non- native fish/Salmon and Plaza Lakes	SHW	L				I
F7	Eval/Restore Cheeney landslide	SHW	H	P		I	
F8	Evaluate dispersed sites/ South Fork bridge	SHW	M		P		
F9	Evaluate dispersed sites/ Linney Creek/Rolling Riffle	SHW	M				P/I
F10	Evaluate campsites at Plaza Lake	SHW	L				P
F11	Evaluate riparian restoration/ Linney Creek/Tumbling Cr.	RR/SHW	M		P	I	
F12	Riparian restoration at Resort at the Mountain	WW	H	I	I	I	
F13	Riparian restoration at Metzger property	WW	H	P			
F14	BLM Quarry restoration	WW	H	P	I		
F15	Fence Jackpot Meadows (grazing issues)	MS	H		I		
F16	Monitor TLL salting	TLS/AP	H	I	I	I	I
F17	Monitor TLL drainfield	TLS/AP	H	I			
F18	Evaluate brook trout control	SM/MC	M		P		
F19	Monitor water quality/ Wild and Scenic river	MOST	H	I	I	I	
F20	Salmon Watch Educational program	LS	H	I	I	I	I
F21	BLM Cascade Streamwatch	WW	H	I	I	I	I
R1	TLL Ski Area Master Plan	TLS	H	P	I		
R2	Develop ATM plan for TLL	TLS	H	P	I		
R3	Salmon/ Huckleberry Wilderness LAC	SHW	H	I	I	I	I
R4	Salmon/Plaza Lake recreation plan	SHW	L				P
R5	District Trail Management Plan (Trillium Lake XC Loop)	MC	L	P	I		
R6	Develop Veg. Mgmt. plans/ Trillium Lake/Gr. Canyon	MC	M		P	I	
R7	Evaluate trail access to Salmon River falls area	SHW	L				P/I
R8	Spur trail maintenance to improve access/Salmon R. trail	LS	M				P/I
R9	Evaluate rec. impacts to WPA/CC site/ Summit Meadows	MC	H	P			
R10	Separate pedestrian/rd traffic Rd. 2618	LS	L				P/I

SALMON ILAD PROJECT PRIORITIES

CODE	PROJECT	IDA	PRIORITY	1998	1999	2000	OUTYEAR
R11	Trillium dam erosion caused by fishing access	MC	H	P/I			
R12	Snowbridges on Yellow Jacket Trail	US	M				P/I
W1	Evaluate deer and elk habitat needs	MOST	H	P	I	I	
W2	Create forage habitat for deer and elk	KH	M	I	I	I	
W3	Survey for Rosy Finch habitat	A/TLS	H			I	
O1	Hwy 26 Right of Way Project	H26	H	P		I	
O2	Hwy 26 Corridor EIS	H26	H	P			
O3	Provide fuel break/ HWY 26 (south of CJ's)	WR	H	P			
O4	Monitor Wapintia Range allotment	SM	H	P		I	
O5	Check utility corridor maintenance (PGE- phone)	US/H26	M	I			
O6	Check Wapinitia landline	SM	M	I			
O7	Establish water rights status within watershed	WW	M	P			
O8	Establish Wapinitia water rights	WW	L				P
O9	Evaluate Clackamas County water needs for future	WW	M	P			
O10	Survey roads MBES/MZIG for inclusion into ATM	SM/MS/RR	H	I			
O11	Rehab. clearcut visuals from TLL	MS	H	I		I	
O12	Develop quarry rehab plans	MS	M	P/I			

PROJECT PRIORITY LIST

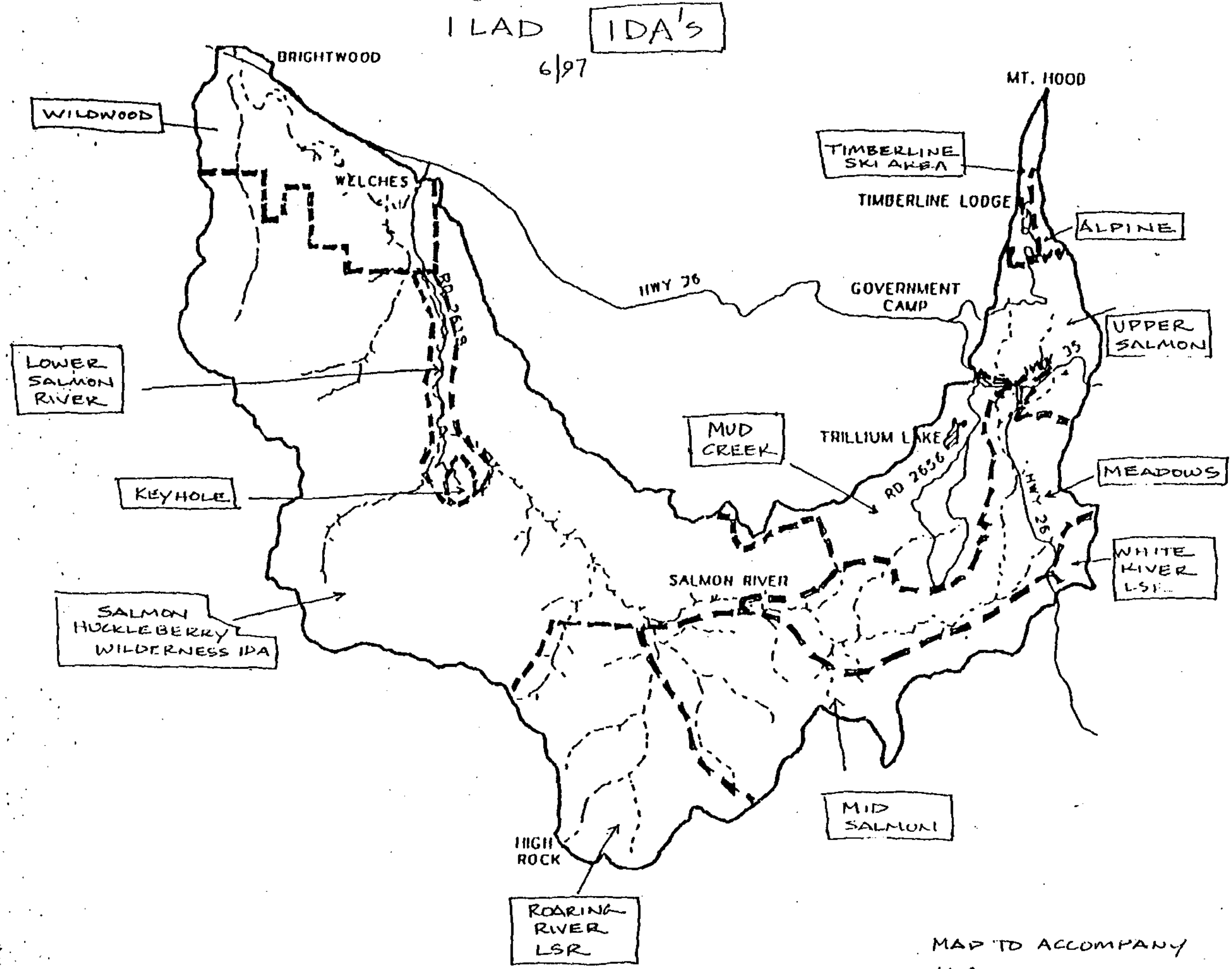
Project Priority: **H** = High **M** = Medium **L** = Low

Project Code **V** = Vegetation
F = Fish/Roads
R = Recreation
W = Wildlife
E = Engineering/roads
O = Other

IDA'S

AP = Alpine
H26 = Hwy 26 Corridor
KH = Keyhole
LS = Lower Salmon River
MC = Mud Creek
MS = Mid Salmon
RR = Roaring River
SHW = Salmon/Huckleberry Wilderness
SM = Salmon Meadows
TLS = Timberline Ski Area
US = Upper Salmon
WR = White River LSR
WW = Wildwood

Figure I-1 Salmon River Watershed



MAP TO ACCOMPANY
ILAD INFO FOR
SALMON WATERSHED