United States
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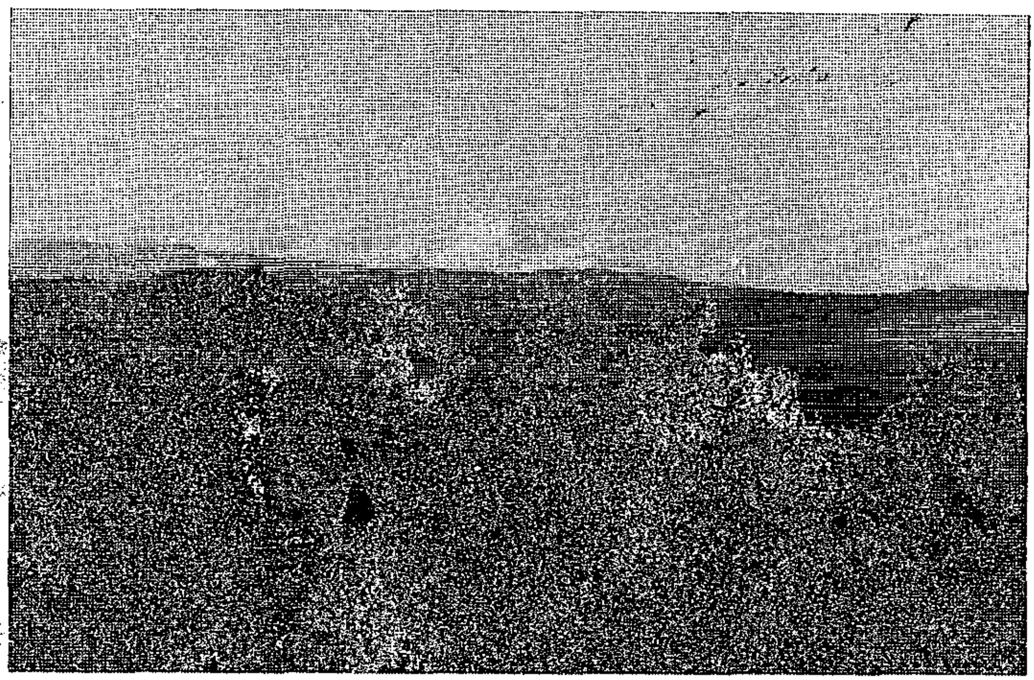
Forest Service

Pacific Northwest Region

1994

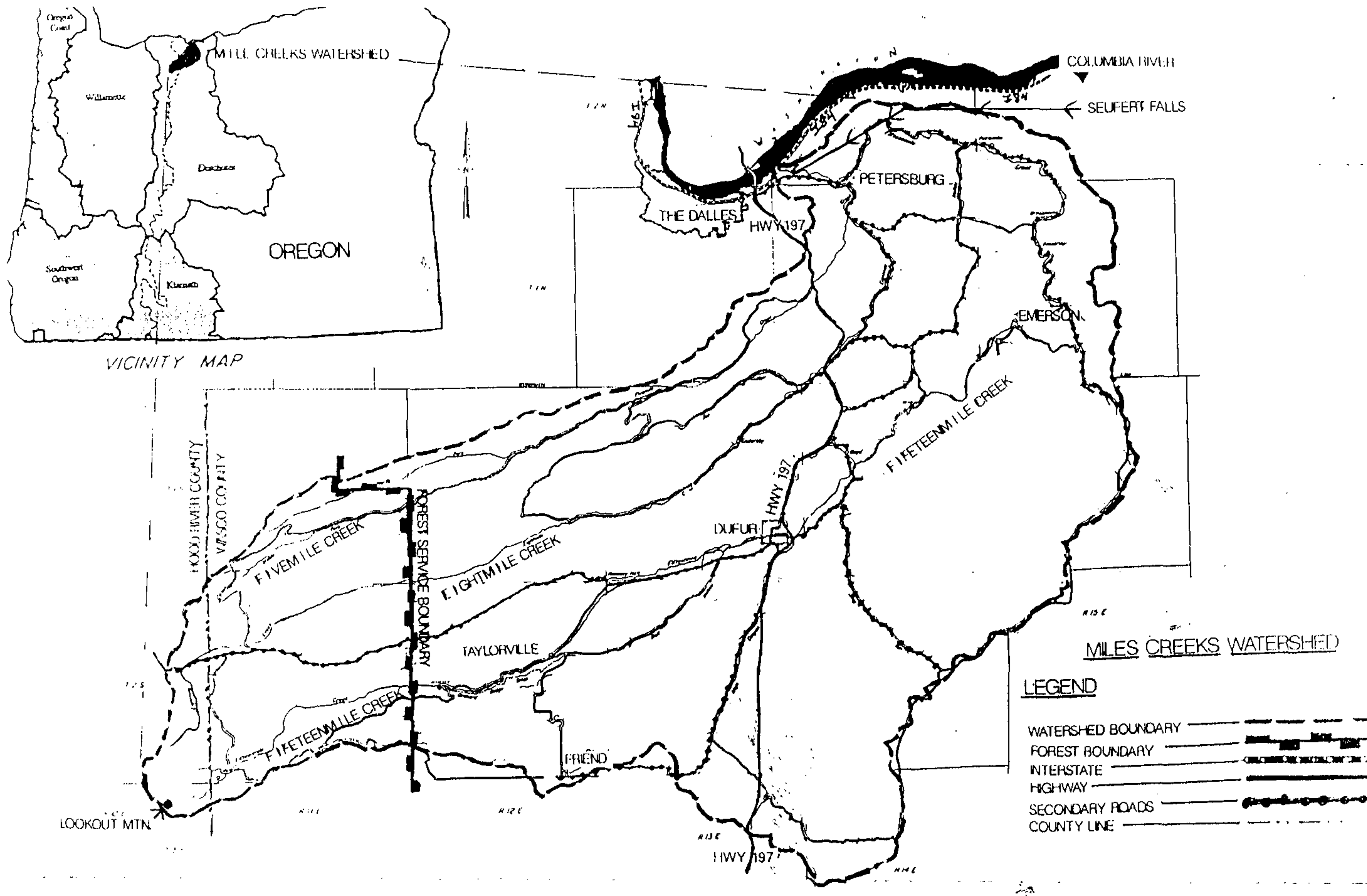
Watershed Analysis

Mile Creeks Watershed



Mt. Hood National Forest

September 1994


MILES CREEKS WATERSHED
LEGEND
WATERSHED BOUNDARY
FOREST BOUNDARY
INTERSTATE
HIGHWAY
SECONDARY ROADS
COUNTY LINE
COLUMBIA RIVER
SEUFERT FALLS
THE DALLES
HWY 197
PETERSBURG
EMERSON
FIFETEENMILE CREEK
DUFUR
EIGHTMILE CREEK
FIVEMILE CREEK
FOREST SERVICE BOUNDARY
TAYLORVILLE
FRIEND
HOOD RIVER COUNTY
WASCO COUNTY
LOOKOUT MTN
I 84
VICINITY MAP
OREGON
MILE CREEKS WATERSHED

Mile Creeks Watershed Analysis
Mt. Hood National Forest

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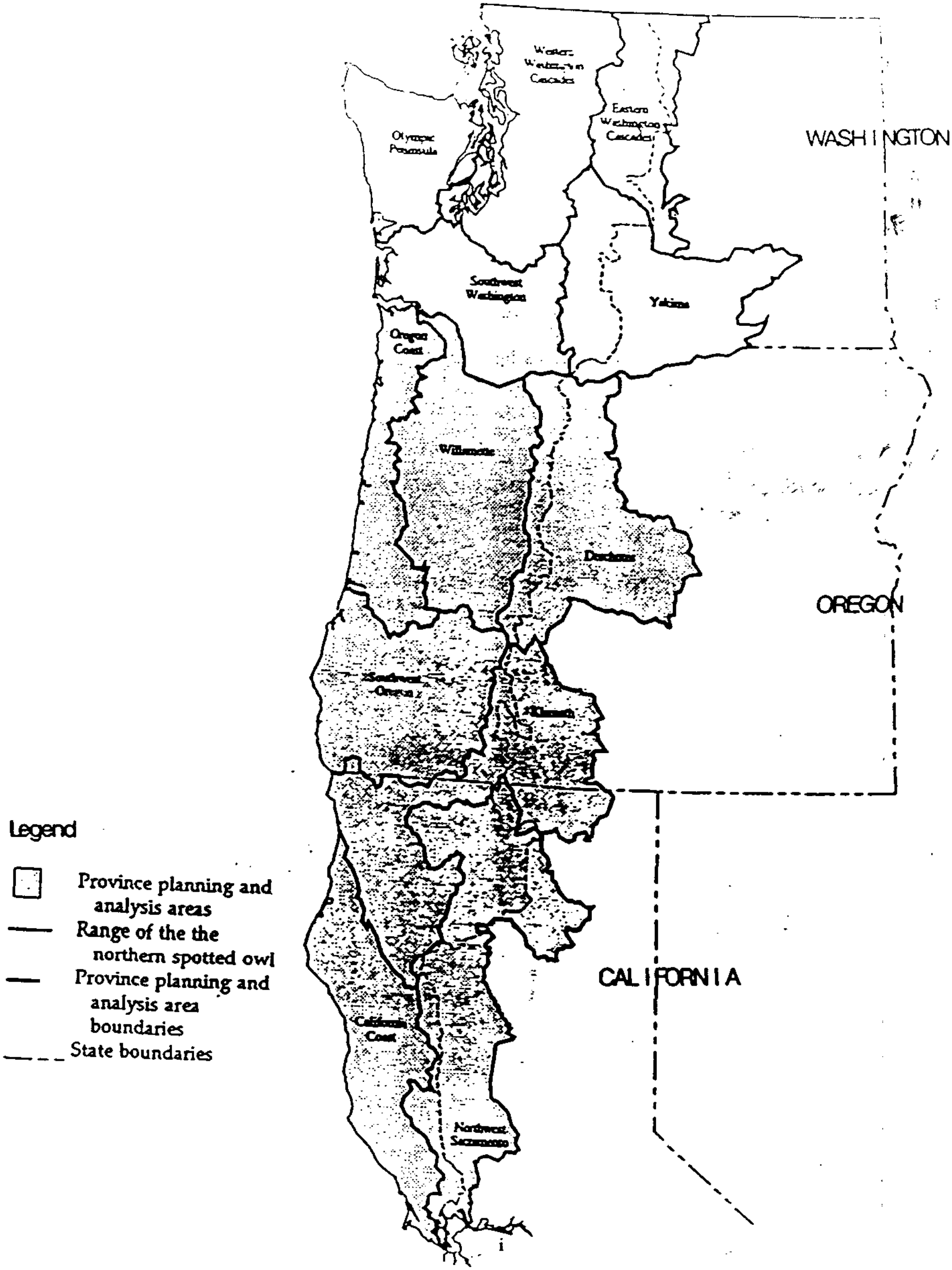
Figure P.1 Forest Ecosystems Within the Range of the Northern Spotted Owl



Preface

In April 1993, President Clinton commissioned an interagency scientific team to develop a set of alternatives for management of forested ecosystems within the range of the northern spotted owl (reference Fig. P.1). This effort culminated in the report by the Forest Ecosystem Management Assessment Team (FEMAT) entitled *Forest Ecosystem Management: An Ecological, Economic, and Social Assessment* in July 1993.

Due to accelerating concerns about declining fish resources, protection and improvement of aquatic and riparian ecosystems are key components of the FEMAT report, which presents a broad strategy for maintaining and restoring the distribution, diversity, and complexity of watershed and landscape-scale processes and characteristics under which aquatic species have evolved. The report also identifies and describes land allocations and standards and guidelines designed to meet specific management objectives. The report **describes a four element Aquatic Conservation Strategy (ACS): Riparian reserves, key watersheds, watershed analysis, and restoration.**

The Record of Decision (ROD) confirmed that a landscape-level analysis of the various components and interrelationships in the ecosystem will be the tool for developing future land management programs and projects. The ROD refers to this landscape level-analysis as a "Watershed Analysis".

The action described in the ROD amends all existing Forest Service and Bureau of Land Management planning documents for the areas and resources covered by the Supplemental Environmental Impact Statement (SEIS). This new management direction will apply to projects that will be conducted after site-specific environmental analysis.

Although the PIG (Policy and Implementation Guide, for Columbia River basin anadromous fish habitat management) is not directly mentioned in the ROD, watershed analysis and resulting recommendations for implementing the ACS are designed to restore and protect salmon and steelhead habitat on federal lands within the range of Pacific ocean anadromy over time.

What WA does and does not do.

As described above, Watershed Analysis is one of four components of the Aquatic Conservation Strategy. It provides decision makers with a scientific assessment of processes within and surrounding a watershed to support planning, as well as a baseline from which to assess maintaining or restoring the condition of aquatic, riparian and terrestrial habitats. Watershed Analysis is required in Key Watersheds and roadless areas prior to management, and recommends Riparian Reserve widths in all watersheds.

Watershed Analysis does not establish the final boundaries of Riparian Reserves, as they are established during site-specific project planning. Rather, the role of watershed analysis is to provide the information needed to decide how to delineate Riparian Reserves.

Watershed analysis will be the mechanism to support ecosystem management at approximately the 20 to 200 square mile watershed level, including terrestrial, riparian, aquatic, and social issues. It will focus on collecting and compiling information within the watershed that is essential for making sound management decisions. Although inventory is not a part of watershed analysis, existing inventory data will be useful in an analysis for prioritizing and designing future inventories, as well as providing the basis for developing project-specific proposals, monitoring and restoration programs. It does not take the place of project-level data-gathering and analysis.

Watershed Analysis is a technically rigorous procedure with the purpose of developing and documenting a scientifically-based understanding of the ecological structures, functions, processes and interactions occurring within the watershed. Some of these include beneficial uses; vegetative patterns and distribution; flow phenomena such as vegetative corridors, streams, and riparian corridors; wind; fire (wild and prescribed fire, and fire suppression); wildlife migration routes; dispersal habitat; terrestrial vertebrate distribution; locally significant habitats; human use patterns throughout the ecosystem; cumulative effects; and hydrology. The number and detail of these aspects considered will depend on the issues pertaining to a given watershed.

Threatened and Endangered Species

The Endangered Species Act (ESA) directs that a program to conserve fish, wildlife, and plants, including those listed as threatened or endangered, be established and implemented. The selected alternative of the President's Forest Plan is designed to provide for the continued existence of threatened and endangered species. Consultation on the plan was conducted with the Fish and Wildlife Service and the National Marine Fisheries Service in accordance with Section 7 of the ESA.

The ESA requires that consultations occur on actions, but not on analyses. A watershed analysis does not make decisions, and does not result in any activities or actions, that would require consultation.

Anadromous Fish

Evaluating the viability of anadromous fishes must be done at the Regional scale. In 1993, the Scientific Analysis Team (SAT) completed their report called: *"Viability Assessments and Management Considerations for Species Associated With Late-Successional and Old-Growth Forests in the Pacific Northwest."* The SAT report includes recommendations of the Pacific Salmon Working Group, also known as PACFish. Another recommendation of the SAT report included: initiating comprehensive watershed restoration measures in watersheds with priority given to those having the greatest potential to provide high quality fish habitat (i.e. Tier 1 key watersheds, ROD 1994).

Old-Growth Ecosystems

The standards and guidelines described in the ROD are designed to:

- Maintain late-successional and old-growth species habitat and ecosystems of federal lands.
- Maintain biological diversity associated with native species and ecosystems in accordance with laws and regulations.

Watershed Analysis at the watershed/subwatershed level should provide a finely tuned assessment of habitat capability within the Late-Successional Reserves (LSR), as well as the current dispersal conditions between the LSRs. This process will help locate areas of concern that were not possible to identify through the large scale, course grained assessment made at the Regional level for the ROD (1994).

River Basin Planning and Beyond

Watershed analysis should also be set in the context of larger landscapes (e.g. river basins, Provinces, and Regions) in order to coordinate with regional strategies of management and restoration, and to integrate large-scale processes that may be difficult to measure at a watershed scale.

River Basin Assessments: Within a hydrologic Province (**thousands** of square miles):

- Identifies values and issues within the River Basin.

- Describes the dominant physical processes within the River Basin and interactions between ecosystem components.

- Identifies watersheds and the sequence of analyses.

In the **absence** of Province-level assessments, the Mt. Hood National Forest undertook a project to gather large-scale information called "PULSE". The PULSE effort provided information at the Forest-level to develop the ecological and human components within the Forest context.

Project Planning

Resource management activities following Watershed Analysis will be subject to site-specific environmental analysis and appropriate public participation. This will involve analysis of cumulative and other environmental effects.

The Watershed Analysis process includes informal public participation involving government, tribal, adjacent landowners, private organizations, industry, and interested citizens. If a NEPA analysis utilizes information from a watershed analysis, the information will be available for public review during the NEPA process for the project.

In some cases, the importance of new data or changing issues may make it useful to re-evaluate parts of the original Watershed Analysis or update the entire document. A watershed analysis should thus be considered an open file and a dynamic document that is never "complete".

Acknowledgments

We, the Eastside Watershed Analysis Team, would like to thank and acknowledge the contributions made, either with time and energy, and/or verbal communications or written works, of all the following Agencies and individuals. Each of them has in some way helped to make this document dynamic and successful in meeting the intent of Watershed Analysis.

Agencies (Federal/State/Local):

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Glossary of terms courtesy of the Shasta-Trinity National Forest Watershed Analysis Team.

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We also want to acknowledge a member of our team who in the middle of our analysis had to move onto other opportunities. A member who had a lot of determination and drive, and kept us always focused on our purpose. **Thank-You Ginnie Grilley!**

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Executive Summary

Mile Creeks are located in North Central Oregon, east of Mt. Hood and on the eastern flank of the Cascade Mountain Range. The Mt. Hood National Forest manages 15 % of the 239,000 acre watershed. The majority (85 %) is privately held. Elevations within the watershed range from 6,525 ft. Lookout Mountain, to the confluence of Fifteenmile Creek with the Columbia River (elevation 120 ft.). Growing conditions created by the extremes of climate and terrain support vegetation as varied as the wet montane subalpine fir and mountain hemlock forest of the high country, to the sparse Columbia Basin bunchgrass communities of the arid lowlands. The Mile Creeks winter steelhead are unique at the Forest, Basin, and Regional scales. They are the only extant stock of wild winter steelhead in Oregon that originated from inland redband trout, and populations of genetically intact wild steelhead are rare throughout the region. This summary looks at past and present conditions, desirable conditions and trends, restoration projects, and monitoring recommendations in Mile Creeks which can improve ecosystem health in the watershed.

I. Past and Present Conditions

The past and present conditions of Mile Creeks do provide us clues about the future of the watershed. Understanding what those conditions are and how they came to be, will ultimately lead us to opportunities we can take advantage of now, and ensure a healthier watershed progressing towards desired conditions.

A. Prehistoric

Mile Creeks has always had a wide diversity of plant and animal life. The topography, elevation changes, and moisture regimes account for much of why there is so much diversity. The five plant stratum that exist today - Subalpine Fir/Mt. Hemlock, Moist Grand Fir, Dry Grand Fir/Douglas-fir, Ponderosa Pine/Oregon White Oak, Steppe - likely existed in prehistoric times. Lack of historic data prohibits us from speculating on how the diversity of the plant communities has changed over time. However, we can speculate that the influence of each community on the landscape is likely much different today than in pre-historic times. The primary differences were caused by the influences of humans to this area. The agents that most influenced the vegetation on the landscape were lightning-caused fires, and frequent low-intensity ground fires set by American Indians (oral history). Below 3,600 feet elevation, the Dry Grand Fir/Douglas-fir strata were dominated by open stands of large Ponderosa pines. The Ponderosa Pine/Oregon White Oak strata were dominated by open stands of large Ponderosa pine, but also included a component of large Oregon white oaks. Precipitation, aspect, lightning, and American Indian fire practices all contributed to the open appearance and condition of these stands, and the resulting fire regime in both strata.

Like the plant communities, the wildlife that inhabit this watershed are also diverse. Lack of historic data does not allow us to quantify changes in wildlife biodiversity that may have occurred over time. We do know, the gray wolf and grizzly bear were extirpated from the watershed in recent history, and the number of potential terrestrial and riparian-dependent wildlife species currently exceeds 260. This information allows us to speculate that in prehistoric times there was equally diverse wildlife biodiversity in this area. Due to increased fire frequency, especially in the Dry Grand Fir/Douglas-fir and Ponderosa Pine/Oregon White Oak strata, we can speculate that there was less large woody debris on the ground, and probably more decadent old trees. Few noxious plants existed in foraging areas. Aquatic conditions in the creeks were conducive to providing habitat for a diverse array of aquatic plant and animal species, including a variety of coldwater fish species.

Early native people were probably subsistence-oriented. Long-term village sites were present near the Columbia and Deschutes Rivers. These sites were fairly large and indicate summer use by large groups of people. Activities were most often related to salmon harvest. Village sites in the winter were often located about a mile from the large rivers. They were used by smaller groups of people and were primarily found in the more sheltered areas of the watershed. Higher elevations brought about the growth of various plants with cultural significance and uses (i.e. plants used for food, medicine, clothing, shelter, tools, and containers). Short-term seasonal camps were associated with hunting and gathering activity, and resources sought included game meat, pelts, fish, and plants such as berries, wild celery, camas, wild onion, nuts, acorns, mushrooms, willow, and cedar.

B. Historic, up to Today

In 1843, the Barlow Road provided access to the area for European Americans. Although the road was first used for emigration, some people did settle, and by late 1800's the Mile Creeks Watershed was fairly well populated.

Prior to 1900 commercial fishing, livestock grazing, agriculture, and logging were well established natural resource industries in the area. Riparian areas in Mile Creeks were used heavily for wood, fuel, irrigation, cropland, roads, flood control, and livestock forage and watering. Several mills with associated wood cutting sites for lumber production were located in the drainages. The open stands of Ponderosa pine found in the Dry Grand Fir/Douglas-fir stratum, along with the pine and oaks found in the Ponderosa Pine/Oregon White Oak stratum provided much of the lumber and fuelwood needs of people in the early days of settlement. Consequently most of the largest Ponderosa pines and oaks were cut to supply fuelwood for homes, railroad locomotives, and Columbia River sternwheel steamers.

Since then, and up to today, experiential pursuits focus on viewing scenery, and driving for pleasure. Recreational opportunities include fishing, hunting, horseback riding, hiking, camping, mountain biking, snowmobiling, and off-highway vehicle use. Today's commodity opportunities include harvesting timber and other wood products, harvesting mushrooms, and firewood cutting. Agriculturally, the private lands off the National Forest support dryland and irrigated crops, and livestock grazing. As upland forest were harvested, roads constructed, and lowlands grazed and converted to cropland, annual peakflows increased, baseflows decreased, and , some sections of creeks in the mid-lower watershed incised within former floodplains. The results were extensive streambank erosion during the 100 year storm events of 1964 and 1974. Flood damage and federal funding assistance from the Soil Conservation Service prompted landowners to remove streambank vegetation and in-channel large woody debris, and channelize creeks. Creeks were from their floodplains which increased streambank erosion during flood events, decreased riparian zones and water storage capacity, and further degraded fish habitat. Since the 1964 and 1974 floods, riparian restoration efforts of State and County agencies and local landowners have created a more complex stream structure and re-vegetated streambanks. These efforts have resulted in some improvement stream temperatures and habitat for fish, re-establishment of wildlife in the riparian areas, and a decrease in streambank erosion on private lands.

As mentioned earlier, the Mile Creeks Watershed is home to the eastern-most stock of wild, winter steelhead in the Columbia River Basin, and are the only extant stock that originated from inland, redband trout. The upper 15 % of the watershed is a critical source of high quality water and refugia for spawning and rearing steelhead because of degraded riparian and aquatic habitat and altered processes in the mid-lower watershed. Water diversions combined with decreased streamshade and shallow, aggraded streams, routinely raises water temperatures to lethal limits for salmonids and other coldwater fishes in the lower watershed during the irrigation season. Roads and road construction, timber harvest, rangeland and agricultural practices have all contributed to increased fine sediments in the streams, which degrades spawning and rearing habitat in the mid-lower watershed.

Historically, the Confederated Tribes of Warm Springs had traditional subsistence fisheries for Mile Creeks steelhead and Pacific lamprey at Seufert Falls, and Mile Creeks steelhead were a locally important recreational fishery. The Mile Creeks subsistence fishery for lamprey is the only one of it's kind within the Hood River Subbasin, or any of the watersheds encompassed by the Mt. Hood National Forest. Subsistence and recreational fisheries for Mile Creeks steelhead and lamprey have been closed since 1984 to conserve declining runs.

The historic range of the Pacific lamprey in the Columbia River Basin was coincident with anadromous salmonids. Mile Creeks steelhead and Pacific lamprey have the same habitat requirements, and are at-risk in the mid-lower watershed. In May 1994, all stocks of steelhead trout were petitioned for listing under the Endangered Species Act across their Alaska to Southern California range. Bases for the petition include genetic and environmental risks, and small extant populations. Pacific lamprey are State Sensitive Species based on significantly depressed populations throughout their range. Loss of the Mile Creeks steelhead would mean extinction of a unique steelhead stock. Pacific lamprey are at-risk of extirpation from Mile Creeks Watershed.

Non-native plant introductions, grazing, and fire exclusion have altered pre-European settlement vegetation considerably. Non-native insect and diseases have contributed to some important changes in vegetation patterns and have the potential to create deleterious cumulative effects in the future. Before the era of fire suppression, within the Moist Grand Fir strata, medium to high intensity fires burned periodically. The patchwork mosaic of the vegetation that resulted served to attenuate fire behavior during the next burning cycle, owing to differences in fuel, stand structure, stem density, and stand age. The forest developing today in this strata is seeing succession increase canopy layering, thus providing pathways for fires to reach the crowns. Combined with infestations of disease and insects, whose depredations add fuel and aid canopy drying, fires are likely to burn hotter and do greater damage to the site. The Dry Grand Fir/Douglas-fir strata (2,100 to 4600 feet elevation), was historically shaped by frequent, irregular underburns, and by the upper elevation forest (typically, the Moist Grand Fir strata) where crown fires predominate. With fire largely excluded from this forest since the early 1900's, stands are well outside their historic ranges for stand composition and structure. There is immense risk of fire reaching conflagration proportions. Moreover, habitat and ecological niches associated with open Ponderosa pine have all but disappeared in the watershed. Forests are no longer dominated by large, fire tolerant Ponderosa pine and Douglas-fir over a grass/forb understory. Logging overstory trees that were more tolerant of underburning has promoted the in-growth of shade tolerant grand fir and Douglas-fir. Today's forest is dominated by grand fir and Douglas-fir trees less than 100 years old - at densities sometimes approaching 1000 stems per acre - instead of stands that had 25 to 75 stems per acre of predominately large trees and scattered patches of reproduction. Trees defoliated by western spruce budworm and stressed by drought are more prone to attacks by bark beetles. Build-up of mortality from bark beetle attacks could lead to stand replacing wildfires.

Humans settling in this area have introduced several things into the landscape, including livestock, exotic forage species, noxious plants, agricultural plant species, bullfrogs, hatchery rainbow trout and eastern brook trout. The introduction of predaceous bullfrogs and trout may contribute to the cumulative effects depressing populations of native amphibians, aquatic reptiles, and fish. Noxious plants compete with native vegetation thereby diminishing the quality and quantity of native plant composition and native plant species diversity. Most of the Steppe stratum has been converted to agriculture and cultivated. Where native vegetation remains the land is not amenable to cultivation, and the dominate use is livestock grazing.

Some terrestrial wildlife species are native year round residents, others are migratory including bald eagles, greater sandhill cranes, peregrine falcon. Changes that have altered the current size, shape, and distribution of the habitats, and disrupted or altered current connectivity and migration patterns include fire exclusion, timber harvest, grazing, roads, and recreation. Key wildlife species habitats analyzed in the Mile Creeks Watershed include deer, elk, northern spotted owl, fisher, wolverine, pine marten, and pileated woodpecker. The National Forest lands within the watershed provides refugia for late-successional forest dependent species, and the upper elevations of Mile Creeks Watershed are part of the eastern-most range of the northern spotted owl in the State of Oregon. Fire suppression has created more cover for deer and elk, and has increased habitat for spotted owls on the uplands within the watershed. Closed roads on private land have provided better security for deer and elk then the open road densities found on public lands.

A noted feature of Mile Creeks is Camp Baldwin. Camp Baldwin is 637 acre parcel, owned and operated by the Boy Scouts of America, is part of a 1,455 acre continuous block of privately owned parcels surrounded by National Forest land in the upper watershed.

II. Desirable Conditions and Trends

Desirable conditions and trends differ with various values. Restoring healthy populations of wild, winter steelhead and Pacific lamprey, open old-growth stands of large Ponderosa pine, travel corridors and Riparian Reserves for the migratory wildlife, and maintenance of jobs and recreation for the people living in the area are some examples. More specific examples of desired conditions and trends include:

- As a Tier 1 key watershed, the national Forest land within Mile Creeks Watershed will have designated Riparian Reserves and be managed for improved viability of the at-risk wild, winter steelhead population.

- Maintain population viability of steelhead and Pacific lamprey by reduction of sediment, increased baseflows, decreased peakflows, decreased water temperatures, riparian zone restoration, and increased production and retention of in-stream large woody debris.

- Provision of cold, clear, clean water for the myriad species of fish, macroinvertebrates, amphibians, wildlife, and humans dependent on this resource.

- Provision of adequate volumes and a continuous supply of water that can sustain fish and wildlife needs, and supply irrigation and other social human needs.

- A recreational infrastructure that is integrated in the landscape and associated resource values. Scenery will improve as the visual effects of past management soften over time. Restoration efforts aimed at recovering stable forest ecosystems will also improve diversity of landscape and vegetative patterns that are desirable in this watershed.

- Sustainable supplies of timber, wood, and other miscellaneous forest products which are of primary social and economic importance for many people associated in the watershed. Opportunities to provide commodities will result from implementation of the recommended restoration projects and through the landscape design and the NEPA process.

- Significant reduction of the risk of catastrophic fire in the Dry Grand Fir/Douglas-fir strata, through silvicultural practices that will return the strata to more fire resistant/tolerant stands. Once the risk has been significantly reduced, maintenance of these stands could be achieved through the reintroduction of frequent, low intensity ground fires.

- An increased number of low intensity ground fires in the Ponderosa Pine/Oregon White Oak strata, to reduce the number of stems per acre, decrease the stems per acre competing for limited resources, and reduce the stress on the trees in this strata.

- Maintenance of native plant and wildlife species biodiversity.

- Population viability of the federally threatened, endangered, and USFS Regionally Sensitive species and special status plant, animal, and fish species in Mile Creeks that are in social demand, unique, or have depressed populations at the basin and regional scales.

The future of Mile Creeks may be different than what anyone desires, however, to achieve the desired conditions and trends, it will take a cooperative effort between several Federal, State, and local agencies, as well as, a special effort of the agencies and the private landowners, within the watershed, to work cooperatively together. The work will be designed for long-term restoration of the processes and habitat components that create and maintain terrestrial, riparian, and aquatic ecosystems.

III. Restoration Projects

The objective for restoration projects in Mile Creeks Watershed is to bring resources, processes, and ecosystem function towards desired conditions, with respect to beneficial values. Restoration project opportunities were described in terms of altered processes, types of projects, objectives, and potential human benefits.

In most cases, the most critical restoration needs for conservation of steelhead and Pacific lamprey, numerous other aquatic and riparian-dependent species, and other instream beneficial values occur off Forest, on private land downstream of federal ownership. Our logic for prioritization of Mt. Hood National Forest restoration opportunities within the upper subwatersheds was based on the ROD Key Watershed concept of providing the greatest opportunity for maintaining, conserving or restoring existing populations of at-risk species and high quality habitat for terrestrial, riparian and aquatic beneficial values, and the greatest perceived risks to beneficial values by vegetative community. Based on the key watershed concept, Fifteenmile subwatershed, including Larch Creek, is the highest restoration priority on the National Forest, followed by Eightmile and Fivemile subwatersheds, in order of priority.

Altered processes where primary project opportunities can be found throughout the watershed are in relation too, peakflows, baseflows, stream temperatures, erosion, channel morphology, wildlife migration, habitat connectivity, forest structure, function and composition. One recommendation to slow these processes from further alterations is through de-commissioning and reducing the amount of system and non-system roads.

The most critical project opportunities for the conservation of wild, winter steelhead, Pacific lamprey, and numerous other aquatic and riparian-dependent species lie in the formation of cooperative partnerships and/or encouragement of private landowners in Mile Creeks watershed downstream of National Forest.

A complete look at project opportunities can be found in Chapter VI Management Recommendations, in this analysis. Highlighted projects are:

- Thinning projects that will move managed stands towards hydrologic maturity of > 70 % canopy closure and 8" diameters at breast height, reduce the number of stems per acre of small understory trees, primarily in the Dry Grand Fir/Douglas-fir, and improve the health and vigor of the stands, and increase resistance to insect and disease infestations.

- Irrigation ditch and delivery system improvements to minimize water loss.

- Channel reconstruction in the mid-lower watershed to increase floodplain storage capacity, raise the watertable, increase baseflows, lower water temperatures, reduce sediment, and stabilize channels.

- Public acquisition of water rights for adequate in-stream baseflows and water temperatures for coldwater fishes and other wildlife.

- Headcut stabilization to stabilize water storage capacity and decrease sedimentation.

- Riparian silviculture to accelerate canopy closure and streamshade to decrease water temperature and increase large woody debris recruitment in riparian and aquatic habitats.

- Upland silviculture to accelerate large diameter, forest structure in managed stands to restore late-successional terrestrial habitats

- Sediment point sources stabilization, including developed and dispersed campsites, recreational trails, road cutslopes, fillslopes, ditches, and culvert outlets.

- *Trail system design that incorporates suitable stream crossings and is suitable for diverse recreational uses* (i.e. off-highway vehicle, equestrian).

- Construction of water gaps and/or out of channel water development for livestock in the mid-lower watershed.

- Riparian zone fencing in the mid-lower watershed to decrease bank erosion, increase streamshade, decrease water temperature, increase large woody debris recruitment, improve water quality, increase riparian habitat quantity and quality, and increase biodiversity of vegetation in the riparian zones.

- Erosion control such as strip planting and retention of residual organic matter on agricultural lands.

- Noxious plant control.

- Road and trail obliteration and seasonal closures.

- Restoration of frequent, low intensity underburns to improve habitat for some of the species that have seen reductions of habitat due to in-growth, and to bring the forest closer to the range of historic variability, thereby reducing some of the drought stress and risk of a catastrophic fire occurring due to fuel loading, caused by decades of fire suppression, primarily in the Ponderosa Pine/Oregon White Oak stratum.

Recommended baseline monitoring opportunities were identified by process or function to assess current, pre-project conditions in the watershed with respect to the beneficial values and desired conditions. The recommended trend monitoring will provide data to assess the effectiveness of implemented reserve recommendations, management plans and restoration projects towards achieving desired condition within the watershed. The monitoring opportunities can be used as the basis for development of a comprehensive monitoring plan to evaluate progress toward desired *conditions in the entire watershed.*

I. Description of the Mile Creeks Watershed

Mile Creeks are located in North Central Oregon, east of Mt. Hood and the Eastern flank of the Cascades Range. Striking features of the watershed are north-south vegetative bands and creeks that flow in an west-east orientation before turning northward to the Columbia River. The 239,000 acre watershed includes the Fivemile, Eightmile, and Fifteenmile subwatersheds, and their tributaries (reference Fig. I.1). Elevation within the watershed ranges from the headwaters on 6,525 ft. Lookout Mountain , to the confluence of Fifteenmile Creek with the Columbia River (elevation 120 ft) (reference inside front cover).

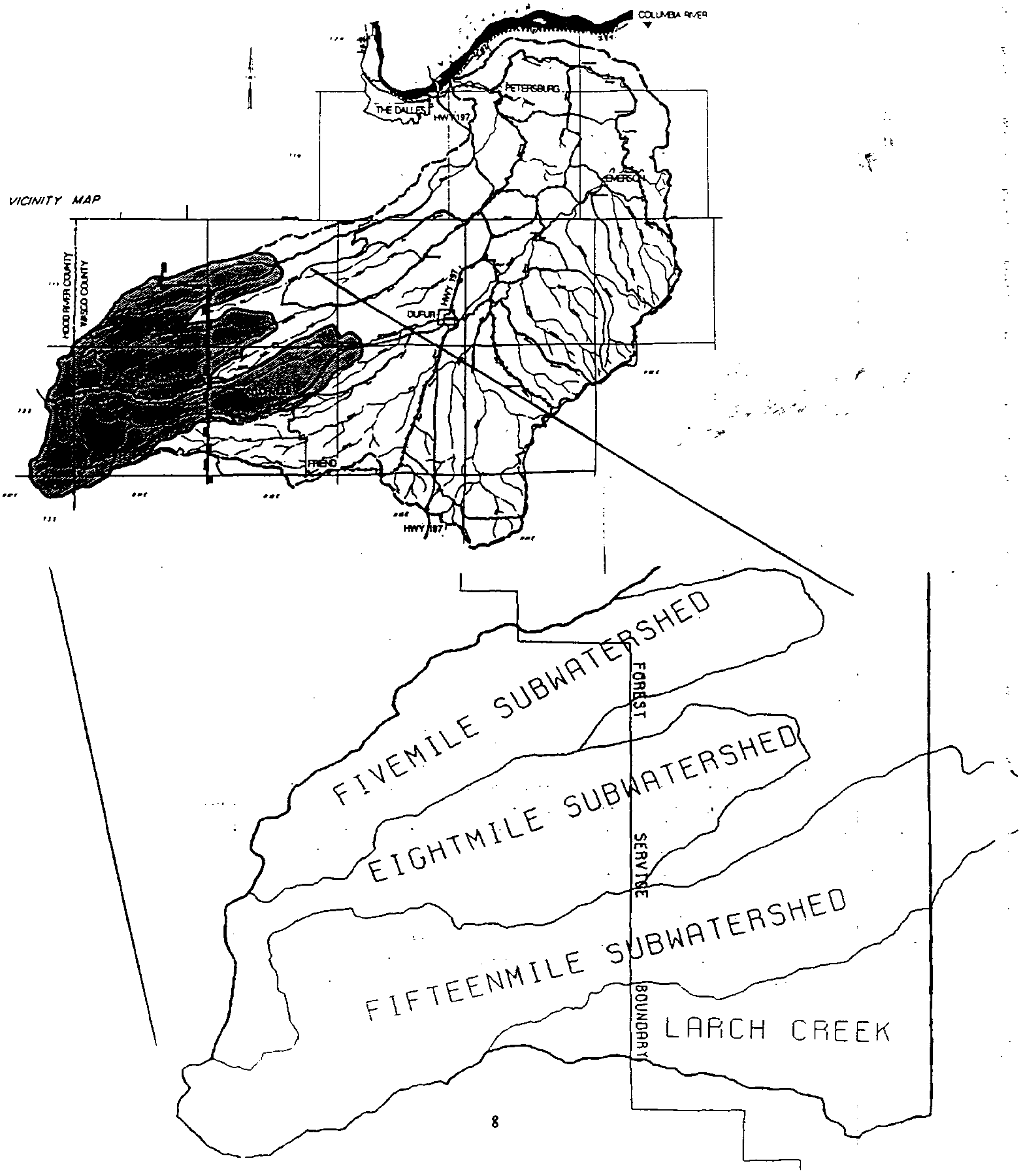
The watershed originates in the Subalpine Fir/Mountain Hemlock stratum, flows west-east through Moist Grand Fir and Dry Grand Fir/Douglas-fir forests, down to xeric Ponderosa Pine/Oregon White Oak , and finally bends northward through agricultural lands and Steppe/bunchgrass open range. The north-south vegetation bands are influenced by elevation, precipitation, aspect and fire regime. Annual precipitation ranges from 12-100 inches depending on elevation, with the highest elevations receiving the greatest amounts. Most of the precipitation falls between October and March. The primary year round source of water feeding into the creeks, is from a series of springs near the headwaters, that formed along the north-south geologic contact point between the resistant andesite formation and the less resistant Dalles formation. Snowmelt influences on the creeks are related to seasonal peakflows and to a much lesser degree to year round baseflows. Snowmelt does contribute to underground water supplies and their replenishment.

The lands within Mile Creeks, are ceded lands from the Confederated Tribes of Warm Springs Indian Reservation. Mt. Hood National Forest manages the mid to high elevation mixed conifer forests in approximately 15 % of the watershed, for multiple-use including timber harvest, recreation, fishing, hunting, maintaining wildlife and fish species viability, and other commodity extraction and experiential pursuits. The Boy Scouts of America have a 637 acre inholding called Camp Baldwin, that includes Hanel Lake , a small reservoir for recreational use on Wolf Run irrigation ditch, located in the upper Eightmile subwatershed. Camp Baldwin is only part of a 1455 acre block of privately owned in-holding , within the National Forest. Outside of the National Forest other large landowners within the watershed include the City of Dufur and the Oregon Department of Fish and Wildlife. The only natural lake in the watershed is Oval Lake located at the headwaters of Fret Creek, in the uppermost part of the Fifteenmile subwatershed. The lake lies entirely inside the Badger Creek Wilderness.

The Bureau of Land Management (BLM) manages 600 acres of second-growth Ponderosa Pine/Oregon White Oak and shrub steppe/bunchgrass, primarily for timber harvest. Most of the BLM land lies within the Fivemile Creek subwatershed. The rest of the mid-elevation, mixed conifer forest is privately owned. The majority of the eastern two-thirds of the watershed is used for private dryland wheat production and rangeland. Pasture and other agricultural crops are of secondary importance, and crop selection is dependent to a large degree on the availability of water for irrigation.

The headwaters for Fivemile, Eightmile, and Fifteenmile Creeks originate, entirely or predominately, in Hood River County. The rest of the watershed is in predominately rural, agricultural Wasco County. Wasco County boasts a population of approximately 22,500 people (1990 census). The majority of people reside in the cities of The Dalles, Dufur, and north Wasco County. There are numerous, small unincorporated communities dotting the countryside within Mile Creeks Watershed (reference inside front cover). Residents of south Wasco County rely on farming and ranching for their income. A few are still employed in the wood products industry, and a few more in various aspects of tourism and recreation. The Mile Creeks Watershed provides a lot of the water needed for irrigation and livestock use. Surface water rights from Fifteenmile Creek supplement the City of Dufur's predominantly groundwater water supply.

Figure I.1 Subwatersheds Mile Creeks Watershed



A historic and bountiful salmon and steelhead fishery on the Columbia River made this area a mecca for American Indian summer activity including subsistence fishing and extensive trade. Mile Creeks Watershed probably provided sheltered winter village sites for American Indians. Streambanks and riparian areas provided habitat for a wide variety of game birds and animals. The upland areas, on what are now National Forest lands, were probably areas of hunting and gathering. Maintenance of habitats to support edible mushrooms, gathering of medicinal plants, and game animals was likely through the use of human-caused frequent low intensity ground fires.

In 1843, the Barlow Road provided access to Mile Creeks Watershed for European Americans. By the late 1800's, the lower Mile Creeks Watershed was settled. Prior to 1900, commercial fishing, livestock grazing, agriculture, and logging were well-established natural resource industries in the area.

The eastern-most stock of wild, winter steelhead in the Columbia River Basin inhabit Mile Creeks Watershed. Winter steelhead and Pacific lamprey provided historical subsistence fisheries for members of the Confederated Tribes of Warm Springs at Seufert Falls on Fifteenmile Creek near The Dalles (reference inside front cover). Both subsistence and recreational fisheries for steelhead and lamprey have been closed to anglers since 1984 because of depressed fish populations.

Perhaps the most significant agents of change on the lands below the National Forest portion of this watershed have been timber harvest, livestock, agriculture, fire (suppression and frequency alterations), and floods. The eastern portion of Miles Creeks watershed, in the Steppe strata, has a naturally high fire frequency regime. Records from 1916 to the present for the national forest portion of the watershed, indicate an average of two fire starts per year. In any given year it is not unusual for half of the fires within the watershed to be caused by lightning, and half caused by humans.

As upland forests were harvested, roads constructed, and the lowlands grazed and converted to cropland, creeks incised within former floodplains, annual peakflows increased and baseflows decreased. The results were extensive streambank erosion during the 100 year storm events of 1964 and 1974. Flood damage and federal funding assistance from the Soil Conservation Service prompted landowners to remove streambank vegetation and in-channel large wood. Channelized creeks were isolated from their floodplains which resulted in increased flood power and streambank erosion, decreased riparian area and water storage capacity, and further degradation of fish habitat.

Since the flood control efforts that followed the flood of 1974, riparian restoration efforts of State and County agencies and local landowners have incrementally created a more complex stream structure and re-vegetated streambanks. These efforts have resulted in improved water temperatures and habitat for fish, re-establishment of wildlife in the riparian areas, and a decrease in streambank erosion on private lands.

Figures I.2 and I.3 are included to reference the readers of this document as to where Mile Creeks is in relation to the Mt. Hood National Forest and the provinces established within the Range of the Northern Spotted Owl. Figure I.2 shows the reference to the provinces. Figure I.3 shows the reference of the Mile Creeks Watershed in relation to other watersheds within the National Forest.

Figure I.2. Province map

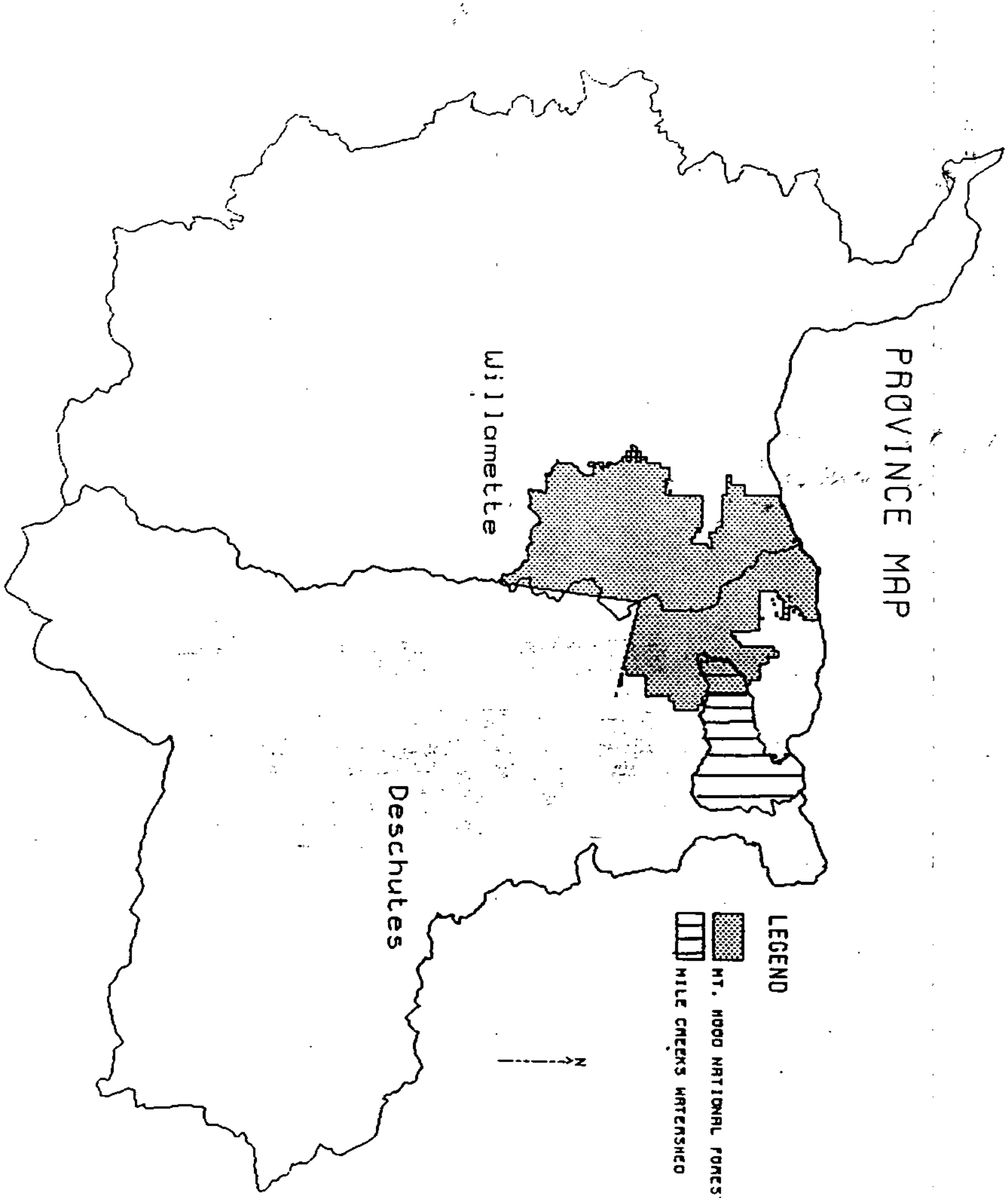
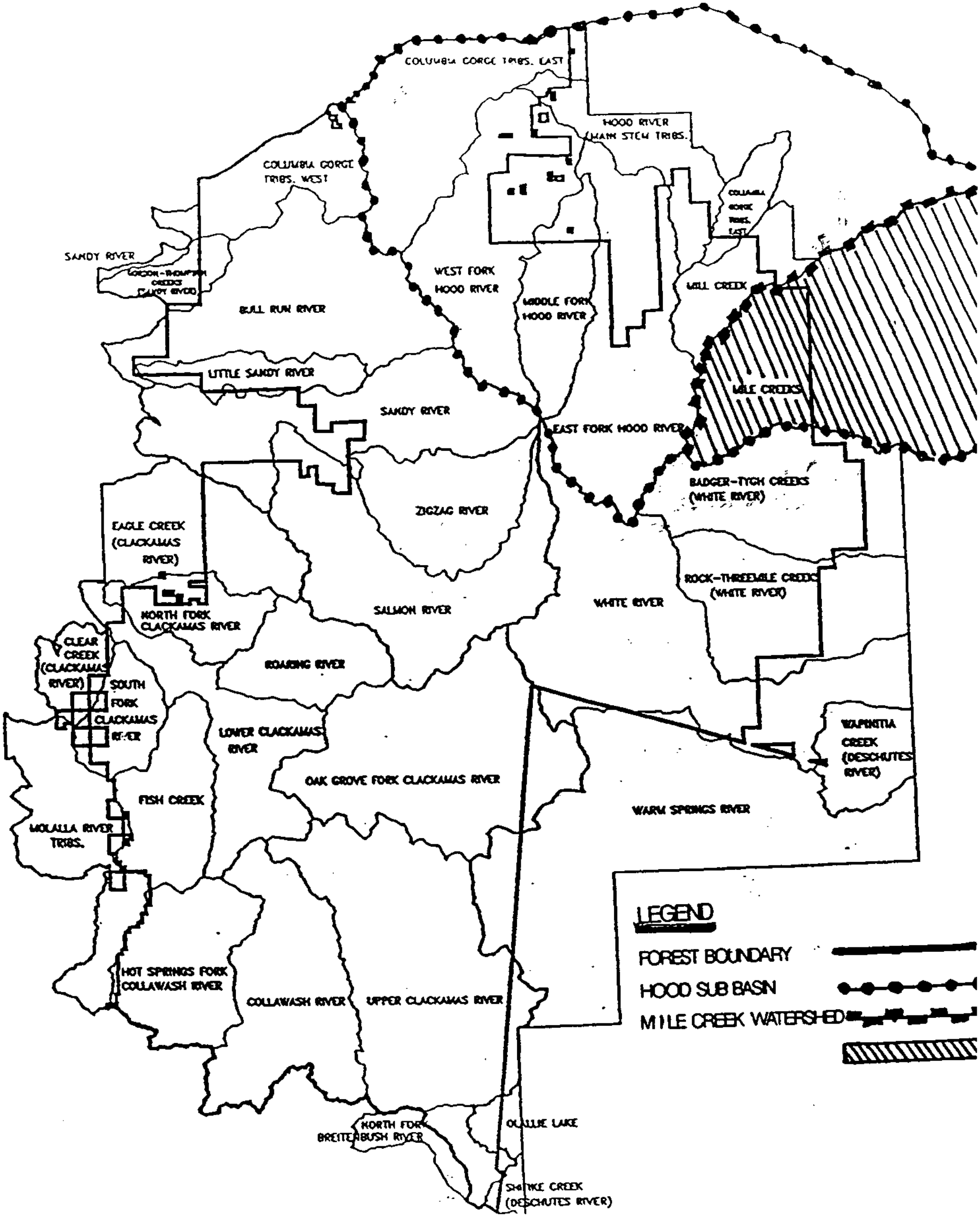


Figure I.3. Mt. Hood National Forest - Watersheds



II. BENEFICIAL VALUES AND WATERSHED ISSUES

The beneficial values and issues of the Mile Creeks Watershed drive the watershed analysis process. They focus the analysis on the important key questions so that efforts are concentrated on the processes and functions most directly related to desired conditions.

A. Beneficial Values

Beneficial values as defined for the Mile Creeks Watershed are those primary or unique values and human uses toward which management expends resources. In this context, **primary** refers to those values which have higher importance relative to other values, and **unique** refers to rareness of occurrence in the Hood subbasin. The following beneficial values were identified:

- **Subsistence Fisheries:** Members of the Confederated Tribes of the Warm Springs have subsistence fishing rights to culturally important and unique stock of wild, winter steelhead and Pacific lamprey ("eels"). Consequently, these fish are protected and managed as cultural resources under Warm Springs Tribal Code.

- **Water Quality:** Clear, clean water is of primary importance to the myriad of fish, macroinvertebrate, amphibian, wildlife species, and humans dependent on this resource.

- **Water Quantity:** A continuous supply of water is essential to the sustainability of fish and wildlife, irrigation, municipal uses, and other social needs of humans in the Mile Creeks Watershed.

- **Recreation and Experiential Values:** The Mile Creeks Watershed is of primary importance as a recreation destination, and provides a unique combination of natural resource settings for recreation and experiential pursuits.

- **Forest Commodities:** A sustainable supply of sawtimber, pulpwood, posts, poles, houselogs, firewood, mushrooms, and other wood and forest products are of primary economic and social importance to the people associated with this watershed.

- **Agriculture and Rangeland Resources:** Dryland and irrigated crops, and livestock are of primary importance to the lifestyles and economies for many people in the Mile Creeks Watershed.

- **Biodiversity and Ecosystem Function:** The position this watershed occupies on the Mt. Hood National Forest and in the Hood Subbasin landscape creates a unique combination of biodiversity relationships and ecosystem functions.

- **Threatened, Endangered, Sensitive, and Special Status Species (TES):** The Federally Threatened and Endangered, and Regionally Sensitive plant, animal, and fish species in the Mile Creeks Watershed are unique or have declining populations at the Basin and Regional scales, and their continued viability requires special consideration at the watershed scale.

B. Issues

"Issues" refers to a topic, subject, category, or value which is registered by a person as something in which they have a high level of interest, and is used synonymously with "concern" (Federal Agency Guide for Pilot Watershed Analysis draft 1994). Identification of potential issues is the first step in the draft Federal Agency Guide Eight-step Watershed Analysis process, and is used to focus the analyses on the issues of greatest concern in the watershed, regardless of ownership.

Initial scoping of issues in the Mile Creeks Watershed involved the Eastside Mt. Hood National Forest Watershed Analysis Team and Ranger District personnel, and interagency fisheries and wildlife biologists. As the watershed analysis progressed the issues became more refined. The following issues describe the connection between the beneficial values (i.e. what people are really interested in), and the altered processes and/or conditions that affect those values. The following processes and functions have been altered in Mile Creeks and affect social and resource values.

- **Altered Hydrologic Regimes** are changes in the timing, magnitude, and duration of peakflows and baseflows. Increased peakflows result in increased flood stages and bedload movement, thereby increasing the sediment in a stream, and consequently degrading fish habitat, lowering spawning success, and degrading water quality. Lowered baseflows result in less water for summer fish habitat, increases in summer stream temperatures, and less water for irrigation and domestic uses.

- **Altered Water Quality** involves changes in the physical, biological, and chemical composition of water. High summer water temperatures and/or high sediment loads can be lethal to fishes and other aquatic dependent wildlife. Sediment laden streams can be unsightly and distract from the recreation and experiential values of water, and de-stabilize the stream network.

- **Altered Stream Geomorphology** results in de-stabilized channel forms that are characterized by streambank erosion, lateral widening of the channel, downcutting, isolation from the functional floodplain, magnified flood effects, and increased sedimentation. These effects reduce the quality of aquatic habitats, instream productivity, water quality, and ecosystem function. Consequently, fish production, riparian biodiversity, and the productivity and function of the adjacent floodplain is reduced.

- **Altered Hillslope Processes** involve soil erosion and compaction. Soil erosion and compaction reduces site productivity, i.e. the ability to grow desired vegetation, and increases sediment supply and delivery to streams. Reduced site productivity decreases the ability to provide sustainable forest, agricultural and rangeland commodities, and recreation and experiential natural resource settings. In addition, wildlife habitat, biodiversity and ecosystem function suffer. High or untimely levels of sediment delivery to streams can be lethal to fishes and other aquatic dependent wildlife, decreases aquatic habitat capability, de-stabilizes stream networks, and degrades water quality.

- **Altered Riparian Ecosystem Function** involves the function of riparian vegetation. Riparian vegetation functions with the floodplain to moderate flood events, stabilize streambanks, provides streamshade to moderate water temperatures, provides habitat and travel corridors for terrestrial wildlife and amphibians, supplies terrestrial food sources such as leaves and terrestrial insects to the creeks, buffers sediment inputs, moderates peak and baseflows, supplies large woody debris for macroinvertebrate and fish habitat, and provides nutrients and substrate for instream productivity. Riparian ecosystems also provide highly sought settings for recreation and experiential pursuits; simply put, people are attracted to water.

- **Altered Distribution, Dispersal or Migration Patterns of Terrestrial, Riparian and Aquatic Species** simply means plant and animal species and populations may not occur where they once did, or are restricted in their movement patterns, thereby reducing the population size over time. Maintaining species distribution, dispersal and migration patterns is paramount in protecting the diversity of species and ecosystem function. It is particularly important in improving the habitat of Threatened, Endangered, and Sensitive (TES), and special status species.

- **Habitat Quality and Recovery for Threatened, Endangered, Sensitive, and Special Status Species (TES)** is important because of the role habitat plays in maintaining the distribution, future options, and viability of inter-related plant and animal communities, biodiversity, and ecosystem health and function. TES and special status species often occupy positions high on the food chain or have a low tolerance for environmental change, hence they can be indicators of ecosystem health. Recovery is therefore important because it may indicate a healthy environment and complex, quality habitats. Recovery is also important because many people view the protective measures provided to these species as inhibiting our ability to manage the Forest and non-forest lands for the products desired by humans.

- **Conservation of Special Habitats and Biodiversity** often ties closely to habitat quality and recovery for TES, and special status species because these species often occupy unique or limited habitats, and are indicators of biodiversity and ecosystem function. There is also an intrinsic human value for special habitats, biodiversity, TES, special status species, and the roles they play in the ecosystem.

- **Altered Forest Composition, Structure, and Function** is closely tied to all of the beneficial values. In general, plant succession in the higher elevation forests has continually been set back to early successional stages in a fragmented pattern due to timber harvest activities, while in the lower elevation forests, plant succession has been advanced by the exclusion of fire from the ecosystem. Harvest openings and the effects on beneficial values become the concern in the higher elevations, while the closing forest canopy in mature forests becomes the concern in the lower elevations. The threats to forest ecosystem function in the higher elevation forests tends to be related to changes in functions related to site specific activities, while the threat in the lower elevation forests is from the increased potential for catastrophic fire. In either case, fish habitat, water quality and quantity decrease, recreation and experiential values decrease, forest commodity production decreases, biodiversity and ecosystem function are lowered, and TES, and special status species may decrease as a result of altered forest composition and structure.

- **Sustainability of Natural Resources to Meet Human Needs** is the focus of discussion for recreational, experiential, and commodity values. The demand for these human needs is increasing as population in the greater Portland and surrounding areas increases. Conversely, the potential for negative interactions between human activities and other natural resource values increases. Human needs are dependent on a variety of natural resources and recreational settings, so the issue on public land becomes one of integrating human values with natural resource values to sustain the quality of resources and human needs over time.

III. Key Questions and Answers

Key questions were developed to group related beneficial values and address common issues affecting those beneficial values. This approach expedited examining interrelationships between different beneficial values, the issues affecting those values, and facilitated synthesis between physical processes, terrestrial and aquatic ecosystem function, and social expectations. Key questions were answered incorporating the following components:

- Stratification of the watershed in appropriate analysis units (i.e. subwatersheds or vegetative zones)
- Identification of the processes, ecosystem functions, or social expectations of concern
- Desired condition for the processes, ecosystem function, or social expectations of concern
- Existing condition for the processes, ecosystem function, or social expectations of concern
- Comparison of existing condition to desired condition for the processes, ecosystem function, or social expectations of concern
- Factors/structures and mechanisms/flows influencing the processes, ecosystem function, or social expectations of concern
- Consequence of the existing condition of the physical processes, ecosystem function, or social expectations of concern with respect to beneficial values
- Predicted future trends of the physical processes, ecosystem function, or social expectations of concern

Five Key Questions were developed and answered in this analysis.

1. What Are The Conditions And Processes Influencing Forest And Steppe Vegetation Today, And How Is Ecosystem Functioning Affected?
2. What Are The Processes And Functions That Are Allowing Or Preventing Hydrologic Processes, And Aquatic And Riparian Ecosystems To Function Within The Range Of Natural Conditions?
3. What Are The Processes And Factors Allowing Or Preventing Terrestrial Connectivity And Migration Or Dispersal Linkages?
4. What Are The Processes And Factors Allowing Or Preventing Biodiversity Of Wildlife And Plants Species To Be Maintained Or Improved?
5. Which Processes And Factors May Be Allowing Or Limiting The Attainment Of Social Expectations?

A. What Are The Conditions And Processes Influencing Forest And Steppe Vegetation Today, And How Is Ecosystem Functioning Affected?

1. Plant Communities In The Watershed

Key Points

- Vegetation conditions and attendant ecosystem functioning have been significantly altered in the dry grand fir/Douglas-fir and shrub steppe strata of the watershed.
- Changes in the dry grand fir/Douglas-fir and shrub steppe strata are well outside the range of natural variability and could lead to catastrophic fire, extirpation of native steelhead trout in the watershed, or both.
- There are actions which can be taken to mitigate environmental effects which have occurred and to ameliorate future deterioration.

Vegetation Overview: The Mile Creeks drainage is rich in variety of plants and diversity of habitats. Within its 239,000-acre bounds, the watershed includes a number of forest and grassland communities from its headwaters in the Cascades to its mouth near The Dalles Dam. Growing conditions created by the extremes of climate and terrain support vegetation as different as the wet montane subalpine fir-mountain hemlock forests of the high country and the sparse Columbia Basin bunchgrass communities of the arid lowlands.

Plant communities in the watershed directly reflect the steeply declining moisture gradient produced by the rain shadow effect of the Cascades crest and Mt. Hood (Topic, 1988). From the near-treeline summit of 6525-foot Lookout Mountain, the land falls east in a succession of east-west trending ridges to the Columbia River. In the intervening 20 miles between Lookout Mountain and the town of Dufur, precipitation decreases with distance east from nearly 100 inches on western ridges to less than 15 inches in Dufur. In the remainder of the watershed east of Dufur, precipitation ranges from 12 to 15 inches. Within this semi-arid environment grow the grasses and shrubs of the steppe plant community.

Moisture, and more specifically the amount of water available to plants during the growing season, is fundamental to the pattern of vegetation development in the watershed. But water that is actually available to plants is strongly influenced by slope aspect and the inherent water-holding ability of the soil. It is the interaction between aspect and soil locally which determines water availability to plants at any given precipitation level. Therefore, aspect and soil in combination are as important to determining the kind of plant community which exists as is the amount of rainfall received.

Fire, too, has been critical to shaping the composition and character of plant communities in the watershed. Dry, hot summers with little rain provides an annual window for burning conditions to develop. Fire is an endemic factor that had much influence in shaping the form and pattern of vegetation. Both nature (lightning) and humans ignited fires, burning much of the watershed at 5 to 30 year intervals. Several of the plant communities described below achieve their greatest stability and resilience in the presence of low intensity but frequent fires. Second only to water availability, fire has played a major role in shaping low elevation forests and adjacent grasslands within the watershed

Today's property ownership pattern has been largely determined by the suitability of the land for growing crops or raising livestock. Grasslands and woods that could be farmed were homesteaded by the pioneers seeking a new life in the West. Consequently, most land in the watershed, about 85 percent (200,000 acres), is privately owned. Much of this property is held by individual owners in farm-size parcels. However, some lands (forested land in particular) are held by private foundations and corporate interests.

The majority of private land is dedicated to production of crops and livestock. Dryland grain farming dominates agricultural land use. Wheat, barley and rappelled (canola) are the principle crops raised. Irrigated crops, pastures and orchards, however, are also a part of total agricultural use in the watershed.

Approximately 30 percent (72,000 acres) of the drainage is forested; roughly half of this acreage is in private ownership and half is in public (Federal) ownership. Most all public land in the Mile Creeks watershed is included within the Mt. Hood National Forest (approximately 38,000 acres). However, scattered tracts of forest land east of the national forest boundary (totaling approximately 600 acres) are administered by the USDI Bureau of Land Management. The Rocky Mountain Elk Foundation (RMEF) owns several thousand acres of forest land adjacent to the national forest boundary. The large but disjunct parcels forming RMEF's holdings were recently acquired from Mountain Fir Lumber Company. Mountain Fir was a logging and milling operation based in Maupin, Oregon that went out of business in 1991. Nearly all of the property acquired by RMEF is cutover. Through mutual agreement, ongoing stewardship of RMEF lands is undertaken by the Oregon Department of Fish and Wildlife.

Partial cutting has long been used to harvest trees from watershed forests. Logging of individual trees dates back to at least the 1880's on lands that now comprise national forest. This cutting occurred in many forms including high-grading, salvage, thinning and sanitation harvests. The total acreage to date, identifying areas where at least some trees were cut, is undetermined due to the span of years within which logging occurred. It is a reasonable to estimate, though, that somewhat more than 50 percent of all acres covered in mid or late seral forest have received at least one and often many partial cut entries over the years. Even areas that today appear at first to be untouched, such as portions of upper Fifteenmile Creek, have been selectively logged in the past.

Within the Mt. Hood National Forest, harvests made to regenerate new forests have occurred on less than 20 percent of total public acres. Clearcutting was the method used most extensively but shelterwood cutting has been employed more in recent years. Several hundred acres remain inadequately stocked with desired conifers. Understocked plantations occur primarily on southern exposures where moisture stress, vegetative competition and gophers have thwarted multiple efforts at reforestation.

How Vegetation was Categorized: To evaluate past and current conditions of native plant communities, vegetation within the watershed was partitioned into distinct groups, or strata, for the purpose of understanding conditions and processes across the landscape. Each stratification includes plant communities having similar characteristics, responses to disturbance and roles in ecosystem function. Vegetative communities having characteristics in common were assembled into a stratum and named.

The names applied to the each stratum are based on what is termed "potential vegetation." As a method for classifying plant communities, potential vegetation disregards current successional stage and also does not consider whether native vegetation has been replaced with cultivated plants. Areas are instead defined by the climax vegetation which would flourish in the area in the absence of disturbance. The premise of potential vegetation is that only one climax vegetation community would eventually develop in a given locality; thus, climax vegetation defines a unique grouping of plant species which re-occur on the landscape within particular environmental tolerances.

Knowing the climax plant community adapted to a particular site provides a way to understand environmental conditions. Classification, then, is not confounded by seral vegetation which represents an intermediate plant development stage that is transient in the progression of a forest or grassland toward climax. Moreover, quite different existing seral conditions, such as an old burn area, logged land or a wheatfield, can be categorized appropriately.

Potential vegetation is described and named after the diagnostic or dominate plants in the tree, shrub or herb layers of climax communities. Vegetation at climax represents the ultimate expression and mixture of plants that an area will support indefinitely, in the absence of disturbance. Climax communities, to the extent they develop fully, are relatively stable groupings of plant species capable of self-perpetuation. Therefore, while climax communities may only develop fully on occasion and may never actually be present in a given locality, they do provide a way to compare land productivity and ecosystem processes.

Potential vegetation series names are used to describe vegetation stratifications below. In-depth descriptions of potential vegetation (except steppe) are available in the several plant association and management guides available for the Mt. Hood National Forest.

Stratification of Vegetation: Within Mile Creeks watershed are forest communities representing all 7 potential vegetation series found on the Mt. Hood National Forest. Four series, subalpine fir-mountain hemlock, grand fir, Douglas-fir and ponderosa pine-Oregon white oak capably classify nearly all forested plant associations within the watershed. The other 3 series, Pacific silver fir, western hemlock and western redcedar, are minor in extent and distribution and/or occur only in special environmental settings, such as areas near streams or springs. Consequently, these 3 series are not included in naming the vegetation strata of the drainage. Nonetheless, for the purpose of understanding how these minor series fit in the context of the major Mile Creeks forest strata, they are categorized as follows: forests of the Pacific silver fir series are included within the subalpine fir-mountain hemlock stratum and forest of the western hemlock/western redcedar series are included within the moist grand fir stratum.

The grassland/shrubland steppe comprising the majority of the Mile Creeks watershed represents a number of potential vegetation communities. Two native grass communities which have been classified generally in the watershed are bluebunch wheatgrass-Idaho fescue-Sandberg bluegrass canyon grassland and Idaho fescue-junegrass canyon grassland. The steppe classification used for this discussion does not attempt to differentiate between shrubland and grassland nor to separate one grassland community from another.

Using 4 potential forest vegetation series then, plus the non-forested steppe plant community, 5 stratifications were created to characterize major plant communities in the watershed. Each stratum represents a grouping of plant associations which are similar in resources use, response to management, natural disturbance pattern, predominate trees and habitat features. The 5 strata for Mile Creeks are:

- Subalpine fir-Mountain Hemlock Forest
- Moist Grand Fir Forest
- Dry Grand Fir/Douglas-fir Forest
- Ponderosa Pine-Oregon White Oak Forest and Oregon White Oak Woodlands/Savannahs
- Steppe (grasslands/shrublands)

For a conceptual picture of how these vegetation strata drape across the entire watershed, refer to Figure III.A.1. This map is a schematic representation and is not intended to convey the complexity with which plant communities actually fit together. Rather, the map is meant only to show the relative position and area of each stratum with regard to one another and the watershed as a whole.

Figure III.A.2. on the other hand, is an example of the complexity with which the strata might actually blend together. The map displayed includes all national forest lands in the watershed plus a selected portion of private land adjacent to the Mt. Hood. As with the previous figure, this map is meant to be illustrative only. Spatial boundaries shown were defined using existing vegetation data to speculate on how potential vegetation communities might appear in response to elevation, aspect, moisture and soil. The map would not, however, be accurate for use in locating potential vegetation boundaries in the field.

Figure III.A.1. Vegetative Strata Within Mile Creeks Watershed (Conceptual)

Disclaimer:

This map is provided to orient and reference the reader in the mile creek watershed analysis. This map is a representation of the stratum throughour the entire watershed.

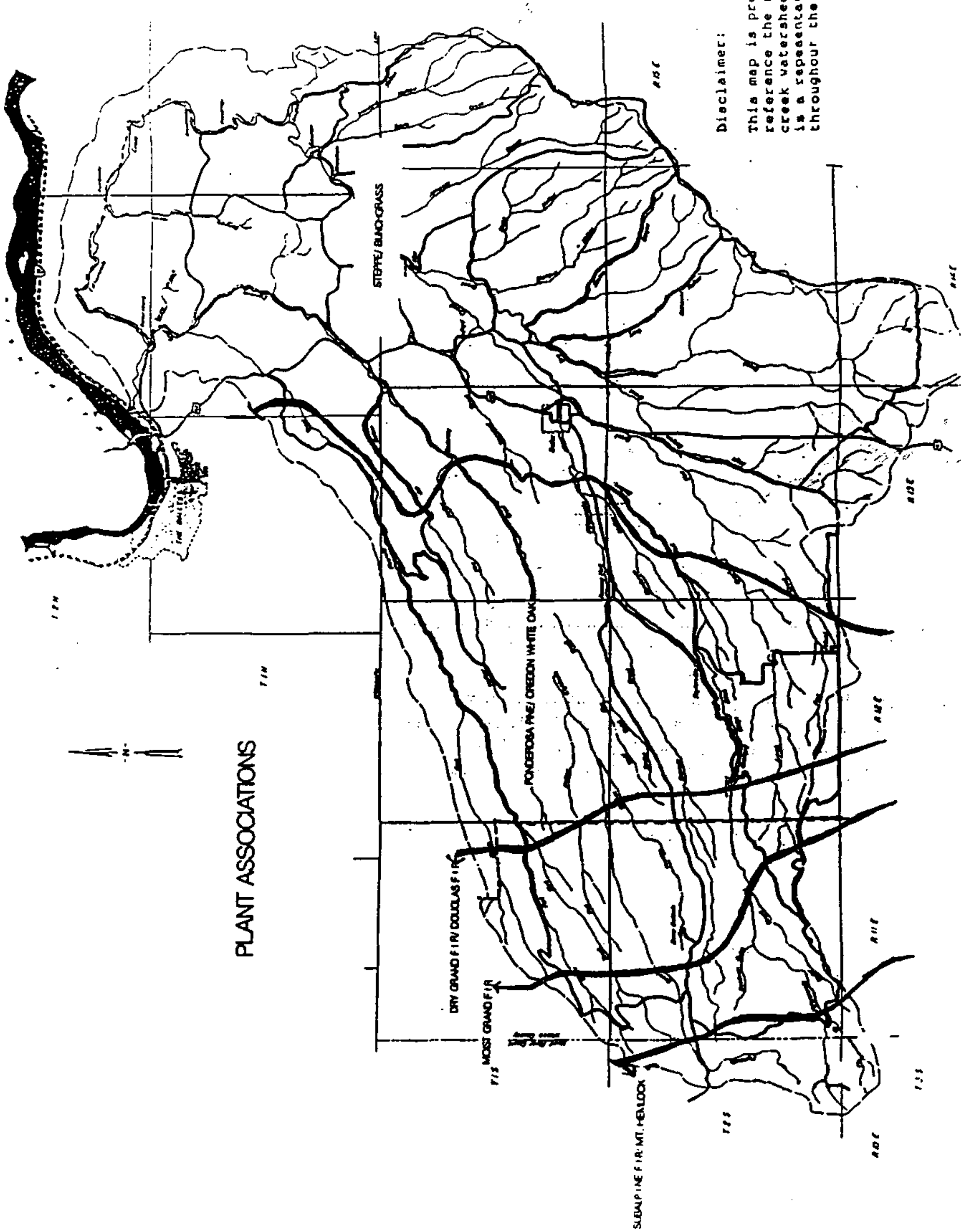
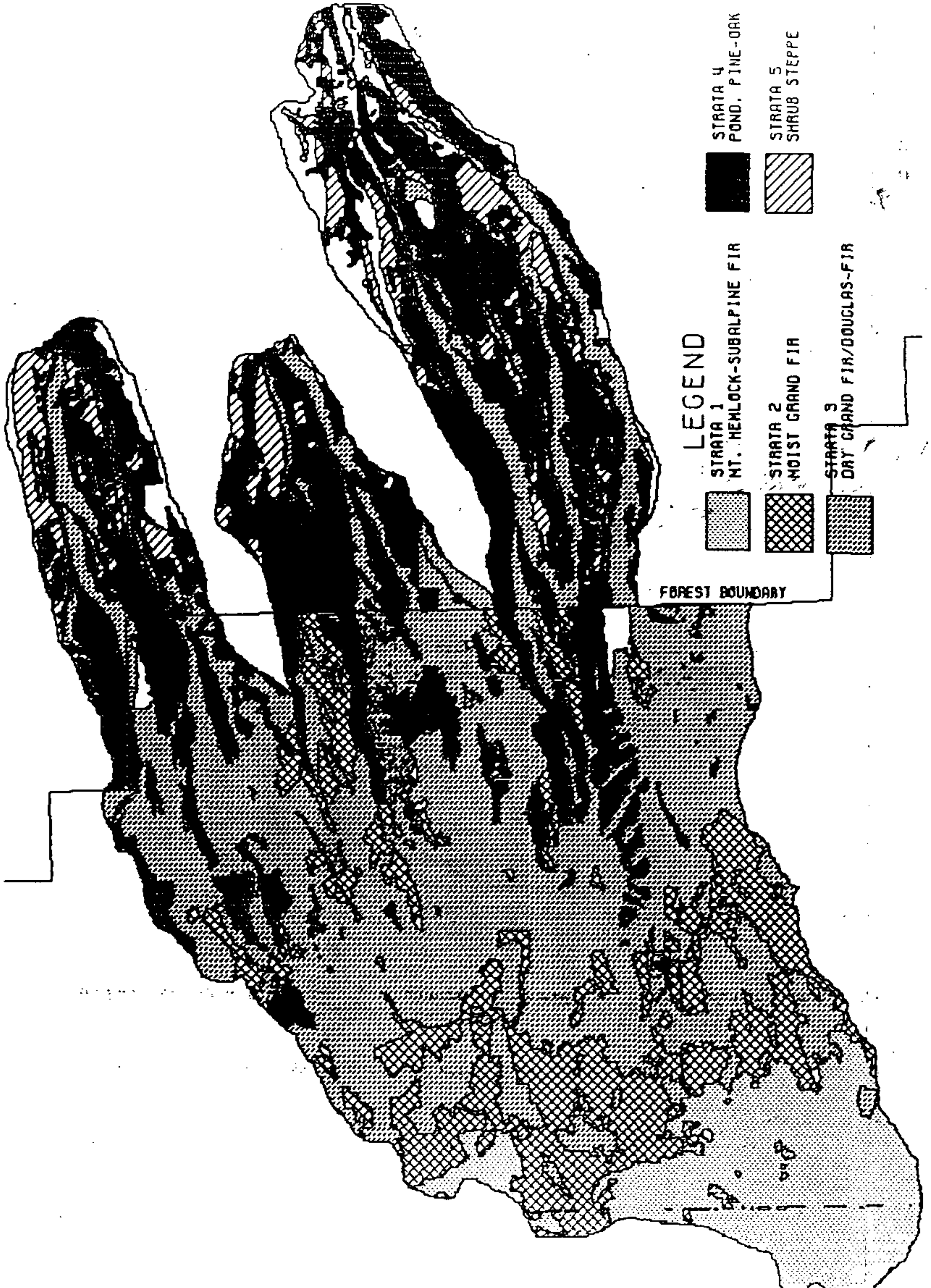


Figure III.A.2. Vegetative Strata Within Mile Creeks Upper Watershed



Comparison Between Current and Past Vegetation Conditions: To see the way in which forests have changed, a point in time with which to make comparisons is needed. The date selected is intended to identify a time before present when forests and their renewal were dominated by natural forces acting upon and within them. This is not to say that the date chosen would separate from the present a time when <u>only</u> nature influenced forests. To discover what forests were like before the influence of people might require going back in time 10,000 years or more. This, of course, would not be useful as there is little known of forests that grew that long ago. So it must be accepted that prior to the reference date humans did influence forests, especially with regard to setting fires.

There is a point, however, when human influence was limited to altering the timing or increasing the frequency of fire. Native peoples removed little from forests and grasslands and did not change their character, structure or ecosystem functioning, except with fire. In contrast, forests in more recent times have been shaped by removal of products such as timber, forage and water. At the same time, great success has been realized in controlling natural forces damaging to resources and improvements.

The period of time to consider in marking the onset of the modern era is the latter two-thirds of the nineteenth century. Before 1840, American Indians were nearly the only inhabitants of the Mile Creeks area. European diseases had spread across the continent killing large numbers of Indian people, so populations were likely much reduced. But even greater changes were to come with the immigration of a new people to this land. In 1843, the Barlow road (a fork of the Oregon Trail) was completed. Although most white immigrants were headed to the Willamette Valley, some settled on the east side of the mountains in the vicinity of Barlow Road.

In 1855, the various tribes of middle Oregon signed a treaty ceding most of their ancestral lands to the United States. In exchange for the area ceded, a portion of their homeland was permanently reserved for their exclusive use. Within a short time after the treaty agreement, American Indians abandoned their traditional way of life in the Mile Creeks area.

European settlement continued until, by 1870, much of the best agricultural land had been claimed. With settlement came the desire to develop communities and improve living conditions on the frontier. The rapidity of change accelerated and increased demands on local resources. Timber was cut for fuel and buildings, livestock was grazed, land was plowed to grow crops and water was diverted for irrigation. At the same time, existing land conditions began to be recorded in written documents. Landline surveys, property records and letters described the vegetation that existed.

This period of transition between eras, which peaked in the 1860's and 1870's, is a useful benchmark for separating nature-dominated forest renewal from human-dominated forest renewal. The coming of concerted resources exploitation and the availability of written records describing those resources coincided about 1870. It is because 1870 marks a turning point in settlement and land development that this date is selected to separate present day forests from forests of the past.

2. Current, Past And Future Conditions Of Native Vegetation

In this section, current, past and future conditions relating to each vegetation stratum are described. Also reported is information regarding disturbance agents, effects of past actions on today's productivity, changes in ecosystem functioning and thoughts on future trends. Some information is to one degree or another speculative and preliminary.

Land area estimates given for each stratum were derived by subjectively proportioning total watershed acres among all 5 vegetation strata. No actual measurements were made. The percentages and acreages given are intended to be relative only. Therefore, acreages should be used with caution as they are subject to inaccuracy.
Restoration/rehabilitation recommendations are described in Chapter V.

a. Subalpine Fir-Mountain Hemlock Forests

This vegetation zone covers approximately 7 percent (5000 acres) of forested land in the watershed. For the watershed as a whole, 2 percent of total acres is subalpine fir-mountain hemlock forests. All of this stratum is within the Mt. Hood National Forest.

These forests cover the highest terrain, typically above 4500 feet, in the southwest corner of the watershed near Lookout Mountain. The subapline fir-mountain hemlock zone may extend as low as 4300 feet in Fifteenmile Creek on north aspects. This vegetation zone does not extend far north of Road 44. Much of this forest stratum lies within the Badger Creek Wilderness.

Winters are wet with annual precipitation ranging between 65 and 100 inches. Much of this accumulates as snowpack 3 to 15 feet deep. Summers are relatively dry with occasional frosts. Cold, well-drained soils and a snow-free period of only 4 to 5 months results in short growing seasons and slow plant growth in these forests.

Current Conditions: A widely variable assemblage of trees occurs in this stratum. Mountain hemlock (*Tsuga mertensiana*) and subalpine fir (*Abies lasiocarpa*) are the most common tree species here. Engelmann spruce (*Picea engelmannii*), western larch (*Larix occidentalis*), and western white pine (*Pinus monticola*) appear as long-lived seral trees. Lodgepole pine (*Pinus contorta*) is a common early seral species, often growing in association with western larch, that is generally most abundant in areas which burned less than 100 years ago. Grand fir (*Abies grandis*), Douglas-fir (*Pseudotsuga menziesii*), Pacific silver fir (*Abies amabilis*), and ponderosa pine (*Pinus ponderosa*) are not common, but are not considered rare. Whitebark pine (*Pinus albicaulis*), western redcedar (*Thuja plicata*) and noble fir (*Abies procera*) are incidental species restricted to microsites or are very limited in distribution. Tree species diversity is highest in mid-seral forests and decreases through time toward climax. Extended fire return intervals allows near-climax plant communities to develop readily.

Many of the stands dominated by lodgepole pine and western larch originated from a fire which burned in 1898. The lodgepole pine component of these stand is in places beginning to deteriorate as trees approach 100 years of age. Stand breakup is not very advanced at this time, except in pockets, but the trend in deterioration will become more pronounced over the next 10 to 30 years. In areas where fire burned particularly hot, such as in the vicinity of Eightmile and Marion Points, lodgepole pine often comprises over 75 percent of the overstory.

The area above 5800 feet on Lookout Mountain is composed of late seral stands of large mountain hemlock intermixed with subalpine fir. Along exposed ridgeline precipices of the summit area, whitebark pines grow in scattered thickets. These krummholtz (e.g., "stunted or crooked wood") pines are typically restricted to open areas where wind, rocky soils or both make growing conditions too harsh for other trees. Whitebark pines are confined on the Mt. Hood National Forest to just a handful of high peaks, most notably the cone of Mt. Hood itself.

In natural old-age stands, understory tree regeneration consists of true firs and mountain hemlock with occasional Engelmann spruce. Where larger canopy gaps have formed, sufficient light is provided to allow some of the earlier seral species, such as western larch and Douglas-fir, to reproduce. Generally, this latter case is limited in extent.

Beargrass and huckleberries dominate understory vegetation within this stratum, although huckleberries are much more common than beargrass. Forbs present include species that indicate cool or cold and dry conditions, such as elk sedge and smooth woodrush. Often, though, the understory contains little in the way of forbs. Even when forbs are present, species diversity tends to be low compared to lower elevation vegetation zones. Areas where canopy closure exceeds 60 percent may have almost no understory vegetation.

Standing dead trees are relatively common in undisturbed forest but often do not remain standing for more than a decade or 2. Snag numbers have generally increased in recent years within Badger Creek Wilderness due to tree killing by a combination of drought, insects and disease. Outside the wilderness, salvage harvests conducted before 1990 have generally reduced the number of large snags significantly.

Large standing dead trees in these forests are often "buckskin" (i.e., without bark and most branches) true firs, hemlocks and western white pines. Deterioration of branches and tops occurs relatively rapidly as moisture and rot works on these decay-prone trees. Down woody detritus of small diameter is usually abundant, owing to slowed decay rates in these cool forests. Much of the available nutrient capital of subalpine fir-mountain hemlock forests is stored in soil surface organic matter.

Plantations of young growth in this stratum are typically well stocked and developing without difficulty. In reforesting logged areas, the tree species most often planted have been western larch, Douglas-fir and lodgepole pine. Units were restocked with at least 2 and sometimes all 3 trees. Many plantations now contain ponderosa pine, true firs, and scattered western white pine which voluntarily seeded in from adjacent forest.

Bottle Prairie and the 2 main openings of Eightmile Meadows are the only 3 high elevation meadows named within the watershed. Eightmile Meadows tends to be dry, with new and old streambeds crossing the meadows. Bottle Prairie tends to be wet year-round. Numerous small, unnamed meadows lie within Badger Creek Wilderness. A boggy area lies along the middle reaches of Fret Creek. In this area, trees are restricted to drier, raised soil hummocks. Rock outcroppings and jumbles are characteristic of ridgeline and headwall areas, particularly in Fifteenmile Creek.

Disturbance Agents and Processes: Subalpine fir-mountain hemlock forests are influenced today by insects, disease, wind, snow, timber harvest and fire. Of these disturbance agents, all but fire are playing a role currently.

Fire is an important agent of stand renewal but is not a process important to stand differentiation or development. The mean fire return interval is estimated to exceed 100 years and probably exceeds 250 years for much of the stratum. However, fires of small size and low intensity may on occasion be ignited. These rather slow-moving burns serve to create canopy gaps through torching, spotting and lethal underburning activity. No fires have occurred in the recent past.

Wind and snow are the principle abiotic forces now acting on these upper elevation forests. Trees of the subalpine fir-mountain hemlock zone are well-adapted to extremes of storms and are not readily damaged. Only individual trees tend to topple in any given area and extensive areas of blowdown or snow breakage are rare. No such areas exist at present. Wind and snow do, however, bring continual if gradual changes to these forests over time. Wind is most likely to knock over trees under 2 conditions. Trees which have lost a significant portion of their roots to disease are susceptible to blowdown at any time of year. In winter, blowdown tends to occur when high winds and saturated but unfrozen soils combine to dislodge shallow-rooted trees. Individual trees along main ridges and plateaus are at greatest risk in this circumstance. Yet, even where forests are highly exposed, only single trees are typically uprooted and not entire stands. Snow tends to break the thin spindly trees, usually small in diameter, throughout stands of this zone.

Within the Badger Creek Wilderness, an outbreak of western spruce budworm (*Choristoneura occidentalis*) has recently caused increased though scattered mortality in true firs. Other trees seem to be in relatively good health for these later successional stands.

Subalpine fir, Engelmann spruce, Douglas-fir, and grand fir are the primary hosts of the budworm, an insect native to the Pacific Northwest. Starting in the early 1980's, a cycle of budworm population buildup began in the watershed. By the mid 1980's, budworm populations were abnormally high, particularly in Fifteenmile Creek. Population numbers seemingly peaked twice within the watershed, once in 1986 and then again in 1991. Since 1992, budworm numbers have declined steadily and little activity was noted during summer 1994.

Spruce budworm shows little preference for weakened individual trees. Feeding is more influenced by condition of the foliage and by its position on the tree. Trees can withstand a great deal of budworm feeding without being seriously affected. However, if sustained defoliation over several seasons destroys a high proportion of needles, the tree may die directly or succumb to secondary agents (Furniss, 1977). Extended budworm feeding over the better part of a decade has contributed substantially to new mortality in the watershed, either directly or by making trees susceptible to bark beetles.

Bark beetles (*Dendroctunus spp., Pseudohylesinus spp., and Ips spp.*) are seldom directly responsible for tree killing in subalpine fir-mountain hemlock forests. Beetles are typically attracted to trees weakened by other agents, though they may in fact be the proximal cause of tree death. Seldom do they kill trees of normal vigor in these forests. The principle role of beetles here as elsewhere in the drainage is to introduce decay fungi to the sapwood of dead trees, thus initiating the decay process.

Three root diseases, Laminated root rot (*Phellinus weirii*), armillaria root disease (*Armillaria ostoyea*) and annosus root rot (*Heterobaidion annosum*) are native parasitic fungi that are a common and endemic agent of change in these forests. Every species of conifer growing in these forests is host to at least one of the root decays. Mortality can be caused directly or in unison with bark beetles, wind or other secondary agents. Root rots tend to be localized with tree killing noticeable as individual pockets. Spread from tree to tree occurs only slowly as the disease moves across roots in contact with one another. As mortality occurs in the gradually expanding disease center, a canopy gap is created (Scharpf, 1993).

Root rots continue living in host roots even after the host tree's death; thus, they are said to be persistent on the site. The dead roots underground harbor the fungus which can then infect living trees whose roots grow into contact with the innoculum. Thus, these diseases play a recurrent role in stand canopy gap formation with renewal of each generation of forest.

Two human-induced disturbance processes are acting on the subalpine fir-mountain hemlock zone outside the Badger Creek Wilderness--timber harvest and roading. Since the mid-1970s timber harvest has created openings of a different size and shape that the natural processes listed above would have created. Reforestation has resulted in different species compositions within the units than the natural processes likely would have promoted initially. Roads have created permanent, linear openings where none existed before.

Harvesting outside the wilderness has emphasized regeneration cutting more than intermediate treatments. Some partial cutting has occurred, however. In the 1960's and early 1970's sanitation logging of western white pine occurred due to fears of white pine blister rust. Reforestation efforts have emphasized western larch, Douglas-fir and lodgepole pine. Many plantations also contain ponderosa pine, true firs, and scattered western white pine from natural seeding.

In the past, general stand deterioration would ultimately lead to a large fire that would start the successional process over again. In this zone, a reburn 20-50 years after the initial fire is likely. The reburn would reduce fuel loadings created by falling snags from the initial fire and allow a new, relatively "fire proof" stand to begin.

The Forest Today Compared With Pre-1870 Forest: Little information is available on what the subalpine fir-mountain hemlock zone looked like prior to 1870. However, it seems reasonable to speculate that existing vegetative composition, structure and ecosystem functioning is likely changed little from forests existing prior to European settlement. Seral stage and individual stand conditions are thought to be inside the natural range of variability.

Effects on Present Productivity and Ecosystem Function: Human-induced changes in this zone are primarily the result of harvesting and roads. Regeneration cutting completed thus far has been done on a small scale and is limited in extent. Where clearcutting has occurred, especially in units logged prior to 1988, harvesting methods coupled with fuels treatment often created openings deficient in snags, downed logs, and duff.

Trees well adapted to low nutrient levels, high levels of sun, and wide daily fluctuations in surface soil temperature have a competitive advantage in these units over species that need higher nutrient levels, less sun, and less daily fluctuations in temperature. One result of these past harvests may have been to artificially prolong the grass-forb stage of succession while also altering somewhat early seral tree compositions. Units harvested after 1988 contain higher levels of snags, downed logs, and duff but are still nutrient- and microsite-poor compared to similar openings created by the natural processes.

Desired Vegetation Conditions and Trends for the Future: Virtually all the subalpine fir-mountain hemlock forests in the watershed are included within Late-successional Reserve and the Badger Creek Wilderness. To implement the intent, then, of these allocations would be to minimize human interference with ecosystem processes affecting forest growth and renewal (ROD). The desired condition is for the stands in this zone to develop, respond and be replaced in ways which include or mimic naturally occurring processes. Scenery, recreation, wildlife habitat and hydrologic functioning are values which will be most benefited.

Mid and late seral stands, as they now exist in Wilderness, are suitable examples of forest composition, structure and function for adjacent LSR. Generally, it would be forests in these successional stages which would be most abundant and persistent on the landscape.

The 10 to 50-year outlook for the forests of the subalpine fir-mountain hemlock zone is one of static or improving conditions relative to the stability, resilience and processes found in pre-settlement forests. Changes brought recently to these stands by the work of people have not been great. Slow growth and development of these stands and limited human intervention has meant that there will not be great difficulty in repairing those changes which have occurred.

The trend long-term, however, may be one of declining conditions and forest health as current mid and late seral stands age. Continued suppression of all fires would eventually lead to changed tree species composition and a decline in forest complexity. Whitebark pine would likely become a vestigial part of the flora. Endemic occurrences of insects and disease may become excessively destructive. There is time to plan, and planning will be needed to manage for controlled stand-replacing events.

b. Moist Grand Fir Forests

Approximately 18 percent (13,000 acres) of forested land in the watershed, or 5 percent of total drainage acres, is in this grouping. Nearly all of this stratum occurs on national forest, although some of these forests are present on private land along streams.

These forests typically are found at elevations between 2200 and 4800 feet. Annual precipitation ranges between 30 and 95 inches. Much of this accumulates as snowpack 2 to 6 feet deep. Summers are relatively dry.

Current Conditions: Forests in this stratum are often referred to as "mixed conifer" because of the variety of tree species found within and among stands. Typically, forests included in the moist grand fir type grow in sheltered, cooler locations such as on gentle slopes of upper elevations, the lower slopes of narrow canyons, on northern and eastern aspects or along streams. Douglas-fir, lodgepole pine, western larch, western white pine and ponderosa pine are the primary seral conifers found here. Grand fir is the predominate climax tree in these forests. Other tolerant associates growing in these stands are Engelmann spruce, western redcedar and western hemlock (*Tsuga heterophylla*). Locally, mountain hemlock, noble fir, Pacific silver fir, subalpine fir and Pacific yew (*Taxus brevifolia*) appear where conditions favor them. Tree species diversity diminishes through time in this stratum as early seral trees die and are replaced by a relatively few shade tolerant species.

A diverse and fairly extensive understory characterizes moist grand fir forests. Vine or Rocky Mountain maple, snowberry, oceanspray, California hazel, baldhip rose, Oregon boxwood, big huckleberry, little prince's pine and dwarf Oregongrape are common shrub layer constituents. Forbs present may include vanillaleaf, star-flower, sidebells pyrola, anemones, woods strawberry and queencup beadlily. In forests on the wetter end of the scale, forbs tend to dominate understory flora, many times forming extensive forest floor carpets diverse in species. The grand fir forests on the dry end of this grouping tend toward shrub dominance.

These mid-elevation forests often provide good habitat for wildlife. Wildlife values are high because of the mix of habitat features found in these forests that include: 1) thermal protection afforded by dense canopies 2), multiple canopy layers 3), variety of trees, shrubs and forbs 4), frequency with which stands are near or adjacent to streams and 5) generally good site productivity which supports large trees. Also, quality forage/browse is often present as part of the transitory range made available following timber harvest. It is in the old age stands of these forests where spotted owls, pileated woodpeckers and other late-successional forest associates most often find habitat suitable for feeding, shelter and reproduction.

Forests in this stratum can be characterized as the "wood basket" of this watershed. Trees grow well and productivity is relatively high. Logging and renewal of forest stands has been an ongoing and primary extractive activity since the 1960's.

In addition to clearcuts and shelterwood harvests used to regenerate stands, considerable salvage and sanitation has occurred within mature forests over the years. Most selective cutting done over the past 3 decades was applied on gentle terrain where tractors could be used. The largest dead, defective and at-risk trees were targeted for removal to achieve several management objectives including: 1), wood volume recovery from dead trees or blowdown 2), fire hazard reduction and 3), removal of white pines anticipated to die from blister rust infection.

The consequence of this logging is that Douglas-fir, western larch, ponderosa pine and white pine snags greater than 20 inches diameter at breast height may be infrequent on gentle ground within these forests. Larger snags which are present may be recently dead grand fir, a species of limited value and persistence for cavity nesting wildlife.

Disturbance Agents and Processes: Spruce budworm, bark beetles and the root diseases described for the lower subalpine fir-mountain hemlock are important disturbance agents in these forests as well. The recent outbreak cycle of budworm feeding seen in upper elevation forests occurred in this zone, producing a similar pattern of scattered tree mortality and top-kill. Root diseases are the prevalent process creating openings in moist grand fir forests. Bark beetles can play a significant role killing trees stressed by infestations of budworm and a number of diseases.

Dwarf mistletoes (*Arceuthobium spp.*) are native plant parasites that are often found on Douglas-fir, grand fir, lodgepole pine, and western larch in this stratum. To a lesser degree, ponderosa pine, subalpine fir, western white pine, and mountain hemlock are hosts to mistletoes also. Of these species, dwarf mistletoe infections are heaviest on Douglas-fir and grand fir. Mistletoes are often important precursors to cavity formation in live and dead trees, benefiting a number of cavity-dwelling wildlife. "Witch's brooms," the thickened and wildly branched limbs formed from at infection sites, are prone to breakage by snow loads or high winds. Cavities form in live and dead trees when, as a result of the exposed wound left at the site of the broken branch, decay fungi gain entry to the bole.

White pine blister rust (*Cronartium ribicola*), a disease introduced from Eurasia, has been active in the watershed since at least the 1920's. It is a disease deadly to both whitebark and western white pines in areas where alternate host plants, goosbeberries and currants (*Ribes spp.*), are found (Scharpf, 1933). Both shrubs occur in Mile Creeks forests.

While top-killing and mortality in white pines are common in this stratum, as well as adjacent forests where white pine is present, the disease has not been unduly destructive. The virulence of the fungus appears subdued in Mile Creeks, probably owing to the overall dryer climate of the drainage. Airborne spores disseminated from the alternate host need high humidity to remain infectious. Springtime spore dispersal and the near 100 percent humidity favorable to infection do not often seem to coincide. Blister rust infection in whitebark pines (within the higher subalpine fir-mountain hemlock stratum) is thought to be minor or non-existent.

Fire has in the past been the primary process of stand renewal within moist grand fir forests. As these stands age toward climax, heavy fuel loadings produced by these productive stands and canopy layering provides a lethal mixture of conditions for carrying fire to the crowns. Under severe burning conditions brought about by prolonged drought or high winds, high intensity fires can burn large acreages. Stand-replacing crown fire is the most typical burn behavior occurring. Evidence of former hot burns is often visible in the composition of postfire stands. Lodgepole pine in pure stands or mixed with western larch commonly occur where fires burned hotly.

The Forest Today Compared With Pre-1870 Forest These forests are within the natural range of variability but are nearing a point where stand conditions exceed pre-settlement environmental tolerances. Before the era of fire suppression, medium to high-intensity fire would burn in these forests periodically. The return interval is estimated to be in the range of 70 to 300 years. The patchwork mosaic of vegetation that resulted between burned and unburned areas served to attenuate fire behavior during the next burning cycle, owing to differences in fuel, stand structure, stem density and stand age.

The change developing in today's forests is the growing uniformity in vegetation and fuels over large areas. Only plantations provide a contrast to other forest stands. Succession is increasing canopy layering and providing a pathway for fire to reach tree crowns. Combined with the infestations of disease and insects, whose depredations add fuel and aid canopy drying, fires are likely to burn hotter and do greater damage to the site.

Effects on Present Productivity and Ecosystem Function: The functioning and productivity of moist grand fir forests has been altered, although modestly. Reduced structural complexity and diversity in these forests is probably the area of greatest concern. Logging, roads and introduction of white pine blister rust have changed the arrangement and amounts of snags and down wood in many stands while also reducing numbers of seral tree species in older forests. In addition, detrimental soil compaction is common where tractor yarding, machine slash piling or both were used to harvest timber (refer to Appendix B for more information). The cumulative effect of these changes is uncertain. Clearly, though, some harm has come to wildlife habitat and fish habitat due to reductions in large snags, down wood and old age white pine. Long-term site productivity may be impaired, too, in areas where tractor yarding and machine piling have taken place.

Moist grand fir forests have in the past often served as fuelbreaks to low intensity ground fires burning to them from drier adjacent forests. Surface fires reaching moist grand fir forest may have burned a short distance into the stand but then tended to die out in moist duff. Conditions which served to support this former pattern have been disrupted today, however. While the structural conditions in moist grand fir forests have not changed greatly, the burning characteristics of dry grand fir/Douglas-fir forests are much more severe.

Desired Vegetation Conditions and Trends for the Future: Moist grand fir forests are naturally diverse and complex in structure, composition and function. They are host to a variety of wildlife, fishes, insects, and diseases. These forests are located to provide key positional and ecosystem linkages between high and low elevations as well as between eastside Cascades and westside Cascades vegetation.

The desired condition for these forests is to maintain and promulgate structural features which support individual stand diversity and key linkages. Snags and down wood are important components in stands of all ages; retention should provide for habitat and nutrient cycling processes. Canopy layering should be featured in mid and late seral stands.

Across the landscape, moist grand fir forests should be managed to mimic patterns historically generated by medium and high intensity fires. Typically, this would create larger disturbance patch sizes than those present today. Where young existing plantations exist, outside Late-successional Reserves and Riparian Reserves, units could be aggregated to enlarge early seral forest.

Short and long term, with implementation of the ROD standards and guidelines, the composition, structure and function of these forests is expected to improve. Greatest gains will occur within the first 3 decades as snags and down wood are recruited from current mid and late seral stands. Continuation of an improving trend from that point will depend on management ability to renew these forests in a way which replicates their former fire history.

c. Dry Grand Fir/Douglas-fir Forest

Approximately 45 percent (32,400 acres) of forested land within the watershed is in this grouping. At 14 percent of the total watershed area, this stratum is by far the largest forest community in Mile Creeks. The majority of this forest lies within the national forest, but a substantial portion is found on northern aspects well east on private land.

These forests typically are found at elevations between 2100 and 4600 feet. Annual precipitation ranges between 23 and 90 inches. Though incident moisture for some stands nearly matches the highest precipitation levels occurring in the watershed, local soil and physiographic characteristics strongly influence effective moisture content during the growing season (Topik, 1988).

Current Conditions: Mature stands in this stratum are dominated by Douglas-fir and grand fir overstories with scattered ponderosa pine. Stands are generally over-stocked and have a continuous canopy of conifers. Typically, ponderosa pine becomes less dominant as moisture and elevation increase while grand fir shows the opposite relationship.

Where present, large overstory ponderosa pines are usually the oldest trees in the stand. Ages for dominant pines and occasional old-growth Douglas-firs usually range between 150 and 250 years. Trees of co-dominant or intermediate crown status are typically 80 to 100 years old. Seedlings and saplings comprise a common, sometimes abundant, understory tree layer consisting almost exclusively of either Douglas-fir or grand fir.

Oregon white oak, lodgepole pine and western larch are locally common stand associates. Western white pine, Engelmann spruce and western hemlock occur in low numbers at the moister fringe of these forests. Tree diversity increases with age.

Dry site shrubs, forbs and grasses dominate the understory of this stratum. Where present, typical shrub species of these forests include snowberry, serviceberry, oceanspray, California Hazel, tall Oregongrape, baldhip rose and Rocky Mountain maple. Grasses are sparse but elk sedge, western fescue or both are found nearly everywhere in these forests.

Disturbance Agents and Processes: Dwarf mistletoe infects a high proportion of Douglas-fir, grand fir and other conifers in this stratum, likely owing to simpler host tree composition in most stands. Infestation within the tree, characterized by "witch's brooms, is usually most pronounced on the lowest live limbs, less evident in middle branches and nearly absent in the upper-third tree crown. Benefits to cavity habitat as described for moist grand fir apply equally as well to this stratum. Here, however, the generally high incidence of mistletoe infection has an added role in promoting fire spread and increasing burn intensity. Fine twigs cast from trees infected with mistletoe and the thickened foliage of the brooms themselves aid in carrying fire into the crowns.

Spruce budworm and the root diseases described for moist grand fir are important disturbance agents in these forests as well. The recent outbreak cycle of budworm feeding seen in upper elevation forests occurred in this zone, producing a similar pattern of defoliation. Top-killing of pole-sized and smaller trees in the mid level canopy of stands is common. Occasional mortality of grand fir also occurs. Host trees Douglas-fir and grand fir are abundant here and a layered canopy structure, which promotes budworm reproductive success, is typical of many stands.

The 3 root diseases common in moist grand fir and high elevation forests are also prevalent agents of change here. However, it is speculated that changed tree species composition is having a beneficial influence on spread and coverage area of the root rots, particularly laminated root rot. Tree composition of today's forests now includes abundant Douglas-fir and grand fir, species that were much less well-distributed in seral forests that formerly existed. Greater densities of trees promotes spread of root rots since potential infection pathways across roots are much increased. Because Douglas-fir and grand fir are the most common and susceptible hosts of laminated root rot, spread of the disease is likely enhanced with much increased numbers of these trees.

High densities of host trees is also advantageous for fungi, such as annosus root rot, having the ability to colonize hosts through dissemination of airborne spores. New infection centers can be started when the fungus enters trees through fresh stumps, fire scars, bark scrapes and other wounds.

Bark beetles play a significant role killing trees stressed by infestations of budworm and diseases in these forests, aided by drought conditions of the last decade. The western pine beetle (*Dendroctonus brevicomis*) and fir engraver (*Scolytus ventralis*) are common secondary invaders which quickly kill stressed trees. Recent observations indicate drought alone has sufficiently stressed large ponderosa pine, growing on south slopes, for western pine beetles to directly attack and kill trees.

Fire was the primary disturbance agent in these forests before settlement. Landscape pattern, forest composition and stand structure were controlled and largely shaped by frequent cycles of underburning. The cycle of frequent fire has been interrupted by the policy of fire exclusion, resulting in substantial changes to these forests. A thorough discussion of fire history, fire occurence, ecology of fire and fire regimes, related to this stratum as well as the rest of the watershed, is available in Appendix A.

The Forest Today Compared With Pre-1870 Forest: These are the transition forests between woodlands on the east shaped by frequent if irregular underburns and upper elevation forests where a crown fire regime predominates. Now, with fire largely excluded from these forests since the early 1900's, stands are well outside the natural range of variability. There is a high risk of fire reaching conflagration proportions. Moreover, habitat and ecosystem functioning associated with open ponderosa pine forest have all but disappeared in the watershed.

Compelling evidence indicates current stand composition and structure have shifted dramatically from conditions existing in pre-settlement forests. Historic diaries, other early observation records, early Forest Service correspondence, stand mapping and General Land Office surveys all substantiate the considerable differences in today's forests from those of the 19th century. As an example of changes documented in old Forest Service records, a quote from a 1922 Mt. Hood report reads:

> *"Mixed with the timber, most of the entire area supports a dense stand of reproduction and brush. Snowbrush which has no forage value appears to be taking the range. It may be of interest to note that the old stockmen, who used the range 20 years ago, say that the area was an open timbered, grass and weed range with scarcely any reproduction or brush at that time."*

Further evidence of the considerable changes which occurred during the 1900's is recorded in a letter from District Ranger Eric H. Gordan to the Regional Forester in 1939. The letter tells of the local "old-timers" who recall:

> *"...the dependent foothill country was a wonderful virgin grassland country covered with the finest stand of bunchgrass, while the forested area was much like the pure pine type of open timbered country, accessible to hacks [open horse-drawn carriage] and which except for the larger trees one could see in all directions, and that it had a fine stand of green timber feed, fern patches, debris and other refuse, or seedlings as they camped and passed through the Mts."*

Before the era of fire suppression, wildfires of low to moderate intensity periodically culled grand fir and Douglas-fir reproduction from forest stands. The thick bark of old-age ponderosa pine, Douglas-fir and the occasional western larch saved these trees from ground fires that burned the competition.

Without fire as a vital force of tree thinning, young thin-barked grand fir and Douglas-fir easily become established in the shade of the large tree overstory. Periodic logging of seral, fire-tolerant overstory trees only served to promote additional regeneration of grand fir and Douglas-fir. Eventually, the understory trees grew to become part of and replaced the dominant stand canopy. This ingrowth has choked former park-like stands with hundreds of stems per acre.

No longer are forests composed of large, widely-spaced ponderosa pine and Douglas-fir over a grass/forb understory. Instead of stands with perhaps 25 to 75 stems per acre of predominantly large trees and scattered patches of reproduction, stands today support grand fir and Douglas-fir trees less than 100 years old at densities sometimes approaching 1000 stems per acre. Periodic cutting of seral, fire-tolerant overstory trees only served to promote additional regeneration of grand fir and Douglas-fir.

Effects on Present Productivity and Ecosystem Function: The dry grand fir/Douglas-fir forests of Mile Creeks are changed to the extent that fire is now a threat to these forests rather than a vital agent of renewal. Fuel concentrations, tree densities and canopy layering present in most stands precludes reintroduction of fire. Nearly all stands are at high risk for being devastated by high-intensity crown fire. Without active intervention, forest succession will compound the existing hazard until fire, insects, disease or a combination of the three cause massive mortality.

In the event of a large fire in the drainage, particularly one which burns within the Fifteenmile Creek subwatershed, a significant or even devastating impact to steelhead is possible. Added sediment, increased water temperatures and an altered flow regime are nearly certain to result from a burn of conflagration proportions. For more detailed information on water quality and quantity impacts, see Appendices C through F.

In contrast, successful fire control will allow these forests continued growth and biomass accumulation. Demand for water within the fixed-volume rooting zone will inevitably exceed the soil's supply capability. Ultimately, competition for available moisture places trees in stress, particularly when drought prolongs and make more severe the summer dry season. The result is lessened ability of each tree to thwart or recover from insect and disease attacks.

Ground water recharge may be inhibited by interaction between rainfall interception of a thicker canopy and the evapo-transpirative demands of hundreds more trees per acre. Now that stem density has increased and layered canopies have replaced vertically stratified stands, hydrologic functioning of the forest has been altered. With the thicker canopy comes greater interception of snow and rain and less moisture reaching the ground. Yet, increasing numbers of trees form a dense, interwoven network of roots to meet evapotranspirational demands. Interception and greater evapo-transpirative demand together effectively reduce water available for maintenance of summer streamflows, possibly exacerbating current baseflow problems in the mid to lower watershed. See Appendix D for more detailed information on hydrologic processes and functions.

Wildlife habitat, too, has been dramatically changed. Forests in this stratum currently have a more complex structure than pre-settlement forests. Where logging has not altered structure, snags and down wood have increased. Also, multiple canopy layers have replaced the vertically stratified canopy of open pine forests. These increases in complexity of habitat have favored wildlife adapted to closed-crown stands but have disadvantaged species adapted to conditions found in the pre-settlement forest. Virtually no habitat remains in the dry grand fir/Douglas-fir stratum which resembles the large tree, open pine forest which dominated the landscape prior to pioneer settlement. Examples of species adapted to conditions provided by former forests include: gray fox, Lewis' woodpecker, pine grossbeak, Townsend's solitaire, pallid bat, long-eared myotis and sharptail snake. Where fire return intervals allowed brush in the understory, solitary vireo, western tanager and green-tailed towhee might also be found.

Desired Vegetation Conditions and Trends for the Future: The desired forest condition in this stratum would feature stands composed of large, irregularly-spaced trees overtopping a relatively open understory dominated by grass/forbs and scattered tree reproduction and shrubs. Densities for trees over 12 inches diameter at breast height would seldom exceed 50 per acre. Canopy closure would generally range from 40 to 60 percent. Overstory trees would be primarily ponderosa pine, but Douglas-fir and western larch would be common constituents as well, depending on local site conditions. Tree reproduction would vary in density and distribution within stands, but would include the above species plus grand fir and occasionally Oregon white oak. Only a small proportion of grand fir and Oregon white oak would survive within most stands beyond 50 years of age.

The main feature of stands in this stratum would be their resilience to burn damage when the inevitable fire occurs. Regardless of the specifics of stand structure and composition most stands should be able to come through a fire event without substantial loss of mature and older trees. Complete loss of trees through crown fire should be unusual over areas larger than 20 acres where above-described stands dominate. Spruce budworm and laminated root rot would be evident only rarely.

Getting to the desired condition is the key to rehabilitating forests of the dry grand fir/Douglas-fir zone. Stands currently existing have low resiliency and sustainability. It is the stand character of pre-settlement forests that must be recreated to protect against catastrophic wildfire. Forestry practices should focus not on restoring the prehistoric fire regime as a process, but should focus on reestablishing stand conditions created by that process.

This zone represents the number 1 priority for rehabilitation of all the plant communities in the watershed. It is forest stands within this zone that are most susceptible to high energy burns over extensive areas. Fires which start in these stands are likely to burn at very high temperatures, spread rapidly and would be difficult to control. The question is not whether these stands will burn, but only a question of when.

To reverse the current trend, three characteristics of today's forests must be corrected. First, stem densities need to be decreased, beginning with the smallest understory trees first. Working with the understory first would reduce fuel laddering, reduce branches which catch mistletoe seeds and would impair buildup of spruce budworm. Secondly, in reducing density, woody debris must be treated so as to not increase fuel loading. Finally, fire-resistant ponderosa pine and Douglas-fir must be selected as overstory trees.

Due to the accumulated heavy fuel loads, it is not possible to simply re-introduce fire to these forests. Mechanical means must be substituted to achieve stand thinning and fuel reduction results initially. Once understories are cleaned, it may again be practical to use fire for maintenance of open stand conditions.

d. Ponderosa Pine-Oregon White Oak Forest and Oregon White Oak Woodlands/Savannahs

Approximately 30 percent (21,600 acres) of forested land within the watershed, or 9 percent of total drainage acres, is in this stratum. Most of this zone occurs off the national forest but some of this grouping extends well up drainages on southern exposures.

These forests typically are found at elevations between 3600 feet down to 1500 feet elevation on north aspects. However, where summertime soil moistures are moderated at sites near streams, springs, and north aspects, stands of pine, oak or pine/oak mixtures are located at disjunct sites nearly to The Dalles. Annual precipitation ranges between 18 and 46 inches.

Current Conditions: Ponderosa pine-Oregon white oak woodlands are the most sparsely timbered forests in this watershed as well as on the Mt. Hood National Forest. These communities are adapted to high summer temperatures and a long, rain-free growing season. Well-drained soils exacerbate the lack of incident moisture during extended drying periods.

Except for occasional Douglas-fir, other tree species are absent from this grouping. Ponderosa pine, Oregon white oak or a mixture of the 2 trees represents the climax seral stage of these forest communities. Growth rates and stocking of ponderosa pine are low in these stands, making commercial timber production a poorly suited or unsuited objective.

Shrubs cover varies from abundant to sparse. Where present, shrubs are dry-site species such as squawcarpet ceanothus, deerbrush ceanothus, bitterbrush, snowberry, serviceberry and greenleaf manzanita.

Forb and grass flora is diverse and ubiquitous. Idaho fescue, western fescue, prairie junegrass and bluebunch wheatgrass are common native grasses. Introduced cheatgrass is also found, especially in association with known sheep driveways, indicating a probable history of over-grazing. Tailcup lupine, yellow hairy hawkweed, western yarrow, nineleaf lomatium and American vetch are often present and conspicuous. The litter layer is typically thin. Lack of wood and charcoal in surface soil layers suggests most large woody detritus is consumed by fire, rather than rotted.

Disturbance Agents and Processes: Before 1870, ground fires were a frequent event in ponderosa pine-Oregon white oak and oak-only stands. Most fires remained on the ground, spreading rapidly and burning with short flame lengths. These low intensity underburns reduced seedling and sapling numbers, knocked back brush, consumed wood detritus, released nutrients and thinned overstory trees.

Researchers report an 8 to 20 year fire return interval in ponderosa pine-dominated forest types. The more xeric the site, the greater is the role of fire in reducing shrub cover and increasing grass cover (Franklin and Dyrness, 1973). *Absence of fire has fostered increases in fuel accumulations and has resulted in greater stem densities.*

The Forest Today Compared With Pre-1870 Forest: These woodlands likely have not changed greatly since 1870. Conditions are so extremely dry during summer that live tree numbers, growth and seedling survival are limited more by effective soil moisture than by underburning or other factors. However, there are subtle changes which have taken place.

These plant communities provided much of the lumber and fuelwood needs of people in the early days of settlement. Consequently, nearly all the large ponderosa pines growing on these sites were cut. Large oaks, too, were cut to supply fuelwood for homes, train locomotives (for the rail line between Friend and The Dalles) and Columbia River sternwheel steamers.

As settlement brought homes and other structures to the forests, fire has been suppressed to protect life and property. Fire exclusion and logging in combination has not substantially changed tree proportions in comparison to forests likely to have existed prior to 1870. However, density of stems has in many instances increased somewhat while the average size of individual trees has likely decreased. In some locations, high densities of small diameter trees have resulted in stagnated stands unable to self-thin or grow larger.

While tree species composition and proportions are similar to pre-settlement forests, the forest canopy has become more closed as smaller trees are crowded more closely together. Also, a grass-dominated understory has been supplanted in places by shrub cover. Stand structure, too, has changed somewhat. Branches, down wood, standing dead trees and shed needles/leaves accumulate on site rather than being burned up by frequent fire.

Effects on Present Productivity and Ecosystem Function: Site productivity is likely reduced as a consequence of fire suppression. Without fire, 2 beneficial roles are lost which have not been replaced through another process. First, absence of frequent fire has allowed vegetation to accumulate to the limits of site capacity. Resulting competition among plants means less water and nutrients are available to any individual, thus depressing potential growth. Secondly, nutrients tied up in plants are not made available for reuse. Detritus in the form of oak leaves, pine needles, branches and whole dead plants is slow to decay and therefore not released and recycled for plant uptake.

Fire exclusion may also have altered the species composition of some plant communities. Lack of disturbance may have favored vegetation which prefers low fire incidence while forcing out plants that depend on burning to maintain their presence in the community. The extent to which a shift in composition may have occurred is difficult to determine. Little historical information is available on the grass/forb layer in these stands and evidence today may be obscured by grazing effects (Evers, in press).

One aspect of ecosystem function, the development of tree cavities, is perhaps diminished by lowered site productivity and tree wounding in the absence of fire. Large trees provide preferred nesting/denning habitat for some wildlife because a large bole can furnish a sizable cavity at a sufficient height above the ground to help in avoiding predators. Without thinning, oaks may become stagnated and never become large enough to provide optimum nest cavities for western gray squirrels, acorn woodpeckers, Lewis' woodpecker and other wildlife. Not only did fire accomplish thinning and nutrient release but burning may have also contributed to development of decay within oaks. Tree wounding or killing from the passage of fires provided the possibility for entry of heart rot fungi. Decay within the trunk is, of course, essential to soften the wood of oaks sufficiently to allow cavity excavation.

Desired Vegetation Conditions and Trends for the Future: Stands of this pine and oak woodland stratum support a tree species composition much like the former forests of the pioneer era. The most significant difference lies in the size and stocking of trees within stands. Increased tree sizes and greater openness would be desirable in these woodlands across the landscape.

e. Grassland/Shrubland Steppe

This stratum is by far the largest of the 5 vegetation zones defined in the watershed. Total area covered is approximately 167,000 acres, or 70 percent of the entire Mile Creeks drainage. All but perhaps a few hundred acres is in private ownership.

The steppe comprises the rolling hills and valleys of the lower two-thirds of Mile Creeks watershed. Elevations range roughly from 2500 feet down to 100 feet at the banks of the Columbia River. These are arid lands where summertime air temperatures often exceed 100 degrees Fahrenheit. Typically, the steppe receives less than 18 inches of precipitation annually, and as little as 12 inches. Most rainfall occurs between October and June.

Current Condition: Within the Mile Creeks watershed, little steppe remains in native vegetative cover. Most of the steppe today has been brought under cultivation to raise human food crops. Conversion of steppe to crop production is not unique to the Mile Creeks area. Much native steppe vegetation which existed throughout the Columbia Basin has been cleared to provide farmland. Cultivated crops occupy nearly all of the steppe now, leaving perhaps 5 to 10 percent un-tilled. The largest undeveloped areas occur in steeper terrain, with the largest contiguous areas lying in the northeastern portion of the watershed.

Shrubs, predominately big sagebrush and gray rabbitbrush, dominate much of the area remaining in native plant cover. These 2 species of woody plants are increasers that are advantaged by reductions of palatable forage species and the absence of frequent fire. Native grasses, particularly those most palatable, are not abundant and are sometimes restricted to areas protected by shrub crowns or rocks. Cheatgrass, needlegrass and annual forbs are common. Interlaced networks of paths which gradually angle across slope contours are evident on moderate slopes used by cattle.

Disturbance Agents and Processes: Livestock grazing and fire suppression have acted together to advance succession of native steppe toward shrub-dominated climax communities. In addition, non-native plant colonization and erosion have exacerbated changed conditions within former bunchgrass areas.

Early-day livestock grazing was especially harsh in its effects on native plant communities. Steppe lands were grazed at nearly all times of year. Ranchers were particularly dependent on the range during winter months as little stored feed was available for cattle. At the same time, steppe was declining in area as more and more land was tilled for crops. Palatable plants such as bluebunch wheatgrass, Idaho fescue and bitterbrush decreased under heavy grazing pressure and site disturbance from livestock. Other plants low in palatability increased in relative dominance as forage plants were consumed. Sage, gray rabbitbrush, needlegrasses and introduced cheatgrass are now dominant in most areas as a result of extensive grazing.

Native flora of the steppe has also been changed by more than shifts in plant dominance. Invasion by a number of non-native plants has further altered the species composition of native steppe as well. As grazing decreased forage species, growing space was made available for other plants. Thistles, knapweeds, numerous grasses and other introduced species have through time colonized many area of the steppe.

Suppression of wildfire has aided establishment and spread of woody plants. Frequent fire typical of the pre-1870 burn regime acted to control shrub ingrowth by scorching individual bushes and by aiding nutrient recycling for competing plants. Freed from frequent burning and largely unpalatable, sage and rabbitbrush colonized growing space made available by grazing and erosion.

The Steppe Today Compared With Pre-1870 Steppe: Today, nearly all lands of the steppe have been converted to agricultural use. More than 90 percent of what was once grasslands or shrublands is now cultivated for the production of wheat, barley, rapeseed (canola), alfalfa or fruits. Where lands are un-tilled and native vegetation remains, the dominant use is livestock grazing.

Upland areas where native plants remain is considerably changed in species composition and structure. Non-native plant introductions, grazing and fire exclusion have favored shrub dominance where grasses formerly prevailed. Riparian areas, too, have been enormously altered as streamside trees and shrubs fell to people's needs for wood, fuel, irrigation, cropland, roads, flood control and livestock forage/watering.

Prior to European settlement, grasses were the predominant cover on the steppe landscape. Bluebunch wheatgrass, fescues, Sandberg bluegrass, and junegrasses dominated upland areas. Shrubs were featured in depressions, canyon bottoms and like places where moisture was greatest and where fire return intervals were lengthened.

Today, shrubs dominate upland areas as grazing and fire suppression have favored woody plant colonization of former grasslands. Palatable vegetation is reduced and often replaced by plants of low forage value. Further, numerous non-native plants are now part of the biota. Surface erosion is frequently seen, enhanced in some measure by compaction, trampling and streambank breakdown caused by livestock. Riparian trees and shrubs (other than sage or rabbitbrush), where present, are confined close to the stream channel.

Effects on Present Productivity and Ecosystem Function: Native vegetation is present primarily as disjunct areas, remnant undeveloped patches within a matrix of cultivated farmlands. Some areas are only several acres in size while other patches are many hundreds of acres large. This disconnected mosaic may work against travel and dispersal of small animals and limits usefulness of smaller patches to resident animals with small territories. On the other hand, deer, elk, birds, coyotes and many other animals move across the landscape with little regard for the pattern of fields and steppe. Lack of connectivity is advantageous in that dispersal of some noxious plants may be impaired.

The consequence of the shift toward reduced native grasses and increased sage is that range productivity is lessened for cattle and many species of wildlife. Habitat niches unique to wide areas of bunchgrass community and common to pre-settlement flora are now relatively scarce, too. For example, the long-billed curlew (*Numenius americanus*) requires open grassland for nesting. This large shorebird is now relatively uncommon as a result of shrubs occupying its traditional nesting territories.

Altered composition of the flora, changed fuel continuity and increased fuel quantities have adversely influenced physical processes such as burning and nutrient cycling. Fires starting in today's steppe are more likely to burn hotter because of sagebrush and continuous cheatgrass/needlegrass fuels. With the added heat, nutrients available in woody material or grasses may be more completely volatilized, leaving less nutrients behind for plant uptake.

Changes to steppe vegetation have had profoundly adverse affects on overall stream ecology within the watershed; this, in turn, has negatively affected summer steelhead and other coldwater fishes. Sediment flushed from tilled fields during summer thunderstorms has clogged spawning gravels. Vegetation grazed, cut or bulldozed from streambanks has reduced stream shade, raising summer water temperatures. In addition, stream flows diminished by irrigation diversions have served to accentuate water temperatures fluctuations.

Desired Vegetation Condition and Trends for the Future: So far as can be determined, the following conditions are both likely and desired to continue into the future. Cultivated grain crops will continue to be the dominant vegetation of Mile Creeks watershed within the steppe zone. In valley bottoms along perennial streams, irrigated fields and pasture supporting non-native plants will be the norm. The trend toward excluding cattle along fish-bearing streams, to promote tree and shrub re-vegetation, is anticipated to continue. Gradually, re-vegetation is expected to provide shade and bank stability almost everywhere along named creeks. Added encouragement over the next couple decades is expected to see re-vegetation of springs and lesser streams as well.

In the future, the trend in farm management is toward decreasing soil erosion. Production of dryland crops is changing to include practices that minimize delivery of soil to streams. For example, on lands greater than 35 percent slope, contour strip planting is increasingly used to minimize erosion and gullying. Also, light tillage of crop residues, to retain 35 percent cover of residue materials over the ground, is another conservation method growing in use.

The trend for native steppe vegetation is seen as static to slightly improving. Heightened sensitivity by landowners to the fair to poor range conditions brought about by grazing is already evident. Management of livestock grazing in native grassland is increasingly sophisticated and is working to improve forage conditions. But it will take time and persistence to correct the substantial changes to native vegetation which has occurred. Greater difficulties emerge in controlling and reducing noxious plants and reestablishing the role of fire in the ecosystem.

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B. What are the processes and functions that are allowing or preventing hydrologic processes, and aquatic and riparian ecosystems to function within the range of natural conditions?

This key question addresses the condition of Mile Creeks Watershed with respect to the Aquatic Conservation Strategy Objectives (ROD 1994) by: 1) determination of the existing condition, 2) comparison of the existing condition to the desired conditions or range of natural conditions, 3) identification of the causal factors and mechanisms responsible for the existing conditions, 4) the consequences of the existing condition to beneficial uses and values, and 5) predictions of reasonably foreseeable trends in the watershed, with respect to the desired conditions based on implementation of the ROD. Detailed analyses of the altered hydrologic processes, and the riparian and aquatic ecosystem function in Mile Creeks are included in the Peakflow, Baseflow, Water Temperature, and Riparian and Aquatic Ecosystem technical reports (Appendices B.-E.).

Figure III.B.1 details the stream network on National Forest Lands

Tie to Beneficial Uses and Values, Processes and Factors.

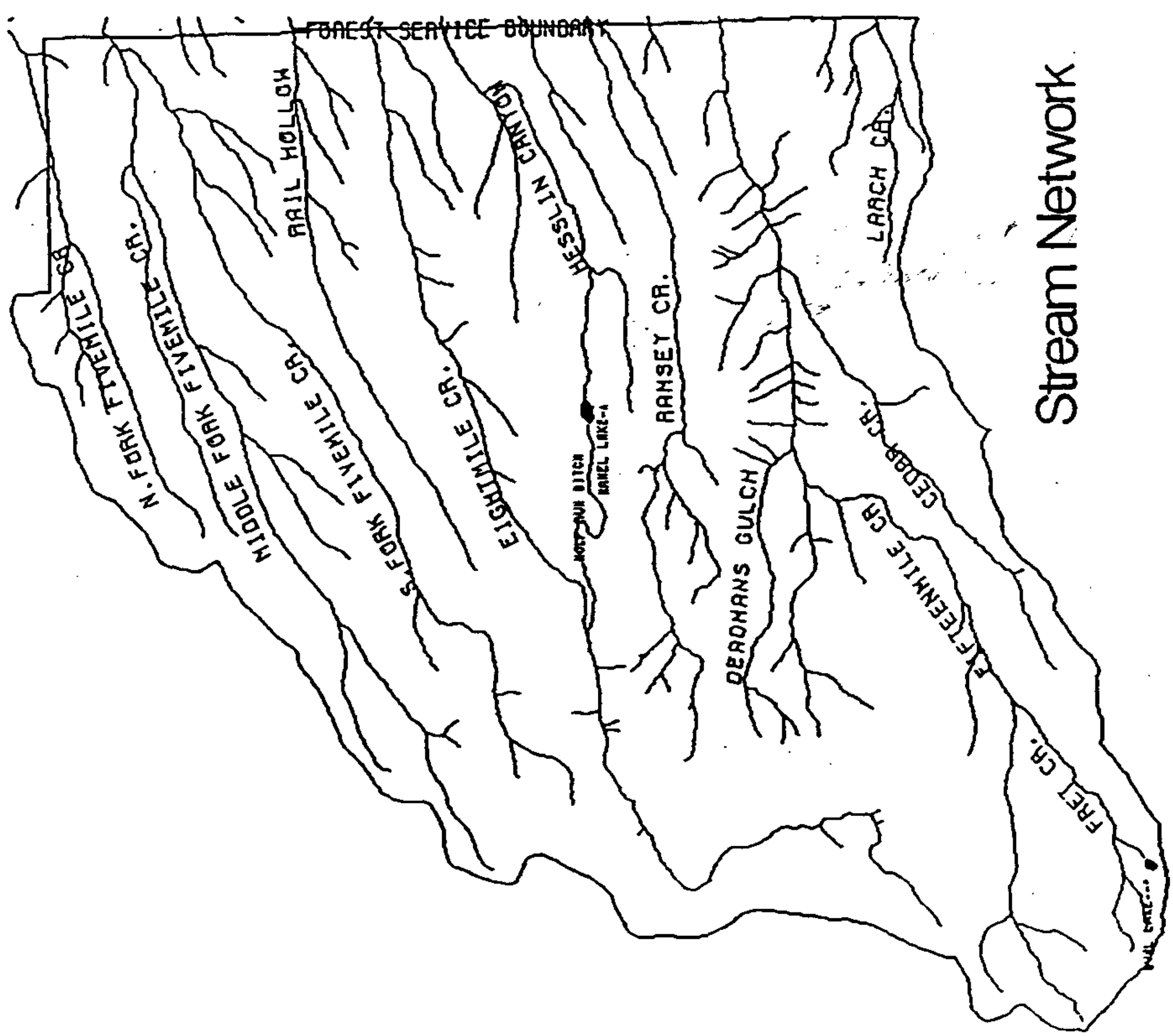
This question is tied to subsistence and recreational fisheries, water quality, water quantity, aquatic and riparian biodiversity, and aquatic and riparian ecosystem function as primary beneficial uses and values in Mile Creeks Watershed. The issues that affect these beneficial uses and values are altered hydrologic regime, altered water quality, altered hillslope processes, altered riparian ecosystem function, gene pool conservation, conservation of biodiversity, and altered distribution, dispersal or migration patterns of terrestrial, riparian and aquatic species.

Desired Conditions.

Desired conditions (DC) or range of natural conditions (RNC) for aquatic, riparian and hydrologic conditions for National Forest lands within the Mile Creeks Watershed were determined from legislation, agreements, and land management plans, and are described in Tables III.B.1.-2. Legislation included: 1) the National Forest Management Act, 2) the Organic Act, 3) the Wilderness Act, 4) the Clean Water Act, and 5) the Endangered Species Act (ESA). Land management direction for National Forest land included: 1) 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 1994), 2) the Mt. Hood National Forest Land and Resource Management Plan (LRMP 1991), 3) the PACFish Strategy (PACFish 1994), and 4) The Confederated Tribes of Warm Springs/Columbia Inter-Tribal Fish Commission and LRMP resolution agreement (in prep.).

Desired conditions for private land within the Mile Creeks Watershed were established from State law and the Oregon Department of Fish and Wildlife and Confederated Tribes of Warm Springs Fifteenmile Subbasin Plan (ODFW/CTWS 1990), ODFW and Mt. Hood National Forest Fifteenmile Basin Fish Habitat Improvement Implementation Plan (ODFW/MTH 1987). State laws included: 1) State Water Quality Standards, 2) Oregon Forest Practices Act, and 3) State Water Rights Law. When no direction was given for private land, the RNC was used as the desired condition.

Figure III.B.1. Stream Network on National Forest Lands



The desired conditions or range of natural conditions for public and private land in Tables III.B.1.-2. were used to quantify or qualify the existing conditions relative to the DC or RNC in Tables III.B.3.-6. Rationale for the hydrologic, riparian and aquatic ecosystem DCs and RNCs in Mile Creeks are included in the Peakflow, Baseflow, *Water Temperature*, and Riparian and Aquatic Ecosystem technical reports (Appendices B.-E.). The DC and RNC parameters are quantifiable physical or biological components of hydrologic processes or riparian and aquatic ecosystems that were used to evaluate the processes or functions that were identified as issues in the Mile Creeks Watershed (Tables III.B.3.-6.). Then, the quantifiable hydrologic, riparian, and aquatic DCs and RNCs were used as indicators of progress toward improved watershed condition in the watershed monitoring and restoration strategy (Tables VI.B.2.-3.).

Table III.B.1. Desired Conditions (DC) and/or Range of Natural Conditions (RNC) for Aquatic, Riparian and Hydrologic Processes and Functions Mile Creeks Watershed

Process/Function	Parameter	Desired Condition or Range of Natural Conditions
Channel Geomorphology	Channel geometry[1] including entrenchment, width:depth, channel sinuosity, channel gradient (below)	Desired conditions for channel geometries in management influenced areas are stable A, B, C, and E channel forms. Laterally widening, aggrading, vertically downcutting and entrenched D, F, and G channels initiated or aggravated by management activities will be evaluated for opportunities to restore or stabilize the channel to the range of natural conditions.[2]
	Entrenchment Ratio[3]	"A" reaches = <1.4 = entrenched "B" reaches = >1.4 2.2 = moderately entrenched "C" reaches = >2.2 = slightly entrenched "E" reaches = >2.2 = slightly entrenched
	Width to Depth Ratio[4]	"A" reaches = <12 = low "B" reaches = >12 = moderate "C" reaches = >12 = moderate high "E" reaches = <12 = very low
	Channel Sinuosity[5]	"A" reaches = <1.2 = low "B" reaches = >1.2 = moderate "C" reaches = >1.4 = moderate high "E" reaches = <1.5 = very high
	Channel Gradient[6]	"A+" reaches = >10 % "A" reaches = 4 9.9 % "B" reaches = 2 3.9 % "C" reaches = 0.1 1.9 % "E" reaches = <2 %
Aquatic Habitat	In-channel Large Woody Debris (LWD)	33-75 pieces LWD/mile (average = 68 pc./mi.) that are > 20" diameter at breast height (DBH) and > 35' long in the Subalpine Fir/Mt. Hemlock stratum[7] 39-144 pieces LWD/mile (average = 106 pc./mi.) that are > 18" DBH and > 35' long in the Moist Grand Fir and Dry Grand Fir/Douglas-fir strata[8] >20 pieces LWD/mile that are > 20" DBH and > 35' long in the Ponderosa Pine/Oregon White Oak strata[9]

[1]DC for channel geometry are based on the range of natural conditions for stable A, B, C, and E channel forms (Rosgen in prep.)
[2] ROD Aquatic Conservation Strategy (ACS); PACFish Strategy 1994
[3]Entrenchment = floodprone width/bankfull width
[4]Width to depth ratio = bankfull width/average depth at bankfull
[5]Channel sinuosity = channel length/valley length
[6]Channel gradient = change in the water surface elevation/length of channel
[7] DC based on stream surveys on Fret Creek in the Badger Creek Wilderness, Fifteenmile subwatershed
[8] DC based on stream surveys in segments of Fifteenmile Creek with no recent history of timber harvest or LWD removal from streams
[9] DC based on PACFish standards for Eastern Cascades

Table III.B.1. (cont) Desired Conditions for Aquatic, Riparian and Hydrologic Processes and Functions Mile Creeks Watershed

Process/Function	*Parameter*	Desired Condition or Range of Natural Conditions
Aquatic Habitat (cont)	Substrate	≤ 20 % surface fines < 6 mm weighted average in pool tail crests and riffles[1] < 25 % embeddedness area-weighted average in riffles or range of natural conditions[2]
	Bank Stability	≥ 95 % or range of natural conditions[3]
	Pools per Mile	Range of natural conditions dependent on geomorphic reach-type and average wetted width[4]
Water Quality	Temperature	Management activities shall not cause any increase in stream temperature that exceed 14.4^{0} C[5]
	Turbidity	No more than a 10 % cumulative increase in natural stream turbidities shall be allowed over background levels[6]
	Stream Shading	Increase stream shading where State Water Quality Standards are exceeded[7] Greater than or equal to 70 % canopy closure or range of natural conditions[8]

[1] The DC of surface fines in salmonid fish-bearing streams was based on research by Bjornn and Reiser (1991); ROD ACS; Confederated Tribes of Warm Springs and Columbia River Inter-Tribal Fish Commission LRMP resolution *agreement (in progress)*
[2] LRMP STG FW 102
[3] LRMP STG FW 102; ROD ACS
[4] DC for number of pools per mile were based on the range of natural conditions in Table III.B.2. (Overton et al. in prep.); ROD ACS; PACFish

Table III.B.2. Desired condition for number of pools per mile by geomorphic reach type and average wetted width

Wetted Width (feet)	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-65	65-100
Number of pools per mile "B" reaches	---	28-78	18-62	10-38	9-31	9-21	7-15	4-12	2-6
Number of pools per mile "C" reaches	39-159	28-84	36-70	8-34	10-50	---	---	---	---

[5] State Water Quality Standards
[6] State Water Quality Standards
[7] *LRMP STG FW 128*
[8] ODFW/MTH Fifteenmile Creek Subbasin Plan 1987

Table III.B.1. (cont) Desired Conditions for Aquatic, Riparian and Hydrologic Processes and Functions Mile Creeks Watershed

Process/Function	Parameter	Desired Condition or Range of Natural Conditions
Water Quantity	Peakflow	The distribution of land use activities, such as timber harvest or roads, must minimize increases in peak flows[1] ± 10 % of the peakflows predicted by the USGS regional equation[2] Maintain favorable conditions of flow[3]
	Baseflow	Baseflows will remain within the range of natural conditions for magnitude, timing and duration in order to protect beneficial uses within the watershed[4] Minimum perennial streamflows of 2 cubic feet per second (cfs) on Fifteenmile Creek at Dufur, 4 cfs on Fifteenmile Creek at the confluence of Eightmile Creek, 2 cfs at the mouth of Eightmile Creek, 2 cfs on Eightmile Creek at Highway 197, and 2 cfs in fish-bearing streams upstream of the Forest boundary[5] Maintain favorable conditions of flow[6]
Aquatic Biology	Distribution	Historic range of fish species within the watershed[7]
	Viability	Average egg - smolt survival of wild steelhead 1.6 %[8] Approximately 900 spawners minimum annual average in Fifteenmile Creek[9]
	Productivity	Approximately 600 wild steelhead minimum annual average for CTWS harvest in Fifteenmile Creek[10] Populations consistent with site potential productivity[11] Fish habitat capability will be maintained at existing levels or higher[12]

[1] ROD ACS
[2] Assumed to predict flows under hydrologically mature, pre-disturbance conditions for this area. Threshold identified for the possibility of adverse effects *Washington Forest Practices, Standard Methodology for Conducting Watershed Analysis,* version 2.0 1994
[3] Organic Act
[4] ROD ACS
[5] Water Policy Review Board to meet ODFW minimum flow requirements for protection of juvenile fishes
[6] Organic Act
[7] ROD ACS
[8] DC for early life history stages of steelhead was based on wild steelhead research in Washington (Bley and Moring 1988); Endangered Species Act
[9] ODFW/CTWS Fifteenmile Creek Steelhead Production Plan 1990; National Marine Fisheries Service (NMFS)recommendation for minimum viable breeding populations is 400-1000 fish to avoid genetic losses
[10] ODFW/CTWS 1990
[11] LRMP B7; ODFW/CTWS 1990
[12] LRMP STG FW 137

Table III.B.1. (cont) Desired Conditions for Aquatic, Riparian and Hydrologic Processes and Functions Mile Creeks Watershed

Process/Function	Parameter	Desired Condition or Range of Natural Conditions
Aquatic Biology (cont)	Fish Passage	Correct established human-made passage barriers[1] New road construction will maintain or enhance fish passage[2] Screen water diversions on fish-bearing streams[3]
Riparian Zone and Floodplain	Floodplain	Functional floodprone areas accessible to bankfull floods[4]
	Riparian-Dependent Wildlife Species	Populations consistent with site-potential productivity[5]
	Riparian Vegetation[6]	Full occupancy by historic plant communities[7] Site-potential large woody debris recruitment potential[8]

[1] LRMP STG SW 115-117; ODFW/CTWS 1990; ROD ACS
[2] LRMP STG FW 143; ROD ACS
[3] LRMP STG FW 143, ROD ACS
[4] ROD ACS
[5] LRMP B7; ROD ACS
[6] DC based on Mt. Hood riparian ecotypes (Diaz draft)
[7] LRMP B7; ROD ACS
[8] ROD ACS

Existing Condition, Range of Natural Conditions, Causal Factors and Mechanisms, Consequences to Beneficial Uses and Values, and Predicted Future Trends.

The following tables display aquatic, riparian and hydrologic processes and functions, their existing condition with respect to desired conditions or the range of natural conditions, factors that are causing the process or function to be within or outside the desired condition, the mechanisms that are causing the process or function to be within or outside the desired condition, effects of the process or functions current state on the beneficial uses and values, and predicted future trends based on current management direction. Aquatic, riparian and hydrologic processes and functions were addressed for Fivemile, Eightmile, and Fifteenmile subwatersheds within the National Forest Boundary (Tables III.B.3.-5.) and Mile Creeks Watershed below the National Forest Boundary (Table III.B.6). Detailed information and analyses of the hydrologic, riparian and aquatic existing conditions with respect to DC or RNC in Mile Creeks are included in the Peakflow, Baseflow, Water Temperature, and Riparian and Aquatic Ecosystem technical reports (Appendices B.-E.).

Figure III.B.2. details the stream network within Fivemile subwatershed.

Figure III.B.2. Stream Network Fivemile Subwatershed

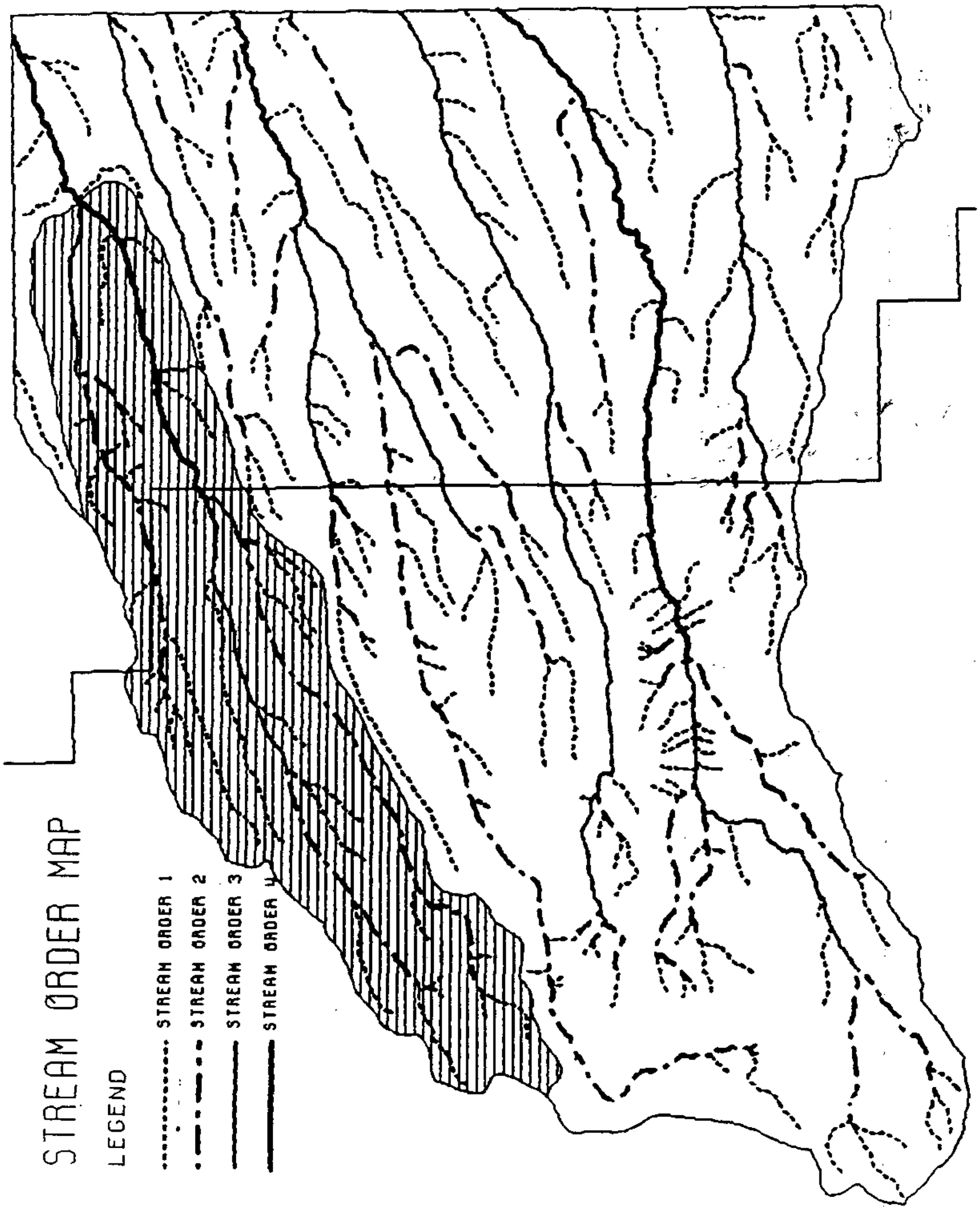


Table III.B.3. Fivemile Subwatershed Within the National Forest Boundary

Process /Function	Existing Condition with respect to DC or RNC	Causal Factors	Mechanism	Consequence with Respect to Beneficial Uses	Predicted Future Trends
Peakflow	Outside DC Peakflows are predicted to be 3-13 % above hydrologically mature, pre-disturbance conditions	Created openings from timber harvest activities and roading	Increased water available for runoff during rain on snow events	Increased bank erosion, bedscour, deposition, downcutting, lateral widening, substrate embeddedness, and pool filling Potential lethal effects for salmonid embryos, and decreased macroinvertebrate production	Recovering due to Riparian Reserves (RRs) and ROD Tier 1 Key Watershed designation, recommended upland silviculture and road obliteration
	4.5 % increase in drainage network above RNC	Ditchlines associated with roads	Changes in timing and magnitude of peakflows	same as above	Improving due to recommended road obliteration
Baseflow	Altered from RNC unquantified	Created openings from timber harvest and road building Intensive plantation management and fire	Effects on baseflow storage and routing, lower baseflows attributed to road densities and increased canopy closure in the Dry Grand Fir/Douglas-fir strata	Reduced baseflows exacerbate stream temperature problems and limit available habitat for fish and other aquatic species	Improving due to recommended road obliteration and upland silviculture

Table III.B.3. (cont) Fivemile Subwatershed Within the National Forest Boundary

Process /Function	Existing Condition with respect to DC or RNC	Causal Factors	Mechanism	Consequence with Respect to Beneficial Uses	Predicted Future Trends
Stream Temperature	Outside DC 15.0-17.9^0 C at the Forest boundary	Created openings due to roading and timber harvest in RR	Increased solar radiation reaching the stream channel	Increased stream temperature creating metabolic stress, limiting growth and smolting potential of juvenile steelhead	Improving due to recommended RRs and riparian silviculture.
Channel Morphology	Within DC for width:depth , entrenchment, gradient, sinuosity, and number of pools	Inherent stability	Geomorphology and fluvial processes	Maintenance of channel form and function	Continued stability
Floodplain Function	Within DC	Inherent stability	Geomorphology and fluvial processes	Maintenance of floodplain function during floodstage events, and maintenance of baseflow regime	Continued function
Sedimentation	Outside DC 31 % surface fines less than 6mm at Forest boundary	Timber harvest, roads, and point sources such as campgrounds, dispersed campsite, stream fords, etc.	Surface erosion, soil compaction, streambank erosion, riparian vegetation removal, and increased drainage density	Potential lethal effects for salmonid embryos, decreased aquatic productivity and habitat complexity	Improving due to RR network, reforestation, and recommended road obliteration and point source stabilization
In-channel Large Woody Debris (LWD) Loading on Fish-bearing Streams	Below DC 12.8 miles of fish-bearing stream have 18-38 pieces of LWD/mile (average = 27 pieces/mile)	Timber harvest within RR and removal of large in-channel wood from streams 1964-84	Harvest and large wood removal to protect roads and stream crossings	Decreased aquatic and riparian vertebrate and invertebrate productivity, decreased habitat and channel roughness elements, altered nutrient cycling	Recovery due to RR designation, current mid-seral stand composition, reforestation, and previous in-channel large woody debris projects in Fivemile and Middle Fork Fivemile

Table III.B,3. (cont) Fivemile Subwatershed Within the National Forest Boundary

Process /Function	Existing Condition with respect to DC or RNC	Causal Factors	Mechanism	Consequence with Respect to Beneficial Uses	Predicted Future Trends
Large Woody Debris Recruitment Potential in Riparian Reserves	Outside DC 166 acres of managed stands with low-fair recruitment potential	Timber harvest	Harvest, altered stand structure and composition	Same as above, and decrease in habitat and forage availability for bats, amphibians and other riparian dependent species	Recovery, same as above with the addition of recommended riparian silviculture
Aquatic Migration and Dispersal	Within DC	Natural barriers	Stream gradient	Naturally limited distribution of steelhead	Historic range
Riparian Migration and Dispersal	Outside DC 116 acres of managed stands within RR with canopy closure less than 50 %	Timber harvest	Harvest, altered stand structure and composition	Decreased cover and thermal refugia for riparian dependent species, spotted owl and other terrestrial species	Recovery due to RR designation and recommended riparian silviculture
Riparian Vertebrate Biodiversity	Unknown until riparian biodiversity surveys are completed Potential habitat for USFS R06 Sensitive Cope's salamander				Improving habitat capability due to RR designation and recommended riparian silviculture
Riparian Vascular Plant Biodiversity	Outside RNC 11 introduced species	Livestock, harvest, roading and erosion control	Accidental and intentional non-native seed introduction by humans and livestock	Unknown, probable competition with native species	No change due to recommended use of native species for future erosion control and forage enhancement projects

Table III.B.3. (cont) Fivemile Subwatershed Within the National Forest Boundary

Process /Function	Existing Condition with respect to DC or RNC	Causal Factors	Mechanism	Consequence with Respect to Beneficial Uses	Predicted Future Trends
Viability and Genetic Conservation of a unique stock of wild, winter steelhead (*Oncorhynchus mykiss gairdnerii*)	Below DC Populations of spawning adults and survival of egg-juvenile stages depressed, Current population size in the watershed is unknown, estimated at 200-300 adult spawners in 1989 Petitioned for listing under the Endangered Species Act No significant hybridization with hatchery rainbow trout	Bonneville Dam Roading, timber harvest, silvicultural, agricultural and rangeland practices, historic fisheries Introduction of predaceous bullfrogs, and an increase in the range of predaceous northern squawfish in the mid-lower Mile Creeks Watershed Limited introduction of hatchery rainbow trout	Migration impediment for anadromous adults and smolts, altered physical and biological processes in the Columbia River Altered physical and biological processes, degradation of riparian and aquatic ecosystems - including sedimentation, decreased in-channel large woody debris, low baseflows and lethal water temperatures during the summer irrigation season, increased peakflows, migration barriers, and decreased aquatic and riparian productivity - primarily in the mid-lower watershed	Risk of extinction of the only extant run of wild winter steelhead from inland, redband trout genetic stock due to estimated, current populations below sustainable levels, and inability of population to re-bound from natural and human-caused stochastic events Loss of Confederated Tribes of Warm Springs subsistence fishery and local recreational fishery Decreased aquatic productivity and altered aquatic ecosystem function	Unknown No foreseeable change in operation of Bonneville Dam Predict stabilization or slight increase in the number of spawning adults with improved egg-smolt survival if ROD and Mile Creeks Watershed Analysis habitat restoration and management recommendations are implemented, and the current moratorium on subsistence and recreational fisheries (1984-present) is maintained until the DC for spawners is met No foreseeable hatchery introductions
Aquatic Vertebrate Biodiversity	Within RNC	No naturalized, exotic introductions in the upper watershed	Stocking	Potential hybridization, competition, or predation by exotic species	Risk of extinction of Mile Creeks wild winter steelhead , no foreseeable hatchery introductions

Key Point Summary of Hydrologic, Riparian, and Aquatic Processes and Functions in Fivemile Subwatershed Within the National Forest Boundary.

1. Populations of wild winter steelhead are significantly depressed in Middle Fork and South Fork Fivemile Creek as a result of altered physical processes and riparian and aquatic ecosystem degradation, primarily on the private land in the mid-lower watershed. The unique stock of Mile Creeks steelhead is at risk of extinction.

2. There is potential habitat for USFS R06 Sensitive Cope's salamander in the upper watershed.

3. Road building, timber harvest, intensive plantation management, and fire suppression have resulted in increased peakflows and decreased baseflows that degrade aquatic habitats, can be lethal for salmonid embryos, and are contributing to aquatic habitat and channel morphology problems and lethal summer water temperatures for coldwater fishes in the lower watershed.

4. Water temperature in Fivemile Creek at the Forest boundary exceeds State Water Quality standards and contributes to lethal water temperatures for coldwater fishes in the lower watershed.

5. Channel morphology and floodplain functions are inherently stable.

6. Cumulative effects of sediment production and delivery from tractor harvest activities, bank erosion at recreation sites and stream fords, roads and associated ditchlines, low resiliency/high erosion potential soils, and other unidentified sediment sources are contributing excessive fine sediment that degrades aquatic habitats, can be lethal for salmonid embryos, and is contributing to aquatic habitat and channel morphology problems fishes in the mid-lower watershed.

7. Large woody debris accumulations and potential recruitment in riparian and aquatic ecosystems is below the range of desired conditions as a result of timber harvest, large wood removal from fishbearing creeks and non-fishbearing tributaries to protect roads and culverts, and silvicultural practices that have altered riparian stand structure and composition resulting in decreased productivity and habitat capability for riparian and aquatic dependent species.

8. Barriers and impediments to fish migration and dispersal are natural.

9. Timber harvest and silvicultural practices have decreased the amount of vegetative cover and thermal refugia for riparian-dependent species, northern spotted owl, and other terrestrial species resulting in altered terrestrial and riparian migration and dispersal patterns, and decreased habitat capability.

10. Wild winter steelhead have maintained their unique genetic stock status because of limited hatchery rainbow trout introductions.

11. There are no naturalized populations of exotic aquatic vertebrate species in the upper watershed.

12. The status of riparian-dependent vertebrate biodiversity is unknown.

13. There are 11 species of naturalized, exotic vascular plants species in the riparian zones as a result of livestock grazing, roading, erosion control projects, and accidental human introductions.

Figure III.B.3. Stream Network Eightmile Subwatershed

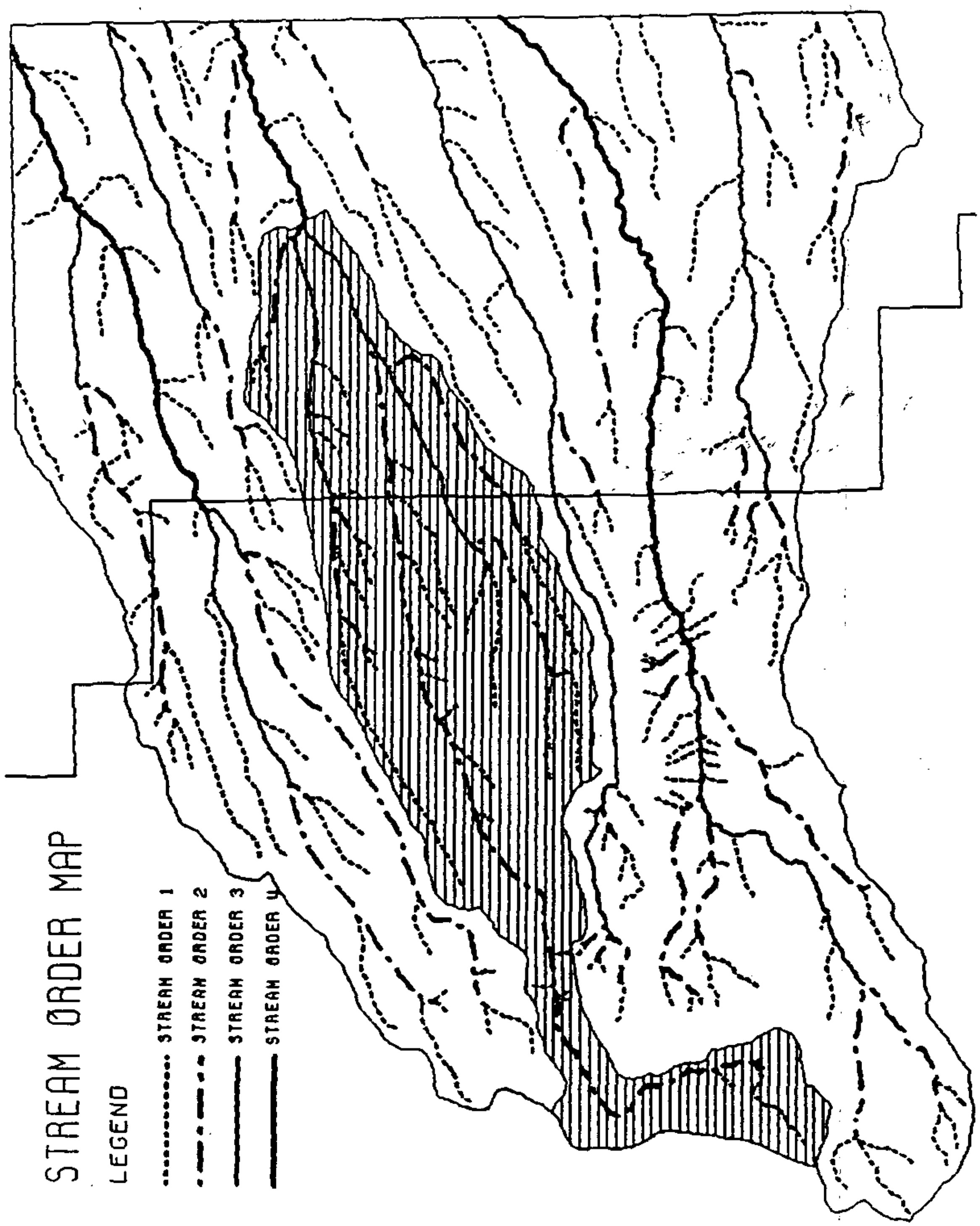


Table III.B.4. Eightmile Subwatershed Within the National Forest Boundary

Process /Function	Existing Condition with respect to DC or RNC	Causal Factors	Mechanism	Consequence with Respect to Beneficial Uses	Predicted Future Trends
Peakflow	Outside DC Peakflows are predicted to be 3 -11 % above hydrologically mature, pre-disturbance conditions	Created openings from timber harvest activities and roading	Increased water available for runoff during rain on snow events	Increased bank erosion, bedscour, deposition, downcutting, lateral widening, substrate embeddedness, and pool filling Potential lethal effects for salmonid embryos, and decreased macroinvertebrate production	Recovering due to RRs and ROD Tier 1 Key Watershed designation, recommended upland silviculture and road obliteration
	5 % increase in drainage network above RNC	ditchlines associated with roads	changes in timing and magnitude of peakflows	same as above	Improving due to recommended road obliteration
Baseflow	Outside DC 1.5 cfs at Forest boundary	Created openings from timber harvest and road building Silvicultural practices and fire suppression Wolf Run Ditch water withdrawal of 1.7 cfs during the irrigation season	Water withdrawal, effects on baseflow storage and routing, and lower baseflows attributed to road densities and increased canopy closure in the Dry Grand Fir/Douglas-fir strata	Reduced baseflows exacerbate stream temperature problems and limit available habitat for fish and other aquatic species	Potential long-term improvement due to proposed conversion Wolf Run Ditch delivery system, and some improvement due to recommended road obliteration and upland silviculture
Stream Temperature	Outside DC 14.3-16.0 ^{0}C at the Forest boundary	Created openings due to roading and timber harvest in RR, reduced baseflow due to Wolf Run Ditch	Increased solar radiation reaching the stream channel, water withdrawal	Increased stream temperature creating metabolic stress, limiting growth and smolting potential of juvenile steelhead	Recovering due to RR designations, and recommended riparian silviculture Proposal to convert Wolf Run Ditch delivery system

Table III.B.4. (cont) Eightmile Subwatershed Within the National Forest Boundary

Process /Function	Existing Condition with respect to DC or RNC	Causal Factors	Mechanism	Consequence with Respect to Beneficial Uses	Predicted Future Trends
Channel Morphology	Outside DC localized increases in channel width to depth ratios and streambank instability	Human and vehicle traffic in developed and dispersed campsites, low water crossings, and grazing	Streambank erosion, riparian vegetation removal, soil compaction, and sedimentation	Laterally unstable channel, increased solar gain, increased sedimentation, impacts to instream beneficial uses	Improvement due RR designation, previously implemented and recommended restoration projects
Floodplain Function	Within DC	Inherent stability	Geomorphology and fluvial processes	Maintenance of floodplain function during floodstage events, and maintenance of baseflow regime	Continued function
Sedimentation	Outside DC 34-56 % surface fines less than 6 mm	Timber harvest, roads, and point sources including campgrounds and low water crossings	Surface erosion, soil compaction, streambank erosion, riparian vegetation removal, and increased drainage density	Potential lethal effects for salmonid embryos, decreased aquatic productivity and habitat complexity	Recovery due to RR network, reforestation, and recommended road obliteration and point source stabilization projects
In-channel Large Woody Debris (LWD) Loading on Fish-bearing Streams	Below DC [1] 5.6 miles of fish-bearing stream have 16-33 pieces of LWD/mile (average = 21 pieces/mile)	Timber harvest within RR and removal of large in-channel wood from streams 1964-84	Harvest and large wood removal to protect roads and stream crossings	Decreased aquatic and riparian vertebrate and invertebrate productivity, decreased habitat and channel roughness elements, altered nutrient cycling	Recovery due to RR designation, current mid-seral stand composition, reforestation, and recommended in-channel LWD projects
Large Woody Debris Recruitment Potential in Riparian Reserves	Outside DC 78 acres of managed stands with low-fair recruitment potential	Timber harvest	Harvest, altered stand structure and composition	Same as above, and decrease in habitat and forage availability for bats, amphibians and other riparian dependent species	Recovery, same as above with the addition of recommended riparian silviculture

[1] See Aquatic and Riparian Ecosystem Technical Report, Appendix G Table VIII.F.2.

Table III.B.4. (cont) Eightmile Subwatershed Within the National Forest Boundary

Process /Function	Existing Condition with respect to DC or RNC	Causal Factors	Mechanism	Consequence with Respect to Beneficial Uses	Predicted Future Trends
Aquatic Migration and Dispersal	Outside DC several miles of suitable habitat in Eightmile Creek inaccessible to juvenile steelhead	Culvert on USFS Road 4430 at Eightmile Campground	Adult and juvenile steelhead migration barrier	Decrease in historic range of steelhead	Recovery due to recommended barrier removal or modification
Riparian Migration and Dispersal	Outside DC 49 acres of managed stands within RR with canopy closure less than 50 %	Timber harvest	Harvest, altered stand structure and composition	Decreased cover and thermal refugia for riparian dependent species, spotted owl and other terrestrial species	Recovery due to RR designation and recommended riparian silviculture
Riparian Vertebrate Biodiversity	Unknown until riparian biodiversity surveys are completed Potential habitat for USFS R06 Sensitive Cope's salamander				Improving habitat capability due to RR designation and recommended riparian silviculture
Riparian Vascular Plant Biodiversity	Outside RNC 11 introduced species	Livestock, harvest, roading and erosion control	Accidental and intentional non-native seed introduction by humans and livestock	Unknown, probable competition with native species	No change due to recommended use of native species for future erosion control and forage enhancement projects

Table III.B.4. (cont) Eightmile Subwatershed Within the National Forest Boundary

Process /Function	Existing Condition with respect to DC or RNC	Causal Factors	Mechanism	Consequence with Respect to Beneficial Uses	Predicted Future Trends
Viability and Genetic Conservation of a unique stock of wild, winter steelhead (*Oncorhynchus mykiss gairdnerii*)	Below DC Populations of spawning adults and survival of egg-juvenile stages depressed, Current population size in the watershed is unknown, estimated at 200-300 adult spawners in 1989 Petitioned for listing under the Endangered Species Act No significant hybridization with hatchery rainbow trout	Bonneville Dam Roading, timber harvest, silvicultural, agricultural and rangeland practices, historic fisheries Introduction of predaceous bullfrogs, and an increase in the range of predaceous northern squawfish in the mid-lower Mile Creeks Watershed Limited introduction of hatchery rainbow trout	Migration impediment for anadromous adults and smolts, altered physical and biological processes in the Columbia River Altered physical and biological processes, degradation of riparian and aquatic ecosystems - including sedimentation, decreased in-channel large woody debris, low baseflows and lethal water temperatures during the summer irrigation season, increased peakflows, migration barriers, and decreased aquatic and riparian productivity - primarily in the mid-lower watershed	Risk of extinction of the only extant run of wild winter steelhead from inland, redband trout genetic stock due to estimated, current populations below sustainable levels, and inability of population to re-bound from natural and human-caused stochastic events Loss of Confederated Tribes of Warm Springs subsistence fishery and local recreational fishery Decreased aquatic productivity and altered aquatic ecosystem function	Unknown No foreseeable change in operation of Bonneville Dam Predict stabilization or slight increase in the number of spawning adults with improved egg-smolt survival if ROD and Mile Creeks Watershed Analysis habitat restoration and management recommendations are implemented, and the current moratorium on subsistence and recreational fisheries (1984-present) is maintained until the DC for spawners is met No foreseeable hatchery introductions
Aquatic Vertebrate Biodiversity	Within RNC	No naturalized exotic introductions in the upper watershed	Stocking	Potential hybridization, competition, or predation by exotic species	Risk of extinction of Mile Creeks wild winter steelhead , no foreseeable hatchery introductions

Key Point Summary of Hydrologic, Riparian, and Aquatic Processes and Functions in Eightmile Subwatershed Within the National Forest Boundary.

1. Populations of wild winter steelhead are significantly depressed in Eightmile Creek as a result of altered physical processes and riparian and aquatic ecosystem degradation, primarily on the private land in the mid-lower watershed. The unique stock of Mile Creeks steelhead is at risk of extinction.

2. There is potential habitat for USFS R06 Sensitive Cope's salamander in the upper watershed.

3. Road building, silvicultural practices, timber harvest, fire suppression, and water withdrawals from Wolf Run Ditch have resulted in increased peakflows and decreased baseflows that degrade aquatic habitats, can be lethal for salmonid embryos, and are contributing to aquatic habitat and channel morphology problems and lethal summer water temperatures for coldwater fishes in the lower watershed. Eightmile Creek baseflow downstream of the Wolf Run Ditch intake is below the ODFW minimum recommendations for protection of juvenile fishes.

4. Water temperature in Eightmile Creek at the Forest boundary exceeds State Water Quality standards and contributes to lethal water temperatures for coldwater fishes in the lower watershed.

5. Channel morphology and floodplain functions are inherently stable. Localized channel morphology problems such as lateral widening and bank erosion that de-stabilize the channel, produce instream sediment, and increase water temperature occur in the vicinity of Eightmile Campground, Lower Eightmile Campground, Bottle Prairie, dispersed recreation sites, and stream fords.

6. Cumulative effects of sediment production and delivery from tractor harvest activities, bank erosion at recreation sites and fords, roads and associated ditchlines, low resiliency/high erosion potential soils, and other unidentified sediment sources are contributing excessive fine sediment that degrades aquatic habitats, can be lethal for salmonid embryos, and is contributing to aquatic habitat and channel morphology problems fishes in the mid-lower watershed.

7. Large woody debris accumulation and potential large woody debris recruitment in riparian and aquatic ecosystems is below the range of desired conditions as a result of timber harvest, large wood removal from fishbearing creeks and non-fishbearing tributaries to protect roads and culverts, and silvicultural practices that have altered riparian stand structure and composition resulting in decreased productivity and habitat capability for riparian and aquatic dependent species.

8. A culvert on USFS Road 4430 at Eightmile Campground is a migration impediment and/or barrier for juvenile steelhead, preventing access to several miles of good summer rearing habitat in upper Eightmile Creek.

9. Timber harvest and silvicultural practices have decreased the amount of vegetative cover and thermal refugia for riparian-dependent species, northern spotted owl, and other terrestrial species resulting in altered terrestrial and riparian migration and dispersal patterns, and decreased habitat capability.

10. Wild winter steelhead have maintained their unique genetic stock status because of limited hatchery rainbow trout introductions.

11. There are no naturalized populations of exotic aquatic vertebrate species in the upper watershed.

12. The status of riparian-dependent vertebrate biodiversity is unknown.

13. There are 11 species of naturalized, exotic vascular plants species in the riparian zones as a result of livestock grazing, roading, erosion control projects, and accidental human introductions.

Figure III.B.4. Stream Network Fifteenmile Subwatershed

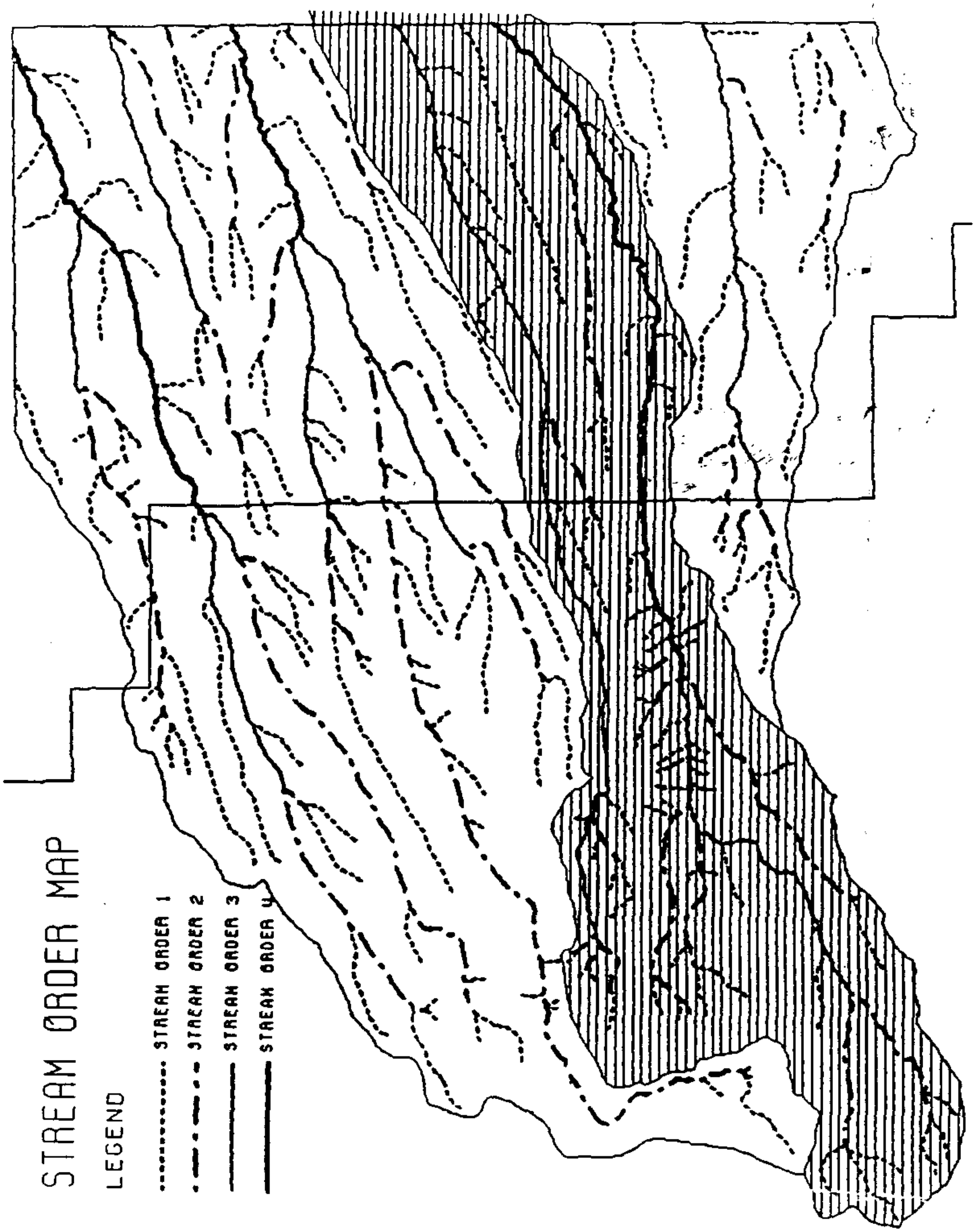


Table III.B.5. Fifteenmile Subwatershed Within the National Forest Boundary

Process /Function	Existing Condition with respect to DC or RNC	Causal Factors	Mechanism	Consequence with Respect to Beneficial Uses	Predicted Future Trends
Peakflow	Outside DC Peakflows are predicted to be 2 -8 % above hydrologically mature, pre-disturbance conditions	Created openings from timber harvest activities and roading	Increased water available for runoff during rain on snow events	Increased bank erosion, bedscour, deposition, downcutting, lateral widening, substrate embeddedness, and pool filling Potential lethal effects for salmonid embryos, and decreased macroinvertebrate production	Recovering due to RRs and ROD Tier 1 Key Watershed designation, recommended upland silviculture and road obliteration
	3.6 % increase in drainage network above RNC	ditchlines associated with roads	changes in timing and magnitude of peakflows	same as above	Improving due to recommended road obliteration
Baseflow	Altered from RNC unquantified	Created openings from timber harvest and road building Silvicultural practices and fire suppression	Effects on baseflow storage and routing, and lower baseflows attributed to road densities and increased canopy closure in the Dry Grand Fir/Douglas-fir strata	Reduced baseflows exacerbate stream temperature problems and limit available habitat for fish and other aquatic species	Potential long-term improvement due to recommended road obliteration and upland silviculture
Stream Temperature	Outside DC 15.0-17.9^0 C at the Forest Boundary	Created openings due to roading and timber harvest in RR	Increased solar radiation reaching the stream channel	Increased stream temperature creating metabolic stress for salmonid fishes	Recovering due to RR designations, and recommended riparian silviculture
Channel Morphology	Outside DC localized increases in channel width to depth ratios and streambank instability	Human and vehicle traffic in developed and dispersed campsites, low water crossings, and grazing	Streambank erosion, riparian vegetation removal, soil compaction, and sedimentation	Laterally unstable channel, increased solar gain, increased sedimentation, impacts to instream beneficial uses	Improvement due RR designation, implemented and recommended restoration projects

Table III.B.5. (cont) Fifteenmile Subwatershed Within the National Forest Boundary

Process /Function	Existing Condition with respect to DC or RNC	Causal Factors	Mechanism	Consequence with Respect to Beneficial Uses	Predicted Future Trends
Floodplain Function	Within DC	Inherent stability	Geomorphology and fluvial processes	Maintenance of floodplain function during floodstage events, and maintenance of baseflow regime	Continued function
Sedimentation	Outside DC 21-35 % surface fines less than 6 mm	Timber harvest, roads, and point sources including campgrounds, low water crossing, headcutting tributaries, and gullies	Surface erosion, soil compaction, streambank erosion and increased drainage density, grazing	Potential lethal effects for salmonid embryos, decreased aquatic productivity and habitat complexity	Recovery due to RR network, reforestation, unstocked grazing allotments, and recommended road obliteration and point source stabilization
In-channel Large Woody Debris (LWD) Loading on Fish-bearing Streams	Within DC 7 miles of fish-bearing stream have 39-144 pieces of LWD/mile (average = 104 pieces/mile)	Timber harvest within RR and removal of large in-channel wood from streams 1964-84	Harvest and large wood removal to protect roads and stream crossings	Decreased aquatic and riparian vertebrate and invertebrate productivity, decreased habitat and channel roughness elements, altered nutrient cycling	Recovery due to RR designation, current mid-seral stand composition, reforestation, and previous in-channel large woody debris projects in Ramsey and Fifteenmile creeks
Large Woody Debris Recruitment Potential in Riparian Reserves	Outside DC 138 acres of managed stands with low-fair recruitment potential	Timber harvest	Harvest, altered stand structure and composition	Same as above, and decrease in habitat and forage availability for bats, amphibians and other riparian species	Recovery, same as above with the addition of recommended riparian silviculture
Aquatic Migration and Dispersal	Within DC	Natural barriers	Stream gradient	Naturally limited distribution of steelhead	No change in historic range
Riparian Migration and Dispersal	Outside DC 76 acres of managed stands within RR with canopy closure less than 50 %	Timber harvest	Harvest, altered stand structure and composition	Decreased cover and thermal refugia for riparian and terrestrial species and northern spotted owl	Recovery due to RR designation and recommended riparian silviculture

Table III.B.5. (cont) Fifteenmile Subwatershed Within the National Forest Boundary

Process /Function	Existing Condition with respect to DC or RNC	Causal Factors	Mechanism	Consequence with Respect to Beneficial Uses	Predicted Future Trends
Viability and Genetic Conservation of a unique stock of wild, winter steelhead (*Oncorhynchus mykiss gairdnerii*)	Below DC Populations of spawning adults and survival of egg-juvenile stages depressed, Current population size in the watershed is unknown, estimated at 200-300 adult spawners in 1989 Petitioned for listing under the Endangered Species Act No significant hybridization with hatchery rainbow trout	Bonneville Dam Roading, timber harvest, silvicultural, agricultural and rangeland practices, historic fisheries Introduction of predaceous bullfrogs, and an increase in the range of predaceous northern squawfish in the mid-lower Mile Creeks Watershed Limited introduction of hatchery rainbow trout	Migration impediment for anadromous adults and smolts, altered physical and biological processes in the Columbia River Altered physical and biological processes, degradation of riparian and aquatic ecosystems - including sedimentation, decreased in-channel large woody debris, low baseflows and lethal water temperatures during the summer irrigation season, increased peakflows, migration barriers, and decreased aquatic and riparian productivity - primarily in the mid-lower watershed	Risk of extinction of the only extant run of wild winter steelhead from inland, redband trout genetic stock due to estimated, current populations below sustainable levels, and inability of population to re-bound from natural and human-caused stochastic events Loss of Confederated Tribes of Warm Springs subsistence fishery and local recreational fishery Decreased aquatic productivity and altered aquatic ecosystem function	Unknown No foreseeable change in operation of Bonneville Dam Predict stabilization or slight increase in the number of spawning adults with improved egg-smolt survival if ROD and Mile Creeks Watershed Analysis habitat restoration and management recommendations are implemented, and the current moratorium on subsistence and recreational fisheries (1984-present) is maintained until the DC for spawners is met
Aquatic Vertebrate Biodiversity	Within RNC	No naturalized, exotic introductions in the upper watershed	Stocking	Potential hybridization, competition, or predation by exotic species	Risk of extinction of Mile Creeks wild winter steelhead , no foreseeable hatchery introductions

Table III.B.5. (cont) Fifteenmile Subwatershed Within the National Forest Boundary

Process /Function	Existing Condition with respect to DC or RNC	Causal Factors	Mechanism	Consequence with Respect to Beneficial Uses	Predicted Future Trends
Riparian Vertebrate Biodiversity	Unknown until riparian biodiversity surveys are completed Potential habitat for USFS R06 Sensitive Cope's salamander				Improving habitat capability due to RR designation and recommended riparian silviculture
Riparian Vascular Plant Biodiversity	Outside RNC 11 introduced species	Livestock, harvest, roading and erosion control	Accidental and intentional non-native seed introduction by humans and livestock	Unknown, probable competition with native species	No change due to recommended use of native species for future erosion control and forage enhancement projects

Key Point Summary of Hydrologic, Riparian, and Aquatic Processes and Functions in Fifteenmile Subwatershed Within the National Forest Boundary.

1. Populations of wild winter steelhead are significantly depressed in Fifteenmile and Ramsey creeks as a result of altered physical processes and riparian and aquatic ecosystem degradation, primarily on the private land in the mid-lower watershed. The unique stock of Mile Creeks steelhead is at risk of extinction.

2. There is potential habitat for USFS R06 Sensitive Cope's salamander in the upper watershed.

3. Road building, silvicultural practices, timber harvest, and fire suppression have resulted in increased peakflows and decreased baseflows that degrade aquatic habitats, can be lethal for salmonid embryos, and are contributing to aquatic habitat and channel morphology problems and lethal summer water temperatures for coldwater fishes in the lower watershed.

4. Water temperature in Fifteenmile Creek at the Forest boundary exceeds State Water Quality standards and contributes to lethal water temperatures for coldwater fishes in the lower watershed.

5. Channel morphology and floodplain functions are inherently stable. Localized channel morphology problems such as lateral widening and bank erosion that de-stabilize the channel, produce instream sediment, and increase water temperature occur in the vicinity of Pebbleford Campground, Fifteenmile Campground, Underhill Campground, dispersed recreation sites, and stream fords.

6. Cumulative effects of sediment production and delivery from tractor harvest activities, bank erosion at recreation sites and fords, roads and associated ditchlines, low resiliency/high erosion potential soils, tributary headcutting, soil compacted by livestock grazing, and other unidentified sediment sources are contributing excessive fine sediment that degrades aquatic habitats, can be lethal for salmonid embryos, and is contributing to aquatic habitat and channel morphology problems fishes in the mid-lower watershed.

7. Large woody debris accumulations in mainstem Fifteenmile Creek were assumed to be within the range of natural conditions based on the length of recovery time from historic timber harvest activity. Large woody debris accumulation and potential recruitment in other riparian and aquatic areas are below the range of desired conditions as a result of timber harvest, large wood removal from fishbearing creeks and non-fishbearing tributaries to protect roads and culverts, and silvicultural practices that have altered riparian stand structure and composition resulting in decreased productivity and habitat capability for riparian and aquatic dependent species.

8. Barriers and impediments to fish migration and dispersal are natural.

9. Timber harvest and silvicultural practices have decreased the amount of vegetative cover and thermal refugia for riparian-dependent species, northern spotted owl, and other terrestrial species resulting in altered terrestrial and riparian migration and dispersal patterns, and decreased habitat capability.

10. Wild winter steelhead have maintained their unique genetic stock status because of limited hatchery rainbow trout introductions.

11. There are no naturalized populations of exotic aquatic vertebrate species in the upper watershed.

12. The status of riparian-dependent vertebrate biodiversity is unknown.

13. There are 11 species of naturalized, exotic vascular plants species in the riparian zones as a result of livestock grazing, roading, erosion control projects, and accidental human introductions.

Table III.B.6. Mile Creeks Watershed Downstream of the National Forest Boundary

Process /Function	Existing Condition with respect to DC or RNC	Causal Factors	Mechanism	Consequence with Respect to Beneficial Uses	Predicted Future Trends
Peakflow	Outside RNC unquantified	Created openings from timber harvest and roading near the Forest boundary	Increased water available for runoff during rain on snow events	Increased bank erosion, bedscour, deposition, downcutting, lateral widening, substrate embeddedness, and pool filling, potential lethal effects for salmonid embryos, and decreased macroinvertebrate production	Increasing due to accelerated timber harvest on private land in the rain on snow zone
	drainage network increased	ditchlines associated with roads, and gullies and rills associated with agricultural and range lands	changes in the timing and magnitude of storm runoff	same as above	Unknown, anticipated increases in drainage network due to additional roads being constructed for timber harvest versus implementation of agricultural erosion control plans

Table III.B.6. (cont) Mile Creeks Watershed Downstream of the National Forest Boundary

Process /Function	Existing Condition with respect to DC or RNC	Causal Factors	Mechanism	Consequence with Respect to Beneficial Uses	Predicted Future Trends
Baseflow	Outside DC below ODFW recommendations of 2-4 cfs for protection of fishes	Irrigation and domestic water withdrawal, channel incision and gullying Reduction of wetlands created by beaver activity No municipal water withdrawals at this time	Effects on baseflow inputs, water storage capacity and routing	Reduced baseflows exacerbate stream temperature problems in the lower watershed that are lethal to coldwater fishes, and limits available habitat for fishes, particularly Pacific lamprey in Fifteenmile below Dufur	No significant change from current condition due to the long-term nature of senior water rights in the watershed, irrigation needs, and disconnected floodplains Future utilization of the City of Dufur water rights could greatly exacerbate the baseflow problem Some interest in water conservation of water delivery systems for irrigation

Table III.B.6. (cont) Mile Creeks Watershed Downstream of the National Forest Boundary

Process /Function	Existing Condition with respect to DC or RNC	Causal Factors	Mechanism	Consequence with Respect to Beneficial Uses	Predicted Future Trends
Stream Temperature	Outside DC routinely exceeds State Standards of 14.4 °C and upper lethal limit of 24°C for salmonids during the irrigation season	Water withdrawals, decreased canopy closure due to timber harvest on public and private land, riparian stand conversion to crops, and livestock impacts	Increased interception of solar radiation due to removal of riparian vegetation, decreased baseflow, and increased channel width to depth ratios	Fish kills in lower watershed, decreased range of coldwater fishes and increased range of predatory warmwater fishes in the lower watershed, increased metabolic stress, limited growth and smolting potential of juvenile steelhead in mid-watershed	Improvement due to RR designations and recommended riparian silviculture on Forest, ODFW riparian fencing projects, decreased salmonid predation by warmwater squawfish Short-term decrease in improvement on private timber land because of accelerated rate of riparian harvest rates prior to September 1994 establishment of 20 ft. "no entry" riparian buffer
Channel Morphology	Outside RNC gullied and entrenched channels - approximately 1.5 miles of Fivemile Creek, 8 miles of Eightmile Creek, and 26 miles of Fifteenmile Creek	Flood control channelization, stream re-location, removal of in-channel large woody debris, increased peakflow, declines in beaver population	Geomorphology and fluvial processes (e.g. headcutting, increased stream gradient and decreased channel length)	Instability of channel form and function, streambed and streambank erosion, reduced baseflows, increased temperature, increased flood velocity, loss of floodplain function	Long-term channel evolution through fluvial processes toward stable channel forms Recommended channel and riparian restoration projects would move channel towards more stable form

Table III.B.6. (cont) Mile Creeks Watershed Downstream of the National Forest Boundary

Process /Function	Existing Condition with respect to DC or RNC	Causal Factors	Mechanism	Consequence with Respect to Beneficial Uses	Predicted Future Trends
Floodplain Function	Outside RNC same as above	Channelization, stream re-location, livestock grazing, removal of riparian vegetation, decrease in riparian area, removal of beaver and instream LWD, reduction in baseflow	Channel incision, confinement of floodstage flows, lowered watertable, headcutting, conversion of riparian vegetation, and decreased riparian complexity	Reduction of water storage capacity, decreased baseflows, flood damage, decreased LWD recruitment potential, increased erosion and sediment delivery, decreased riparian habitat for wildlife, decreased aquatic habitat and productivity	Permanent, long term loss of floodplain function, water storage capacity, and riparian area on incised segments of stream unless recommended channel and riparian restorations are implemented
Sedimentation	Outside RNC approximately 149,000 tons of fine sediment produced annually from agricultural land	Agricultural and rangeland practices, channelization, timber harvest, roading, and other point sources	Precipitation and runoff induced surface erosion, gullying and rilling, livestock trampling and chiseling streambanks, soil compaction, streambank erosion during peakflows, and increased drainage density	Potential lethal effects for salmonid embryos, decreased aquatic productivity, increased channel width to depth ratios, increased streambed and bank erosion at high flows, increased sediment deposition in low gradient reaches, decreased spawning success and habitat complexity for fishes, loss of perennial flow in aggraded reaches	Improvement due to implementation of erosion control plans on agricultural land, ODFW riparian fences and water gaps for livestock in the mid-lower watershed, and recommended channel and riparian restorations Reforestation, recommended road obliteration and point source stabilization on NF land in the upper watershed

Table III.B.6. (cont) Mile Creeks Watershed Downstream of the National Forest Boundary

Process /Function	Existing Condition with respect to DC or RNC	Causal Factors	Mechanism	Consequence with Respect to Beneficial Uses	Predicted Future Trends
In-channel Large Woody Debris Loading on Fish-bearing Streams	Outside RNC less than 20 pieces of LWD greater than 20 inches diameter and 35 feet long per mile of stream	Timber harvest within RR, conversion of riparian hardwoods and conifers to agricultural crops, livestock, removal of riparian trees for flood control, and removal of down large wood from streams, reduced recruitment potential	Timber harvest, alteration of timber stand structure and composition, vegetative type conversion for agriculture, large wood removal for protection of road and agricultural investments	Decreased aquatic and riparian habitat, forage, and vertebrate and invertebrate productivity, decreased channel roughness elements and increased erosion at peakflows, altered nutrient cycling	Some improvement due to ODFW in-channel large woody debris projects and 36 miles of riparian fencing and State Forest Practices 20 foot riparian reserves on Class I streams after September 1994, if LWD that recruits to the active channel is no longer removed

Table III.B.6. (cont) Mile Creeks Watershed Downstream of the National Forest Boundary

Process /Function	Existing Condition with respect to DC or RNC	Causal Factors	Mechanism	Consequence with Respect to Beneficial Uses	Predicted Future Trends
Large Woody Debris Recruitment Potential in Riparian Reserves	Outside RNC most riparian corridors on private timber, range, and agricultural land less than 100-125 feet or one-site potential tree on either side of the stream	Agricultural and rangeland practices, private land timber harvest, loss of riparian and floodplain function	Timber harvest, altered stand structure and composition, livestock grazing and trampling effects on riparian vegetation, riparian vegetation conversion to crops	Same as above, and decrease in habitat and forage availability for bats, amphibians and other riparian dependent species	Improvement due ODFW fencing riparian corridors 20 ft. to 1/4 mile wide on either side of fish-bearing streams on agricultural and rangelands (50 % or 36 miles completed to date) Short-term decrease in improvement on private timber land because of accelerated rate of riparian harvest rates prior to September 1994 establishment of 20 ft. "no entry" riparian buffer Width of 20 foot buffer to narrow for significant improvement on private timber land after September 1994

Table III.B.6. (cont) Mile Creeks Watershed Downstream of the National Forest Boundary

Process /Function	Existing Condition with respect to DC or RNC	Causal Factors	Mechanism	Consequence with Respect to Beneficial Uses	Predicted Future Trends
Aquatic Migration and Dispersal	Outside RNC	Partial migration barriers for adult steelhead at rivermile (RM) 0.4 SF Fivemile Creek, and RMs 2.2 and 2.4 NF Fivemile Creek Intermittent flow on Fivemile Creek during irrigation season	Adult delay or partial barriers Juvenile steelhead and resident fish lowflow migration barrier	Decreased steelhead spawning and rearing success due to increased energy consumption and delay of migration, increased risk of predation, increased metabolic stress due to water quality and quantity issues in the mid-lower watershed, and decreased accessibility of quality habitat in the upper watershed	Restoration of numerous passage problems due to human-made structures, unscreened irrigation pumps and ditches have been completed by the Mt. Hood NF and ODFW since 1987, modification of all man-made barriers is recommended No foreseeable improvement in Fivemile Creek baseflow
Riparian Migration and Dispersal	Outside RNC	Timber harvest	Harvest, altered stand structure and composition	Decreased cover and thermal refugia for riparian dependent species, spotted owl and other terrestrial species	Recovery due to RR designation and recommended riparian silviculture

Table III.B.6. (cont) Mile Creeks Watershed Downstream of the National Forest Boundary

Process /Function	Existing Condition with respect to DC or RNC	Causal Factors	Mechanism	Consequence with Respect to Beneficial Uses	Predicted Future Trends
Riparian Vertebrate Biodiversity	Outside RNC Introduction of bullfrogs Depressed populations of native riparian dependent species	Humans, decreased baseflows and increased water temperatures Agricultural and rangeland practices, timber harvest, lowered water table, reduced beaver populations, removal of in-channel large woody debris	Naturalized populations of bullfrogs Reduced riparian and wetland habitat area and complexity, altered riparian and timber stand structure and composition, decreased levels of large woody debris	Bullfrogs are an introduced predator of native fishes, other amphibians, and juvenile turtles Decreased utilization by migratory species such as bald eagle, greater sandhill cranes, common merganser, beaver Depressed populations of non-migratory species such as beaver, painted and western pond turtles	Probable increase in bullfrog populations Improved riparian habitat capability on agricultural and range lands due to ODFW fenced riparian corridors 20 ft. to 1/4 mile wide on fish-bearing streams No change on private timber land because the 20 ft. width of riparian buffers is too narrow for significant improvement
Riparian Vascular Plant Biodiversity	Outside RNC numerous introduced exotics, livestock forage species, noxious plants and agricultural species, reduction of native riparian and wetland biodiversity	Agriculture and rangeland practices, timber harvest, roading and erosion control	Accidental and intentional seed introduction, increased dispersal potential, vegetative conversions, lowered water table, trampling, soil compaction	Decreased habitat, dispersal, range and populations of native plant species Increased habitat, dispersal, range and populations of non-native and noxious plant species	Some improvement likely within fenced riparian corridors

Table III.B.6. (cont) Mile Creeks Watershed Downstream of the National Forest Boundary

Process /Function	Existing Condition with respect to DC or RNC	Causal Factors	Mechanism	Consequence with Respect to Beneficial Uses	Predicted Future Trends
Viability and Genetic Conservation of a unique stock of wild, winter steelhead (*Oncorhynchus mykiss gairdnerii*)	Below DC Populations of spawning adults and survival of egg-juvenile stages depressed, but not quantified Current population size in the watershed is unknown, estimated at 200-300 adult spawners in 1989 Petitioned for listing under the Endangered Species Act	Bonneville Dam Roading, timber harvest, silvicultural, agricultural and rangeland practices, historic fisheries Introduction of predaceous bullfrogs, and an increase in the range of predaceous northern squawfish in the mid-lower Mile Creeks Watershed Limited introduction of hatchery rainbow trout	Migration impediment for anadromous adults and smolts, altered physical and biological processes in the Columbia River Altered physical and biological processes, degradation of riparian and aquatic ecosystems - including sedimentation, decreased in-channel large woody debris, low baseflows and lethal water temperatures during the summer irrigation season, increased peakflows, migration barriers, and decreased aquatic and riparian productivity - primarily in the mid-lower watershed	Risk of extinction of the only extant run of wild winter steelhead from inland, redband trout genetic stock due to estimated, current populations below sustainable levels, and inability of population to re-bound from natural and human-caused stochastic events Loss of Confederated Tribes of Warm Springs subsistence fishery and local recreational fishery Decreased aquatic productivity and altered aquatic ecosystem function	Unknown No foreseeable change in operation of Bonneville Dam Predict stabilization or slight increase in the number of spawning adults with improved egg-smolt survival if ROD and Mile Creeks Watershed Analysis habitat restoration and management recommendations are implemented, and the current moratorium on subsistence and recreational fisheries (1984-present) is maintained until the DC for spawners is met

Table III.B.6. (cont) Mile Creeks Watershed Downstream of the National Forest Boundary

Process /Function	Existing Condition with respect to DC or RNC	Causal Factors	Mechanism	Consequence with Respect to Beneficial Uses	Predicted Future Trends
Viability of Pacific Lamprey (*Entosphenus tridentatus*)	Below DC Populations of spawning adults and survival of ammocete larvae depressed, but not quantified State Sensitive Species	Agricultural and rangeland practices, primarily increased peakflows, sedimentation, rapid and prolonged water draw-downs, and lethal water temperatures during the irrigation season	Reduction of slow, edgewater habitat for larvae that reside in freshwater 4-6 years before migrating to the ocean, increased bed scour and sedimentation, altered biological and physical processes in the mid-lower watershed	Risk of extirpation of Mile Creeks Pacific lamprey due to current populations below sustainable levels, inability of population to re-bound from natural and human-caused stochastic events Loss of the Confederated Tribes of Warm Springs subsistence lamprey fishery Decreased aquatic productivity and altered aquatic ecosystem function	Predict increased larval survival if peakflows, baseflows, water temperatures, and sedimentation are brought within the range of DC, and the current moratorium on the subsistence fishery (1984-present) is maintained until the DC for spawners is met
Aquatic Vertebrate Biodiversity	Outside RNC Increase in the range and population of northern squawfish Small naturalized population of brook trout Risk of extinction of Mile Creeks winter steelhead Risk of extirpation of Mile Creeks Pacific lamprey	Degradation of coldwater habitat and increase in warmwater habitat as a result of forestry, agricultural and rangeland practices, naturalized exotic introductions	Decreased baseflow, increased water temperature, stocking, live bait Altered physical and biological processes, primarily in the mid-lower watershed	Extinction of a unique stock of wild, winter steelhead Loss of Confederated Tribes of Warm Springs steelhead and lamprey subsistence fisheries Loss of steelhead recreational fishery	Unknown, populations of steelhead and Pacific lamprey may stabilize or increase slightly if ROD and Mile Creeks Watershed Analysis habitat restoration and management recommendations are implemented, and the current moratorium on subsistence and recreational fisheries is maintained until the DC is met

Key Point Summary of Hydrologic, Riparian, and Aquatic Processes and Functions in Mile Creeks Watershed Below the National Forest Boundary.

1. Populations of wild winter steelhead and Pacific lamprey are significantly depressed in mid-lower Mile Creeks Watershed as a result of altered physical processes and riparian and aquatic ecosystem degradation, primarily on the private land in the mid-lower watershed. The unique stock of Mile Creeks steelhead is at risk of extinction. The Pacific lamprey is at risk of extirpation.

2. The effects of the Bonneville Dam and hydroelectric power facilities on upstream and downstream migration of Mile Creeks steelhead are unquantified, but significant.

3. The cumulative effects of road and ditchlines, silvicultural practices, timber harvest, fire suppression, water withdrawals for irrigation and domestic use, gullies and rills associated with agricultural and range lands, channel morphology changes, loss of wetlands associated with beaver activity, and removal of riparian vegetation have resulted in increased peakflows and decreased baseflows that increase sediment production and delivery, degrade aquatic habitats, can be lethal to embryonic and juvenile salmonids and lamprey, contribute to channel morphology problems and lethal summer water temperatures for coldwater fishes in the mid-lower watershed.

4. Historically perennial flow in Fivemile Creek is currently intermittent during the irrigation season resulting in lowflow migration barriers for fishes, decreased aquatic habitat availability, increased risk of terrestrial predation on juvenile steelhead and resident fishes, and lethal water temperatures for juvenile steelhead and resident coldwater fishes.

5. Water temperatures in Mile Creeks Watershed downstream of the National Forest Boundary exceeds State Water Quality standards, are metabolically stressful and routinely lethal for coldwater fishes in the lower watershed during the irrigation season. ODFW riparian fencing projects are improving canopy closure and stream shading.

6. Channel morphology changes and loss of floodplain function have resulted from loss of riparian vegetation, channelization projects, livestock impacts, declines in beaver populations, increases in peakflows, increased sediment production and delivery, roading, removal of instream large woody debris. As a result, channels are unstable, prone to erosion during flood events, floodplains have reduced water storage capacity and ability to moderate baseflow, recruitment potential of large woody debris is decreased, productivity and habitat capability of the riparian and aquatic ecosystems are greatly reduced.

7. Cumulative effects of sediment production and delivery from private timber, agricultural and range land practices, bank erosion associated with increased peakflows and channelization, roads and associated ditchlines, high erosion potential soils, tributary headcutting, and other unidentified sediment sources are contributing excessive fine sediment that degrades aquatic habitats, can be lethal for salmonid embryos, and is contributing to channel morphology problems in the mid-lower watershed. Fine sediment from a private wheatfield 4-5 miles below the National Forest Boundary is contributing lethal levels of fine sediment to anadromous reaches of Eightmile Creek.

8. Large woody debris accumulations and potential recruitment in riparian and aquatic ecosystems is below the range of desired conditions as a result of conifer and hardwood timber harvest in the riparian zones, large wood removal from fishbearing creeks and non-fishbearing tributaries to protect roads and private property, and silvicultural, agricultural and rangeland practices that have altered riparian stand structure and composition resulting in decreased productivity and habitat capability for riparian and aquatic dependent species. Current and future ODFW riparian fencing projects will improve woody debris recruitment proportionate to the width of the fenced exclosures.

9. The majority of unnatural migration barriers and impediments for fishes have been modified or removed by ODFW in the mid-lower watershed since they were identified in 1987. A culvert and 2 irrigation dams that are impediments to adult steelhead migration in Fivemile Creek, and some unscreened pump intakes that are lethal to juvenile steelhead were identified by ODFW, and are scheduled to be modified or screened.

10. Timber harvest, rangeland, and agricultural practices have decreased the amount of vegetative cover and thermal refugia for riparian-dependent species, northern spotted owl, and other terrestrial species resulting in altered terrestrial and riparian migration and dispersal patterns, and decreased habitat capability.

11. Wild winter steelhead have maintained their unique genetic stock status because of limited hatchery rainbow trout introductions.

12. There is a small population of naturalized, exotic brook trout in the mid-lower watershed. The range and population of northern squawfish that are predators of salmonids and other fishes and invertebrates has increased in the lower watershed as a result of increased water temperatures.

13. Bullfrogs are naturalized, exotic species in the mid-lower watershed, and are predators of native fishes, amphibians, and aquatic reptiles. Slow, warm water habitat created by irrigation withdrawals, sedimentation, and reduced streamshade favors bullfrogs and squawfish over salmonids and other coldwater fishes.

14. The current beaver population in the mid-lower watershed is a remnant of the historic population. Reductions in wetlands and side-channel habitat constructed by beaver has reduced the extent and complexity of rearing and over-wintering habitat for juvenile steelhead. The status of other riparian-dependent vertebrates is unknown, but populations are assumed to be depressed as a result of decreased riparian habitat area and complexity.

15. Numerous exotic vascular plant species have been introduced accidentally or intentionally as a result of agriculture, lowered riparian watertables, decreased wetland area, livestock grazing, roading, erosion control projects, and other human introductions.

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C. What are the processes and factors allowing or preventing terrestrial connectivity and migration or dispersal linkages?

Processes and factors allowing or preventing connectivity and migration or dispersal linkages include fire exclusion, timber harvest, grazing, roads, and recreation. These processes and factors have shaped the current landscape conditions. Key wildlife species addressed in the analysis and affected by these processes and factors include deer and elk, northern spotted owl, fisher, wolverine, marten, and pileated woodpecker (Appendix G)

Deer and elk

Mile Creeks Watershed is a significant migration pathway between the summer range meadows to the west and the winter range lowlands to the east (Diaz, pers. comm.). Migration patterns generally follow water sources and ridgetops (ODFW and D. Thorsen, 1994). Maps on file at Barlow Ranger District.

Currently, elk numbers exceed 100 % of the management objective for the White River Management area. Deer numbers have never exceeded 80 % of the management objective (ODFW, 1994); this may indicate habitat conditions cannot support deer management objectives. Historically, deer and elk numbers were much lower in the past (European settlers journals and diaries, late 1800's). Tables III.C.1.-2. illustrate estimated deer and elk populations by vegetation strata (Fig.III.A.2) and causal factors which may limit or improve habitat in the entire watershed.

Table III.C.1. Estimated Percent of Deer Population

Vegetation Strata	Historic	Current	Causal Factors
Steppe	5 %	5 %	Same due to land in agricultural status
Ponderosa Pine/Oregon White Oak and Oregon White Oak Woodlands/Savannah	25 %	40 %	Increase due to less livestock grazing and greater security on private land
Dry Grand Fir/Douglas-fir and Moist Grand Fir	60 %	30 %	Decrease due to greater open road densities for access to timber harvest units in the upper watershed causing less security
Subalpine Fir/Mountain Hemlock	10 %	25 %	Increase due to combination of timber harvest and fire suppression[1]

Table III.C.2. Estimated Percent of Elk Population

Vegetation Strata	Historic	Current	Causal Factors
Steppe	< 5 %	< 5 %	Same due to land in agricultural status
Ponderosa Pine/Oregon White Oak and Oregon White Oak Woodlands/Savannahs	50 %	75 %	Increase due to less livestock grazing and greater security on private land
Dry Grand Fir/Douglas-fir and Moist Grand Fir	40 %	10 %	Decrease due to greater open road densities for access to timber harvest units in the upper watershed causing less security
Subalpine Fir/Mountain Hemlock	5-10 %	10-15 %	Slight increase due to combination of timber harvest and fire suppression[2]

[1] see Appendix G

[2] see Appendix G

Key Points

1. Less livestock grazing, as compared to historic grazing, has improved forage distribution on private land in the Ponderosa Pine/Oregon White Oak and Oregon White Oak Woodlands/Savannah strata by reducing competition. Production of alfalfa fields on private land in the Steppe strata provides good forage for deer and elk.

2. Fire suppression in combination with timber harvest in the Subalpine Fir/Mountain Hemlock and Moist Grand Fir strata has improved vegetative habitat conditions for deer and elk.

3. Although these vegetative conditions have improved, the benefits have been outweighed by the increased open road densities and subsequent loss of security.

4. Closed roads on private land provide better security for deer and elk than the existing open road densities on National Forest land (Table III.C.3.).

5. Current high road densities and motorized trails may disrupt use patterns and alter migration routes (Fig. III.C.1.). Excessive roading impacts habitat of deer and elk by increasing human disturbance (ODFW, no date; USFS, 1982). Roads are currently being closed in the watershed, thus starting to reduce road densities and increasing habitat effectiveness and use. Since more migration routes of deer and elk have been documented in Fivemile Creek subwatershed and it also has the greatest open road density, as compared to other subwatersheds on National Forest land, efforts to reduce open road densities in Fivemile Creek subwatershed should be a priority.

6. Opportunity exists to make Fifteenmile Creek subwatershed an unroaded area for wildlife security.

7. Cover to forage ratios can generally be used to monitor habitat quality of elk summer and winter range, and can be used to assess trends in use of habitat (Leckenby, 1984). Currently, cover values are high and forage values are low on National Forest land, relative to optimal habitat conditions (Table III.C.4.).

8. Based on ROD designation of the LSR and 100 acre northern spotted owl core habitats (100 Acre LSRs), and recommended RRs, and retention of the CHU, forage quantity in these areas will decrease, and thermal and hiding cover will increase in Mt. Hood NF portions of Fifteenmile Creek subwatershed. It is speculated deer and elk use patterns will shift slightly to forage in natural openings, pine/oak and oak savannahs, and meadows, as man-made forage areas (harvest units in transition) develop to mid and late seral stages.

9. Outside Reserved areas in the Matrix land allocation (ROD, 1994), primarily in the Dry Grand Fir/Douglas-fir and Ponderosa Pine/Oregon White Oak and Oak Woodlands/Savannah strata, forage areas may increase and cover may decrease due to future timber management activities, such as thinning.

10. Change in cover to forage ratio should not limit use and migration in and out of the watershed (Table III.C.4).

Table III.C.3. Road Densities (miles per square miles) On National Forest Land

Habitat Type	Historic Conditions*	Current Conditions	Desired Conditions Based on ROD[1] and LRMP SG[2]
Summer range	≤ 2.5	3.2	2.5
Winter range	≤ 2.0	2.9	2.0

* Historic is defined as prior to late 1950's - early 1960's when widespread use of the chainsaw occurred to facilitate timber harvest. More road construction began to occur to access the timber harvest units.

Table III.C.4. Cover:Forage Ratios On National Forest Land

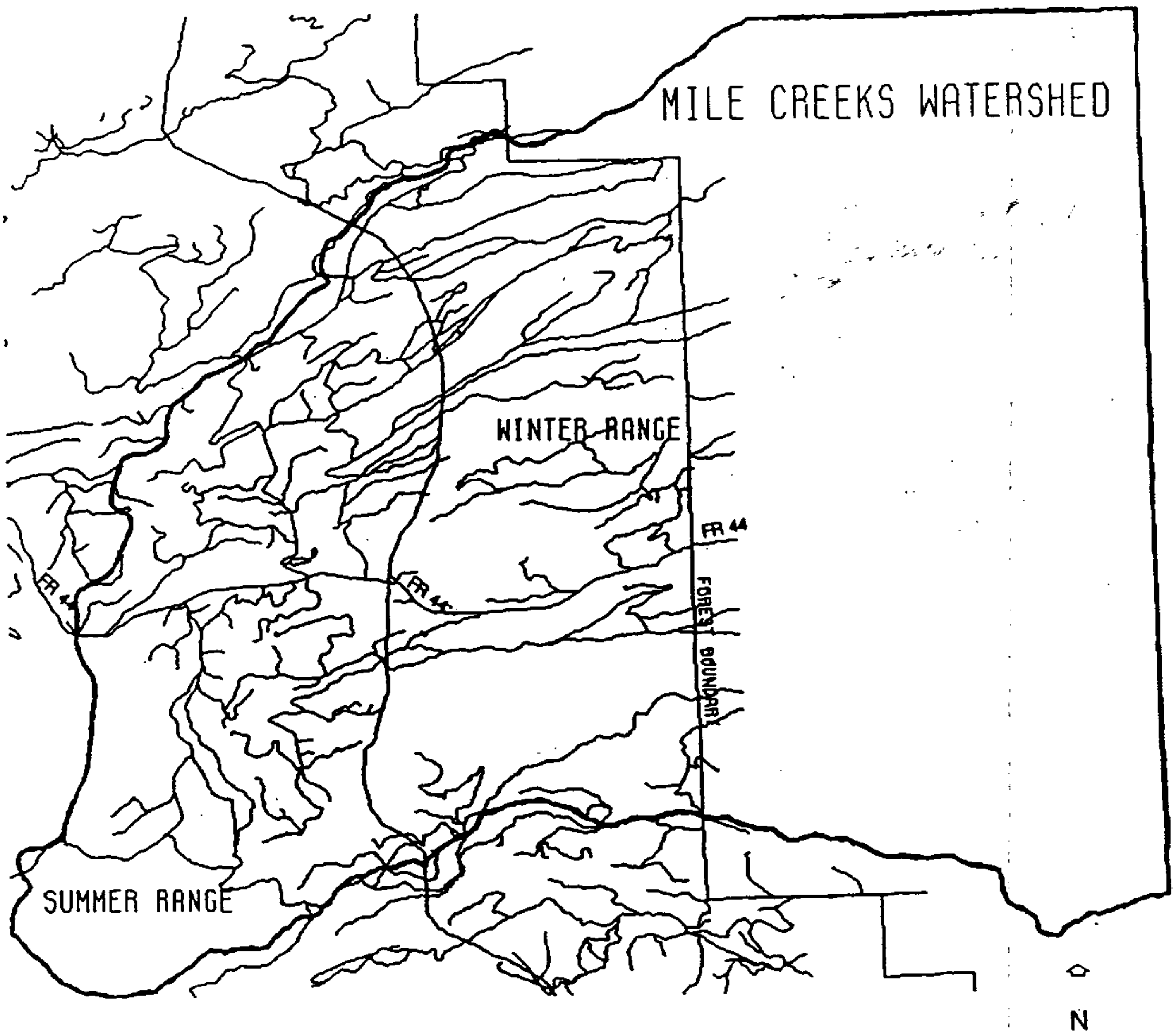
Habitat Type	Historic Conditions	Current Conditions	*Optimal Habitat Conditions	Future Conditions Based on ROD SG
Hiding and Thermal Cover	Unknown	42 % hiding + 33 % thermal = 75 % total cover	60 %	Increase in Late-Successional Reserve (LSR) and Riparian Reserves (RRs) May decrease in Dry Grand Fir/Douglas-fir strata outside LSR and RRs
Forage	Unknown	25 %	40 %	Decrease in LSR and RRs May increase in Dry Grand Fir/Douglas-fir strata outside LSR and RRs

* Optimal cover:forage ratios are defined as the maximum possible elk use of the maximum area of summer and winter ranges projected to occur (Leckenby, 1984).

[1] Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl

[2] Mt. Hood National Forest Land and Resource Management Plan Standards and Guidelines

Figure III.C.1. Current open road densities, and deer and elk summer and winter range on National Forest land.



Northern spotted owl, pileated woodpecker, pine marten, fisher, and wolverine. The northern spotted owl and pileated woodpecker occur in Mile Creeks Watershed. Historical records from ODFW document pine marten occurring in the Fifteenmile Creek subwatershed. The fisher and wolverine may potentially occur based on existing suitable habitat in the watershed; no known sightings exist. Desired conditions for these species is to provide adequate distribution of habitat (Appendix G).

It is speculated that the spotted owl historically occupied riparian areas of the drier portion of the watershed receiving ≤ 45" of rain per year, and headwaters, upper slopes, and riparian areas of the more moist portion of the watershed receiving > 45" of rain per year, below the 5,500 ft. elevation. Occupied forested stands were structurally complex with an abundance of large woody debris (LWD), snags, and large trees with some form of defect (i.e. mistletoe, broken limbs or tops). Currently known spotted owl centers of activities occur in the same types of habitats, and are expected to occur there in the future. However, due to change in vegetative structure, primarily in the Dry Grand Fir/Douglas-fir strata, northern spotted owls are thought to be more abundant now, and in areas not historically occupied due to fire suppression creating stands more favorable (multi-layer, increased canopy closure, defected large trees) to northern spotted owls.

The pileated woodpecker, pine marten, and fisher are strongly associated to riparian areas. The most significant positive predictor of density of pileated woodpeckers in an area is density of snags ≥ 20" DBH (Bull and Holthausen, 1993). Roosting, resting, and denning sites optimally occur within 0.5 mile of water. Travel corridors, varying between 300' - 600' in width, of the marten and fisher optimally occur within mature (generally > 40 % canopy closure, preferably 60 %-100 % canopy closure, multi-layered, multi-species climax coniferous forests with a high number of large snags and large woody debris) stands. Historically, riparian areas throughout the watershed provided these habitat components for the species, and the more moist portion of the watershed provided habitat throughout. Travel corridor locations primarily extend along creeks and through saddles over ridgetops which adjoin major drainages. The wolverine probably used the same habitat components distributed throughout the watershed.

Currently, an estimated 8,000 acres of suitable habitat exists in the upper watershed. Approximately 1,455 acres of the total are within a privately-owned inholding which includes Camp Baldwin, and may be harvested in the future. This is based only on mosaic patch aggregations of late seral stage forest, for species using large home ranges. Field verification is needed to determine if the late seral stands have the complex structural characteristics to support prey-base, roosting, resting, denning, and nest sites. The majority of these acres (13,611 acres) are in an LSR, a CHU, and a Congressionally Reserved Area (CRA). The rest occur in recommended RRs outside these and other 100 Acre LSRs designated reserves (3,826 acres).

Table III.C.5. Processes and factors allowing or preventing connectivity of terrestrial wildlife habitat, migration or dispersal habitats throughout the watershed.

Species Codes[1]	Current Conditions in Relation to Desired or Historic Conditions[2]	Causal Factors	Consequence with Respect to Beneficial Values	Predicted Future Trend
STOC DRPI MAAM MAPE GUGU	Created more habitat on uplands, primarily in Strata 3	Fire suppression	Habitat loss due to catastrophic fire	Thinning and possibly underburning stands to reduce fuel loads and bring conditions closer to historic conditions Long-term habitat improvement
Primarily GUGU Secondarily STOC, DRPI, MAAM, and MAPE	More open roads, OHV, snowmobiles, timber harvest units, and human presence, primarily in Fifteenmile and Eightmile subwatersheds, Strata 1 and 2	Timber management activities, road construction, and recreation Road construction, recreation	Limit GUGU population, potential disturbance primarily during reproductive season	Seasonal road closures, road obliteration to reduce human presence LSR and CHU will function as a buffer to wilderness. Long-term habitat improvement

[1] Species Codes
STOC - Spotted owl
DRPI - pileated woodpecker
MAAM - pine marten
MAPE - fisher
GUGU - wolverine
[2] Vegetative Strata Codes (Figure III.B.2)
Strata 1 - Subalpine Fir/Mountain Hemlock
Strata 2 - Moist Grand Fir
MAAM - pine marten
MAPE - fisher
GUGU - wolverine

Table III.C.5. (cont) Processes and factors allowing or preventing connectivity of terrestrial wildlife habitat, migration or dispersal habitats throughout the watershed.

Species Codes	Current Conditions in Relation to Desired or Historic Conditions	Causal Factors	Consequence with Respect to Beneficial Values	Predicted Future Trend
STOC, DRPI, MAAM, MAPE, and GUGU	High concentration of past timber harvest units, primarily in Fivemile and Eightmile subwatersheds	Timber harvest, primarily tractor machine	Habitat loss due to fragmentation, and decrease in quantity of large woody debris and snags	Create mature forest structure Habitat will improve
Primarily STOC, DRPI, MAAM, and MAPE Secondarily GUGU	Large Ponderosa pine trees have decreased, primarily in Strata 4 Some historic/natural vegetative patterns of pine/oak on upland, south-facing slopes exist	Timber harvest activities	Least amount of dispersal habitat in north-south direction.	Retain 3 B5 areas Habitat will improve

Key points

1. Recommended RRs, the designated CRA, LSR , and CHU desired future conditions, will provide adequate connectivity and migration routes from a vegetative standpoint for the northern spotted owl and other species within the guild, to disperse and move throughout the watershed and out of the watershed in an east-west direction. Other LSRs will improve connectivity and migration in an east-west direction, and slightly improve north-south direction of connectivity and migration (Fig. V.A.1.).

   Opportunity exists to retain all LRMP "B5" Pileated Woodpecker and Pine Marten Areas (B5). Riparian Reserves provide adequate connectivity for late-successional-dependent species. To provide better north-south connectivity and migration, analysis recommends retaining three of the eight B5 management areas (LRMP 1990) including 1081W Pileated Woodpecker Management Area 1081W and Pine Marten Management Areas 1041M and 1271M (Fig. VI.A.2.). Retaining the three B5 management areas will connect major drainages by ridgetop corridors, between portions of the landscape which are highly fragmented from past timber management activities (Fig. III.C.2).

   Pileated Woodpecker Management Area 1081W connects South Fork Fivemile Creek drainage over Pleasant Ridge to Rail Hollow drainage. Management area 1081M is currently comprised of an estimated 20% early, 50% mid, and 30% late seral stages.

   Pine Marten Management Area 1041M is currently comprised of an estimated 10% early, 50% mid, and 40% late seral stages, and connects South Fork Fivemile Creek to Rail Hollow drainage and an unmapped LSR (100 acre Late-Successional Reserve) in Eightmile subwatershed. The landscape between the two B5 management areas is highly fragmented with past timber harvest units.

Pine Marten Management Area 1271M connects Ramsey Creek to the LSR and the rest of the Fifteenmile subwatershed. Management area 1271M is currently comprised of an estimated 66% mid and 34% late seral stages. The headwater portions of Ramsey Creek, west of 1271M, are highly fragmented from past timber harvest (Fig. V.A.3.).

Retention of the three B5 management areas will provide connectivity in a north-south direction by linking Fivemile, Eightmile, and Fifteenmile subwatersheds, will improve late-successional biological and ecological flows, and viability of animals and plants associated with late-successional forests in Mile Creeks watershed.

2. Within the upper watershed, the Dry Grand Fir/Douglas-fir strata poses greatest risk of habitat loss due to catastrophic fire. This strata overlaps with portions of the LSR and CHU; the CHU would play an important role in retaining late-successional forests over the long- term in case large-scale, stand-replacing fires occurred in the LSR or Badger Creek Wilderness.

3. It is speculated that fire suppression has increased dispersal habitat for the spotted owl in the Dry Grand Fir/Douglas-fir strata. Due to past fire suppression, the Dry Grand Fir/Douglas-fir strata is at greatest risk to large-scale, stand-replacing fires. Silvicultural treatment to reduce fuel loads is a priority, primarily in the LSR to reduce the threat of large-scale late-successional habitat loss. Thinning prescriptions should maintain a minimum of 40 % canopy closure, retain large, mature trees while thinning out the younger, stagnated growth. More fire tolerant species would be desired in the understory by underplanting or underburning. Short-term loss of multi-layered habitat may result, however habitat conditions would improve over the long-term.

4. These 5 species are presently federally listed as endangered or; threatened, Regionally Sensitive, Oregon State Sensitive, or declining in population status.

5. For these 5 species requiring large home ranges and late seral stage forests with complex structural features, past timber harvest has fragmented their habitat, and removed the many of the largest trees, snags, and terrestrial large woody debris from the cutting units.

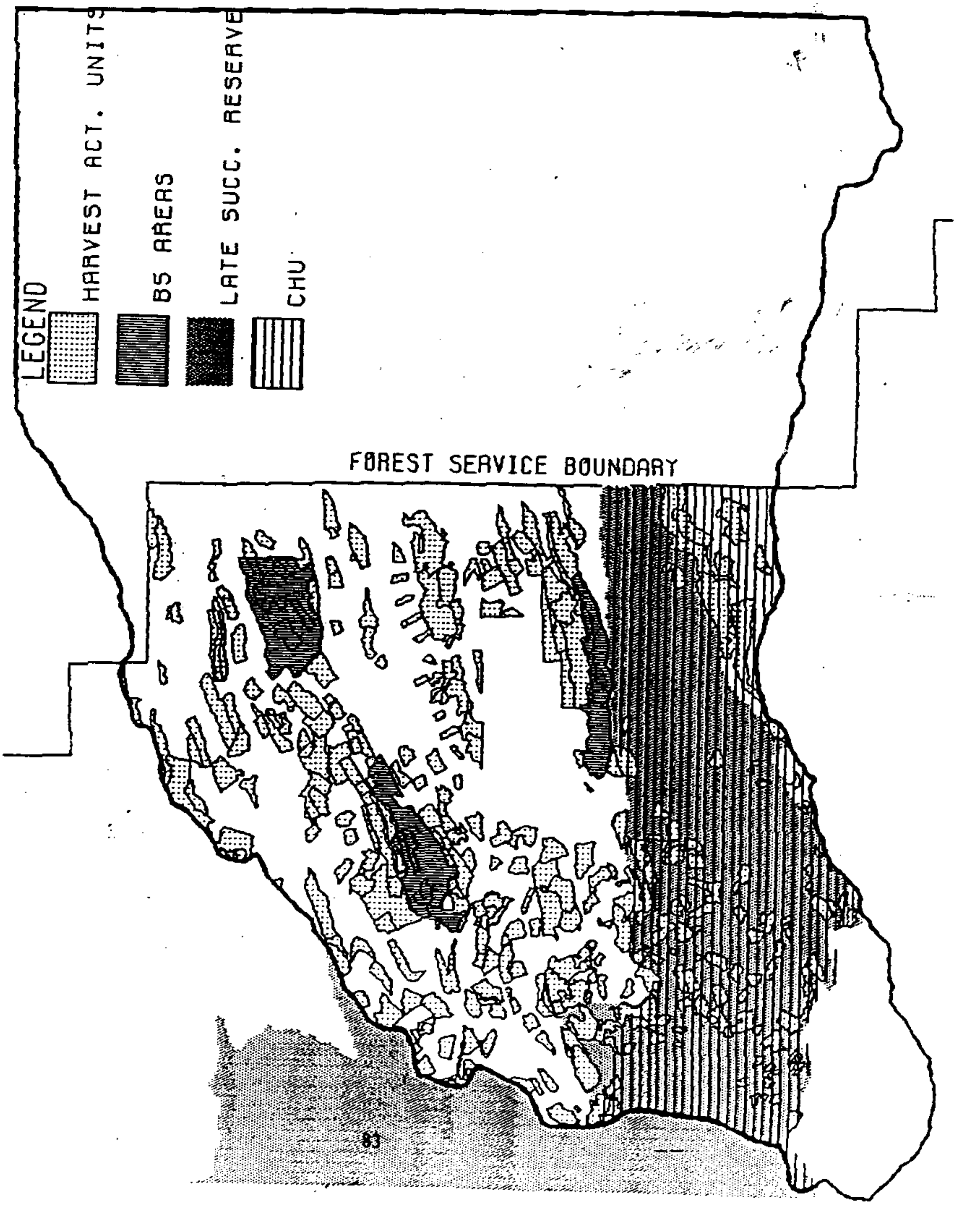
6. Past timber harvest activities has occurred more at lower elevations, where possible, than higher elevations, having a greater negative impact on fishers than on martens.

7. Timber harvest of large Ponderosa pine has been the primary reason for habitat loss impacting the pileated woodpecker.

8. Past timber harvest units are highly concentrated throughout headwater areas of the major drainages and throughout most of Fivemile and Eightmile subwatersheds within the upper watershed.

9. Road construction, primarily to access harvest units, has increased human activity in the watershed, negatively impacting the wolverine more than the other species in this guild or group. Off-highway vehicles (OHV) and snowmobiles will limit wolverine populations.

Fig. III.C.2. Habitat fragmentation as a result of timber harvest on National Forest land.



D. What are the processes and factors allowing or preventing biodiversity of wildlife and plants species to be maintained or improved?

Wildlife species diversity (i.e. number of species) and plant community diversity in Mile Creeks Watershed are high relative to the Western Cascades Range side of the Mt. Hood National Forest (Species and Community Conservation Analysis or SCCA, 1994), due to the extremely steep environmental gradients found between different aspects and across the elevation range. Environmental gradients may largely be a function of rainshadow effects of Mt. Hood. A full elevational compliment of forests occurs, along with many types of natural openings, mosaics of forest and openings, and the pine/oak vegetation type (Diaz, pers. comm.; Section A. Forest and Steppe Ecosystem Function).

1. Historic wildlife species diversity is unknown.

2. Desired condition is to conserve present wildlife species diversity.

3. An estimated 261 wildlife species of the total 307 species on Mt. Hood National Forest may occur in the watershed based on existing potential habitat. Relatively, the few introduced species add a small amount to the wildlife species diversity. Only the bullfrog would negatively impact native aquatic and riparian-dependent wildlife (Appendix F).

4. Refer to Appendix G for total number of species and status of the species with potential habitat in the watershed on National Forest land.

5. Thirty two neotropical migratory bird species potentially occur in the watershed on National Forest land (Appendix G).

6. Almost 50 % of the species predicted to occur in the watershed on National Forest land are dependent upon large woody debris and snags (Appendix G). It is speculated that Euro-American conditions of stand structure may have been different than noted in these results, due to a more frequent, natural fire regime, especially in the Dry Grand Fir/Douglas-fir and Ponderosa Pine/Oregon White Oak and Oregon White Oak Woodlands/Savannah strata; thus, large woody debris and snag densities may have been less. Although snag densities may have been less, there were probably more decadent, old trees, with natural decay in the limbs, mistletoe, and deformities which would provide cavities and forage for snag dependent species. Fire suppression has allowed more large woody debris to occur than what may have historically occurred in the Ponderosa Pine/Oregon White Oak and Oregon White Oak Woodlands/Savannah strata.

   The best available, current information for large woody debris densities in unmanaged stands is the desired condition for the habitat types and strata within Mile Creeks Watershed (Table III.D.1.). The ROD recommends a minimum of 120 linear feet per acre, for all plant communities.

   The best available, current information for snag densities in unmanaged stands is the desired condition for the habitat types and strata within Mile Creeks Watershed (Table III.D.2.).

   The white-headed woodpecker, requires the greatest density of snags compared to other woodpeckers associated with Ponderosa pine (USFS, 1979). At present, in unmanaged stands, the mixed conifer area (which includes Ponderosa pine) can support an estimated 50 % biological potential of the species.

   The hairy woodpecker requires the greatest density on snags compared to other woodpeckers associated with mixed conifer, fir, and pine forests (USFS, 1979). At present, in unmanaged stands, these forests can support an estimated 50 % - 100 % biological potential of the species.

The ROD requires provision of a minimum of 40 % biological potential and the Mt. Hood National Forest Land Management Plan (LRMP) requires a range of 40 % - 60 % biological potential for woodpeckers. If the existing condition of snags per acre are applied across the watershed, management of woodpeckers would be in accordance with the ROD and LRMP.

118 wildlife species use large woody debris and snags for primary or secondary use for breeding, feeding and resting. Of the 118 species, 48 depend on large woody debris and 73 depend on snags; 34 species depend on both large woody debris and snags.

Past management activities which have had a negative impact on the densities of large woody debris and snags include firewood gathering and timber harvest activities. Opportunity exists to survey and verify the existing information, not only in managed stands but also unmanaged stands. Where densities are low, opportunity exists to create more snags and large woody debris by tree top blasting and girdling, and deter firewood gatherers to an area where densities may exceed the range of desired conditions.

Long-term trend in RRs, Key Site Riparian Areas, Late-Successional Reserves (LSRs), other LSRs, Critical Habitat Units (CHUs), LRMP Standards and Guidelines to manage for 60 % biological potential for species listed in the Wildlife and Botanical Report, and recommended 3 B5 Areas (pileated woodpecker and pine marten areas) should provide habitat for large woody debris and snag dependent species. If 15 % green tree retention with clumps of trees and snags are retained in the Matrix, and adoption of more restrictive salvage of dead trees than previously practiced, are applied in the future, than the Matrix should also be able to provide a useful distribution of habitat for these species.

7. Sensitive and unique habitats contribute to species diversity (Appendices F-G).

8. Primary risk to wildlife species diversity is catastrophic fire, as a result of past fire suppression. Other potential risks include recreation, roading, past timber harvest, and noxious plant invasion.

9. Future trend of habitat conditions will improve and wildlife species diversity will be maintained with upland and riparian silviculture, underburning, maintenance of meadows, buffers where appropriate to reduce human presence, seasonal road or trail closures, road obliteration, survey and manage requirements by the ROD (Appendix G Survey and Manage Table), and reduction of noxious plants.

Table III.D.1. Large woody debris per acre in unmanaged stands on National Forest land.

Habitat Type	Western Hemlock** LWD 1	2	3	T*	Pacific Silver Fir** LWD 1	2	3	T	Mountain Hemlock** LWD 1	2	3	T	Mixed Conifer** LWD 1	2	3	T
Large saw	3	8	7	18	4	5	7	16	1	6	10	17	1	1	4	6
Small saw	0	4	16	20	2	6	7	15	0	0	0	0	0	2	13	15
Poles	0	6	11	17	0	3	21	24					0	0	9	9
Average				18				18				8				10

* Averaged for LWD >16' length and >21" DBH

LWD 1 = Decay Condition Class 1, intact texture, twigs and bark present

LWD 2 = Decay Condition Class 2, intact, partially soft texture, twigs absent, bark present

LWD 3 = Decay Condition Class 3, hard, large pieces, twigs absent, trace of bark

T = Total pieces of large woody debris per acre

**Habitat Types and Strata

Western Hemlock	=	Moist Grand Fir
Pacific Silver Fir	=	Subalpine Fir/Mt. Hemlock
Mountain Hemlock	=	Subalpine Fir/Mt. Hemlock
Mixed Conifer	=	Ponderosa Pine/Oregon White Oak and White Oak Woodlands/Savannah, Dry Grand Fir/Douglas-fir, Moist Grand Fir

Table III.D.2. Snags per acre in unmanaged stands on National Forest land.

Habitat Type	Western Hemlock Snags hard	soft	T*	Pacific Silver Fir hard	soft	T	Mountain Hemlock hard	soft	T	Mixed Conifer hard	soft	T
Large saw	2.6	3.4	6.0	3.0	2.1	5.0	4.0	0.5	4.0	2.8	1.0	4.0
Small saw	3.0	3.4	6.0	3.7	2.5	6.0	1.5	0.3	2.0	3.2	0.8	4.0
Poles	0.3	0.8	1.0	1.2	2.1	3.0	0.6	0.1	1.0	0.2	0.4	1.0
Average			4.3			4.7			2.3			3.0

* Averaged for snags > 15" DBH

Hard = Decay Condition Classes 1-3, limbs and branches all present to limb stubs only, sapwood condition is sound to fibrous and soft

Soft = Decay Condition Classes 4-5 = Soft, few or no limb stubs to none, sapwood condition is cubical and soft

T = Total of hard and soft snags per acre

Table III.D.3. Some Terrestrial Sensitive and Unique Habitats

Sensitive and Unique Habitats, Number or Acreage, and Some Associated Species	Current Condition in Relation to Historic or Desired Condition	Causal Factors	Consequence with Respect to Beneficial Values	Predicted Future Trend
Old-Growth[1] 12,205 acres on National Forest land Late-successional dependent species, some neotropical migratory birds	Highly fragmented at headwaters of Fifteenmile and Eightmile Creeks Portions throughout Fivemile subwatershed	Timber management activities	Limited connectivity primarily along headwaters of drainages in upper watershed and portions throughout Fivemile subwatershed	Long-term connectivity through designated LSRs and recommended RRs and B5 areas
Cave[2] One Townsend's big-eared bat	Unknown, needs survey	NA	If occupied, potential abandonment of habitat from human disturbance	If occupied, habitat improvement by gating entrance of cave
Dry Meadows 20 acres in the upper watershed (private and public land) Deer, elk, sicklepod rockcress	Unknown in Camp Baldwin tract of land Presently located in Fifteenmile Creek and North Fork of Fivemile Creek Noxious plants present in dry meadow within Fivemile subwatershed Size of dry meadows may have decreased	Noxious plants invasion associated with roads Encroachment of trees along edges of meadows	Spread of noxious plants and reduction in size of dry meadows Limit quality and quantity of native plants	Habitat improvement by reduction of noxious plants and maintenance of meadow openings
Shrub-Steppe 410 acres on National Forest land some neotropical migratory birds	Presently located in Larch Creek, Ramsey Creek, and Eightmile subwatershed	NA	None known	Maintenance of habitat

[1] Meets Pacific Northwest Research 447 and/or USFS Region 6 definitions
[2] Near Dufur, T01S, R13E, Sec. 23, SE 1/4

Table III.D.3. (cont) Some Terrestrial Sensitive and Unique Habitats

Sensitive and Unique Habitats, Number or Acres, and Some Associated Species	Current Condition in Relation to Historic or Desired Condition	Causal Factors	Consequence with Respect to Beneficial Values	Predicted Future Trend
Ponderosa Pine/Oregon White Oak 2,200 acres on National Forest land Western gray squirrel and wild turkey[1]	Large Ponderosa pine and oak trees harvested Less acreage now, then what historically occurred	Timber management and firewood gathering activities Fire suppression	Reduction of large ponderosa pine and oak trees Potentially greater forage competition between gray squirrels and wild turkeys	Upland silviculture to bring conditions closer to range of historic variability
Rock Cliff 1 acre on National Forest land Peregrine falcon	Located in Fifteenmile subwatershed, needs survey	NA	None known	If suitable nesting habitat for peregrine falcon and occupied, habitat improvement by buffering site to reduce or prevent human and peregrine falcon interactions
Rock Outcrop Patches 5 acres on National Forest land Potential wolverine, marten, and fisher denning sites	Located in Fifteenmile subwatershed, need surveys	NA	None known	If suitable denning habitat and occupied, then, habitat improvement by buffering site to reduce or prevent human presence

[1] Appendix G

Plant species diversity (i.e. the number of species) in Mile Creeks Watershed is low, even though plant community diversity is high, relative to most of the watersheds in Mt. Hood National Forest, potentially due to a combination of reasons (SCCA, 1994). One reason may be that very few wetlands occur in Mile Creeks Watershed; since plant species diversity is positively correlated to wetlands then this may be related to low plant species diversity. Another reason may be due to the fact that past fire suppression has increased percent canopy closure of stands and increased fuel loading in stands, primarily in the Dry Grand Fir/Douglas-fir and Moist Grand Fir zones. Thus not much light reaches the ground and limits plant growth (L. Evers, pers. comm.). A third reason may be due to the abundance and distribution of noxious plants out-competing native plants.

1. Historic plant species diversity is unknown.

2. Desired conditions include, at a minimum, maintaining plant species diversity.

3. Impacts from previous grazing may limit plant species diversity through disturbance. Over-grazing reduces native perennial species competitive abilities, causing populations to decline; the denuded areas then may more likely be filled by the noxious plant, cheatgrass (Reyes. 1992).

4. Noxious plants compete with native vegetation and once established, spread rapidly and dominate the site (USDI, BLM and USDA, USFS. 1994.), thereby diminishing the quality and quantity of native plant composition and native plant species diversity.

5. Regionally sensitive plant species which occur in the watershed include tall agoseris, sicklepod rockcress, and Bolander's grass. Sixteen other sensitive plant species may potentially occur in the watershed based on existing suitable habitat. They are all associated with sensitive, unique, and riparian habitats; thus conservation or maintenance of the habitats would be positively correlated to conservation or maintenance of current plant species diversity .

6. Survey and management requirements designated by the ROD (Appendix G Survey and Manage table) will improve our knowledge of species diversity and population demographics for management and conservation of native plant communities.

7. Noxious plant control will decrease competition with native plant species.

E. Which processes and factors may be allowing or limiting the attainment of social expectations?

1. Tie To Beneficial Values/Process Factors.

Recreation and experiential values, forest commodities, and agriculture and rangeland resources are the beneficial values in this watershed. Each of these beneficial values has several individual activities associated with it that can potentially alter natural processes and other human factors. The issue revolves around the ability to meet human needs while simultaneously maintaining sustainable natural resources.

2. Past And Current Conditions.

Throughout prehistory and history, the social expectations of the Mile Creeks watershed has focused on the area's natural resources.

Prehistoric uses of the Mile Creeks Watershed were probably more subsistence oriented than experiential. Near the Columbia and Deschutes Rivers, long-term village sites were present. These sites were fairly large and indicate summer use by large groups of people. Activities were most often related to salmon harvest. Village sites for winter use by smaller groups of people were often located about a mile from the large rivers and were primarily found in sheltered areas near the Mile Creeks. The upland (Forest Service) area of Mile Creeks was primarily used for hunting and gathering activity. Seasonal changes at different elevations brought about the growth of various plants with cultural significance (i.e., plants used for food, medicine, clothing, shelter, tools, and containers). Depending upon the individual plants, spring or fall were the primary gathering times. Short-term seasonal camps were associated with the hunting and gathering activity, and resources sought included game meat, pelts, and fish, and plants such as berries, wild celery, camas, wild onion, nuts and acorns, mushrooms, willow, and cedar.

Cultural resource sites found on National Forest land reflect the hunting and gathering use and include several small lithic scatters, a number of isolated projectile points, and many peeled cedar trees. Although experiential use may have occurred, the natural setting was most likely not affected by this use, and there are no known prehistoric experiential sites in the Mile Creeks area of the Forest.

Oral history and other evidence indicates that prehistoric human-caused fires were frequent and deliberate. These fires were most often associated with gathering sites. Old records indicate that the Forest Service discouraged the American Indians from starting these fires.

It is important to note that although American Indians use and dependence upon the plant and animal resources available in the Mile Creeks area has changed through contact with Euro-American culture, the area is probably still in use today by American Indians. Although there is little documentation, hunting and gathering may still occur on a small level. Also, a couple modern-day experiential use sites of an intrusive nature (non-local tribes) have been noted in the Forest.

Historically, the area was also more workhorse than experiential. In 1845 the Barlow Road provided access to the area for European Americans. Although the road was at first used for emigration, some people did settle, and by the late 1800s the Mile Creeks area was sparsely populated. Although not as populated as the lower elevation of the Mile Creeks area, many people did live and work in the area now administered by the Forest Service.

In the 20th century, within the National Forest boundaries, commodity use was generally limited to harvesting timber and domestic livestock grazing with sites for lumber production located in the drainages. Mills were located along the edges of the forest and logs were taken to those sites. The old Dufur Mill along Eightmile Creek may have been in use as early as 1906, and the Westfall Mill on Fivemile Creek was in use in the 1920s. In the late 1940's these small mills were not equipped to move logs the distance necessary to keep them in production. Central locations for mill sites were needed. From this need the Tygh Valley and Maupin mills were established. These mills were a boom to the economy of both communities. About 25 million board feet of National Forest timber was needed for each mill every year. The timber industry became the largest industry for the area.

Grazing of both cattle and sheep were common in previous years. While most of this activity took place on private land there was one allotment on National Forest land within the Mile Creeks Watershed. Records show that this allotment was active until 1926 when grazing in this allotment was discontinued. Activities within the remainder of the Mile Creeks area included grazing, hay, and dry land wheat. Some orchards were present in early days.

Meanwhile, lookout towers and tree platforms such as those at Fivemile Butte and Perry Point were used for fire detection and were located on most of the high areas. The current lookout at Fivemile Butte was built in 1957, but old towers and tree platforms were in use in the 1930s and earlier. Also, telephone lines were strung through the Forest in association with the fire lookouts. To aid in irrigation, ditches were dug to divert water from the creeks. Township and range maps from the 1880s show old roads, homesteads, and cabin sites. In addition, sheep camps, small trash scatters with cans and bottles, and wagon remains sites also indicate historic use in the area.

Early historic use was primarily oriented toward work-related activities necessary for subsistence. As towns were settled and some commodities became more easily available, some of these work-related activities probably changed in nature to more recreational type pursuits. These activities may have included fishing, hunting, horseback riding, hiking, and camping, all of which continue as recreational uses of the Forest today. Human interest in the Mile Creeks watershed continues as evidenced by a variety of recreational, experiential, commodity, and agricultural opportunities.

Currently within the National Forest boundaries the emphasis has changed. No longer is the Tygh Valley mill in operation, and the Maupin mill is only a small log home manufacturer. Other forest products in demand include poles, posts and firewood. Forest Plan standards have required that existing material in most cases be left; therefore, firewood availability has reduced to a point that not enough product is available for everyone who wants it. Other cultures have created a demand for different products and increased the awareness of products that used to be taken for granted. For example, mushrooms have always been of value to forest users. Within the National Forest there are many commercial mushroom pickers and a lot of competition for the product.

The key industry in South Wasco County, and the zone between Dufur and The Dalles is agriculture. This part of the county comprises 85% of the Mile Creeks Watershed and is outside the National Forest Boundary. Dry land wheat crops and irrigated hay are the prime money crops of the South County. The narrow band of land immediately south of The Dalles is used for high value fruit crops - primarily cherries.

Much of the Mile Creeks area is on the "dry side" of the Cascade Range. Most of theFrecreation sites on the eastside of the National Forest are less congested than those nearer the Portland Metro corridor, which appeals to certain recreationists. The ecosystems, topography, wildlife, and vegetation communities are very diverse, which is an important consideration for many users.

Recreation opportunities include six developed campgrounds, numerous dispersed sites, a winter rental lookout program, environmental education sites, 144 miles of summer and winter trails, snowmobile routes, a snow-park, and hunting and fishing (see table below).

Table III.E.1. Present Supply Of Recreational Opportunities

Trails:

Summer

Trail	Number	Miles
Lookout Mt.	#450	3.5 miles
Bottle Prairie	#455	3 miles
Fifteen Mile	#456	10.3 miles
Cedar Creek	#457	5 miles
Fret Creek	#456A	2.1 miles
Underhill Trails	#683	3 miles
Knebal Springs	#474	4 miles
Total Miles		30.9 miles

Miles Of Trails Per User Group

Use Type	Miles
Hiking	30.9
Horseback Riding	30.9 miles
Mountain Bikes	28.8 miles
Motorcycles	21.8 miles

New Trails Planned For Construction

Trail	Miles
Eightmile Loop Trail	5 miles
Eightmile Creek Interpretive Trail	1/2 mile

Campgrounds

Campground	Number of sites	RVD's[1]
Eightmile	22	8645
Lower Crossing	3	1321
Underhill	3	1200
Knebal Springs	6	1776
Pebble Ford	4	1792
Fifteen Mile	3	1158

Dispersed Sites

- 60 inventoried sites within this watershed.

Snowmobile Trails Groomed

- 32 miles of groomed snowmobile routes on an average snow year.

Roads

Miles Of Road Maintenance Level/Vehicle Type

	SUB-WATERSHED			
MAINTENANCE LEVEL	8-MILE	15-MILE	5-MILE	LARCH
LEVEL 1 (Closed to motorized traffic)	13.2	14.4	15.3	3.2
LEVEL 2 (High clearance vehicles	20.9	21.3	24.3	1.4
LEVEL 3 (single lane passenger cars)	2.8	11.1	8.4	0.6
LEVEL 5 (double lane, paved, passenger cars)	5.0	2.2	0.0	0.0
Other	8.9	6.2	8.3	2.2
TOTAL MILES	50.8	55.2	56.3	7.4

Other Opportunities

- Rental Lookout-Five Mile
- Mushroom Picking
- Gathering Firewood/Greenery
- Cross-country Skiing

Most of the campgrounds and trails were constructed in the 1930's and are in need of reconstruction or replacement of most of their facilities. Since water is an important part of recreation on the dry eastside, all the campgrounds except Knebal Springs are located near creeks. Some of these campground sites have an impact on the creek banks and may need to be redesigned

[1] RVD = Recreation Visitor Day with 12 visitor hours in a day. May consist of one person for 12 hours, or 12 persons for one hour, or any combination thereof

The recreational use within this area is light at most of the facilities, with only 15 to 25% of capacity typically in use. On holidays all campgrounds are usually full or overflowing, while during the week most of the campgrounds are nearly empty. The increase in use per year is 1 to 2%. This is expected to increase in the next several years. The use of dispersed sites is high during hunting seasons and holidays. Barlow ranks first in the Mt. Hood National Forest for number of visiting hunters. The use of the Knebal Springs Campground and trail system is high; it is one of only two campgrounds with horse facilities. The use of trails within the Mile Creeks area has increased over the past years due to increasing use of mountain bikes. There has been and increase in OHV-winter use of snowmobiles and cross-country skiing. The Mile Creeks area has most of the snowmobile use on the Barlow District.

The experiential pursuits focus on viewing scenery and driving for pleasure. Forest Road 44 (Road 44 or FR 44) is the primary east-west travel route through the Mile Creeks Watershed. It is utilized extensively by recreationists, and travelers to and from the Portland Metro area, and to a lesser extent for timber management. Consequently, Road 44 and its associated "seen area" was identified as a Designated Viewshed in the Mt. Hood Forest Plan (1990). Designated viewsheds are identified in the Forest Plan as having higher visual quality objectives than other viewsheds. FR 44 is the only designated viewshed in Mile Creeks Watershed. The visual quality objectives for FR 44 are Retention/Foreground, Partial Retention/Middleground and Background. All other viewsheds in the Mile Creeks drainage have a visual quality objective (VQO) of Modification for all distance zones (except trails whose VQO's vary

Existing Visual Condition (in VQO Levels) for each Viewshed and Distance Zone

Two methods were used to ascertain the existing scenic conditions: (1) acres currently visually disturbed calculation; and (2) field observation and evaluation by a Landscape Architect (see Existing Scenic Condition Chart). Please note that the percent visually disturbed does not consider vegetative screening nor the aesthetics of the activities in a viewshed but is important for giving an overview of the condition of a viewshed. The field evaluation does take into account the placement and design of timber harvests. All viewsheds were given a field rating by the District Landscape Architect, but not all viewsheds were calculated for percent of visual disturbance.

In order to better understand the Existing Scenic Condition Chart, the following terms need definition:

% Visually Disturbed

- RETENTION (RET) ALL DISTANCE ZONES------8%(RET)
- PARTIAL (PR) RETENTION ALL ZONES-------16%(PR)
- MODIFICATION (MOD) ALL ZONES-----------25%(MOD)
- UNSATISFACTORY (UM) MODIFICATION--OVER 25%(UM)

(UM is not a Mt. Hood NF VQO . It is used to indicate an unsatisfactory existing condition only.) (LRMP, FW 564-66)

FOREGROUND (Fg)-------0 to 1/2 mile from viewing point
MIDDLEGROUND (Mg)-----1/2 TO 5 miles from viewing point
BACKGROUND (Bg)-------5 miles & beyond from viewing point

Table III.E.2. EXISTING FR 44 SCENIC CONDITION CHART

Viewshed	Viewpoint	% Visually Disturbed	LMP Standard	Field Rating	Forest Plan VQO
FR 4400; 4430 & WEST	Continuous Corridor	FOREGROUND 27%	8%	MOD	RETENTION
FR 4400; 4430 & WEST	Continuous Corridor	MIDDLEGROUND -	16%	PR	PR
FR 4400; 4430 & WEST	Continuous Corridor	BG Mt. Hood; Adams -	16%	RET	PR
FR 44; 4430 & EAST	Continuous Corridor	FOREGROUND 12%	8%	RET-PR	RETENTION
FR 44; 4430 & EAST	Continuous Corridor	MIDDLEGROUND -	16%	RET	PR
FR 44; 4430 & EAST	Continuous Corridor	BG mostly unseen -			PR
FR 44 OVERALL	Continuous Corridor	FOREGROUND 17%	8%	PR	RETENTION
FR 44 OVERALL	Continuous Corridor	MIDDLEGROUND 7%	16%	RET	PR
FR 44 OVERALL	Continuous Corridor	BACKGROUND -	16%	RET	PR

Distance Zones without a % Visually Disturbed listed were evaluated by field observation only. Openings are considered recovered for scenic resources after trees reach a height of 20' (LRMP, FW563)

Results:

The western portion of FR 44 is composed of mostly a mosaic of moist and dry grand fir associations which means historically it was a mosaic of open and moderately dense forest which underburned in places and experienced crown fires in others. Fire occurrence was a mosaic of 25-100 years and 70-200 years. This contrasts with the eastern portion of FR 44 which is composed of dry grand fir and hot, dry ponderosa pine or Douglas-fir associations. Historically prescribed or natural underburning occurred quite frequently at 5-100 year intervals depending on the association. This means that East of FR 4430 within the FR 44 viewshed, fire suppression has put the area out of the range of natural variability. Current fire behavior (crown fires with lethal underburning) due to unnatural fuel loadings puts it at risk for a catastrophic fire. This risk conflicts with the Forest Plan VQO and desired percent disturbance per decade standards for Designated Retention VQO viewsheds. In order to reach the Desired Future Condition (DFC) thinnings and underburnings will have to progress at 4% of the area per decade, and 8% disturbance at any one time while remaining unevident to the typical forest visitor. Other viewsheds within these plant associations suffer less from this conflict because the Modification VQO allows 25% disturbance at any one time and activities may be evident or dominate the scene (refer to Existing Scenic Condition of Vistas chart).

The Foreground of FR 44 is outside the range of natural variability for landscape pattern. The landscape pattern could be brought back to natural conditions slowly through time with aggregation of some straight-edged harvest units into mosaics resembling a spotty crown fire with underburning. Priority should be given to units mentioned as *negative to scenic quality* in the FR 44 Viewshed Guide filed at the Barlow Ranger District.

Most other Forest roads do not meet the scenic quality objective of Modification due to geometrically (straight-edged) shaped harvest units, unburned slash piles, visible non-rehabilitated landings, and large, un-vegetated cut slopes. Restoration projects to correct these situations should be considered during project planning.

An exception to this general condition is FR 1720 which meets Retention to Partial Retention in the Foreground. Stands along this road are out of the range of natural variability and at risk for catastrophic fire. Large diameter ponderosa pine still remain but are being crowded by the true fir and Douglas-fir understories. Excellent possibilities exist for reaching the Forest Plan (DFC) in this area. Views to the Cascade mountains are also an opportunity here.

Table III.E.3 Existing Scenic Condition Of Vistas

VISTA NAME AND LOCATION (See Map for Exact Locations)	NATURAL OPENING (Permanent)	HARVEST CREATED (Maintenance)	VQL[1]	LMP VQO[2]
Top ridge end of 4460 (Appears meadow-like on top of ridge-poor regen after harvest)		X	Fg/PR Mg/UM Bg/AG LAND	MOD MOD N/A
Wampus Springs 2730-240 (View of Mt. Adams-Foreground is HCC; Middleground almost meets PR.; Parallel view on 4420. Access poor & erosional)		X	Fg/UM Mg/MOD Bg/RET	MOD MOD MOD
Near Junction 4420 & 2730 (View of Mt. Adams and Rainier. Viewer above Harvest Clear Cut (HCC) makes it easier to rehabilitate & maintain view. Access good.)		X	Fg/UM Mg/MOD Rg/RET	MOD MOD MOD
Eightmile Point (View from nice meadow-like opening through larch to Mt. Hood Have to walk through HCC to reach it)	X		Fg/PR Mg/RET Bg/RET	MOD MOD MOD
Fivemile Lookout (Best view from tower; Mt. Adams; Rainier Hood behind trees Needs vegetation. management plan and maintenance on tower; shed toilet and new gate. Access confusing)		X	Fg/UM Mg/MOD-UM Bg/MTS-UM	MOD MOD MOD
2730 view to Jordan Butte (see map). (View to Jordan Butte over Jordan Creek. Pleasant FG. Rock outcrop	X		Fg/RET Mg/UM-RET (CLOSE UM FAR UM) Bg/AG LAND	MOD MOD MOD N/A
Frailey Point (Another view of Jordan Butte almost 360 degrees but trees interrupt. Hygraded rock outcrop. Access in jeopardy due to road closure)	1/2 X	1/2 X	Fg/PR Mg/MOD-UM Bg/MT. & AG	MOD MOD MOD

Results:

Historically these viewpoints would not probably have all existed. Although fire on ridgetops is a frequent occurrence that would have maintained openings, most of these views are a result of openings from harvest activity. These sites are valuable places (in past and present use) to seek solitude and get in touch with one's spiritual beliefs. Most of these in Mile Creeks are not in good scenic condition in the Foreground and Middleground. Access is either peculiar, unpleasant or in jeopardy.

[1] VQL-Visual Quality Level
[2] VQO-Visual Quality Objective

These viewpoints should be identified as Special Places under the Forest Plan, and therefore acquire higher VQO's in the Foreground (to be determined in a management prescription for the Special Place (See LMP under Special Places). *Barlow does not have an official Special Place list. In general,* the VQO's for these vistas seem too low for the values they represent. Partial Retention Fg and MOD Mg/Bg would be supported by the Forest Plan and the current condition of plant associations. It would help if harvest units in the Middlegrounds blended with the landscape, which they often do not. Project possibilities for Restoration exist at these locations.

3. Desired Conditions

The desired future conditions for commodities in the Mile Creeks watershed would involve a variety of activities; individually, each will make a relatively small contribution, but collectively they will provide a broad spectrum of sustainable values. These activities would include a predictable supply of timber, wood products harvest, and miscellaneous forest products like mushrooms. Employment opportunities in restoration and rehabilitation work would also be available.

Existing recreation opportunities would continue, but campgrounds, trails, and dispersed camping sites would be redesigned, relocated, and reconstructed to integrate human needs with aquatic and terrestrial ecosystem values. Roads would be decommissioned as appropriate and converted to trails to provide for the growing demand of mountain bike, cross-country skiing, and other non-motorized use opportunities.

The watershed would provide high quality scenery by maintaining the natural beauty of the diverse landscape and vegetative patterns, and by designing facilities to be harmonious with the landscape. The Forest Plan desired conditions for Road 44 are:

FOREGROUND RETENTION: This management intensity applies to lands visible up to a distance of .5 mile from selected travelways, water bodies or use areas. Vegetation is composed primarily of multi-age, multi-species stands with diverse understory of natural plant associations. Numerous large diameter, old trees are a major component of the stands. Small, natural appearing openings provide diversity and a sense of depth. The ground is generally free of unnatural forms and patterns of debris and litter. Seasonal changes in vegetation color and texture are emphasized. Target Tree diameters for mature trees: Pond. pine, Douglas-fir, Grand fir 24" DBH. Pacific silver fir 26" DBH. W. Hemlock, 32"DBH. Mountain Hemlock, 24" DBH.

MIDDLEGROUND AND BACKGROUND PARTIAL RETENTION: This management intensity applies to lands *visible from .5 to 5 miles for Middleground* and 5 miles to infinity for Background.

Natural appearing forest landscape, with little evidence of human alteration. Dominant visual impression is mostly continuous tree canopies, with diversity in occasional natural appearing openings. Mosaic of species and age classes add texture and color contrast in natural patterns. Management activities repeat form, line, color and texture common to the characteristic landscape (see Experiential Factor Report in Appendix).

FOREGROUND MODIFICATION: This management intensity applies to lands visible up to a distance of .5 miles from roads, water bodies, or public use areas. Diversity of species and ages, representative of the naturally occurring vegetative type, in patterns similar to, and compatible with the characteristic landscape. Seasonal changes in color are noticeable. Management activities are blended with adjacent vegetative and landform elements so that any unnatural edges, and the size of the affected area is generally not obvious, and does not dominate the scene.

MIDDLEGROUND AND BACKGROUND MODIFICATION: This management intensity applies to lands visible for distances farther than .5 mile from selected travelways, water bodies, or public use areas. Diversity of species and ages distributed in patterns similar to, and compatible with the characteristic landscape. Management activities are blended with natural landforms and existing vegetation with natural shapes, edges, patterns, and sizes. Views of interesting landscape features. Offers a wide variety of land uses and recreation opportunities. Natural appearing openings provide diversity and enhance views to landscape features (Land and Resource Management Plan, Four 9-10, Four 219-20).

Agriculture and rangeland production would continue to provide a stable economic base while restoring the aquatic, hydrologic, and riparian functions along the streams.

4. Condition Trends And Potential Effects Of Future Management.

The trend for commodity production is less timber and other wood products than was available over the recent past; however, the ongoing restoration and rehabilitation efforts will provide a sustainable and predictable level of outputs.

Scenery will improve as the visual effects of past management soften over time. Restoration efforts aimed at recovering stable forest ecosystems will also improve the diversity of landscape and vegetative patterns that are desirable in this watershed.

Recreation opportunities will shift from dominating the riparian ecosystems to being compatible with ecosystem function and landscape.

Agriculture and rangeland values will continue, and the aquatic and riparian resources will gradually improve as coordinated efforts are implemented.

5. Effects of Processes, etc, on Social Expectations

The relationships between physical and biological processes, flows, and management activities affect the quality and quantity of social expectations provided. Social expectations are dependent on sustainable natural resources, and the relationships between the natural processes and management activities are complex. In order to simplify the myriad of relationships, 27 primary processes, flows, and management activities, and 23 different kinds of social expectations were identified in the Mile Creeks Watershed. The Social Relationships Matrix below attempts to illustrate the complexity, define the correlation's, and identify future trends for meeting expectations. Unlike other analyses, this matrix illustrates the effects of processes, etc. on social expectations instead of vice-versa.

Results:

In the context of this analysis, a positive correlation means the process, flow or activity positively affects the social expectation; for example, regeneration harvest activity produces house logs and saw timber. The converse is true for negative correlation's; for example, erosion and sediment processes have a negative effect on developed camping. Where soil erosion and sedimentation is occurring in campgrounds, the quality of the camping experience is lessened due to loss of vegetation, dusty conditions, and lowered water quality. The correlation's are based on past and current practices including the influence of the FSEIS and ROD standards and guidelines. Short term and long term effects often cancel each other out. The trend column illustrates the accumulated affect on the ability to meet an expectation in the future.

Table III.E.4 Social Relationships Matrix

Social Expectations	Processes/Flows/Activities: Erosion Sediment	Under-burning	Crown Burning	Regen. Harvest	Intermed. Harvest	Water Withdrawal	Hydro. Regime Changes	Fish Migration	Deer and Elk Migration	Water Temp.	Chemical Input	Road Building	Trail Building	Channel Morp. Changes	Wind
Posts and Poles	-	(-)	(-)	(+)	(+)	0	-	0	(-)	0	0	(+)	0	-	-
Scout Camp	0	+	-	-	0	-	-	0	0	+	-	0	+	0	0
Firewood	-	0	(-)	(+)	(+)	0	-	0	-	0	0	(+)	0	-	+
Fishing	(-)	+	(-)	-	0	(-)	(-)	(+)	0	(-)	(-)	-	+	(-)	+
House logs/ timber	-	+	(-)	(+)	(+)	0	-	0	-	0	0	(+)	-	-	+
Water Supply	(-)	+	(-)	(-)	0	[illegible]	[illegible]	0	0	(-)	[illegible]	[illegible]	(-)	0	+
Vistas	(-)	+	0	-	0	0	0	+	+	0	0	+	+	0	0
High Quality Scenery	(-)	+	0	-	0	0	-	+	+	0	0	(-)	(+)	-	[illegible]
Mushrooms	-	+	+	+	+	0	0	0	0	0	0	+	+	0	0
Deer & Elk Hunting	-	+	0	+	0	0	-	0	(+)	0	0	0	+	0	[illegible]
Turkey Hunting	-	+	-	-	+	0	-	0	0	0	-	-	+	0	-
Dev. Camping	-	0	-	(-)	+	(-)	(-)	(+)	+	0	[illegible]	(+)	(+)	-	[illegible]
Disp. Camping	-	+	-	(-)	+	(-)	(-)	(+)	(+)	0	-	(+)	(+)	-	-
Mtn. Bikes & XC Skis	-	+	0	[illegible]	0	[illegible]	[illegible]	+	+	0	[illegible]	[illegible]	(+)	[illegible]	0
Horse & Hiking	-	+	0	-	0	-	-	+	+	-	-	-	(+)	-	0
Motorcycle Trails	-	+	0	-	0	[illegible]	-	+	[illegible]	0	[illegible]	[illegible]	(+)	-	0
Snowmobiles	-	+	0	(+)	0	0	-	0	-	0	-	+	(+)	-	0
Tourism & Pleasure Drive.	-	+	0	-	+	[illegible]	[illegible]	+	+	0	[illegible]	+	+	(-)	0
Wilderness	-	(+)	0	(-)	(-)	(-)	(-)	+	+	(-)	(-)	(-)	0	(-)	+
Air Quality	-	-	-	[illegible]	+	0	0	0	0	-	[illegible]	0	0	-	0
Grazing	-	+	-	+	0	0	-	0	-	(-)	(-)	-	+	(-)	0
Off Forest Ag.	(-)	NA	+	NA	(+)	(-)	0	[illegible]	0	[illegible]	0	0	0	(-)	0
Old Growth	-	0	-	(-)	0	-	-	+	+	-	-	(-)	0	-	+

+ = Positive Correlation

- = Negative Correlation

0 = No Correlation

(+) = Strong Positive Correlation

(-) = Strong Negative Correlation

Closing Roads	Obliterating Roads	Precipitation and Snow	Altered Fire Regimes	LWD and Snags	Fire Suppression	Past Harvest	Past Grazing	Plant Succession	Fish and Game Stocking	Increased Recreational Use	Insects and Disease	Trend
(-)	(-)	+	-	+	+	+	0	(+)	0	+	+	Increased availability
0	0	-	-	0	-	0	0	-	+	0	-	Decreased availability
(-)	(-)	+	(-)	(-)	-	+	+	+	0	+	+	Decreased availility
+	+	+	(-)	(+)	-	(-)	(-)	+	(-)	-	0	Decreased availability
-	-	+	-	-	-	(-)	-	-	0	-	-	Decreased Availability
+	(+)	(+)	(-)	+	[illegible]	(-)	(-)	+	0	[illegible]	[illegible]	No effect
(-)	+	+	(-)	0	(-)	(-)	-	+	0	-	0	Increased availability
(-)	+	+	(-)	0	(-)	(-)	-	+	0	-	0	Increased availability
-	0	+	-	+	-	+	+	0	0	0	+	Decreased availibility
0	+	+	-	+	+	0	-	+	0	-	[illegible]	Decreased availibility
0	+	0	-	+	-	-	-	+	+	0	+	Decreased availibility
-	-	(-)	[illegible]	+	[illegible]	(-)	0	+	+	+	-	No effect
-	-	(-)	-	+	-	+	0	+	+	-	-	Decreased availibility
+	(-)	[illegible]	[illegible]	+	[illegible]	[illegible]	0	+	0	[illegible]	[illegible]	No effect
+	+	-	-	+	-	-	0	+	+	-	-	No effect
+	[illegible]	[illegible]	[illegible]	+	[illegible]	[illegible]	0	+	0	-	[illegible]	No effect
-	-	(+)	-	+	-	-	0	+	0	-	-	No effect
(-)	(-)	-	[illegible]	+	[illegible]	(-)	[illegible]	+	0	+	0	Increased availability
+	+	+	(-)	+	(-)	-	0	+	(-)	(-)	(+)	No effect
0	0	+	[illegible]	0	-	-	0	+	0	0	0	No effect
0	0	+	-	0	-	+	-	-	0	-	0	Decreased availibility
+	+	(+)	[illegible]	0	[illegible]	0	0	[illegible]	[illegible]	(-)	(-)	No effect
+	+	+	-	(+)	+	-	-	+	-	-	+	Increased availability

Interpretations

From the Social Relationship Matrix, the following groupings were made:

Commodities	Experiential	Recreational	Agricultural
Posts & Poles	Vistas	Scout Camp	Grazing
Firewood	High Quality Scenery	Fishing	Ag Crops
House logs/Timber	Tourism/Pleasure Driving	Deer & Elk Hunting	
Water Supply	Air Quality	Turkey Hunting	
Mushrooms	Old Growth	Developed Camping	
		Dispersed Camping	
		Mountain Bikes/Cross Country Skiing	
		Horse Riding & Hiking	
		Motorcycle Trail Riding	
		Snowmobiling	

The following matrix represents a summary of the Social Relationship Matrix. It was developed by grouping the 27 social expectations into the four beneficial value classes: social commodities, social experiential, social recreational, and agriculture (including rangeland). The correlation effect of each process, flow and management activity on an individual social expectation was summarized for a class of social expectations. The Wilderness Resource values are often an exception because of the unique combination of values and Congressional mandates.

Table III.E.5. Processes/Flows/Management Activities and their Effect on Social Expectations

	SOCIAL EXPECTATION CLASSES			
Processes/Flows/ Management Activities	COMMODITY	EXPERIENTIAL	RECREATIONAL	AGRICULTURE
Erosion/sediment	-	-	-	-
Underburning	+	+	+	NA
Crown-burning	-	0	-	-
Regen harvest	+	-	-	NA
Intermed. harvest	+	+	+	+
Water withdrawal	0	-	-	0
Hydro. regime changes	-	-	-	0
Fish migration	0	+	+	-
Deer & Elk migration	-	+	+	0
Water temp changes	0	-	0	-
Chemical inputs	0	-	-	0
Road building	+	/	/	0
Trail building	0	+	+	0
Channel morph. changes	-	-	-	-
Wind	+	+	0	0
Road closures	-	-	/	+
Road obliteration	-	+	/	+
Precipitation	+	+	-	+
Altered fire regime	-	-	-	-
LWD & Snag recruitment	/	+	+	0
Fire suppression	-	-	-	-
Past harvest activities	/	-	-	0
Past grazing activities	/	-	0	0
Plant succession	+	+	+	-
Fish & game stocking	0	0	+	-
Increased recreation use	/	-	-	-
Insect & disease	/	0	-	-

+ = Positive correlation
- = Negative correlation
0 = No correlation
/ = Varies by expectation

Key Points:

Changes in the basic physical processes, i.e. erosion, sedimentation, hydrologic regimes (base and peak flows), and channel morphology (downcutting and headcutting) negatively affect and will reduce the ability to meet social expectations. In other words, where hillslopes are being eroded, or streams are full of sediment, then the recreation and experiential settings are compromised. The ability to produce commodities and agricultural products is also reduced because of lowered site productivity capacity.

b. The history of fire suppression and altered fire regimes negatively affects the ability to meet social expectations. The resulting high risk and subsequent effects of catastrophic fire will severely reduce the quality of recreation and experiential settings in the short term, and will eliminate a potential source of commodities.

c.	Utilization of intermediate harvest and underburning can positively affect the ability to meet social expectations. Intermediate harvest can produce a variety of wood products as well as improving stand conditions around campgrounds and improving scenery. Underburning will help restore the natural fire regimes and reduce the risk of catastrophic fire, thereby maintaining or improving the quality of recreation and experiential settings.

d.	*Plant succession creates a range of vegetation conditions that are beneficial to meeting social expectations on* the National Forest. A mixture of early seral to late seral plant communities provides more diverse opportunities for recreation, experiential, and commodity settings.

The next step is to carry these interpretations into a restoration and monitoring strategy that will identify management opportunities.

IV. Significance of the Mile Creeks Watershed to At-Risk Fish Species

A. Significance of the Mt. Hood National Forest land to the viability of the wild, winter steelhead in the Mile Creeks Watershed

The Record of Decision (ROD 1994) designated Mile Creeks Watershed as a Tier 1 Key Watershed. Tier 1 Key Watersheds were selected for their ability to contribute directly to the conservation of at-risk fishes as potential refugia, or have a high potential of being restored, and have the highest priority for restoration as part of the Aquatic Conservation Strategy. As a Tier 1 Key Watershed, the National Forest land within Mile Creeks Watershed will have designated Riparian Reserves and be managed for improved viability of the at-risk wild, winter steelhead population (ROD 1994).

Watershed analysis of Mile Creeks Watershed identified current conditions such as high water temperatures, low summer baseflows, channelization, and excessive sedimentation to have sub-lethal and lethal effects on embryonic and juvenile steelhead in the mid-lower watershed. Water quality and habitat conditions in the mid-lower 85 % of the watershed downstream of the National Forest Boundary are improving due to Oregon Department of Fish and Wildlife and private landowner restoration efforts, Soil Conservation Service and Wasco County Soil and Water Conservation District guidance, and the State Forest Practices Act. However, achievement of desired condition for riparian and aquatic ecosystems are limited by State Water Rights law, private land ownership, economics, timber, agricultural and rangeland practices.

Therefore, the National Forest land in the upper 15 % of the watershed is a critical source of high quality water and refugia for spawning and rearing steelhead in Mile Creeks Watershed (Fig. IV.A.1). Watershed analysis identified water temperatures, peakflows, baseflows, fine sediment, and large woody debris levels outside the range of desired conditions upstream of the National Forest Boundary. Designation of Riparian Reserves, recommended restoration projects and watershed condition monitoring have high potential for restoring high quality riparian and aquatic habitat in the upper watershed.

B. Significance of the Mile Creeks Watershed in relation to conservation of wild, winter steelhead and Pacific lamprey at the Forest, basin, and regional scales

Mile Creeks steelhead (*Oncorhynchus mykiss gairdnerii*) are unique at the Forest, Basin and Regional scales. The Mile Creeks steelhead are the only extant stock of wild, winter steelhead in Oregon that originated from inland redband trout, and populations of genetically intact wild steelhead, that have not been significantly impacted by introductions of hatchery fish, are rare throughout their range.

In May 1994, all stocks of steelhead trout were petitioned for listing under the Endangered Species Act across their Alaska-Southern California range. Basis for the petition included genetic and environmental risks, and small extant populations. Loss of the Mile Creeks steelhead would result in extinction of a unique genetic steelhead stock.

Pacific lamprey (*Entosphenus tridentatus*) are State Sensitive Species based on significantly depressed populations throughout their range. The historic range of the Pacific lamprey in the Columbia River Basin was co-incident with anadromous salmonids.

Mile Creeks steelhead and Pacific lamprey have the same habitat requirements, and are at-risk in the mid-lower watershed. Historically, the Confederated Tribes of Warm Springs had traditional subsistence fisheries for Mile Creeks steelhead and Pacific lamprey, and Mile Creeks steelhead were a locally important recreational fishery. The Mile Creeks subsistence fishery for lamprey is the only one of it's kind within the Hood River Subbasin, or any of the watersheds encompassed by the Mt. Hood National Forest. Subsistence and recreational fisheries for Mile Creeks steelhead and lamprey have been closed since 1984 to conserve declining runs

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3. Recommended Riparian Reserves on perennial nonfish-bearing streams are the minimum ROD distance of 150 ft. on either side of the stream. Site-specific project planning will be needed to: 1) determine the actual site-potential tree height in the riparian zone, 2) increase the recommended Riparian Reserve width to meet minimum ROD requirements when the height of 1 site-potential tree exceeds 150 ft., 3) apply the recommended Riparian Reserve widths to the actual slope distance, and 4) consider the sufficiency of recommended Riparian Reserves for protection of downstream beneficial uses.

4. Recommended Riparian Reserves on intermittent and ephemeral nonfish-bearing streams are the minimum ROD distance of 1 site-potential tree height (i.e. 125 ft. in the Subalpine Fir/Mt. Hemlock, Moist Grand Fir, and Dry Grand Fir/Douglas-fir strata, and 100 ft. Ponderosa Pine/Oregon White Oak strata). Site-specific project planning will be needed to: 1) determine the actual site-potential tree height in the riparian zone, 2) increase the recommended Riparian Reserve width to meet minimum ROD requirements when the height of 1 site-potential tree exceeds 125 ft., 3) apply the recommended Riparian Reserve widths to the actual slope distance, and 4) consider the sufficiency of recommended Riparian Reserves for protection of downstream beneficial uses.

5. The recommended Riparian Reserve on Oval Lake in the Subalpine Fir/Mt. Hemlock Forest of the Badger Creek Wilderness is the minimum ROD requirement of 300 feet. Site-specific project planning will be needed to: 1) determine the actual site-potential tree height in the riparian zone, 2) increase the recommended Riparian Reserve width to meet minimum ROD requirements when the height of 2 site-potential trees exceeds 300 ft., 3) apply the recommended Riparian Reserve widths to the actual slope distance, and 4) consider the sufficiency of recommended Riparian Reserves for protection of the only natural lake in the watershed.

6. An unnamed 0.5 acre diked pond at the confluence of Ramsey Creek and an intermittent tributary south of Camp Baldwin Boy Scout Camp is within the 300 ft. Riparian Reserve recommended for Ramsey Creek.

7. The recommended Riparian Reserve for each mapped spring is the height of 1 site-potential tree (i.e. 125 ft. in the Subalpine Fir/Mt. Hemlock, Moist Grand Fir, and Dry Grand Fir/Douglas-fir strata) from the estimated extent of seasonally saturated soil (estimated at 0.5 acres for watershed analysis) to meet minimum ROD requirements for protection of wetlands less than 1 acre. Site-specific project planning will be needed to: 1) identify and protect the numerous unmapped springs that feed the stream system in the upper Mile Creeks Watershed, 2) determine the actual area of seasonally saturated soil and riparian vegetation around each spring, 3) determine the actual site-potential tree height around the springs, 4) increase the recommended Riparian Reserve width to meet minimum ROD requirements when the height of 1 site-potential tree exceeds 125 ft., 5) apply the recommended Riparian Reserve widths to the actual slope distance, and 6) consider the sufficiency of recommended Riparian Reserves for protection of the seasonally saturated soils, the outer edge of riparian vegetation, and downstream beneficial uses.

8. Riparian Reserves of 300 ft. are recommended around areas of high soil erosion potential and low-moderate soil resiliency. The recommended reserve width for these unstable and potentially unstable areas exceeds the minimum ROD requirement of 1 site-potential tree to ensure restoration and protection of intermittent, nonfish-bearing tributaries that are contributing excessive sediment to winter steelhead habitat areas. Specific sites include:

   a) South aspect, intermittent tributaries on Fifteenmile Creek that were previously compacted from grazing and are actively headcutting.

   b) The upper mainstem of Eightmile Creek in the vicinity of a high use Off Highway Vehicle area known as Bottle Prairie.

Site-specific project planning will be needed to: 1) determine the actual area and location of high soil erosion potential and low-moderate soil resiliency, 2) apply the recommended Riparian Reserve widths to the actual slope distance, and 3) consider the sufficiency of recommended Riparian Reserves for protection of the highly erosive and low-moderate resiliency soils associated with the tributary headcuts and off-highway vehicle use, and downstream beneficial uses.

9. Recommended Riparian Reserves are hand-drawn 150 ft. from the estimated extent of seasonally saturated soil and riparian vegetation to meet the minimum ROD requirements for protection of wetlands greater than 1 acre. [The locations of previously surveyed and mapped wetlands are in the project file, but are not available in the Mt. Hood National Forest Geographic Information System.] Mapped sites are:

   - Bottle Prairie
   - Eightmile Meadow
   - an Engelmann Spruce swamp in upper Eightmile Creek (Sec. 25)
   - a Juncus wetland in upper Eightmile Creek (Sec. 25)
   - 2 unnamed grass/forb wetlands in the Badger Creek Wilderness

10. Site-specific project planning will be needed to: 1) identify and protect unmapped wetlands, 2) determine the actual area and location of seasonally saturated soil and riparian vegetation, 3) apply the recommended Riparian Reserve widths to the actual slope distance, and 4) consider the sufficiency of recommended Riparian Reserves for protection of seasonally saturated soil riparian vegetation, and any downstream beneficial uses.

11. A Late-Successional Reserve (LSR) is located in Fifteenmile Creek subwatershed. The objective of LSR is to protect and improve conditions of late-successional and old-growth forest ecosystems and related species including the northern spotted owl. Five known spotted owl activity centers are located in the LSR within Mile Creeks Watershed. Riparian Reserve and LSR desired future conditions, as stated in the ROD standards and guidelines, will provide adequate connectivity and migration routes from a vegetative standpoint for the northern spotted owl and other species within the guild, to disperse and move throughout the watershed and out of the watershed in an east-west direction.

12. Critical Habitat Unit (CHU) is located in Larch Creek subwatershed and a portion of Fifteenmile Creek subwatershed. CHUs were designated in 1992 by the US Fish and Wildlife Service, Department of Interior to assist in recovery for the northern spotted owl. CHUs are specific areas occupied by the northern spotted owl at the time of listing that have physical or biological features essential to conservation of the species, may require specific management considerations or protection, are outside areas that are known to be occupied by the species, and determined essential to the conservation of the species.

13. Badger Creek Wilderness is a designated Congressionally Reserved Areas (CRA). Standards and guidelines for CRAs provide greater benefits to late-successional dependent species, generally preclude timber harvest, and are managed by written direction from applicable legislation and management plans.

14. Eight other known spotted owl activity centers in Mile Creeks Watershed that occur outside of the Late-Successional Reserve, Critical Habitat Unit, and Congressionally Reserved Area were designated as 100 acre Late-Successional Reserves (100 Acre LSRs) and are not available in the MTH Geographic Information System. The 100 Acre LSRs will improve east-west connectivity and migration, and slightly improve north-south connectivity and migration for northern spotted owl and other species associated with late-successional forests.

15. Opportunity exists to retain all <u>LRMP "B5" Pileated Woodpecker and Pine Marten Areas</u> (B5). Riparian Reserves provide adequate connectivity for late-successional-dependent species. To provide better north-south connectivity and migration, analysis recommends retaining three of the eight B5 management areas (LRMP 1990) including 1081W Pileated Woodpecker Management Area 1081W and Pine Marten Management Areas 1041M and 1271M (Fig. V.A.2.). Retaining the three B5 management areas will connect Fivemile, Eightmile, and Fifteenmile subwatersheds in a north-south direction by ridgetop corridors, between portions of the landscape which are highly fragmented from past timber management activities, improve late-successional biological and ecological flows, and viability of animals and plants associated with late-successional forests in Mile Creeks Watershed.

16. Project level planning may identify additional opportunities for providing connectivity and migration habitat across the landscape pattern.

Table V.A.1. Summary of Recommended Riparian Reserve Widths

Category	Subalpine Fir/ Mt. Hemlock	Grand Fir/ Douglas-fir	Ponderosa Pine/ White Oak
Fish-bearing streams	300 feet	300 feet	300 feet
Perennial, nonfish-bearing streams	150 feet	150 feet	150 feet
Intermittent and ephemeral, nonfish-bearing streams	125 feet	125 feet	125 feet
Oval Lake	300 feet		
Wetlands < 1 acre	125 feet	125 feet	
Unstable areas		300 feet	300 feet
Wetlands > 1 acre	150 feet	150 feet	

Table V.A.2. Total Acres of Recommended Riparian Reserve, Late-Successional Reserve, Critical Habitat Unit, Congressionally Reserved Areas, 100 Acre LSRs, and B5 Areas

Reserves and Areas	Acres
LSR	9,516
100 Acre LSRs	800
CHU	1,695
CRA	2,400
B5 Areas	960
RRs outside	
designated areas	3,826
Total	**19,197**

Table V.A.3. Summary of Harvested Acres With Less Than 70 % Canopy Closure Within the Recommended Riparian Reserves

Recommended Riparian Reserves	Harvested Acres With < 70 % Canopy Closure
300 feet	421
150 feet	18
125 feet	220
Total	659

Table V.A.4. Summary of Harvested Acres and Current Seral Stages within the Late-Successional Reserve and Critical Habitat Units [1]

Allocation	Early Seral	Mid Seral	Late Seral	Total
LSR[2]	673	713	91	1477
CHU	58	636	108	802

[1] Determined from the Barlow Ranger District Harvest layer and the SCCA database
[2] Area that was both in the LSR and CHU was accounted for in the LSR

Figure V.A.1. Recommended Riparian Reserves and Terrestrial Connectivity on the Mt. Hood National Forest in Upper Mile Creeks Watershed

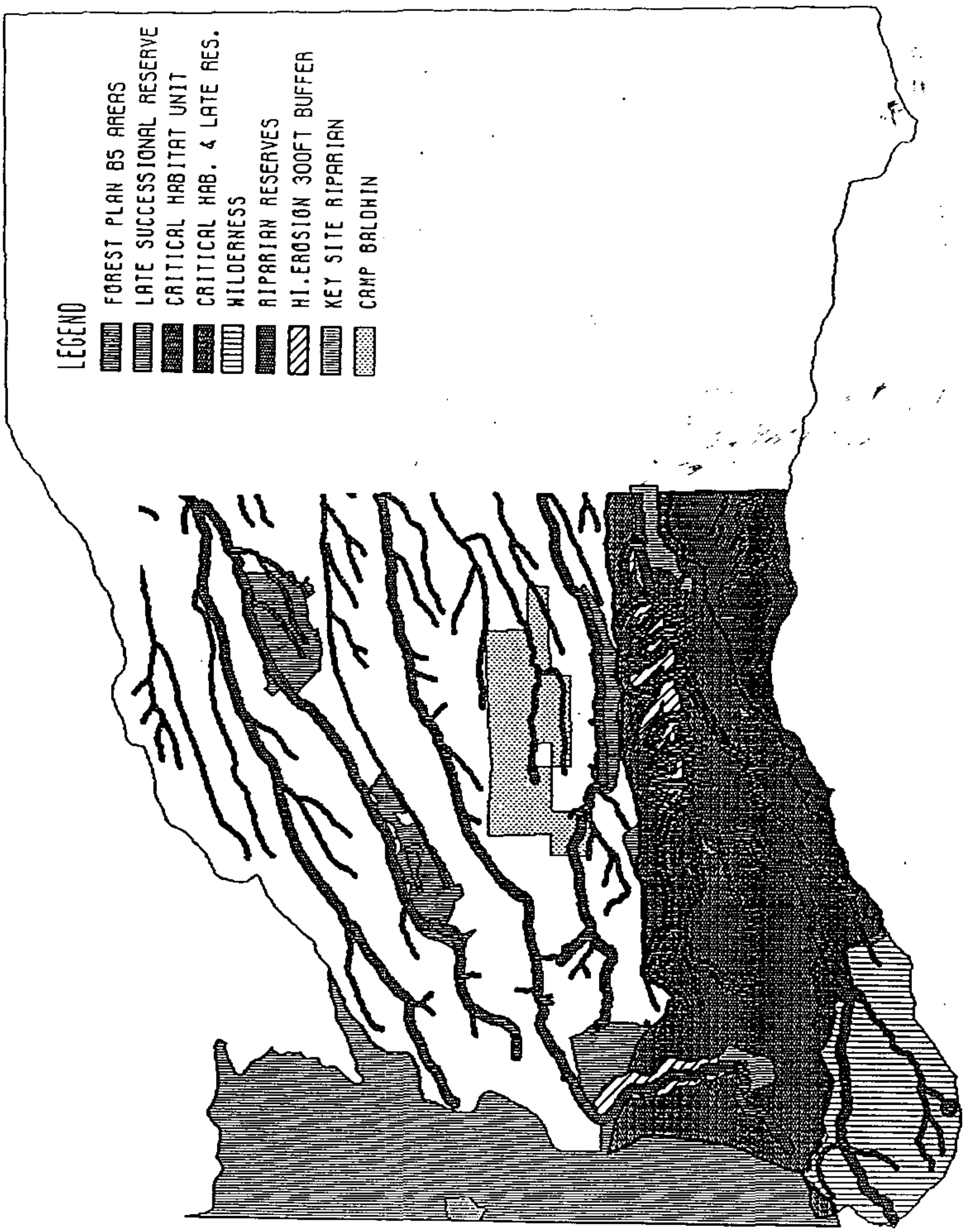


Figure V.A.2. Late-Successional Reserve, Critical Habitat Unit, and Congressionally Reserved Area Connectivity on the Mt. Hood National Forest

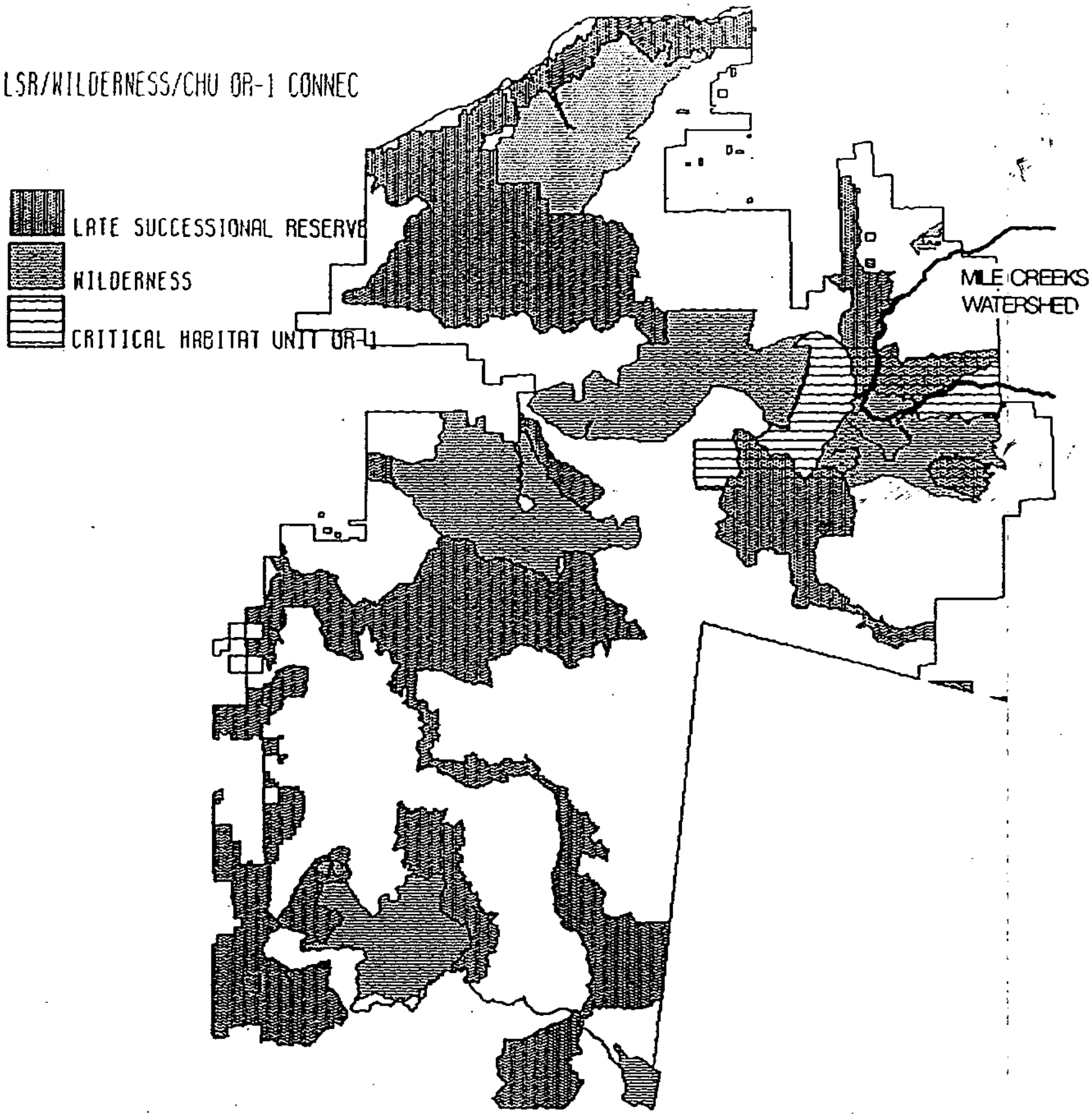


Figure V-1

Figure V.A.3. Harvest Units With Less Than 70 Percent Canopy Closure Within the Recommended Riparian Reserves

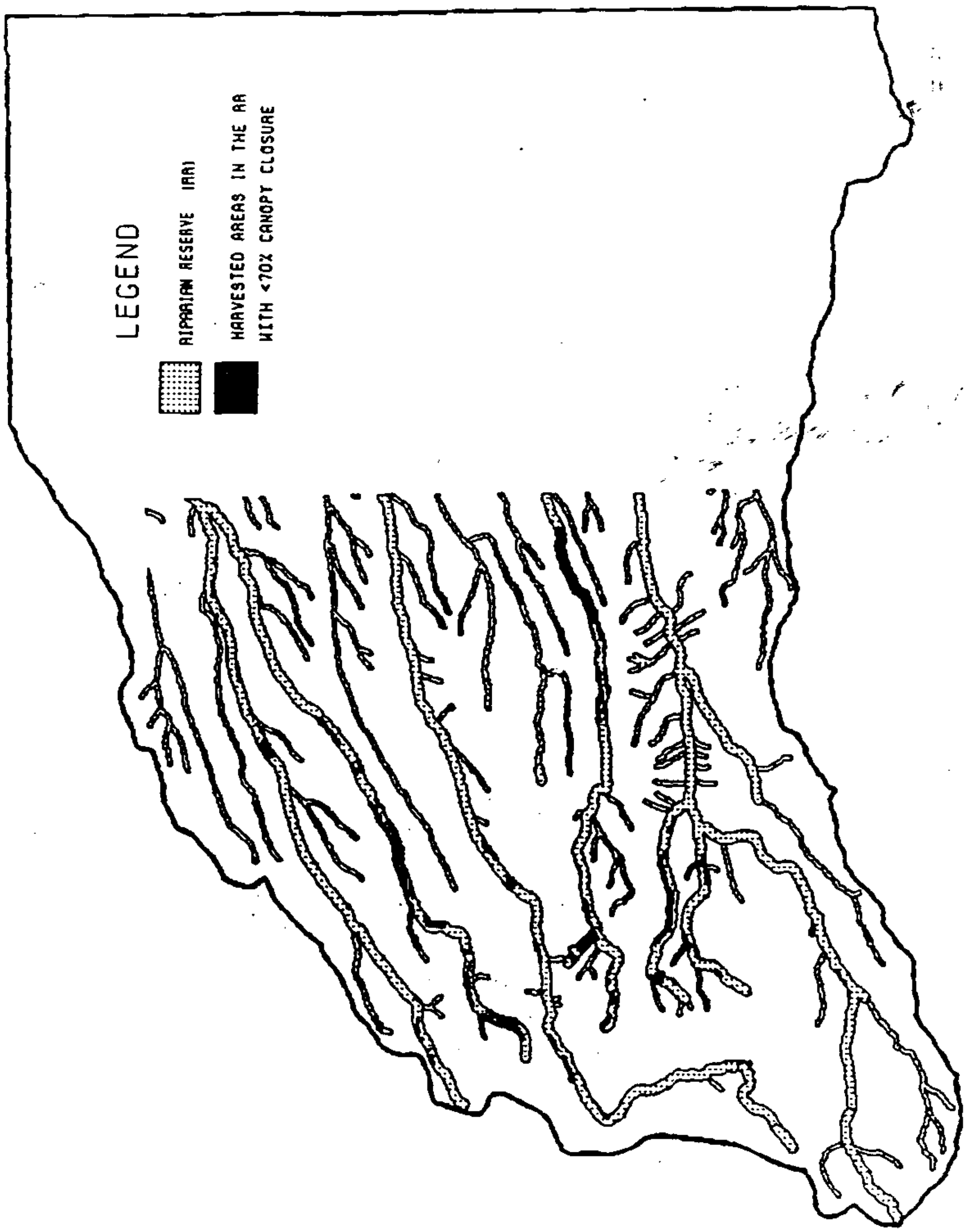
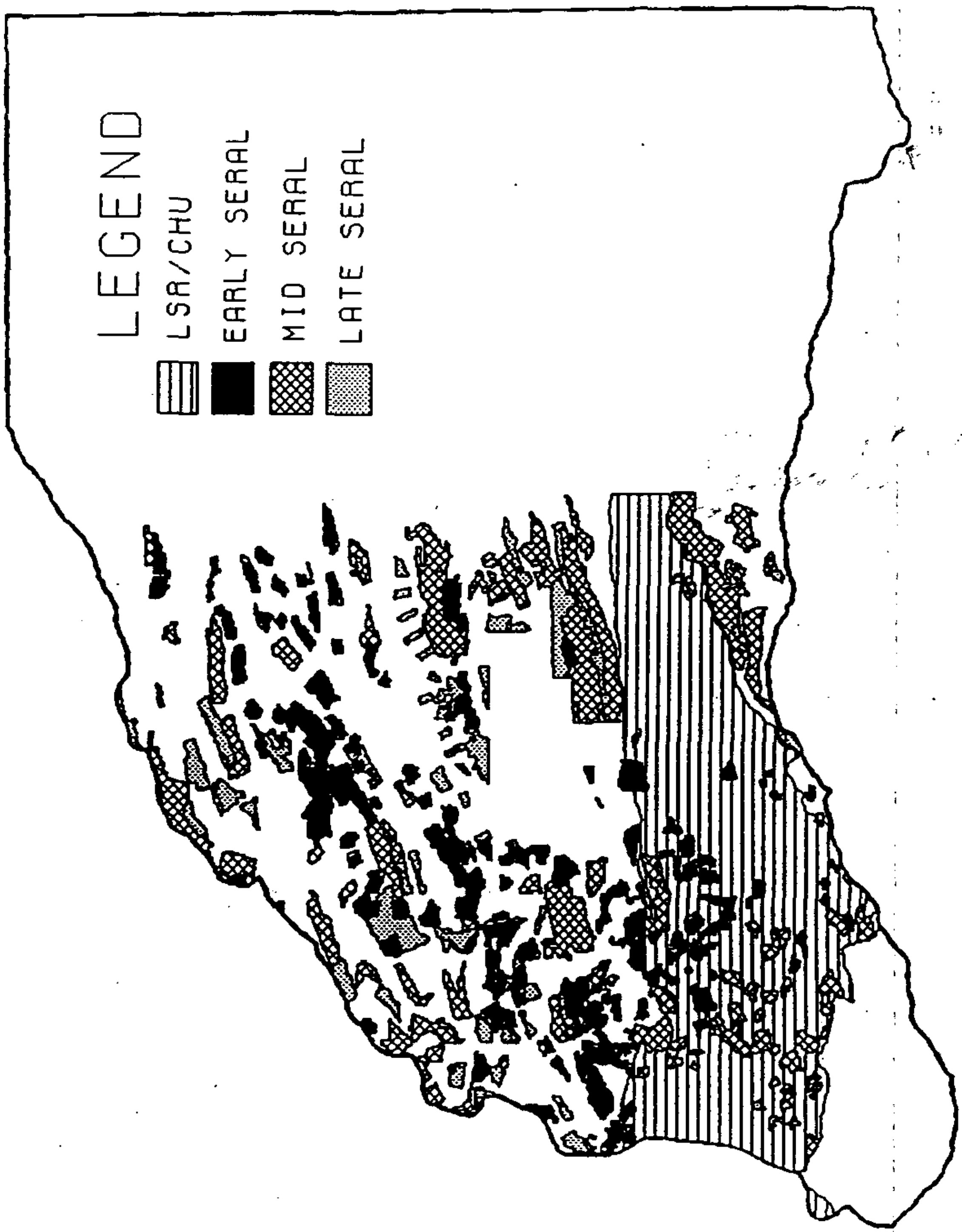


Figure V.A.4. Harvested Acres and Current Seral Stages Within the Late-Successional Reserve and Critical Habitat Unit, from the Species Community Conservation Analysis



B. Watershed monitoring and restoration objectives

Restoration. The objective for restoration in the Mile Creeks Watershed is to bring resources, processes, and ecosystem function towards desired conditions with respect to the beneficial values described in Section II.A. The legally-mandated beneficial values in Mile Creeks Watershed are water quality (Clean Water Act), water quantity (Organic Act) , Threatened and Endangered Species (Endangered Species Act) and biodiversity (National Forest Management Act). Restoration project opportunities were described in terms of altered processes, types of projects, objectives, and potential human benefits.

Monitoring. Recommended baseline monitoring opportunities were identified by process or function to assess current, pre-project conditions in the watershed with respect to the beneficial values and desired conditions. The recommended trend monitoring will provide data to assess the effectiveness of implemented reserve recommendations, management plans and restoration projects towards achieving desired condition within the watershed. The monitoring opportunities can be used as the basis for development of a comprehensive monitoring plan to evaluate progress toward desired conditions in the entire watershed.

Restoration and Monitoring Prioritization. Primary and secondary restoration and monitoring priorities were established within the watershed based on subwatershed and process priorities. Processes that were expected to cause large-scale failure of function at the landscape or watershed scales - increased peakflows, decreased baseflows, increased stream temperature, accelerated erosion, altered channel morphology, decreased steelhead and Pacific lamprey viability, altered wildlife migration patterns, altered habitat connectivity, decreased terrestrial biodiversity, altered forest structure and composition, and altered fire regime - were identified as **primary** priorities for restoration (Table V.B.2.). In addition, road de-commissioning projects were incorporated as **primary** restoration opportunities whenever possible to meet ROD objectives for Key Watersheds. Processes considered **secondary** priorities for restoration were large woody debris loading, amphibian viability, fish migration, invasion of noxious plants, altered nutrient cycling, and altered insect and disease regimes (Table V.B.3.).

In most cases, the most critical restoration needs for conservation of steelhead and Pacific lamprey, numerous other aquatic and riparian-dependent species, and other instream beneficial values occur off Forest, on private land downstream of federal ownership (Section II.C.; Appendices D-G) . Our logic for prioritization of Mt. Hood National Forest restoration opportunities within the upper subwatershedF (Table V.B.1.) was based on: 1) the ROD Key Watershed concept of providing the greatest opportunity for maintaining, conserving or restoring existing populations of at-risk species and high quality habitat for terrestrial, riparian and aquatic beneficial values, 2) the greatest perceived risks to beneficial values by vegetative community (Fig. III.B.1.), and 3) ROD land designations (Fig.VI.A.1.). Based on the key watershed concept, Fifteenmile subwatershed, including Larch Creek, is the highest restoration priority, followed by Eightmile and Fivemile subwatersheds, in order of priority. Therefore, we recommend prioritization of the primary restoration projects in the Fifteenmile subwatershed, unless otherwise specified, followed by primary project implementation in Eightmile and Fivemile subwatersheds (Table V.B.2.). Implementation of secondary restoration projects are recommended in order of subwatershed priority (Table V.B.3.).

Table V.B.1. Restoration Priority Area Codes Used in Tables VI.B.2. & 3.

Subwatershed (SWS)	SWS Code
Fifteenmile/Larch	15mile
Eightmile	8mile
Fivemile	5mile

Vegetative Community (Veg)	Veg.Code
Subalpine Fir/Mountain Hemlock	Strata 1
Moist Grand Fir	Strata 2
Dry Grand Fir/Douglas-fir	Strata 3
Ponderosa Pine/Oregon White Oak and Oregon White Oak Woodlands/Savannahs	Strata 4
Steppe Grasslands and Shrublands	Strata 5

Management Unit (Unit)	Unit Code
Off Forest	-
Riparian Reserves	RR
Late-Successional Reserves	LSR
Critical Habitat Unit	CHU
Pileated Woodpecker/Marten Areas	B5

Table V.B.2. Primary Needs for Monitoring and Restoration for Mile Creeks Watershed

Altered Process	Watershed Condition Baseline and Trend Monitoring	Monitoring Objective	Restoration Project Opportunities	Restoration Objective	Priority Areas	Potential Human Benefits
Increased Peakflows	Crest stage gauges, channel cross sections and particle size distribution sampling	Determine magnitude and effect of altered peakflows	Road Obliteration where road densities exceed LRMP standards of 2.5 miles per square mile	Decrease created openings, decrease stream drainage network, stabilize peak flows, decrease erosion and increase channel stability	15mile	Reduced magnitude, and frequency of peak flow events, higher fish survival, increased angler satisfaction
			Upland silviculture to move stands to hydrologic maturity of 8" DBH and ≥70 % canopy closure	Accelerate reduction of created openings, stabilize peak flows, decrease erosion, increase channel stability	15mile Strata 1-2	Less flooding, higher fish survival, increased angler satisfaction, wood products, local economic benefit
Decreased Baseflows	Baseflow measurements on Forest Continuous stream gaging on Fivemile, Eightmile and Fifteenmile Creeks	Determine factors influencing baseflows regime Assess compliance with ODFW minimum flows recommendation for fishes	Road Obliteration where road densities exceed LRMP standards of 2.5 miles per square mile	Decrease drainage density, increase baseflows and maintain perennial flows, lower stream temperature	15mile	More water available for beneficial values -including irrigation and domestic water supply
			Irrigation ditch and delivery system improvements including Wolf Run Ditch Other water conservation projects	Conserve water, increase baseflows and maintain perennial flows, lower stream temperature	Off Forest and 8mile	More water available for beneficial values, higher fish survival, increased angler satisfaction

Table V .B.2. (cont.) Primary Needs for Monitoring and Restoration for Mile Creeks Watershed

Altered Process	Watershed Condition Baseline and Trend Monitoring	Monitoring Objective	Restoration Project Opportunities	Restoration Objective	Priority Areas	Potential Human Benefits
Decreased Baseflows (cont.)			Thinning of upland forest understory to reduce stem densities, reduce vegetative interception and transpiration	Increase baseflows and maintain perennial flows, lower stream temperatures, reduce ladder fuels, interrupt budworm feeding	15mile Strata 3-4	More water available for beneficial values, crown fire hazard reduction
			Improve pump chances	Increase baseflows by limiting pump chances to areas with adequate baseflows and reduce sediment by armoring	Off Forest	More water available for beneficial values, higher fish survival, increased angler satisfaction
			Channel reconstruction of unstable Rosgen D, F, G reaches	Increase floodplain storage capacity, raise watertable, increase baseflows and maintain perennial flows, lower water temperatures, reduce sediment, and stabilize the channel	Off Forest	Higher fish survival, increased angler satisfaction, more water available for beneficial values
			Obtain water rights to secure adequate in-channel baseflows	Increase baseflows and maintain perennial flows, lower water temperatures	Off Forest	Higher fish survival, increased angler satisfaction
			Headcut stabilization	Stabilize water storage capacity, lower stream temperatures, decrease sedimentation	Buck Hollow Off Forest and 15mile	Higher fish survival, increased angler satisfaction, more water available for beneficial values

Table V .B.2. (cont.) Primary Needs for Monitoring and Restoration for Mile Creeks Watershed

Altered Process	Watershed Condition Baseline and Trend Monitoring	Monitoring Objective	Restoration Project Opportunities	Restoration Objective	Priority Areas	Potential Human Benefits
Increased Water Temperature	Continuous stream temperature recorders	Assess compliance with State Standards, and identify magnitude of increases from point sources determined by the SHADOW model	Riparian silviculture to accelerate canopy closure to ≥70 %	Decrease stream temperatures by shading the stream, increase in-channel large woody debris and snag recruitment	Off Forest and 15mile	Higher fish survival and productivity, increased angler satisfaction
Accelerated Erosion	Channel cross section and particle size, distribution sampling Continuous turbidity monitoring to determine magnitude and timing of sediment inputs Survey to identify point sources of sediment including intermittent and ephemeral tributaries	Determine magnitude, biological effects, channel response and compliance with DC Determine magnitude and timing of sediment inputs Identify restoration opportunities	Stabilize and vegetate point sources of erosion including agricultural and rangelands, harvest units, developed and dispersed campsites, recreational trails, road cutslopes, fillslopes, ditches, and culvert outlets	Decrease sedimentation, meet LRMP standards for soil stabilization and erosion control, provide better fish habitat, meet State Water Quality standards, stabilize channels	Off Forest farm and range lands, and 15mile	Clear water, higher fish survival and productivity, increased angler satisfaction, aesthetically pleasing recreation sites
			Obliterate roads and convert roads to mountain bike and cross country ski trails	Decrease sediment and sediment delivery, provide better fish habitat, meet State Water Quality standards	15mile snow zone	Clean water, higher fish survival, increased angler satisfaction, more mountain bike and cross country skiing opportunities, aesthetically pleasing viewsheds

Table V .B.2. (cont.) Primary Needs for Monitoring and Restoration for Mile Creeks Watershed

Altered Process	Watershed Condition Baseline and Trend Monitoring	Monitoring Objective	Restoration Project Opportunities	Restoration Objective	Priority Areas	Potential Human Benefits
Accelerated Erosion (cont.)			Design trail system suitable for recreational use type such as off highway vehicle or equestrian, and incorporate suitable stream crossings	Reduce sediment detachment and sediment delivery, provide better fish habitat, meet State Water Quality standards, stabilize channels, reduce negative wildlife interactions	Upper 15mile and 8mile	Clean water, higher fish survival and productivity, increased angler satisfaction, recreational and interpretive opportunities, aesthetically pleasing viewsheds
			Water gaps and/or out-of-channel water developments for livestock	Reduce sediment inputs, provide stable channel form, reduce stream temperature, increase baseflows and maintain perennial flows	Off Forest	Clean, cold water, higher fish survival and productivity, increased angler satisfaction, more water available for beneficial values, aesthetics
			Livestock exclosure fences adjacent to riparian areas	Reduce sedimentation though reduction of streambank trampling, re-establish riparian vegetation, provide stream shade	Off Forest	Clean water, higher fish survival and productivity, increased angler satisfaction, stable channels that will not erode fields
			Strip planting and retention of residual organic matter on agricultural lands	Reduce sediment sources and delivery	Off Forest	Clean water, higher fish survival and productivity, increased angler satisfaction, long term site productivity

Table V .B.2. (cont.) Primary Needs for Monitoring and Restoration for Mile Creeks Watershed

Altered Process	Watershed Condition Baseline and Trend Monitoring	Monitoring Objective	Restoration Project Opportunities	Restoration Objective	Priority Areas	Potential Human Benefits
Soil Compaction			Deep soil tillage to reduce soil compaction, increase infiltration, reduce sediment production and delivery	Meet State Water Quality standards, restore site productivity, increase baseflows and maintain perennial flows, stabilize channels	15mile tractor harvested and machine piled units on low resiliency soils	Clean water, more water for beneficial values, higher fish survival and productivity, increased angler satisfaction
Altered Channel Morphology	Mt. Hood National Forest Stream Survey Protocols	Quantification of channel condition and stability throughout the watershed	Restoration of channel geometry	Create stable channel form, minimize sedimentation due to channel adjustments, improve stream shade and aquatic habitat	Off Forest	Clean water, higher fish survival and productivity, increased angler satisfaction
			Streambank stabilization and removal or appropriate design of user-built fords	Reduce sediment inputs, protect channel morphology, reduce water temperature, amphibian protection	15mile dispersed campsites	Aesthetics, improved scenic quality, higher fish survival and productivity, increased angler satisfaction
Steelhead and Pacific Lamprey Viability	Operate migrant traps for adult and juvenile fishes on mainstem Fifteenmile near the mouth and at the Forest boundary	Assess adult steelhead and lamprey populations, and survival of juvenile steelhead and lamprey			Off Forest and 15mile	

Table V .B.2. (cont.) Primary Needs for Monitoring and Restoration for Mile Creeks Watershed

Altered Process	Watershed Condition Baseline and Trend Monitoring	Monitoring Objective	Restoration Project Opportunities	Restoration Objective	Priority Areas	Potential Human Benefits
Late-Successional Species Viability	Late-Successional dependent species surveys	Assess effectiveness of connectivity, and habitat quality	Create large diameter forest structure in managed timber stands	Restoration of aquatic, riparian and late-successional terrestrial habitats and biodiversity	15mile Strata 3-4 LSR/ CHU/B5	Wood products, higher fish and wildlife productivity, local economic benefit, increased angler and hunter satisfaction
			Road obliteration and seasonal road closures where road densities exceed Forest Plan Standards	Improve terrestrial connectivity and reduce migration barriers and reduce human presence	15mile LSR/ CHU/B5	Stable wildlife populations
Deer and Elk Migration	Continue monitoring species movement and migration barriers or human harassment	Assess effectiveness of migration habitat	Road obliteration, and seasonal road and motorized trail closures	Meet LRMP standards for road densities, reduce terrestrial migration barriers and human presence, increase deer and elk use of National Forest habitat	5mile	Increased hunter satisfaction on Forest
Peregrine Falcon Viability	Peregrine falcon and habitat surveys	Determine peregrine falcon occupancy and potential habitat capability	Road/trail obliteration and/or seasonal closures in the vicinity of nesting sites	Reduce peregrine falcon and human interactions	cliff faces	Maintenance of biodiversity
Townsend's Big-eared Bat Viability	Townsend's big-eared bat and habitat surveys	Determine Townsend's big-eared bat occupancy and potential habitat capability	Gate cave entrance	Reduce bat and human interactions	Off Forest mapped cave near Dufur	Maintenance of biodiversity

Table V .B.2. (cont.) Primary Needs for Monitoring and Restoration for Mile Creeks Watershed

Altered Process	Watershed Condition Baseline and Trend Monitoring	Monitoring Objective	Restoration Project Opportunities	Restoration Objective	Priority Areas	Potential Human Benefits
Decreased Fire Frequency and Increased Fire Intensity	Monitor changes in vegetation structure and composition under natural and managed conditions	Assess effectiveness of vegetation management	Thinning of upland forest understory to reduce stem densities, unnatural fuel buildup, and ladder fuels, promote growth of fire resistant tree species	Move fire regime closer to the range of natural variability, decrease risk of sediment delivery to streams, improve wildlife forage quantity and quality, reduce risk of epidemic budworm and bark beetle infestations	15mile Strata 3 LSR/ CHU	Reduced risk of catastrophic fire, maintain or improvement of wildlife habitat, clean water, increased baseflows, higher fish survival, increased hunter and angler satisfaction
	same as above	same as above Assess affect on acorn production	Underburning in upland forest to reduce unnatural fuels buildup and reduce stem densities	same as above	Strata 4	same as above
Altered Forest Structure and Composition	Complete upland and riparian vegetation, snag and large woody debris inventories under natural and managed conditions	Determine stand composition and structure to assess habitat capability and use for terrestrial, riparian and aquatic species and guilds	Create large diameter forest structure in managed timber stands	Restore aquatic, riparian and terrestrial habitats, reduce habitat fragmentation	15mile Strata 3-4 LSR/ CHU/B5	Wood products, higher fish and wildlife productivity, local economic benefit, increased angler and hunter satisfaction
	same as above	same as above	Create complex forest structure including multi-storied canopy, and increase snag and large woody debris densities	same as above	15mile Strata 1-2 RR/LSR	same as above

Table V .B.2. (cont.) Primary Needs for Monitoring and Restoration for Mile Creeks Watershed

Altered Process	Watershed Condition *Baseline and* Trend Monitoring	Monitoring Objective	Restoration Project *Opportunities*	Restoration Objective	Priority Areas	Potential Human Benefits
Altered Forest Structure and Composition (cont)	same as above	same as above	Erect nest boxes and platform structures	Increase wildlife habitat diversity and capability	15mile	Maintain biodiversity
	Survey potential habitat for deer, elk, and great gray owl	Assess forage capability for deer and elk Assess forage and nesting potential and capability for great gray owl	Vegetation management for maintenance of meadows and natural openings	Maintain plant biodiversity, and improve habitat capability and forage quantity and quality for wildlife on the Mt. Hood NF	15mile	Wood products, local economic benefit, increased deer and elk hunting *opportunities on* public land
Terrestrial Biodiversity	Complete surveys for terrestrial wildlife species of concern	Meet ROD direction to survey and manage Table 3.C.[1], LRMP standards and guidelines, and biodiversity objectives			Off Forest and 15mile	Maintain biodiversity

[1] see Appendix G Wildlife and Botanical Report

Table V .B.3. Secondary Needs for Monitoring and Restoration for Mile Creeks Watershed

Altered Process	Watershed Condition Baseline and Trend Monitoring	Monitoring Objective	Restoration Project Opportunities	Restoration Objective	Priority Areas	Potential Human Benefits
Low Levels of In-channel Large Woody Debris (LWD)	Mt. Hood National Forest Stream Survey Protocols	Quantification of aquatic habitat capability including LWD throughout the watershed	Riparian silviculture to promote growth of large diameter cedar, larch, and Douglas-fir, and recruitment of large woody debris	Provide material for instream structures, and maintain streamshade and overhanging streamside vegetation	Off Forest and 15mile RR	Higher fish survival and productivity, increased angler satisfaction, private land wood fiber production, local economic benefit
Amphibian Viability	Conduct time constrained amphibian surveys on perennial and intermittent streams	Assess species distribution, age class structure, relative abundance, and community composition	same as above	Increase amphibian habitat capability	same as above	Maintain biodiversity
Fish Migration	Barrier surveys complete		Removal or modification of human-created barriers, and screening pump intakes	Restore historic distribution of fishes, decrease anadromous migration obstacles, and increase survival of juvenile steelhead	Off Forest and 8mile	Higher fish survival and productivity, increased angler satisfaction
Invasion of Noxious Plants	Continue USFS noxious plant surveys	Assess distribution and population viability of noxious plants	Reduction of noxious plants	Secure viability and distribution of native plant communities, and provide habitat and forage for native animal communities	Off Forest and 15mile RR/ wetlands/ meadows	Reduced noxious plant competition with desirable and native species

Table V .B.3. (cont.) Secondary Needs for Monitoring and Restoration for Mile Creeks Watershed

Altered Process	Watershed Condition Baseline and Trend Monitoring	Monitoring Objective	Restoration Project Opportunities	Restoration Objective	Priority Areas	Potential Human Benefits
Altered Insect and Disease Infestation Patterns	Complete Forest Health Inventory in natural and managed conditions	Identification of stands at-risk of budworm, white pine blister rust, balsam woolly aphid, and root rot epidemic infestations	Thinning of upland forest understory to reduce stem densities, promote tree compositional and age class diversity	Decrease conditions favorable to epidemic insect and disease infestations, restore western white pine as viable species	Strata 3	Provide sustainable wood products, local economic benefit

C. Additional Planning Needs for National Forest Land

The public forest land within Mile Creeks Watershed is managed by the Hood River, Barlow, and Bear Springs District Rangers. The Eastside Basins, comprised of USFS district personnel, will use the information and recommendations in the *Mile Creeks Watershed Analysis* to create and implement a *Mile Creeks Landscape Design* that is a landscape-level synthesis and graphical depiction of the desired conditions in the upper watershed, and will meet ROD Aquatic Conservation Objectives for Tier 1 Key Watersheds and Late-Successional Reserves, and Threatened, Endangered, and Sensitive Species Conservation Strategies as they are developed (Endangered Species Act; USFS Manual Direction). Watershed analysis in conjunction with landscape design should move the natural resources on public land towards the range of desired or natural conditions described in this report, and provide public commodity and recreational opportunities. Additional planning that needs to completed for the landscape design - in no particular order of priority - includes:

1. *Access and Travel Implementation Plan* that will integrate recreational, experiential, and commodity extraction needs for system and non-system roads, off highway vehicle trails, equestrian trails, mountain bike trails, hiking trails, cross country ski trails, snowmobile routes with ROD Aquatic Conservation Objectives for Tier 1 Key Watersheds and wildlife objectives identified in watershed analysis.

2. Update *Road 44 Viewshed Guide* to provide consistency with watershed analysis range of desired or natural conditions, and implement landscape analysis.

3. *Watershed Condition Baseline and Trend Monitoring Plan* to track watershed condition with respect to desired or natural conditions in the upper watershed, and meet ROD and LRMP condition and trend monitoring objectives.

4. *Campground Site Plans* to identify patterns of use and maintenance, reconstruction, and restoration needs, and integrate social expectations with ROD Aquatic Conservation Objectives for Tier 1 Key Watersheds and desired conditions for adjacent and downstream riparian and aquatic dependent resources identified in watershed analysis.

5. *Dry Grand Fir/Douglas-fir Zone Fire Hazard Reduction Plan* to reduce the risk of catastrophic fire and potential loss or degradation of Riparian Reserves, Late-Successional Reserves, aquatic resources, timber, other forest products, recreational and experiential values, soil productivity, and ecosystem function by reducing the number of stems per acre and fuels reduction.

6. *Ponderosa Pine/Oregon White Oak Zone Fire Hazard Reduction Plan* to reduce the risk of catastrophic fire and potential loss or degradation of Riparian Reserves, Late-Successional Reserves, aquatic resources, timber, other forest products, recreational and experiential values, soil productivity, and ecosystem function by prescribed underburning.

7. *Wilderness Fire Plan* that will identify the areas and conditions appropriate for prescribed fire in the Subalpine Fir/Mt. Hemlock and Moist Grand Fir/Douglas-fir forests.

8. Update *Wilderness Implementation Schedules* to provide consistency with watershed analysis range of desired or natural conditions, and restoration project opportunities.

9. *Management Assessment for Late-Successional Reserves* for each large Late-Successional Reserve or group of smaller Late-Successional Reserves before habitat manipulation activities are designed and implemented (ROD 1994).

10. *Terrestrial, Riparian, and Aquatic Habitat Restoration Project Plans* to bring terrestrial, riparian, and aquatic ecosystems within the range of desired conditions or natural conditions to meet ROD Aquatic Conservation Strategy restoration objectives for Tier 1 Key Watersheds and provide restoration program opportunities.

VI. Data and Analysis Modules Completed for Mile Creeks Watershed Analysis

Table VI.1. Modules

Analytical Module	Type	Source
Existing Vegetation	Data	RG[1]
Potential Vegetation	Data	RG
Fire History	Data	RG
Mass Wasting	Condition	RG/TFW[2]
Surface Erosion	Condition	TFW
Hydrologic Change/ Peakflow	Condition	TFW
Hydrologic Change/Baseflow	Condition	RG
Riparian Function/ LWD Recruitment Potential	Condition	TFW
Riparian Function/ Stream Temperature	Condition	RG
Stream Channel Assessment	Condition	TFW
Plant Species of Special Concern	Data	RG
Aquatic Biology	Condition	TFW/RG
Wildlife Habitat	Condition	RG
Social/Experiential	Data	MTH[3]
Social/Recreation	Data	MTH

[1] Draft Federal Agency Guide For Pilot Watershed Analysis
[2] Washington Timber/Fish/Wildlife Watershed Analysis Manual Version 2.0
[3] Method developed by Mt. Hood NF Watershed Analysis Team

VII. Data and Analysis Gaps Identified in Mile Creeks Watershed Analysis

In completing the Mile Creeks Watershed analysis, analysis gaps were noted when a process or function could not be assessed using the standard methods outlined in the Regional Watershed Analysis Guidebook for Pilot Watersheds or the Washington Department of Natural Resources Watershed Analysis Handbook Version 2.0, or could not be completed due to time, data, methodology, and/or resource constraints. Data gaps were defined as incomplete, missing, or unvalidated data that was needed to assess the process or function, and monitor watershed condition over time.

Table VII. Data and Analysis Gaps

Process	Data Gap	Analysis Gap
Aquatic Habitat - Large Woody Debris (LWD)	Site-specific data on vegetative composition, seral stage, canopy closure and structure within the recommended Riparian Reserves in the upper watershed, and the riparian zones of the mid-lower watershed to accurately model LWD recruitment potential	Model the large woody debris recruitment potential analysis in the Subalpine Fir/Mt. Hemlock and Grand Fir/Douglas-fir zones with canopy closure $\geq$ 70 % equal to "low recruitment potential"
	Incomplete or dated large woody debris survey information for fish-bearing and on-fish bearing streams in the upper watershed	
	Large woody debris data in the mid-lower watershed	
Aquatic Habitat - Habitat Quality and Capability	Complete and comparable stream survey data for fish-bearing streams in the watershed	
	Oval Lake water quality, riparian and aquatic biological data	
Aquatic Habitat - Sedimentation	Percent surface fines in the mid-lower watershed	Quantification of point source contributions of sediment in the watershed
	Identification of sediment point sources in the watershed	
	Turbidity data throughout the watershed	
	Road surface, condition, construction, and culvert data in the watershed	
	Spawning gravel embeddedness and/or inter-gravel fines data in the watershed	Percentage of fines in spawning substrate in the watershed

Table VII. (cont.) Data and Analysis Gaps

Process	Data Gap	Analysis Gap
Aquatic Habitat- Sedimentation (cont)	Streambank stability data in campgrounds and depositional reaches in the mid-lower watershed	
Hillslope - Soil Erosion	Tons/acre of road and trail related sediment production by subwatershed in the upper watershed	
	Tons/acre of developed campground and dispersed campsite sediment production by subwatershed in the upper subwatershed	
Hillslope - Soil Compaction	Acres, location, and percentage of campground, dispersed campsite, and grazing activity area that has compacted soil in the upper watershed	
Channel Morphology	Field validation of interpreted Rosgen reach classifications in the watershed	
Flow Regime - Peakflow	Channel cross section profile to assess impacts of altered peakflows on channel substrate and steelhead and Pacific lamprey reproductive success in the watershed	Assess changes in channel substrate associated with altered peakflows in the watershed
	Site-specific long-term peakflow data throughout the watershed	
Flow Regime - Baseflow	Continuous long-term baseflow data to assess the baseflow regime in the watershed	Estimated loss of water storage capacity in the mid-lower watershed
Water Quality - Water Temperature	Data on vegetative composition, seral stage, canopy closure and structure on perennial streams within the recommended Riparian Reserves and in the mid-lower watershed	Run the SHADOW model to assess point sources of stream temperature increases in the watershed
	Continuous temperature monitoring in the mid-lower watershed	
Population Viability - At-Risk Fish Species	Steelhead population and survival information in the watershed	Run Intermountain Research Station population viability model for resident redband trout
	Pacific lamprey population and survival information in the mid-lower watershed	
	Distribution and species identification of lamprey species in the mid-lower watershed	Limiting factor analysis for steelhead and Pacific lamprey in the watershed

Table VII. (cont.) Data and Analysis Gaps

Process	Data Gap	Analysis Gap
Population Viability - At-Risk Fish Species (cont)	Steelhead tag-recapture data to assess impacts of Bonneville Dam, and subsistence and commercial fisheries on Mile Creeks steelhead	Analysis of steelhead tag-recapture data
	Steelhead and Pacific lamprey temporal and seasonal distribution and spawning surveys	Analysis of steelhead habitat utilization by life stage and age class
Biodiversity - Amphibian Biodiversity	Amphibian community composition, species distribution, relative abundance, and age class structure information in the watershed	Amphibian Biodiversity Index in the watershed
Human Habitat - Recreation and Experiential	Inventory of dispersed recreation sites and use in the upper watershed	Analysis of dispersed recreation site use patterns by user group in the upper watershed
	Survey of user groups in developed campgrounds	Analysis of developed recreation site use patterns by user group in the upper watershed
	Survey of user groups on developed trail system	Analysis of developed trail use patterns by user group in the upper watershed
	Inventory of user-built trail systems and use in the upper watershed	Analysis of trail use by user group in the upper watershed
	Data on individual or user group preferences for other recreational and experiential activities in the upper watershed	Analysis of other recreational and experiential use patterns and preferences by user group in the upper watershed
Terrestrial Vegetation	Current community composition, density and structure, and seral stage of public and private vegetation in the watershed	Quantification of current vegetative communities and seral stages versus historic information in the watershed
	Inventory of wetland habitats associated springs in the upper watershed	Analysis of landscape fragmentation and patterns in the watershed
	Current vegetation database	Determine threshold of concern for disease and insect infestations
		Exotic species/native species competition analyses
Terrestrial Wildlife - Connectivity, Migration and Dispersal	Identify land not capable of meeting 11/40 habitat requirements for northern spotted owl in the upper watershed	Validation of the wildlife habitat relationship/life history and vegetation databases linkage analysis model
Terrestrial Wildlife - Habitat	Data on location, quantity, and quality of foraging and roosting habitat for the northern spotted owl in the upper watershed	Detailed analysis of suitable nesting habitat for northern spotted owl in the upper watershed
	Field validation of location, quantity, and quality of terrestrial wildlife guild habitats in the upper watershed	Subwatershed analysis of forage and cover ratios for deer and elk in the watershed

Table VII. (cont.) Data and Analysis Gaps

Process	Data Gap	Analysis Gap
Terrestrial Wildlife - Habitat (cont)	Data on location, quantity, and quality of terrestrial wildlife guild habitats in the mid-lower watershed	Detailed habitat connectivity analysis in the mid-lower watershed and adjoining watersheds
	Field validation of large woody debris and snag data for managed and unmanaged stands in the watershed	Habitat capability analysis for large woody debris and snag dependent species in the watershed

VIII. Glossary

Accelerated Erosion and Sediment Yield - The increase in erosion and sediment yield above natural levels as caused by human activities.

Aggradation - The up-building performed by a stream in order to establish or maintain uniformity of grade or slope.

Alluvial - Deposited by a stream or running water.

Aquatic Ecosystem - A water based ecosystem (see ecosystem). An interacting system of water with aquatic organisms (plants and animals).

Anadromous - Fish that swim from the ocean up streams to spawn.

Beneficial Values - Beneficial values as defined for the Mile Creeks Watershed are those primary or unique values and human uses toward which management expends resources. In this context, **primary** refers to those values which have higher importance relative to other values, and **unique** refers to rareness of occurrence in the Hood subbasin.

Biodiversity - see Biological Diversity

Biological Diversity - The variety of life and its processes, including the variety in genes, species, ecosystems, and the ecological processes that connect everything in ecosystems.

Biomass - The total mass of living organisms in a biological system. The above-ground portions of shrubs and trees, excluding material that meets commercial sawlog specifications.

Biota - All the species of plants and animals occurring within an area or region.

Candidate Species (C2) - A species of plant or animal being considered for listing as a federally endangered or threatened species.

Catastrophic Event - A large-scale, high-intensity natural disturbance that occurs infrequently.

Channel (watercourse) - An open outlet either naturally or artificially created which periodically or continuously contains moving water, or which forms a connecting link between two bodies of water. River, creek, run, branch, anabranch, and tributary are some of the terms used to describe natural channels. Natural channels may be single or braided.

Climax Community - The final or stable biotic community in a successional series which is self-perpetuating and in dynamic equilibrium with the physical habitat.

Community - An aggregation of living organisms having mutual relationships among themselves and to their environment.

Connectivity - see Landscape Connectivity

Corridor - Route that permits the movement of species from one Ecoregion, Province, landscape or ecosystem to another, or the landscape elements that connect similar patches through a dissimilar matrix or aggregation of patches.

Cumulative Effects Analysis - An analysis of the effects on the environment which results from the incremental impact of a proposed action when added to other past, present, and reasonable foreseeable future actions, regardless of what agency or person undertakes such other actions.

Cumulative Watershed Impacts - Impacts occurring away from the site of primary development which are transmitted through the fluvial system. The impacts occur through both increases in peak stream flows and through increased sediment levels. The effects generally are concentrated within stream channels which can lead to bank undercutting, channel aggradation, degradation and inner gorge mass wasting.

Debris Torrents - A mass wasting process which results from a debris slide or avalanche entering and flowing down a steep gradient stream channel. As the mass entrains more water, it scours and transports large quantities of organic material and sediment. This material is generally deposited as the channel gradient decreased or a significant obstruction is met. Torrents generally contribute to secondary mass wasting along the margins of the scoured channel.

Debris Slide/Avalanche - A mass wasting process characterized by a relatively shallow failure plane, which generally corresponds to the soil/bedrock interface. The distinction between an avalanche and a slide is that a slide moves slower, and retains more of a coherent slide mass. An avalanche generally fails rapidly, with the slide mass dis-aggregating, and sometimes flowing, depending on the water content.

Desired Condition - Objectives for physical and biological conditions within the watershed. They may be expressed in terms of current conditions, ecosystem potential, or social expectations. They describe the conditions that are to be achieved and are phrased in the present tense.

Desired Future Condition - see Desired Condition

Disturbance - A discrete event, either natural or human induced, that causes a change in the existing condition of an ecological system.

Diversity - The distribution and abundance of plant and animal species and communities in an area.

Drainage Area - The drainage area of a stream at a specified location is that area, measured in a horizontal plane, which is enclosed by a drainage divide.

Ecological Classification - A multifactor approach to categorizing and delineating, at different levels of resolution, areas of land and water having similar characteristic combinations of the physical environment (such as climate, geomorphic processes, geology, soil, and hydrologic function), biological communities (such as plants, animals, microorganisms, and potential natural communities), and the human dimension (such as social, economic, cultural, and infrastructure).

Ecological Processes - see Ecosystem Functions

Ecology - The science of the interrelationships between organisms and their environments.

Ecoregion - A continuous geographic area in which the environmental complex, produced by climate, topography, and soil, is sufficiently uniform to develop characteristics of potential major vegetation communities.

Ecosystem - The complex of a community of organisms and its environment functioning as an ecological unit in nature.

Ecosystem Functions - The major processes of ecosystems that regulate or influence the structure, composition and pattern. These include nutrient cycles, energy flows, trophic levels (food chains), diversity patterns in time/space development and evolution. cybernetics (control), hydrologic cycles and weathering processes.

Ecosystem Processes - see Ecosystem Functions

Ecosystem Management - Using an ecological approach to achieve the multiple-use management of national forests and grasslands by blending the needs of people and environmental values in such a way that national forests and grasslands represent diverse, healthy, productive, and sustainable ecosystems. The careful and skillful use of ecological, economic, social, and managerial principles in managing ecosystems to produce, restore, or sustain ecosystem integrity and desired conditions, uses, products, values, and services over the long-term.

Ecosystem Sustainability - The ability to sustain diversity, productivity, resilience to stress, health, renewability, and/or yields of desired values, resource uses, products, or services from an ecosystem while maintaining the integrity of the ecosystem over time.

Ecotone - A transition between two or more biotic communities.

Ecotype - A locally adapted population of a species which has a distinctive limit of tolerance to environmental factors: a genetically uniform population of a species resulting from natural selection by the special conditions of a particular habitat.

Endangered Species - A species which is in danger of extinction.

Endemic - Restricted to a specified region or locality.

Environment - The complex of climatic, soil and biotic factors that act upon an organism or ecological community and ultimately determine its form and survival.

Environmental Change - A shift in the rate or timing of a physical process or a shift in state of physical or biotic character.

Erosion - The group of processes whereby earthy or rock material is worn away, loosened or dissolved and removed from any part of the earth's surface. It includes the processes of weathering, solution, corrosion, and transportation. Erosion is often classified by: the eroding agent (wind, water, wave, or raindrop erosion); the appearance of the erosion (sheet, rill, or gully erosion); the location of the erosional activity (surface, or shoreline); and/or by the material being eroded (soil erosion or beach erosion).

Erosion Hazard Rating - A relative (not absolute) rating of the potential for soil loss due to sheet and rill erosion from a specific site. Commonly used to address erosion response expected from a given land management activity. Ratings are the result of a cumulative analysis of the following factors: soil, topography, climate, and vegetative and protective cover.

Eyrie - A raptor's cliff nest, such as a peregrine falcon.

Exotic Species - Non-native species which occur in a given area as the result of deliberate or accidental introduction of the species from a foreign country.

Fault Zone - A fault that is expressed as a zone of numerous small fractures.

Fauna - All animals, including birds, mammals, amphibians, reptiles, fish and invertebrates (clams, insects, etc.).

Flora - All plants, including trees, shrubs, forbs, and grasses, and considered as a whole.

Fragmentation - Breaking up of contiguous areas into progressively smaller patches of increasing degrees of isolation.

Fuel Loading - The amount of combustible material present per unit of area, usually expressed in tons per acre.

Fuels - Any material capable of sustaining or carrying a forest fire, usually natural material, both live and dead.

Gap Analysis - Process to determine distribution and status of biological diversity and assess adequacy of existing management areas to protect biological diversity.

Geologic Province - Any large area or region considered as a whole, all parts of which are characterized by similar features or by a history differing significantly from that of adjacent areas.

Guild - A group of species that have similar habitat requirements. Can also be known as an assemblage.

Habitat Type - The collective land area in which one vegetation type is dominant or will come to be dominant as succession advances.

Habitat Connections - A network of habitat patches linked by areas of like habitat. The linkages connect habitat areas within the watershed to each other and to areas outside the watershed. These connections include riparian areas, mid-slopes, and ridges.

Home Range - The geographic area within which an animal travels to carry out its activities.

Impact - A negative environmental change. The value judgment of "negative" is generally construed to mean that conditions or processes are moving away from desired states.

Increaser - A plant low in palatability which tends to increase in numbers or relative dominance under heavy grazing or site disturbance.

Integrated Resource Management - The simultaneous consideration of ecological, physical, economic, and social aspects of lands, waters, and resources in developing and carrying out multiple-use, sustained-yield management.

Issue - Refers to a topic, a subject, a category, or a value which is registered by a person as something in which they have a high level of interest. Used synonymously with the term "concern". Identification of issues can occur through formal solicitation, content analysis of publication and periodicals, or informal communications.

Key Questions - Questions that Watershed Analysis attempts to answer. These are the interdisciplinary team's expectations for the analysis.

Landscape - The mixture of topographic, vegetative, and biologic attributes within an area. An area composed of interacting and interconnected patterns of habitats, that are repeated because of the geology, land forms, soils, climate, biota, and human influences throughout the area. Landscape structure is formed by patches, connections, and the matrix. Landscape function is based on disturbance events, successional development of landscape structure, and flows of energy and nutrients through the structure of the landscape.

Landscape Connectivity - The spatial contiguity within the landscape. A measure of how easy or difficult it is for organisms to move through the landscape without crossing habitat barriers.

Landscape Ecology - The study of spatial and temporal interactions and exchanges across heterogeneous landscapes, the influences of spatial heterogeneity on biotic and abiotic process, and the management of spatial heterogeneity.

Landscape Unit - A continuous geographic area with fairly consistent landform and vegetation communities.

Linkage - Route that permits movement of individual plant (by dispersal) and animals from a Landscape Unit and/or habitat type to another similar Landscape Unit and/or habitat type.

Lithology - The description of rocks on the basis of such characteristics as color, mineralogy, and grain size.

Mass wasting - A general term for the dislodgment and downslope transport of soil and rock material under the direct application of gravitational body stresses. In contrast to other erosional processes, the debris removed by mass wasting is not carried within, on or under any other medium. Mass wasting includes many processes, including relatively slow displacement, such as creep, or rapid movement such as rock falls, debris avalanches, or debris torrents.

Microsite - A rock outcrop, snag, seep, stream pool, or other small scale feature that is unique in character.

Monitoring - To watch, observe, or check, especially for a specific purpose, such as to keep track of, regulate, or control.

Naturalized - Naturally-reproducing populations of introduced and exotic species.

Natural Range of Variability- The spectrum of conditions possible in ecosystem composition, structure, and function considering both temporal and spatial factors.

Peak Streamflows - The highest level of streamflow in response to a rainstorm or period of snow melt.

Physical Process - The rate and timing of the interaction of biotic and abiotic ecosystem components.

Plant Association - A potential natural plant community of definite floristic composition and uniform appearance.

Population - A group of individuals of a species living in a certain area. They have a common ancestry and are much more likely to mate with one another than with individuals from another area.

Potential Natural Community - The biotic community that would be established if all successional sequences of its ecosystem were completed without additional human-caused disturbances under present environmental conditions. Grazing by native fauna, natural disturbances such as drought, floods, wildfire, insects, and disease, are inherent in the development of potential natural communities which may include naturalized non-native species.

Pool Frequency - The number (occurrence) of pools or a certain size pool within a general or selected stream reach.

Proposed Species - Any species that is proposed in the Federal Register to be listed as threatened or endangered.

Province - A continuous geographic area wherein species composition, both plant and animal, is more homogeneous than between adjacent areas.

Range of Variability (Natural Variability, Historic Variability) - The spectrum of conditions possible in ecosystem composition, structure, and function considering both temporal and spatial factors.

Rehabilitation - Returning of land to productivity in conformity with a prior land use plan, including a stable ecological state that does not contribute substantially to environmental deterioration and is consistent with surrounding aesthetic values.

Resilience - The ability of an ecosystem to maintain diversity, integrity and ecological processes following disturbance.

Restoration - The process of restoring site conditions as they were before a land disturbance.

Riparian Ecosystem - Ecosystems transitional between terrestrial and aquatic ecosystems. Streams, lakes, wet areas and adjacent vegetation communities and their associated soils which have free water at or near the surface.

Riparian Reserve - The area which encompasses streams, lakes, and wetlands and is designed to protect aquatic and riparian functions and values. The Riparian Reserve is a function of site characteristics, physical processes linked to the area, and the type and timing of activity proposed.

River Basin - An area, defined by physical boundaries, in which all surface water flows to a common point. River basins are associated with large river systems and are typically 1000s of square miles in size.

River Basin Analysis - The collection and organization of aquatic and fisheries issues and processes or condition.

SCCA, Species and Community Conservation Analysis 1994 --An analysis project undertaken on the Mt. Hood National Forest in 1993 to develop a methodology for synthesizing existing information so Forest Plan analysis and planning can be accomplished across disciplines on an ecological basis. SCCA also compiled a corporate database of existing information in a retrievable and useable way on distribution and habitat relationships of plants, fish, wildlife, invertebrates, and human use, and create habitat/community maps. Gaps in knowledge were also identified. The project also developed an analysis procedure that would allow the Forest to design and analyze alternatives for species and community diversity, including a Forest-wide GAP analysis to identify areas of high species diversity, and species and communities at risk. Finally, the SCCA developed a process to cover multiple scales appropriate to the species, habitat or community being analyzed. It tiered the analysis to Regional approaches such as GAP, REAP, SAT, NASA Landscape Pattern Analysis Project, and the Ecosystem Management Assessment Working Group (post-Forest Conference group).

Sediment - Fragmental material that originates from weathering of rocks and is transported by, suspended in, or deposited by water or air or is accumulated in beds by other natural agencies. (USGS, 1960)

Sensitive Species - A species not formally listed as endangered or threatened, but thought, by a Regional Forester, to be at risk.

Seral - A biotic community which is a developmental, transitory stage in an ecological succession.

Seral Stage - A biological community viewed as a single developmental or transitional stage in an ecological succession.

Sinuosity - Meander length and pattern of a stream. Stream length divided by valley length.

Site - An area described or defined by its biotic, climatic, and soil condition as related to its capacity to produce vegetation; an area sufficiently uniform in biotic, climatic, and soil conditions to produce a particular climax vegetation.

Soil Map Units - Groupings of soils that are too intricately mixed to be mapped discretely at the scale of soils survey mapping being conducted.

Spawning Sites - Graveled areas within a stream system having the appropriate attributes, i.e. dissolved oxygen, water depth, water velocity, water temperature, substrate composition, and cover that are selected as suitable for spawning by adult fish.

Special and Unique Habitats - A rock outcrop, snag, seep, stream pool, and other environmental features small in scale but unique in character.

Stochastic - Random or uncertain variation.

Stratification - The delineation of areas within a watershed which will respond relatively uniformly to a given process or set of conditions.

Stream Order - A method of numbering streams as part of a drainage basin network. The smallest unbranched mapped tributary is called first order, the stream receiving the tributary is called second order, and so on. It is usually necessary to specify the scale of the map used. A first-order stream on a 1:62,500 map, may be a third-order stream on a 1:12,000 map. Tributaries which have no branches are designated as of the first order, streams which receives only first-order tributaries are of the second order, larger branches which receive only first-order and second-order tributaries are designated third order, and so on, the main stream being always of the highest order.

Succession - An orderly process of biotic community development that involves changes in species, structure and community processes with time. It is reasonably directional and therefore, predictable.

Sustainability - The ability to sustain diversity, productivity, resilience to stress, health, renewability, and/or yields of desired values, resource uses, products, or services from an ecosystem while maintaining the integrity of the ecosystem over time.

Terrestrial - Living primarily on land rather than in water.

Terrestrial Ecosystem - An interacting system of soil, geology, topography with plant and animal communities.

Threatened Species - A species which is likely to become an endangered species.

Threshold of Concern (TOC) - Used in cumulative watershed effects analyses to describe the point (in terms of percent equivalent road area) where the risk of watershed degradation is significant if mitigation measures are not employed.

Transient Snow Zone - The area between 2,500 and 5,000 feet elevation subject to rain-on-snow events during winter months.

Underburning - The prescribed use of fire beneath a forest canopy.

Valley Inner Gorge - A zone with slopes adjacent to stream channels, having slope gradients greater than 65 %, which are separated from the upslope area by a distinctive break in slope. Valley inner gorges are formed by mass wasting and therefore are noted for their instability.

Viability - The likelihood of continued existence in an area for some specified period of time.

Watershed - A region or area bounded peripherally by a water parting feature and draining ultimately to a particular watercourse or body of water. There are many watersheds within a river basin. Watershed areas range from 20 to 200 square miles in size.

Watershed Analysis - Development and documentation of a scientifically based understanding of the processes and interactions occurring within a watershed in order to make more sound management decisions.

Watershed Product - Terrestrial ecosystem components that move in the fluvial system: water, sediment, chemicals, organic debris, and heat.

Weir - An obstruction placed across a stream thereby causing the water to pass through a particular opening.

Wetland - An area at least periodically wet or flooded, an area where the water table stands at or above the land surface.

VIV. Appendices

Mile Creeks Watershed
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APPENDICES

A. Fire /Fuels Management and Ecology in Mile Creeks
B. Hillslope Processes Report
C. Peakflow Report
D. Baseflow Report
E. Water Temperature Report
F. Riparian and Aquatic Ecosystems Report
G. Wildlife and Botanical Report (including Survey and Manage Table)
H. Social Report
I. Map List

United States Department of Agriculture

Forest Service

Mt. Hood National Forest

Barlow Ranger District
P.O. Box 67
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503-467-2291

Reply To: 5100

Date: May 11, 1994

Subject: Fire/Fuels Management and Ecology in Miles Creeks

To: Watershed Analysis Team

Introduction

This report covers fire and fuels management and fire ecology in the Fifteenmile Creek watershed, also known as Miles creeks. The area analyzed includes just the watershed with the exception of historic fire occurrence on National Forest lands. Historic fire occurrence also includes an additional one quarter mile beyond the watershed boundary. Topics covered in this report include available data and its location, fire management direction, fire protection infrastructure, fire occurrence, past fuel treatments, fire ecology and regimes, and fire management concerns and opportunities. The bulk of the report focuses on National Forest lands, which cover only 20% of the total watershed. This focus is due to the lack of time and data to analyze other ownerships in detail.

Available Data

Fire Occurrence. Historic fire occurrence between National Forest lands and Dufur exists in the form of Individual Fire Reports available at the Oregon Department of Forestry office in The Dalles (ODF-The Dalles). There is no data on fire occurrence east of an area bounded by Mays Canyon Creek, Dufur, and the powerline between Dufur and The Dalles.

Fire occurrence records for National Forest lands exist at Barlow Ranger Station in Dufur. These records consist of two Quattro-Pro based spreadsheets that cover fire occurrence from 1916-1930 and 1931-present. The district has paper copies of Individual Fire Reports for 1989-present. The locations of fire starts for 1931-1990 have been digitized and stored in the district's Geographic Information System (GIS). These locations are attributed with unique numbers tied to the spreadsheet records as well as occurrence year, statistical cause, and size class. This attribute allows creation of maps based on year or decade of occurrence, cause, and fire size.

Past Fuel Treatment. Past fuel treatment records exist only for National Forest lands. These records have been compiled into a spreadsheet that includes stand number (GIS based), sale name, unit number, acres, silvicultural prescription, and fuel treatment method. In addition, the district has maintained copies of Brush Disposal plans (BD plans) and prescribed burning plans. The prescribed burning plans more accurately reflect actual fuel treatment method than BD plans.

Fire Ecology and Regimes. The Pulse effort completed by the Mt. Hood National Forest resulted a a crude map of fire regimes and a draft fire ecology guide for the forest. Stand exams in Eightmile and Fivemile creeks allowed for further refinement of the fire regime map on National Forest lands in those two subwatersheds. Interpretation of aerial photograpghs allowed some mapping in Ramsey and Fiffteenmile creeks and on other ownerships. This map is incomplete and exists as a clear mylar overlay at 1:24,000 scale. Completion of the map will require additional stand exams and ground truthing.

The district has copies of reports dating back to the 1930s that discuss various aspects of existing vegetation and management activities of the time and the past. We also have copies of two early fire control maps that describe vegetation at a coarse to very coarse scale. The earliest map dates to approximately 1916 and the later map to about 1938-40.

Fire Management Direction

National Forest Lands. 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 resource values).

2. Use the appropriate suppression response for all wildfires, based on objective 1.

3. Fire management activites shall contribute to the most cost effective fire protection program consistent with Management Area management direction.

Fire management activites include presuppression (such as construction and maintenance of fuelbreaks, helispots, water sources, and so forth), prevention, suppression, detection, and treatments of both natural and activity fuels.

Additional direction in the various land allocations includes:

In Key Site Riparian Areas (A9), heavy equipment (e.g. dozers) should not be used for fire suppression and use of chemical fire retardants should be minimized. Prescribed burning should be considered for the purpose of enhancing riparian resource values.

In Outdoor Education Areas (A12--Underhill Site), reduced levels of down woody material may be permitted and prescribed burning may occur.

In Scenic Viewsheds (B2--Road 44), 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 may occur for eastside pine communuities. Exceptions to the downed woody Standards and Guidelines may occur within near-foreground (i.e. 200 feet) areas with Retention and Partial Retention Visual Quality Objectives (VQOs).

In Pileated Woodpecker/Pine Marten Habitat Areas (B5) prescribed fire may occur to achieve mature and/or old growth habitat objectives. Fuel treatments shall maintain at least 6 downed logs per acre and prescibed snag numbers.

In Special Emphasis Watersheds (B6) prescribed burning may be permitted to enhance watershed resistance to catastrophic wildfire.

In General Riparian Areas (B7) dozer firelines should not be constructed during wildfire suppression activites, although perpendicular crossings are allowed with subsequent rehabilitation. Broadcast burning may be allowed where prescriptions are consistent with riparian management activities.

The Forest Plan does not specifically allow for consideration of prescribed natural fire (PNF) within Miles creeks. Unless PNF is specifically allowed, a Forest Plan amendment is needed to permit that activity.

Based on this direction, the most common suppression response in Miles creek is a Control strategy. Confine strategy may be feasible very early or very late in the year, but has not been used to date. The terrain in Miles creeks limits the use of dozers for contructing firelines to the ridgetops and Eightmile plateau. Ridges tend to become broader as elevation increases. Further, most of the eastern half of Miles creeks was identified as tentatively suitable for inclusion within the district's natural fuels prescribed burning program.

In addition to the direction described above, the President's Forest Plan created new land allocations and additional Standards and Guidelines related to fire and fuels management. Allocations in Miles creeks include Late-Successional Reserves (Fifteenmile and Ramsey creeks), Riparian Reserves, and Matrix lands within a Tier 1 Key Watershed.

<u>Late-Successional Reserves.</u> 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. Treatments should be designed to provide effective fuel breaks. Associated fuel treatments should promote the use of minimum impact suppression tactics during wildfires. The goal of wildfire suppression is to limit the size of all wildfires. Prescribed natural fire may be considered.

<u>Riparian Reserves.</u> Fire and fuel management activities should meet the Aquatic Conservation Strategy objectives and minimize disturbance of riparain ground cover and vegetation. Management strategy should recognize the role of fire in the ecosystem and identify where fire suppression or fuels management activites 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 litter, duff, and downed logs unless it is appropriate for the specific communitiy or stand condition. Additional wildfire hazard reduction activities may occur in coordination with local governments, agencies, and landowners in the wildland/urban interface.

State Protected Lands. ODF-The Dalles provides fire protection services for the area between the National Forest and Dufur. The eastern boundary of their protection zone lies along Mays Canyon Creek and a main powerline between Dufur and The Dalles. Although the State of Oregon and BLM own some land within this area, most of it is privately owned. Fire management direction is to keep all wildfires as small as possible, using the most cost-effective suppression strategies and tactics. This direction translates to exclusive use of a Control strategy and heavy reliance on engines and dozers.

Unprotected Lands. The remaining lands in Miles creeks (from Dufur to the confluence with the Columbia River) have no formal fire protection services and fire management direction.

Fire Protection Infrastructure

The fire protection infrastructure in Miles creeks consists of detection, water sources, helispots, prevention signs, and prevention patrols. Primary fire detection is provided by Flag Point Lookout in the Badger Creek Wilderness. Secondary detection is provided by Fivemile Butte Lookout. Fivemile is staffed in the afternoon during periods of high fire danger and after lightning storms. It also serves as a bunkhouse for the prevention patrol on the north end of the district (Patrol 108).

Miles creeks contains 18 water sources on National Forest lands, including one source on private land. Ten sources lie in perenniel streams, although none currently exist directly in Fifteenmile Creek. Two sources lie in intermittent streams (Blue Creek and Larch Creek). Two sources lie in springs (Knebal and Puma). Engines and water tenders can draw water from Wolf Run Ditch in three locations.

No formally designated helispots exist within Miles creeks. Light helicopters (Bell 206, Hughes 500, Lama, Alouette, etc.) can land at Fivemile Butte, Skyline Pit, Joes Point Pit, and Hesslan Ridge and may be able to large at some large road junctions. Medium helicopters (Bell 204, 205, and 212, Siskorsky 55T, etc) can land at Joes Point Pit and Hesslan Ridge.

If needed, air tankers support the Mt. Hood National Forest and ODF-The Dalles, primarily out of Redmond Air Center. Other air tankers may come from La Grande and Wenatchee, WA. Refueling and retardant is available at Troutdale Tanker Base. Only Redmond Air Center currently provides fugitive retardant (retardant whose color fades with 2-6 weeks exposure to sunlight).

Prior to 1994, Barlow Ranger District provided a prevention patrol for Miles creek watershed, Patrol 108. This person ususally stayed at Fivemile Butte Lookout. Patrol 108 was a 300 gallon engine with a slip-on pump and tank setup. In 1994, Hood River Ranger District will provide a prevention patrol for the north end of Barlow as well as the east half of Hood River District. This person will probably spend less time on Barlow, due to the larger patrol area, and will not stay at Fivemile Butte Lookout. How long this arrangement continues will depend on future budgets. The prevention patrolperson also maintains the prevention signs on the mainline roads (44, 4430, 4440, 1722, etc.).

Fire Occurrence

Due to the lack of time, no data was collected for fire occurrence on State protected lands. In general, fire occurrence rates are low and most fires are human-caused. Seventy-five years of data are available for National Forest lands. This data covers 1916 to present with no data for 1922, 1923, and 1939.

Within this time period, 135 fires have started within the Miles creeks fire occurrence analysis area. Table 1 summerizes the statistical causes and size classes. Data in the 1970s decade is suspect. During that time, direction to the districts was to report all abandoned or unattended campfires as statistical fires. An abandoned or unattended campfire does not meet the national definition of a statistical wildfire unless it has burned beyond the containment ring or structure. The district knows that some of the campfires reported in the 1970s do not meet this definition, but information recorded on the fire reports does not allow separation of true statistical wildfires from nonstatistical ones. As many as 24 wildfires may not be true wildfires.

Miles creeks experiences 0.045 wildfires per 1,000 acres per year, based on an area of 40,187 acres (Miles creeks watershed plus one quarter mile). This occurrence rate translates to an average of 2 wildfires per year; 1 caused by lightning and 1 caused by human activities. The actual occurrence rate may be slightly higher since Miles creeks includes a large parcel of private land along Road 44 (Camp Baldwin and other owners--1400 acres) and another parcel in Fivemile Creek formerly owned by Longview Fibre (approximately 240 acres). Through time the Forest Service and Oregon State have traded protection responsibility for in-holdings. Thus, the wildfire records are incomplete

Four wildfires exceeded 100 acres in size. Two burned in 1924. Ward fire started from a careless smoker near the present-day Camp Baldwin. It burned 80 acres of National Forest lands and 120 acres of nonFederal lands. Lightning started the Dog River fire, burning 300 acres of National Forest lands. This fire may not have burned into Eightmile Creek, given that it started in the Dog River subwatershed. However, large fires on the district tend to burn towards the east. No evidence of these two fires can be found in the present vegetation.

More recently, two large fires started from equipment use. North Fork fire, 1967, burned 200 acres of National Forest lands and 9 acres of other ownership. Ceanothus brushfields still dominate most of the fire area. Football fire, 1982, burned 198 acres of National Forest lands and 16 acres of land that used to belong to Longview Fibre. The Longview Fibre land now *belongs to the Forest Service. Football fire was seeded with* sod-forming exotic grasses, such as orchardgrass, after salvage was completed. Much of the fire area is inadequately stocked with conifers.

In addition to these four fires, the ranger present in 1939 mentioned a large wildfire that burned in 1898 between the head of Eightmile Creek and Bottle Prairie. The burn area was heavily stocked with lodgepole pine, western large, and white (grand) fir with small patches of ponderosa pine. Evidence of this fire is readily apparent, although the lodgepole pine has begun to die out of the unharvested portions of that area.

Table 1. Fire occurrence on National Forest lands in Miles creeks.

Cause	Wildfires	Size Class	Wildfires
Lightning	62	0-1/4 ac	113
Humans	73	1/4-10 ac	16
Total	135	10-100 ac	2
		100-300 ac	3
		300-1000 ac	1
		Total	135

Occurrence Rate = (135 wildfires/40.2 thousand acres)/75 years
= 0.045 wildfires/1000 acres/year

Past Fuel Treatments

No records are available for lands other than National Forest. Timber harvest has occurred on an irregular basis in these other ownerships. Resulting fuels have primarily been dozer-piled or windrowed and burned.

Prior to the mid-1970s most harvest on National Forest lands involved selective cuts over very large areas with little or no fuel treatments except along access roads. The few concentrated harvest units were either dozer piled and burned or broadcast burned in the fall. Records are very scattered and sparse for this time period.

After the 1973 Rocky fire, the district moved away from selective cutting and into even-aged management strategies with relatively small cutting units. It also moved from fall broadcast burning to spring burning. Harvesting and associated fuel treatments accelerated rapidly in the 1980s. Dozer piling was, and remains, one of the least costly fuel treatment measures available. It is also the most likely treatment method to cause detrimental environmental impacts.

Prior to 1985, little or no woody material was left in the harvest units. In 1985, the piling specifications called for retaining 80 cubic feet of downed logs per acre. This specification increased to 200 cubic feet in 1988 and 240 cubic feet in 1990. At this same time, the district switched from multiple dozer pilinmg contractors operating on yearly contracts and paid by the acre to a single contractor operating on a three-year contract and paid by the hour.

These two changes have greatly reduced the impact of dozer piling on soils. However some concern remains in current units and in units piled under older, less environmentally sensitive specifications. Most units have been entered more than once. Earlier entries and harvest entries prior to 1990 occured without the use of designated skid trails. Further, dozer piling is very difficult, if not impossible, if the operator is restricted to designated skid trails. Monitoring elsewhere on the district indicates that older dozer piled units may not meet Forest Plan standards and guidelines for soil compaction. Attached to this report are a series of tables listing fuel treatments by sale and unit for each subwatershed and a table listing units and acres of areas dozer piled and burned before 1988.

In addition to dozer piling and burning, several other fuel treatment methods have been used in Miles creeks. Handpiling and burning is the second most common treatment type followed by broadcast burning/underburning. The district is moving away from handpiling in favor of broadcast burning and underburning for three main reasons.

First, handpiling does a poor job of effectively reducing the hazard associated with activity fuels. Frequently the material most associated with wildfire starts and rapid fire spread, material less than 1/4 in diameter and pine needles, does not get piled. It is nearly impossible to write an enforceable contract specification that would force the contractor to pile most of this material.

Second, many the plant communities more typical of Miles creeks evolved under a regime of frequent underburning. These communities and certain species within them need the type of fire intensity and severity more associated with broadcast burning and underburning than with handpile burning.

Third, broadcast burning and underburning are less costly methods than handpiling and burning. Handpiling and burning typically costs $300-350 per acre. Broadcast burning and underburing typically cost $125-200 per acre.

Other fuel treatment methods used in Miles creeks include swamper burning (burning as fuel is handpiled), jackpot burning, crushing, and no treatment. Crushing is most often used in commercially thinned units with tight spacing or where fire sensitive conifers dominate the residual stand. No treatment is most often used in final removals of shelterwoods and precommercially thinned units.

In addition to treating activity fuels, the district has underburned natural fuels along the east edge of Miles creeks. One burn has occurred in both Fifteenmile and Ramsey creeks, two in Eightmile, and three in Fivemile. The most recent was Blue Wolf in 1992. These projects have concentrated on the broader ridgetops and south aspects.

Fire Ecology and Regimes

Fire Groups. Fire groups 1 through 5 occur within Miles creeks, based on descriptions developed under the Pulse project. Readers should refer to the draft fire ecology guide for a more complete description of the fire ecology groups. Fire Group 0, special habitats, occurs only in limited areas on National Forest lands and extensively in the remainder of Miles creeks.

FIRE GROUP 0

On National Forest lands, Fire Group 0 occurs in Eightmile Meadows and various rock outcrops too small to map at 1:24,000 scale. Bottle Prairie technically falls into Fire Group 0 but so little of the orginal meadow remains after the last realignment of Road 44 that it was not included. Fire Group 0 also covers the agricultural and range lands in Miles creeks. Land management practices, such as intensive grazing, plowing, summer fallow, and irrigation, means that these areas usually burn only under controlled or carefully selected conditions. Escaped fires do occur, but rarely burn for more than one afternoon.

FIRE GROUPS 1 AND 2

Fire Group 1, the hottest and driest forest type, occurs mostly on south aspects on the forest, gradually transitioning to ridgetops and north aspects towards the east. Fire Group 2 tends to intermix with Group 1 near the National Forest boundary and occupies a narrow elevational band on south aspects above Fire Group 1. The fire frequency for these two groups has considerable overlap. Within Miles creeks, the presettlement fire return interval for both groups was probably very similar, if not the same. Since Fire Group 2 occupies slightly moister sites, the successional pathway and rate differs from Group 1.

Prior to white settlement, Fire Groups 1 and 2 were characterized by open, parklike stands of ponderosa pine, ponderosa pine and Oregon white oak, and Oregon white oak savannahs maintained by frequent, low intensity underburning. Fires would typically burn for several weeks to several months with very low intensities and severities. The scarcity of soil wood indicates that downed logs usually burned up before becoming incorporated into the soil.

Research has shown that ponderosa pine plant communities experienced very similar fire frequencies and were typified by very similar plant communities throughout the western United States. These communities were very open with a vertically stratified canopy structure, grassy understories, and little or no brush and woody material. Conifer regeneration usually occured as small, even-aged groups. Overall plant diversity was very low but within Fire Groups 1 and 2 but community resilience was very high. Frequent, low intensity fires served as an agent of community stability.

Approximately the eastern one third of National Forest lands and most or all the forest lands further east fall within Fire Groups 1 and 2. Plant communities on south aspects probably have changed little since the era of fire exclusion began, with some in-growth of Oregon white oak and ponderosa pine. Major changes have occurred along the ridges as forest canopies have closed and the grass dominated understory gave way to one dominated by forbs and shrubs.

Fire behavior prior to white settlement consisted primarily of low flame lenghts and highly variable rates-of-spread. Underburning was the rule with occassional torching when fire burned into conifer regeneration patches. Expected fire behavior today has changed little on south aspects but greatly on ridgetops. Stand-replacing crown fire is much more likely due to closed canopies and extensive ladder fuels, particularly in Fire Group 2.

FIRE GROUP 3

Fire Group 3 occupies most of the National Forest portion of Miles creeks. It extends east of the National Forest boundary on north aspects in Eightmile and Fifteenmile creeks and may in Ramsey Creek. It stops just west of the National Forest boundary in Fivemile Creek.

Prior to white settlement Fire Group 3 was characterized by highly variable stand conditions. In general, stands were probably less dense than present and dominated by early seral species, such as ponderosa pine and Douglas-fir. Oregon white oak was probably present in the more open and younger stands within this group. Understories probably ranged from grass dominated to shrub dominated to forb dominated.

Fire Group 3 represents the transition between a dominance by underburning to one of crown fire. As such, "typical" presettlement fire behavior is difficult to characterize. In general, the eastern portion of Fire Group 3 probably underburned more often than crowned while the opposite was true in the western portion. Fire behavior for each fire depended very heavily on several factors, such as time since the last fire, understory composition, extent of ladder fuels, dominant conifer species present in both the overstory and understory, and weather.

Fire Group 3 probably has had relatively high plant species and stand structural diversity when considered over the landscape, although diversity may have been low in any given stand. The group's resilience to change was also probably variable. Frequent, low intensity fire would serve as an agent of stability while less frequent and higher intensity fire would serve as an agent of instability.

Currently, Fire Group 3 shows high species diversity and low stand structural diversity. In the drier portion of this group extensive ladder fuels, changing species composition in both the overstory and understory, deep buildups of duff and bark around large ponderosa pines, and increasing fuel loadings places the entire Group 3 at high risk of crown fire. Large fires will tend to burn much "hotter" with prolonged smoldering, placing the large diameter ponderosa pines at high risk of direct mortality from burning.

FIRE GROUP 4

Fire Group 4 lies in a narrow band near the headwaters of the Miles creeks basin. It extends far to the east in narrow riparian areas along the main perenniel streams. Fire Group 4 can lie immediately adjacent to Fire Group 1 in the tight canyons typical of this watershed.

This group contains the "classic" mixed conifer forest, supporting a wide variety of tree species even in early successional stands. Tree species diversity decreases through time in this group, rather than increasing as in Fire Groups 2 and 3. Shrubs and forbs dominate the understory with little or no grass.

Understory plant species diversity is initially very high after the stand replacing event and decreases into the mid-successional stages. Dense closed canopy conditions remove some species from the stand and greatly reduces vegetative ground cover. Several stands in Miles creek have almost no understory vegetation, instead containing moderate to heavy loadings of downed woody material.

Eventually the tree canopies begin to open as the stands move either into a late-successional condition or mid-successional old growth condition. Increased sunlight allows vegetation to return to the understory and species diversity probably increases again. Fuel loadings also begin a dramatic increase as suppressed trees die and begin to fall over. The probability of a stand replacing event begins to increase rapidly as the stands move into the late-successional stages.

Stand conditions and typical fire behavior over the landscape probably have not changed much since the era of fire exclusion began. Typical fire behavior then and now was of mostly stand-replacing crown fire that covered several hundred to several thousand acres per event.

FIRE GROUP 5

Fire Group 5 occurs in the headwaters of Fifteenmile, Ramsey, and Eightmile creeks. Many stands in this area were misclassified into warm, moist western hemlock and Pacific silver fir plant associations. Ground truthing revealed the area so classified lies in the mountain hemlock-subalpine fir zone. Many of these plant associations have not been described.

Fire Group 5 is very similar to Fire Group 4 with a few exceptions. The cold conditions tend to result in a more open canopy structure. Understory plant species diversity may be higher throughout the life of the stand than in Fire Group 4. Even though this group occurs at the highest elevation where more lightning typically strikes, the cold climate limits the potential fire season. Fire return intervals can be significantly higher than in Fire Group 4 and the near-climax plant community can develop readily. Fire Group 5 is dominated by fire sensitive conifer species whereas Fire Group 4 tends to support more fire resistant conifer species.

Available information suggests that many stands in Fire Group 5 in Miles creeks originated approximately 100 years ago. Lodgepole pine and Engelmann spruce were the apparent dominant species. The lodgepole is now beginning to die out of these stands, and Engelmann spruce, subapline fir, mountain hemlock, and Pacific silver fir are beginning to dominate with a scattering of ponderosa pine, Douglas-fir, grand fir, and white pine.

<u>Presettlement and Early Post-settlement Landscape Patterns.</u> Fire was probably the primary shaper of landscape patterns prior to white settlement. Evidence of the early, fire-maintained patterns remained on the landscape until the

1940s and 1950s. Early reports on the Forest Reserve, grazing reports, and letters document these conditions to some extent. In addition, early maps created for use in fire control provide a coarse-scale view of vegetation and changing conditions due to fire exclusion.

The earliest depiction of presettlement conditions available at Barlow is a map prepared about 1916. This map indicates a forest containing 50-100% ponderosa pine extended nearly to the head of Eightmile, Ramsey, and Fifteenmile creeks. Although difficult to be certian, it appears this forest type covered all of Fivemile subwatershed. The brief report that accompanies this map specifically mentions an open pine forest with a grass understory that provided excellant grazing. Wildfire often burned large areas but did little damage to the pines. A letter to the Regional Forester from District Ranger Eric H. Gordan (1939) mentions that local oldtimers recall "the dependent foothill country was a wonderful virgin grassland country covered with the finest stand of bunch grass, while the forested area was much like the pure pine type of open timbered country, accessable to hacks and which except for the larger trees one could see in all directions, and that it had a fine stand of green timber feed, and that it was the policy in those days for both whites and Indians to burn fern patches, debris and other refuse, or seedlings as they camped and passed through the Mts."

The same map includes the headwaters of Eightmile, Ramsey, and Fifteenmile creeks as part of a large burn. Gordon's letter mentions a large fire that burned in 1898 between the head of Eightmile Creek and Bottle Prairie. The mapped fire may include this 1898 fire. By 1939, the burn area was heavily stocked with western larch, lodgepole pine, and "white" fir (most likely grand fir) with scattered patches of ponderosa pine.

The area mapped as ponderosa pine forest very roughly corresponds to Fire Groups 1, 2, and 3. The burn area roughly corresponds to Fire Groups 4 and 5.

<u>Landscape Patterns Since 1916.</u> By the late 1930s, extensive vegetation changes were noted throughout the mid- and lower elevations of Miles creeks on National Forest lands. Similar changes probably occurred at the same time between National Forest lands and Dufur.

In 1937 the Regional Office prepared a fuel type mapping guide. Maps were prepared sometime between 1937 and 1940 that depict the timber type, the factor contributing most to wildfire rates-of-spread, and the factor contributing most to resistance to control.

No key exists to the timber type codes, although the guide does identify some codes. Of most importance in Miles creeks are timber types 20 and 20.5. These two types represent open, parklike ponderosa pine old growth. Descriptions in th guide indicate that these types contain few, if any, snags and large logs and an understory of grass or needles, cones, and scattered brush.

Approximately one half of the National Forest lands in Miles creeks were mapped as old growth ponderosa pine (timber types 20 and 20.5) with a grass understory. The grass was the main factor in rate-of-spread. However, reproduction is listed as the main factor in resistance to control. Gordon's letter states that dense stands of young conifers had replaced most of the "green timber feed" present when the area was settled. Grazing reports of the same era mention a 60% loss of the forage base 1906, due in large part to tree regeneration replacing grass understories. These reports expected additional large losses in what grazing areas remained due to continuing conifer reproduction.

Currently, pine-oak overstories with grass understories are become restricted to very harsh sites on National Forest lands. This community type is more extensive between the National Forest and Dufur, but stand densities are probably greater than typical prior to 1850.

Both stand densities and species compositions have changed at mid- and lower elevation stands on National Forest lands. Closed canopy forests have replaced more open forests. Douglas-fir and grand fir are replacing ponderosa pine and Oregon white oak, except on the harshest sites. Shrubs and forbs have replaced most of the grasses. Woody fuels and duff depth have increased. Stands are vertically integrated instead of stratified. The area has all but lost the open-parklike stands of ponderosa pine and ponderosa pine-Oregon white oak old growth that characterized this area prior to 1906. Fire Group 1 on ridgetops, Fire Group 2, and the drier portion of Fire Group 3 are probably outside their range of natural conditions for species composition, stand structures, and potentail fire behavior.

Stand densities and species compositions probably lie within their range of natural conditions in the moister portion of Fire Group 3, Fire Group 4, and Fire Group 5. Fire return intervals are long enough that late-successional communities have a chance to develop. In Fire Group 5, near-climax conditions normally are possible before the next major disturbance.

Fire/Fuels Management Opportunties and Concerns

Opportunities.

1. Reintroduce fire into Fire Groups 1, 2, and the drier portions of Fire Group 3 on a large scale. The district has accomplished some natural fuels underburning, but has not obtained funding for environmental analysis, burning operations, and monitoring since 1992.

2. Continue to explore new fuel treatment methods that reduce wildfire hazard, meet other resource objectives, and are cost effective.

Concerns.

FIRE SUPPRESSION INFRASTRUCTURE AND PREATTACK PLANNING

1. What type of maintenance or redesign work is needed on water sources to comply with the Aquatic Conservation Strategy objectives? Should use of any current water sources be discontinued? What opportunities may exist for developing new water sources?

2. Where can we consider constructing helispots during fire emergencies? Alternatively, what areas should we avoid?

3. Where might we be able to locate fire camps or spike camps and what areas should we avoid?

4. What are appropriate guidelines for initial attack and extended attack tactics, particularly in the late-successional reserve and riparian reserves? What guidelines should resource advisors follow when providing input on daily tactical planning on project fires?

PRESCRIBED NATURAL FIRE (PNF)

The district will conduct wilderness fire planning for the Badger Wilderness, which includes the headwaters of Fifteenmile Creek and would like to consider areas outside the wilderness in a PNF program that lie within Miles creek. The Forest Plan currently does not allow for PNF in the allocations present in Miles creek. The President's Forest Plan does allow for PNF in late-successional and riparian reserves.

1. Assuming the President's Forest Plan is implemented, which plan would take precidence in allowing PNF without further NEPA documentation (no further documentation is needed where PNF is permitted).

2. What areas in Miles creeks should we consider for PNF and what areas should we exclude?

3. What burning prescription guidelines should we follow in Miles creeks?

NATURAL FUELS UNDERBURNING

1. Where is prescribed underburning of natural fuels appropriate and where not?

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9/9/94

I. Mile Creeks Watershed Hillslope Processes

This report was prepared utilizing and incorporating information from three technical reports prepared for the Mile Creeks Watershed Analysis: (1) Road Related Sediment: Preliminary Evaluation. R.Piehl, D.Smith, and T.DeRoo, 7/13/94.; (2) Hillslope Processes. J.Dodd, 6/13/94; and (3) Landslide Analysis. T.Deroo and D.Smith, 6/23/94.

A. Assumptions and Analysis-Specific Methods

1. Surface Soil Erosion and Sediment Delivery

a. Assumptions:

Based on local knowledge and observation, it was assumed that two primary activities were causing surface erosion: (1) timber management activities and associated fuel management activities; and (2) road-related use and off-highway vehicle (OHV) use.

b. Analysis-Specific Methods:

The following methods were employed to estimate surface soil erosion and sediment delivery potential.

1) Timber and Fuel Management Activities (refer to J.Dodd, Hillslope Processes Report):

First, the Mt. Hood NF Soil Resource Inventory (SRI) unit potential surface erosion ratings were validated by slope, surface texture, and aspect (recovery rates). This resulted in a GIS map identifying high, moderate, and low soil erosion potential map units (Figure 1 -Soil Erosion Potential Map).

Second, disturbance types were identified by harvest and fuel management activity (Figure 2 - Harvest Type Map) with an associated disturbance coefficient:

Tractor harvest = moderate
Tractor harvest + machine pile = high
Cable or skyline = low
Underburn = low

The product was a GIS map of disturbance area by rating class (Figure 3 - Soil Erosion Risk Map).

Figure 1 - Soil Erosion Potential Map

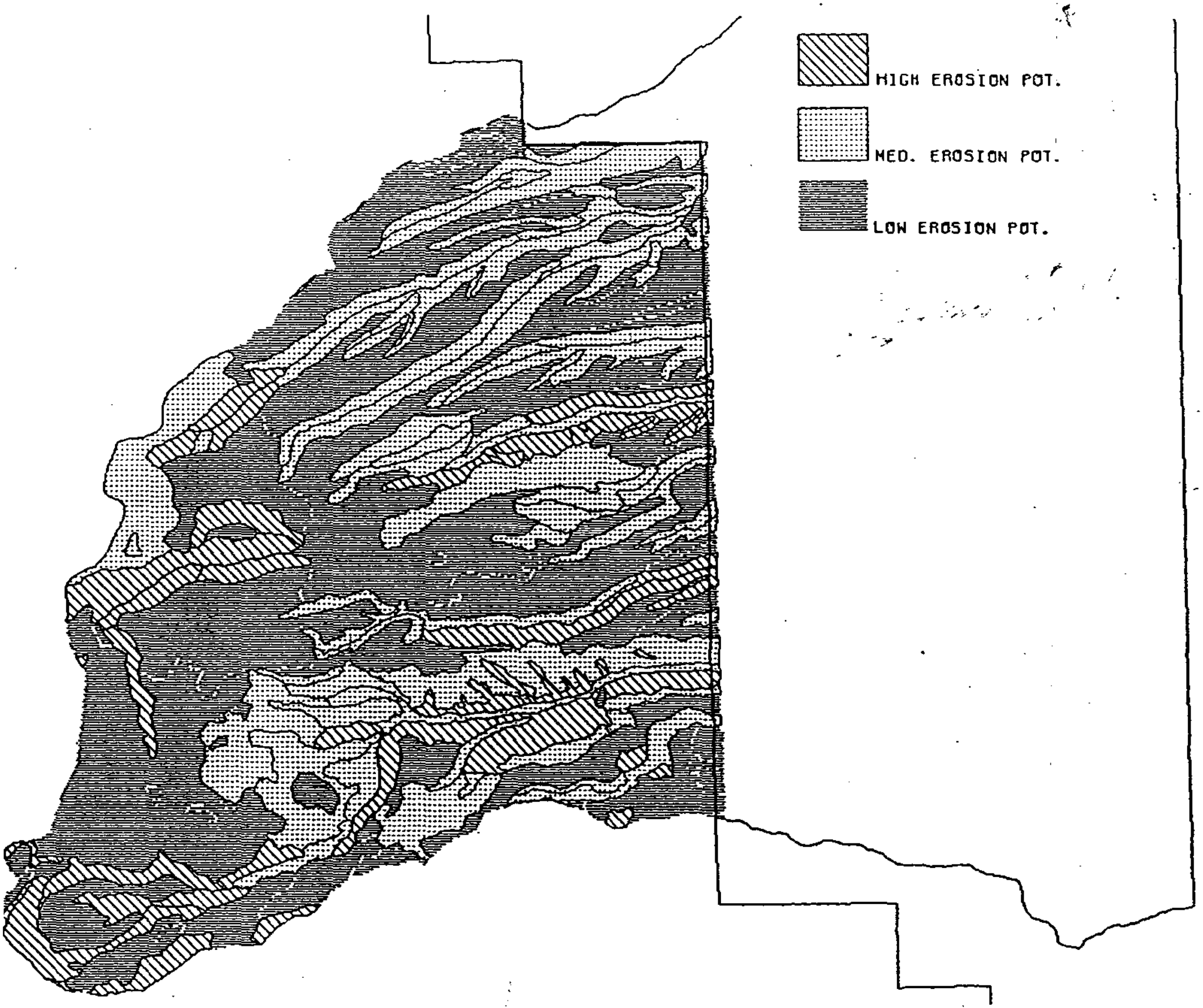


Figure 2 - Harvest Type Map

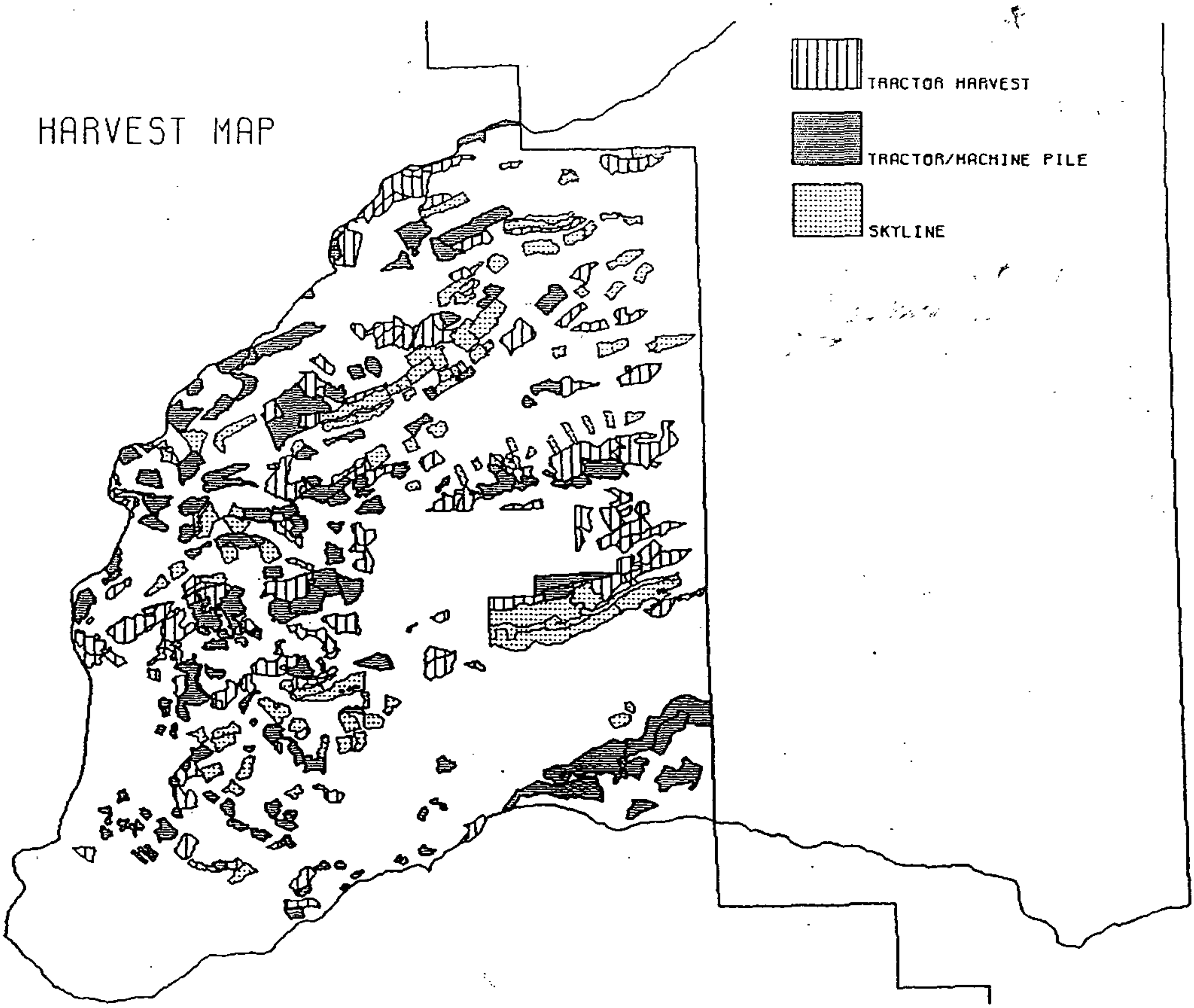
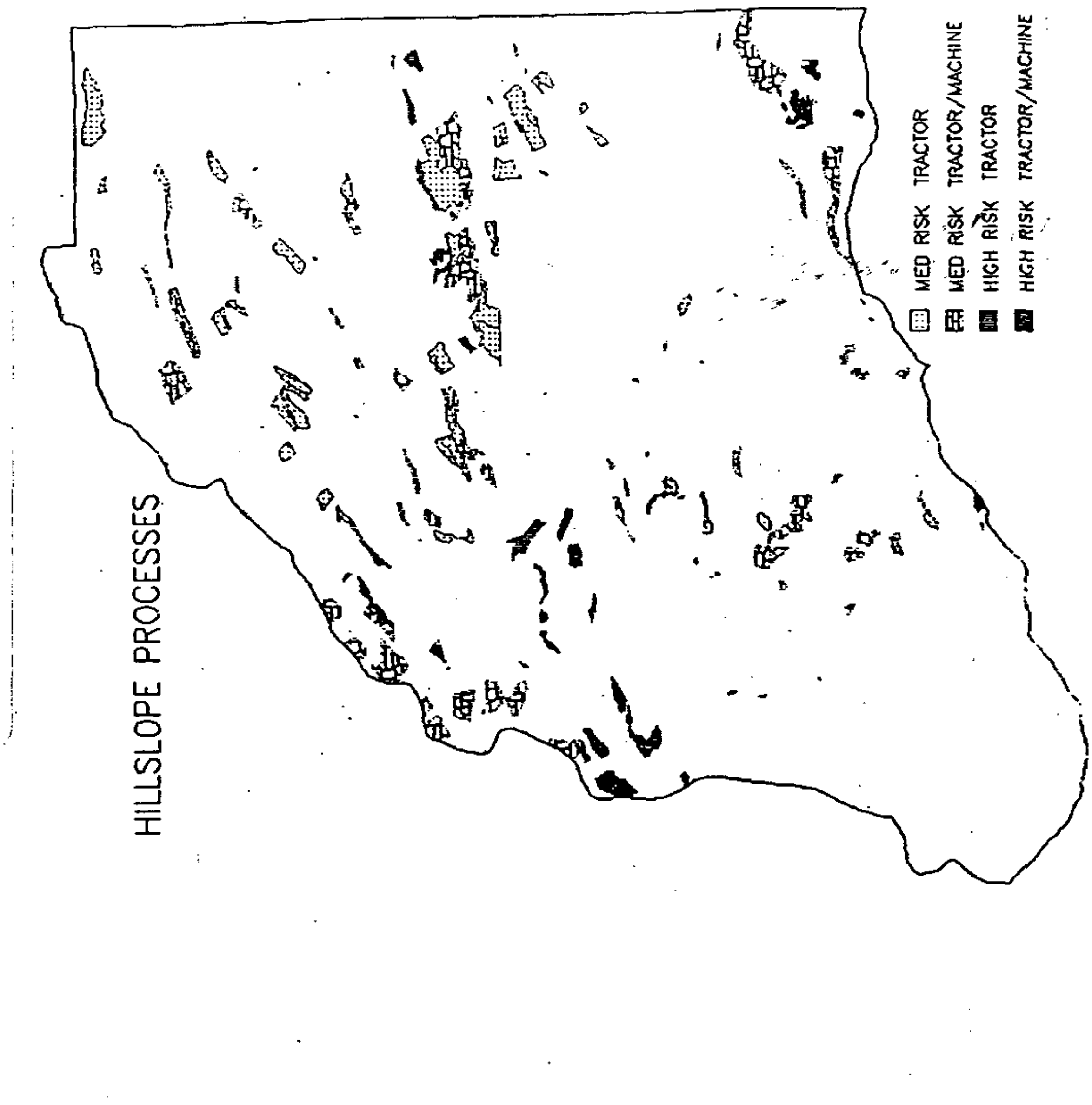


Figure 3 - Soil Erosion Risk Map



Third, delivery of sediment was estimated by combining distance to stream, slope gradient (SRI unit) and disturbance class. The product is a matrix of stream miles by erosion hazard class and disturbance class:

Erosion Hazard

Disturbance	H	M	L
H	0.33	2.06	3.22
M	0.25	2.93	3.69
L	2.20	7.79	1.67

2) Road-related Use and Off-highway Vehicle Use:

a) Road-related Sediment: Road-related sediment delivery potential was estimated by combining road and stream intersections, 200 ft. stream buffers (TFW Surface Erosion Module), native-surfaced and surfaced roads, and soil erosion potential (SRI). This resulted in stratifying sediment delivery into high, medium, low, and very low ratings for roads within a 200 ft. stream buffer, and roads beyond a 200 ft. buffer. The miles of each category were then derived to determine the overall potential for roads to deliver sediment in this watershed (refer to Piehl, et al, Road Related Sediment report).

b) OHV-related Sediment: First, sediment delivery to key sample points in subwatersheds was determined using the Pebble Count Procedure (Wolman, 1954). Second, miles of OHV road and trail use by subwatershed Pebble Count sample areas was measured. Finally, the significance of OHV road and trail sediment delivery was determined by running a regression analysis with other sediment contributing management activity factors.

2. Soil Productivity

a. Assumptions

The primary factor in lowering soil productivity and quality has been disturbance, namely compaction from timber harvest and associated activities. Domestic livestock grazing may have also played a role in creating compacted soil conditions.

b. Analysis-Specific Methods

Three factors were examined to deternmine significant detrimental soil quality conditions in the Mile Creeks watershed: natural disturbance impacts, management disturbances, and soil resiliency or the ability to recover from compaction (refer to J.Dodd, Soils report).

1) Three natural disturbance impacts were considered:

a) Fire, which varies with intensity, frequency, and location on the landscape can cause loss of organic matter and nutrients, but it also facilitates nutrient cycling. Fire can also accelerate erosion and can affect soil organisms.

b) Windthrow is present across the landscape and can be localized or widespread depending on a variety of factors.

c) High intensity precipitation events can be a natural source of surface soil disturbance.

2) Management related disturbances include compaction, prescribed fire, and fire exclusion.

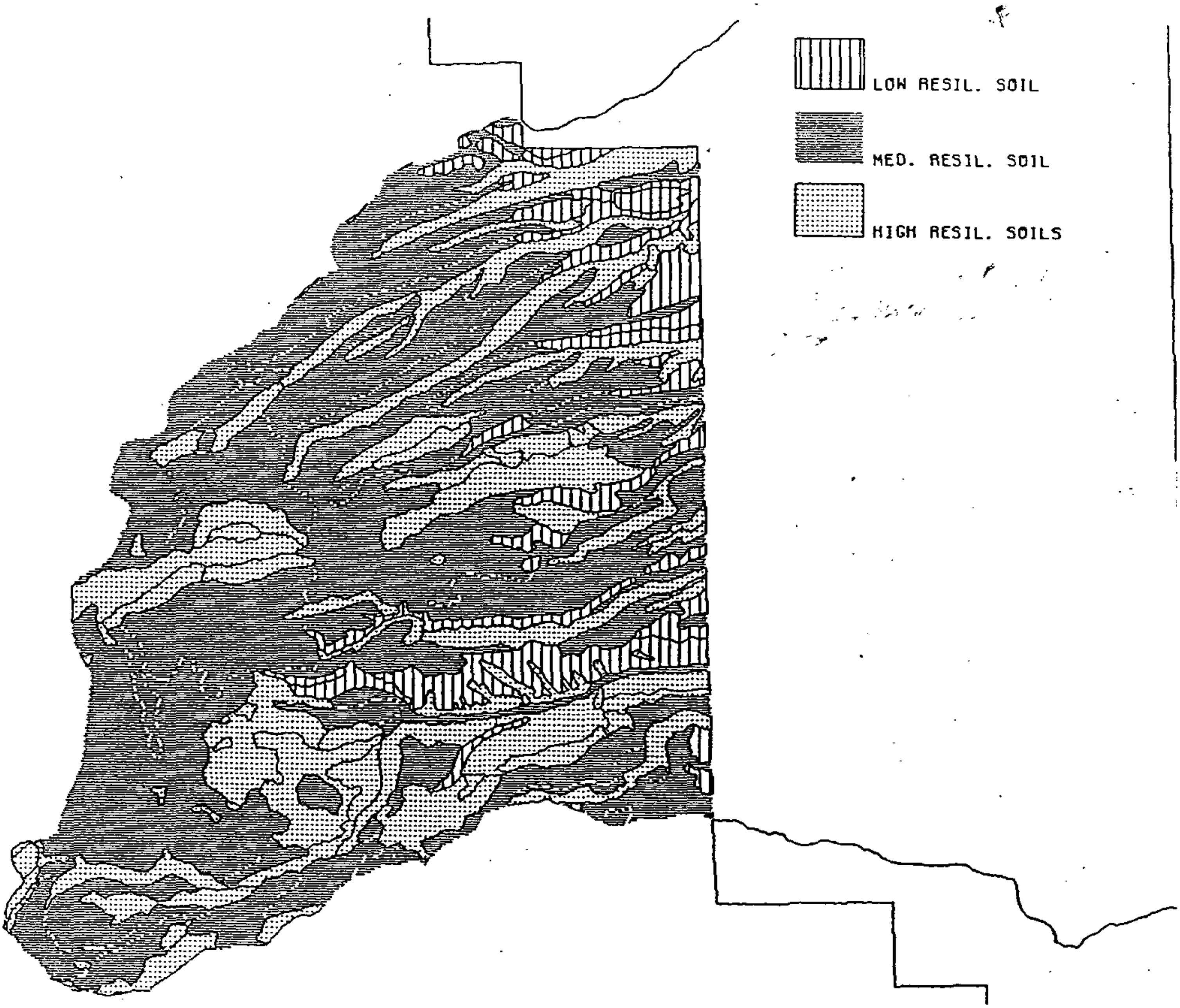
3) Soil resiliency or the ability to recover from disturbance is primarily affected by aspect and the soil moisture regime.

Other assumptions considered include:

- Compaction hazard is similar across soil types.
- Soils are not recovered from past compaction.
- multiple entry areas were incorporated.

To determine timber harvest disturbance effects, soil resiliency by SRI type (Figure 4 - Soil Resiliency Map) was overlayed with the disturbance activity map to generate acres by resiliency class. These acres were then multiplied by a percentage activity area compacted factor developed from ground monitoring results to attain total compacted acres.

Figure 4 - Soil Resiliency Map



B. Range of Natural Conditions in the Watershed

The following discussion refers to the pre-European settlement time period.

1. Processes affecting sediment production and delivery to streams

Four primary factors affect erosion and sedimentation delivery in the Mile Creeks Watershed: geology, landforms, landslides, and soils. Of these, the combination of geology, landforms and soils appear to be the most significant, with the influence of soils being the most pronounced.

a. Geology

1) Description:

Seven geologic units have been identified during previous geologic mapping of the National Forest portion of the Mile Creeks watershed (see hard copy map in analysis file). The units are briefly described below, from youngest in age to oldest in age.

Qg — GLACIAL DEPOSITS: glacial till deposits in the upper basins of Eightmile Creek and Fifteenmile Creek.

QTb — BASALTIC ANDESITE AND BASALT: lava flows from vents near Dog River Springs and Frailey Point. Occurs along the upper slopes along the west side of the watershed and caps the ridge between Eightmile and Ramsey Creeks.

QTs — SEDIMENTARY ROCKS AND DEPOSITS: poorly indurated to unconsolidated sand and gravel deposits. Occurs as small deposits near the northeast corner of the watershed area.

Taft — *ANDESITE OF FIFTEENMILE CREEK:* andesite unit that forms much of the upper western valley slopes and ridge tops near Fifteenmile Creek.

Tlma — ANDESITE: andesite lava flows that form the upper slopes of Lookout Mountain, near the southwest corner of the watershed.

Td — DALLES FORMATION: tuff breccias, volcanic sandstones, and volcanic conglomerates. This is the largest single unit within the watershed. Forms most of the lower valley slopes in all the major drainages.

Tafv — ANDESITE OF FIVEMILE BUTTE: andesite flows near Fivemile Butte and capping the ridges on either side of lower Eightmile Creek.

The geology units can be grouped into three general categories:

resistant rock: QTb, Tlma, Taft, Tafv.

weak rock: Td.

unconsolidated material: Qg, QTs.

2) Processes:

The natural geological processes of mountain building and erosion formed the geologic structure of the area.

b. Landforms

1) Description:

The National Forest portion of the Miles Creek watershed contains nine subparallel drainages that flow to the northeast or east. The creeks have carved valleys into an older, generally flat erosion surface that slopes gently to the east. The result is a series of steep-walled canyons separated by flat-topped ridges, all oriented in an east-west direction. The western headwater areas of the larger drainages are gently- to moderately-sloped uplands, with the exception of the steep, north-east facing slopes of Lookout Mountain located in the Fifteen-mile subwatershed. This area on Lookout Mountain is the only part of the watershed to have been recently glaciated.

The watershed was divided into five general landform types based primarily on slope angle and resistance to weathering of the underlying geologic unit:

GLACIATED VALLEYS (GV): valley floor and lower side slopes in the headwaters area of Eightmile and Fifteenmile Creeks that have been mantled with glacial till. Slopes range from 0% to about 50%, with moderately incised drainages.

RESISTANT ROCK - GENTLE SLOPES (RRGS): western uplands and some of the flat-topped central and eastern ridges. Slopes vary from 0% to 20%. This landform unit has widely spaced and only slightly incised drainages.

RESISTANT ROCK - STEEP SLOPES (RRSS): includes the upper northeast facing slopes of Lookout Mountain, the slopes around Fivemile Butte, and the upper canyon slopes of Fifteenmile Creek. Slopes range from 40% to 90%. Tributary streams within this landform are usually moderately incised.

WEAK ROCK - GENTLE SLOPES (WRGS): includes some of the flat-topped ridges in the central and eastern parts of the watershed within the National Forest. Slopes range from 0% to about 10%. There are very few streams within this landform unit.

WEAK ROCK - STEEP SLOPES (WRSS): forms most of the lower canyon slopes of the nine drainages within the National Forest. Fifteenmile Creek has the largest drainage area and the deepest and steepest canyon. Slopes range from 40% to 90%. This landform unit has moderately incised to very incised tributary streams that tend to be straight and steep.

2) Processes:

The natural erosional processes were at work to form the characteristic landforms.

c. Landslides

1) Description:

The landslide potential and relative sediment delivery rating for the landform units was evaluated by examining some aerial photos and by consulting with four people who have worked in the watershed for many years. These people were: John Dodd, Soil Scientist at Barlow Ranger District; Ken Huskey, Engineer at Hood River Ranger District; and two road maintenance personnel, Randy Brown and Roger Shute.

Miles Creek watershed has some of the most stable land within the Mt. Hood National Forest. Very few landslides or debris flows are known to have occurred within the last 10 years. Even after the 1986 storm there was little to no mass movement. Older air photos show no recent evidence of landsliding. The few small debris slides that have occurred on the steeper slopes will often not reach a drainage channel.

The watershed is in the rain shadow of Mt. Hood and the Cascade crest and only receives 25 to 45 inches of precipitation per year. About 51% of the watershed has slopes less than 30% and a low potential for any type of mass-wasting (landform units RRGS and WRGS). Since the number of developed drainages on the gentle slopes is low, the potential for sediment delivery to channels is very low for those landform units. The GV landform unit is on gentle to moderate slopes and has a low to moderate potential for small stream bank failures. Most of the RRSS landform unit is located in the topographically higher portions of the watershed and has not weathered very deeply. There are no known landslide occurences within these two units. The GV and RRSS landform units were assigned a relative sediment delivery rating of low.

The WRSS landform unit contains weak enough material and steep enough slopes to have a moderate to high potential for mass-wasting. The lack of much recent evidence for landsliding is due to the low precipitation. The landform has the appearence of being developed in the geologic past through landslide processes (gullying that undercuts tributary stream banks, resulting in debris slides and debris flows). South-facing slopes, in particular, have this appearance. An unusual very intense storm is likely to produce some small landslides that will deliver sediment to channels. This landform unit was assigned a relative sediment delivery rating of medium.

2) Processes:

Precipitation and slope appear to be the primary processes affecting landslide existence.

d. Soils

1) Description:

Generally speaking, the soils in the National Forest portion of the Mile Creeks watershed are loess (wind-blown) and volcanic ash, or basalt derived.

The loess and volcanic ash soils typically have medium to coarse textures varying depth and rock content. The erosion potential increases on steeper slopes, and the compaction hazard is generally low to moderate with slow recovery rates.

The basalt derived soils are also medium to coarse textured with high amounts of rock and generally shallow in depth. The erosion potential is severe, while the compaction hazard is low with slow recovery rates.

The soils in the agricultural low lands of the Mile Creeks watershed generally formed from loess, volcanic ash, and colluvium weathered from basalt. The soils are generally loamy of varying depth and rock content depending on the slope and position on the landscape. The valley bottoms are often deep silt loams which tend to be very erosive.

2) Processes:

The processes affecting sediment production and delivery to streams in the natural conditons were primarily environmental with some influence by past American Indian activities. These processes appeared to be a function of ground cover, and precipitation, fire, and wind events. The natural rates of erosion and sedimentation are unknown. American Indians most likely had some affect on erosion rates due to their use of fire in the landscape, but the extent and intensity is unknown.

2. Processes affecting soil productivity within the watershed

a. Soils

1) Description:

Refer to soils description in Section B.1.d. above.

2) Processes:

The processes affecting soil productivity within the watershed were most likely tied to organic matter inputs and nutrient cycling. Again, the rates are unknown, and the use of fire by American Indians and their encampments probably played a role in soil productivity.

C. Management Activities Affecting Natural Processes and Flows

1. How has roading, OHV use, timber harvest, and altered fire regimes affected the production and delivery of sediment?

a. Roading and OHV Use:

Roading and OHV use affect sediment production through erosion of the cutbanks, fillslopes, and the road and trail surface. Delivery is affected by management of the surface water, principally by ditching and proximity to stream crossings.

1) Roading:

Of the approximate 175 miles of roads in the Mile Creeks watershed about 25 miles occur within the 200 ft stream buffer. Of these, about 1 mile or less than 4% are high erosion potential, 14 miles or 56% are medium erosion potential, and about 10 miles or about 40% are low potential respectively.

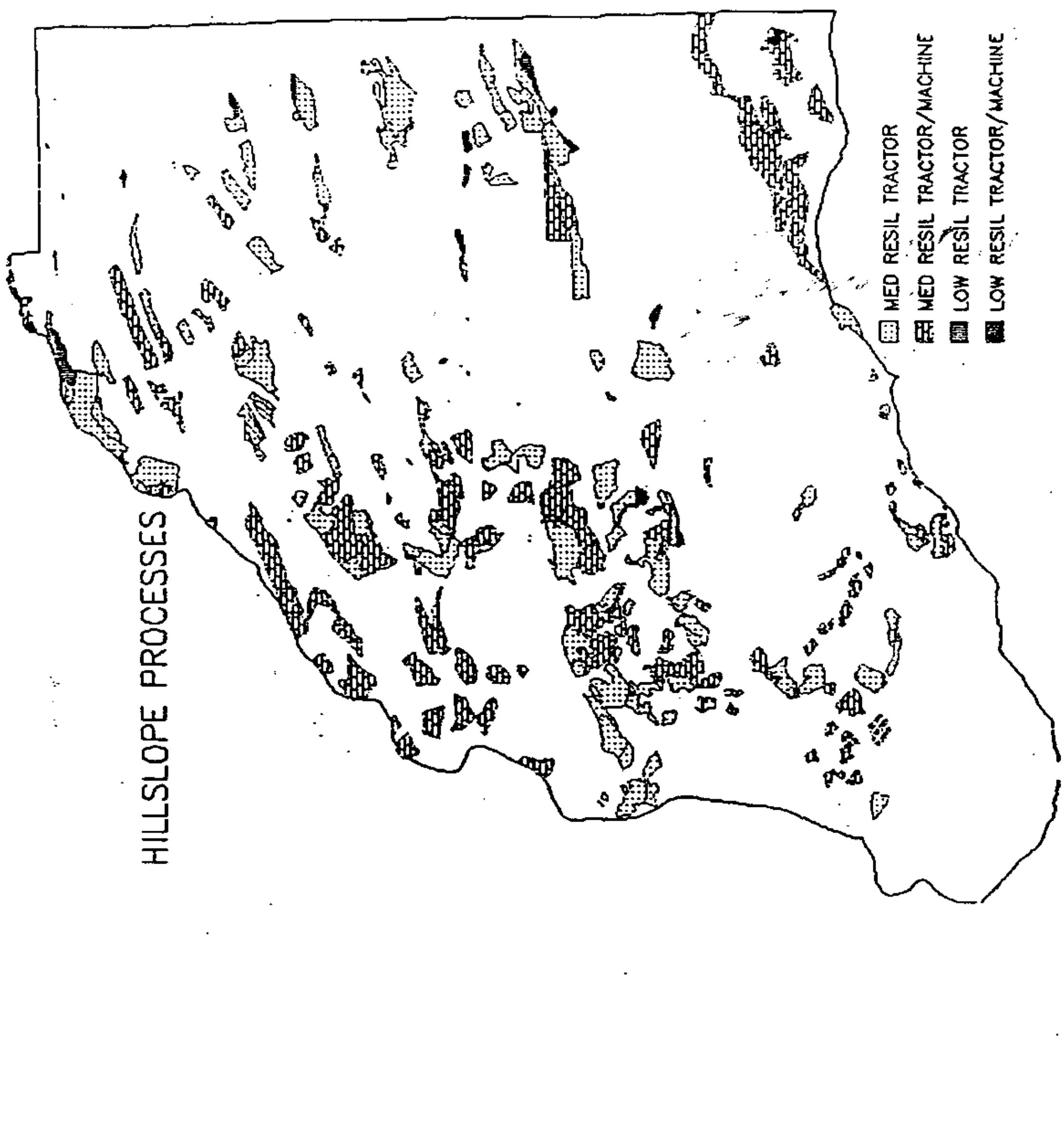
2) OHV Use:

The regression analysis described earlier indicated no significant relationship between OHV use and sediment delivery at the sample points. However, the pebble count data does indicate possible point source sediment contributions from heavy use areas.

b. Timber Harvest:

The harvest type map, erosion hazard and stream location shows that most of the high and moderate disturbance has occurred in the headwater areas, while most of the low disturbance (i.e. skyline and cable) has occurred lower down in the National Forest portion of the drainage (Figure 5 - Soil Resiliency Risk Map). This makes sense since the gentler ground is located in the headwaters while the steeper skyline ground is located in the more incised section of the watershed.

Figure 5 - Soil Resiliency Risk Map



In summary, of the 135 miles of GIS mapped stream in Mile Creeks, 24 miles have had some type of adjacent harvest.

The following matrix shows acres of all harvested land (disturbance) by erosion hazard:

Erosion Hazard

Disturbance	H	M	L
H	164	906	2118
M	178	743	2153
L	571	1174	445

c. Altered Fire Regimes:

The altered fire regime has changed the potential to produce sediment. Due to the fuel build up from fire exclusion, the next large fire will likely be a high intensity, catestrophic, crown burning event as opposed to the low intensity ground fires of the past. The resulting loss of ground cover and organic matter from a catestrophic fire greatly increases the potential for erosion and subsequent sediment delivery to the creeks.

2. How has Timber Harvest and Altered Fire Regimes Affected Soil Productivity?

a. Timber Harvest:

The primary disturbance has been from timber harvest and associated activities. Total GIS acreage by resiliency class in the watershed is 3,850 acres of low, 19,825 of medium, and 11,168 acres of high (Figure 4 - Soil Resiliency Map). Overlaying the harvest type with resiliency resulted in the following (Figure 5 - Soil Resiliency Risk Map):

	Low Resil	Med Resil		
Tractor and pile	15	2465	X 21% =	521 acres
Tractor only	133	2195	X 12% =	279 acres
Total acres				800

Percentage coefficients are from the averages of on the ground monitoring for several harvest units in the watershed. According to the GIS study, approximately 800 acres are in a compacted condition within the watershed. This does not include system roads, campgrounds, or remnant compaction that still may be present from old grazing allotments.

b. Altered Fire Regimes:

As with the discussion above on affects of altered fire regime on soil erosion potential, a catestrophic crown fire would most likely consume most of the vegetation including the large wood component, thereby disrupting the nutrient cycling process and facilitating additional erosion. This would result in decreased soil productivity.

3. Conclusions:

The following conclusions can be drawn from the preceding analysis:

a. Pre-activity monitoring to determine existing soil conditions is a critical component of project planning. This is particularly true in area that have had repeated entries or management activities in the past.

b. The soils in the lower Fivemile, Eightmile and Fifteenmile subwatersheds are very sensitive to surface vegetation and ground disturbing management activity. The south slopes are often compacted from past grazing, and suffer from a slow capability to recover (resiliency), and the north slopes are highly erosive. The combination of these two conditions create a landscape that has endured past soil productivity degradation, and is sensitive to future disturbance.

c. Approximately 15 miles of road occur on high and medium erosion potential soils within 200 ft of streams. These are of primary concern for sediment delivery to the stream system.

d. The OHV use is occurring on non-system, user-built trails and non-system roads that were not designed for that use. Consequently, the use is largely unmanaged and non-sustainable. These areas are another primary concern for sediment delivery to the stream systems.

e. Fire exclusion and subsequent changes in the fire regime have created a situation where catestrophic crown fire is likely which would result in further soil erosion and soil productivity losses.

D. Future trends in hillslope process effects

1. Surface Soil Erosion and Sediment Delivery:

Given the appropriate combination of improved management practices, restoration activities, and monitoring, the trend should be to reduce soil erosion, and the production and delivery of sediment to streams.

2. Soil Productivity:

Given an effective pre-activity monitoring program to identify existing soil conditions, improved project planning and implementation to reduce site impacts, and restoration of existing impacted areas, soil productivity should improve over time.

Appendix C
Peak Streamflows:

Tables and Figures

I. Introduction:

The method used for the assessment of changes in peak streamflows was developed for the Washington Department of Natural Resources Watershed Analysis Manual and 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 peak flows during rain-on snow events is the focus of the assessment.

The hydrologic performance of forested watersheds is affected by three broad Classes of processes (Washington Department of Natural Resources Watershed Analysis Manual).

1. Delivery of water to the forest (determined by rates of condensation and precipitation, largely controlled by climate)

2. Delivery of water to the forest floor (determined by interception and snowmelt, which are largely controlled by vegetation)

3. Delivery of water to streams (determined by the balance between precipitation, evapotranspiration, and runoff generated processes, the later involving several surface and subsurface pathways)

Forest Practices can alter each of these processes in several ways. Opening of the canopy by timber harvest and roads can cause greater snow accumulation in the winter (because snow on the ground is less affected by interstorm melt than is snow in the canopy) or increased snowmelt in spring (by removal of overstory shade); openings also allow accelerated melt rates, due to increased radiation and wind-assisted flux of sensible and latent heat to the snowpack (DNR Watershed Analysis Manual).

Research has shown that more snow accumulates in openings than under canopies and that during rain on snow events the runoff from snow accumulations in openings is faster than from canopied areas. Channel degradation may result as increased peak flows scour, cut, or widen the stream bed. Water quality is degraded by these processes which provide increased sediment to the stream. Therefore clearcut harvesting can lead to increased peak flows (Christner & Harr).

The method used for the assessment of changes in peak streamflows was developed for the Washington Department of Natural Resources Watershed Analysis Manual and 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 peak flows during rain-on snow events is the focus of the assessment.

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 (B. Wemple, 1994). 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.

II. Washington Forest Practices Watershed Analysis Manual Hydrologic Change Module

This method involves establishing:

1. The current watershed conditions influencing hydrologic response to landuse and historic floods;
2. Historic trends of floods in the watershed indicating trends with past land use effects;
3. The change in water available for runoff with change in forest vegetative cover;
4. The change in flood peaks associated with changes in available water;
5. The potential effects on public resources of changes in flood peaks.

The current watershed condition is established by identifying the general watershed characteristics that are likely to significantly affect storm runoff. This involves delineating the watershed into 4 precipitation zones (highland, snow dominated, rain on snow, and rain dominated) and determining the vegetative cover within these three zones.

Historic patterns of flooding and disturbance in the watershed are established by using records from available flow gages within the watershed. If flow gages are not available within the watershed being analyzed records from appropriate watersheds nearby may be used. If no flow records are available Regional flood-frequency regression equations developed by the USGS are used. For this analysis it is assumed that the historic patterns of flooding occurred under hydrologically mature conditions (unless evidence indicates otherwise).

Water Available for Runoff (WAR) is developed by assessing the processes that affect runoff including (1) storm rainfall, (2) snow accumulation, (3) snow melt; and the processes that generate flood flows as function of rainfall including (4) prediction of flood hydrographs and flood frequency analysis.

The assessment of WAR begins with establishing the baseline precipitation amounts associated with storm events with recurrence intervals varying from 2 to 100 years. Snow accumulation for the watershed is then determined as a function of elevation and forest cover and snow melt for the watershed is determined as a function of wind speed, temperature, elevation and forest cover (snow accumulation and melt are calculated for current and hydrologically mature conditions). Snow accumulation and melt are estimated for average rain on snow conditions and unusual conditions (i.e. deeper snowpack, warmer and windier conditions). The additional water generated from snow as a function of forest cover is added to the baseline estimates of precipitation to determine the WAR for each hydrologic analysis unit for each combination of storm intensity, vegetative cover condition, and recurrence interval.

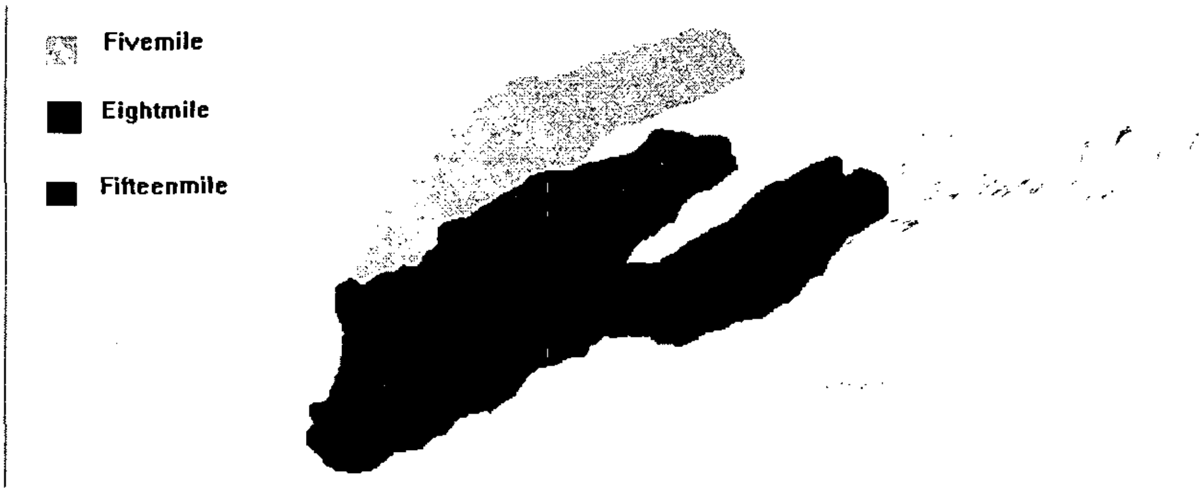
Storm peak flows are generated based on a relationship between runoff (WAR) and discharge (annual peak flow). USGS regional rainfall/flood peak equations are used with simulated values of WAR to determine peaks with recurrence intervals ranging from 2 to 100 years. Flood frequency curves between existing and hydrologically mature forest are then compared.

Increases in peak streamflows are then assessed for their influence on beneficial uses within the hydrologic analysis units. This may involve assessing changes due to increased flood stage or changes in bedload movement associated with the altered hydrologic regime.

A. Mile Creeks:

The peak flow analysis for Mile Creeks was completed on the three major subwatersheds (Fifteenmile, Eightmile and Fivemile). These subwatersheds were delineated to a logical watershed break which included private land outside the Forest Boundary. Fifteenmile include the following six field watersheds: Fifteenmile, Ramsey, Fret and Cedar. Eightmile includes: Eightmile, Rail Hollow and Hesslan. Fivemile includes: North Fork Fivemile, South Fork Fivemile, and Middle Fork Fivemile. Larch Creek was not included in this analysis because of it's small size (1384 acres) within the National Forest Boundary and the inability to merge this sixth field watershed with Fifteenmile subwatershed without overly enlarging the analysis area (the confluence of Fifteenmile Creek and Larch Creek is located near Dufur).

Figure 1. Subwatersheds Mile Creeks Watershed.



1. Current Watershed Condition:

The current watershed condition was established using a modified SCCA (Species and Community Conservation Analysis vegetative database which is rasterized in the form of 100 meter square pixels) to determine basin acreage by precipitation zone and hydrologic maturity (based on canopy closure) within each precipitation zone.

Figure 2. Precipitation Zones Mile Creeks Watershed

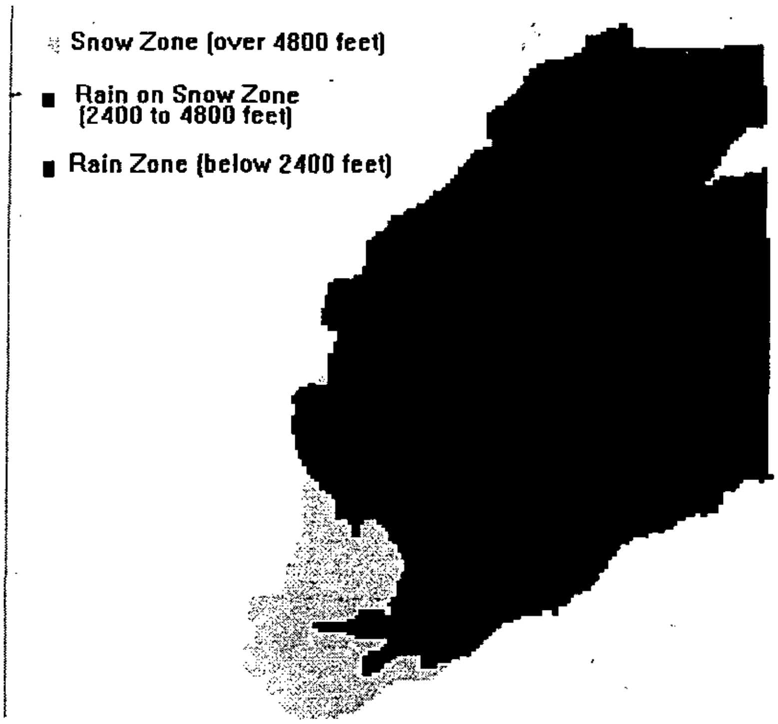


Table 1. Hydrologic Recovery by Precipitation Zone (within the Forest Boundary)

Subwatershed	Hydrologic Recovery Status	Acres in Rain Dominated Zone (<2400 feet)	Acres in Rain on Snow Zone (2400 to 4800 feet)	Acres in Snow Dominated Zone (>4800 feet)	Total acres
Fivemile	Recovered	20	2837	0	2857
Eightmile	Recovered	5	3998	830	4833
Fifteenmile	Recovered	0	3855	1619	5474
Fivemile	Intermediate	47	5896	0	5943
Eightmile	Intermediate	0	4694	148	4842
Fifteenmile	Intermediate	0	6625	801	7426
Fivemile	Unrecovered	0	383	12	395
Eightmile	Unrecovered	0	469	10	479
Fifteenmile	Unrecovered	0	591	37	628
Recovered - Greater than 70% Canopy Closure					
Intermediate - Between 10% and 70% Canopy Closure					
Unrecovered - Less than 10% Canopy Closure					

Figure 3. Cover Classes Mile Creeks Watershed

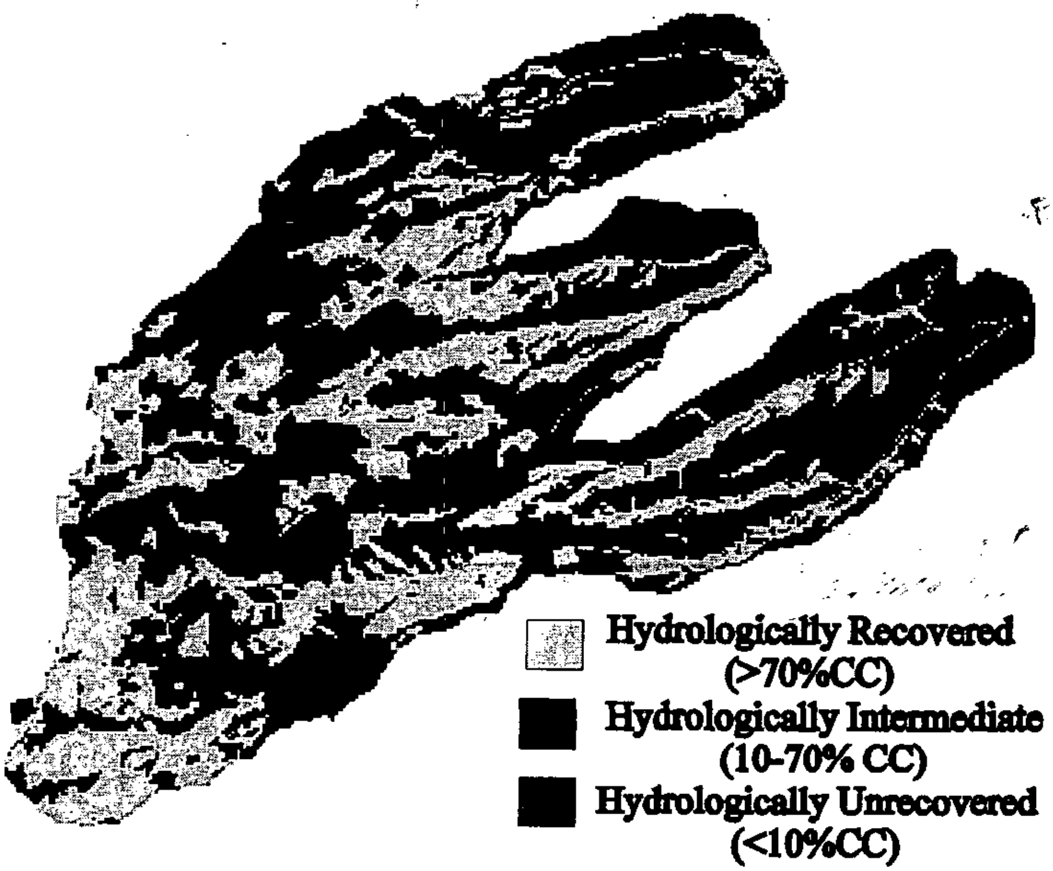


Table 2. Hydrologic Recovery Lands Outside the Forest Service Boundary

Subwatershed	Hydrologic Recovery Status	Total acres
Fivemile	Recovered	1865
Eightmile	Recovered	929
Fifteenmile	Recovered	5490
Fivemile	Intermediate	973
Eightmile	Intermediate	929
Fifteenmile	Intermediate	2305
Fivemile	Unrecovered	499
Eightmile	Unrecovered	884
Fifteenmile	Unrecovered	1386

2. Water Available for Runoff (WAR)

The primary mechanism by which forest practices affect peak streamflows is alteration of snow accumulation and melt in response to forest canopy density. WAR is calculated by determining how much additional water over that generated by the precipitation event is from the melting snowpack during the rain on snow event. The U.S. Army Corps of Engineers snowmelt equation is used to determine snowmelt during rain on snow events. WAR is calculated for 2, 5, 10, 25, 50, and 100 year return interval precipitation events and two storm intensities (average and unusual) and two vegetative cover conditions (existing and hydrologically recovered). 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 in the Grand fir, Mountain Hemlock, Silver Fir and Western Hemlock plant communities; 50% canopy closure of all trees in the Pine Oak community, and; 20% canopy closure of all trees in the shrub/steppe community.

Baseline Precipitation

Baseline precipitation was determined from precipitation records from the National Weather Service station at Dufur (period of record 1944-1993). The maximum daily total for precipitation was determined for each year and a Log Pearson Type III analysis was completed on the annual data to determine the 2, 5, 10, 25, 50, and 100 year return interval precipitation amount for Dufur. Precipitation data from the Pollywog weather station (located within the analysis area) from 1987 through 1992 was used to establish a relationship between the precipitation amounts within the watershed and the data from Dufur. From this relationship the 2, 5, 10, 25, 50 and 100 year return interval precipitation amounts were determined for the analysis area.

Table 3. Precipitation amounted associated with recurrence interval

Recurrence Interval	Precipitation Amount (inches) Dufur	Precipitation Amount (inches) Pollywog
1	0.4	0.8
2	0.5	0.9
5	1.2	1.5
10	1.4	1.6
25	1.6	1.8
50	1.8	1.9
100	1.9	2.0

Snow Accumulation

Snow accumulation (in snow water equivalent from the January meaurement) was determined from manually measured snowcources within the analysis area. There are 3 manually measured snowcourses in or adjacent to the analysis area they are: Brooks Meadow (elevation 4300 feet), High Prairie (elevation 6100 feet) and Mill Creek Meadow (4400 feet). The readings from the Mill Creek Meadow site were used to characterize the snow accumulation within the watershed because the elevation of this site better characterized the watershed and the period of record was better than the site at Brooks Meadow. The average snow water equivalent for January at Mill Creek Meadow was 5.4 inches. This reading was collected in an open area so it was characterized as hydrologically immature.

Snowmelt

Snowmelt is derived using the U.S. Corps of Engineers (1956) snowmelt equations and is a function of storm temperature, windspeed and precipitation.

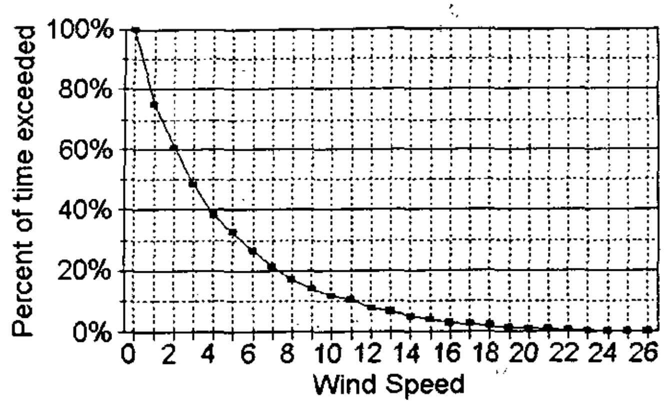
Storm Temperature.

The storm temperature was determined by examining the records from the Weather Station in Dufur looking at the maximum temperature for the months of Novemeber, December, January and February for the period of record (1944-1988). The mean high temperature was 62.5 degrees F. and the unusual high temperature (the mean temperature plus one standard deviation) was 66.8 degrees F. These temeperatures were adjusted by the mean adiabatic lapse rate of 3.6 degrees F per 1000 feet to reflect conditions in the analysis area.

Windspeed.

Windspeed was derived from the fire weather station located at Pollywog Springs within the analysis area. The daily windspeed for the months of November, December, January, and February was graphed (figure5) the windspeed that was exceeded 50% of the time was selected for the average storm and the windspeed that was exceeded 16% of the time was selected for the unusual storm. The average windspeed was determined to be 3 mph and the unusual windspeed was 8 mph. These windspeeds were assumed to be in a hydrologically mature forest.

Figure 4. Wind Frequency Pollywog Weather Station

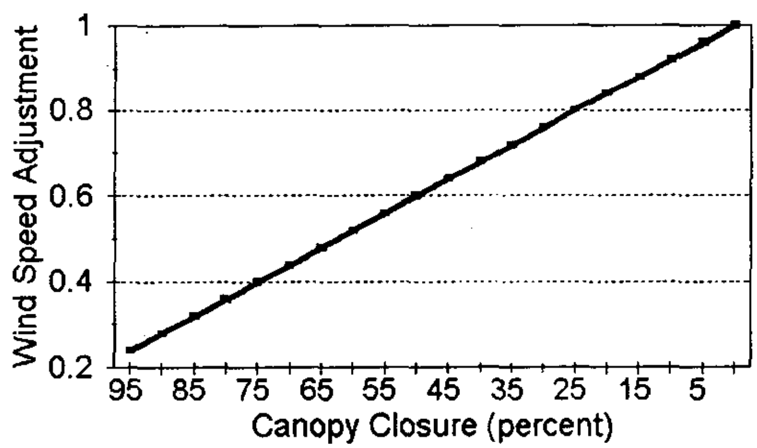


The windspeed was then modified to reflect the influence of land use/ cover type with the following equation.

adjusted wind speed = windspeed *(1-(0.8*Canopy Closure))

The influence of land/use cover type was calculated for each canopy closure class in the SCCA vegetative database. Figure 6 details the influence of canopy closure on windspeed.

Figure 5. Wind Speed Adjustment for Canopy Closure



Snowmelt Calculation. Snowmelt was calculated for each canopy closure class by using the US Army Corps of Engineers snowmelt equation (1956).

Snowmelt (24 hour period)=Storm Temperature[0.133+(0.086*Adjusted Wind Speed)+(0.0126*Precipitation)]+0.23

The only variable that changes between the existing condition and a hydrologically mature forest is adjusted wind speed that is based on canopy closure. Snowmelt is calculated for the average and unusual storms and existing and hydrologically mature forest cover conditions.

WAR is then calculated by adding calculated snowmelt from the US Corps of Engineers to the appropriate precipitation amount for each recurrence interval storm.

3. Adjusted Peak Flow Estimate

Storm runoff needs to be related to increases in WAR. This is accomplished by establishing a relationship between precipitation amounts and discharges. Precipitation amounts and discharges having the same recurrence interval (e.g. the 2 year precipitation amount and the 2 year flow) are related to establish a relationship between precipitation and discharge. ***A concern with this method is that this assumes that the flow events calculated from the USGS regional equation are from only rain events and this is not necessarily the case. For Mile Creeks we know that there were 100 year flow events in 1964 and 1974 from rain on snow events and these events were used to develop the USGS regional equations.*** Linear regression was used to establish relationships between precipitation and peak flows for Fifteenmile, Eightmile and Fivemile subwatersheds (the correlation bewteen precipitation and peakflows expressed as R^2 was above 0.82 for all the relationships).

Modified peak flows were then estimated (tables 4 - 6) by substituting the calculated WAR into the regression equation for the precipitation amount that was used to develop the relationship between precipitation and runoff. The numbers that were generated for the peak flow values appeared to be excessively high when compared to the values generated from the USGS regional equation for estimating peakflows. This was attributed to the fact that the relationship between flow and precipitation was based on flow events being generated exclusively from rainfall when at least 2 rain on snow events (1964 and 1974) were used to generate the USGS regional equation. To adjust the estimated peak flows to reflect what was felt to be occurring in the watershed the percentage increase in peak flows between the existing condition and the hydrologically mature condition was used to modify the values calculated with the USGS regional equation.

Table 4. Modified Peak Flows Fivemile Watershed

		Water Available for Runoff (inches)			Flow (cfs) from WAR			Flow Predicted (cfs)	
Recurrence Interval	Storm Intensity	Existing Condition	Hydrologically Recovered	Percent Change	Existing Conditions	Hydrologically Recovered	Percent Change	USGS Predicted	USGS Adjusted
2 years	Average	2.3	2.2	4.1	1484	1388	6.9	197	210
2 years	Unusual	3.5	3.2	9.5	2754	2434	13.2	197	222
5 years	Average	2.9	2.8	3.2	2188	2092	4.6	428	447
5 years	Unusual	4.1	3.8	7.8	3479	3159	10.1	428	471
10 years	Average	3.1	3.0	3.0	2380	2284	4.2	605	631
10 years	Unusual	4.3	4.0	7.7	3693	3362	9.8	605	665
25 years	Average	3.3	3.2	2.8	2583	2487	3.9	903	938
25 years	Unusual	4.6	4.3	6.9	4002	3682	8.7	903	981
50 years	Average	3.5	3.4	2.6	2786	2690	3.6	1141	1181
50 years	Unusual	4.8	4.5	6.6	4205	3885	8.2	1141	1235
100 years	Average	3.6	3.5	2.6	2882	2786	3.4	1471	1521
100 years	Unusual	4.9	4.6	6.6	4258	3938	8.1	1471	1590

Figure 6. Modified Peak Flows Fivemile Subwatershed

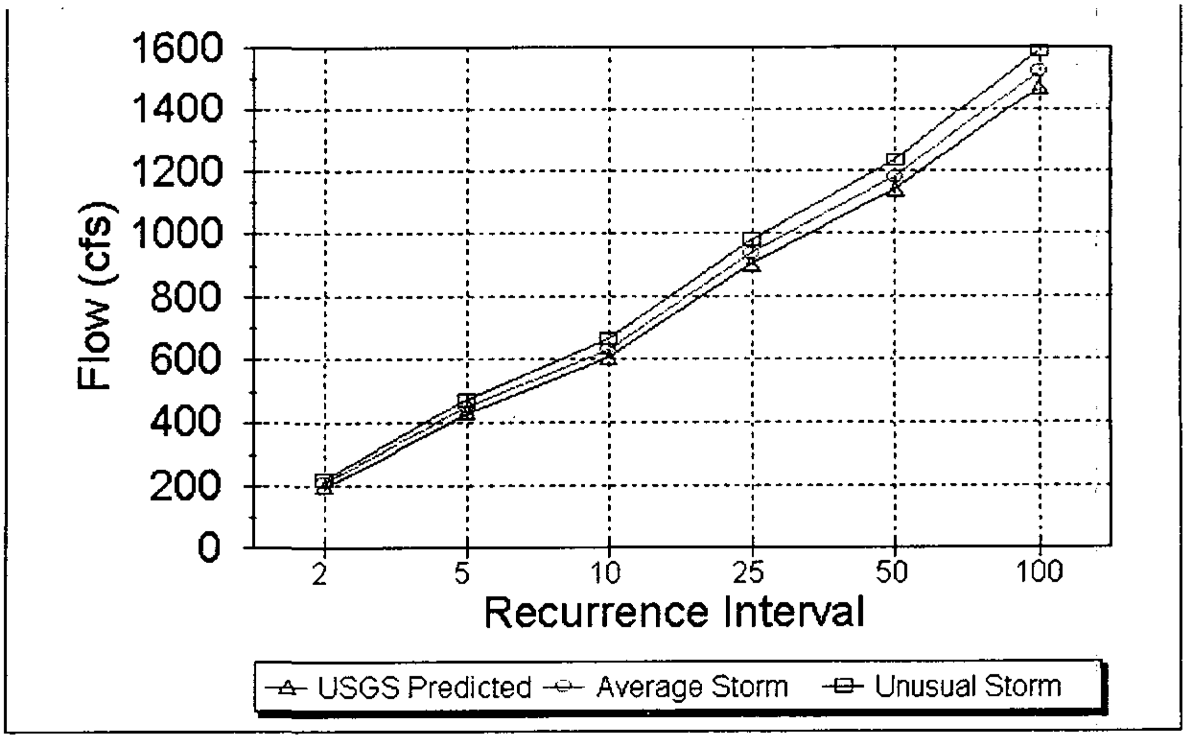


Table 5. Modified Peak Flows Eightmile Subwatershed

		Water Available for Runoff (inches)			Flow (cfs) from WAR			Flow Predicted (cfs)	
Recurrence Interval	Storm Intensity	Existing Condition	Hydrologically Recovered	Percent Change	Existing Conditions	Hydrologically Recovered	Percent Change	USGS Predicted	USGS Adjusted
2 years	Average	2.2	2.2	3.7	1507	1419	6.2	205	218
2 years	Unusual	3.4	3.1	8.0	2746	2469	11.2	205	228
5 years	Average	2.9	2.8	2.5	2226	2148	3.6	445	461
5 years	Unusual	4.0	3.8	6.6	3498	3221	8.6	445	484
10 years	Average	3.1	3.0	2.3	2436	2359	3.3	630	650
10 years	Unusual	4.2	4.0	6.0	3708	3443	7.7	630	678
25 years	Average	3.3	3.2	2.2	2646	2569	3.0	938	966
25 years	Unusual	4.5	4.3	5.6	4029	3763	7.1	938	1004
50 years	Average	3.5	3.4	2.1	2856	2779	2.8	1184	1217
50 years	Unusual	4.7	4.5	5.4	4239	3973	6.7	1183	1262
100 years	Average	3.6	3.5	2.0	2956	2878	2.7	1526	1567
100 years	Unusual	4.8	4.5	5.5	4305	4029	6.9	1525	1630

Figure 7. Modified Peak Flows Eightmile Subwatershed

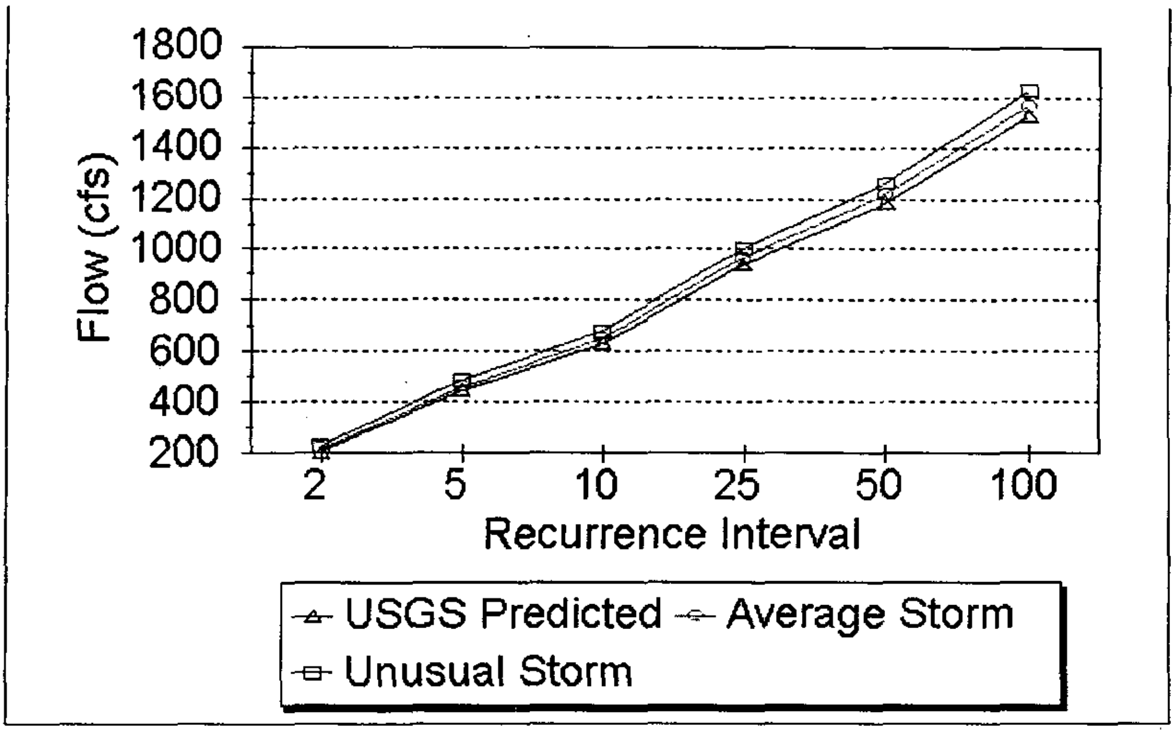
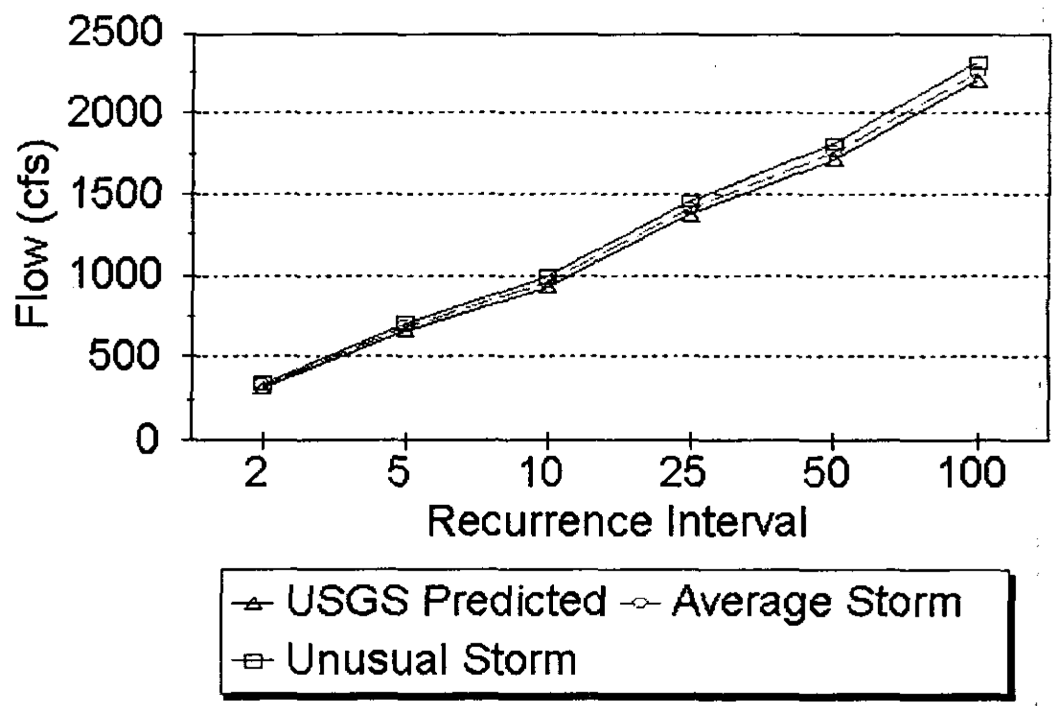


Table 6. Modified Peak Flows Fifteenmile Subwatershed

		Water Available for Runoff (inches)			Flow (cfs) from WAR			Flow Predicted (cfs)	
Recurrence Interval	Storm Intensity	Existing Condition	Hydrologically Recovered	Percent Change	Existing Conditions	Hydrologically Recovered	Percent Change	USGS Predicted	USGS Adjusted
2 years	Average	2.3	2.2	2.7	2199	2104	4.5	314	328
2 years	Unusual	3.4	3.2	6.2	4035	3719	8.5	314	341
5 years	Average	2.9	2.9	2.1	3244	3149	3.0	667	687
5 years	Unusual	4.1	3.9	5.1	5112	4795	6.6	667	711
10 years	Average	3.1	3.0	2.0	3545	3450	2.8	933	959
10 years	Unusual	4.3	4.1	5.1	5429	5096	6.5	933	994
25 years	Average	3.3	3.2	1.9	3845	3750	2.5	1375	1410
25 years	Unusual	4.6	4.4	4.8	5888	5555	6.0	1375	1458
50 years	Average	3.5	3.4	2.1	4146	4035	2.7	1717	1784
50 years	Unusual	4.8	4.6	4.6	6189	5856	5.7	1717	1815
100 years	Average	3.6	3.5	1.7	4289	4194	2.3	2201	2251
100 years	Unusual	4.8	4.6	4.3	6268	5951	5.3	2201	2318

Figure 8. Modified Peak Flows Fifteenmile Subwatershed



III. Channel Network Expansion

Introduction

Channel network expansion was analyzed on the three major subwatersheds and sixth field watersheds within the Mile Creeks Watershed (within the Forest Service Boundary). Analysis was completed only on the Forest Service land since information on stream densities was not available on private land.

A. Methodology

Channel network expansion was determined using methodology that was developed on the Siskiyou National Forest for the Elk River Watershed Analysis. Channel network expansion is calculated by counting the number of stream crossing within a watershed, multipling that distance by the distance to the first culvert up from the stream crossing and adding that distance to the stream network.

For this analysis it was assumed that the dirchlines 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.

B. Existing Condition:

Table 7. Stream Drainage Network Expansion Related to Roads.

Area	Miles of Streams	Culvert Spacing (feet)	Stream Crossings (number)	Percent Channel Expansion
Subwatershed				
Fivemile	50.33	200	31	4.5
Eightmile	51.52	200	36	5.0
Fifteenmile	79.4	200	39	3.6
Sixth Field Watershed				
Lower Fivemile	13.94	200	8	4.2
N Fork Fivemile	14.51	200	6	3.0
M Fork Fivemile	15.86	200	10	4.6
S Fork Fivemile	12.46	200	9	5.2
Eightmile	19.17	200	10	3.8
Hesslan Canyon	14.94	200	8	3.9
Fifteenmile	50.82	200	20	2.9
Ramsey	23.92	200	14	4.2
Fret	3.55	200	1	2.1
Cedar	4.97	200	4	5.7
Larch	28.97	200	0	0.0
Lower Eightmile	36.31	200	2	0.4
Area	Miles of Streams	Culvert Spacing (feet)	Stream Crossings (number)	Percent Channel Expansion
Subwatershed				
Fivemile	50.33	250	31	5.5
Eightmile	51.52	250	36	6.2
Fifteenmile	79.4	250	39	4.4
Sixth Field Watershed				
Lower Fivemile	13.94	250	8	5.2
N Fork Fivemile	14.51	250	6	3.8
M Fork Fivemile	15.86	250	10	5.6
S Fork Fivemile	12.46	250	9	6.4
Eightmile	19.17	250	10	4.7
Hesslan Canyon	14.94	250	8	4.8
Fifteenmile	50.82	250	20	3.6
Ramsey	23.92	250	14	5.3
Fret	3.55	250	1	2.6
Cedar	4.97	250	4	7.1
Larch	28.97	250	0	0.0
Lower Eightmile	36.31	250	2	0.5
Area	Miles of Streams	Culvert Spacing (feet)	Stream Crossings (number)	Percent Channel Expansion
Subwatershed				
Fivemile	50.33	300	31	6.5
Eightmile	51.52	300	36	7.4
Fifteenmile	79.4	300	39	5.3
Sixth Field Watershed				
Lower Fivemile	13.94	300	8	6.1
N Fork Fivemile	14.51	300	6	4.5
M Fork Fivemile	15.86	300	10	6.7
S Fork Fivemile	12.46	300	9	7.6
Eightmile	19.17	300	10	5.6
Hesslan Canyon	14.94	300	8	5.7
Fifteenmile	50.82	300	20	4.3
Ramsey	23.92	300	14	6.2
Fret	3.55	300	1	3.1
Cedar	4.97	300	4	8.4
Larch	28.97	300	0	0.0
Lower Eightmile	36.31	300	2	0.6

IV. Results and Conclusions

Flow Regime/Bed Mobility. Depositional stream reaches (less than 3% gradient) near the forest boundary currently exceed the Forest Plan Standard, ≤ 20% surface fines < 6 mm weighted average in pool tail crests and riffles or range of natural condition[1], for Fivemile (31%), Eightmile (56%),and Fifteenmile (34%). Increased peakflow in the range of 2.2 to 13.1% from vegetation manipulation and road building have the potential to aggravate this situation in response reaches, aquatic habitats, and instream productivity at risk from increased streambank erosion, bedscour, deposition, downcutting, lateral widening of the channel, substrate embeddedness, and pool filling. The current situation poses the greatest risk in Eightmile Creek which has the greatest level of fine material in the streambed and moderate (2.7 to 11.2%) projected increases in peak flow. Fivemile has the next greatest risk with moderate amounts of fine in the channel bed (31%) and highest increases in peak flows (3.4 to 13.1%). Fifteenmile has the lowest risk with moderate amounts of fines (34%) and the lowest projected increase in peak flows (2.2 to 8.5%).

Steelhead evolved with the drought cycles and infrequent, large flood events that can wipe out the reproductive effort of an entire spawning season. As a result, the life history cycle of the steelhead provides each age class 3 consecutive years to contribute successfully to the spawning gene pool. Therefore, the greatest risk to steelhead results when increased peakflows occur during bankfull or average floodstage, and successive age classes are effected.

Channel Network Expansion. Stream drainage network expansion related to roads varies from 3.6 to 7.4% based on subwatershed and culvert spacing. Current research suggests that specific parts of the road network may contribute disproportionately to the effects of roads on peak flow increases by rapidly routing precipitation and snowmelt and changing the magnitude and duration of peak flows (B.Wemple, 1994). Currently, the magnitude of increased peak flows resulting from channel netwoek expansion is unknown. However, disequilibrium invokes a series of channel morphology changes that will progress until the channel returns to equilibrium in an altered stable state (Rosgen in prep.). Increases in the magnitude of peak flows from the road network have the potential to exacerbate changes caused by increased peak flows due to vegetative changes. This has the potential to contribute even more fine material in the depostitional stream reaches near the Forest Boundary, so as methodolgies are developed to assess the change in peak flows due to increased stream network densities from roads they should be applied to Mile Creeks.

[1] Mt Hood National Forest, Confederated Tribes of Warms Springs and Columbia River Intertribal Fish Commision resolution agreement on Mt Hood National Forest Land Management and Resource Plan Standard and Guideline Fish and Wildlife 97-98.STG FW 97-98.

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Appendix D. Baseflow

I. Introduction:

Baseflow is an important component of the hydrologic regime in the Mile Creeks providing habitat to fisheries in the summer months (both on and off National Forest system lands), protection against increases in stream temperature (a greater volume of water buffers increases in solar radiation that increase stream temperatures), and water for irrigation..

II. Methodology:

The methodology for the Baseflow Module from *A Federal Agency Guide for Pilot Watershed Analysis* was used to complete this analysis. The analysis was only completed for areas within the National Forest Boundary because information on baseflow and factors potentially affecting baseflow were not available outside the Forest Boundary. Steps in the analysis included

1. Examining Water Rights within the National Forest Boundary to determine the amount of water withdrawal

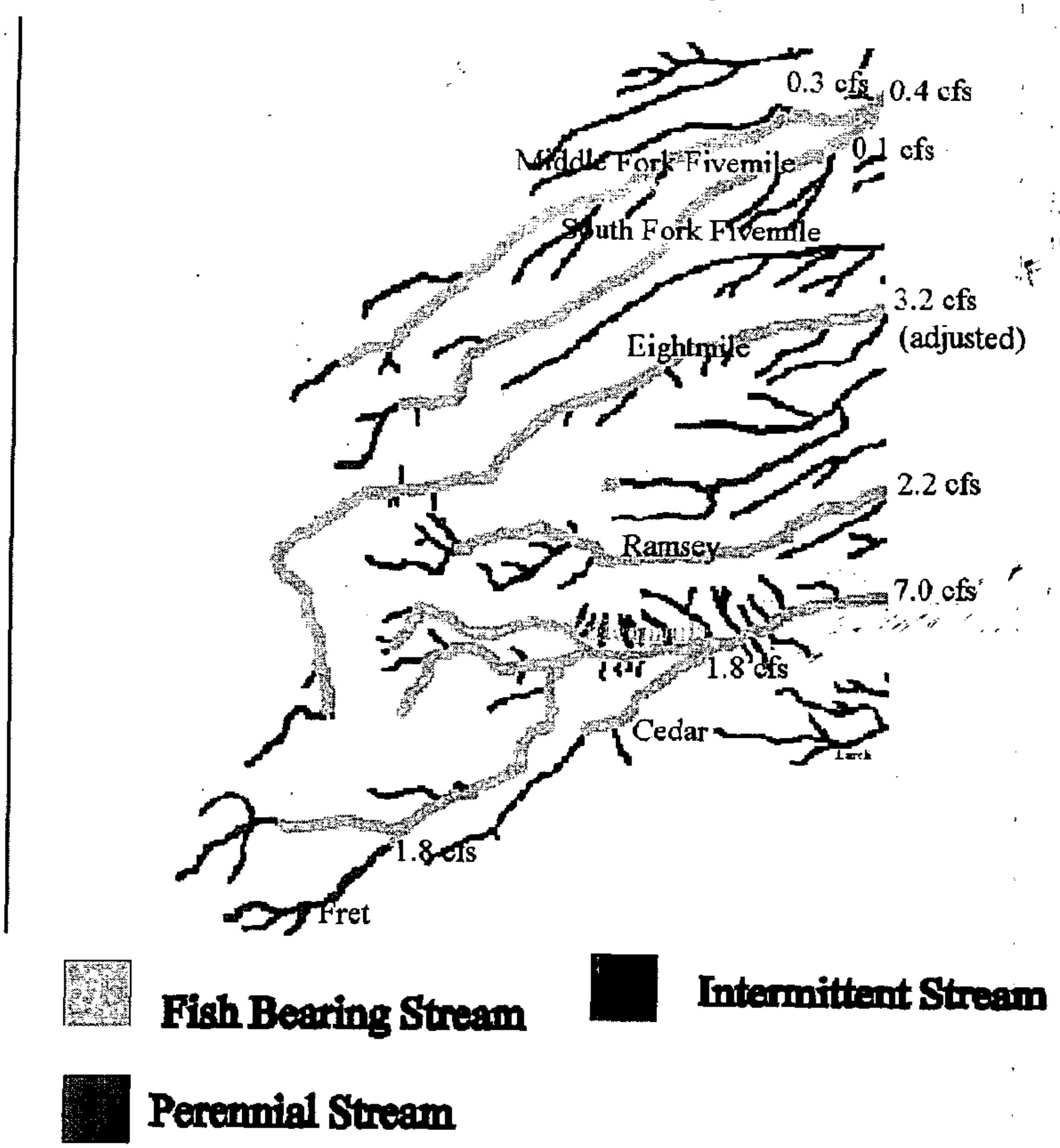
2. Reviewing gaging records within the National Forest Boundary (including point discharge measurements taken by basin personnel and stream survey crews) and adjusting flow based on the review of existing water rights (Figure 1).

3. Stratifying the watershed into subwatersheds to quantify baseflow (Figure 1).

4. Identifying variables within the watershed that had the potential to influence the baseflow regime

5. Analyzing identified variables for their individual and cumulative effect on baseflow..

Figure 1. Map of Subwatersheds used to Characterize Baseflow Regime



Baseflow measurements are expressed in cubic feet per second (cfs)

III. Existing Condition

Water Rights. Wolf Run Ditch is the only priority water right in Mile Creeks Watershed within the Forest Service Boundary. Diversion of water into Wolf Run Ditch occurs on Eightmile Creek with a volume of 3.4 acre feet per day (1.7 cubic feet per second) being diverted.

Table 1 details the baseflow character. Included in Table 1 is information that was used to identify influences on the baseflow regime. The 1.7 cfs that was withdrawn at Wolf Run Ditch is added to the measured value (1.5 cfs) from Eightmile Creek at the Forest Boundary to get the value of 3.2 cfs. This was done so that the baseflow value at the Forest Boundary would reflect the total baseflow output of Eightmile Creek

Table 1. Baseflow Worksheet Mile Creeks Watershed.

Basin	Baseflow (cfs)	Acres	Baseflow per 1000 acres	Watershed Area at the upstream limit of ephemerality (acres)	Ave. Canopy Closure	Percent of Watershed in Snow Zone	Percent of Watershed in ROS Zone	Geology	Percent of Watershed Roaded	Percent of Watershed S Aspect	Snowpack year of measurement	Number of stream crossings	Stream Order
FRET	1.8	993	1.81	71	85	98.4	1.1	1	0.1	28.8	6.2	1	2
CEDAR	1.83	1675	1.09	133	41	8.2	92.0	2	6.1	16.8	6.2	4	2
RAMSEY	2.18	3069	0.71	303	45	0.5	99.7	2	7.6	22.2	11.1	15	2
FIFTEENMILE	7.04	10461	0.67	11	59	29.5	69.6	3	3.8	8.1	11.1	25	3
EIGHTMILE	3.24	5545	0.58	68	33	23.8	69.6	4	4.2	12.2	11.1	10	2
FIVEMILE	0.4	7398	0.05	421	46	0.9	99.2	6	6.7	19.2	8.6	19	3
FIVEMIDDLE	0.3	4129	0.07	94	41	0.0	99.1	6	7.0	18.7	13	9	2
FIVE SOUTH	0.1	3269	0.03	349	52	2.1	96.4	5	6.3	20.7	13	8	2

An attempt was made to identify variables that would influence baseflow inputs, storage and routing in order to quantify the baseflow regime. These variables included: watershed area at the upstream limit of ephermerality in acres (this was determined by identifying the watershed area at the uppermost limit of intermittent streams on the streams layer), average canopy closure for the subwatershed (from the Species and Community Conservation Analysis Vegetative Database), percent of the subwatershed in the snow zone (greater than 4800 feet), percent of the subwatershed in the rain on snow zone (2400 to 4800 feet), geology (determined from the parent material map completed by Doug Smith), snowpack year of measurement (expressed in inches of snow water equivalent and determined from the March snowcourse reading at Brooks Meadow), number of stream crossing (from the MOSS stream crossings layer), and stream order. If possible variables were normalized to reflect the percent of the subwatershed influenced.

Correlation Analysis was completed to determine if relationships existed between individual variables and baseflow for each area. Table 2 details the strength of the relationship (expressed as R^2) between individual variables in Table 1 and baseflow per 1000 acres. Baseflow per 1000 acres was used as the dependent variable. Table 2 also indicates whether the correlation was positive (as the variable goes up baseflow goes up) or negative (as the variable goes up baseflow goes down).

Table 2

Variable	R^2	Positive (+) or Negative (-) Correlation
Ephemerality (total acres)	.26	+
Canopy Closure (average)	.42	-
Percent of Subwatershed in the Snow Zone	.68	+
Percent of Subwatershed in the Rain on Snow Zone	.66	+
Geology	.84	+
Percent of Subwatershed that is roaded	.57	+
Percent of Subwatershed south aspect	.13	-
Snowpack year of measurement	.56	+
Road, Stream Crossings	.22	+
Stream order	.07	+

Considering the level of correlation between individual variables and baseflow a multiple regression analysis was completed using the Statistical Analysis Software (SAS) multiple regression analysis to determine the cumulative effect of the variables on baseflow. Variables were required to be significant at the 0.1 level to be included in the equation. This analysis yielded the following equation:

Baseflow = -7.002941+0.112280*Snowzone-0.025674*Canopy Closure+0.0937323*Rain on Snow-0.169159*Geology-0.019687

The R^2 for the equation is 0.9943 which indicates a strong relationship between the dependent and the independent variables. Table 3 details the correlation between individual variables and baseflow.

Table 3

Variable	Correlation Coefficient	*p*-value
Percent of Subwatershed in the Snowzone	0.83	0.0113
Average Canopy Closure	0.64	0.0862
Percent of Subwatershed in the Rain on Snow Zone	-0.81	0.0139
Geology	-0.92	0.0014
Roaded	-0.76	0.0301

The correlation coefficient details the strength of the relationship and the *p*-value is the observed significance level. The lower the *p*-value the greater the significance level. It should be noted that Average Canopy Closure and Percentage of the subwatershed that is roaded are not as significant relationships as the other variables.

Table 4 details the regression equation with all the variables.

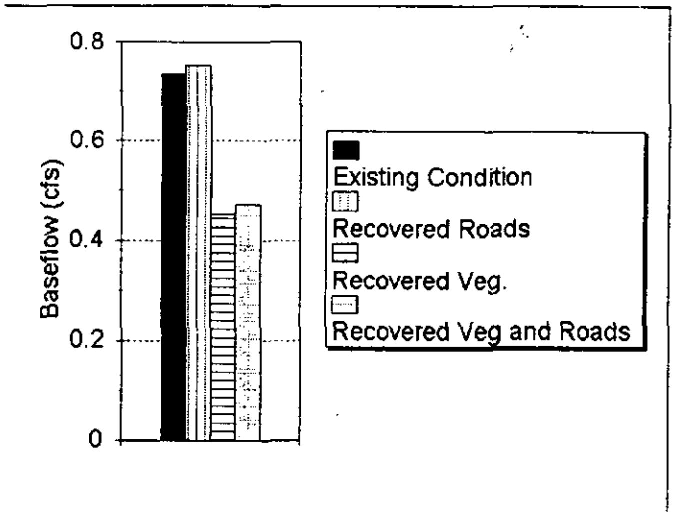
Table 4.

Variable	DF	Estimate	Error	Parameter=0	Prob > |T|
INTERCEP	1	-7.002941	2.65041308	-2.642	0.1183
SNOWZONE	1	0.112280	0.03140405	3.575	0.0701
CC	1	-0.025674	0.00684746	-3.749	0.0643
ROS	1	0.093723	0.03111296	3.012	0.0948
GEO	1	-0.169159	0.02447639	-6.911	0.0203
ROADED	1	-0.019687	0.07418659	-0.265	0.8156

The Prob > |T| value of 0.8156 for percent of the watershed that is roaded means that a very small correlation is explained by this variable.

A comparison was completed between the existing condition and a hydrologically mature landscape (Mountain Hemlock, Silver Fir and Grand Fir communities with 70% canopy closure, Pine/Oak communities with 50% canopy closure, and Shrub Steppe communities with 20% canopy closure) along with road densities of 2 miles per acre (the Forest Plan Standard for elk summer range and sometimes used as a target maximum road density for protecting watershed values) to assess changes in the baseflow regime between the existing and a hydrologically recovered condition. Figure 3 details the results of the comparison.

Figure 3. Baseflow Predictions Fifteenmile Subwatershed



IV. Results and Conclusions:

Based on this limited analysis (with only eight observations) it appears that physical characteristics affecting groundwater inputs (percent of area in the snow and rain on snow zones) and storage (geology) are well correlated with baseflows in both linear and multiple regression (as would be expected), however, other influences associated with management of the Mile Creeks Watershed (road density and average canopy closure) were also present as influences on the baseflow regime. The significance levels of road density and canopy closure indicate that these variables are not as significant as the physical variables influencing baseflows.

Calculations were made with the regression equation developed during this analysis to compare existing conditions and a hydrologically recovered forest (with respect to peak flow events). This analysis yielded that as road densities go down baseflow goes up, as canopy closure goes up baseflow goes down and when the two are combined the overall effect is a reduction in baseflow. It should be noted that the data used to calculate the recovered conditions for canopy closure and road densities are outside the range of data that were used to develop the regression equation for this analysis so the results are suspect and the predicted baseflows should be used for comparison only. This analysis points out that management activities have the potential to influence baseflow regime and that more data is needed to develop the relationship between baseflow and management activities in the Mile Creeks Watershed.

In the interim reduction of road densities to reduce impacts on peak flows and in-channel sedimentation appear to be prudent as it would also have the potential to increase baseflow. However, it is not recommended to reduce canopy closures to increase baseflows due to the detrimental effect on other processes such as peak streamflows (due to increased openings where snow accumulates and during rain on snow events melts faster and causes increased runoff) and wildlife habitat.

References

USDA Forest Service, A Federal Agency Guide for Pilot Watershed Analysis, Version 1.2, January 1994

Appendix E. Stream Temperature

I. Introduction

Water Temperature is an important water quality component for aquatic habitat and domestic water supply use. and a key determining factor in the composition and productivity of aquatic ecosystems (Park, 1994). Fish and other aquatic organisms are greatly effected directly and indirectly by changes in water temperature. Young of the Year (0+) steelhead fry require temperatures in the range of 7.2 to 15.0^0, smolting ceases at temperatures of $14\text{-}18^0$ C, oxygen uptake becomes difficult at 20^0 C, and temperatures greater than 23.9^0 C represent the upper lethal limits (Barnhart, 1986). Lethal temperatures for rainbow and cutthroat trout are 29.4^0 C and 22.8^0 C respectively (Meehan, 1992). Direct solar radiation intercepting the stream surface is the principle factor in raising stream temperature (Brown, 1969). Variables influencing the amount of solar radiation available to the stream are shade (vegetative and topographic) and channel form. Since channel form is stable on the channel types within the National Forest Boundary maintenance of water temperature is largely a function of the quality and quantity of shade producing vegetation (Park, 1994). Management activities such as timber harvest, road building and grazing have the potential to influence the amount of solar radiation intercepted by the stream surface by altering the vegetation adjacent to the stream.

II. Methods

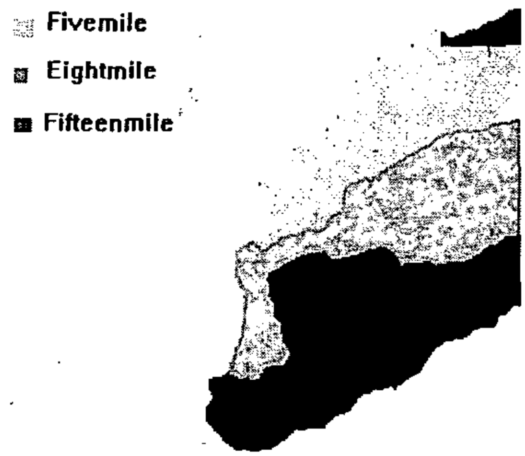
The methodology outlined in *A Federal Agency Guide for Pilot Watershed Analysis* for Water Temperature was followed for this analysis.

1. Existing information on stream temperature was reviewed including: continuous stream temperature data for June-September 1990-1993 at the Forest Boundary for Fivemile Creek, Eightmile Creek, Ramsey Creek, and Fifteenmile Creek, and; point samples taken by the stream survey crews (Figure 1). Data outside the Forest Boundary was provided by the Oregon Department of Fish and Wildlife.

2. Stream Shade was assessed in areas that had the potential to be altered by timber harvest. This was accomplished by overlaying canopy closure, from the SCCA (Species Community and Conservation Analysis) Vegetative Database, within the riparian reserves and areas that had received timber harvest. Stream shade was mapped and summarized within the three main subwatersheds (Figure 2 and Table 3) by three categories HIGH(greater than 80% shade), MEDIUM (60-79% shade), and LOW (less than 60% shade). For this analysis canopy closure was used as a surrogate for stream shade.

3. Stream Shade was then assessed in the same manner for unmanaged areas, and the entire riparian reserve system within the Mile Creeks Watershed. This data was mapped and summarized by subwatershed (Figure 1 and Table 3). The percentage shade in each category was then compared between managed and unmanaged stands within the Riparian Reserves to assess any impacts from management activities (timber harvest).

Figure 1. Subwatersheds used for Analysis



II. Existing Condition.

Tables 1 and 2 summarize temperature data at the Forest Boundary.

Table 1. Seven Day Average High Temperature ^{0} C (measured at the Forest Boundary)

Subwatershed	1990	1991	1992	1993
Fivemile	16.9	16.8	-------	14.8
Eightmile	16.4	15.1	15.8	14.3
Fifteenmile	17.9	15.0	18.6	15.9

Table 2. Annual Peak Temperature ^{0} C (measured at the Forest Boundary)

Subwatershed	1990	1991	1992	1993
Fivemile	18.0	17.5	-------	15.5
Eightmile	17.0	15.5	16.5	15.5
Fifteenmile	18.5	18.0	19.5	16.5

Figure 1 illustrates the relationship between observed temperatures and the State Standard for water temperature of 14.4^0 C.

Figure 1. Seven Day Average High Temperatures (1990-1993)

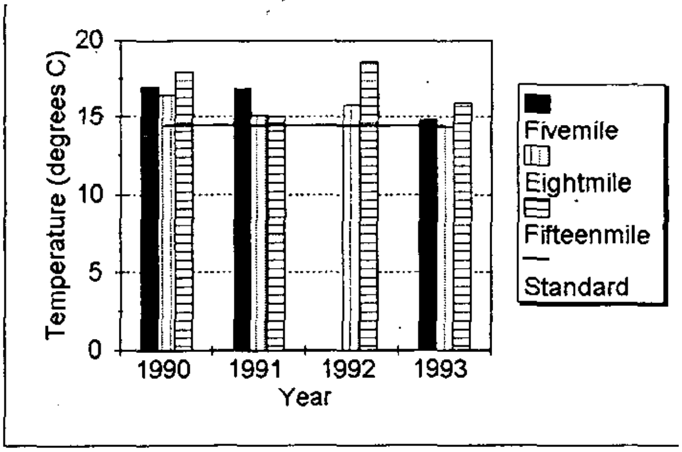
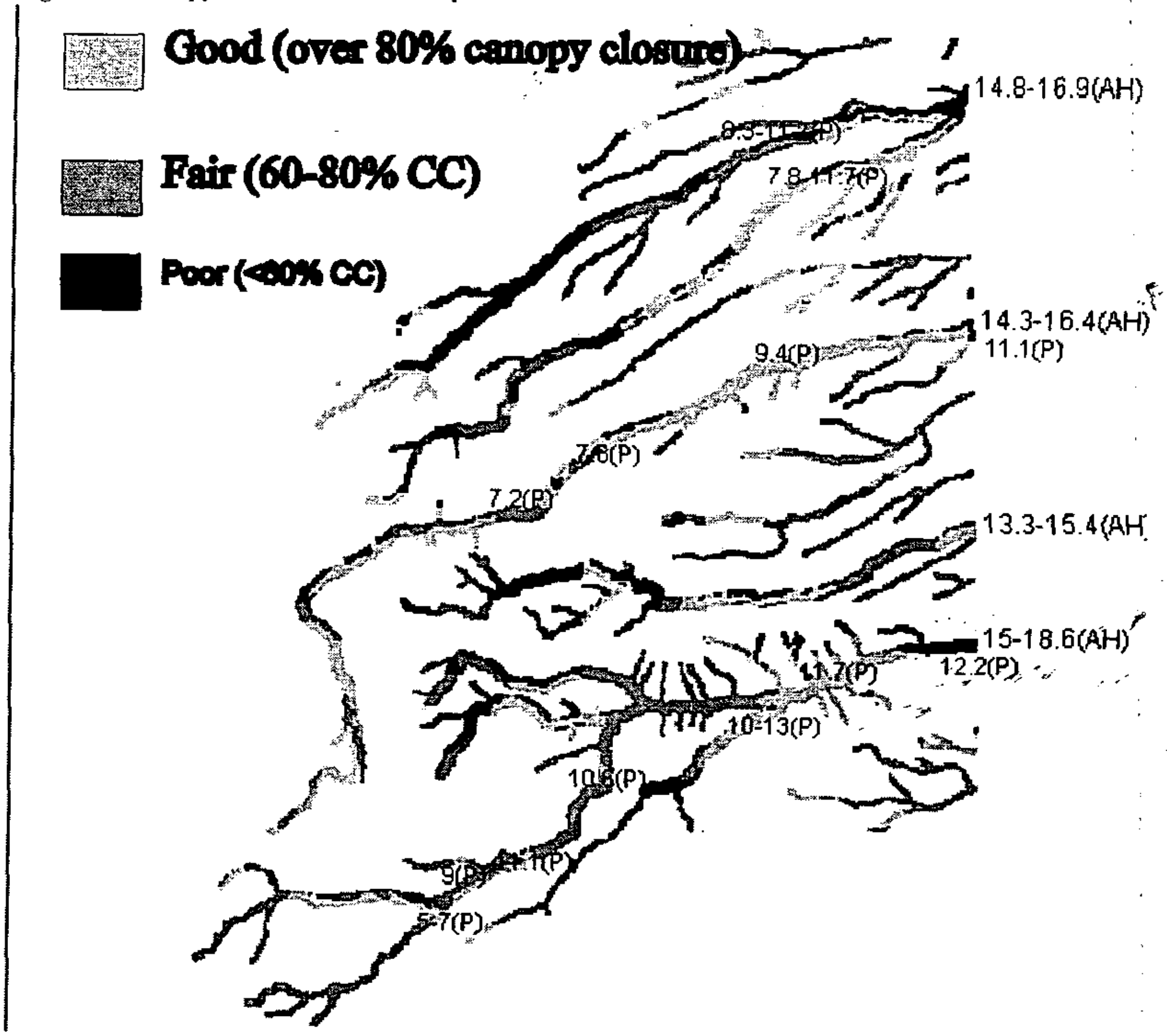


Table 3 details stream shade condition in unharvested areas, harvested areas, and the entire riparian reserve system in Mile Creeks Watershed. Shade condition is based on a snapshot of canopy closure from the SCCA Vegetation Database and should reflect conditions as of the summer of 1994.

Table 3. Shade Condition within the Riparian Reserves

		Acres within the Riparian Reserve			Percent of Total		
	Category	POOR	FAIR	GOOD	POOR	FAIR	GOOD
Fivemile	Unharvested	553	241	381	47	20	32
Eightmile		188	347	616	16	30	54
Fifteenmile		484	875	580	25	45	30
Fivemile	Harvested	212	73	75	59	20	21
Eightmile		84	90	55	37	39	24
Fifteenmile		166	87	64	52	28	20
Fivemile	Total	765	313	456	50	20	30
Eightmile		272	437	671	20	32	49
Fifteenmile		650	963	645	29	43	29

Figure 2. Canopy Closure within the Riparian Reserves



Numbers adjacent to streams indicate temperature (degrees C)

AH - seven day average high temperature

P - Point data

Figure 3. Canopy Closure of Managed Areas within the Riparian Reserves

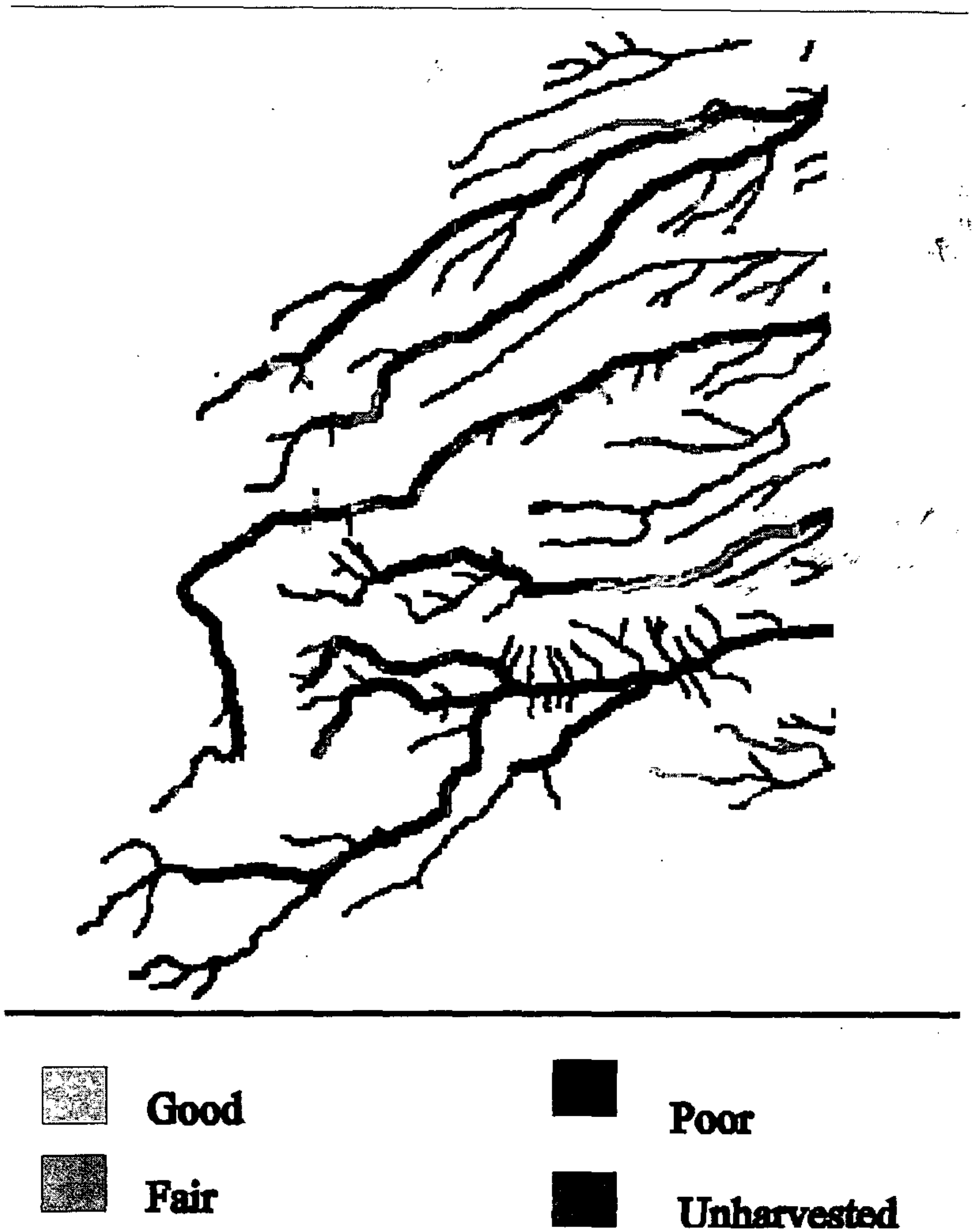


Figure 4. Stream Shade Conditions Fivemile Subwatershed

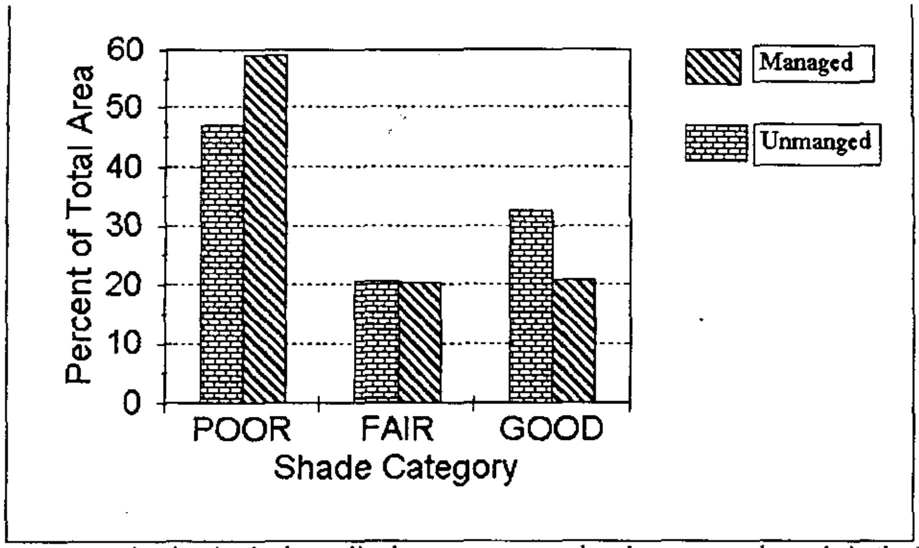


Figure 4 illustrates a reduction in shade quality between managed and unmanaged stands in the Fivemile subwatershed. More area in the poor and fair categories in managed stands ,67% compared to 79%, and less in the good category in managed stands, 21% versus 32%)

Figure 5. Stream Shade Conditions Eightmile Subwatershed

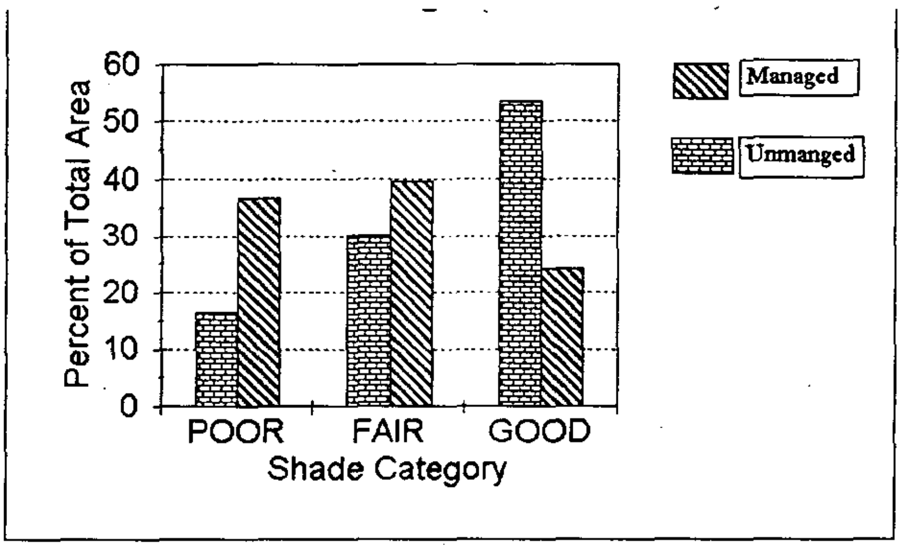


Figure 5 illustrates a reduction in shade quality between managed and unmanaged stands in the Eightmile subwatershed. More area in the poor and fair categories. 76% compared 46%, and less in the good category, 24% versus 54%.

Figure 6. Stream Shade Conditions Fifteenmile Subwatershed

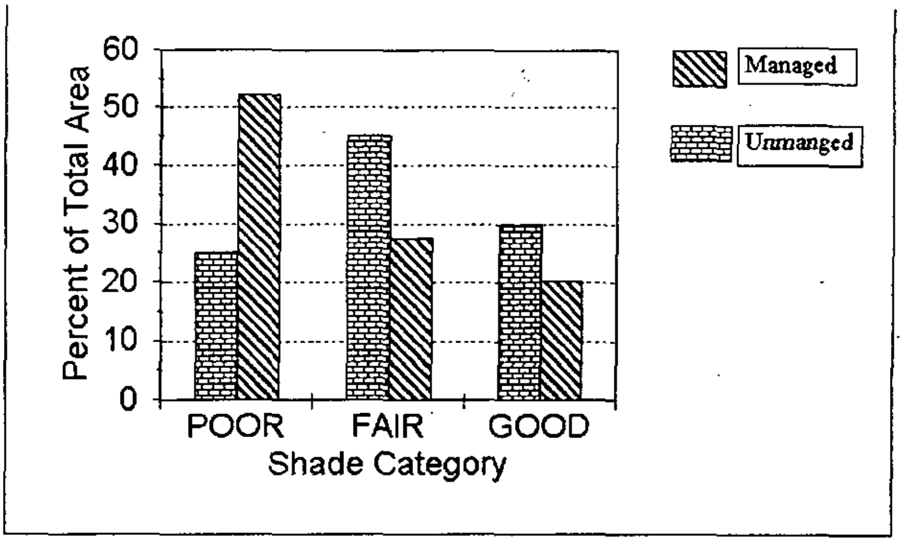


Figure 6 illustrates a reduction in shade quality between managed and unmanaged stands in the Fifteenmile subwatershed. More area in the poor category, 52% compared to 25%, and less area in the good category, 20% versus 30%.

Figure 7 illustrates harvested areas that do not meet the stream shade guidelines, Oregon Department of Fish and Wildlife Mount Hood National Forest Agreement (1978), of greater than or equal to 70% canopy closure in managed stands..

Figure 7. Harvested Areas With Less Than 70% Canopy Closure

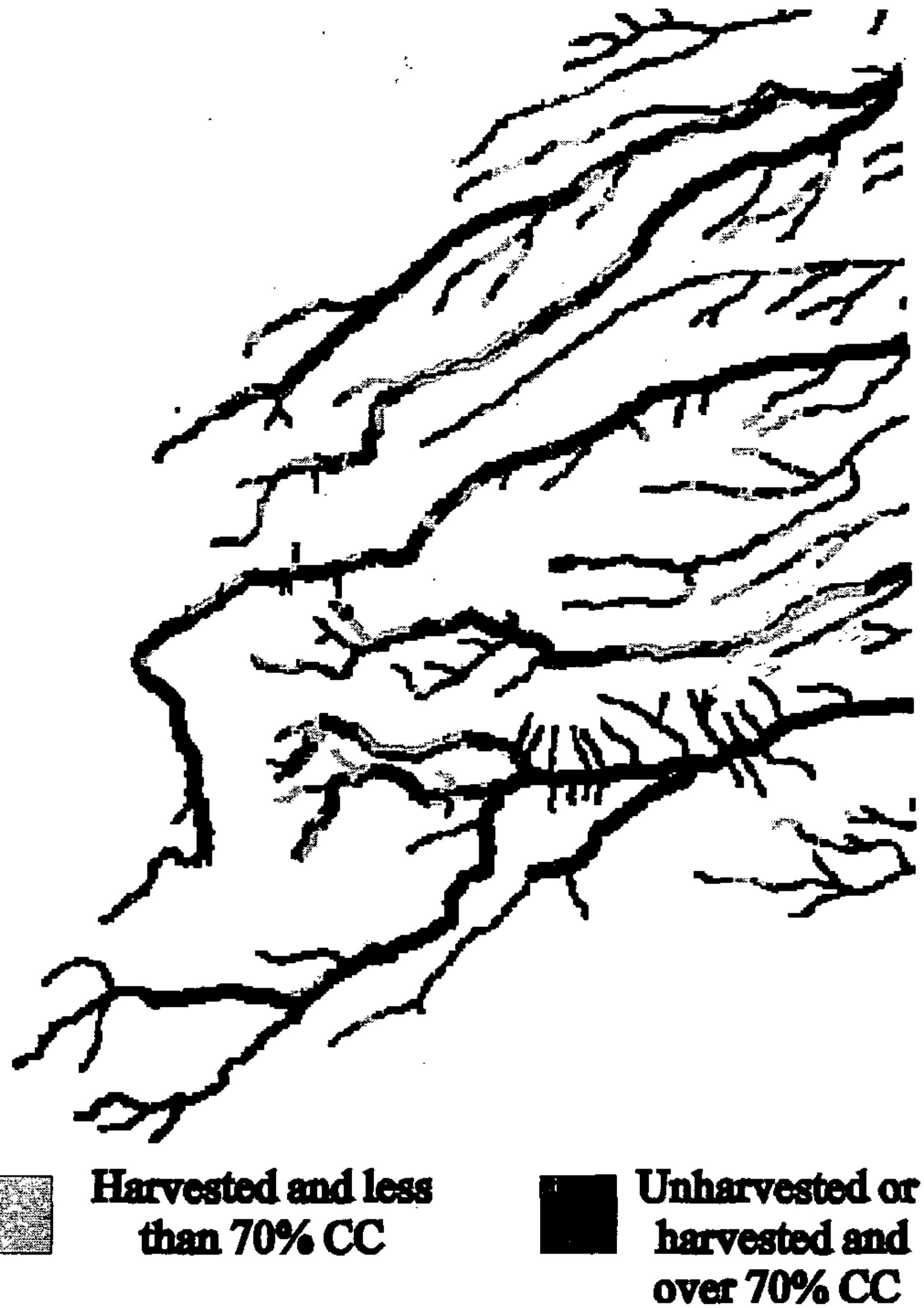


Table 4. Harvested Areas With Less Than 70% Canopy Closure In The Riparian Reserves (acres/percent of riparian reserve)

Subwatershed	Fish-bearing		Perennial		Intermittent	
Fivemile	220	22%	19	17%	120	29%
Eightmile	69	9%	36	19%	125	27%
Fifteemile	264	18%	17	8%	36	7%
Larch Creek	N/A		N/A		43	28%
TOTAL	553	17%	72	14%	281	18%

III. Results and Conclusions

As table 2 and figure 1 illustrate the state standard of 14.4^0 C is exceeded for all three subwatersheds within Mile Creeks Watershed at the Forest Boundary. Table 3 and figures 4-6 illustrate a reduction in the quality of shade provided by the canopy between managed and unmanaged areas in the Riparian Reserves, and 908 acres of the riparian reserves are outside the desired condition for stream shade in managed areas.

Within Mile Creeks Watershed there appears to be a correlation between the reduction in shade quality in harvested areas and increased stream temperatures within a subwatershed. Fifteenmile subwatershed has the greatest reduction in shade quality (75% in the good and fair category for unmanaged areas to 48% in the good and fair category in managed stands) and the highest stream temperatures (both 7 day average and instantaneous peak). This relationship implies that historical management within the Mile Creeks watershed has resulted in increased stream temperatures. With water temperatures above the State Standards on the forest and water temperatures above lethal limits for steelhead, rainbow and cutthroat trout in Fifteenmile Creek below the Forest Boundary (peak of 31.5^0 C and 7 day average of 29.6^0 C from Oregon Department of Fish and Wildlife data) management of stream temperature becomes paramount within Forest Service lands within Mile Creeks Watershed to ensure protection of the fishery.

In order to assess the impacts of altered stream shade on stream temperature an assessment using an appropriate stream temperature model such as SHADOW (Park C., 1994) is needed.

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Appendix F. Aquatic and Riparian Ecosystems

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APPENDIX F. AQUATIC and RIPARIAN ECOSYSTEMS

I. Key Point Summary

Downstream of the Forest Boundary

- Mile Creeks Watershed has a genetically unique stock of wild, winter steelhead that has been petitioned for listing under the Endangered Species Act, and may be at-risk of extinction. The current population of Mile Creeks steelhead is estimated at 200-300 fish. National Marine Fisheries Service recommends a minimum population of 400-1000 fish for genetic conservation of stocks.

- Pacific lamprey is a State Sensitive Species that occupies the mid-lower Fifteenmile Creek and is at-risk of extirpation in Mile Creeks Watershed.

- Members of the Confederated Tribes of Warm Springs have subsistence fishing rights for steelhead and Pacific lamprey in Mile Creeks that have not been exercised since 1984 because of depleted stocks.

- Oregon Department of Fish and Wildlife closed the recreational steelhead fishery in Mile Creeks Watershed in 1984 because of depleted stocks.

- Historically, the most productive steelhead and lamprey habitat occurred in the low-moderate gradient reaches downstream of the Forest boundary.

- Current habitat availability for spawning and rearing steelhead is approximately 70 percent of the historic habitat availability.

- High summer water temperatures combined with water withdrawals are a lethal combination for juvenile steelhead, redband trout, and lamprey downstream of the Forest boundary.

- Intermittent flow resulting from irrigation withdrawals are limiting steelhead and Pacific lamprey habitat capability and availability downstream of the Forest boundary.

- High levels of fine sediment and low levels of large woody debris have reduced the spawning success and survival of embryonic and juvenile steelhead in the watershed.

- Instream habitat improvement work, migration barrier modification, and riparian fencing are incrementally improving fish distribution, habitat capability, large woody debris recruitment potential, channel stabilization, and water temperature downstream of the Forest boundary.

- Agricultural and rangeland practices, channelization, loss of floodplain function, and increased peakflows have reduced water storage capacity and de-stabilized creeks downstream of the Forest boundary.

- Warm, slow-water habitats that have resulted from agricultural, forestry, and rangeland practices, primarily in the mid-lower watershed, favor bullfrogs and northern squawfish that are predators of juvenile steelhead, other coldwater fishes, amphibians, and aquatic reptiles.

- Steelhead and Pacific lamprey viability in Mile Creeks is dependent on improved water quality and quantity, riparian and aquatic habitat restoration in the mid-lower watershed, and does not appear to be compatible with the current and foreseeable resource expectations of the local, agriculturally-based community.
- Interagency and local community commitment and solutions to water conservation, erosion control, riparian restoration, and water quality issues will be necessary to make the landscape level changes necessary to maintain viable fish stocks.

Upstream of the Forest Boundary

- The National Forest land in Mile Creeks Watershed is a Tier 1 Key Watershed for conservation and/or restoration of good quality aquatic habitat to protect the Mile Creeks winter steelhead stock.
- *Fifteenmile Creek has the largest steelhead population and the best habitat potential for steelhead in the upper watershed.*
- Redband trout and cutthroat trout populations are healthy and viable in the upper watershed.
- Cope's Salamander, a USFS Regionally Sensitive and State Threatened Species, has potential habitat upstream of the Forest boundary.
- Timber harvest, roading, off-highway vehicles, and developed campsites are contributing to sedimentation and increased peakflows upstream of the Forest boundary.
- Baseflows in Eightmile Creek do not meet minimum State standards for protection of fishes because of water withdrawals from Wolf Run Ditch during irrigation season.
- A USFS road culvert near Eightmile Creek is a barrier to several miles of good juvenile steelhead rearing habitat upstream in Eightmile Creek.
- Re-forestation, riparian and channel restoration, campground restoration, and barrier modifications are making incremental improvements in habitat capability upstream of the Forest boundary.
- Cold, clean water from the upstream of the Forest boundary is important for mitigation of poor water quality and quantity in the mid-lower watershed.

II. Methods and Assumptions

Larch Creek: Larch Creek is not discussed in detail because the headwaters of Larch Creek are not fish-bearing, and there is no USFS stream survey data for Larch Creek.

Channel Condition: Private land geomorphic reach classifications (Rosgen in prep.) were made by USFS fisheries biologists from USGS 1:24,000 quadrangle maps and 4,500 ft. elevation aerial photographs taken in the summer of 1987. Public land reach classifications were based on gradients, valley forms, and dominant substrates summarized from 1989-91 R06 modified Hankin and Reeves stream surveys.

Channel condition validation protocols were developed by Mt. Hood NF fisheries biologists and hydrologists for watershed analysis (Wold et al. unpub.). Geomorphic reach parameters and surface particle distribution were collected in Fifteenmile, Ramsey, Eightmile, Fivemile, Fret and Cedar creeks April-May 1994 at sites stratified by gradient, accessibility and locations with gauging stations.

Stream Surveys: Oregon Department of Fish and Wildlife (ODFW) fisheries biologists did pre-project stream surveys on private segments of Fifteenmile, Eightmile, Ramsey, Fivemile, May's Canyon, Dry, Pine, and Larch creeks in 1986 that included percentages of stream gradient, pool habitat, streamshade and yards of spawning gravel by stream segment (ODFW/USFS 1987).

Mt. Hood National Forest (USFS) fisheries biologists surveyed Fivemile, South Fork Fivemile, Middle Fork Fivemile, Eightmile, Ramsey, Fret and Cedar creeks (1989-91) using the modified USFS R06 Hankin and Reeves protocol. Fifteenmile Creek pre-project surveys were conducted in 1991 using the Mt. Hood NF monitoring and evaluation protocol. USFS will survey the public reaches of Fifteenmile Creek in 1994 using the Mt. Hood NF protocol (Dore and Wold unpub.) that incorporates R06 stream survey techniques, PacFish large woody debris size classes, Rosgen geomorphic parameters and pebble count protocols.

Large Woody Debris Recruitment Potential. Large woody debris recruitment potential within riparian reserves was modeled after the Washington State Department of Natural Resources, Timber Fish and Wildlife Watershed Analysis Guide version 2.0 (TFW) that considers seral stage, canopy closure, and vegetative classification. Eastside canopy closure values in the TFW model for Ponderosa pine/Oregon white oak stratum (≥ 50 % = dense) were too low for the moist Grand fir and dry Grand fir/Douglas-fir and Subalpine fir/Mountain hemlock strata in Mile Creeks. As a result, the large woody debris recruitment potential is over-estimated for these strata. Re-calculating the model with canopy closures of greater than or equal to 70 percent in the moist Grand fir and dry Grand fir/Douglas-fir and Subalpine fir/Mountain hemlock strata would be a more accurate representation of mature canopy closure and large woody debris recruitment potential in upper Mile Creeks Watershed.

In addition, the vegetation database information used in the large woody debris recruitment potential analysis was not site-specific enough to discriminate riparian vegetation that follows creeks within the Riparian Reserves. Therefore, the results of the large woody debris analysis are average conditions of the entire width of the recommended Riparian Reserves, but are not good representations of the site-potential tree s in streamside corridors. Future vegetation surveys within Riparian Reserves could be used to improve the resolution of the large woody debris potential and water temperature analyses, plan restoration projects, and monitor attainment of desired conditions.

Macroinvertebrate Surveys: Aquatic macroinvertebrates were collected on public and private segments of Fifteenmile, Eightmile, Fivemile and Ramsey creeks 1986-92. Additional sampling sites on private land include Dry Creek and May's Canyon.

Spawning Surveys: ODFW and USFS fisheries biologists conducted annual visual spawning surveys April-March 1985-94.

Fish Distribution and Community Composition: ODFW and USFS fisheries biologists used electrofishing and snorkeling surveys along with local knowledge to estimate the present distribution of fish species. Historical distribution information for Mile Creeks watershed was based on professional judgment of ODFW Fisheries Biologist, Jim Newton, USFS fisheries biologists, Gary Asbridge and Tom Macy, and anecdotal information. Historical steelhead distribution information for the Columbia River Basin was based on personal communication with ODFW geneticist, Katherine Kostow.

Desired Conditions: Desired conditions for maintaining or restoring aquatic and riparian beneficial uses, biodiversity, range of natural conditions and productivity in aquatic and riparian habitats influenced by management activities are based on the Standards and Guidelines in the Record of Decision for the President's Plan (ROD 1994), the Mt. Hood National Forest Land and Resource Management Plan (LRMP 1990), the PacFish Strategy (PacFish 1994), the Federal Pilot Watershed Analysis Guide (PWAG 1994), the Columbia River Policy Implementation Guide/Salmon Summit (PIG 1991), the Fifteenmile Creek Subbasin Plan (ODFW/CTWS 1990) and the Fifteenmile Basin Fish Habitat Implementation Plan (ODFW/MTH 1987).

Large woody debris desired conditions were based on 1991 surveys of undisturbed or fully recovered reaches on Fifteenmile Creek for this analysis. Large woody debris size classes differed by ± 2 inches (18-20 inch diameters) between the 1989 and 1991 surveys. Since surveyors use ocular estimates to determine size class, the difference is probably within the range of sampler variability. Fifteenmile Creek surveys (FY 1994) will use the PacFish size criteria for large woody debris and can be used to validate the proposed desired condition for large woody debris.

Aquatic habitat units are highly variable within the range of natural conditions and dependent on gradient, confinement, stream width, and presence/absence of hydraulic controls. Desired conditions for number of pools per mile was based the mean ± 1 standard deviation for a large sample of undisturbed or fully recovered streams within the range of natural conditions (Overton et al. in prep).

Geomorphic desired conditions for stable channel forms were based on the range of natural conditions for channels from Rosgen's classification of natural rivers (in prep.).

Desired conditions for egg to smolt survivorship were based on wild steelhead egg-smolt survival research from the Snow Creek Research Station in Washington (1976-84) (Bley and Moring 1988).

Sedimentation: A multiple regression analysis was used to correlate the potential sources of sediment from roads, tractor harvest units, low resiliency and highly erosive soils with site-specific fine sediment data.

III. TES and Special Status Fish Stocks

Winter Steelhead. In May, 1994 all stocks of steelhead trout were petitioned for listing under the Endangered Species Act across their Alaska-Southern California range. Bases for the petition included genetic and environmental risks, and small extant populations. The National Marine Fisheries Service determination on the proposal is due February 1995.

Mile Creeks steelhead are unique at the Forest, subbasin, basin and regional scales. Mile Creeks watershed has a unique stock of steelhead (*Oncorhynchus mykiss gairdneri*) that is the only extant stock of winter steelhead that originated from the redband trout east of the Cascade Range in the Columbia River Basin (Fig. I.1.). Mile Creeks steelhead are genetically intact, "wild" fish because the watershed has never been stocked with hatchery steelhead (ODFW Wild Fish Policy). Populations of wild steelhead are rare throughout their range (Behnke 1992).

The Hood River watersheds in the same subbasin, have a subspecies of winter steelhead that originated from coastal rainbow trout stocks (*O. mykiss iridius*) (Behnke 1992). Preliminary results indicate Mill Creek watershed, between the Hood River and Mile Creeks watersheds, may be a hybridization zone for coastal rainbow and inland redband steelhead stocks (Kostow in. prep).

All other steelhead stocks east of the Hood Subbasin are summer run redband steelhead. It is unlikely Mile Creeks watershed ever supported a summer run of steelhead because the creeks do not have the large bedrock pools necessary for summer cover and thermal refugia.

Historically, the great majority of steelhead trout in the Columbia River system must have been redband steelhead, since only a small portion of the basin is west of the Cascades Range (Behnke 1992). In 1987, ODFW/USFS estimated the carrying capacity of Mile Creeks Watershed, based on current conditions, at 752 adult steelhead. In 1989, the run size was estimated at 200-300 fish (ODFW/CTWS 1990). There is no information on the current status of the winter steelhead runs, except for spawning surveys, or smolt production in Mile Creeks. National Marine Fisheries Service recommends 400-1000 individuals as the minimum population to conserve a genetic stock.

Adult steelhead return to Mile Creeks watershed February-March and spawn March-May. Juvenile steelhead rear in freshwater 1-3 years before the smolts migrate to the ocean (ODFW 1986). The majority of smolts out-migrate as 2+ fish, April-May. Fry emerge from the substrate June to mid-July. A period of drought years, 1986-92, reached critical levels in Mile Creeks watershed in 1992. The low baseflows and high temperatures in the mid-lower watershed during the drought probably effected survival of the 1986-92 age classes. Potential drought effects on the 1986-92 age classes will be evident when the adults return 1987-95.

ODFW and CTWS set their desired conditions for annual average adult escapement at 600 fish for tribal harvest and 900 spawners to occur within 10 years following implementation of all the proposed strategies in Fifteenmile Subbasin Plan (ODFW/CTWS 1990). The escapement goal of 900 spawners and the desired condition for egg-smolt survivorship (Table III. B.1.) assuming 50:50 sex ratios and 2,000 eggs/kg body weight of steelhead (Moyle 1976) would yield an annual average smolt production at the low range of earlier ODFW/CTWS (1990) and ODFW/USFS (1987) estimates.

1.6% egg-smolt survival x 450 females x 2,400 eggs/female = 16,200 smolts

It will be necessary to monitor the population trend and the success of meeting desired conditions for egg-smolt survivorship, by maintaining fish traps to count numbers of returning adults and out-migrating smolts. Traps at the Forest boundary and at the mouth of Fifteenmile Creek would allow comparisons between Forest and private land productivity and habitat capability.

Pacific Lamprey. Pacific lamprey are Oregon State Sensitive Species based on significantly depressed populations throughout their range (Weeks, 1993; Downey et al. 1993). In addition to Pacific lamprey, Mile Creeks has potential habitat for resident brook lamprey of the *Tridentata* group (Beemish pers. comm.). Larval lamprey of unknown species have been found in Fifteenmile Creek upstream of the Dufur bridge (Newton pers. comm.).

The historic range of the Pacific lamprey (*Entosphenus tridentatus*) in the Columbia River Basin was coincident with anadromous salmonids. Pacific lamprey use the same spawning substrate as anadromous salmonids. Larval lamprey (ammocetes) spend 5-6 years in slow water, fine substrate, freshwater habitats before migrating to the ocean. Rapid or prolonged water withdrawals that dry out edgewater stream habitat is the greatest risk to larval lamprey (Beemish pers. comm.). High water temperatures, water quality, and extremely high barriers are additional risk factors.

Subsistence Fisheries. In Mile Creeks, there were historic American Indian subsistence fisheries for Pacific lamprey and steelhead at Seufert Falls near the mouth of Fifteenmile Creek and the city of The Dalles. The Confederated Tribe of Warm Springs (CTWS) mandates protection and management of lamprey and steelhead as cultural resources under Warm Springs Tribal Code Chapter 490, Ordinance 68. To meet those objectives, the Warm Springs Tribe voluntarily closed both the lamprey and steelhead fisheries at Seufert Falls in 1984 to conserve declining stocks (Newton pers. comm.).

The current winter Zone 6 Commercial Treaty fishery on the mid-Columbia River may take some Mile Creeks steelhead that are migrating upstream to spawn. Actual impacts cannot be determined without tag-recapture studies.

Recreational Fisheries. Recreational steelhead fisheries were locally important to residents of the Mile Creeks watershed. ODFW closed the Mile Creeks recreational steelhead fishery in Fifteenmile and tributaries above Petersburg (RM 2.0) in 1984 to rebuild the stock. The mouth of Fifteenmile to Petersburg had a small fishery late-April to November for steelhead kelts until it was closed in 1994. Re-evaluation of recreational fishing regulations for Mile Creeks steelhead will depend on the rate of recovery and CTWS management plans.

Identification of resident trout and steelhead smolts is problematic for anglers. The current recreational fishery for Mile Creeks resident redband trout has an unquantified impact on 6-8" juvenile steelhead.

Recreational anglers in the mid-Columbia River use Pacific lamprey for sturgeon bait.

IV. Other Salmonid Fishes

Resident redband trout. Resident redband trout (*Oncorhynchus mykiss gairdneri*) in Mile Creeks watershed are the Eastern Cascades subspecies of redband/steelhead trout (Behnke 1992). In the Mile Creeks watershed resident redband trout occupy the same range as steelhead trout and are not reproductively isolated (Fig. IV. A.1.) (Kostow in prep). Gene flow between resident and anadromous trout has been documented in similar watersheds (e.g. Yakima, Deschutes, Rogue, Klamath) that do not have migration barriers effectively isolating the populations (Kostow in prep.; Everest 1973).

Resident cutthroat trout. The Hood Subbasin may be a natural hybridization zone for coastal and inland stocks of cutthroat trout (*Oncorhynchus clarkii*). Hybridization of coastal and inland stocks may account for the genetically different resident cutthroat trout found in Hood River, Mill and Mile Creeks watersheds (Kostow in prep.).

The only identified populations of resident cutthroat trout in Mile Creeks are in the Middle Fork and South Forks of Fivemile subwatershed (ODFW/USFS survey data) (Fig. IV.A.1.). Typically, resident cutthroat are found in the smallest, headwater streams, and resident cutthroat and redband trout do not cohabitate, but natural barriers that would restrict cutthroat to Fivemile subwatershed have not been identified, so their range may be coincident with the resident redband trout in Eightmile and Fifteenmile subwatersheds. To verify cutthroat trout distributions USFS and ODFW are conducting genetic analyses on resident trout from Fivemile and Eightmile subwatersheds (Kostow in prep.).

Rainbow trout. In the past, ODFW planted catchable redband/rainbow trout from Deschutes River and Cape Cod stocks in Fifteenmile Creek below the USFS boundary at the Taylorville Bridge and at the bridge near downtown Dufur. ODFW has not stocked hatchery rainbow trout at Taylorville Bridge for more than 20 years. The last time hatchery rainbow trout were stocked at the Dufur Bridge was 1991.

The hatchery rainbow trout may have interbred with the native redband and steelhead, however, the gene pool dilution is probably minimal since only a fraction of catchable-size hatchery fish survive to reproduce. If ODFW maintains the current no-stocking policy in Mile Creeks there will be no future risk of genetic dilution in the wild steelhead population.

The USFS has planted catchable hatchery rainbow trout in Eightmile Creek subwatershed in Hanel Lake reservoir on Wolf Run Ditch at Camp Baldwin for National Fishing Week 1992-94. The Camp Baldwin boy scout camp probably stocked trout in the reservoir prior to 1992. A screen on the inlet of Wolf Run Ditch and an ephemeral draw at the outlet are barriers to fish migration in or out of the ditch.

Brook Trout. There are no ODFW records of eastern brook trout (*Salvelinus fontinalis*) stocking in Mile Creeks watershed, although stocking in Eightmile Creek above Endersby and in Fifteenmile Creek above Dufur began as early as 1902 (The Dalles Times-Mountainer 1902). 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. Currently, brook trout have no significant impact on native fishes in Mile Creeks, since significant populations of naturalization of brook trout have not been established (ODFW survey data).

V. Non-salmonid Fishes

Unidentified sculpins, speckled and longnosed dace, and mountain suckers are the only non-salmonid, coldwater fishes in the mid-watershed. Sculpins have been found on Forest in Fivemile Creek. Dace and suckers have not been found on Forest. Adult sculpins and longnose dace are benthic inhabitants of coarse substrate in fast water riffles, and are sensitive to high levels of fine sediments. Adult mountain suckers and speckled dace are benthic fishes too, but may use slower velocity habitats with more variable substrate than sculpins and longnosed dace (Wydoski and Whitney 1979).

Like salmonids, sculpins, dace and mountain suckers spawn in riffles with clean, coarse substrate. The juveniles are found in shallow areas with slow velocities (Wydoski and Whitney 1979). Eggs and juveniles of these species are prey species for juvenile steelhead and resident redband trout.

Northern squawfish occupy the lower watershed where summer temperatures exceed lethal limits for salmonids ($> 24^0$ C). Young squawfish compete for food with salmonids. The diet of adult squawfish includes juvenile salmonids, lamprey, dace, suckers, and sculpins. Squawfish predation on steelhead smolts and other salmonids has increased in the mid-lower Columbia River, and probably lower Mile Creeks, because management impacts have increased the range of squawfish by creating unfavorable habitat for salmonids (i.e. warm, slow water, fine substrate). ODFW has a bounty fishery for squawfish on the Columbia River but there are no important sport or subsistence fisheries for squawfish in Mile Creeks.

VI. Amphibians

All perennial streams are potential habitat for amphibians in Mile Creeks Watershed. Amphibian surveys have not been conducted in Mile Creeks, but Cope's salamander, a USFS Regionally Sensitive Species and a State Species of Special Concern, has been found in the adjacent Mill Creek Watershed. Tailed frogs, a prey species of Cope's salamander, have been found in Cedar Creek in upper Mile Creeks, above the Forest boundary. Both species have similar habitat requirements, and it can be assumed Mile Creeks has potential habitat for Cope's salamander (Leonard et. al 1993).

Bullfrogs are an exotic species that have been introduced in the mid-lower watershed, downstream of the Forest boundary. Bullfrogs are voracious predators of the small adults and early life stages of native fishes, amphibians, and reptiles. Bullfrogs prefer the slow-moving, warmwater habitats (Corkran and Thoms 1994; Leonard et. al 1993) created by irrigation withdrawals, low streamshade, and sedimentation in the mid-lower watershed.

VII. Productivity

Fish community. Relative growth and survival of any species is dependent on primary productivity, organic habitat elements and interactions with other prey and predator species. Juvenile steelhead feed heavily on high calorie eggs and fry of salmonids and other fish species during their 1-3 years rearing in freshwater.

Habitat factors depressing the productivity of salmonids in mid-lower Mile Creeks are undoubtedly depressing the rest of the coldwater fish community. Declines in production of fish eggs, fry and spawned-out steelhead carcasses effects the whole aquatic and riparian dependent food chain, productivity of the system, and has a direct effect on size-dependent ocean survival of steelhead smolts (Ward and Slaney, 1988).

Terrestrial Macroinvertebrates. Drifting terrestrial insects are more important than aquatic insects in the diet of stream-dwelling salmonids (Behnke 1992). In small streams 5-10 meters wide with good riparian vegetation, drift insects of terrestrial origin make up ≥ 50% of the summer diet of trout (Behnke 1992). Openings in the riparian canopy from timber harvest and riparian zone alteration in the Mile Creeks watershed has undoubtedly decreased terrestrial insect productivity.

Aquatic macroinvertebrates. Aquatic insects are a less important food source for salmonids, but are sensitive to fine sediment and certain taxa are dependent on riparian vegetation for food and reproduction. Newbold et al. (1977) demonstrated significant decreases in community diversity and increases in the total number of individuals and populations of certain taxa (e.g. "shredders" and clean water taxa versus organic enrichment and sediment tolerant taxa) between logged and unlogged streams. Openings in the riparian canopy from timber harvest, agricultural and rangeland practices favors some taxa, and may have increased overall aquatic insect productivity as a result of increased solar radiation and primary productivity (Behnke 1992).

In general, low numbers of "shredders", declines in biological community index (BCI) values, and increases in organic enrichment and sediment tolerant taxa in Mile Creeks watershed indicates increased sedimentation, organic loading and decreased riparian condition increases downstream of the Forest boundary (MTH Macroinvertebrate Survey Reports 1986-92). Ramsey Creek, which lies primarily upstream of the agricultural and rangeland practices of the lower watershed, was the exception. BCI values for Ramsey Creek were consistently good-excellent on Forest. Off Forest BCI values for Ramsey Creek were similar to Forest values, but occasionally dropped into the fair range.

Water chemistry. Northwest streams are typically low in productivity and nitrogen limited (Norris et al. 1991 in Meehan). Forestry, rangeland, agricultural and fire suppression practices may increase nutrient availability from fertilizer, lime, fire retardant applications, and livestock excrement. The primary productivity response to nutrient loading is dependent on canopy closure and incident solar radiation.

Mile Creeks has relatively productive water and moderate-high biomass potential because of lower rainfall than the West Cascades Range and inherently warmer water temperatures with the potential to meet optimal conditions for growth (12^{0} C) (Barnhart 1986). The Hood River watersheds in the same subbasin have relatively unproductive water. Both Mile Creeks and the Hood River watersheds have the same parent material and slightly acidic soils, but the Hood River watersheds do not have high percentages of the agricultural and range lands that contribute to nutrient loading. Ranges for pH (5.6-8.98), specific conductance (12-340 micromho), total alkalinity (24-179 mg/L), and sulfate (0-13 mg/L) indicates nutrient loading in the lower Mile Creeks watershed are similar to those in the agricultural and rangeland influenced Deschutes Basin (ODFW/CTWS 1990).

VIII. Channel Stability

Geomorphology. Geomorphic stream reaches have variable entrenchment ratios, width to depth ratios, gradients, sinuosity and substrates. Rosgen (in prep.) developed a classification system for stable channel forms based on a combination of these characteristics. Montgomery and Buffington (1993) used the principles of applied physics and fluvial geomorphology, and similar channel parameters to classify "transport", "transition", and "depositional" reaches that are similar to the Rosgen reach types. As used in this report, a reach is a geomorphically distinct segment of stream based on the Rosgen classification system (Table III C.1.).

Natural channels will seek and maintain a stable channel form (Table III. C.1.) until a large perturbation (e.g. debris torrent, earthquake) creates disequilibrium in the system. Channelization, sedimentation, changes in timing and stage of peakflow events, and bank erosion are examples of management actions or effects that can initiate channel de-stabilization in the depositional Rosgen C and E "response" reaches. Disequilibrium invokes a series of dynamic channel adjustments until a new, but altered equilibrium state is reached (Rosgen in prep.).

Off Forest. In the mid-lower watershed, agricultural, forestry and rangeland practices have de-stabilized 36 miles of creek (Table F.1.). The unstable Rosgen G and F channel forms in Fifteenmile (26.4 miles), Eightmile (8.2 miles) and Fivemile (1.3 miles) are indicative of differing stages of channel downcutting and recovery. Entrenched channels will downcut in the former floodplain until they reach a resistant baselevel and increase their length and sinuosity at the new level, unless they are restored to their former floodplains, gradients, width to depth ratios, entrenchment and meander patterns (Rosgen in prep.).

Table F.1. Channel sinuosity, stream gradient, and Rosgen reach classification for creeks downstream of the Forest boundary.

Creek Name	River Miles	Channel Sinuosity	Stream Gradient	Rosgen Reach Type
Fivemile	0.0-1.3	1.1	1.7	G3
	1.3-4.3	1.2	1.2	C3
	4.3-5.4	1.1	2.8	C3b
	5.4-11.9	1.1	1.6	C3
	11.9-14.1	1.1	2.4	B3
Eightmile	0.0-1.3	1.1	1.3	F3
	1.3-6.0	1.1	1.9	C3
	6.0-11.2	1.1	0.7	C2c-
	11.2-12.2	1.1	1.5	C3
	12.2-17.9	1.1	1.2	F3
	17.9-22.0	1.0	2.2	B3
	22.0-23.8	1.0	4.6	B3a
Fifteenmile	0.0-1.0	1.0	15.0	A2a+
	1.0-3.6	1.1	1.8	F2
	3.6-22.8	1.1	0.6	F3
	22.8-25.9	1.1	1.7	G3
	25.9-27.4	1.2	0.9	F3
	27.4-32.4	1.1	1.5	B3c
	32.4-39.3	1.1	2.0	B3

On Forest. The upper watershed is primarily stable Rosgen A and B transport and transition reaches that are not morphologically sensitive to management activities (Table F.2.). Field surveys of stream reaches in the developed campgrounds of Eightmile, Lower Eightmile, and Pebbleford campgrounds (1994), indicate they are the most sensitive to channel morphology changes upstream of the Forest boundary (Table F.4.).

STREAM NAME	REACH	VALLEY FORM	ROSGEN REACH	ENTRENCHMENT	% GRADIENT	MILES SURVEYED	AVG WIDTH	POOLS/ MILE	LARGE WOODY DEBRIS/MILE	VEG ZONE
MF FIVEMILE CREEK 89 (PR 93)	1	7	B4	M	3	2.3	8	79	39* (PR 106)	DF/GF
MF FIVEMILE CREEK 89	2	5	C5	S	2	2.8	7	90	38*	DF/GF
MF FIVEMILE CREEK 89	3	7	B4	M	3	1.9	5	66	33*	DF/GF
SF FIVEMILE 89	1		B4	S	4	5.8	1	71	24*	DF/GF
SF FIVEMILE 89	2		A4	M	7	2.3	2	27	18*	DF/GF
EIGHTMILE 89 (PR 93)	1	3	A4	M	4	4.1	10	68	42* (PR 75)	DF/GF
EIGHTMILE 89	2	10	B4	M	3	1.3	9	49	33*	DF/GF
EIGHTMILE 89	3	3	A4	M	6	1.9	9	55	18*	DF/GF
EIGHTMILE 89	4	10	B4	M	3	2.4	9	38	16*	DF/GF
FRET CREEK 91	1	3	A4+	M	43	0.5	8	16	75*	MH/SF
FRET CREEK 91	2	5	A4	M	8	1.1	7	8	74*	MH/SF
FRET CREEK 91	3	3	A3+	M	22	0.3	3	3	33*	MH/SF
CEDAR CREEK 91	1	3	A3+	D	13	1.7	9	11	68*	DF/GF
FIFTEENMILE 91 (PR 93)	1		B4		3	2.1	20	31	79** (PR 212)	DF/GF
FIFTEENMILE 91 (PR 93)	2		A		5	2.6	15	38	144** (PR 129)	DF/GF
FIFTEENMILE 91	3		A+		14	0.7	13	60	39**	DF/GF
FIFTEENMILE 91	4		A		9	1.5	11	43	106**	DF/GF
RAMSEY CREEK 92 (PR 93)	1		B	M	3	2.6	7	56	38** (PR 160)	DF/GF

(PR) Post-Restoration Project

*Size class > 20" dbh x > 35' long

**Size class 18" dbh x > 33' long

VALLEY FORM CODES

1	Box-like Canyon	6	Trough-like, open
2	Narrow V-shaped <100 f	7	Broad, trough-like
3	Moderate V-shaped <100	8	Narrow flat-floored 100-300 ft
4	Low V-shaped <100 ft	9	Moderate flat-floored 300-600 ft
5	U-shaped >100 ft	10	Wide flat-floored >600

Vegetation Zone Codes

DF/GF	Douglas Fir/Grand Fir
MH/SF	Mt. Hemlock/Silver Fir

Note: Rosgen Reach Types were not determined in the field. Gradient and Valley Form were used to assign a Rosgen Channel Classification by Reach.

Table F.2. Stream survey summary data for Mile Creeks Watershed upstream of the Forest boundary.

IX. Riparian Habitat

Riparian Function. Riparian vegetation functions to stabilize streambanks, provides shade to moderate water temperature, provides habitat and travel corridors for terrestrial wildlife and amphibians, supplies terrestrial food sources such as leaves and terrestrial insects to the creek s, buffers sediment inputs, moderates peak and baseflows, supplies large woody debris for macroinvertebrate and fish habitat, and increases instream productivity.

Fire. Fire played an important role in the early history of Mile Creeks watershed (Section III. A. Forest and Steppe Ecosystem Fucntion). Frequent fires in the mid-lower watershed maintained open Ponderosa pine/Oregon white oak stands. Moist micro-climate conditions typically spared riparian zone from fires, and the riparian zones buffered the creeks from fire-generated hillslope sediment.

Decades of fire suppression has increased fuel loading and the risk of catastrophic fire in the mesic, moderate fire frequency dry Grand fir/ Douglas-fir and moist Grand fir strata. (Fig. I.5.; Section III. A. Forest and Steppe Ecosystem Fucntion). Englemann Spruce and other fire in-tolerant species in the riparian zones indicate fire is likely to be localized, rather than large scale impacts to riparian vegetation. Typically, the primary consequence of upland fire is increased erosion and potential delivery of sediment to the aquatic ecosystem. However, the current risk of conflagration poses a threat to riparian zone vegetation and could effect large woody debris loading and recruitment potential and streamshade at a landscape scale in the Grand fir/Douglas-fir strata (Section III. A.) - key components of riparian and aquatic ecosystems.

The Role of Beaver. Historically, riparian hardwoods and beaver were probably important components of low gradient reaches in the Ponderosa pine/Oregon white oak, and Steppe strata of the mid-lower watershed. For a time, early Euro-American settlement and trapping essentially extirpated beaver from the private land in the Mile Creeks watershed. Beaver are making a comeback in the lower watershed. Repatriation of beaver in the mid-lower watershed is limited by relatively low levels of hardwood riparian vegetation, and ODFW traps problem animals at the request of private landowners.

The narrow Ponderosa pine/Oregon white oak stratum above the Forest boundary still supports a few beaver, but the availability of hardwoods for forage is probably a natural limiting factor in the narrow floodplains and canyons associated with headwater reaches. Early post-harvest succession on the National Forest may temporarily benefit hardwood species and provide forage for beaver on a limited landscape scale, as evidenced by a series of abandoned beaver dams on a steelhead spawning reach on Ramsey Creek that was harvested in the riparian zone several decades ago.

Beaver increase habitat complexity and moderate baseflow and peakflow changes, and provide increased rearing capacity for steelhead. Kostow (pers. comm.) speculates changes in the hydrograph and instream habitat complexity that resulted from extirpation of beaver was a large factor in extirpations of anadromous salmonids from parts of their range in the Deschutes and John Day systems.

Floodplain function. Natural channels have variable floodplain development (i.e. entrenched to slightly entrenched) based on gradient and confinement (Table III. B.1.). Moderate-steep, low sinuosity Rosgen A and B reaches are high energy, sediment transport reaches with modest floodplain development. In low gradient, high sinuosity Rosgen C and E reaches, the interaction between the channel and active floodplain dissipates the erosive force of floodstage flows, recharges the watertable, and deposits fine sediment from the stream bedload.

Off Forest. The historic distribution and extent of riparian dependent vegetation in the mid-lower watershed has been permanently altered by livestock grazing, agriculture, timber harvest, herbicide application, channelization, extirpation of beaver, and urbanization at the landscape scale (ODFW/USFS 1990). Many of the perennial, intermittent and ephemeral reaches in mid-lower Fifteenmile watershed are downcut and entrenched. When the C and E reaches downcut in their floodplains, they loose sinuosity, and increase in gradient and stream power, and became Rosgen G (i.e. gully) and F channels. As a result, the former floodplains became terraces and the erosive power of floodstage flows was confined within the channel. The natural recovery process involves long-term evolution of the channel geometry and floodplain to an altered stable state. Restoration of the channel geometry and floodplain will speed recovery (Rosgen in prep.).

Channel headcutting was probably initiated in the mid-1800's when livestock grazing was introduced to the watershed. Livestock was probably more numerous before the advent of tractors than it is today, since farmers were dependent on teams to pull their equipment.

At the mid-lower elevations the pre-Euro-American riparian forests were logged and converted to cultivation or pasture by the turn of the century. Channelization after the 1964 and 1974 floods effectively isolated miles of creek and converted former floodplains to terraces (Table F.1.). The combined results of these impacts are increased sediment loads, lowered watertables, reduced riparian zone potential, increased peak flows, and reduced water storage capacity in the mid-lower watershed (ODFW/CTWS 1990). Changes in water storage capacity were not calculated for this analysis, but storage capacity is a function of depth of channel incision, water holding capacity of the soil and the groundwater cone of influence.

Current Oregon law provides direct access to streams for livestock watering rights. Riparian vegetation and streambank damage from livestock grazing and mechanical impacts has been identified as a fisheries issue (ODFW/CTWS 1990; ODFW/USFS 1987). Since 1987, ODFW has been working with landowners to provide 40-50 ft. wide water gaps for livestock in fenced riparian corridors ≥ 20 ft. wide on either side of the stream. To date, ODFW has fenced 40 miles of riparian habitat at a minimum width of 20 ft. to ¼ mile on either side of Ramsey, Dry, Eightmile and Fifteenmile creeks (restoration site maps available in the project file). ODFW is continuing to fence riparian corridors to increase canopy closure and reduce stream temperatures that make ≥ 35-40 miles of steelhead rearing habitat unsuitable during summer months, and meet upper lethal limits 25-29.4 ^{0} C for steelhead. State Standard for Hood Basin is 14.4 ^{0} C at the mouth of Fifteenmile Creek.

In 1991, CTWS built a riparian exclosure fence and water gap for a single, tribally owned grazing allotment on lower Fifteenmile Creek. Streambanks that were severely eroded and denuded of vegetation except for sage, have responded with a dense growth of willow since the exclosure was built.

Forested Land. On public and private forest lands in the Grand fir/Douglas-fir strata, the primary loss of riparian vegetation and riparian ecosystems has resulted from timber management practices. USFS timber management of riparian stands continued until the late 1980's. The Aquatic Conservation Strategy in the President's Plan requires the USFS to establish Riparian Reserves to protect all perennial and intermittent streams, lakes, ponds, wetlands, springs and reservoirs during project implementation (ROD 1994).

Prior to the 1972 State Forest Practices Act (SFPA), private timber harvest practices included tractor logging 70-80% slopes, skidding and decking logs in the creeks and riparian zones, and clear cutting riparian zones (Buckman pers. comm.). The effects of pre-1972 timber harvest in Mile Creeks are healing, but are still evident in Ramsey Creek.

Since 1972, SFPA has required an average canopy closure retention equivalent to 75% of the pre-project streamshade within 30-100 feet of fish-bearing streams. In September 1994 the new SFPA rules will include a 20 foot "no touch" buffer with some harvest options and variable basal area requirements (dependent on stream size) for riparian zones east of the Cascades Range. The intent of the new rules is to meet the State Water Quality Act requirements and improve large woody debris recruitment potential in the aquatic and riparian zones. In the interim, there is a trend for accelerated harvest in private land riparian zones before the September 1994 rules take affect.

However, the old and new SFPA rules are likely to provide equivalent riparian and aquatic protection in Mile Creeks watershed because the moist Grand fir and dry Grand fir Douglas-fir forest is more typical of West Cascades Range ecosystems than East Cascades Range ecosystems (Buckman pers. comm.). For example, the height of a site-potential tree that will recruit large woody debris to the creek is 125 ft. in the moist Grand fir and dry Grand fir/Douglas-fir strata. In the Ponderosa pine/Oregon white oak stratum, a site-potential tree is 100 feet.

On Forest. Permits for the upper watershed USFS grazing allotments have not been issued since 1992. There is current public interest in the grazing permits. If re-instatement of the permits is considered, the Riparian Reserve recommendations for protection of riparian zones, aquatic resources, and the south-facing, highly erosive-low resiliency soils can be applied to mitigate the impacts of livestock grazing.

X. Aquatic Habitat

Migration and Passage Barriers. Since the late 1930's , migrating Mile Creeks steelhead and Pacific lamprey have had to negotiate the hydroelectric facilities and a fish ladder at the Bonneville dam on the mid-Columbia River. The effects of the Bonneville facilities on their upstream and downstream migrations, and spawning success are unquantified, but significant.

Seufert Falls near the mouth of Fifteenmile Creek is a natural migration obstacle for adult steelhead, and may have been a migration barrier during drought years. In 1985, the ODFW chapter of mid-Columbia Chapter of Salmon/Trout Enhancement Program and local volunteers constructed a low-flow fish passage enhancement structure at Seufert Falls to benefit migrating steelhead.

The majority of historical steelhead spawning and rearing habitat in Mile Creeks probably occurred in low gradient 4^{th}-6^{th} order reaches on the agricultural land below the USFS boundary (Table F.1.). ODFW surveys (1987) identified a number of human-made passage problems on mid-lower Fivemile, Fifteenmile, and Ramsey creeks downstream of the Forest boundary. The majority of passage problems were unscreened diversions, and log or concrete dams for irrigation. Since 1987, ODFW has modified or screened the majority of passage problems on mid-lower Fifteenmile Creek. Woody debris jams that were considered barriers at the time of the survey have been recognized as important habitat elements, and will not be removed (Springston pers. comm.).

ODFW installed two Denil steep passes in July 1994 at 2 concrete diversion dams on Ramsey Creek at river miles (RM) 2.0 and 2.7. The other passage problems on private segments of Ramsey Creek have already been modified.

<u>On Forest</u>. Fifteenmile Creek has the only 4^{th} order stream habitat on Forest (Fig. F.1.). The majority of stream miles are first-second order headwater step-pool and cascade-pool reaches that have natural migration barriers and temporal hydrograph fluctuations which limit the availability and accessibility of steelhead spawning and rearing habitat upstream of the Forest boundary. Barrier falls, that delineate the historic range of steelhead distribution, occur in the lower reaches of Cedar Creek, South Fork Fivemile Creek, and in upper-Fifteenmile before the confluence with Fret Creek. Downstream of the barrier falls, stream gradients up to 12% in confined-unconfined reaches can provide good spawning, summer and winter rearing habitat for steelhead and resident trout (Washington Forest Practices unpub.). Confined-unconfined reaches with gradients 12-20% provide fair habitat, except for spawning in confined reaches, which is poor.

Both anadromous steelhead and resident trout are known to use seasonally intermittent portions of streams and tributaries to spawn (Carroll 1985; Kralik and Sowerwine 1977; Everest 1973). The young-of-the-year fish move out into perennial mainstem reaches early in the season in search of summer rearing habitat and may move back into intermittent reaches as refugia from high winter flows (Everest 1973). Therefore, intermittent reaches and tributaries in Mile Creeks Watershed may be important spawning and over-wintering habitat for steelhead, but have not been surveyed.

In 1983, District fisheries biologists baffled USFS Road 4450 culvert on Ramsey Creek (RM 11.4) that was a partial steelhead migration barrier. Another culvert on USFS Road 4430 at Eightmile Crossing Campground may be a passage problem for steelhead upstream to several miles of good, juvenile steelhead rearing habitat on Eightmile Creek (Fig. IV. A.).

Spawning habitat. Historically, mainstem Fifteenmile Creek probably had the largest steelhead population of the Mile creeks, as it does today (Newton pers. comm.). Landscape scale changes and channel degradation associated with rangeland, agricultural and forestry practices has decreased the historic levels of steelhead spawning habitat in the watershed by 30% (ODFW/USFS 1987). ODFW/USFS spawning surveys (1985-94) indicates the majority of current spawning activity takes place downstream of the Forest boundary on mainstem Fifteenmile Creek (average = 7 redds/mile off Forest, 2 redds/mile on Forest).

During the 1980's, Eightmile Creek downstream of the Forest boundary had steelhead spawning densities equivalent to Fifteenmile (average = 7 redds/mile) (ODFW 1985-90). Since 1990, heavy point source erosion from a private wheatfield 4-5 miles downstream of the Forest boundary has buried steelhead redds in Eightmile Creek (Newton pers. comm.). There is no pawning information for the 4 miles of Eightmile Creek immediately downstream of the Forest boundary. Excessive sediment production in Eightmile subwatershed has probably been a problem for many years, as evidenced by a delta of fine sediment below the confluence of Eightmile and Fifteenmile creeks. Upstream of the Forest boundary, Eightmile Creek averaged ≤ 1 redd/year, all within 0.75 miles upstream of the Forest boundary, 1984-94.

Middle Fork Fivemile averaged ≤ 1 redd/year, within two miles upstream of the Forest boundary (sporatic surveys 1984-94). There are no spawning surveys on Middle Fork Fivemile Creek downstream of the Forest boundary.

Ramsey Creek averaged 1.6 redds/mile downstream of the Forest boundary 1985-91, and 0.2 redds/mile just upstream of the Forest boundary 1985-94. Ramsey Creek downstream of the Forest boundary averaged 19.5 redds/year (1985-94).

Pools. 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, 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.

Desired conditions for pools per mile (Table III. B.1.) are based on the range of natural conditions (average ± 1 SD) (Overton et al. *in prep.*). 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 in the mid-lower watershed, the lateral scour pools on the outside of meander bends are the primary pools (Rosgen, in prep.; Montgomery and Buffington 1993). Large wood - especially rootwads - tree roots, and boulders are obstructions that create additional backwater and scour pools, and anchor point bars and pools (Montgomery and Buffington 1993). Channel straightening and entrenchment in the mid-lower watershed has decreased the natural meander pattern of C reaches (Table F.1.). Currently, the loss of sinuosity, increase in streambed gradient, channelization, sedimentation, and low levels of instream large woody debris are the primary factors limiting the number, volume, and quality of pools in the mid-lower watershed. ODFW estimated the current pool habitat for rearing steelhead is at 36% of historic levels in the mid-lower watershed (ODFW/USFS 1987). Since 1987, ODFW has improved the rearing habitat with instream rock and large wood structures.

<u>On Forest</u>. The surveyed reaches of Middle Fork and SF Fivemile, upper Eightmile, upper Fifteenmile, Cedar and Fret creeks within the Forest boundary are stable Rosgen A-B channels with pools/mile within the range of natural conditions (Table F.2.). In moderate to high gradient A-B reaches, the step-pool and cascade-pool sequences are formed by the interaction of fluvial processes and boulder-bedrock substrate elements. The channel geometry and pool to riffle ratios of A and B reaches, are generally insensitive to management activities. However, the quality and complexity of the pool and riffle habitats are very responsive to management effects. For example, large woody debris adds habitat complexity, depth, and volume to pools. In transition (Rosgen B) and transport (Rosgen A) reaches, large wood can "force" additional secondary pools into stable step-pool and cascade-pool systems (Montgomery and Buffington 1993).

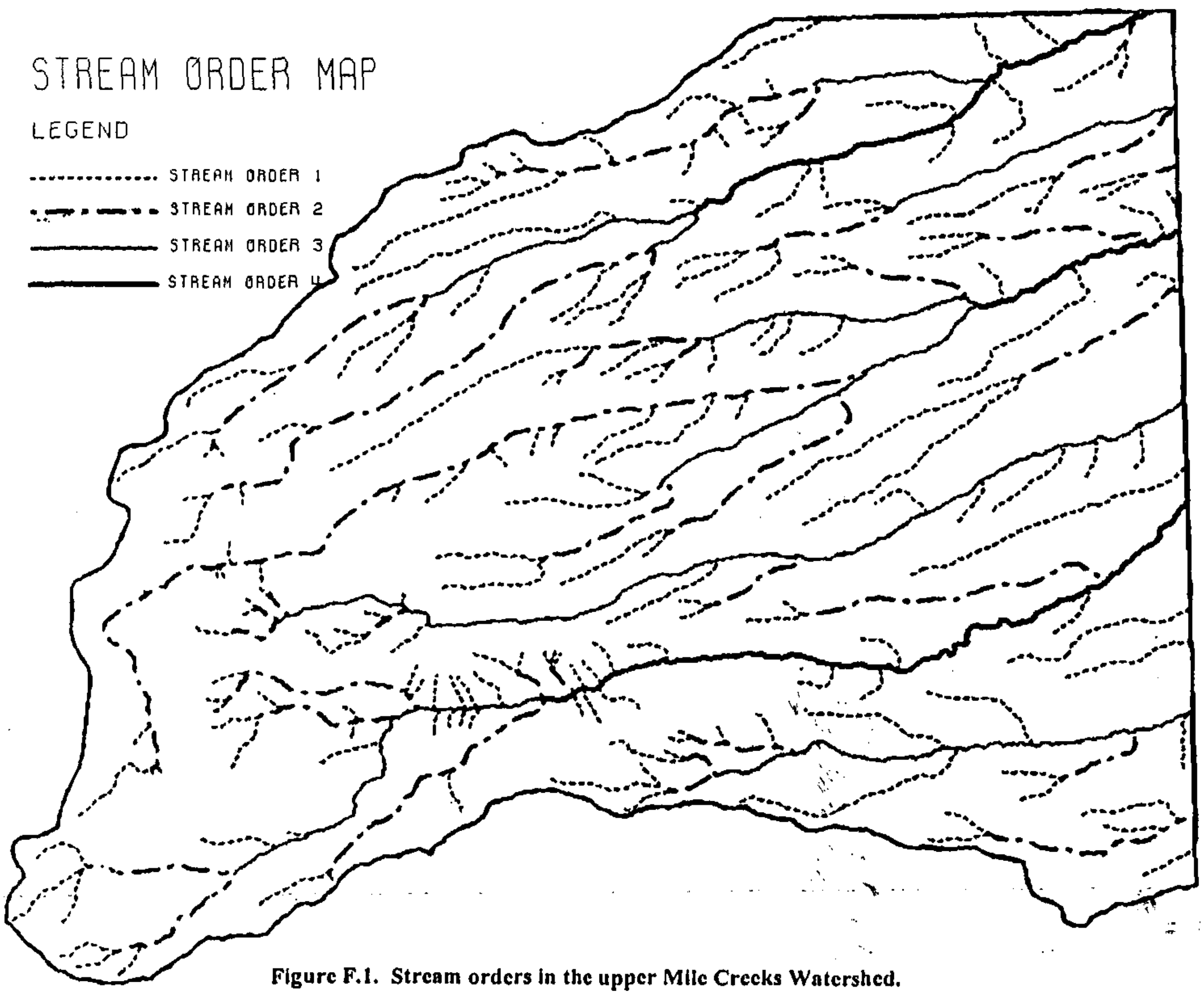

Figure F.1. Stream orders in the upper Mile Creeks Watershed.

Large Woody Debris. Large woody debris provides pool structure, substrate, habitat, cover, nutrients, channel roughness, and velocity refuge for aquatic plants, fish, macroinvertebrates, and amphibians. Agricultural, forestry, and rangeland practices have permanently reduced the potential for large woody debris recruitment in mid-lower watershed. Following the 1964 and 1974 floods landowners were required to remove streambank vegetation and instream large wood to receive federally funded damage assistance. It is still common practice for the landowners and/or ODFW at the request of the landowners, to remove large woody debris that has fallen onto the riparian exclosure fences, or is considered a hazard to private property in the event of natural channel migration during flood events.

The ODFW and privately fenced riparian corridors established since 1987 (project work is on-going) have increased the potential large woody debris recruitment to the aquatic and riparian ecosystems in the mid-lower watershed. If ODFW and the private landowners were to increase the minimum fenced riparian corridor width from 20 feet to 100 feet (i.e. the height of 1 site-potential tree in Ponderosa pine/Oregon white oak stratum), recruitment potential would be greatly enhanced within the streamside zone (ROD 1994).

Existing levels of instream large woody debris on Forest. Decades of timber harvest activities and two decades of instream large woody debris removal following the 1964 floods, depleted large woody debris in Middle Fork and North Fork Fivemile creeks and their tributaries, tributaries to South Fork Fivemile Creek, Ramsey Creek and it's tributaries, Deadman Gulch and it's tributaries, Rail Hollow, Cedar Creek, Larch Creek and it's tributaries (map in project file). .). Fifteenmile Creek has no recent history of timber harvest or large woody debris "stream cleaning", so Fifteenmile pre-project large woody debris levels were used as the desired condition for Grand fir/Douglas-fir strata in the upper watershed (Table III. B.1.).

In 1989, the pre-restoration project large woody debris levels in surveyed reaches of Middle Fork and South Fork Fivemile, Eightmile, and Ramsey creeks were outside the range of desired conditions for the Grand fir/Douglas-fir strata (Table III. B.1.) and lower then the average desired condition (Table. F.2.). Restoration projects to re-introduce large woody debris has raised the large woody debris levels in the first reaches of Middle Fork Fivemile Creek, Eightmile Creek, and Ramsey Creek (Table F.2).

Many of the nonfish-bearing tributaries with low levels of large woody debris are intermittent streams that are 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.).

Fish-bearing creeks in Fivemile and Eightmile subwatersheds have the highest potential to benefit from future instream restoration work. The benefits of riparian vegetation management to long-term recruitment potential is a factor to consider in restoration project planning.

Large Woody Debris Recruitment Potential on Forest Lands. Timber harvest within 125 ft. or the height of 1 site-potential tree in the moist Grand fir and dry Grand fir/Douglas-fir and Subalpine fir/Mountain hemlock riparian zones has reduced the current large woody debris recruitment potential on the public forests of the upper watershed (Fig. F.2.). Large woody debris recruitment potential was not quantified on private forest lands.

Large woody debris recruitment potential for managed and unmanaged stands in the recommended Riparian Reserves of Fivemile, Eightmile and Fifteenmile subwatersheds varies from 73-89% high and 7-18% low (Table F.3.). Stands that have been managed for timber harvest in the Riparian Reserves have more acres with low large woody debris recruitment potential than occurred naturally in unmanaged stands.

Table F.3. Large woody debris recruitment potential in the recommended Riparian Reserves.

Large Woody Debris Recruitement Potential within Riparian Reserves							
			Acres			Percent of Total	
	Category	POOR	FAIR	GOOD	POOR	FAIR	GOOD
Fivemile	Unmanaged	168.68	85.84	924.48	14	7	78
Eightmile		53.6	21.57	1069.92	5	2	93
Fifteenmile		173.02	93.4	1672.6	9	5	86
Fivemile	Managed	116.06	50.04	193.03	32	14	54
Eightmile		48.93	29.36	150.11	21	13	66
Fifteenmile		75.61	62.49	179.47	24	20	57
Fivemile	Total	279.77	135.88	1117.51	18	9	73
Eightmile		102.52	50.93	1220.03	7	4	89
Fifteenmile		248.63	155.9	1852.06	11	7	82

Fivemile Creek had the highest percentage of both managed and unmanaged stands with low large woody debris potential in the Riparian Reserves. Fivemile subwatershed has been heavily managed for timber production, as evidenced by the managed acres of low-fair large woody debris recruitment potential, low canopy closures and fragmentation in the recommended Riparian Reserves. (Fig. V. A.3.). The low potential in unmanaged stands of Fivemile subwatershed reflects the south-facing Ponderosa pine/Oregon white oak stands north of Forest Road 1722, and not the streamside/riparian band that contributes large woody debris to the creeks (Fig. F.3).

Eightmile Creek had the greatest percentage of Riparian Reserve acres with high large woody debris potential, and the lowest percentage of managed stands with low large woody debris potential.

Currently, the high percentages of mid-seral stage conifers (i.e. < 21" diameter closed sapling/pole, open and closed small conifer) upstream of the Forest boundary, indicates an upward trend in large woody debris recruitment potential in the moist Grand fir and dry Grand fir/Douglas-fir (52%) and Ponderosa pine/Oregon white oak (48%) strata, and recovery from previous logging in the riparian zone. The current percentages of mid-seral stage conifers in the Subalpine fir/Mountain hemlock strata are 71-79 %. Silviculture projects to release conifers, increase snags and large woody debris in the Riparian Reserves would benefit both the riparian and aquatic ecosystems.

Miles Creeks Watershed
Large Woody Debris Recruitment Potential Within Harvested Areas in the Riparian Reserves

High
Low
Medium
Unharvested

Miles Creeks Watershed
Large Woody Debris Recruitment Potential
Within Riparian Reserves

XI. Sedimentation

Agricultural Impacts. The mid-lower watershed has been in crop and rangeland production since the 1880's (Eddy pers. comm.). Approximately 172,000 acres of the mid-lower Mile Creeks Watershed is in range or cropland production (State Water Resources Board 1965). Dryland wheat, canola, and rangeland account for 121,000 acres. Irrigated land, primarily orchards and pasture, another 3,600 acres. Dryland wheat has been a subsidized crop since 1978, and farmers with water rights are switching to orchard production (Eddy pers. comm.).

Historic and current land-use practices have contributed to large amounts of fine sediment in the mid-lower watershed (ODFW/CTWS 1990). Approximately 149,000 tons of sediment are produced in the Mile Creek watershed annually as a direct result of agricultural practices (Wheeler 1975 in ODFW/CTWS 1990). The efficiency of modern farm machinery has allowed landowners to cultivate increasingly steep slopes with highly erosive soils. Precipitation and run-off December-March are the primary erosion agents in the watershed (Eddy pers. comm.).

The moderate-low gradient reaches in the lower watershed are inefficient at moving excessive amounts of sediment. Excessive sediment loading has potentially systematic and de-stabilizing effects on stream channel morphology and aquatic habitat (Rosgen in prep.; Montgomery and Buffington, 1993).

On Forest. The desired conditions for fine sediment in spawning habitat (i.e. < 20 % surface particles) (Table III. B.1.) is based on the relationship of embryo survival and percentage of substrate particles < 6.35 mm for chinook, kokanee, rainbow, cutthroat and steelhead trout (Bjorn and Reiser in Meehan 1991). Above 20% surface fines, the survival of salmonid embryos decreases rapidly. Field measurements of surface particles in upper Mile Creeks following Wolman (1954) were taken April-May 1994. In all cases, the percentage of fines exceeded the desired condition by 55-95% at the Forest boundary (Table F.4.).

Table F.4. Surface particle size distribution upstream of the Forest boundary.

Stream	Site	Channel Type	%<6mm	6-96mm	96-256mm	256+mm
Fifteenmile-U	Below Fret	B4a	21	40	17	22
Fifteenmile-C	Below Cedar	B4	26	47	16	11
Fifteenmile	4421	B4	35	36	18	11
Fret	2730	A4a+	17	49	19	15
Cedar-U	2730-160	B4a	29	65	6	0
Cedar	At 15mile	B4	21	60	16	3
Fivemile	Gage	B4	31	31	29	9
Eightmile-U	Eightmile CG	E4b	54	42	4	0
Eightmile	Lower 8mile CG	C5b	56	41	2	1
Eightmile-G	Gage	B4	34	39	16	11
Eightmile -B	Boundary	B4	39	36	16	9
Ramsey-P	Pebbleford CG	C4b	48	49	3	0
Ramsey-G1	Gage	B4	35	55	7	3
Ramsey-B	Boundary	C4b	35	43	17	5

System and non-system roads, ditch lines, culverts, tractor harvest units, recreational trails, campgrounds, dispersed campsites, bank erosion, highly erosive soils, and low resiliency soils are sources of sediment on the Forest. Only the percentage of tractor harvested acres and fine sediment production were significantly correlated, but other sources of sediment are contributing to the accumulation of fines in the creeks (Table F.5.).

Table F.5. Sources of sediment by area and subwatershed upstream of the Forest boundary.

Sample Point	Acres in Watershed	Acres in Riparian Reserve	Percent of fines <6mm	Acres of Road	Percent Roaded	Acres of Road within RR	Percent RR roaded	Tractor Harvest	Percent Harvested	Tractor harvest in RR	Percent Harvest in RR	Acres of Low Resil. Soils	Percent Low Resil	Acres of High Erosion Potential Soils	Percent High Erosion	OHV Use Miles
Fifteenmile (below Fret)	2780	238	21.49	122.54	4.41	3.78	1.59	318.02	11.44	0	0.00	0	0.00	651	23.42	3.2
Fifteenmile (below Cedar)	7488	1200	25.71	292.44	3.91	19.13	1.59	675.4	9.02	25.8	2.15	1039	13.88	1689	22.56	15.2
Fifteenmile (4421 road)	7702	1337	34.91	292.44	3.80	19.13	1.43	675.4	8.72	25.8	1.93	1121	14.55	1718	22.31	8.4
Fret (above 2730)	998	125	17.19	0.89	0.09	0.89	0.71	0	0.00	0	0.00	1	0.10	511	51.20	0
Cedar (2730-160)	1444	94	29.23	101.19	7.01	5.78	6.15	151	10.46	4	4.26	12	0.83	151	10.46	3.1
Cedar (mouth)	1687	202	21.15	101.63	6.02	6.23	3.08	151	8.95	4	1.98	74	4.39	320	18.97	3.7
Fivemile (gage)	7394	1365	31.13	409	5.53	63	4.62	1653	22.36	140	10.26	627	8.48	514	6.95	
Eightmile (above 44)	1772	176	54.05	39.41	2.22	0	0.00	301	16.99	2.22	1.26	0	0.00	361	20.37	2
Eightmile (elev 3640')																4.5
Eightmile (29.40)	3381	464	55.94	156.34	4.62	27.8	5.99	772.14	22.84	20.68	4.46	0	0.00	1016	30.05	
Ramsey (boundary)	3074	586	35.25	234.4	7.63	22.24	3.80	728	23.68	36.36	6.03	419	13.63	530	17.24	
Ramsey (gage 11.0)																
Ramsey (above 4450, elev 3400)	2085	282	35.25	171.69	8.23	12.9	4.57	614	29.45	32.25	11.44	110	5.28	140	6.71	5.8
Ramsey (Pebbleford)	631	24	47.69	42.48	6.73	0.89	3.71	301	47.70	6	25.00	0	0.00	2	0.32	1.1

The developed USFS campgrounds in upper Mile Creeks Watershed - Pebbleford, Fifteenmile Eightmile Crossing, Lower Eightmile, Underhill Site - are sources of sediment from trampled and chiseled streambanks, riparian and understory vegetation removal, and soil compaction. Despite previously completed restoration work, the highest percentages of surface fines of all sampled sites occurred at Eightmile Crossing Campground (54%), Lower Eightmile Campground (56%), and Pebbleford Campground (48%). Some fine sediment was deposited in pools and other slow water areas between the campgrounds and the downstream Forest boundary, where the percentages of surface fines still exceeded the desired condition by 75-95%.

Other factors contributing to the high percentage of fine sediment in Eightmile Creek are off-highway vehicle trails, particularly in the vicinity of Bottle Prairie, highly erosive and moderate resiliency soils, tractor harvest, roads and stream crossings. Barlow Ranger District is currently developing an off-highway vehicle plan that will tier to the Mile Creeks *Watershed Analysis Report.*

Point sources of sediment were identified in Fifteenmile subwatershed, including a very large gully at the outlet end of a shotgun culvert east of the 4460 stream crossing (Sec. 15) and a barriered non-system road (Sec. 16), both on Ramsey Creek. Other point sources of sediment in the subwatershed are the south-facing slopes in the moist Grand fir and dry Grand fir/Douglas-fir and Ponderosa pine/Oregon white oak strata on Fifteenmile Creek that have low resiliency, high erosion potential soils drained by intermittent tributaries. The soils have been compacted by livestock grazing and are naturally slow to recover. Increased runoff and sedimentation from the compacted soils, coupled with streambank trample and chisel, and vegetation damage from grazing livestock probably initiated headcutting in the intermittent tributaries. The headcutting will continue in an upstream direction - contributing large volumes of sediment to the steelhead spawning sites in Fifteenmile Creek - until the headcut reaches a resistant point in the channel, or the headcuts are stabilized with geotextiles and/or vegetation.

XII. Temperature

Off Forest. Increased channel width to depth ratios in the mid-lower subwatershed decreases the creeks' ability to moderate the range of daily temperature fluctuation during summer and winter baseflows. In the lower Mile Creeks watershed, water temperatures during the low baseflow, irrigation season routinely exceed the upper lethal limit for salmonids (ODFW/USFS 1987). The lethal temperatures are the result of increased solar radiation from sparse riparian canopy closure, exacerbated by water withdrawals for irrigation and other uses (ODFW/USFS 1987).

State Standards for water temperature in the Hood Subbasin is 14.4^0 C. Steelhead fry require temperatures of 7-15^0 C to grow and develop (Barnhart 1986). Smolting ceases at temperatures 14-18^0 C, oxygen uptake becomes difficult at $\geq$ 20^0 C, and 24^0 C is the upper lethal limit for steelhead (Barnhart 1986). The proposed desired condition for temperature at the mouth of Fifteenmile Creek near The Dalles is $\leq 24^0$ C (ODFW/CTWS 1990) - the published upper lethal limit for steelhead. However, redband trout/steelhead have evolved higher temperature tolerances than coastal rainbow/steelhead (Behnke 1992).

There were 21 days of recorded water temperatures $< 1^0$ C - the lower lethal limit for salmonids - at the Forest boundary December 93-February 94. Reaches with sparse riparian vegetation in the mid-lower watershed typically ice over in the winter months. Reaches with dense riparian vegetation have less extensive icing (Newton pers. comm.). Frequent freezing and thawing, coupled with low residual pool volumes, could be lethal factors for over-wintering juvenile steelhead. Daily maximum and minimum temperature monitoring and winter sampling of residual pool depths (Lisle 1992) could be used to evaluate the fisheries impacts of temperature fluctuations.

Riparian canopy closure is increasing in the mid-lower watershed as a result of ODFW and private landowner riparian fencing projects. Woody riparian vegetation has responded rapidly within the exclosures. However, shade is only part of the water temperature equation. Changes in the water allocations and sediment loading in the mid-lower watershed are necessary for significant changes in water temperature. For example, during a recent week of 40^0 C air temperatures, the water temperatures in Fifteenmile Creek at the Dufur bridge reached 27^0 C. ODFW received reports of dead dace, juvenile steelhead and trout, sculpins, and crayfish from Dufur downstream to Highway 197 bridge. Both live and dead salmonids were observed by ODFW Biologists (Newton pers. comm.).

On Forest. Annual peak temperatures at the Forest boundary exceeded State Standards (14.4^0 C) in Fivemile Creek, Eightmile, and Fifteenmile for the years 1990-93 (Table F.6.). Eightmile Creek had the lowest increase in temperatures despite a 1.7 cfs water diversion to Wolf Run Ditch at Eightmile Crossing Campground.

Table F.6. Seven day average high temperature ^{0} C at the Forest boundary.

Subwatershed	1990	1991	1992	1993
Fivemile	16.9	16.8	-	14.8
Eightmile	16.4	15.1	15.8	14.3
Fifteenmile	17.9	15.0	18.6	15.9

Based on the vegetative database used for the stream temperature analysis (Appendix E. Water Temperature Report), timber harvest in the Riparian Reserves has increased the percentage of acres with low canopy closure by 6% in Fivemile, 25% in Eightmile, and 16% in Fifteenmile subwatersheds (Table F.7.). The differences in canopy closure between managed and unmanaged stands, particularly for Fivemile subwatershed, are probably greater than the analyses were able to discriminate based on the resolution of available vegetation information.

Table F.7. Current canopy closure conditions in the Riparian Reserves of Fivemile, Eightmile, and Fifteenmile subwatersheds upstream of the Forest boundary.

		Acres within the Riparian Reserve				Percent of Total	
	Category	POOR	FAIR	GOOD	POOR	FAIR	GOOD
Fivemile	Unharvested	553	241	381	47	20	32
Eightmile		188	347	616	16	30	54
Fifteenmile		484	875	580	25	45	30
Fivemile	Harvested	212	73	75	59	20	21
Eightmile		84	90	55	37	39	24
Fifteenmile		166	87	64	52	28	20
Fivemile	Total	765	313	456	50	20	30
Eightmile		272	437	671	20	32	49
Fifteenmile		650	963	645	29	43	29

The relatively high temperatures in 1990-92 correlated with drought conditions that culminated in 1992. The relatively low temperatures in 1993 correlated with a wetter hydrologic year. Therefore, the relative magnitude of annual variability probably represents the natural fluctuations in the East Cascades Range hydrographs, rather than improved shade conditions.

Monitoring water temperatures at the headwaters and at the Forest boundary are necessary to evaluate the magnitude of management impacts on stream temperatures in the upper watershed, and maintain the source of cold water to the thermally stressed mid-lower watershed.

XIII. Hydrology

Flow Regime. The flow regime in Mile Creeks watershed is dominated by snow melt and spring rains. Approximately 70-80% of the precipitation in Mile Creeks watershed falls November-March (ODFW/CTWS 1987). Peakflows typically occur January-February (State Stream Gauge Records). Numerous springs in the upper watershed moderate summer baseflows.

Baseflow. Water rights in the Mile Creeks watershed have been over-allocated, resulting in lower volume and longer periods of low summer baseflow in mid-lower Mile Creeks. Mile Creeks water rights, established in the 1920's, require instream flow be maintained but do not specify a minimum flow in terms of cubic feet per second (cfs). After the advent of electricity in the 1940's, the irrigation system changed from a series of gravity flow ditches to electric pumps. Increased pumping efficiency created intermittent stream segments in lower Mile Creeks during the annual irrigation season until the mid-1960's (Kelly pers. comm.). In the 1960's a combination of economics and pump efficiency increased the number of water rights, and the State Water Resources Board hired a Watermaster to regulate water rights in Wasco County.

Prior to regulation of the flow requirement, irrigators used an equivalency system of water withdrawals that de-watered creeks for several days at a time (Toll pers. comm.). Under the current rotation system the flow requirement is enforced on a more or less continuous basis, although low gradient and/or aggraded segments of Fifteenmile Creek often go dry for short periods of time in mid-July to early August before they are shut off for the season (Toll pers. comm.).

In 1983, instream water rights, including minimum perennial streamflows of 2 cfs on Fifteenmile Creek at Dufur, 4 cfs on Fifteenmile at the confluence of Eightmile, 2 cfs at the mouth of Eightmile Creek, and 2 cfs on Eightmile Creek at Highway 197, and withdrawal of unappropriated waters were established by the Water Policy Review Board to meet ODFW minimum flow recommendations for protection of fishes. National Marine Fisheries Service supported the minimum flow proposal with the realization that 2 cfs was not available during most, if any years July-October. NMFS stated "investments in fisheries habitat restoration would be unwise without improvement in summer base flows, and improved watershed conditions and restoration of riparian vegetation could increase the duration and amount of summer base flows in Mile Creeks" (NMFS letter to the Water Policy Review Board, dated 9/12/1980). Unfortunately, the minimum flow requirement is not enforceable because only one water right can be shut off to meet minimum flows (Toll pers. comm.), and whenever water has been conserved, the farmers have put more land into cultivation (Eddy pers. comm.).

During the irrigation season, agricultural water withdrawals on Fivemile Creek create an intermittent creek from 1/4 mile downstream of the Forest boundary to the confluence with Fifteenmile near Petersburg. During these months, mainstem Fivemile Creek is a barrier to fish migration. Juvenile steelhead and other fish rearing in Fivemile Creek are likely to be stranded in intermittent pools where they are easy prey for terrestrial predators, and are subject to high metabolic stress and potentially lethal water temperatures (ODFW/USFS 1990).

<u>On Forest.</u> Percentage of the subwatersheds in the snow and rain on snow zones, geologies, and annual snowpack accumulation are positively correlated with the baseflow regime of upper Mile Creeks subwatersheds. Forest baseflow reference information is not available, however road densities are positively correlated with baseflow, and canopy closures are negatively correlated with baseflow (Appendix. C. Baseflow Report).

Wolf Run Ditch on Eightmile Creek at Eightmile Crossing Campground, is the only priority water right on Forest. Wolf Run supplies Hanel Lake, a 49.1 acre ft. recreational reservoir for the Camp Baldwin Boy Scout Camp and 12 domestic, stock and irrigation water rights. Outlet for the reservoir is Hesslan Canyon, an intermittent tributary that enters Eightmile Creek below the Forest boundary (Fig. I.6.).

Calculated baseflow potential for Eightmile Creek at the Forest boundary is 3.3 cfs (Appendix D. Baseflow Report). Half of that, or 1.7 cfs, is withdrawn by Wolf Run Ditch during the irrigation season, leaving 1.6 cfs for instream beneficial uses. Therefore, summer baseflows at the Forest boundary do not meet ODFW recommended minimums of 2 cfs for the protection of fishes. In addition, the water withdrawals are exacerbating annual peak water temperatures that currently exceed State Standards on Eightmile Creek at the Forest boundary (Table F.5.), and the second highest percentage of roaded acres in the upper watershed (6%) (Table F.6.) adds to the cumulative effect of low baseflow in the subwatershed. Increased water temperatures and low baseflows have the potential to negatively impact the entire Forest population of steelhead in the Eightmile subwatershed (Fig. IV. A.1.).

Good fish habitat and summer baseflow are available above Eightmile Crossing Campground but a culvert on Road 4430 at the campground may be a barrier for juvenile steelhead migration. Modification of the culvert would open up the historic range of anadromy, above the influence of Wolf Run Ditch, as a summer lowflow and temperature refugia for Eightmile Creek juvenile steelhead.

Peakflow. The effects of peakflow increases in the Mile Creeks watershed were exemplified by two 100 year interval floods in December 1964 and January 1974. Both floods resulted in channel migrations, washed-out bridges, extensive streambank erosion, and deposition of large woody debris and silt-cobble sediment on private property in the mid-lower watershed (Kelly and Davidson pers. comm.). After the floods, federally funded flood damage assistance from the Soil Conservation Service required landowners to remove streambank vegetation and instream large wood in a misguided attempt at channel stabilization (Newton 1981). Creeks were straightened and "channelized" with D-8 tractors.

Fifteenmile Creek instantaneous peakflow annual maximums 1953-83 ranged from 640-4,850 cfs at the Rice gaging station on Fifteenmile Creek 0.1 mile below the confluence of Dry Creek. On January 16 during the 1974 flood, the Rice gage blew out at an estimated 2,200 cfs. A conservative estimate calculated the 1974 flood peaked at 9.6 ft. and ≥ 7,300 cfs from peakflow rating curves. Undoubtedly the 1974 flood did more damage to private property as a result of the post-1964 streambank vegetation removal and channelization work that shortened stream lengths, thereby increasing stream gradient and power.

<u>On Forest.</u> Calculated peakflow increases in Fivemile, Eightmile and Fifteenmile watersheds are the result of expanded drainage networks, and created openings from harvest units and roads in the snow and rain on snow zones (Appendix C. Peakflow Report). Increased peakflow puts response reaches, aquatic habitats, and instream productivity at risk from increased streambank erosion, bedscour, deposition, downcutting, lateral widening of the channel, substrate embeddedness, and pool filling.

Steelhead evolved with the drought cycles and infrequent, large flood events that can wipe out the reproductive effort of an entire spawning season. As a result, the life history cycle of the steelhead provides each age class 3 consecutive years to contribute successfully to the spawning gene pool. Therefore, the greatest risk to steelhead results when increased peakflows occur during bankfull or average floodstage, and successive age classes are effected.

Fisheries resources in Eightmile Creek subwatershed are at the greatest relative risk from increased peakflows due to high levels of fine sediment, moderate increases in peakflow, and the greatest increases in drainage network from roading in the upper watershed.

Fivemile subwatershed has a moderate relative risk from a combination of moderate levels of fine sediment, the greatest peakflow increases and moderate increases in the drainage network from roading.

Fifteenmile subwatershed has the lowest relative risk to fisheries with moderate amounts of fine sediment, lowest increases in peakflows and drainage networks.

Hydrologic recovery and decreased miles of roads, stream crossings, and shortened culvert spacing would bring the peakflows back into the range of natural conditions and decrease the risk to fisheries from increased bedscour and sediment deposition. Increases in peakflows have relatively higher impacts on intermittent and ephemeral streams that naturally experience extreme "flashy" flows, then on perennial streams with greater channel capacity to moderate the flood effects. Inventories of the intermittent and ephemeral tributaries in the upper watershed would identify additional point source erosion problems for restoration project planning.

XIV. Lakes

Oval Lake is a 1.9 surface acre, shallow lake at the headwaters of Fret Creek in the Badger Creek Wilderness, Fifteenmile subwatershed. Oval Lake is the only natural lake in the watershed. Oval Lake has not been surveyed, and there are no records of ODFW fish stocking. It may be a valuable resource as a wetland.

Hanel Lake is a 5.5 surface acre recreational reservoir on Wolf Run Ditch in Eightmile subwatershed on the Camp Baldwin Boy Scout property. The area is not considered a wetland.

The reservoir is stocked with catchable rainbow trout for the annual USFS National Fishing Week event. Wolf Run Ditch is screened to prevent wild trout and steelhead from entering the reservoir. There may be an opportunity for a cooperatively funded USFS, US Fish and Wildlife Service (USFWS) and private landowner project to enclose the ditch for water conservation.

XV. Springs and Wetlands

Springs. A unique feature of the upper Mile Creeks watershed are the numerous perennial springs that follow the north-south geologic contact point between the resistant andesite formation and the less resistant Dalles formation. Only a few of the larger springs and their associated wetlands are mapped. The springs moderate the baseflows of this predominantly snow-fed system and provide water, forage and microclimates for terrestrial plants and animals.

Wetlands. In the upper Mile Creeks watershed, the wetlands are small and scarce, and as such, have high value for terrestrial wildlife and plant biodiversity. Overall, the low plant biodiversity in the upper watershed is probably correlated with low wetland diversity. The only mapped wetlands are Bottle Prairie, Eightmile Meadow, an Engelmann Spruce swamp, and a *Juncus* wetland in the headwaters of Eightmile subwatershed, and the Badger Creek Wilderness.

The USFWS national wetlands inventory identified some wetlands in the mid-lower watershed that have not been field validated.

XVI. Previous Restoration Efforts

Instream and Riparian Restoration. Public land managers and private landowners cannot control the numbers of adult steelhead returning to spawn in Mile Creeks watershed because of the numerous environmental and human impacts anadromous fish encounter during their migratory and ocean phases. What land managers and owners can influence is quality of the riparian zones and freshwater spawning and rearing habitat to improve the survivorship of early life stages of steelhead.

Since 1987, ODFW and private landowners have completed numerous instream structural projects with rock and large woody debris, barrier modifications, riparian fencing and restoration projects in the mid-lower watershed (ODFW project maps on file). ODFW restoration efforts are continuing incrementally in the mid-lower watershed.

In 1985, the Food Security Act passed a law requiring all farmers on highly erodible land to file an erosion plan by 1995. Approximately 80-85% of the mid-lower watershed fits the highly erodible land category (Eddy pers. comm.). Under guidance from the Soil Conservation Service, the County Soil and Water Conservation District, private landowners are using improved techniques for residue management on the wheat fields, strip planting, terracing steep hillsides, dust mulching to retain moisture, and putting poor production land into the Conservation Resource Program. However, improvement in water quality is not visibly detectable at high flow (Newton pers. comm.) and will require turbidity monitoring to quantify improvements.

On Forest. In the upper watershed, the USFS has completed instream rock and log structures, riparian restoration, campground restoration, trail maintenance, streambank stabilization, riparian planting, re-forestation, culvert removal and/or modification, road closure/obliteration/storm-proofing projects to benefit aquatic and riparian beneficial uses.

In 1992, riparian restoration and "people control" work was completed in Eightmile Crossing Campground as part of the Salmon Summit Agreements. Additional Eightmile Crossing Campground restoration was completed in 1994.

In 1994, as part of the Salmon Summit Accord commitments, the MTH purchased a previously logged 1 mile^2 section of Fifteenmile Creek adjacent to the Forest boundary (Sec. 19) from the Rocky Mountain Elk Foundation (RMEF) for the benefit of anadromous fish. The Barlow RD is preparing a restoration plan for the acquired parcel. Restoration of the parcel is a 1995 District priority.

In July 1994, MTH proposed the purchase of another 2,500 acres of previously logged RMEF land on the north and south banks of mainstem Ramsey Creek, adjacent to the Forest boundary (R. 12E., Sec. 7-9, 16-18). ODFW and RMEF acquired the parcel in 1990, and planted it with Ponderosa pine in March of 1992. RMEF and ODFW have a 20 year lease to manage the property for public multiple-use purposes. RMEF have yet to approve the proposed sale. If the sale proposal is accepted, the USFS Regional Office will need to approve the purchase.

MTH/GP Ecologists have developed riparian vegetation classifications that can be used to predict plant associations in the Mile Creeks Riparian Reserves, or to plan restoration of native plant communities in Riparian Reserves (Diaz in prep.). Use of native plants is recommended for restoration projects to reduce the spread of introduced species and noxious weeds that compete with native species.

Riparian stand exams are needed for future restoration planning, and watershed condition baseline and trend monitoring.

XVII. Personal Communications

Dr. Richard Beemish, Canadian Department of Fisheries, Research Fisheries Biologist

John Buckman, Department of Forestry, Unit Forester, The Dalles Unit

Barbara Davidson, Dufur Historical Society and long-term resident of Mile Creeks Watershed

Dusty Eddy, Soil Conservation Service, Soils Scientist

Wilbur Kelly, long-time resident of Mile Creeks Watershed

Dr. Katherine Kostow, Oregon Department of Fish and Wildlife, Research Geneticist

Jim Newton, Oregon Department of Fish and Wildlife, District Fisheries Biologist

Steve Springston, Oregon Department of Fish and Wildlife, Fisheries Biologist

Larry Toll, Wasco County Watermaster

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Appendix G. Wildlife and Botanical Report
(including Survey and Manage Table)

Special acknowledgements to Rich Thurman for input to the wildlife portion of the report.

Assumptions and methods used in analysis.

1. The vegetation structure and composition has changed due to human intervention, primarily fire suppression and timber harvest.

2. Road densities for the National Forest portion of the watershed were calculated from existing road densities, 1994, in the Geographical Information System (GIS).

3. 11-40 data was calculated from existing information, 1994, in GIS.

4. Vegetation zones, in which estimated percent of deer and elk populations are classified into, were derived from fire classification map which is only hard copy at this time, 1994. Percentages and locations of deer and elk are base on professional judgement.

5. Winter/summer range map layer in GIS is from the Mt. Hood National Forest Land and Resource Management Plan (LMP), 1992.

6. Turkey population trends were obtained from Jim Torland, Oregon Department of Fish and Wildlife (ODFW), 1994.

7. Professional judgement of deer, elk, wild turkey, and western gray squirrel numbers patterns of use were based upon ODFW studies and input.

8. Threatened, endangered, and Region 6 sensitive (TES) plant and wildlife species' surveys were conducted by Mt. Hood National Forest.

9. Wildlife habitat information was derived from the Species and Community Conservation Analysis (SCCA, 1994) database. The database, from preliminary assessments, appears to be 80% accurate at the Forest and watershed scales. See Appendix G.1.

10. Special habitats was derived from SCCA and Barlow Ranger District input. The old-growth, with district updates, is presently only hard copy.

11. The harvest activity layer in GIS and SCCA was updated to 1993 to illustrate all known past harvest activities.

12. Terrestrial large woody debris (LWD)
LWD Description (J.Reis, Mt. Hood NF)
Data: 610 Vegetative Resource Survey (VRS) plots installed forest-wide in 1986. Forest was pre-stratified into 24 condition classes (combination of Eco-zone, dominant size class, primary species and stocking) with sample size per class determined to produce confidence for volume.

Two 70' woody debris transects installed per plot. Tallied diameter at intersection, length, size class, and condition class.

Procedure: Equation for determining pieces/acre is N = ((43,560*Pi)/(2*L)*(Sum(1/1))

N = Number of pieces/acre
L = Length of transect
1 = Length of tallied piece

Breakdown (reflected in filenames)

S = 3 - 11.9" diameter
M = 12 - 15.9"
S = >= 16"

S = <=15.9' Length
B = >= 16'

1 - 24 = Stand condition class

(Eg file MS 22 is pieces per acre for pieces between 12-15.9 diamenter, less than 16' long, for the mixed conifer zone, small saw, high and medium stocking.)

Files were creatd crosstabbing pieces by piece condition class by plot for each stand condition class.

Filed in EXCEL
Table: dwthree
Read Password: No
Modify Password: No

Column definitions

#	Name	Type			Index	Expression
1	PlotNr	TEXT		4		
2	DWDiameter	NUM	6	1		
3	DWLength	NUM	6	1		
4	DWCondition	TEXT		1		
5	DWSizeCls	TEXT		2		
6	leco	REAL			*	(1/dwlength* 488.7420571)

length coefficient
Current number of rows: 2000

13. Snag description (S.Selvaggio, Clackamas Ranger Station)
Data: Survey information collected under the 1986 Forest Resource Survey (VRS) was used to determine snag densities in plant series and unmanged forest types (i.e. other than clearcuts and managed sapling pole or small saw stands).

The 1986 survey was a ground-based survey of 610 plots scattered across the Mt.

Hood National Forest. Each plot consisted of 10 sub-plots (called points) located in a regular manner within a stand. Live and dead trees were counted and measured at a sub-plot if they fell within the angle of the prism subtended from the point center (standard variable-radius plot method). Standard vegetative information including tree DBH, tree height, species, crown class, decay class (if dead) and other data was collected for each tree falling within the sub-plot. At each sub-plot (point) additional dead trees were counted using a prism set at a smaller BAF factor. Thus, data for dead tree density is available from 20 points within each plot.

Summary data for each plot (representing the average of the sub-plots) is available for parameters such as trees per acre, quadratic mean stand DBH, plant association and climax plant series, growth information, percent overstory, etc.

For more information about the 1986 survey data, contact Jeff Reis at the Mt. Hood Supervisor's Office in Gresham.

The amount of acreage classified in different seral stages ("Habitat Types) was determined using the Species and Community Conservation Analysis (SCCA) database. The SCCA database was last updated in the summer/fall of 1993.

Tree data collected from each plot was then tallied by number of snags per plot by diameter class and decay class. Diameter and decay class used for this analysis are as follows:

diameter: 16" - 20.9" dbh
$\succ$= 21" dbh.

decay class: 1, 2, and 3 = hard
4 and 5 = soft.

Each snag counted within the variable plot radius plot was assumed to represent several other snags over the acre surveyed as determined by applying the following formula:

$$\frac{\text{Snags}}{\text{Acre}} \text{ (by diameter class and tree condition) and by plot} = \frac{\text{BA per acre}}{\text{BA per tree}}$$

Where BA per acre = Snags tallied per plot/total sub-plots * BAF

and

Where BA per tree = (Mid-point of diameter class) squared * .005454

BAF = Basal Area Factor used

After labeling plots by "Habitat Type" and stratifying by plant series, where possible, number of snags per acre were averaged in each diameter class and decay class by the number of plots that had been grouped into that habitat type and plant series; this also included plots that had no snags at all in these calculations.

Riparian and Aquatic

Riparian and aquatic dependent wildlife species listed in Appendix J2, FSEIS.

d - documented occurrence

p - potential occurrence based on existing suitable habitat

n - not expected to occur

SPECIES	SURVEY STRAT.	MHNF	M	MC	WR	WF	HABITAT	KNOWN GEOGR. RANGE or EXTANT
Cope's giant salamander		d	d	p	p	p	Up to 3198' in elev. Sm. rocky creeks, seeps and streams, cold mtn. lakes. Adults found beneath surface debris on margins of water.	W. WA and NW OR.
Black salamander		n	n	n	n	n	Mixed evergreens and hardwoods. In moist crevices of decaying logs or stumps, w/in moist to wet talus slopes, under surface debris during wet weather. During drier times, retreat to stream edges.	So. OR, Santa Cruz and Santa Clara counties, CA.
Cascade torrent salamander		p	p	p	p	p	Very near cold, clear streams, seeps, rocks in splash zones, waterfalls, and seepages through talus.	CRG, Cascades N. of Mt.St. Helens WA to NE Lane County OR.
Olympic salamander		n	n	n	n	n	" "	Olympic Penninsula
Columia torrent salamander		p	p	p	p	p	" "	Coast ranges of OR and WA.
Southern torrent salamander		p	p	p	p	p	" ", and sometimes forests than are drier than mentioned above.	Coast ranges NW OR to Mendocino County CA.
Tailed frog		d	d	d	d	p	Cold rocky, up to 5,250 ft. elev. Feed in streams and moist woods nearby. Prey base for Cope's giant salamander.	Between Cascades and Pacific coast.

SPECIES	SURVEY STRAT.	MHNF	M	MC	WR	WF	HABITAT	KNOWN GEOGR. RANGE or EXTANT
Clouded salamander		p	p	p	p	p	Forests & forest edges. Forest clearings created by fires. Mainly under loose bark in decayed standing & fallen snags and stumps and in cracks on cliffs under rocks, moss, and leaf litter. Generally not found on valley floors.	Mountainous areas up to 5000' elev. in Cascades.
Oregon slender salamander		p	p	p	p	p	Common in mature and old growth coniferous forests, & in second growth. Found under bark and LWD, and inside LWD and stumps. Subterranian in late spring/summer. Sometime in talus and recent lava flows on crest of Cascades.	Endemic to OR, mainly on W. slopes of Cascades. Found in CRG into Hood River Co. and east of Mt. Hood into w.edge of Wasco Co.
long-legged myotis		p	p	p	p	p	Crevice roosting bats which use snags, decadent trees, caves, buildings, and bridges for roosting and hybernating. Forage primarily over riparian zines, especially streams and ponds.	Widespread distribution. Nonmigratory.
long-eared myotis		p	p	p	p	p		
pallid bat*		p	p	p	p	p		
fringed myotis		p	p	p	p	p		
hoary bat		p	p	p	p	p	Obligatory foilage roosting bat. It uses large, old coniferous trees. Forage primarily over riparian zones, especially streams and ponds.	Widespread distribution. Migratory.
silver-haired bat		p	p	p	p	p	Roosts in snags, caves, decadent trees, and buildings. Forage primarily over riparian zones, especially streams and ponds.	Widespread distribution. Migratory.

SPECIES	SURVEY STRAT.	MHNF	M	MC	WR	WF	HABITAT	KNOWN RANGE or GEOGR. EXTANT
Keen's myotis		n	n	n	n	n	Forage primarily over riparian zones.	Endemic to coastal areas of Puget Sound and Olympic Penninsula.

* Populations presently declining.

Since amphibians are very sensitive to environmental change (FEMAT, 1993), they can be useful indicators for the health of the systems in which they are found. Many are highly specialized and have specific habitat requirements (FEMAT, 1993).

Six amphibians which are associated with small permanantly flowing headwater streams, potentially occur in the Mile Creeks watershed; one, the tailed frog is documented in the watershed. These species need cool, clear water conditions which are critical for foraging and thermoregulation. Protection of intermittant streams are a key factor in regulating downstream water quality for these amphibians (J2 Appendix, FSEIS, 1994).

Five bats potentially occur in the watershed. These bats forage primarily over riparian zones, especially streams and ponds (J2 Appendix, FSEIS, 1994).

Decreases of the Pacific northwest bat populations have resulted from a variety of reasons. Major factors of concern are loss of snags and decadent trees from widespread conversion of late successional forests to young, even-aged plantations on upslope and riparian areas, and human disturbance and destruction to caves, mines, and old buildings. Btk (Bacillus thuringiensis (Berliner) var. kurstaki) spraying affects nontarget lepidoptera (Miller, 1993) and subsequently may impact bat populations.

Within the range of these riparian dependent and aquatic wildlife species, Riparian Reserves established through Mile Creeks watershed analysis should help restore habitat requisites of the species and provide connectivity and migration corridors, along with conducting surveys in potential habitats to determine distribution and age class structure.

Terrestrial

Deer and elk:
Mile Creeks watershed is a significant migration pathway between the summer range meadows to the west and the winter range lowlands to the east (Diaz, pers. comm.). Migration patterns generally follow water sources and ridgetops (maps on file at Barlow Ranger District. ODFW and D. Thorsen, 1994). Water, primarily in summer range, and security are critical factors affecting the distribution and landscape use of deer and elk in the watershed; forage and cover are also important.

Cover:Forage Ratios

Habitat type	Current conditions Mt. Hood NF land	Optimal habitat conditions (USFS, 1979)
Hiding cover	42%	
	- 75% cover	40%
Thermal cover	33%	
forage	25%	60%

Currently, cover values are high and forage values are low, relative to optimal habitat conditions. Historic cover:forage ratios may be analyzed in the future.

Currently, elk numbers have exceeded 100% of the management objective for the White River Management area. Deer numbers have never exceeded 80% of the management objective (ODFW, pers. comm.). Historically, deer and elk numbers were much lower in the past (Historical European settlers journals and diaries, late 1800's).

Historically fire was the mechanism that scaped the vegetation patterns of the landscape. Fire also influenced the numbers and location of deer and elk.

In the bunchgrass zone (currently where most of the agriculture ground is located) deer and elk were never plentiful in numbers and currently still are not plentiful in this zone. They are associated more with the riparian and spring areas within this zone. Approximately 50 percent of the watershed is in this zone.

In the oak zone deer and elk numbers start to increase and are greatest when ponderosa pine and Douglas Fir enter into this zone. This private ownership has created security areas which are very important to especially elk. It is believed the upwards of 75% of the elk in this watershed spend most of their time in this zone. Water is still very important in this zone and deer and elk use patterns reflect this importance. Approximately 23 percent of the watershed is in this zone.

The dry grand fir zone currently and historically is one of the most important zone for deer and elk. This zone's vegetation patterns were always such that the best mix of cover an forage (quality and quantity) occur in this zone. This zone is currently under mainly federal ownership. This zone is relativelysmall (19%) as related to the rest of the watershed.

Historically elk probably used this zone more than current use patterns reflect. The main reason for this is the current high human presence due to large numbers of open roads and other recreational uses.

The wet grand fir zone includes most of the higher elevation true fir community. Fire was not a frequent entity within this zone thus large areas of thermal cover were present with limited forage areas. This zone is used by deer and elk mainly in mid and late summer. This zone is currently within federal ownership. Approximately 8% of the watershed is within this zone.

Currently elk number are exceeding 100% of the management objective for the White River Management area. The deer number have never exceeded 80% of the management objective (ODFW correspondence). The Forest Service portion of the watershed currently has 33% thermal cover, 42% hiding cover and 25% forage.

Agriculture practices have changed the vegetation component in the bunch grass zone. The overall impacts on deer and elk have not changed drastically. A few more elk may have used this zone prior to European settlement. The frequency of fire has definitely been reduced in this zone.

The oak zone has undergone some of the most dramatic changes. Numerous human residences occur in this zone in addition to smaller size agriculture areas. This is the zone of most potential conflict between humans and deer/elk. Fire has been for the most part excluded from this zone because of the human residences. The cover areas have become thicker where timber harvest has not occurred. The agricultural areas produce high quality forage for deer and elk.

In the areas where timber harvest has occurred, the timber is relatively slow growing, thus taking longer for thermal cover to become established.

Even though we have high human inhabitancy in the area we still have relatively low human harassment. This creates a security area especially liked by elk. The mixture of agriculture and cover is an attractive situation for deer and elk.

On the Forest Service portion of this zone some timber harvest has occurred and the reintroduction of fire into the ecosystem has started. This will alter the stand to a more open area with less thermal cover and probably more forage.

The road densities are higher 2.9 miles/ square mile than the Standards and Guide (S & Gs) for the Mt. Hood LMP of 2.0 mile/square mile. There is possibility of making some security areas within this vegetation zone by closing roads. Roads are currently being closed in this area, thus starting the process to reduce road densities.

Cattle and sheep grazed this zone extensively from the late 1800's to the early 1990's. This helped keep the vegetation more open than is currently seen. It is after this time that deer and elk numbers really started to increase as the vegetation became thicker.

The dry grand fir zone has undergone a lot of timber harvest activity. Numerous roads were constructed for the timber harvest activities. On the summer range portion of this zone the road densities are 3.23 mile/sq. mile. The winter range portion has road densities of 2.91 mile/sq. mile. The target road densities from the Mt. Hood LMP are 2.5 miles/sq. mile on summer range and 2.0 miles/sq. mile on winter range. Roads are currently being closed in this area thus starting to reduce road densities. The presence of people on these roads may disrupt use pattern of deer and elk (i.e. alter migration routes, forage and cover areas etc.).

Fire suppression in the last 50+ years has altered the vegetation structure, density and composition. This by itself would have reduced forage and increased thermal cover for deer and elk within this zone. However, the timber harvest activities have replaced fire (for the most part) as the forage creating mechanism. Deer numbers are still fairly high within this zone, however elk numbers are probably lower due to the high open road density. The wet grand fir zone has undergone the least amount of change for deer and elk. Timber harvest activities and road construction have contributed the most to change this zone. Fire suppression within this zone has altered the landscape pattern. These no longer are several hundred acre patches of burned areas. Timber harvest has created 10-40 acre small patches distributed evenly through areas of the zone. There are probably more elk and deer using this area now than were historically.

The most significant changes has been the suppression of fire in all vegetation zones. This has created more thermal cover (except where harvested) in the short term, and in the long term an increased risk of insects, diseases and catastrophic fires (especially in the dry Grand Fir and oak zones).

The oak and grand fir zone have undergone the most change due to fire suppression. The oak zone was more open historically and probably better suited for elk than deer. The best thermal cover in this zone was found on the northern exposures and in the riparian corridors. These thermal cover areas are currently denser than they historically would have been. Timber harvest activities have altered the natural patterns of vegetation in this zone. This has had positive and negative impacts on deer and elk. On the positive side increased patches of forage mixed in the thermal areas have increased the amount of the zone utilized by deer and elk. On the negative side increased road densities have made these same areas less secure for deer and especially for elk.

The lower oak zone is where most of the human residences occur. This zone is currently ideal for deer and elk as high quality forage (agriculture fields) is interspersed with thicken cover patches (fire excluded).

As more people move into this zone, there will be increased conflicts with deer and elk. The numbers of deer and elk may have to be reduced in order to resolve these conflicts.

The desired condition for the oak zone is to minimize human harassment by reducing road densities. Reduce the risk of losing thermal cover to catastrophic fire and insects. This zone will most likely have increased forage possibilities and decreased thermal areas on the National Forest land. The private portion will most likely remain similar to current conditions.

In the dry grand fir zone, fire historically scaped the landscape with fairly frequent (15-50 years) burns maintaining high quality forage (ceanothus and grass) and thinner (than currently exists) thermal cover stands. Currently, timber harvest activity has maintained these forage areas. However, some of the thermal cover areas which have not been entered are thicker than they were historically.

Road densities have increased with increased timber harvest. Roads are currently being closed to reduce road densities.

The elk use pattern in this zone has changed a little from the historical patterns. Higher elk densities were noted prior to timber harvest activities (mainly within the last 30 years). This increased harassment has caused a shift in use patterns more toward the oak zone.

This zone is still very important to deer and they seem a little more tolerant of harassment if good quality forage and cover exist.

The desired condition for this zone is to maintain the high quality forage and cover. Reducing road densities may create enough security for elk that a shift in use from oak zone to the dry Grand Fir zone could happen. If elk number do increase, it is possible deer numbers could decrease.

In the wet Grand Fir zone, the most significant change has been the increased timber harvest (mainly regenerative cuts). This has produced 20-40 acre forage areas interspersed through this zone. Historically the forage areas would have been large 100+ acre areas caused by stand replacing fires.

A large portion of this zone is in a late successional reserve (President's plan). This will cause fewer forage areas to occur in the future with the emphasis on mature and old growth.

The deer and elk use pattern will shift to the open natural meadows which will be the forage areas. The total amount of forage will decrease. To maintain the natural meadows encroachment from trees will have to be considered.

The desired condition for deer and elk in this zone is to maintain as much forage as possible within spacial limits.

Northern spotted owl, pileated woodpecker, marten, fisher, and wolverine:
All these species are presently federally listed as threatened, C2, Regionally sensitive, Oregon state sensitive, or presently declining in population status. See Appendix G.2. for list of wildlife species and listing status.

The northern spotted owl and pileated woodpecker are documented to occur in the watershed. The wolverine, marten, and fisher may potentially occur within the watershed. They all are expected to breed, forage, and migrate through the watershed. Non-native and exotic species introduced in the watershed include the wild turkey, house mouse, house sparrow, ring-necked pheasant, chukar, bullfrog, and European starling; none of these species should have a negative impact on habitats or populations of the native species within this guild.

Thirteen spotted owl activity centers presently exist in the watershed on Mt. Hood national Forest land.

Owl Pairs & Resident singles	LSR	CHU	Overlap w/RR outside LSR and CHU	Suitable acres w/in 0.7 mile, *-below "take"	Suitable acres w/in 1.2 mile, *-below "take"
1029Z91	y	y		312 *	1571
1143Z91	y	y		428 *	1183
1142Z90			y	512	1305
1159Z91			y	342 *	1072 *
1273Z91	y	y		514	1326
1274Z91	y	y		74 *	321 *
1184Q90 R*			y	409 *	722 *
1213Z91			y	286 *	1218
1141Y91			y	116 *	617 *
1032Z92	y	y		377 *	1329
1137R91 R*			y	430 *	1130 *
1076Z91	y	y		620	1630
1144Y90		y		188 *	598 *
TOTAL	6	7	6		

R* - Resident single
Take - Desired conditon is 500 acres of suitable habitat w/in 0.7 mile home range radius, and 1157 acres of suitable habitat w/in 1.2 mile home range radius. "Take", from the Endangered Species Act (16 U.S.C. 1532) is defined as: "To harass, harm (could be removal of suitable habitat), pursue, hunt, shoot, wound, kill, trap, capture or collect any species protected under the Endangerd Species Act, or attempt to engage in any such conduct."

A total of 6 activity centers are below "take", within 0.7 and 1.2 mile of the spotted owls' home range. Five of these occur in the eastern most area of the watershed where Dry grand fir/Douglas fir and pine oak zones predominate. These 5 activity centers are at a high risk of habitat loss due to catastophic fire. It may be difficult to nearly impossible to bring habitat conditions above the "take" threshold. The 6th activity center mentioned, #1159 occurs in the western area of the watershed. At present, this upper reach of South Fork of Fivemile Creek is fragmented due to timber harvest activities. Tractor harvesting methods have greatly compacted the soils, although the area has potential to grow into "suitable" habitat again, perhaps in an estimated 150-200 years.

Five spotted owl activity centers exist within 1.2 mile of the watershed.

Owl pairs	LSR	CHU	Wilderness	Suitable acres w/in 0.7 mile, *-below "take"	Suitable acres w/in 1.2 mile, *-below "take"	Watershed
1275Z91	y	y		387 *	918 *	White River
1011	y			?	?	White River
1093Z89	y			489 *	1523	White River
1078				?	?	Mill Creek
1019			y	?	?	White River
Total	3	1	1			

The first pair of spotted owls was documented in July, 1981, and it was pair# 1032. One hundred acre cores were established in July, 1994 as part of the analysis; the best, most suitable and continuous habitat was retained around the pairs and resident singles.

The fisher appears to require closed canopy forests as long as they contain adequate prey populations; they avoid clear cuts and openings. In the Pacific northwest they are associated with low to mid-elevation forests which do not accumulate snowpacks; unlike the marten they do not move within the subnivean layer. They prefer forests which have complex physical structure near the forest floor; structure is a key habitat feature in maintaining prey populations and and providing access to prey during the winter. Fisher denning and roosting habitat optimally occurs within 0.25-0.5 mile of water; optimal density of den snags or live trees equate to >6 per acre. Travel corridors optimally occur within mature stands ->600' in width (Freel, 1991). Decadent, mature trees, and snags provide natal den sites for the species (J2 Appendix-FSEIS, 1994). Habitat for the fisher exists within Mile Creeks watershed; no documented sitings exist to date in the watershed.
Martens are more abundant in the Pacific northwest than the fisher; they are closely associated with closed canopy forests and can inhabit higher elevation forests than the fisher since they use the subnivean layer. Forest structure is important to the species; LWD in various decay classes support prey populations, and large trees and snags provide resting sites. Resting sites occur more in riparian areas possibly due to cooler microclimate conditions, proximity to prey which are more abundant in streamside habitat, and possibly due to large trees occurring more in mesic condition near streams (J2 Appendix-FSEIS, 1994). Marten resting habitat optimally occur within -<0.25 mile to riparian and/or wet meadows; resting and denning tree density equate to 3 per acre. Travel corridors optimally occur within mature stands >300' in width (Freel, 1991). Habitat for the marten exists within Mile Creeks watershed; no documented sightings exist to date in the watershed.

Past timber harvest activities has occurred more at lower elevations, where possible, than higher elevations, having a greater negative impact on fisher habitat than on marten habitat. In addition, fishers were overtrapped in Oregon during the early part of the century (seasons closed in the 1930's) (J2 Appendix-FSEIS, 1994). Both species have experienced significant habitat loss due to forest fragmentation and removal of LWD and snags from cutting units. Harvest units cut during the past 5 years have had adequate quantities of LWD and snags left, and may meet the desired conditions (R.Thurman, pers. comm.). The marten population may recover more quickly than the fisher due to it's capability of having a higher reproductive rate, thus may respond more quickly to habitat restoration, and they are well adapted to higher elevations.

Pileated woodpeckers inhabitat coniferous and deciduous forested areas containing mature dense, productive stands. Critical components of habitat include large snags, large trees, diseased trees, dense forest stands, and high snag densities. Roosting and nesting sites are found < 0.5 mile from water. Minimum habitat areas are 320 acres (Schroeder, 1983). New research indicates that snags and terrestrial LWD are both critical structures for foraging, and foraging habitat can be more limiting than nesting habitat (Bull, 1993). New research also indicates different snags are used for roosting vs. nesting, and roosts are often found in hollow green trees (Bull, 1993) Past timber harvest activities have been the primary reason for habitat loss.

Currently, an estimated 8,000 acres of suitable habitat exist on Forest and the privately owned land, Camp Balwin (the 1455 acres associated with the privately owned tract of land may be harvested in the future) (Fig. G. 1.). This is based only on mosaic patch aggregations of late seral stage forest for species using large home ranges. Field verification is needed to determine if the late seral forested stands have the complex structural characteristics to support preybase, roosting, resting, denning, and nest sites. The majority of these acres are in the Late-Successional Reserve (LSR), Critical Habitat Unit (CHU), and a Congressionally Reserved Area (CRA), and portions occur throughout Riparian Reserves (RRs) outside the other reserves (Table V. A. 2.).

The Late-Successional Reserve, CHU, CRA, and RRs desired conditions will, in the long-term, provide adequate connectivity and migration habitat from a vegetative standpoint for the northern spotted owl and other species within the guild, to disperse and move throughout the watershed and out of the watershed in an east-west direction. Other LSRs will improve connectivity and migration in an east-west direction, and slightly improve north-south direction of connectivity and migration. To provide better north-south connectivity and migration, opportunity exists to retain 3 of the 8 B5 management areas (Mt. Hood LMP); they include 1081W (pileated woodpecker management area), and 1041M and 1271M (marten management areas) (see Figure V. A.1.)

Non-federal lands comprise 86% of the watershed. Historically, vegetation primarily consisted of bunchgrass, oak, and oak scattered with pine and Douglas fir. At present, the grand fir has extended into the upper riparian areas of non-federal lands; a very small amount, if any, of suitable nesting habitat exists in the watershed outside the Mt. Hood NF. Timber harvest activities, agricultural practices, grazing, and development would probably prevent suitable habitat from occurring in the future. A private withholding, Camp Baldwin, provides 1249 acres which meet 11/40 standards; 11/40 may not be retained in the future.

On private land 10,063 acres are known to meet 11/40 standards. An estimated 19,000 acres of forested lands of private lands were not typed, at this time. The majority of the lower watershed is in agricultural or range production.

Mt. Hood NF encompasses 14% of the Mile Creeks watershed. Within the Matrix 4753 acres of 11/40 habitat was harvested and presently does not meet 11/40 standard. Lands not capable of meeting 11/40 standards was not analyzed at this time. On Mt. Hood NF lands, 20,337 acres meet 11/40 standards; this totals 60% of NF ownership within Mile Creeks watershed.

Land allocation acres and 11/40

Land allocation and private	Acres	% all watershed	% MTH	Acres 11/40 and (%)	% 11/40 all watershed	% 11/40 MTH
LSR (only)	9516	4	28	6620 (70)	3	20
CHU (only)	1695	1	5	1392 (82)	1	4
Wilderness	2400	1	7	2278 (95)	1	7
Other LSR	800	0	2	800 (100)	0	2
RR (only)	3826	2	11	3115 (81)	1	9
Matrix	15146	6	45	6132 (40)	3	18
Camp Baldwin	1455	-	-	1249 (86)	0	-
* Private	-	-	-	8814	?	-
			100			60

* Private land typed - 19,000 acres. Of the 19,000 acres, 10,063 acres meet 11/40 standards.

11/40 on Mt. Hood National Forest land (Maps on file at Barlow District office)
The eastern portion of the upper watershed will limit 11/40 standards for dispersal habitat, connectivity, and migration in a north-south direction due to natural vegetation patterns and occurrence. It also has a high risk of catastrophic fire since fire has been suppressed for an extensive period of time. The eastern portion contains LSR and CHU acreage in the Fifteenmile Creek and Larch Creek subwatersheds. The CHU would play an important role in retaining late successional forests over the long-term in case catastrophic fire occurred in the LSR or Badger Creek Wilderness (Figure V.1.)

The middle area of the upper of the watershed can maintain 11/40 standards and north-south dispersal, connectivity, and migration better than the eastern area. It has a moderate risk of catastrophic fire, which could be a risk to LSR and CHU to function as intended by the ROD. Greater risk in Fivemile and Eightmile Creeks exist, due to a concentration of old harvest units, habitat fragmentation, and compacted soils.
The western area of the upper watershed can maintain 11/40 standards and north-south dispersal, connectivity, and migration better than the middle area of the watershed due to natural vegetation patterns and occurrence, and more moist conditions, although a great concentration of old harvest units and habitat fragmentation presently exist in Fivemile, Eightmile, and Fifteenmile Creeks.

Human disturbance in Fifteenmile Creek subwatershed from roads and OHV use on trails in the western and middle portions of Eightmile and Fifteenmile Creeks may have a negative impact on the guild of species during the reproductive season. Past timber harvest activities, associated road construction, and OHV use, especially in riparian areas and the north facing slopes have had negative impacts on the connectivity and migration habitats used by most species in this guild. Closing roads and motorized trails in Fifteenmile subwatershed would improve habitat for this guild, especially the wolverine since it is very sensitive to human presence. The LSR and CHU will provide a buffer between Badger Creek Wilderness and matrix land.

Wolverine inhabit high elevation forests; their territories may encompass 150 to 200 square miles, usually including large roadless areas devoid of human presence. Populations are limited by clear-cut logging practices, road construction, snowmobile and OHV use. Intensive human activity has had the greatest impact on the wolverine compared to the other species within this guild, and will limit the population. Presently, populations are low in the limited habitat available (Ingram, 1973) (Hash, 1987). Dens are generally in an area with a high concentration of fallen logs, or under tree roots or protruding rocks, in caves, or in burrows in overhanging banks, or in deep snow next to cliff faces (USDA-Forest Service, 1992). Habitat exists in the watershed, although no verified sightings exist. Cliff faces and rock faces are sensitive and unique habitat components in Mile Creeks watershed.

Sensitive and unique habitats were identified and mapped (SCCA and Barlow Ranger District personnel input) throughout the watershed. Maps are on file at the Barlow Ranger District office.

Rock outcrops, located in Fifteenmile Creek subwatershed, are potential denning and foraging sites for wolverine. Some timber harvest activities have occurred around the rock outcrops (Fig. G. 2.).

A cliff in Fifteenmile Creek subwatershed is potential habitat for the peregrine falcon and needs to be surveyed (Fig. G. 2.). The closest known eyrie is near Rowena, Oregon which is an estimated 10 miles from Mile Creeks watershed. No known nest sites exist in the watershed. No harvest units exist adjacent to the cliff.

A cave located on private land (T01S, R13E, Sec.23, SE 1/4) near Dufur, in Eightmile Creek subwatershed, may be potential roosting or hybernacula for the Townsend's big-eared bat. It also needs to be surveyed.

All known springs, lakes, wet meadows, and wetlands are addressed under the Riparian and Aquatic Ecosystems and Riparian Reserve Reports.

An estimated 20 acres of dry meadows exist within the watershed (Fig. G. 3.). They occur in Camp Baldwin, Fifteenmile and north fork Fivemile riparian reserves. These may provide high quality forage values for big game and should be maintained.

410 acres of shrub-steppe habitat exist in the watershed (Fig. G. 3.). Field validation of these sites is recommended. Shrub-steppe habitat is one habitat type that is important to neotropical migratory birds in the Deschutes Province. Other habitat types important to neotropical migratory birds east of the Cascade Crest include riparian areas and old growth stands of ponderosa pine (USFS, 1993).

The pine/oak habitats encompass an estimated 2200 acres of the watershed on Forest. Harvest activities have occurred within Fifteenmile Creek, Fivemile Creek, and Larch Creek subwatersheds. Two species of interest are the wild turkey, an introduced species, and the western gray squirrel, a native species of Oregon. They primarily occupy oak and pine/oak habitats.

The following chart illustrates a comparison of wild turkey and western gray squirrel life requisites and processes and management activities which may limit or improve habitat in the watershed.

+ - improve habitat components
- - limit habitat components

Species	Vegetative Zone	Nesting	Forage	Processes & Activities
Wild turkey	Oak and dry grand fir	Thinned mixed conifer	Oak mast, poderosa pine seed, bugs, other seed	+ timber harvest thinnings - timber harvest regeneration - harvest of large ponderosa pine in both zones.
Western gray squirrel	Oak	Ponderosa pine trees 180m from water	Oak mast, ponderosa pine seed, fungi.	- Fire suppression-increased dry grand fir zone at expense of oak zone. - timber harvest of large ponderosa pine in oak zone. - hunting season (occurs during second nesting cycle, ~Sept.1 which is more productive than first nesting cycle). - Potential food source competition w/ turkeys, when limited.

Merriam's wild turkey was first successfully introduced into the White River Management area in 1961 (Crawford, 1984). Merriam's turkey mainly uses the oak and dry grand fir zones. From the first introduction of 38 birds the population increased rapidly and reached a high of approximately 10,000 birds in the early 1970's (Torland, 1993). The population then started to decline and has stabilized at approximately 3,000 birds within the White River Management area. Thinned mixed conifer stands seemed to be preferred for nesting (Crawford, 1984). Regeneration timber harvest units were avoided by Merrian's turkeys.

The western gray squirrel is native to the oak zone of this watershed. THe population appears to be cyclic and dependent on oak mast and ponderosa pine seed production. Historically, the oak zone probably extended into the current dry grand fir zone. Nest sites are located within 180 meters of water and mainly in ponderosa pine trees which average 8.5 inches DBH and had 60% canopy closure (Foster, 1992).

In an ideal year, the annual diet of the western gray squirrel is: acorns from winter through early spring; fungi, both hypogeous and epigeous, from early spring through late fall; ponderosa pine seeds from late summer through fall; and succulent vegetation from late spring through early summer (Foster, 1992).

The suppression of fires within the oak and dry grand fir zones has changed the vegetation structure and composition. The oak zone probably extended into the current dry grand fir zone more than it does currently.

Timber harvest activities have altered tree species composition and structure. This is especially evident in the oak zone where mature ponderosa pine were harvested and a ponderosa pine seed source was not available. This would have impacted the food supply for western gray squirrels and now wild turkeys.

The timing of hunting seasons especially for western gray squirrel may impact the number of squirrels reproduced in any given year. Currently the western gray squirrel season starts around the first of September which happens to be the second nesting cycle (and most productive) for the squirrel (Foster, 1992).

The timing of underburning (currently, mainly in spring) impacts turkey nesting in the upper oak zone and dry Grand Fir zone.

Probably the most significant change has been the harvest of (mature) ponderosa pine in the oak and dry grand fir zones. This reduced the amount of seed available to western gray squirrels and turkeys, thus potentially reducing the numbers of squirrels and turkeys. Reducing the number of western gray squirrels could limit the spread of fungi spores and consequently reduce the number of conifers growing in a given area.

The limitation of fire in the oak and dry grand fir zones has caused a different vegetation species mix from historic times. The boundaries of each of these zones has shifted from historic times. Fire exclusion has caused these boundaries to shift further east. Currently, less ponderosa pine in addition to more grand fir and Douglas Fir are present in the two zones. Oak trees are less frequent in the dry grand fir zones. This in turn has altered the amount and location of habitat for wild turkeys and western gray squirrels.

If an introduction of a nonnative species (i.e. wild turkey) is proposed in an area where the species can disperse into the LSR, then an analysis of impacts should be completed to avoid any introduction that would retard or prevent achievement of LSR objectives.

Primary risk to sensitive and unique habitats located throughout the eastern and middle portions of all subwatersheds within Mile Creeks watershed is catastrophic fire. In the western portion of the watershed recreation use, primarily OHV use may limit these habitats from functioning well.

Sensitive and unique botanical sites, and noxious plants (C.Cray, Barlow R.D.)

Regional Forester's Sensitve (RFS) Species List
Of the 42 vascular plant species from the Regional Forester's Sensitive Species List for the Mt. Hood National Forest, the following 19 species are known or suspected to occur in the Mile Creeks Watershed. Sensitive plant species who's range does not extend into Mile Creeks Watershed, or for which no suitable habitat exists within the watershed have been excluded from the following list.

The 19 species are associated with unique habitat types including wetlands, riparian zones, rock outcrops, and both wet and dry meadows. Sensitive plant surveys should be conducted in these habitats prior to implementing any projects that could effect the local hydrology or plant community (i.e. digging, road construction, grazing, burning). In general, these areas should be managed in order to maintain natural native plant community, avoid soil erosion or lowering the watertable, and control or prevent noxious plant infestation.

Documented Species in Mile Creeks Watershed:

Agoseris elata (Nutt.) Greene	tall agoseris
Arabis sparsiflora var. atrorubens (Greene) Rollins	sickle-pod rockcress
Scribneria bolanderi (Thurb.) Hack.	Bolander's grass

Tall agoseris is a perennial plant which occurs in vernally moist to wet montane meadows from Washington to California. One small population (ca. 16 individuals) occurs in the watershed, with a second, larger population (ca. 45 individuals) in a wet meadow adjacent to the watershed. Both populations appear to be secure as no livestock grazing occurs near either population, nor are any noxious weed species present in these meadows.

Sicklepod rockcress is a perennial plant which occurs in open areas within ponderosa pine and white oak woodlands. In the two known populations within Mile Creeks Watershed, number of individuals appears stable or increasing; based on approximate counts conducted periodically from mid 1980's to 1994. Possible threats to these populations include habitat loss (due to logging or road construction) and increased competition for water and nutrients from introduced plant species (i.e. diffuse knapweed (Centaurea diffusa), cheatgrass (Bromus tectorum), or native species that have increased due to fire exclusion (such as grand fir and ponderosa pine seedlings.

Bolander's grass is an annual grass which grows in vernally moist swales, scabland, and other poorly drained sites. Known populations exist in Wasco, Lake, and Joshephine counties, Oregon (Oregon Natural Heritage Program, 1993) and it is reported from "dry, disturbed areas" in southern California (Hickman, 1993). One population occurs on the northern edge of Mile Creeks Watershed. Discovered in 1992, the population harbors more than 1000 individuals, with "no threats apparent at time of survey" (C. Wright, Rare Plant Sighting Report, Barlow Ranger District, June, 1992).

Species Suspected to Occur in Mile Creeks Watershed

Botrychium lanceolatum (Gmel.) Angstrom	lance lvd grapefern
Botrychium minganense (Vict.)	moonwort
Botrychium montanum (W.H. Wagner	mountain grapefern
Botrychium pinnatum St. John	pinnate grapefern
Calamagrostis breweri (Thurb.)	Brewer's grass
Calochortus longebarbatus Wats. var. longebarbatus	longbeard calochortus
Carex livida (Wahl.) Willd.	pale sedge
Lewisia columbiana ((How.) Robins. var. columbiana	Columbia lewisia
Lomatium watsonii Coult. and Rose	Watson's desert parsley
Lycopodium complanatum	ground cedar
Lycopodium inundatum	bog club-moss
Lycopodium selago	fir club-moss
Meconella oregana Nutt.	white meconella
Ophioglossum pusillum Raf.	adder's tongue
Ranunculus reconditus Nels. and Macbr.	Dalles Mtn. buttercup
Utricularia minor L.	lesser bladderwort

Oregon Natural Heritage Program (ONHP) Species of Concern (Oregon Natural Heritage Program, 1993)

Documented Species	Common Name	ONHP Status*
Arabis furcata Wats.	Cascade rockcress	4
Chaenactis nevii Gray	Nevius' chaenactis	4
Collomia larsenii (Gray) Payson	Larsen's collomia	4

Suspected Species	Common Name	ONHP Status*
Allium campanulatum (Wats)	Sierra onion	4
Allium douglasii Hook. var nevii (Wats.)	Nevius' onion	4
Allium macrum (Wats.)	rock onion	4
Cypripedium montanum Dougl.	mountain ladyslipper	4
Linanthus bolanderi (gray) Greene	Baker's linanthus	3

*ONHP Status: 3 = Species which may be threatened or endangered in Oregon or throughout their range but for which more information is needed to determine status. 4 = Species which are not currently threatened or endangered. May be extremely rare but with secure populations, or species which are declining in numbers. (Oregon natural Heritage Program, 1993)

Known populations of ONHP species of concern on Barlow Ranger District are currently secure. Collomia, chaenactis and several populations of Cascade rockcress occur on rock outcrops in the Badger Wilderness Area near Lookout Mt. The onion species, ladyslipper, and linanthus occur on Barlow Ranger District, south and west of Miles Watershed. Vernally moist scabland and meadows within the watershed should be surveyed for these species. Suitable habitat should be protected from noxious plants, hydrologic alteration, and soil disturbance.

Survey and Manage Species from Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl (USDA, USDI, 1994).

The following list includes species that could possibly occur in Mile Creeks Watershed. Species included on the above lists (Regional Forester's Sensitive, ONHP Species of Concern) are excluded, as well as those species whose range does not occur in the watershed.

Polyozellus multiplex	blue chantrelle
Albatrellus ellisii	greening goat's foot
Allotropa virgata	sugar stick

Noxious Plants

The Noxious Weed Management Plan for Mt. Hood National Forest (Helliwell, et. al., 1990) identifies "A" rated, "B" rated, and Detection plants for each Ranger District (see Appendix A, Noxious Plants of Barlow Ranger District). According to this plan, "A" rated plants should be controlled or eradicated at Ranger District level. "B" rated plants are generally more widely distributed;

infestations should be controlled or contained at Ranger District level in cooperation with Oregon Department of Agriculture. Detection plants generally include species with small, isolated populations. These species should be eradicated as sites are discovered. Top priority under the noxious plant management plan is ti prevent establishment of Detection plants.

Four "B" rated plants, including Canada thistle (Cirsium arvense), diffuse knapweed (Centaurea diffusa), scotch broom (Cytisus scoparius), and st. johnswort (Hypericum perforatum) occur in the watershed. Houndstongue (Cynoglossum officinale), an aggressive invader which is toxic to livestock, occurs elsewhere on Barlow R.D and on neighboring Bear Springs R.D. but has not yet been seen in Mile Creeks watershed.

Noxious plants compete with native vegetation and can displace desirable plants, thereby diminishing the quality and quantity of wildlife forage and reducing biological diversity. Management activities should, therefore, minimize introduction and spread of noxious plants and eradicate infestations, where feasible.

Noxious Plant Species of Barlow Ranger District (from Helliwell, et.al., 1990)

	"A" Rated Plants*
tansy ragwort	Senecio jacobaea
spotted knapweed	Centaurea maculosa
	"B" Rated Plants*
Canada thistle	Cirsium arvense
St. johnswort	Hypericum perforatum
scotch broom	Cytisus scoparius
diffuse knapweed	Centaurea diffusa
	Detection Plants*
gorse	Ulex europaeus
dalmation toadflax	Linaria dalmatica
leafy spurge	Euphorbia escula
musk thistle	Carduus nutans
rush skeletonweed	Chondrilla juncea
yellowstar thistle	Centaurea solstitialis
white top	Cardaria spp.
scotch thistle	Onopordum acanthium
yellow toadflax	Linaria vulgaris
Russian knapweed	Acroptilon repens
brown/meadow knapweed	Centaurea jacea/C. pratensis
purple loosetrife	Lythrum salicaria
poison hemlock	Conium maculatum
perennial pepperweed	Lepidium latifolium
kochia	Kochia scoparia

* List is subject to change at the Forest Supervisor's discretion.

Wildlife and plant species diversity

The wildlife species diversity of Mile Creeks watershed are high due to the extremely steep environmental gradients found between different aspects and across the elevation range (this may lagrely be a function of rainshadow effects of Mt. Hood). A full elevational compliment of forests occurs, along with many types of natural openings, mosaics of forest and openings, and the pine/oak vegetation type (Diaz, pers. comm.). An estimated 261 wildlife species may potentially occur in Mile Creeks watershed. Relatively, the few introduced species add a small amount to the species diversity. Primary risk to wildlife species diversity is catastrophic fire, as a result of past fire suppression. Other potential risks include grazing, some recreational uses, collection of special forest products (i.e. fungi), road buildling, and timber harvest.

The following is a list of neotropical migrant bird species, summer residents, which have potential habitat in Mile Creeks watershed (SCCA Wildlife Information database, 1994).

turkey vulture
American goldfinch
Sainson's thrush
common nighthawk
Vaux's swift
western wood-pewee
black-throated gray warbler
hermit warbler
yellow warbler
Hammond's flycatcher
dusky flycatcher
common yellowthroat
MacGillivray's warbler
flammulated owl
osprey
black-headed grosbeak
western tanager
vesper sparrow
rufous hummingbird
mountain bluebird
Williamson's sapsucker
red-naped sapsucker
chipping sparrow
calliope hummingbird
tree swallow
violet-green swallow
house wren
western kingbird
Nashville warbler
warbling vireo
solitary vireo
Wilson's warbler

Wildlife species using terrestrial LWD and snags for primary or secondary use for breeding, feeding, resting. The list of species was generated from the Species and Community Conservation Analysis (SCCA), J2 Appendix FSEIS, and Barlow Ranger District knowledge.

** Species population status presently declining.

SPECIES	LWD	SNAGS
Cooper's hawk	x	x
northern goshawk	x	x
sharp-shinned hawk	x	x
northern saw-whet owl		x
pallid bat **		x
golden eagle	x	
OR slender salamander	x	
ruffed grouse	x	
red-tailed hawk		x
great horned owl		x
turkey vulture	x	x
CA quail	x	
coyote	x	
brown creeper		x
rubber boa	x	
Vaux's swift		x
w. red-backed vole	x	
northern flicker	x	x
olive-sided flycatcher		x
sharptail snake **	x	
w. rattlesnake	x	
Stellar's jay	x	
blue grouse	x	
VA opossum	x	x
pileated woodpecker**	x	x
no. alligator lizzard	x	
so. alligator lizzard	x	
Pacific slope flycatcher		x
Hammond's flycatcher**		x
dusky flycatcher		x
Cordilleran flycatcher		x
big brown bat		x
western skink	x	
American kestrel		x
mountain lion	x	
no. pygmy owl		x
no. flying squirrel	x	x
dark-eyed junco	x	
silver-haired bat		x
snowshoe hare	x	
bobcat	x	x

SPECIES	LWD	SNAGS
Fisher **	x	x
wild turkey	x	
Lewis' woodpecker	x	x
song sparrow	x	
striped skunk	x	
long-tailed vole	x	
creeping vole	x	
ermine	x	x
long-tailed weasel	x	x
mink	x	
long-eared myotis		x
CA myotis	x	x
Townsend's solitaire	x	
long-legged myotis		x
Yuma myotis		x
bushy-tailed woodrat	x	x
mule & black-tailed deer	x	
flammulated owl		x
w. screech owl		x
black-capped chickadee		x
mountain chickadee	x	x
chesnut-backed chickadee		x
deer mouse	x	x
heather vole	x	
white-headed woodpecker	x	x
green-tailed towhee	x	
rufous-sided towhee	x	
gopher snake	x	
downy woodpecker		x
hairy woodpecker	x	x
raccoon	x	x
sagebrush lizzard	x	
w. gray squirrel	x	x
w. fence lizzard	x	
coast mole	x	
white-breasted nuthatch**	x	x
mountain bluebird **		x
pygmy nuthatch	x	x
red-breasted nuthatch	x	x
dusky shrew	x	
Trowbridge's shrew	x	
vagrant shrew	x	

SPECIES	LWD	SNAGS
marten **	x	x
yellow-bellied marmot		x
red-naped sapsucker		x
red-breasted sapsucker		x
Williamson's sapsucker		x
no. spotted owl **		x
barred owl	x	x
European starling		x
mountain cottontail	x	
yellow-pine chipmunk	x	x
tree swallow		x
Douglas' squirrel	x	x
violet-green swallow		x
Townsend's chipmunk	x	x
Bewick's wren	x	x
w. terrestrial garter snake	x	
northwestern garter snake	x	
common garter snake	x	
house wren	x	x
winter wren	x	x
barn owl		x
western kingbird		x
black bear	x	x
gray fox	x	x
red fox	x	
w. jumping mouse	x	
Pacific jumping mouse	x	
Cope's giant salamander **	x	
black-backed woodpecker **	x	x
golden-mantled ground squirrel	x	
northern three-toed woodpecker		x
great gray owl		x
hoary bat		x
fringed myotis		x
tailed frog	x	
clouded salamander	x	
Total # species:	48	73

Total # species dependent upon both LWD and snags: 34.

Terrestrial wildlife habitats for all guilds on Forest were mapped using Linkage Analysis (SCCA). Mile Creeks watershed boudary was overlayed on these maps to determine which habitas were limited in distribution or lacking. Wildlife guilds which presently have limited distribution in Mile Creeks watershed include the following:

TLML: Species with a large home range, using mosaic patch matrix and late seral stage forests. The species include northern spotted owl, northern goshawk fisher, marten, wolverine, and pileated woodpecker.

TMPE: Species with a medium home range, using patch matrix and early seral stage forest. The species include black-billed magpie and mountain cottontail. Within this guild, the black-billed magpie has been documented to occur primarily in the buchgrass zone, off Forest. Mountain cottontail should occur on Forest.

The plant species diversity of Mile Creeks watershed are low. One theory as to why they are presently low is that due to fire suppression, fuel loading is high (many sticks on the ground) and some stands are more dense with greater canopy closure than what may have historically occurred. Thus not much light reaches the ground and limits plant growth (L.Evers, pers. comm.).

Species of concern dropped from further analysis

Ferruginous hawk (R6 Sensitive) - Documented sightings exist in Wasco County, Oregon mainly in the winter. This hawk inhabits dry open country. This habitat type lies mainly off National Forest land. There have not been any recorded sightings on National Forest land. The breeding range map for "Field Guide to the Birds of North America" shows this area as potential breeding habitat. No known nest sites exist in Wasco County.

Bald eagle (Endangered) - The birds are mainly observed during the winter in this watershed. There are no known nest sites and no suitable nesting habitat within this watershed.

Harlequin duck (R6 Sensitive) - Fifteenmile Creek was surveyed in 1993 and no birds where found during the survey. It is speculated that this creek is too small to be potential habitat. Since mainstem Fifteenmile is the largest order stream in the watershed, then all other creeks in the watershed are also too small to provide suitable habitat.

Greater Sandhill crane (R6 Sensitive) - These birds are Fall migrants through the watershed. No suitable nesting habitat exists within the watershed. The closest nesting birds are located on Bear Springs Ranger District, which is to the south of this watershed.

Western pond turtle (R6 Sensitive) - These turtles are found along the Columbia River. They occupy marshes, sloughs, ponds and slow-moving sections of rivers and other streams, generally below 2500' elevation (Nussbaum, 1983). In Miles Creeks watershed, no documented sightings exist on federal land. The species could be found within the watershed on private land along the Columbia River corridor.

Painted turtle (R6 Sensitive) - These turtles range throughout North America from Canada down to northern Mexico. They occupy marshy ponds or small lakes, slow-moving streams and quiet backwaters of rivers (Nussbaum, 1983). They may occur along the Columbia River corridor within Miles Creeks watershed, on private land; no documented sitings exist on federal land within the watershed.

Common merganser (J2 Appendix, FSEIS) - This species occupies low elevation waterways and riparian habitat primarily on non-federal lands in the Pacific northwest. It potentially occurs in the lower elevation private land of the Mile Creeks watershed. Cumulative effects from loss of riparian habitat on private land are a threat to common merganser viability in the watershed.

Grizzly bear (Threatened) and gray wolf (Endangered) - These species are extirpated from Oregon. Reintroduction is unlikely.

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Fig. G.1.

Large Home Range, Mosaic
Late Seral Stage Species

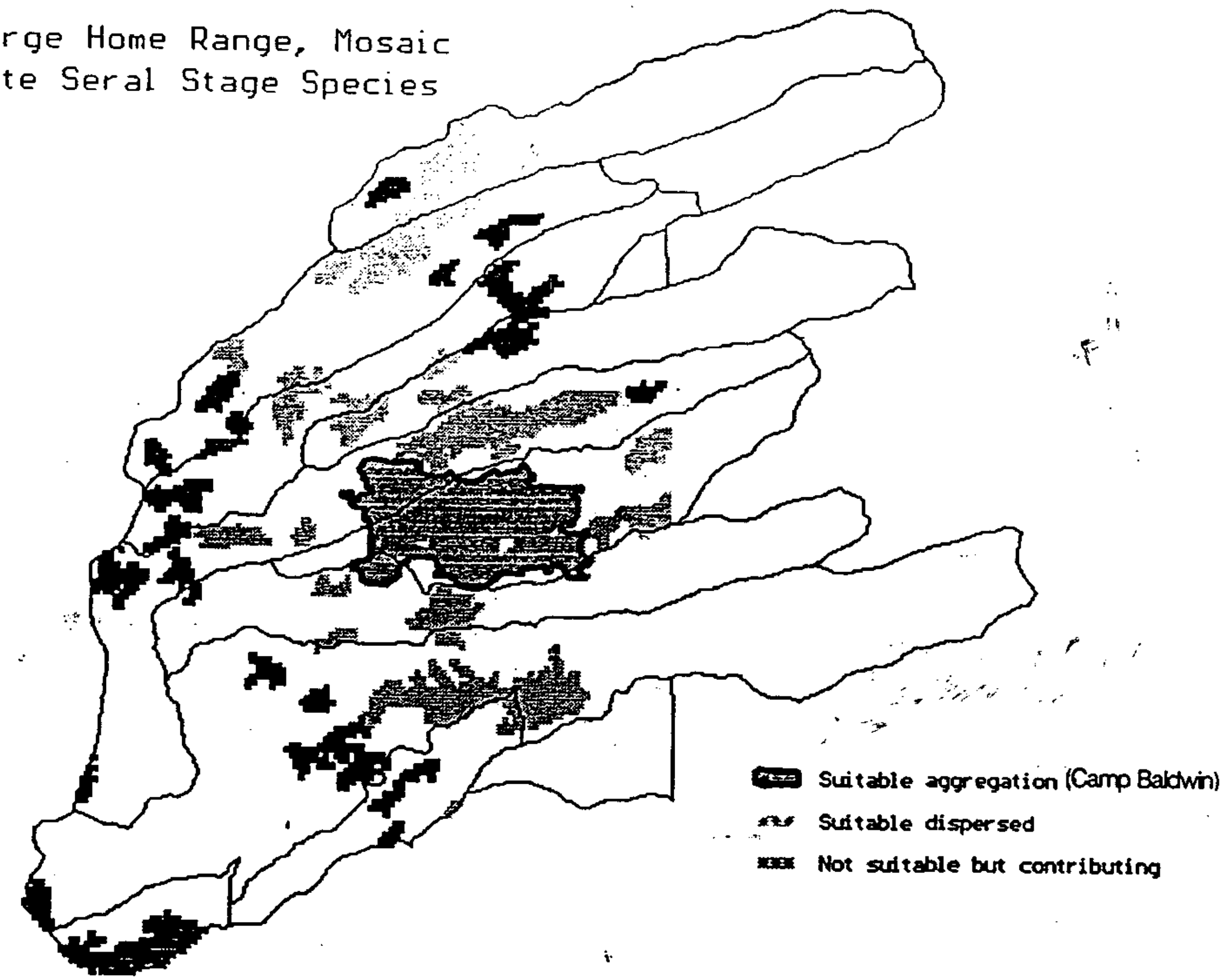


Fig. G. 2

CURRENT CONDITIONS

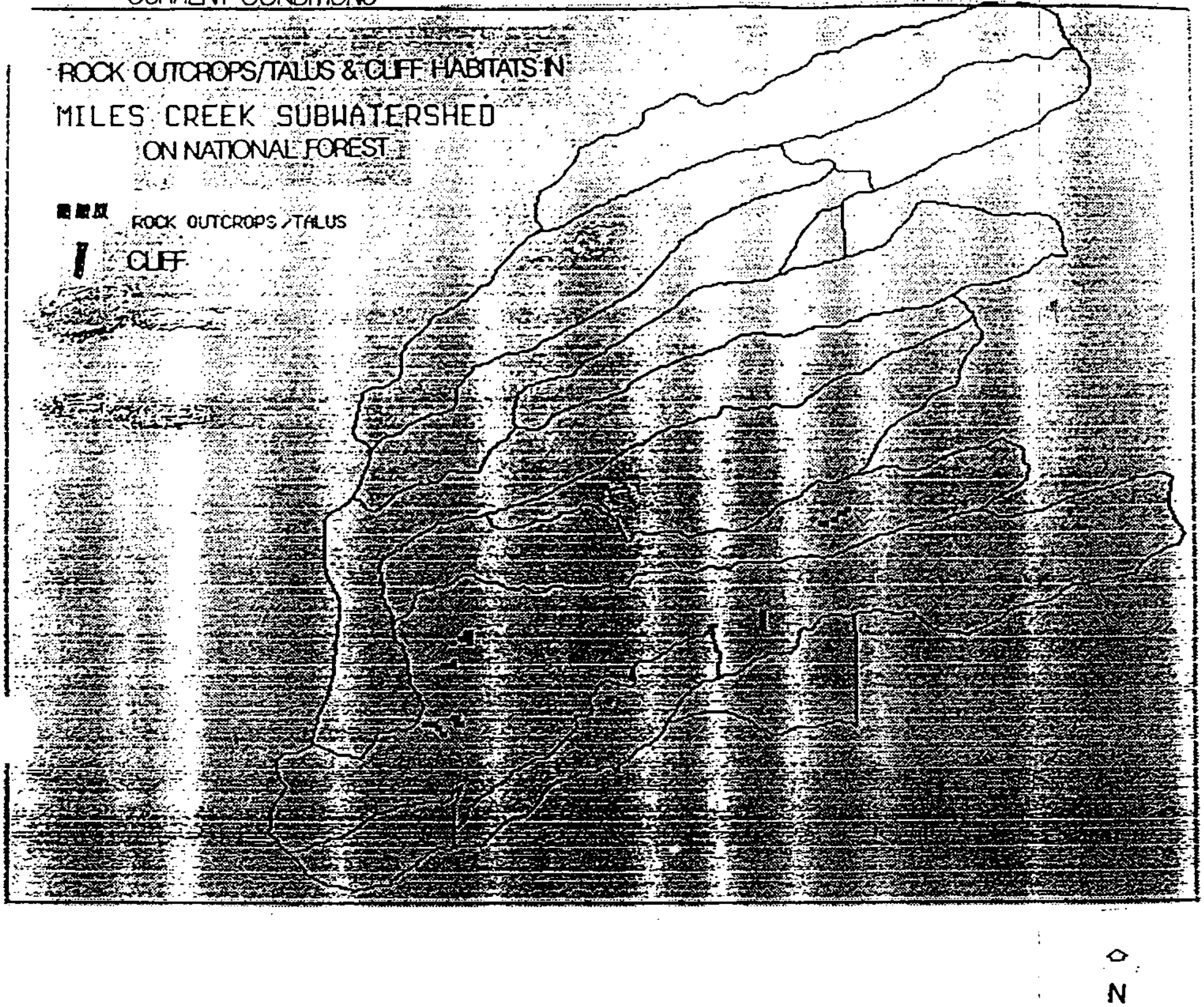
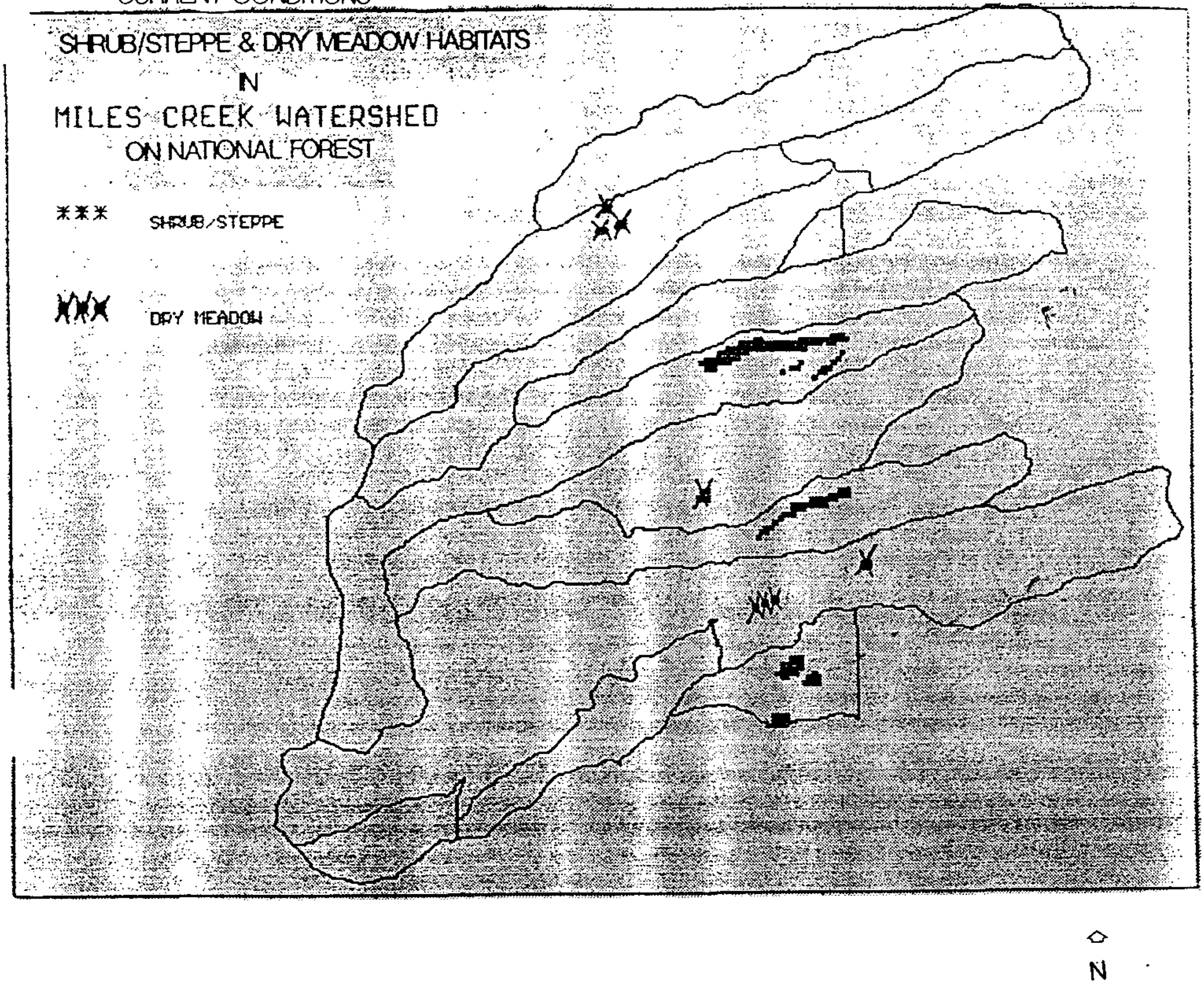


Fig. G. 3.

CURRENT CONDITIONS



INTERPRETING LANDSCAPE PATTERNS: A VERTEBRATE HABITAT RELATIONSHIPS APPROACH

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INTRODUCTION

Most wildlife habitat relationship information is available at the stand scale. For the Pacific Northwest this information has been compiled in Brown (1985) for the westside of the Cascade Mountains and in Thomas (1979) for the Blue Mountains. Hansen and Urban (1992) assessed avian habitat at the landscape scale using stand based habitat relationship information and species life history information. They assumed that patches of habitat needed to be available in sizes at least as large as the home range of the species for the species to occur in a particular landscape.

It has been recognized that distribution of habitat at a larger scale, in particular fragmentation of habitat blocks, may also be an important component of wildlife habitat relationships (Lehmkuhl and Ruggiero, 1991). However, attempts to link habitat use to landscape pattern indices has not been very successful. Only a few species have been linked to "interior habitat" in the Pacific Northwest (Hansen and Urban, 1992). Lehmkuhl and Raphael (1993) did find that amount of habitat, variation in patch sizes, and an isolation index (a proximity index) did differ between sites occupied by northern spotted owls (Strix occidentalis caurina) and random sites.

We developed a methodology to assess habitat at the landscape scale for all terrestrial vertebrates and aquatic amphibians on the Mt. Hood National Forest by building on the concepts presented by Hansen and Urban (1992). In order to assess all 307 species occurring on the Forest we grouped species into "life-history guilds" based on home range size, patch configuration use, and general habitat use (stand scale). We then assessed habitat for each guild based on the amount and distribution of habitat within a circle that represented the home range of species within the guild. This process assesses landscape parameters simlar to those Lehmkuhl and Raphael (1993) found to effect spotted owl habitat use.

This "life-history guild" approach is a suggested procedure in the Wildlife Habitat Module (steps 1-4) of "A Federal Agency Guide for Pilot Watershed Analysis".

OBJECTIVE

Develop an analysis procedure to predict terrestrial vertebrate and aquatic amphibian occurrence relative to landscape patterns.

ASSUMPTIONS AND LIMITATIONS

1) Assesses habitat for individuals of species not for populations.
2) Assesses primary or good habitat not marginal habitat.
3) Output is a list of species that may occur in the landscape and the number of acres available for the guild to which each species belongs. If a species is on the list it is assumed that the landscape is capable of supporting at least 1 individual of the species on the list. The acres available for each guild can be used to estimate the expected number of individuals of a species, based on that species home range size (not necessarily the guild home range size), that may occur in the landscape.
4) The guild approach to assessing habitat is meant to be a "screen" to determine if adequate habitat occurs in a watershed for species that we expect to react to different distributions and amounts of habitats in similar ways. This process will not replace single species analysis for TES species or other species of concern.

THE PROCEDURE

The analysis procedure involves linking a wildlife habitat relationship and life history database to a spatially-referenced vegetation database by using a common vegetation/habitat classification scheme. The databases are all in Paradox 4.0 so that UTOOLS/UMAP (Ager 1993) can be used for analysis and display.

Wildlife Habitat Relationship/Life History (WHR/LH) Database

Appendix 8 of "Management of Wildlife and Fish Habitats in Forests of Western Oregon and Washington", Brown (1985) was used as a starting point for the databases. Oregon Department of Fish and Wildlife's OSIS (Oregon Species Information System) was also used for distribution and habitat use information for most species. Additional literature and sources of information were used to update and create the databases. "Wildlife and vegetation of unmanaged Douglas-fir forests", Ruggiero et al. (1991) was used extensively to update the database. The LITCITED database contains a complete citation list.

The WHR/LH database is actually a set of relational databases. The data dictionary for the database is attached as appendix A. Refer to the appendix for information on the databases and the fields within the databases.

Vegetation Database

The vegetation database is really the engine that drives the analysis procedure. Each acre of the analysis area (Mt. Hood National Forest in our case) must be assigned to a vegetation/habitat classification category.

The Mt. Hood Vegetation Database was developed by importing data from MOMs (Mature and Over-mature inventory data), MOSS, and OSIS into a Paradox database using UTOOLS/UMAP. The Forest was divided into 1 hectare (2.47 acre) pixels. Vegetation information and other data was assigned for each pixel on the forest, resulting in a very large database with almost 1/2 million records.

Information stored for each pixel included county, district, presence of special habitats, presence of riparian buffer, associated watershed and the following vegetation information for up to 3 canopy layers: tree species composition, average dbh of trees, canopy cover and vegetation series. The vegetation information was used to classify each pixel into a series of categories, from a complex classification scheme to a simple scheme. The most complex scheme has up to 18 structural categories (divided by composition and structure) within each vegetation series (community) and the simplest scheme has only 3 structural categories (early, mid, and late seral). The "medium" scheme relates directly to the habitat categories in the WHR/LH database.

Guilding Species

Wildlife species were grouped into "life-history guilds". Species were first divided into 3 groups: special and unique habitat obligates, riparian habitat obligates, and terrestrial habitat users. The riparian habitat and terrestrial habitat groups were then further divided into guilds. The special and unique species did not fit well into guilds; they were treated as individual species.

The terrestrial habitat group was further divided into guilds based on combinations of home range size category, patch configuration use, and use of early, mid, or late seral habitats. Home range size categories included: small (<60 acres), medium (60-1,000 acres) and large (>1,000 acres). Patch configuration categories included: patch (use 1 homogeneous patch), mosaic (aggregate patches), contrast (use 2 different seral stages in close proximity), and generalist (use a variety of seral stages). The patch configuration categories are described in more detail in Appendix A under the INFO.DB Patch/Mosaic field.

The riparian habitat group was further divided into guilds based on combinations of association with water body, aquatic or terrestrial portion of riparian habitat, and early or mid/late seral stages. Water body categories included lakes, riverine, or lake and riverine. Aquatic/terrestrial categories included association with aquatic portion of riparian habitat only, terrestrial portion of aquatic habitat only, or both.

Rules and rationale for guilding wildlife species are described in detail in Appendix G.1.a.

As a result of the process 286 species were grouped into 18 terrestrial guilds and 13 riparian guilds; 21 species were special and unique habitat obligates that were not guilded. Appendix G.1.b. is a list of guilds in which species occur.

Some species needed to be placed in guilds based on professional judgement because species don't all fit the rules used to group them. Each guild was reviewed to ensure the species in the guilds were logical based on our knowledge of the species. Several hardwood obligates and bats were guilded using professional judgement rather than a strict application of the rules.

Linkage Analysis - Linking the Vegetation and WHR/LH Databases

Once the vegetation and WHR/LH databases are complete it is relatively simple to create habitat maps for individual species through UTOOLS/UMAP. Each pixel that is in a classification category that the species uses is mapped. However, this does not address if enough habitat, in the correct distribution is available to support an individual of the species. "Linkage analysis" was developed to assess the adequacy of amount and distribution of habitat for guilds of species. The steps in linkage analysis are outlined below.

Step 1 - CREATE PATCH MAP

An isolated 2.5 acre pixel of habitat is probably not adequate to support most species. Thus it was necessary to determine if each pixel was part of a larger patch and how large that patch was. A FORTRAN program was written to "grow" pixels into patches based on the type of habitat surrounding each pixel. Separate patch maps were created for early, mid, and late seral habitats. Early/mid seral and mid/late seral patches were also created to assess habitat for "generalists" that are associated with only two major seral stages. THIS PROGRAM IS CURRENTLY BEING TESTED AND DOCUMENTED.

Step 2 - DETERMINE SUITABILITY FOR EACH GUILD

Once patches were created each pixel was assessed for suitability for each guild of species. Habitat for patch species was assessed by determining if each pixel belonged to a minimum sized patch. For mosaic and contrast species the assessment was done by centering a home range sized circle on each pixel and analyzing amount and distribution of habitat within that circle. The pixel needed to be the correct seral stage and be part of a patch of a minimum size to be considered suitable habitat. There also needed to be a minimum amount of habitat within or adjacent to the home range circle for the pixel to be considered habitat.

For mosaic and contrast species 4 different home range radii were used. The 225 m radius relates to the small home range category, 800 m relates to most species in the medium home range category, 1135 m relates to some species in both medium and large home range categories, and 1970 m relates to most species in the large home range category. The home range radius applied to each guild depended on average home range size of the majority of species in the guild. These radii can be changed to any home range size during initiation of the program.

The rules used for each home range group on the Mt. Hood follow. The parameters can all be changed at the beginning of the program to account for better local information or different assumptions. We feel the parameters used here are conservative. Our objective was to examine good quality habitat.

GENERALIST SPECIES

All pixels are considered habitat

PATCH SPECIES

Home Range Class	Minimum patch size
Small	20 acres
Medium	500 acres
Large	no species

MOSAIC SPECIES - this includes "generalists" that use just early and mid or just mid and late seral stages.

Home Range Radius	Acres	Min patch size	% Habitat	Total Suitable
225 m	52	4.8 acres	50%	30 acres (70%)
800 m	500	20 acres	50%	350 acres (70%)
1135 m	1001	20 acres	50%	700 acres (70%)
1970 m	3007	40 acres	50%	2100 ac (70%)

Home Range Radius - the scan distance from the center of each pixel that relates to the home range size for each guild

Acres - the number of acres encompassed by the circle, home range size

Min patch size - each pixel must belong to a patch of habitat at least this size to be considered a habitat patch

% habitat - percent of area within the circle that must be in habitat patches (of minimum size) averaged for all pixels in the patch

Total suitable - amount of habitat which must be in patches within the circle or in patches that the outer edge of the circle touches - most of these acres of habitat may be outside the home range radius thus the amount of habitat needed is higher (70% of the home range size) - if 1 pixel in the patch meets this rule all pixels in the patch are considered suitable

Outcomes - each pixel is assigned a number based on how it contributes to habitat

0 - not suitable - pixel not the correct seral stage to be habitat

1 - pixel is suitable - part of a habitat patch that is 50% of the home range size or larger

2 - pixel is suitable - part of a habitat patch which meets minimum patch size and $\geq$ 50% of area of circle around the patch is in habitat

3 - pixel is suitable - part of a habitat patch which meets minimum patch size and enough habitat is intersected by the radius of the circle around the pixel to meet total suitable habitat requirement (acres equal to 70% of home range size)

4 - pixel is not suitable - meets minimum habitat patch size and contributes to making another pixel in another patch suitable; there is not enough habitat around #4 pixels to call it habitat but when the circle is moved to the center of another pixel the #4 contributes to total suitable habitat for the patch to which the pixel belongs

5 - pixel is not suitable - meets minimum patch size, but doesn't meet the 50% or 70% rules and doesn't contribute to another patch that is suitable.

6 - pixel is not suitable - part of a patch that doesn't meet the minimum patch size

Decision Flowchart

```
Suitable Seral Stage?
     |         |
     YES       NO ---------------> Not suitable (Outcome 0)
     |
Pixel in patch larger
than minimum size?
     |         |
     YES       NO--------------> Not suitable (Outcome 6)
     |
Large patch >= 50%
of home range size?
     |         |
     NO        YES-------------> Suitable patch (Outcome 1)
     |
> minimum patch size and
> 50% HR suitable?
     |         |
     NO        YES-------------> Suitable aggregation (Outcome 2)
     |
> minimum patch size and
> total suitable habitat
patches at edge of
home range circle?
     |         |
     NO        YES------------> Suitable dispersed (Outcome 3)
     |
> minimum patch size and
contributes to making
another patch suitable?
     |         |
     NO        YES------------> Not suitable but contributing (Outcome 4)
     |
> minimum patch size only?
               |
               YES------------> Not suitable (Outcome 5)
```

CONTRAST SPECIES

Step 1 - generate a separate patch maps with late seral and early seral patches which meet minimum patch size.

Step 2 - merge the early and late seral patch maps

Step 3 - take each pixel that is within a late patch and determine if an early seral pixel is within a given distance (buffer width) - if so code as late contrast habitat. Repeat for early seral pixels

Step 4 - within the home range radius of each contrast pixel determine the number of acres in early contrast and late contrast habitat. Early and late contrast habitat must each be at least 25% of total contrast habitat to ensure adequate contrast. Late and early contrast habitat combined must be at least 20% of the area of the home range circle around the pixel for the pixel to remain suitable. Both the 25% contrast and 20% total habitat can be modified in the program.

Home Range Radius	Acres	Min patch size	Buffer width	% Habitat
225 m	52	4.8 acres	100m	20 %
800 m	500	10 acres	200	20%
1135 m	1001	10 acres	200	20%
1970 m	3007	20 acres	400	20%

Outcomes

1 - pixel is suitable and is part of an early patch

2 - pixel is suitabile and is part of a late patch

List of Species and Acres of Habitat by Landscape (Watershed)

The Linkage Analysis was conducted at the Forest scale. Lists of guilds, species and amount of habitat was assessed at the Watershed scale. Because species will readily cross watershed boundaries, habitat outside the watershed contributed to making pixels of habitat within the watershed suitable. However, only pixels within the watershed were tallied to calculate amount of habitat in the watershed.

Each watershed was analyzed for all guilds on the forest. If adequate amounts and distribution of habitat was available for the guild the guild was initially listed as having habitat in the watershed. The next step was to examine the list of species in those guilds to determine which species in the guilds might occur in the watershed. If the species occurred in counties that were included in the watershed and the species used habitats in communities (vegetation series) that occurred in the watershed then the species were listed as potentially occurring in the watershed.

The amount of habitat available for each guild does not equate to that number of acres being available for each species within the guild. The guild approach to assessing habitat is meant to be a "screen" to determine if adequate habitat occurs in a watershed for species that we expect to react to different distributions and amounts of habitats in similar ways. The amount of acres of habitat for each guild will aid in determining relative amounts of habitat for different groups of species. For those guilds with very little habitat in the watershed a closer look at the species within the guild may be warranted.

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TERRESTRIAL GUILDS

These are species that will use terrestrial habitats regardless of the presence or absence of riparian or special and unique habitats. Many of these species will use riparian or special and unique habitats but they do not require these habitats.

Rule: The "Use" field in the HABITAT database must contain a use code of 1-4 for that species. If a 6 or 7 occurs in the "Use" field the species belongs to a Riparian or Special Habitat guild.

The Terrestrial guild was further divided into guilds based on combinations of home range size category and patch configuration category. Rules used to assign species to a patch configuration category (patch_matrix field) are described in the data dictionary.

Each of these combinations was further divided by general habitat use (early, mid, or late seral) following the rationale below. Some guilds had not species associated with them - not every possible combination of home range size, patch configuration category, and seral stage resulted in combinations that had species associated with them.

Use of seral/structural stages was lumped into early, mid and late categories. Grass/forb, shrub, leave tree/shelterwood, and open sapling/pole were considered EARLY seral; closed sapling/pole, open small conifer, and closed small conifer were considered MID seral; large conifer and old growth were considered LATE seral. Hardwoods, lodgepole, and sub-alpine habitats "floated" - they were not assigned to a seral stage as they functioned as more than 1 structural/seral stage for different species. Use of these stages was also lumped into simpler codes - 1s and 3s became 1, 2s and 4s became 4s, 6s and 7s became 5.

Patch and Mosaic species: primary habitat is restricted to 1 major seral stage

Early Seral - species with 1 in early, 0 or 2 in mid, 0 in late OR 2 in early, 0 or 2 in mid and late

Mid Seral - species with 1 in mid, 0 or 2 in early, 0 or 2 in late OR 2 in mid, 0 or 2 in early and late

Late Seral - species with 1 in late, 0 or 2 in mid, 0 in early OR 2 in late, 0 or 2 in early and mid

Generalist species: primary habitat is not restricted to 1 major seral stage for these species - some may find primary habitat in 2 major seral stages only.

Early/mid Seral -	species with 1 or 2 in early, 1 or 2 in mid, and 0 in late
Mid/late Seral -	species with 1 or 2 in mid, 1 or 2 in late, and 0 in early
Generalist -	species 1 or 2 in early, 1 or 2 in mid, and 1 or 2 in late

Contrast Species: These species are not assigned to seral stages. They require the contrast between early and late seral stages.

Note: There may be overlap between generalist and patch and mosaic species in terms of use combinations. A mid/late generalist may have the same combination as a late seral mosaic species. The assignment of species to a patch configuration category was done before seral stages were lumped and for some species use of all categories and professional judgement was used to assign the species to categories.

RIPARIAN GUILDS

These are species that are found only where riparian habitats exist. They may use terrestrial or upland habitats if riparian habitat is nearby. They may also use special habitats but do not require them.

Rule: The "Use" field in the HABITAT database must contain a Y for "Riparian". The "Use" field must be either blank for all seral/structural stages or contain a 6 or 7 for at least 1 seral/structural stage. There may or may not be Y for "Special". The "Use" field in the RIPAR database must not contain a 5 or 6 or 7.

The Riparian guild was further divided into guilds based on combinations of association with water body (RIPAR database), aquatic or terrestrial portion of riparian habitat (INFO database), and early or mid/late seral stages (RIPAR database). Not every possible combination had associates species - some "guilds" were blank.

Use of seral/structural stages was lumped into early and mid/late categories. Grass/forb/shrub was considered EARLY seral; Hardwood sap/pole and mid/late, and Conifer sap/pole, and mid/late were considered MID/LATE seral. Use of these stages was lumped following the same rationale as for terrestrial habitats.

Lake species: Codes of 1-4 in "Use" field for at least 1 Lake associated riparian habitat, and blanks in "Use" field for River, Stream, and Headwater riparian habitats.

Aquatic species: Code of 7 in "Moisture_gradient" field of INFO database, or code of 8 in "Moisture_gradient" field and MI or WR in "Residence_status" field of INFO database. The last rule is meant to pick up species that may use terrestrial portions of riparian habitats on their breeding grounds but just use aquatic portions of riparian habitat while on the Forest.

Aquatic/terrestrial species: Code of 8 in "Moisture_gradient" field and PR, SR, EX, or IN in "Residence_status" field of INFO database. The last part of the rule eliminates those species that use both aquatic and terrestrial portions of riparian habitats on the breeding grounds but not on the Forest.

EARLY Seral Species: Code of 1 in "Use" field for early seral habitats and 0 or 2 for mid/late seral habitats, or 2 for early seral and 0 for mid/late seral habitats.

MID/LATE Seral Species: Code of 1 in "Use" field for mid/late seral habitats and 0 or 2 for early seral habitats, or 2 for mid/late seral and 0 for early seral habitats.

GENERALIST Species: Code of 1 in "Use" field for early seral habitats and 1 for mid/late seral habitats, or 2 for early seral and 2 for mid/late seral habitats.

Terrestrial riparian species: Code of 9 in "Moisure_gradient" field of INFO database.

same seral stage divisions as Aquatic/terrestrial riparian species

Riverine species: Codes of 1-4 in "Use" field for at least 1 River, Stream, and/or Headwater associated riparian habitat, and blanks in "Use" field for Lake associated riparian habitats.

same divisions as Lake species

Lake/Riverine species: Codes of 1-4 in "Use" field for at least 1 River, Stream, and/or Headwater associated riparian habitat, and codes 1-4 in "Use field for at least 1 Lake associated riparian habitat.

same divisions as Lake species

SPECIAL HABITAT GUILD

These are species that are found only where special and unique habitats exist. They may use terrestrial or riparian habitats if a special habitat is nearby.

> Rule: The "Use" field in the HABITAT database must contain a Y for "Special". The "Use" field must be either blank for all seral/structural stages or contain a 6 or 7 for at least 1 seral/structural stage. There may or may not be a Y for "Riparian". The "Use" field in the RIPAR database must be all blank (species not in RIPAR database) or contain a 5 or 6 or 7.

The special habitat guild was not further divided. Each species in this guild is so unique that they must be dealt with on a species by species approach.

Appendix G.1.b.
WILDLIFE SPECIES LIFE HISTORY GUILDS

Terrestrial Guilds: use upland, terrestrial habitats

Code	Description of Guild	# of Species
TSPE	small home range, patch, early seral	37
TSPM	small home range, patch, mid seral	1
TSPL	small home range, patch, late seral	6
TSME	small home range, mosaic, early seral	12
TSMM	small home range, mosaic, mid seral	1
TSGEM	small home range, generalist for early and mid	5
TSGML	small home range, generalist for mid and late	8
TSGG	small home range, generalist for all stages	88
TMPE	medium home range, patch, early seral	3
TMME	medium home range, mosaic, early seral	4
TMML	medium home range, mosaic, late seral	2
TMGG	medium home range, generalist for all stages	19
TLME	large home range, mosaic, early seral	2
TLML	large home range, mosaic, late seral	7
TLGG	large home range, generalist for all stages	7
TSC	small home range, contrast species	4
TMC	medium home range, contrast species	7
TLC	large home range, contrast species	6

Riparian Guilds: riparian habitat obligates - use aquatic or terrestrial portion of riparian habitats or both portions

Code	Description of Guild	# of Species
LAKEA	aquatic habitats of LAKES	10
LAKEARE	aquatic and terrestrial early seral of LAKES	1
LAKERE	riparian early seral of LAKES	6
LKRVA	aquatic habitats of LAKES AND RIVERS	12
LKRVARE	aquatic and terrestrial early seral of LAKES/RIVERS	7
LKRVARML	aquatic and terrestrial mid/late seral, LAKES/RIVERS	8
LKRVARG	aquatic and terrestrial, all stages of LAKES/RIVERS	9
LKRVRE	terrestrial early seral stages of LAKES AND RIVERS	5
LKRVRG	terrestrial habitats, all stages of LAKES AND RIVERS	1
RIVA	aquatic habitats of RIVERS	1
RIVARML	aquatic and terrestrial, mid/late stages of RIVERS	3
RIVARG	aquatic and terrestrial, all stages of RIVERS	2
RIVRE	terrestrial early seral habitats of RIVERS	1
RIVRML	terrestrial mid/late seral habitats of RIVERS	1

Special Habitat Guild: special habitat obligates

Code	Description of Guild	# of Species
SPCL	require specific special habitats	21

Appendix G2.

WILDLIFE SPECIES WITH
POTENTIAL HABITAT IN EAU129

Species	Class	Species_description	Introduced	TES	FEMAT	SNAGS
ACCO	B	Cooper's hawk				
ACGE	B	northern goshawk		C2		
ACMA	B	spotted sandpiper				
ACST	B	sharp-shinned hawk				
AEAC	B	northern saw-whet owl				1
AGPH	B	red-winged blackbird				
AISP	B	wood duck				1
AMGR	A	northwestern salamander				
AMMA	A	long-toed salamander				
ANAC	B	northern pintail				
ANCL	B	northern shoveler				
ANCR	B	green-winged teal				
ANDI	B	blue-winged teal				
ANST	B	gadwall				
APCO	B	scrub jay				
APRU	M	mountain beaver				
AQCH	B	golden eagle				
ARHE	B	great blue heron				
ASOT	B	long-eared owl				
ASTR	A	tailed frog		ORS	Y	
AYCO	B	ring-necked duck		NHP4		
BAWR	A	Oregon slender salamander		ORS	Y	
B[illegible]	B	cedar waxwing				
[illegible]	B	ruffed grouse				
B[illegible]	B	bufflehead		ORS		
BUBO	A	western toad		ORS		
BUIS	B	Barrow's goldeneye		ORS		1
BUJA	B	red-tailed hawk				
BUVI	B	great horned owl				
CAAU	B	turkey vulture				
CACAL	B	California quail				
CACAS	B	Cassin's finch				
CAGU	B	hermit thrush				
CALAT	M	coyote				
CAPI	B	pine siskin				
CARPU	B	purple finch				
CASCAN	M	beaver				
CATME	B	canyon wren				
CATR	B	American goldfinch				
CAUS	B	Swainson's thrush				
CEAL	B	belted kingfisher				
CEAM	B	brown creeper				1
CEEL	M	elk				
CHBO	R	rubber boa				
CHGR	B	lark sparrow				
CHMI	B	common nighthawk				
CHVA	B	Vaux's swift				1
CHVO	B	killdeer				
CIME	B	American dipper				
CL[illegible]	M	western red-backed vole				
[illegible]	B	northern flicker				1
[illegible]	B	olive-sided flycatcher				
COBR	B	American crow				
COFA	B	band-tailed pigeon				
COLCO	R	racer				
CONTE	R	sharptail snake		ORS		
CORCO	B	common raven				

WILDLIFE SPECIES WITH
POTENTIAL HABITAT IN EAU129

Species	Class	Species_description	Introduced	TES	FEMAT	SNAGS
COSO	B	western wood-pewee				
COVE	B	evening grosbeak				
CRVI	R	western rattlesnake				
CYST	B	Steller's jay				
DENCO	B	yellow-rumped warbler				
DENI	B	black-throated gray warbler				
DEOB	B	blue grouse				
DEOC	B	hermit warbler				
DEPE	B	yellow warbler				
DETO	B	Townsend's warbler				
DICO	A	Cope's giant salamander		RFS	Y	
DIPU	R	ringneck snake				
DITE	A	Pacific giant salamander				
DIVI	M	Virginia opossum	IN			1
DRPI	B	pileated woodpecker		ORS		1
ELCO	R	northern alligator lizard				
ELMU	R	southern alligator lizard				
EMDI	B	Pacific slope flycatcher				
EMHA	B	Hammond's flycatcher				
EMOB	B	dusky flycatcher				
EMOC	B	Cordilleran flycatcher				
EMTR	B	willow flycatcher				
ENES	A	Ensatina				
[illegible]	M	big brown bat				1
E[illegible]	B	horned lark				
ERDO	M	porcupine				
EUCY	B	Brewer's blackbird				
EUSK	R	western skink				
FACO	B	merlin		NHP2		
FASP	B	American kestrel				1
FECO	M	mountain lion				
GAGA	B	common snipe				
GAIM	B	common loon		RFS		
GLGN	B	northern pygmy-owl		ORS		1
GLSA	M	northern flying squirrel				1
GUGU	M	wolverine		C2		
HALE	B	bald eagle		T		
HIHI	B	harlequin duck		C2		
HIPY	B	cliff swallow				
HIRU	B	barn swallow				
HYTO	R	night snake				
ICGA	B	northern oriole				
IXNA	B	varied thrush				
JUHY	B	dark-eyed junco				
LACI	M	hoary bat			Y	
LAEX	B	northern shrike				
LALU	B	loggerhead shrike		C2		
LANO	M	silver-haired bat			Y	1
LEAM	M	snowshoe hare				
LOCUC	B	hooded merganser				1
[illegible]	B	red crossbill				
[illegible]	M	river otter				
LYRU	M	bobcat				
MAAM	M	marten		ORS	Y	1
MAFL	M	yellow-bellied marmot				
MAPE	M	fisher		C2	Y	1
MATA	R	striped whipsnake				

WILDLIFE SPECIES WITH
POTENTIAL HABITAT IN EAU129

Species	Class	Species_description	Introduced	TES	FEMAT	SNAGS
MEFO	B	acorn woodpecker		ORS		1
MEGA	B	wild turkey	IN			
MELE	B	Lewis' woodpecker		ORS		1
MELME	B	song sparrow				
MEMEP	M	striped skunk				
MERME	B	common merganser				1
MILO	M	long-tailed vole				
MIOR	M	creeping vole				
MITO	M	Townsend's vole				
MOAT	B	brown-headed cowbird				
MUER	M	ermine				
MUFR	M	long-tailed weasel				
MYCI	B	ash-throated flycatcher				1
MYEV	M	long-eared myotis			Y	1
MYOCA	M	California myotis				1
MYOCI	M	western small-footed myotis				
MYTO	B	Townsend's solitaire				
MYVO	M	long-legged myotis			Y	1
MYYU	M	Yuma myotis				1
NECI	M	bushy-tailed woodrat				
NEGI	M	shrew-mole				
ODHE	M	mule deer and black-tailed deer				
[illegible]	B	MacGillivray's warbler				
[illegible]	B	mountain quail		C2		
[illegible]	B	flammulated owl		ORS		1
OTKE	B	western screech-owl				1
PAAMO	B	lazuli bunting				
PAAT	B	black-capped chickadee				1
PAGA	B	mountain chickadee				1
PAHA	B	osprey				1
PAIL	B	fox sparrow				
PARU	B	chestnut-backed chickadee				1
PECA	B	gray jay				
PEMA	M	deer mouse				
PEPA	M	Great Basin pocket mouse				
PETRU	M	pinon mouse				
PHCO	B	ring-necked pheasant	IN			
PHDO	R	short-horned lizard				
PHIN	M	heather vole				
PHME	B	black-headed grosbeak				
PIAL	B	white-headed woodpecker		ORS		1
PIAR	B	black-backed woodpecker		ORS	Y	1
PICH	B	green-tailed towhee				
PIEN	B	pine grosbeak		NHP3		
PIER	B	rufous-sided towhee				
PILU	B	western tanager				
PIME	R	gopher snake				
PIPU	B	downy woodpecker				1
PITR	B	northern three-toed woodpecker		ORS		1
PIVI	B	hairy woodpecker				1
[illegible]	B	vesper sparrow		ORS		
[illegible]	B	pied-billed grebe				
PRLO	M	raccoon				1
PSHI	B	bushtit				
PSRE	A	Pacific treefrog				
RACAT	A	bullfrog	IN			
RANCA	A	Cascade frog		C2		

WILDLIFE SPECIES WITH
POTENTIAL HABITAT IN EAU129

Species	Class	Species_description	Introduced	TES	FEMAT	SNAGS
RECA	B	ruby-crowned kinglet				
RESA	B	golden-crowned kinglet				
SAOB	B	rock wren				
SAYSA	B	Say's phoebe				
SCGR	R	sagebrush lizard				
SCIGR	M	western gray squirrel				1
SCIN	A	Great Basin spadefoot toad				
SCOC	R	western fence lizard				
SCOR	M	coast mole				
SERUF	B	rufous hummingbird				
SICAR	B	white-breasted nuthatch				1
SICU	B	mountain bluebird				1
SIME	B	western bluebird		ORS		1
SIPY	B	pygmy nuthatch		ORS		1
SITCA	B	red-breasted nuthatch				1
SOBE	M	Pacific water shrew				
SOME	M	Merriam shrew				
SOMO	M	dusky shrew				
SOPAL	M	water shrew				
SOTRO	M	Trowbridge's shrew				
SOVA	M	vagrant shrew				
SPBEE	M	California ground squirrel				
S[illegible]	M	golden-mantled ground squirrel				
[illegible]	B	red-naped sapsucker				1
S[illegible]	B	chipping sparrow				
SPPU	M	spotted skunk				
SPRU	B	red-breasted sapsucker				1
STELCA	B	calliope hummingbird				
STNE	B	great gray owl		ORS		1
STOC	B	northern spotted owl		T		
STNE	B	western meadowlark				
STVA	B	barred owl				1
STVU	B	European starling	IN			1
SYBA	M	brush rabbit				
TAAM	M	yellow-pine chipmunk				
TABI	B	tree swallow				1
TADO	M	Douglas' squirrel				1
TAGR	A	roughskin newt				
TATA	M	badger				
TATH	B	violet-green swallow				1
TATO	M	Townsend's chipmunk				
THBE	B	Bewick's wren				
THEL	R	western terrestrial garter snake				
THMA	M	western pocket gopher				
THOR	R	northwestern garter snake				
THSI	R	common garter snake				
THTA	M	northern pocket gopher				
TRAE	B	house wren				1
TRTR	B	winter wren				
[illegible]	B	American robin				
[illegible]	B	barn owl				1
[illegible]	B	western kingbird				
URAM	M	black bear				
URCI	M	gray fox				
USTS	R	side blotched lizard				
VECE	B	orange-crowed warbler				
VERU	B	Nashville warbler				

WILDLIFE SPECIES WITH
POTENTIAL HABITAT IN EAU129

Species	Class	Species_description	Introduced	TES	FEMAT	SNAGS
VIGI	B	warbling vireo				
VISO	B	solitary vireo				
WIPU	B	Wilson's warbler				
ZAPR	M	western jumping mouse				
ZATR	M	Pacific jumping mouse				
ZEMA	B	mourning dove				
ZOAT	B	golden-crowned sparrow				
ZOLE	B	white-crowned sparrow				

SUMMARY FOR EAU129

Total number of species: 236
Number of introduced species: 5
Number of TES species: 11
Number of State and NHP listed species: 22
Number of FEMAT species of concern: 10
Number of snag dependent species: 52

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

WILDLIFE SPECIES WITH
POTENTIAL HABITAT IN EAU130

Species	Class	Species_description	Introduced	TES	FEMAT	SNAGS
ACCO	B	Cooper's hawk				
ACGE	B	northern goshawk		C2		
ACMA	B	spotted sandpiper				
ACST	B	sharp-[illegible]nned hawk				
AEAC	B	northern saw-whet owl				1
AGPH	B	red-winged blackbird				
AISP	B	wood duck				1
AMGR	A	northwestern salamander				
AMMA	A	long-toed salamander				
ANAAM	B	American wigeon				
ANAC	B	northern pintail				
ANCL	B	northern shoveler				
ANCR	B	green-winged teal				
ANDI	B	blue-winged teal				
ANPA	M	pallid bat —		ORS	Y	
ANST	B	gadwall				
APCO	B	scrub jay				
APRU	M	mountain beaver				
AQCH	B	golden eagle				
ARHE	B	great blue heron				
ASOT	B	long-eared owl				
ASTR	A	tailed frog —		ORS	Y	
A[illegible]	B	ring-necked duck		NHP4		
[illegible]	A	Oregon slender salamander —		ORS	Y	
B[illegible]	B	cedar waxwing				
BOUM	B	ruffed grouse				
BUAL	B	bufflehead		ORS		
BUBO	A	western toad		ORS		
BUIS	B	Barrow's goldeneye		ORS		1
BUJA	B	red-tailed hawk				
BUVI	B	great horned owl				
CAAU	B	turkey vulture				
CACAL	B	California quail				
CACAS	B	Cassin's finch				
CAGU	B	hermit thrush				
CALAT	M	coyote				
CAPI	B	pine siskin				
CARPU	B	purple finch				
CASCAN	M	beaver				
CATME	B	canyon wren				
CATR	B	American goldfinch				
CAUS	B	Swainson's thrush				
CEAL	B	belted kingfisher				
CEAM	B	brown creeper				1
CEEL	M	elk				
CHBO	R	rubber boa				
CHGR	B	lark sparrow				
CHMI	B	common nighthawk				
CHVA	B	Vaux's swift				1
CH[illegible]	B	killdeer				
[illegible]	B	northern harrier				
[illegible]	B	American dipper				
CLCA	M	western red-backed vole				
COAU	B	northern flicker				1
COBO	B	olive-sided flycatcher				
COBR	B	American crow				
COFA	B	band-tailed pigeon				

WILDLIFE SPECIES WITH
POTENTIAL HABITAT IN EAU130

Species	Class	Species_description	Introduced	TES	FEMAT	SNAGS
COLCO	R	racer				
CONTE	R	sharptail snake		ORS		
CORCO	B	common raven				
COSO	B	western wood-pewee				
COVE	B	evening grosbeak				
CRVI	R	western rattlesnake				
CYCO	B	tundra (whistling) swan				
CYST	B	Steller's jay				
DEMCO	B	yellow-rumped warbler				
DENI	B	black-throated gray warbler				
DEOB	B	blue grouse				
DEOC	B	hermit warbler				
DEPE	B	yellow warbler				
DETO	B	Townsend's warbler				
DICO	A	Cope's giant salamander		RFS	Y	
DIPU	R	ringneck snake				
DITE	A	Pacific giant salamander				
DIVI	M	Virginia opossum	IN			1
DRPI	B	pileated woodpecker		ORS		1
ELCO	R	northern alligator lizard				
ELMU	R	southern alligator lizard				
EMDI	B	Pacific slope flycatcher				
E[illegible]	B	Hammond's flycatcher				
[illegible]	B	dusky flycatcher				
E[illegible]	B	Cordilleran flycatcher				
EMTR	B	willow flycatcher				
ENES	A	Ensatina				
EPFU	M	big brown bat				1
ERAL	B	horned lark				
ERDO	M	porcupine				
EUCY	B	Brewer's blackbird				
EUSK	R	western skink				
FACO	B	merlin		NHP2		
FAPE	B	peregrine falcon		E		
FASP	B	American kestrel				1
FECO	M	mountain lion				
GAGA	B	common snipe				
GAIM	B	common loon		RFS		
GETR	B	common yellowthroat				
GLGN	B	northern pygmy-owl		ORS		1
GLSA	M	northern flying squirrel				1
GRCA	B	sandhill crane		RFS		
GUGU	M	wolverine		C2		
HALE	B	bald eagle		T		
HIHI	B	harlequin duck		C2		
HIPY	B	cliff swallow				
HIRU	B	barn swallow				
HYTO	R	night snake				
ICGA	B	northern oriole				
IX[illegible]	B	varied thrush				
[illegible]	B	dark-eyed junco				
[illegible]	B	herring gull				
LACI	M	hoary bat			Y	
LADE	B	ring-billed gull				
LAEX	B	northern shrike				
LALU	B	loggerhead shrike		C2		
LANO	M	silver-haired bat			Y	1

WILDLIFE SPECIES WITH
POTENTIAL HABITAT IN EAU130

Species	Class	Species_description	Introduced	TES	FEMAT	SNAGS
LEAM	M	snowshoe hare				
LOCUC	B	hooded merganser				1
LOXCU	B	red crossbill				
LUCA	M	river otter				
LYRU	M	bobcat				
MAAM	M	marten		ORS	Y	1
MAFL	M	yellow-bellied marmot				
MAPE	M	fisher		C2	Y	1
MATA	R	striped whipsnake				
MEFO	B	acorn woodpecker		ORS		1
MEGA	B	wild turkey	IN			
MELE	B	Lewis' woodpecker		ORS		1
MELME	B	song sparrow				
MEMEP	M	striped skunk				
MERME	B	common merganser				1
MILO	M	long-tailed vole				
MIOR	M	creeping vole				
MITO	M	Townsend's vole				
MOAT	B	brown-headed cowbird				
MUER	M	ermine				
MUFR	M	long-tailed weasel				
MUMU	M	house mouse	IN			
	B	ash-throated flycatcher				1
	M	long-eared myotis			Y	1
M[illegible]CA	M	California myotis				1
MYOCI	M	western small-footed myotis				
MYTO	B	Townsend's solitaire				
MYVO	M	long-legged myotis			Y	1
MYYU	M	Yuma myotis				1
NECI	M	bushy-tailed woodrat				
NEGI	M	shrew-mole				
ODHE	M	mule deer and black-tailed deer				
OPTO	B	MacGillivray's warbler				
ORPI	B	mountain quail		C2		
OTFL	B	flammulated owl		ORS		1
OTKE	B	western screech-owl				1
PAAMO	B	lazuli bunting				
PAAT	B	black-capped chickadee				1
PADO	B	house sparrow	IN			
PAGA	B	mountain chickadee				1
PAHA	B	osprey				1
PAIL	B	fox sparrow				
PARU	B	chestnut-backed chickadee				1
PECA	B	gray jay				
PEMA	M	deer mouse				
PEPA	M	Great Basin pocket mouse				
PETRU	M	pinon mouse				
PHCO	B	ring-necked pheasant	IN			
PHDO	R	short-horned lizard				
	M	heather vole				
	B	black-headed grosbeak				
	B	white-headed woodpecker		ORS		1
PIAR	B	black-backed woodpecker		ORS	Y	1
PICH	B	green-tailed towhee				
PIEN	B	pine grosbeak		NHP3		
PIER	B	rufous-sided towhee				
PILU	B	western tanager				

WILDLIFE SPECIES WITH
POTENTIAL HABITAT IN EAU130

Species	Class	Species_description	Introduced	TES	FEMAT	SNAGS
PIME	R	gopher snake				
PIPU	B	downy woodpecker				1
PITR	B	northern three-toed woodpecker		ORS		1
PIVI	B	hairy woodpecker				1
PLTO	M	Townsend's big-eared bat		C2		
POOGR	B	vesper sparrow		ORS		
POPO	B	pied-billed grebe				
PRLO	M	raccoon				1
PSMI	B	bushtit				
PSRE	A	Pacific treefrog				
RAAU	A	red-legged frog		C2		
RACAT	A	bullfrog	IN			
RANCA	A	Cascade frog		C2		
RECA	B	ruby-crowned kinglet				
RESA	B	golden-crowned kinglet				
RHCA	A	Cascade torrent salamander		ORS	Y	
SAOB	B	rock wren				
SAYSA	B	Say's phoebe				
SCGR	R	sagebrush lizard				
SCIGR	M	western gray squirrel				1
SCIN	A	Great Basin spadefoot toad				
SCOC	R	western fence lizard				
S[illegible]	M	coast mole				
[illegible]	B	rufous hummingbird				
S[illegible]	B	white-breasted nuthatch				1
SICU	B	mountain bluebird				1
SIME	B	western bluebird		ORS		1
SIPY	B	pygmy nuthatch		ORS		1
SITCA	B	red-breasted nuthatch				1
SOBE	M	Pacific water shrew				
SOME	M	Merriam shrew				
SOMO	M	dusky shrew				
SOPAL	M	water shrew				
SOTRO	M	Trowbridge's shrew				
SOVA	M	vagrant shrew				
SPBEE	M	California ground squirrel				
SPLA	M	golden-mantled ground squirrel				
SPNU	B	red-naped sapsucker				1
SPPA	B	chipping sparrow				
SPPU	M	spotted skunk				
SPRU	B	red-breasted sapsucker				1
STELCA	B	calliope hummingbird				
STNE	B	great gray owl		ORS		1
STOC	B	northern spotted owl		T		
STUNE	B	western meadowlark				
STVA	B	barred owl				1
STVU	B	European starling	IN			1
SYBA	M	brush rabbit				
TAAM	M	yellow-pine chipmunk				
TA[illegible]	B	tree swallow				1
[illegible]	M	Douglas' squirrel				1
[illegible]	A	roughskin newt				
TATA	M	badger				
TATH	B	violet-green swallow				1
TATO	M	Townsend's chipmunk				
THBE	B	Bewick's wren				
THEL	R	western terrestrial garter snake				

WILDLIFE SPECIES WITH
POTENTIAL HABITAT IN EAU130

Species	Class	Species_description	Introduced	TES	FEMAT	SNAGS
THMA	M	western pocket gopher				
THOR	R	northwestern garter snake				
THSI	R	common garter snake				
THTA	M	northern pocket gopher				
TRAE	B	house wren				1
TRME	B	greater yellowlegs		NHP2		
TRTR	B	winter wren				
TUMI	B	American robin				
TYAL	B	barn owl				1
TYVE	B	western kingbird				
URAM	M	black bear				
URCI	M	gray fox				
USTS	R	side blotched lizard				
VECE	B	orange-crowed warbler				
VERU	B	Nashville warbler				
VIGI	B	warbling vireo				
VISO	B	solitary vireo				
WIPU	B	Wilson's warbler				
ZAPR	M	western jumping mouse				
ZATR	M	Pacific jumping mouse				
ZEMA	B	mourning dove				
ZOAT	B	golden-crowned sparrow				
	B	white-crowned sparrow				

SUMMARY FOR EAU130

Total number of species: 251
- Number of introduced species: 7
- Number of TES species: 15
- Number of State and NHP listed species: 25
- Number of FEMAT species of concern: 12
- Number of snag dependent species: 52

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

Species to be protected through survey and management standards and guidelines (ROD, 1994).

A number of knowledgable specialists were consulted during research for this document (see page 28). Without exception these individuals stressed that the information currently available on habitat types, distribution range, geographic extent, and ecology of fungi, lichens, and bryophytes (mosses and liverworts), is not at all conclusive. There is a paucity of information available for these groups, due in part to the lack of actual field surveys and expertise. Therefore the data in this report should only be used as a priliminary analysis of base information to be expanded upon prior to actual field verification surveys.

The information in this document should not be used exclusively to determine whether or not a species occurs of the Mt. Hood National Forest.

TABLE OF CONTENTS

I. POINTS OF INTEREST - SUMMARY

1. Appendix J2-172, Rare Gilled Mushrooms, Cortinarius wiebeae, section VII. C. Mitigation Measures.: "Establish Mycological Interest Area to provide protection for the type locality (the only know location) of C. weibeae." Currently this species has documented occurrence only in the White River Watershed, MHNF. (See page 12)

2. Appendix J2-159, section IV. E.: "According to chanterelle experts, our common chanterelle is not Cantharellus cibarius, but could be more related to or the same as C. formosus." C. formosus is in survey strategy 1 and 3; C. cibarius is in survey strategy 3 and 4. (See page 8)

3. Appendix J2-163, 164, Uncommon and Rare Coral Fungi, section IV. E.: "The taxonomy of this group is currently being reviewed by Currie Marr." (Changes in grouping and ranking may or may not be necessary as a result.) (See page 10)

4. Appendix J2-166, 167, Phaeocollybia, section # IV. E.: "The genus is currently under investigation by Lorelei Norvell, [UW]. Therefore, improved knowledge...is forthcoming." (See page 11)

5. Appendix J2-168, Uncommon Gilled Mushrooms, section IV. E.: "The distribution, frequency and ecology of these species requires extensive study." (See page 12)

6. ROD C-58, Additional Lichens: Habitat information could not be found in Appendix J2 or available references (page 28) for the following species; Cladonia norvegica, Heterodermia sitchensis, Hygomnia vittiata.

7. The most prevalant message in Appendix J2 regarding lichens and bryophytes: "Knowledge of distribution and ecology within the region is inadequate."

II. DISCREPANCIES

1. Appendix J2 and ROD C-3: Under Undescribed Taxa, Rare Truffles & False Truffles, sp. nov. #Trappe 7516, and 9608 are listed as Gastrosuillus. According to the PNW Research Station database of fungi, these species numbers are recorded as the genus Gastroboletus.

2. ROD C-3 Fungi, Rare Cup Fungi, page C-54: Aleuria rhenana and Bryoglossum gracile are not ranked under a survey strategy, however, Appendix J2 pages 198, 199 section C. indicates a ranking of 1 and 3 is appropriate. This adjustment was made herein.

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: manage known sites; 2 - survey prior to activities manage sites; 3 - conduct extensive surveys and manage sites; 4 - conduct general regional surveys

Watersheds:

- M - Mile
- WF- West Fork Hood River
- MC- Mill Creek
- WR- White River

Occurrence:

- D - Documented sites on MHNF
- p - Potential habitat present
- n - Not likely to occur
- ? - Unknown, inadequate info.

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	M	MC	WR	WF	HABITAT	KNOWN GEOGR. RANGE or EXTENT
MYCORRHIZAL FUNGI									
BOLETES									
Gastroboletus subalpinus	1	3	D	p	p	D	p	above 4500', ecto-michorrizal w/pines	Endemic Ore. Casc. & N. Sierras
Gastroboletus turbinatus		3	D	p	?	D	p	mid-high elev. w/true firs, PIEN/PISI, TSHE/TSME, w/abundant large woody debris, humus	WA to N. CA, WA/OR Coast Range, Sisk. Mts., Klam. Mts., N. ID, MI, Mexico
BOLETES LOW ELEV.									
Boletus piperatus		3	D	p	p	D	p	low-mid elev forests, requires course woody debris in Douglas-fir	Unknown
Tylopilus pseudoscaber	1	3	?	?	?	?	?	low elev, moist hab., often w/Sitka spruce.	PNW coast endemic
RARE BOLETES									
Boletus haematinus	1	3	p	?	n	p	p	high elev silver fir	Cal. north to Wash
Boletus pulcherrimus	1	3	p	p	p	p	p	low-mid elev conifer	Cal. to Canada, north to Olympics
Gastroboletus imbellus	1 1	3 3	p p	p p	n n	p p	p p	upper mid elev (5000') w/ABAM, ABGR, PSME, TSHE, TSME, possibly ectomycorrhizal w/pine	locally endemic to Willamette NF(WNF) Ollalie Trail & Lamb Butte Scenic
Gastroboletus rubra	1	3	D	p	n	p	p	upper mid-high elev. w/mature TSME and developed humus layer.	endemic to WA N. Casc. south to Willamette Pass OR
FALSE TRUFFLES									
Nivatogastrium nubigenium	1	3		p	p	p	p	mid-high elev. in mature forests w/abundant lg. coarse woody (relies on mammals for	Casc. Mts. of CA, N. to Mt. Adams, & north ID. dispersal)
Rhizopogon abietis		3	p	p	?	p	p	high elev. mixed conifer (true firs, pines, PSME, TSME), in moderate to dry sites.	E. Canada, E. USA N. Rockies, Strawberry Mts. OR, Casc. & Klam. Mts.
R. atroviolaceus		3	p	p	?	p	p		
R. truncatus		3	p	p	?	p	p		

SPECIES	SURVEY STRAT.	MHNF	M	MC	WR	WF	HABITAT	KNOWN GEOGR. RANGE or EXTENT
Thaxterogaster pinque	3	D	p	?	D	p	only mid-high elev. true firs, w/ thick humus, lg. crs. woody	Casc. Mts. S. of Canada border to N Sierras, Sisk. Mts OR, Klam. Mts. CA
UNCOMMON FALSE TRUFFLES								
Macowanites chlorinosmus	1 3	?	n	n	?	?	low elev. PISI, PSME, TSHE w/lg. crs. woody	endemic OR coast & Coast Ranges
RARE FALSE TRUFFLES								
Alpova alexsmithii	1 3	D	p	p	p	p	mid to upper mid elev. w/true firs, TSHE, and possibly pines.	endemic to Casc. Mts. & British Columbia Coast Rng
Alpova olivaceotinctus	1 3	?	?	?	?	?	a single site known in the range of N. Spotted owl w/Shasta fir	Unknown
Arcangeliella crassa	1 3	?	?	?	?	?	mid to high elev. montane forests w/ Abies spp. and /or TSME.	Western OR, N. CA Mts. Shasta/Lassen
A. lactarioides	1 3	?	?	?	?	?		
Destuntzia fusca	1 3	p	p	p	p	?	low to lower-mid elev. in variously mixed true firs, TSHE, PSME, oaks, pines, redwood	Mendocino Cnty. CA & Willamette N.F. (WNF), Linn Cnty.
D. rubra	1 3	p	p	p	p	?		
Gautieria magnicellaris	1 3	p	p	n	p	p	high elev. w/TSME and true firs	WNF, Klamath NF, Mt. Wash. Wildns., NE USA, Germany, Czechoslovakia
Gautieria otthii	1 3	p	p	p	p	p	mid to upper-mid elev. ectomychorrizal w/ Pinaceae	N. CA, Sisk. Mts, OR Centr. Cascades Europe, Alaska
Leucogaster citrinus	1 3	p	p	p	p	p	low to high elev. w/ PSME, TSHE, CACH, manzanita, tanoak, or in stands w/lg. woody	Mendocino Cnty. CA north to Linn & Benton Counties

SPECIES	SURVEY STRAT.		MHNF	M	MC	WR	WF	HABITAT	KNOWN GEOGR. RANGE or EXTENT
Leucogaster microsporus	1	3	D	p	p	p	p	mid elev. w/PSME or in stands w/abundant legacy of crs. woody	Slopes of W. Casc. Mts., N. Casc. & Coast Range OR, to S. Casc. of WA
Macowanites lymanensis	1	3	P					mid elev. old-growth TSME/ABPR forest	Lyman Lake, Wenatchee NF
Macowanites mollis	1	3	D	p	p	p	p	mid elev. mature to old-growth PSME, Pines	Mt. Rainier NP, Larch Mt., MHNF
Martellia fragrans	1	3	p	p	p	p	p	mid-high elev. old-growth TSME/Abies spp.	S. OR, N. CA, & ID
Martellia idahoensis	1	3	p	p	?	p	p	mid-upper mid elev. w/ true firs & Pinacea	Coast Range SNF, Cascade Range, WNF N. ID
Martellia monticola	1	3	p	p	?	p	p	mid-high elev. old-growth TSME/Abies spp.	Central to North Oregon Cascades
Octavianina macrospora	1	3	D	p	p	p	p	mt. foothills in PSME/TSME old-growth forest	former Twin Brdgs. forest Camp
Octavianina papyracea	1	3	?	?	?	?	?	coastal mixed PSME/TSME/PISI forest in a fog belt	Humboldt Co, CA
Rhizopogon brunneiniger	1	3	D	p	p	D	?	low-high elev. dry old growth PSME/TSME/fir/pine forest	N. OR Cascades & coast ranges, & N. CA
Rhizopogon evadens var. subalpinus	1	3	D	?	n	p	?	upper mid elev. TSME/fir/pine forest near timberline	N. CA to WA & ID
Rhizopogon exiguus	1	3	p	p	p	p	p	moist-dry mature to old-growth PSME/TSME low-mid elev. forest	Cascade Mt., WA & coast ranges of Or
Rhizopogon flavofibrillosus	1	3	p	p	p	p	p	mid-upper mid elev. mature to old-growth mixed conifer forest	N. CA, Siskiyou mts, & central Cascades of OR

SPECIES	SURVEY STRAT.	MHNF	M	MC	WR	WP	HABITAT	KNOWN GEOGR. RANGE or EXTENT
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 TSME/Abies spp.	Mt. Shasta to Yuba Pass, CA & CO
UNDESCRIBED TAXA, RARE TRUFFLES & FALSE TRUFFLES								
Alpova sp. nov. Trappe #9730 Trappe #1966	1 3	?	?	?	?	?	mid-high elev. mature to old-growth PSME/PILA/ARsp/PIAT/ABMASH forest	Siskiyou Mts. of southwestern OR
Arcangeliella sp. nov. #Trappe 12382	1 3	?	?	?	?	?		
Arcangeliella sp. nov. #Trappe 12359	1 3	?	n	n	?	?	mature to old-growth PISI/TSME/PSME coastal fog belt forest	Lane, Lincoln, & Tillamook counties OR
Chamonixia pacifica sp. nov. #Trappe 12768	1 3	?	n	n	?	?	upper mid elev. old growth PSME/TSME/PISI/ABAM forest	N. coastal OR & N. Cascades of WA
Elasmomyces sp. nov. #Trappe 1038	1 3	?	n	n	?	?	mature to old-growth PISI/TSME/PSME coastal fog belt forest	Lane, Lincoln, & Tillamook counties OR
Gastroboletus sp. nov. #Trappe 2897	1 3	p	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	?	n	p	p	high elev. old-growth TSME forest	Crater Lake National Park
+Gastrosuillus sp. nov. #Trappe 7516	1 3	p	?	n	p	p	high elev. mature to old-growth true fir & coniferous forest	Klamath NF, OR
+Gastrosuillus sp. nov. #Trappe 9608	1 3	p	?	n	?	n	upper mid elev. mature mixed conifer forest w/ PILA	Lassen NF, CA

SPECIES	SURVEY STRAT.	MHNF	M	MC	WR	WF	HABITAT	KNOWN RANGE or GEOGR. EXTENT
Gymnomyces sp. nov. #Trappe 4703 & #5576	1 3	?	n	n	?	?	upper mid elev. mature ABPR forest	Siuslaw NF, OR Coast range of OR
Gymnomyces sp. nov. #Trappe 5052	1 3	D	?	n	p	p	high elev. mature to old-growth TSME/ABAM forest	Phlox Pt., Mt.Hood NF, OR
Gymnomyces sp. nov. #Trappe 1690 & #1706, 1710	1 3	p	p	p	p	p	upper mid elev. mature to old-growth ABGR/ ABPR/ABAM/TSME forest	W. OR Cascades, Willamette NF (WNF
Gymnomyces sp. nov. #Trappe 7545	1 3	p	?	n	p	p	high elev. mature to old-growth true fir & coniferous forest	Klamath NF, OR
Hydnotrya sp. nov. #Trappe 787, 792	1 3	D	p	p	p	p	upper mid elev. old-growth ABAM/TSME forest	Mt. Jefferson, WNF
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, 649	1 3	D	?	n	p	p	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, WNF
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	?	?	mid-high elev. mature to old-growth PSME/ PILA/ARsp/PIAT/Shasta forest	Siskiyou Mts. of southwestern OR pine)

SPECIES	SURVEY STRAT.	MHNF	M	MC	WR	WF	HABITAT	KNOWN GEOGR. RANGE or EXTENT
Rhizopogon sp. nov. #Trappe 1692, 1698	1 3	p	p	p	p	p	upper mid elev. mature to old-growth ABGR/ ABAM/PSME/TSME forest	Willamette NF, OR
Thaxterogaster sp. nov. #Trappe 4867, 6242 & #7427, 7962, 8520	1 3	?	n	n	?	?	mature to old-growth PISI/TSME/PSME coastal fog belt forest	Lane, Lincoln, & Tillamook counties OR
Tuber sp. nov. #Trappe 2302, 12493	1 3	?	n	n	?	?	same as above	same as above
RARE TRUFFLES								
Balsamia nigra	1 3	p	p	p	p	n	low elev. mature xeric pine/oak forest	Sierra Nevada Mts, CA to YamhillCo,OR
Choiromyces alveolatus	1 3	D	p	n	p	p	mid-high elev. old-growthTSME/Abies spp. forest	Mt. Hood, OR to Yuba Pass, CA
Choiromyces venosus	1 3	p	p	p	p	p	low elev. w/coniferous decidious or mature PSME forest	Springfield, OR & Europe
Elaphomyces anthracinus	1 3	p	p	p	p	?	mature PIPO forest	W. Europe, E.North America, & E. OR Cascades
Elaphomyces subviscidus	1 3	p	p	p	p	?	mid elev. mature to old-growth pine forest	Central to S. OR Cascades
RARE CHANTERELLES								
Cantharellus formosus	1 3	p	p	p	p	p	coniferous & mixed forest	N. CA, OR, & WA
Polyozellus multiplex	1 3	p	p	n	p	p	intermittent steams of montane fir forest	N Sierras, CA & Cascades, OR & WA
CHANTERELLES								
Cantharellus cibarius	3,4	p	p	p	p	p	coniferous & mixed forest	N. CA, OR, & WA
C. subalbidus		p	p	p	p	p		
C. tubaeformis		p	p	p	p	p	late-successional forest	

SPECIES	SURVEY STRAT.	MHNF	M	MC	WR	WF	HABITAT	KNOWN GEOGR. RANGE or EXTENT
CHANTERELLES - GOMPHUS								
Gomphus bonarii	3	p	p	p	p	p	late successional west	throughout region
G. clavatus	3	p	p	p	p	p	conifer forests	especially N. CA
G. floccosus	3	p	p	p	p	p	" (& w/hemlock in east	
G. kauffmanii	3	p	p	p	p	p	" N. America)	
RARE CHANTERELLE								
Cantharellus formosus	1 3	p	p	p	p	p	a variety of mixed & conifer forest	N. CA, OR, & WA
Polyozellus multiplex	1 3	p	p	p	p	p	in montane areas along intmnt. streams/seeps w/true fir and spruce	N. Sierras, OR, & WA Cascades
UNCOMMON & RARE CORAL FUNGI (App. J2, pp 163, 164)								N. CA, OR, WA
(Ramaria spp.)	**(1 3) & (3)**	**p**	**p**	**p**	**p**	**p**	**w/TSHE, Abies, Picea, Pinus, Pseudotsuga, & Taxus**	**Overall distribution of individual spp., unknown.**
PHAEOCOLLYBIA (App. J2, p. 166)							**low elev. to montane, w/conifers, moist hab.**	**Distribution and frequency current-**
(Phaeocollybia spp)	**(1 3)**	**p**	**p**	**p**	**p**	**p**	**(prefers low elev.)**	**ly under study.**
UNCOMMON GILLED MUSHROOMS (App. J2, p. 168) (Catathelasma sp., Cortinarius spp., Dermocybe sp., Hebeloma sp., Hygrophorus spp., Russula sp.)	**(1 3) & (3)**	**p**	**p**	**p**	**p**	**p**	**ectomycorrhizal in low low elev. to montane, w/conifers**	**Distribution and range of individual species is unknown. Some may be PNW endemics.**
RARE GILLED MUSHROOMS								
Chroogomphus loculatus	**1 3**	**p**	**p**	**?**	**p**	**p**	**upper mid-elev (5000') w/ABAM, ABGR, PSME, TSHE, TSME.**	**local endemic, type locality Ollalie Trail, WNF**
Cortinarius canabarba	**1 3**	**p**	**p**	**p**	**p**	**p**	**The range of elev. and host species are unknown.**	**Overall ecology and distribution**
C. rainierensis	**1 3**	**p**	**p**	**p**	**p**	**p**	**known. All require**	**are not well known**
C. variipes	**1 3**	**p**	**p**	**p**	**p**	**p**	**diverse coniferous**	**for these species.**
Tricholoma venenatum	**1 3**						**forests w/heavy hummus layer and crs. woody.**	

SPECIES	SURVEY STRAT.	MHNF	M	MC	WR	WF	HABITAT	KNOWN GEOGR. RANGE or EXTENT
Cortinarius verrucisporus	1 3	p	p	n	p	p	high elev. montane, w/ conifers & true firs, hypogeous (fruits underground)	CA and OR
Cortinarius wiebeae	1 3	D	?	n	D	p	(same as above)	Local endemic/MHNF only known site
UNCOMMON ECTO-POLYPORES								
Albatrellus ellsii	3	?	?	?	?	?	coastal old-growth & mixed hardwood forest	WA, OR, N. CA, Rocky Mts., NE. US & Europe
A. flettii		?	?	?	?	?		
RARE ECTO-POLYPORES								
Albatrellus avellaneus	1 3	?	?	?	?	?	coastal old-growth & mixed hardwood forest	WA, OR, N. CA, Rocky Mts., NE. US & Europe
A. caeruleoporus		?	?	?	?	?		
TOOTH FUNGI								
Hydnum repandum	3	p	p	p	p	p	late-successional & second growth conifer & hardwood forest	Widespread in N. America & Europe
H. umbilicatum		p	p	p	p	p		
Phellodon atratum		p	p	p	p	p		
Sarcodon fuscoindicum		p	p	p	p	p		
S. imbricatus		p	p	p	p	p		
RARE ZYGOMYCETES								
Endogone acrogena	1 3	p	?	p	p	p	low elev. mesic old-growth PSME/TSME forest	W. Cascades from Mt. Rainier to Whitechuck Rv.
Endogone oregonensis	1 3	?	n	n	?	?	low elev. old-growth PSME/PISI/TSME coastal forest	Suislaw NF, OR
Glomus radiatum	1 3	p	?	?	p	p	mature to old-growth Coastal Redwood/Alaska cedar mesic wet forest	OR & WA Cascades, N. CA, & NE. U.S.
SAPROBES (DECOMPOSERS)								
UNCOMMON GILLED MUSHROOMS (App. J2 p. 179)								
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	N. CA, OR, & WA

SPECIES	SURVEY STRAT.	MHNF	M	MC	WR	WF	HABITAT	KNOWN GEOGR. RANGE or EXTENT
RARE GILLED MUSHROOMS								
Clitocybe subditopoda	1 3	p	p	p	p	p	low-mid elev. moist late successional forest, large logs in later stages of decay	WA, OR, & CA
C. senilis		p	p	p	p	p		
Neolentinus adherens	1 3	p	p	p	p	p	low-mid elev. moist late successional forest, large logs in later stages of decay	Olympic Natl. Park
Rhodocybe nitida	1 3	p	p	p	p	p	low-mid elev. moist late successional forest, large logs in later stages of decay	WA, OR, & CA
Rhodocybe speciosa	1 3	p	p	p	p	p	low-mid elev. moist late successional forest, large logs in later stages of decay	Mt. Rainier Natl. Park to BarlowPass
Tricholomopsis fulvescens	1 3	D	p	p	p	p	low-mid elev. moist late successional forest, large logs in later stages of decay	Mt. Hood area, Mt. Rainier Natl. Park Mt. Baker-Snoq. NF
NOBLE POLYPORE(rare and endangered)								
Oxyporus nobilissimus	1 2 3	D	p	p	p	p	late-successional forest on Abies spp. esp. A. procera	OR & WA Cascades
BONDARZEWIA POLYPORE								
Bondarzewia montana	1 2 3	p	?	n	p	p	late-successional high elev. forest on ass'd w/Abies	Pacific Northwest, W. NV, & ID
RARE RESUPINATES AND POLYPORES								
Aleurodiscus farlowii	1 3	p	p	p	p	p	on wood, humus, litter stumps, & dead roots	WA, OR, & N. CA
Dichostereum granulosum	1 3	p	p	p	p	p	(same as above)	(same as above)

SPECIES	SURVEY STRAT.	MHNF	M	MC	WR	WF	HABITAT	KNOWN GEOGR. RANGE or EXTENT
Cudonia monticola	3	p	p	p	p	p	duff layer of mature conifer forest	WA, OR, & N. 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		p	p	p	p	p		
G. infula		p	p	p	p	p		
G. melaleucoides		p	p	p	p	p		
G. montana(syn. G. gigas)		p	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		p	p	p	p	p		
O. smithii		p	p	p	p	p		
Plectania melastoma	3	p	p	p	p	p	late-successional to old-growth conifer forest duff	NE. & NW. North 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	p	p	p	p	p	conifers & Fagaceae sp on chalky soils	Pacific Northwest, CA, Rockies, NE. U.S. & Europe
Spathularia flavida	3	p	p	p	p	p	duff layer of mature conifer forest	OR, WA, & N. CA
RARE CUP FUNGI								
+Aleuria rhenana	1 3	p	p	p	p	p	late succesional conifer forest liter	San Francisco to Mt. Rainier
+Bryoglossum gracile	-	p	p	p	p	p	mossy, wet, alpine/ subalpine montane conifer forest	artic & alpine N. America & Europe

SPECIES	SURVEY STRAT.	MHNF	M	MC	WR	WF	HABITAT	KNOWN RANGE or GEOGR. EXTENT
Gelatinodiscus flavidus	1 3	p	?	n	p	p	needles, cones, & twig of high elev. Alaska Yellow cedar	BC, Olympic Penn., OR & WA Cascades, & Central OR
Helvella compressa	1 3	p	p	p	p	p	low-mid elev. riparian & wet late succession forest	temperate forested areas of N. America
H. crassitunicata		p	p	p	p	p		
H. elastica		p	p	p	p	p		
H. maculata		p	p	p	p	p		
Neournula pouchetii	1 3	p	p	p	p	p	late-successional Thuja and Tsuga forest	N. OR & WA
Pithya vulgaris	1 3	p	?	n	p	p	high elev. Abies forest	BC, WA, ID, & OR
Plectania latahensis	1 3	p	?	n	p	p	upper montane, sub-alpine conifer forest	OR, WA, ID, & BC
Plectania milleri	1 3	p	?	n	p	p	montane, subalpine conifer forest	OR, WA, ID, & BC
Pseudaleuria quinaultiana	1 3	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	3,4	p	p	p	p	p	cool/cold moist late-successional hardwood or conifer forest, increases in frequency w/increasing lat. & elev., need well-developed litter layer	Pacific Northwest BC, AK, Midwest, & eastern N. America
		p	p	p	p	p		
C. pistilaris	3,4	p	p	p	p	p		
C. truncatus	3,4	p	p	p	p	p		
C. borealis	3,4	p	p	p	p	p		
C. lovejoyae	3,4	p	p	p	p	p		
C. sachalinensis	3,4	p	p	p	p	p		
C. subfastigiatus	3,4	p	p	p	p	p		
JELLY MUSHROOM								
Phlogoitis helvelloides	3,4	p	p	p	p	p	riparian zones, upper headwater seeps, & intermittent streams w/large woody debris	Pacific Northwest, northwest, midwest & Rockies

SPECIES	SURVEY STRAT.	MHNF	M	MC	WR	WF	HABITAT	KNOWN GEOGR. RANGE or EXTENT
BRANCHED CORAL FUNGI								
Clavulina cinerea	3,4	p	p	p	p	p	late-successional forest w/well-developed liter layer	Pacific Northwest & elsewhere
C. cristata		p	p	p	p	p		
C. ornatipes		p	p	p	p	p		
MUSHROOM LICHEN								
Phytoconis ericetorum	3,4	p	p	p	p	p	large woody debris in well lit forest w/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 p. 212.	3	p	p	p	p	p	late-successional moist forest on a host fungus	Pacific Northwest, distribution and ecology unknown.
CAULIFLOWER MUSHROOM								
Sparassis crispa	3	p	p	p	p	p	low-mid elev. old-growth conifer forest on large roots, esp. PSME	Pacific Northwest & N. 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 & dependent upon mosses	Pacific Northwest, Olympic Peninsula
CORAL FUNGI								
Clavicorona avellanea	3	p	?	p	p	p	low-mid elev. moist late-successional forest on large roots	Pacific Northwest

V. C-3 LICHENS

SPECIES	SURVEY STRAT.	MHNF	M	MC	WR	WF	HABITAT	KNOWN GEOGR. RANGE or EXTENT
RARE FORAGE LICHENS								
Bryoria tortuosa	1 3	p	p	p	p	?	low-mid elev, coastally on conifers, inland in pine/oak wet regimes	Central Cal. to Brit. Col., Cascades
RARE LEAFY LICHENS								
Hypogymnia duplicata	1 2 3	?	n	n	?	?	low elev wet, foggy, windy coast & maritime sites on conifers	Ore. to Alaska
Tholurna dissimilis	1 3	p	?	n	p	p	subalpine fog zone on stunted TSME, canopy of old-growth PSME	Montane areas of Ore. & Wash.
RARE NITROGEN FIXING LICHENS								
Dendriscocaulon intricatulum	1 3	p	?	?	p	p	low-mid elev wet, boreal, riparian, late successional forest	Southern Wash. to southeast Alaska
Lobaria hallii	1 3	p	?	?	p	p	low-mid elev wet, foggy forest on large diam. hardwoods & on shrubs	Central coastal Cal. to N. Alaska
Lobaria linita	1 3	p	?	?	p	p	old-growth PSME & moist fir forest	N. Ore. to south-east Alaska, Idaho
Nephroma occultum	1 3	p	?	?	p	p	pristine old-growth approx. 400 yrs old	Willamette NF to Brit. Col.
Pannaria rubiginosa	1 3	p	p	p	p	p	bases of trees in mature forest	Salem, Ore. & Mt. Rainier, Wash.
Pseudocyphellaria rainierensis	1 3	*D	p	p	p	p	old-growth forest on trunks of PSME	Cascades of Wash. and Ore.

SPECIES	SURVEY STRAT.	MHNF	M	MC	WR	WF	HABITAT	KNOWN GEOGR. RANGE or EXTENT
NITROGEN FIXING LICHENS								
Lobaria oregana	4	*D	p	p	p	p	open 200 yr old-growth & coastal forests on conifers	Pacific Northwest Cascades
Lobaria pulmonaria	4	*D	?	?	p	p	moist, hardwood, old-growth forest & swamps	Pacific Northwest Cascades
Lobaria scrobiculata	4	*D	p	p	p	p	old-growth forest from 140-200 yrs old	Pacific Northwest Cascades
Nephroma bellum	4	p	p	p	p	p	open old-growth & along roadsides	Pacific Northwest Cascades
Nephroma helveticum	4	*D	p	p	p	p	N. coastal, montane forests & foothill woodlands & valleys	Pacific Northwest Cascades
Nephroma laevigatum	4	p	p	p	p	p	low elev. coastal & old-growth forests	Pacific Northwest Cascades
Nephroma parile	4	*D	p	p	p	p	moist coniferous & decidious old-growth forests	Pacific Northwest Cascades
Nephroma resupinatum	4	*D	p	p	p	p	low-mid elev. coastal & montane coniferous shady forests	Pacific Northwest Cascades
Pannaria leucostictoides	4	*D	p	p	p	p	low-elev. open coastal & old-growth forest	Pacific Northwest Cascades
Pannaria mediterranea	4	p	p	p	p	p	old-growth forest from 140-200 yrs old	Pacific Northwest Cascades
Pannaria saubinetii	4	p	p	p	p	p	old-growth forest from 140-200 yrs old	Pacific Northwest Cascades
Peltigera collina	4	*D	p	p	p	p	low-mid elev. coastal, montane, & old-growth forests	Pacific Northwest Cascades

SPECIES	SURVEY STRAT.	MHNF	M	MC	WR	WF	HABITAT	KNOWN GEOGR. RANGE or EXTENT
Peltigera neckeri	4	*D	p	p	p	p	old-growth forest from 140-200 yrs old	Pacific Northwest Cascades
Peltigera pacifica	4	*D	p	p	p	p	old-growth forest from 140-200 yrs old	Pacific Northwest Cascades
Pseudocyphellaria anomala	4	*D	p	p	p	p	low-mid elev. coastal, montane, & old-growth forests	Pacific Northwest Cascades
Pseudocyphellaria anthrapsis	4	*D	p	p	p	p	low-mid elev. open, coniferous old-growth forest	Pacific Northwest Cascades
Pseudocyphellaria crocata	4	*D	p	p	p	p	old-growth forest from 140-200 yrs old	Pacific Northwest Cascades
Sticta beauvoisii	4	*D	p	p	p	p	old-growth forest from 140-200 yrs old.	Pacific Northwest Cascades
Sticta fuliginosa	4	*D	p	p	p	p	low elev. coastal & moist coniferous old-growth forests	Pacific Northwest Cascades
Sticta limbata	4	*D	p	p	p	p	low-mid elev. coastal & old-growth forests	Pacific Northwest Cascades

PIN LICHENS (See App. J2, pp 234, 235)
Species grouped collectively; all have potential to occur in MHNF watersheds. Three species listed below, from the Pin Lichen group, have special information.

SPECIES	SURVEY STRAT.	MHNF	M	MC	WR	WF	HABITAT	KNOWN GEOGR. RANGE or EXTENT
Calicium adaequatum	4	*D	p	p	p	p	sheltered microsites w/high atmospheric	Pacific Northwest & N. Europe
C. viride	4	*D	p	p	p	p	humidity provided by old-growth forest	
Stenocybe clavata	4	p	p	p	p	p	conditions, substrate and texture specific	Endemic to the Pacific Northwest
RARE ROCK LICHENS								
Pilophorus nigricaulis	1 3	p	p	p	p	p	talus rock patches w/in old-growth forest w/ low fire frequency	Coastal Ore., Wash. & Brit. Col.

SPECIES	SURVEY STRAT.	MHNF	M	MC	WR	WF	HABITAT	KNOWN GEOGR. RANGE or EXTENT
Sticta arctica	1 3	?	?	?	?	?	rock outcrops in foggy wet coastal forest	Coast range of Ore
RIPARIAN LICHENS								
Cetrelia cetrarioides	4	*D	?	n	p	p	low-mid elev. foggy, riparian forest on older hardwood trees	Coastal Ore. to Alaska
Collema nigrescens	4	p	?	?	p	n	low-mid elev. foggy riparian forest mostly on QUGA	Pacific Northwest to Alaska (to Equador)
Leptogium burnetiae var. hirsutum	4	*D	?	?	p	p	low-mid elev. foggy riparian forest on older hardwood trees	Pacific Northwest & N. Europe
Leptogium cyanescens	4	*D	?	?	p	p	low-mid elev. foggy riparian forest on older hardwood trees	Equador to Alaska including Ore.
Leptogium saturninum	4	*D	?	?	p	p	low-mid elev. boreal riparian forest on older hardwood trees	Pacific Northwest (mostly Canada)
Leptogium teretiusculum	4	p	?	?	p	p	low-mid elev. foggy riparian forest on older hardwood trees	Pacific Northwest & Montana
Platismatia lacunosa	4	p	p	p	p	p	low-mid elev. moist forest on decidious & hardwood trees	Central Ore. to southcentral Alaska
Ramalina thrausta	4	p	p	p	p	p	low-mid elev. boreal forest on hardwood & coniferous trees	Ore., Wash., Idaho Mont., Cal., & Brit. Col.
Usnea longissima	4	*D	?	?	p	p	low-mid elev. wet coniferous/hardwood forests and swamps	Northwest Cal. to Alaska
AQUATIC LICHENS								
Dermatocarpon luridum	1 3	p	p	p	p	p	low-mid elev. streams	Ore., Brit. Col., Colo., & Virginia

SPECIES	SURVEY STRAT.		MHNF	M	MC	WR	WF	HABITAT	KNOWN GEOGR. RANGE or EXTENT
Hydrothyria venosa	1	3	*D	p	p	p	p	mid-high elev. clear, cold streams in pristine old-growth	Central Cal. to central Brit. Col.
Leptogium rivale	1	3	p	p	p	p	p	low-mid elev. streams	Oregon & Montana
RARE OCEANIC INFLUENCED LICHENS									
Bryoria pseudocapillaris	1	3	n					PISI forests, open sand dunes on coast	Oregon coast
Bryoria spiralifera	1	3	n					pantropical areas, on peninsulas & headlands	Northern Cal.
Bryoria subcana	1	3	n					coastal bays & streams	Ore., Cal., Alaska
Buellia oidalea	1	3	?	?	?	n	n	low-elev. dry coastal oak forest	Mexico to Brit. Col.
Erioderma sorediatum	1	3	n					stabilized dunes in old PISI & PICO forest	Oregon coast
Hypogymnia oceanica	1	3	*D	n	n	n	p	coast & maritime microclimates in old-growth forest	Inland & coastal Oregon
Leioderma sorediatum	1	3	n					stabilized dunes in old PISI & PICO forest	Oregon coast
Leptogium brebissonii	1	3	n					stabilized dunes in old PISI & PICO forest	Oregon coast
Niebla cephalota	1	3	n					promontories of land along windspept coasts	Coastal S. Cal. to maritime N. Wash.
Pseudocyphellaria mougeotiana	1	3	n					coastal old-growth PISI forest	Oregon coast
Teloschistes flavicans	1	3	p	p	p	p	?	dry uplands & praries, on coastal shrubs	Equador to Oregon coasts
Usnea hesperina	1	3	n					broken dune PICO forest	Oregon Coast

SPECIES	SURVEY STRAT.		MHNF	M	MC	WR	WF	HABITAT	KNOWN GEOGR. RANGE or EXTENT
OCEANIC INFLUENCED LICHENS									
Cetraria californica	1	3	n					scrubby dune areas on old growth PICO	S. Cal. to South east Alaska coasts
Heterodermia leucomelos	1	3	n					on large PISI in forested headlands	S. Cal. to N. Wash coasts
Loxospora sp nov "corallifera"	1	3	n					old-growth conifers on immediate coast	Pacific Northwest coasts
Pyrrhospora quernea	1	3	n					old-growth conifers on immediate coast	S. Cal. to N. Wash coasts
ADDITIONAL LICHENS (Added after Appendix J2)									
Cladonia norvegica		**3**	**?**					**unknown (not listed in Appendix J2)**	**unknown**
Heterodermia sitchensis		**3**	**?**					**unknown (not listed in Appendix J2)**	**unknown**
Hygomnia vittiata		**3**	**?**					**unknown (not listed in Appendix J2)**	**unknown**
Hypotrachyna revoluta		**3**	**p**	**p**	**n**	**p**	**p**	**high elev. open forest**	**N. Cal., W. Ore. & W. Wash.**
Ramalina pollinaria		**3**	**?**	**n**	**n**	**n**	**n**	**low elev. N. coastal forest with sandstone outcroppings**	**W. Ore. & W. Wash**
Nephroma isidiosum		**3**	**?**					**unknown (not listed in Appendix J2)**	**unknown**

VI. BRYOPHYTES

SPECIES	SURVEY STRAT.	MHNF	M	MC	WR	WF	HABITAT	KNOWN GEOGR. RANGE or EXTENT
Antitrichia curtipendula	4	*D	p	p	p	p	low-mid elev. old-growth forest canopies	N. Cal. to N. Ore. west of Cascades
Bartramiopsis lescurii X	1 3	p	p	p	p	p	old-growth forest	Pacific Northwest, esp. Wash.
Brotherella roellii X	1 3	p	p	p	p	p	low-mid elev. old-growth forest on rotting logs	Wash. Cascades
Diplophyllum albicans X	1 3	?	n	n	n	n	coastal old-growth TSME/PISI forest	unknown
Diplophyllum plicatum	1,2,	?	n	n	n	n	coastal PISI forest	W. Ore. & W. Wash.
Douinia ovata	4	p	?	?	p	p	low-mid elev. foggy old-growth forest w/ ridges & rock outcrops	Pacific Northwest Cascades and coast
Encalypta X brevicolla var. crumiana	1 3	p	p	p	p	p	foggy rock outcropping shaded by old-growth forest	Mountains of Ore. & Wash.
Herbertus X aduncus	1 3	p	?	n	p	p	high elev. old-growth forest	N. coast & Cascade of Ore. & W. Wash.
Herbertus X sakurali	1 3	?	n	n	?	?	foggy rock faces in old-growth forest	N. coast range of Ore.
Iwatsukella X leucotricha	1 3	?	n	n	?	?	bark in old-growth forest	N. coast range of Ore.
Kurzia makinoana	1,2	p	p	p	p	p	low-elev. old-growth forest	Ore. & Wash. old growth
Marsupella emarginata var aquatica	1,2	p	p	p	p	p	mid-high elev. stream splash zones	Oregon Cascades
Orthodontlum gracile X	1 3	?	n	n	n	n	old-growth redwood forest	N. Cal. & south-western Ore.

(X = Added after Appendix J2)

SPECIES	SURVEY STRAT.	MHNF	M	MC	WR	WF	HABITAT	KNOWN GEOGR. RANGE or EXTENT
Plagiochila X satol	1 3	p	p	p	p	p	old-growth forest on cliffs, rocks, & bark	Pacific Northwest
Plagiochila X semidecurrens var. crumniana	1 3	?	n	n	n	?	foggy cliffs & shaded rocks	Oregon coast range
Pleuroziopsis X ruthenica	1 3	p	p	p	p	p	low-elev. shrub thickets, old-growth swamps, stream edges	Wash.
Ptilidium californicum	1,2	p	p	p	p	p	conifers in old-growth forest	N. Cal. to Wash.
Racomitrium X aquaticum	1 3	p	p	p	p	p	shaded moist rocks & streambanks of old-growth forest	unknown
Radula brunnea X	1 3	?	n	n	n	?	foggy rock walls in old-growth forest	N. coast range of Ore.
Scouleria marginata	4	p	p	p	p	p	splash zone of streams	Pacific Northwest endemic
Tetraphis X geniculata	1 3	p	p	p	p	p	low-mid elev. old-growth forest on shaded, moist wood	N. Cal. to W. Wash
Tritomaria exsectiformis	1,2	p	p	p	p	p	old-growth forest on moist shaded rocks	Ore. & Wash. old-growth
Tritomaria X quinquedentata	1 3	p	p	p	p	p	old-growth forest on moist shaded rocks	Ore. & Wash. old-growth

(X = Added after Appendix J2)

VII. VASCULAR PLANTS

SPECIES	SURVEY STRAT.	MHNF	M	MC	WR	WF	HABITAT	KNOWN GEOGR. RANGE or EXTENT
VASCULAR PLANTS								
Allotropa virgata	1,2	D	p	p	p	D	1500'-5000' elev. under closed canopy ABAM, ABGR, PICO, PSME requires association w/fungus & vasc. plnts (saprophytic)	east slopes Casc. range to coast, BC to CA, disjunct in ID & MO.
Arceuthobium tsugense	1,2	p	?	n	p	p	parasitic primarily on TSHE older than 600 years, & on shore pine	rare from AK south to CA, & S. OR
Aster vialis	1,2	?	n	n	n	n	low elev. w/mid-successional conifers, thriving in edge habs. or in canopy openings	endemic to OR, Lane, Linn, & Douglas Counties (Willamette Valley
Bensoniella oregana	1,2	?	n	n	n	n	3000'-5000' elev. w/ mixed evergreen & white fir, meadow/strm	Coast Range OR, CA Douglas, Josephine Curry, Roseburg Counties, (Sisk.NF
Botrychium minganense	1,2	D	p	p	D	p	variable elev. w/THPL and/or ACCI, ACMA variable habitats	Endemic to North America, difficult taxonomically
Botrychium montanum	1,2	D	p	p	p	p	between 3200' & 4100' (MHNF) in deep shade old-growth THPL, seeps	Enemic to western North America
Clintonia andrewsiana	1,2	n	n	n	n	n	coastal redwood forest	California coast
Coptis asplenifolia	1,2	p	?	?	?	?	from 360'-3600' w/ABAM TSHE, THPL, in cool, wet, shady habitats	OR Coast Rng., WA Cascades, Olympic Peninsula
Coptis trifolia	1,2	D	p	?	D	p	perimeters of small wetlands/swamps w/PSME	Disjunct in OR (MHNF), East. OR (Geographic Extent
Corydalis aquae-gelidae	1,2	D	n	n	?	n	1220'-4260' on gravel bars in cold perrenial streams w/high canopy	Gifford Pinchot NF Mt. Hood NF, Salem BLM

SPECIES	SURVEY STRAT.	MHNF	M	MC	WR	WF	HABITAT	KNOWN GEOGR. RANGE or EXTENT
Cypripedium fasciculatum	1,2	?	?	?	?	?	1300'-5300' in 60-100% shade by numerous plnt communities	Western US
Cypripedium montanum	1,2	D	p	p	p	?	broad range of habs., presence of specific symbiotic fungi	All Cascade Provinces, (Hood River, Wasco Cnty)
Galium kamtschaticum	1,2	p	?	?	p	p	seeps w/conifers and west Cascades riparian associated species	Circumboreal Olympic & West. WA Casc. Provinces
Habenaria orbiculata	1,2	p	?	?	?	?	mesic-dry mossy forest w/deep litter in TSHE and lower ABAM zones	uncommon, wide-spread, W. WA Casc Provinces (Geographic extent
Pedicularis howellii	1,2	n/?	n	n	n	n	4200'-6300' in mixed conifer/shrub, edge of openings or damp shade	Endemic to the Siskiyou Mts.
Scoliopus biglovei	1,2	n/?	n	n	n	n	low elevation Redwood forest	Endemic to CA, Sisk. NF, Six Rivers NF
AMPHIBIANS								
Del Norte salamander	2	n	n	n	n	n	rocky, older-forested stands	SW Oregon and NW California
Larch Mountain salamander	2	y	n	n	n	p	steep talus slopes kept moist by a covering of mosses and dense overstory of coniferous trees, up to 3,400 ft. elev.	Columbia River Gorge, near Mt. Saint Helens and Mt. Rainier
Shasta salamander	1,2	n	n	n	n	n	rocky habitats	Mt. Shasta area
Siskiyou Mountains salamander	1,2	n	n	n	n	n	rocky habitats	Jackson and northern Siskiyou Counties

SPECIES	SURVEY STRAT.	MHNF	M	MC	WR	WF	HABITAT	KNOWN RANGE or	GEOGR. EXTANT
Van Dyke's salamander (Cascades) Willapa	2	n	n	n	n	n	seepages, streams, splash zone or creeks or waterfalls, under rocks, logs, bark, far from or next to water	Washington: the Olympic Mountains, S Cascades, Hills, including Long Island	
MAMMALS									
Red tree vole	2	d	p	p	p	p	Douglas fir forests, or redwood and Sitka spruce forests	coastal OR, NW Oregon and California	

ARTHROPODS

The Forest has noticed a discrepancy in information regarding species/groups or species identified as being of concern within FEMAT and the ROD. We have submitted to the Regional Ecosystem Office the following message/question:

"Table C-3 of the ROD describes those species that are to be protected through the "survey and manage" standards and guidelines, as identified on pages C-4 to C-6. In that Table, under Arthropods, are listed "Understory and forest gap herbivores". In an effort to determine specifically what species fall in this category, I have perused Appendix J2, FEMAT, and the FSEIS. In those three documents, the group "Understory and forest gap herbivores" has been broken out into a southern range and northern range (this has been done for all other groups of arthropods also). In Appendix J2, FEMAT, and the FSEIS, only the southern range (which includes the California Coast Range PRovince, the Oregon and California Klamath Provinces, and the California Cascades Province only) has been denoted as having species requiring additional analysis and protection. Is the ROD printing of Table C-3 in error (should it have contained only the southern range group?) or has new analysis determined that the north range is of concern also, and should fall under the "survey and manage" standards and guidelines? If so, where can I obtain information regarding the species in the northern range group?"

When we get a response to this question we should be able to respond to the request you have outlined.

MOLLUSKS

The extent of knowledge about the mollusk and arthropod species in Table C-3 is minimal at best. Identifying which species listed in Table C-3 actually occur on the Mt. Hood National Forest is dependent upon sketchy survey/inventory data. This data should not be used exclusively in determining whether the species occurs here or not. Items such as historic range, habitat types, etc., should be used in conjunction with information on survey results. The following table is divided into three categories of likelihood of species occurrence on the Forest: 1) known to occur on MTH NF or Oregon side of the CRGNSA; 2) occurs within the CRGNSA, but unknown whether on Oregon side; and 3) occurs either within CRGNSA on WA side, or historic habitat may have been present on our Forest; ie., there is a likelihood surveys would help determine presence on our Forest or not.

The species in the third group listed below are high candidates for surveys. 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 where the species range is.

Of the 10 species listed in the table below, only one, Hemphillia malonei, is known to occur on our Forest, outside of the CRGNSA. This species known occurrence is on the northwest part of our Forest, on the Columbia Gorge Ranger District. As is shown in the above information, distribution and occurrence information is not well known. Seven of the 10 species listed above are currently considered associated with the Columbia River Gorge. Some of the 10 species listed above might be candidates for occurrence in the above mentioned watersheds. Only through survey work will one know with any assurance where the current range lines is for these species.

1) Known to occur on MTH/CRGNSA Oregon side

SPECIES	SURVEY STRAT.	HABITAT	KNOWN RANGE
Hemphillia malonei	1,2	Moist forest, not necessarily in riparian areas	Western end of the Columbia River Gorge
Juga (Oreobasis)n.sp.2	1,2	Springs in small drainages at low elevation	Central and eastern Columbia Gorge, OR side only
Lyogyrus n. sp. 1	1,2	Springs and spring outflows, from low to high elevations in cold, pure, well oxygenated water	Central and eastern Columbia Gorge

2) Known to occur within the CRGNSA, but not known if on Oregon side

SPECIES	SURVEY STRAT.	HABITAT	KNOWN RANGE
Monadenia fidelis minor	1,2	Springs, seeps, talus slopes	Columbia Gorge; a significant portion of the range falls outside the range of the STOC.

3) Not known on MTH NF, but surveys may help confirm

SPECIES	SURVEY STRAT.	HABITAT	KNOWN RANGE
Cryptomastix devia	1,2	Permanent streams, springs and seeps, moist shaded ravines.	Southern Vancouver Island to the Columbia Gorge; the Puget Trough to Carson WA. (No OR reference).
Cryptomastix hendersoni	1,2	Talus, springs and seeps	Columbia Gorge (speaks about GIP, but not MTH).
Deroceras hesperium	1,2	riparian areas, and intact upland old forest	western Cascades from BC to lower Columbia River.
Hemphillia pantherina	1,2	Deep forest litter in riparian zone	Only one known location; Miller Creek Crossing, GIP
Prophysaon coerulem	1,2	moist coniferous forest, low to middle elevations	Originally from south Puget Sound down to Willamette Valley; no current known locations.
Prophysaon dubium	1,2	Partial riparian associate;also found in rockslide areas	Clackamas and Hood River Counties, OR; Pierce Co,WA; Trinity Co, CA. (no known locations on our Forest)

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USDA Forest Service. Sensitive Plants of Mt. Hood National Forest. May 1994

Personal Communication Sources:

Forestry Sciences Laboratory (PNW): 6-7-94, Michael Castellano, mycologist. (Data base list of J2 and C3 fungi species in Oregon and Washington). ph. 503-750-7329 (fax).

Oregon Natural Heritage Program: 6-8-94, John A. Christy, bryophytes. (C3 bryophytes habitat and potential for occurrence on the MHNF). ph. 503-228-3153 (fax).

Oregon Natural Heritage Program: 6-8-94, David H. Wagner, liverworts. (Synopsis of liverworts on the Oregon Natural Heritage Program list).

Oregon Natural Heritage Program: 6-6-94, Sue Vrilakas, data base contact. (C3 species on the Oregon Natural Heritage Data Base List of Rare, Threatened, and Endangered [species] of Oregon). ph. 503-228-3153 (fax).

USDA Forest Service, Mt. Hood National Forest, Gresham OR, 5-14-94, Rob Huff, Wildlife Biologist, TES. (List of mollusks and arthropods). ph. 503-666-0606.

USDA Forest Service, Mt. Hood National Forest, Parkdale OR, 6-25-94, Susan Nugent, Botanist. ph. 503-352-6002.

USDA Forest Service, Mt. Hood National Forest Herbarium, Gresham OR, 6-14-94, Mark Boyll, Ecologist. (List of lichen specimens in the MHNF Herbarium). ph. 503-666-0700

USDA Forest Service, Siuslaw National Forest, Corvallis OR, 6-15-94, Linda Geiser, lichen specialist. (R/E coastal species, habitat potential) ph. 503-750-7000

USDA Forest Service, Mt. Hood National Forest, Zig-Zag/Columbia Gorge Ranger Districts, 6-15-94, Molly Sullivan, District Botanist. (Species inventory list of fungi in Old Maid Flats, 109 species). ph. 503-622-5622

P.Duncan
7/11/94

Eastside Watershed Analysis
Summary on Public Involvement
on
Mile Creeks

1. Completed a WSA Public Involvement Plan (seemed to be in Draft form at all times, with each different WS we used different tools to get our Public Involved.

2. Set Goals, targeted who we wanted to reach (who our audience was), listed different types of tools and usage of them.

3. Short timeframe, contacted landowners via a letter and news releases, set up a Ice Cream Social to meet with them (the landowners and other interested publics) to discuss and share information on what the WSA team was doing and why, collect information from them on prior history of the area. Gave them some options on becoming involved:

   a) Ice Cream Social - a open, fun workshop where the public can come in and share what they know about the watershed. We had a series of booths; fish, water, cattle, mushrooms, etc., that folks could stop at and help work on things that interested them.

   b) Field trips - Go out with members of the Watershed Analysis team and District specialist and have them help with on the ground data gathering.

   c) Newletters - For those who want to be informed, keeping them in the loop.

   d) Personal visits - For those that like one-on-one interaction.

   e) Others may be included....we are going to try and stay away from the big group meetings.

4. Response forms returned from Landowners on how they want to become involved or be kept informed, still receiving them as of 6/27/94. Most want to be kept informed either thru newletters, and to be told of any meetings going to be held.

5. Various other agencies became involved with different WAT members, discussing how, what and why they become involved with private landowners, what their programs are, how we can utilize their data and information into the WSA, either they can attend one of our WAT meetings or we can send one of our members to one of their meetings.

6. Include Environmental Education, where I have discussed with a large group of Teachers on how to work Environmental Education into their daily work plans, also discussed Watershed Analysis and how they can play a role in

becoming involved and participate with us. Various monitoring and data gathering are types of information that we can utilize in our Watershed Analysis. I then went to one of the schools in the area to share an Environmental Education program. The teacher has been very involved with Environmental Education and was first runner up for National Environmental Education Teacher of the year "93". The class became quite excited as we talked about Watershed Analysis and how they could become involved. We were able to work them into our tight schedule for a field day with the Barlow R.D. fisheries folks and have made a partnership with the school to have them become more involved in the future with monitoring and collecting data.

7. The supervisors office was instrumental in getting a special SPROUTS publication out to our mailing lists and for all our Basins. This was to inform the public on what a WSA is, why we are doing them, explained the Presidents Forest Plan, shows the areas we will be doing Watershed Analysis on this fiscal year "94".

   Marcia Sinclair, PAO for Supervisors Office has publicized another publication called Mud on Your Boots, this is a employee newsletter outlining what's going on with Watershed Analysis and Watershed Restoration. Keeping our employees informed.

Eastside Watershed Analysis
Summary on Public Involvement
on
Mile Creeks

The Timelines for doing Public Involvement for Mile Creeks Watershed was somewhat short. There are a large amount of private landowners that go from the Forest boundary to the Columbia River, we felt that it was important to inform them of what the Watershed Analysis process is and ask them if they would like to be involved in that process.

We went to the County Assessors office and purchased a list of these landowners with addresses from the mile creeks area, this became our mailing list with additional names from other Federal and State agencies. The next step was to put together an informational letter discussing what Watershed Analysis is, why we are doing a Watershed Analysis, the Presidents Forest Plan and how you as a landowner or public citizen can become involved, we listed several options. We invited the landowners and any other interested public to a Ice Cream Social, held at the school here in Dufur. The Watershed Analysis Team was wanting to get a variety of information from the public (mainly history of what the area was like in the past), our setting was in a mini-mart form, this allowed the public to go from one booth to another and share their information on all areas we were focusing on for the evening. We did not have a large turnout (probably due to the short notification time), but the folks who came had a wealth of information. The Watershed Analysis team felt it was a very worth while evening.

When I sent the letter out to the landowners, we put a return envelop with a questionnaire. The response from the letter has been good, we now have a list of folks who want to know what is taking place on their Forest and several have come forth to want to be involved with us in the Field.

I was a participant at an Environmental Education for Teachers on how to develop Environmental Education in their daily work plans. Teachers from five counties and 18 schools were invited we discussed Watershed Analysis and how their classes could become involved and participate in our process for Watershed Analysis. Several schools are interested in helping us monitor, as we get into each new watershed it would be very valuable for us and for the school to include them in our process.

I taught a environmental program at one of the schools in the area, while talking with the students it became quite evident that this school was really into Environmental Education. They had been monitoring and recording data on Fifteen Mile Creek for several years. I discussed involving them in our Watershed Analysis with the Watershed Analysis Team and Public Affairs office at the Supervisors office, our conclusion was to get them involved and to have them participate with some of the Barlow R.D. fisheries employees to work on doing some monitoring and data collection that was needed for our Watershed Analysis Process. Not only did we strengthen our Environmental Education program, we have made a partnership with this school. This fall when school goes back in session they will be going on Forest occasionally to continue to monitor and collect various data.

Many of the different agencies (SWCD, ODF, & ODF&W) met at various times with our some of our Watershed Analysis Team, they discussed many issues and concerns that each Agency has dealt with. Sharing of information on how they collect data and how it helped them understand what they offer to the landowners (private lands), how some of their programs work and if their data would be useful in our Watershed Analysis.

Our District (Barlow) had a OHV Plan meeting held in April, I gave a briefing on what, and why we were doing the WSA. There was a lot of discussion on what was going to be the outcome of doing a WSA. The District Ranger has met with various civic groups and discussed the reasons for WSA and WSR, getting a few more names that want to be involved or be kept informed. Information reply cards were put at all campgrounds, several replies have been received on how they would like to be informed or involved.

The supervisors office was instrumental in getting a special Sprouts publication out for our mailing lists for all Basins. This is to inform the public of what A Watershed Analysis is, why we are doing them, explains the Presidents Forest Plan, shows what areas watershed analysis is being done for 1994. Marcia Sinclair is my contact for getting materials published at the Supervisors Office. She also publishes Mud on your Boots, an employee newsletter outlining where we are in Watershed Analysis and Watershed Restoration.

United States Department of Agriculture | Forest Service | Mt. Hood National Forest | Barlow Ranger District
P.O. Box 67
Dufur, OR 97021
503-467-2291

Reply To: 2520

Date: 6/7/94

Subject: RECREATIONAL USE WITHIN THE WATERSHED

To: WATERSHED ANALYSIS TEAM

INTRODUCTION

THE REPORT WILL DISCUSS THE DIVERSE LANDSCAPE HISTORY OF THE DEVELOPED SITES AND CONDITION, RECREATIONAL USES CURRENT AND FUTURE, CURRENT FACILITIES UNDER CONSTRUCTION, AND FUTURE FACILITY NEEDS.

A brief description of Barlow's diverse landscape and the fact that much of the District is on the "dry side" of the Cascade Range presents the recreation user with more opportunities or options when weather is stormy on the westside of the Cascades. This and the fact that most of our recreation sites are less congested than those nearer the Portland corridor appeal to certain recreationists. Our ecosystems, topography, wildlife, and vegetation communities are very diverse. This diversity is an important consideration for many of our users.

The miles creek area is very diverse for its users: 6 developed campgrounds, numerous dispersed sites, a rental lookout, environment education sites, miles of summer trails and winter trails, snowmobile routes, and a snowpark.

Most of the campgrounds and trails were constructed in the 1930's and are in need of reconstruction or replacement of most of their facilities. Since water is an important part of recreation on the dry eastside, all the campgrounds except Knebal Springs are located near creeks. Some of these campground sites have an impact on the creek banks and may need to be relocated. The newest campground is Eightmile, which was re-designed and reconstructed in 1979, with 22 units. It is a non-fee campground.

Future recreational improvement will be a 5 mile Loop Trail out of the Eightmile campground to be constructed in 94/95. This interpretive trail from Eightmile campground to Lower Crossing will be completed in 94. Planning for the relocation of 1 & 1/2 miles of the Knebal Springs Trail and an ORV management plan for Barlow District to be completed in 94.

The recreational use within this area is light at most of the facilities, with a 15 to 25% use of capacity. On holidays all campgrounds will be full or overflowing. On weekdays you will find most of the campgrounds with empty sites. The increase in use per year is 1 to 2%. We expect this increase to rise in the next several years. The use of dispersed sites is high during hunting seasons and holidays. Barlow ranks first in the Mt. Hood National Forest for number of visiting hunters. The use of the Knebal Springs campground and trail system is high, it is one of only two campgrounds with horse facilities. The use of trails within the mile creeks area has increased over the past years due to increasing use of mountain bikes. There has been and increase in ORV-winter use of snowmobiles/cross-country skis. The Mile Creeks area has most of the snowmobile use in the District.

We see a need in the future to develop more trails for mountain bikes, cross-country skiers, and motorbikes. We do not see a need to increase the camping capacity in the campgrounds, but there is a need to reconstruct most of our campgrounds.

PRESENT SUPPLY OF RECREATIONAL OPPORTUNITIES

TRAILS:

SUMMER

Lookout Mt.	#450	3.5 miles
Bottle Prairie	#455	3 miles
Fifteen Mile	#456	10.3 miles
Cedar Creek	#457	5 miles
Fret Creek	#456A	2.1 miles
Underhill Trails	#683	3 miles
Knebal Springs	#474	4 miles
* Total Miles		30.9 miles

MILES OF TRAILS PER USER GROUP

Hiking-	30.9 miles
Horseback Riding-	30.9 miles
Mountain Bikes-	28.8 miles
Motorcycles-	21.8 miles

NEW TRAILS UNDER CONSTRUCTION

Eightmile Loop Trail-	5 miles
Eightmile Creek interpreting-	1/2 mile

CAMPGROUNDS

Eightmile	22 sites	use	8645	RVD's
Lower Crossing	3 sites	use	1321	RVD's
Underhill	3 sites	use	1200	RVD's
Knebal Springs	6 sites	use	1776	RVD's
Pebble Ford	4 sites	use	1792	RVD's
Fifteen Mile	3 sites	use	1158	RVD's

DISPERSED SITES

60 inventory sites within this watershed.

SNOWMOBILE TRAILS GROOMED

32 miles of groomed snowmobile routes on an average snow year.

ROADS

OTHER

Rental Lookout-Five Mile
Mushroom Picking
Gathering Firewood/Greenery
Cross-country Skiing

ACTIVITY OCCASION CATEGORIES

11 Viewing Scenery
111 Travel-Automobile
112 Travel-Motorcycles
113 Travel-Snowmobiles
114 Travel-ATV's
141 Hiking & Walking
142 Bike Touring
143 Horseback Riding
144 Mountain Bike
145 Trailhead/Snowpark Activity
311 Fishing Cold Water
411 Camping General Day
412 Camping Vehicle
413 Camping Trailer
414 Camping Tent
431 Picnicking
463 Recreation Cabin Use
514 Snow Play
515 Cross-country Skiing
611 Hunting Big Game
612 Hunting Small Game
613 Hunting Upland Birds
615 Trapping
641 Gathering Forest Products
816 Walking Un-guided

United States Department of Agriculture
Forest Service
Mt. Hood National Forest
Barlow Ranger District
P.O. Box 67
Dufur, OR 97021
503-467-2291

Reply To: Watershed Analysis

Date: 5/23/94

Subject: Commodity Use in Miles Creek Watershed

To: Glenn Sachet

Introduction

The following report will describe known historical commodity uses. It will also show current use based on the previous 20 years. The third part of this report will discuss future trends and what may or may not be available as commodities from the Miles Creek Watershed.

Sources of information for the following were based on historical Ranger diaries, Sarah Crump, Cultural Resource Technician, district knowledge from both past experiences and current records. Community input from a recent public involvement meeting.

Information on grazing came from Dan Fissel and a magic card file from many years ago.

Historical Use:

Within the National Forest boundaries, commodity use was generally limited to harvesting timber and grazing. Mills were located along the edges of the forest and logs were taken to those sites. In the late 1940's these small mills were not equipped to move logs the distance necessary to keep them in production.

Central locations for mill sites were needed. From this need the Tygh Valley and Maupin mills were established. These mills were a boom to the economy of both communities. About 25 million board feet of National Forest timber was needed for each mill every year. From this need Cody Logging Company was established and started logging most of the timber sales in the area. The company grew fast and employed many people in and around these communities. The timber industry became the largest industry for the area.

Grazing of both cattle and sheep were common in previous years. While most of this activity took place on private land there was one allotment on National Forest land within the Miles Creek Watershed. Records show that this allotment was active until 1926 when grazing in this allotment was discontinued. Activities within the remainder of the Miles Creek area included grazing, hay, and dry land wheat. Some orchards were present in early days.

Current Use:

Within the National Forest boundaries the emphasis has changed. No longer is the Tygh Valley mill in operation, and the Maupin mill is only a small log home manufacturer. At one time it was timber with every thing else as a by product. Now since the harvest has been slowed specific demands are being made upon the forest.

Poles, posts. and firewood have been in great demand. The forest standards have required that existing material in most cases be left so that these standards can be met. Firewood availability has reduced to a point that not all will be able to cut as they normally do.

Other cultures have introduced new products and made us more aware of some products we took for granted. Beargrass, and mushrooms for an example. Mushrooms have always been of value to forest users. Now we are aware and have intense interest in many varieties of mushrooms. Within the National Forest there are many commercial mushroom pickers and lots of competition for the product.

Future Trends:

With the recently adopted Land Use Management Plan the availability of some commodities were affected. Down woody requirements in the Miles Creek area reduced the amount of firewood available.

Late Successional Reserves have further limited the amount of area that these commodities can be obtained from. Both mushrooms and firewood cutting have been discontinued in these areas.

Of the almost 35,000 acres in Miles Creek Watershed, about 5,200 acres have been designated as stream buffers. Another 9,500 acres are within Late Successional Reserves, and 2,400 remain in the Badger creek wilderness. This leaves about 18,000 acres or about half of the original area for obtaining these commodities.

Problems that have developed from these designated areas are mapping and public awareness. Since only the wilderness areas are marked on the ground public awareness and tolerance is very limited. Information assistants are the ones usually being impacted.

United States Department of Agriculture
Forest Service
Mt. Hood National Forest
Bear Springs Ranger District
Route 1, Box 222
Maupin, OR 97037
FAX 503-328-6228

Reply To: Watershed Analysis

Date: 5/12/94

Subject: Experiential Factors Mile Creeks Watershed

To: Ginnie Grilley

INTRODUCTION/METHODS/SOURCES

This report will be presented in five parts. Each part will discuss the History (if known), Existing Condition, LMP/PFP Desired Condition and Trends for each subject covered. Part V, the conclusion, will summarize the findings and discuss effects.

Information sources and analysis methods for each Part are listed below:

PART I-Demographics

Method: Questionnaire, Review LMP FEIS
Source: Doug Jones, Rural Community Assistance Coordinator, LMP FEIS

PART II-Scenic Viewsheds and Vistas

Methods: Reviewed LMP, Pulse Synthesis and Road 44 Viewshed Guide
Sources: As above and Louisa Evers (Fuels Specialist) Jack Archer (Recreation) at Barlow Ranger District. NO OFF-FOREST INFORMATION.

Calculated Percent Visually Disturbed for Road 44 Foreground & Middleground by dividing clearcut, shelterwood, and 1/2 thinning acres by total acres in the Designated (LMP) Viewshed. The 1989 photos were used to locate units. It was assumed that the activities since '89 would not significantly change the percentage. The Designated Viewshed is smaller than the viewshed in the Road 44 Viewshed Guide.

Conducted Field recon to compare calculated percent disturbance to the Visual Quality Level evident in the landscape. Also, field evaluated most of the Forest Roads which would be used for driving for pleasure but did no percent disturbed calculations other than for FR 44.

Reviewed Pulse Special Places and consulted with District personnel about vistas in Mile Creeks. Evaluated each vista on site.

PART III-ROS Classes

Methods: Reviewed LMP and a summary document written by Glen Sachet
NO OFF-FOREST INFORMATION

PART IV- Other Special Places

Methods: Reviewed Pulse and interviewed Scott Stemke (Confederated Tribes of the
Sources: Warm Springs of Oregon) and Sara Crump (Cultural Resource Technician at Barlow RD).

Wrote questionnaire asking general public where their places are (which see)

PART I: DEMOGRAPHICS

Wasco County has a population of about 22,500 people total. Of that, the majority reside in or near The Dalles and within the Columbia River zone of influence. The population of South Wasco County (everything from Dufur to Antelope) is roughly 2,800.

Four incorporated cities exist in South Wasco County: Dufur (pop 510), Maupin (pop 460), Shaniko (pop 36), and Antelope (pop 35)

The key industry in South Wasco (and the zone between Dufur and The Dalles) is agriculture. Dry land wheat crops and irrigated hay are the prime money crops of the South County. The narrow band of land immediately south of The Dalles is used for high value fruit crops - primarily cherries.

Lumbering and timber industry used to be shown as a key industry. This is no longer the case since Mountain Fir closed its two mills. The number of direct timber jobs in the area are negligible except for Pine Grove which hosts the Richard Dodge Logging Company. The Millcraft log home company in Maupin employs 7 people as of April, 1994.

Tourism is the second ranking industry in the South County and, with the exception of Deschutes River boating businesses, the industry is fledgling. The services and infrastructure for a vibrant tourism industry are lacking (quality lodging, quality restaurants, additional service business). The South County area has joined the Mid-Columbia Region of counties to name tourism as a key industry for development in its Regional Strategy.

Key areas of dependence of the communities on the Forest are: 1) access to firewood and miscellaneous products by local residents, 2) three major road systems serving tourists and linking the zone with the Portland Metro area -- Hwy 216, Roads 48 and 44. These are transportation corridors for tourists and are very popular areas that provide recreation opportunities and scenic driving. Driving for pleasure is still ranked at the top of recreation activities.

Rural residents look to the Forest for their community watersheds, log supplies, grazing, wood for heating, and recreation. The Dalles Watershed is the primary source of drinking water for The Dalles, and for irrigation in rural Wasco County (LMP FEIS III-91).

Eco-tourism is a new buzzword. Some might contend that camping, hiking and birdwatching are eco-tourism. Others point to visitors seeking out specific sites to observe and learn about ecosystem structure and process. A fairly new concept in outdoor tourism is the working vacation ala "City Slickers". The Hazel Phillips travel agency in The Dalles currently has a grant from a bank to study feasibility of vacations where guests pay to work on Forest Service field projects typically done with volunteer labor - such as trail contruction. Hazel Phillips is utilizing the Small Business Development department at Columbia River Community College for the study and is tied to the Mt Hood and Gifford Pinchot NF's as experimental areas. **Demand for eco-tourism** is difficult to ascertain as few grasp what it is! The demand is being generated by marketing in other areas - little marketing has occured in the Wasco County area. The only example I'm aware of are old growth tours along Barlow Road and other areas.

The economic status of the South County area is a mixed bag. The agricultural and white water industries are fairly solvent and stable. The remaining population has a below average income base and is not stable. Family-wage jobs for new and old time residents are not readily available. They have actually dwindled since the two mill closures. Few opportunties exist for high school graduates in the area.

One economically stable segment of South Wasco County's population is retirees. Dufur, Maupin, Wamic, Sportsmans Park and Pine Hollow areas all serve a growing number of retired persons. These people typically come to the area because of low cost-of-living, pleasant climate and quiet rural environment. They are close to hunting, fishing and other outdoor recreation pursuits.

Cultural Factors

People in Wasco County generally oppose rapid growth and feel strongly about independence and local control (LMP FEIS III-91).

Quality of Life Effects

Actions that can affect the quality of life sought by local residents include:

- -Road closures
- -Restrictions on historically popular activities (mushrooms, berry hunting)
- -Damage to scenic quality along main cross-forest routes and to views seen from their homes
- -Large recreation developments which <u>dramatically</u> increase the influx of tourist and off-site development. Potential for positive effects if such development is well planned with colloboration of the residents. A destination resort complex on private lands can also present negative effects if done poorly.

Commodity Uses and Needs

Tourism needs quality recreation and scenic resources in the Forests and needs to cross-market NF opportunities with those on BLM and private lands.

Agriculture requires a sustained flow of irrigation water from ditch systems with adjudicated water rights. All permitted irrigation facilities on the Forest lose between 35-55% of their water between initial diversion points and final crop application. Any management actions that help reduce water loss would benefit agriculture and allow it to leave more in-stream flows for aquatic resources.

Very little commercial recreation use occurs in Wasco County on the Forest. Some o/g horse rides in Hwy 35 area, some commercial kayaking on White River. This is an untapped area of business. The concessionaire at Rock Creek is only one on Barlow.

Theres no mining on Forest other than incidental common variety mineral permits (flagstone, gravel). Geothermal testing around Mt. Hood was not conclusive.

No oil & gas permits or applications.

Grazing allotments are not in great demand for increased numbers of permitted pairs REALISTICALLY.

Demands Not Met: Post & pole sales, commercial firewood, house log sales

Information Not Available: There is a need for a social science study of the lifestyles, religious practices and cultural values of the local area. No information or statistics on these subjects could be found in the time allowed for the research.

PART II: SCENIC VIEWSHEDS AND VISTAS

INTRODUCTION

MAINTENANCE AND ENHANCEMENT OF SCENIC QUALITY

This paper will discuss the historic (characteristic) conditions and existing scenic condition of viewsheds within the Mile Creeks Watershed in terms of the Forest Plan(1990), the President's Forest Plan, and the Forest Road 44 Viewshed Guide's desired conditions and applicable standards and guidelines. The direction for scenic resource management is found in the Mt. Hood NF Land and Resource Management Plan and the National Forest Landscape Management Handbooks.

FOREST PLAN DESIRED FUTURE CONDITIONS

The Mt. Hood National Forest is viewed by an estimated 7 million travelers in a year. The Forest Plan(1990) will provide and maintain pleasant, high quality scenic experiences for Forest users in two ways: First, through the allocation of visually sensitive lands as scenic viewsheds or other recreational categories with standards and guidelines designed for high scenic quality. Secondly, through long term management of designated viewsheds and other lands to achieve the desired future conditions described in the Forest Plan (ROD p.12).

FOREGROUND RETENTION: This management intensity applies to lands visible up to a distance of .5 mile from selected travelways, water bodies or use areas
Vegetation is composed primarily of multi-age, multi-species stands with diverse understory of natural plant associations.
Numerous large diameter, old trees are a major component of the stands.
Small, natural appearing openings provide diversity and a sense of depth.
The ground is generally free of unnatural forms and patterns of debris and litter.
Seasonal changes in vegetation color and texture are emphasized.
Target Tree diameters for mature trees: Pond. pine, Douglas-fir, Grand fir 24"
Pacific silver fir 26" DBH
W. Hemlock, 32"DBH
Mountain Hemlock, 24" DBH

MIDDLEGROUND AND BACKGROUND PARTIAL RETENTION: This management intensity applies to lands visible from .5 to 5 miles for Middleground and 5 miles to infinity for Background (PR/BG for Timberline Lodge is limited to 12 miles).

Natural appearing forest landscape, with little evidence of human alteration.
Dominant visual impression is mostly continuous tree canopies, with diversity in occassional natural appearing openings.
Mosaic of species and age classes add texture and color contrast in natural patterns.
Management activities repeat form, line, color and texture **common to the characteristic landscape.**

FOREGROUND MODIFICATION: This management intensity applies to lands visible up to a distance of .5 miles from roads, water bodies, or public use areas.
Diversity of species and ages, representative of the naturally occurring vegetative type, in **patterns similar to, and compatible with the characteristic landscape.**
Seasonal changes in color are noticeable.
Management activities are blended with adjacent vegetative and landform elements so that any unnatural edges, and the size of the affected area is generally not obvious, and does not dominate the scene.

MIDDLEGROUND AND BACKGROUND MODIFICATION: This management intensity applies to lands visible for distances farther than .5 mile from selected travelways, water bodies, or public use areas.
Diversity of species and ages distributed in **patterns similar to, and compatible with the characteristic landscape.**
Management activities are blended with natural landforms and existing vegetation with natural shapes, edges, patterns, and sizes.
Views of interesting landscape features. Offers a wide variety of land uses and recreation opportunities.
Natural appearing openings provide diversity and enhance views to landscape features (Land and Resource Management Plan,Four 9-10, Four 219-20).

THE CHARACTERISTIC LANDSCAPE - PONDEROSA PINE ZONE

This zone typically forms a narrow band on the eastern flanks of the Cascade Range at elevations between 300-1500 meters. Upper limits grade into other plant associations including douglas fir, grand fir and A. Concolor. Lower limits blend with juniper, sage or oak. On the Mt. Hood N.F. ponderosa pine associations are found on the Barlow Ranger District. Important scenic qualities associated with ponderosa pine are also found in early seral stages of Douglas-fir and grand fir zones on a much larger portion of the forest.

Ponderosa pine forests are associated with a limited number of other tree species including grand fir, Douglas-fir, and Oregon white oak. Ponderosa pine tends to visually dominate the view. Site conditions are generally hot and dry with course textured soils in a variety of topographic conditions.

Frequent natural and human caused fires have historically contributed to the scenic quality of ponderosa pine forests; influencing species distribution and tree density. Fire disturbance contributed to the development of open park-like stands of pine. Fire has maintained pine in ecotonal areas where, without fire disturbance, the climax tree species would have attained dominance. Fire control activities during the past 60-70 years have, on moister sites, resulted in a gradual replacement of ponderosa pine dominance by such species as Douglas-fir. Fire also influences the appearance of understory vegetation and may reduce shrub and increase grass cover. Fire may regulate the amount of advanced regeneration and result in open grassy, parklike stands.

Structural diversity of pine forests is great and contributes to scenic quality. Stands usually have a clumpy distribution with large and small openings irregularly spaced. Factors contributing to structural diversity include variety in species and size class, and spacial diversity. A shrub, grass/forb understory component also adds to structural diversity.

Ponderosa pine forests tend to have an open canopy and may exhibit structural diversity within the stand or between stands, depending on fire history, and on site conditions.

The landscape character of these forests is rarely even-aged, but rather multistoried, truly uneven-aged or structured with small groups of different age classes. This is an important characteristic which adds to scenic quality.

Ponderosa pine stands may have "big tree" character or may not depending on site productivity and fire interval. Groups of large diameter (30" plus) with deeply fissured bark are found in ponderosa pine forests on the Barlow district and contribute much to the scenic quality.

In many areas management has created geometrically shaped ponderosa pine plantations with even-aged regularly spaced trees, little structural or species diversity and consequently little visual diversity. In other areas of the zone, the large diameter pines were removed and fire suppression has created less open, more even-aged small diameter oak and pine stands.

The characteristic landscapes of these forest types contain stands that are visually dense, though not necessarily continuous. Diversity in tree, shrub and ground cover species is characteristic of these types. Structural diversity associated with multiple age classes, both within stand and between-stand, is also common. A thick litter layer and very productive soils are common.

The Douglas-fir zone occurs as an elevational band separating ponderosa pine and grand fir zones at elevations with sufficient moisture to support Douglas-fir regeneration. This zone can be found on the eastern portion of the Bear Springs Ranger District and a small portion of the eastern part of the Barlow Ranger District. This zone features many attractive ponderosa pine forests. Oregon oak is common, but it is as an early successional species, gradually being over-topped and eliminated by ponderosa pine and Douglas fir. This forest type is commonly associated with many shrubs such as manzanita, oceanspray, and snowberry. Fire disturbance is frequent and underburning creates open ponderosa pine stands. Variable sized natural forest openings are a common landscape feature but tend to be smaller than openings in the ponderosa pine zone.

This forest type is one of the most visually diverse found on the Mt. Hood National Forest. The mix of overstory tree species and constantly shifting spacial arrangement of trees contributes to the visual interest. Large diameter douglas fir and ponderosa pine trees are common and add a strong vertical element. Diverse textural elements come from a varied understory component of trees and shrubs. Species may be influenced by fire and sizes of created openings.

Grand fir zone forests typically include several other conifers (notably Douglas fir, larch, white and ponderosa pine); but grand fir dominates the regeneration. Upper elevation grand fir blends with stands dominated by Pacific silver fir, subalpine fir or mountain hemlock. This zone occupies a large portion of the Barlow Ranger District and is common in the eastern, lower elevation portions of the Hood River and Bear Springs Ranger Districts.

Scenic features contributed by ponderosa pine and Douglas fir largely depend on site conditions. Dry grand fir associations experience frequent underburning fires which create large tree character, within-stand structural diversity and uniform canopies of large early seral trees.

Moist grand fir associations experience less frequent, more stand replacing fires. Small fire-created openings are fewer and between-stand diversity is high due to stand replacing fires. Diseases, including root rot, contribute to structural diversity by affecting growth and vigor in some stands. Windthrow also may contribute to created openings. Regeneration tends to be scattered throughout the stand and not clumped into groups, giving stands a uniform appearance.

Management has changed the characteristic pattern, process, structure and species composition of the stands due to fire suppression, geometric harvest units dispersed unnaturally across the landscape, and individual tree selection harvests which removed most of the large diameter early seral species leaving the true fir understories.

MILE CREEKS-THE CHARACTERISTIC PHYSICAL LANDSCAPE AND LANDSCAPE PATTERN

The most notable physical features of the Mile Creeks landscape are 1) The parallel drainages going west to east forming canyons with characteristic vegetation for north versus south-facing slopes, 2) The climate gradation going west to east from higher elevation moister to lower elevation drier, and 3) The canyonlike terrain going north and south and the gentle ridge or drainage going east and west.

The characteristic landscape pattern is greatly influenced by the above physical features. Were it not for the north and south facing canyons, the vegetation cover would have been generally more dense the further west and more open the further east one traveled in the climate gradient. The canyons, however introduce an element of complexity and the resulting pattern is more complicated with interlocking fingers of open and dense stands depending more on aspect than elevation.

The characteristic vegetation pattern was a complex mosiac depending on fire disturbance (underburns in the eastern gradient and stand replacing in the more western gradient complicated by site conditions and aspect), soil conditions (rocky and thin versus forested), and elevation (more open mosiac lower and more dense higher with large infrequent openings). Ridgetops in the higher elevations were often open due to rocky conditions, harsh climate and fire. The eastern portion of the forested land is generally more linear in pattern and in the west dense with greater contrast in the opening shapes which were still a very complex and variable mosiac of small & large openings and diverse canopy coverages.

The characteristic landscape of what is now the agricultural area was largely open desert steppe and grassland with only occassional trees on the ridgetops and stringers of trees along draws and drainages. Fires were very frequent and often set by American Indian tribes.

Management of the Forest and Agricultural lands has changed the characteristic landscape pattern. Clearcutting in geometrically shaped units dispersed rather evenly across the landscape and fire suppression are the major processes of change. Both of these changes have tended to simplify the complexity of the mosiac.

Agriculture has increased the contrast of shapes on the landscape and introduced geometric shapes which now dominate the landscape. Because the terrain is not entirely flat and fertile, however, this conversion to agricultural patterns is not as complete as in the midwestern states. Many natural patterns persist in the landscape where grazing occurs or where no agricultural activities have taken place, or where fields are shaped according to topographical features. The social acceptability of geometric shapes on agricultural lands is much higher than on Forest land.

EXISTING SCENIC CONDTION

Viewsheds and Designated Viewsheds are different in that viewsheds designated by the Forest Plan have higher visual quality objectives than other viewsheds. Mile Creeks Watershed contains one Designated Viewshed: Forest Road 44 with a visual quality objective of Retention/Foreground, Partial Retention/Middleground and Background.

All other viewsheds in the Mile Creeks drainage have a visual quality objective (VQO) of Modification for all distance zones (see pg. 5). (except trails whose VQO's vary). Not all viewsheds were analyzed for existing condition in the time allowed. Those which have been evaluated are:

FR 44

Special Place Vistas (vistas are viewsheds which tend to have a single-point viewing position with long-distance views) See map for locations.

Forest Roads 4460, 4430, 4440, 4420, 2730, 2730-191, 2730-160

Visual Quality Objectives and Visual Quality Levels are two different things. Visual quality **ojectives** are the goals to be attained or maintained over time on the landscape. Visual quality **levels** rate the existing condition at any one time. For example, the Foreground of Forest Road 44 has a VQO of Retention. However, the Visual quality level it currently meets is Partial Retention overall.

EXISTING VISUAL CONDITION (IN VQO LEVELS) FOR EACH VIEWSHED AND DISTANCE ZONE

In order to meet the required Visual Quality Objectives in the Mile Creeks Watershed, the existing scenic conditions must first be ascertained. Two methods are used to do this. One method, developed by the Siskiyou National Forest involves calculating the number of acres currently visually disturbed[1] in a particular viewshed and dividing it by the number of acres in the viewshed. This results in a percentage of visually disturbed area within the viewshed which is equivalent to a certain VQO. The second method involves field observation and evaluation by a landscape architect. Both methods were used to develop the Existing Scenic Condition Chart. Please note that the percent visually disturbed does not consider vegetative screening nor the aesthetics of the activities in a viewshed but is important for giving an overview of the condition of a viewshed. The field evaluation does take into account the placement and design of harvests. All viewsheds were given a field rating by the District Landscape Architect, but not all viewsheds were calculated for percent of visual disturbance.

In order to better understand the Existing Scenic Condition Chart, the following terms need definition:

RETENTION ALL DISTANCE ZONES---- 8%(R)

PARTIAL RETENTION ALL ZONES------16%(PR)

MODIFICATION ALL ZONES-----------25%(MOD)

UNSATISFACTORY MODIFICATION--OVER 25%(UM)
(UM is <u>not</u> a Mt. Hood NF VQO .
It is used to indicate an unsatisfactory <u>existing condition</u> only.)

FOREGROUND-------0 to 1/2 mile
MIDDLEGROUND-----1/2 TO 5 miles
BACKGROUND-------5 miles & beyond

(LRMP, FW 564-66)

1 trees less than 20 ft. tall, including beneath shelterwood harvests

EXISTING SCENIC CONDITION CHART

Viewshed	Viewpoint	% Visually Disturbed	LMP Standard	Field Rating	Forest Plan VQO
FR 44 4430 & WEST	Continuous Corridor	FOREGROUND 27% MIDDLEGROUND BG Mt. Hood, Adams	8% 16% 16%	MOD PR RET	RETENTION PR PR
FR 44 4430 & EAST	Continuous Corridor	FOREGROUND 12% MIDDLEGROUND BG mostly unseen	8% 16%	RET-PR RET	RETENTION PR PR
FR 44 OVERALL	Continuous Corridor	FOREGROUND 17% MIDDLEGROUND 7% BACKGROUND	8% 16% 16%	PR RET RET	RETENTION PR PR

Distance Zones without a % Visually Disturbed listed were evaluated by field observation only. Openings are considered recovered for scenic resources after trees reach a height of 20' (LRMP, FW563).

Comments:

The FR 44 Viewshed Guide breaks the viewshed of FR 44 into design cells and discusses the desired and existing condition of each cell. A map of the design cells and photo points taken when the guide was written (1990) is included in the hard copy of this report. Also attached to this report will be the text of the guide which is keyed to the design cells on the map. The Viewshed Guide is a two volume document located in the Fire/Recreation Office at the Barlow RD. Percent disturbance in this study disagrees with the calculations for the guide. Other circumstances have also changed but the guide still is the best source for design cell information.

The western portion of FR 44 is composed of mostly a mosiac of moist and dry grand fir associations which means historically it was a mosiac of open and moderately dense forest which underburned in places and experienced crown fires in others. Fire occurence was a mosiac of 25-100 years and 70-200 years. This contrasts with the eastern portion of FR 44 which is composed of dry grand fir and hot, dry ponderosa pine or Douglas-fir associations. Historically underburning occurred quite frequently at 5-100 year intervals depending on the association. This means that East of FR 4430 within the FR 44 viewshed, fire suppression has put the area out of the range of natural conditions. Current fire behavior (crown fires with lethal underburning) due to unnatural fuel loadings puts it at great risk for catastrophic fire. This risk conflicts with the Forest Plan VQO and desired % disturbance per decade for Retention viewsheds because thinnings and underburnings to reach the DFC will have to progress at 4% of the area per decade, 8% disturbance at any one time while remaining unevident to the typical forest visitor.

Other viewsheds within these associations suffer less from this conflict because the Modification VQO allows 25% disturbance at any one time and activities may be evident or dominate the scene (See pg.5).

The Foreground of FR 44 is way out of the range of natural conditions for landscape pattern. Rehab of this situation could be achieved slowly through time with aggregation of some geometric units into mosiacs resembling a spotty crown fire with underburning. Priority should be given to units mentioned as negative to scenic quality in the FR 44 Viewshed Guide.

Other Forest roads are mostly not meeting the scenic quality objective of Modification due to geometrically shaped harvest units, unburned slash piles and visible unrehabbed landings. Some have large, unvegetated cut slopes and all suffer from not meeting ROS classes due to use of industrial (non-native) materials and urban designs. Restoration projects to rehab these situations should be considered during project planning.

An exception to this general condition is FR 1720 which meets Retention to Partial Retention in the Foreground. Stands along this road are out of the range of natural conditions and at risk for catastrophic fire. Large diameter ponderosa pine still remain but are being crowded by the true fir and Douglas-fir understories. Excellent possiblilities exist for reaching the LMP DFC in this area. Views to the Mts. are also an opportunity here.

EXISTING SCENIC CONDITION OF VISTAS

VISTA NAME AND LOCATION (See Map for Exact Locations)	NATURAL OPENING (Permanent)	HARVEST-CREATED (Maintenance)	VQL	LMP VQO
Top ridge end of 4460 (Appears meadowlike on top of ridge-poor regen after harvest)		X	FG/PR MG/UM BG/AG LAND	MOD MOD N/A
Wampus Springs 2730-240 (View of Mt. Adams-Foreground is HCC, Middleground almost meets PR. Parallel view on 4420. Access poor & erosional)		X	FG/UM MG/MOD BG/RET	MOD MOD MOD
Near Junction 4420 & 2730 (View of Mt. Adams and Ranier. Viewer above HCC so easier to rehab & maintain view. Access good.)		X	FG/UM MG/MOD BG/RET,AG	MOD MOD MOD
Eightmile Point (View from nice meadowlike opening thru larch to Mt. Hood. Have to walk thru HCC to reach it)	X		FG/PR MG/RET BG/RET	MOD MOD MOD
Fivemile Lookout (Best view from tower, Adams, Ranier, Hood behind trees. Needs veg. management plan and maintenance on tower, shed, toilet, and new gate. Access confusing)		X	FG/UM MG/MOD-UM BG/MTS. & AG	MOD MOD MOD

2730 view to Jordan Butte (see map). (View to Jordan Butte over Jordan Creek. Pleasant FG. Rock outcrop).	X		FG/RET MG/UM-RET (CLOSE UM FAR UM) BG/AG LAND	MOD MOD MOD N/A
Frailey Point (Another view to Jordan Butte almost 360 degrees but trees interrupt. Hygraded rock outcrop. Access in jeopardy due to road closure).	1/2 X	1/2 X	FG/PR MG/MOD-UM BG/MT. & AG	MOD MOD MOD

Comments:

Historically these viewpoints would not probably have all existed. Although fire on ridgetops is a frequent occurence, most of these are a result of harvest activity. These sites are valuable places (in past and present use) to seek solitude and get in touch with the Creator. Most of these in Mile Creeks are not in good scenic condition in the Foreground and Middleground. Access is either peculiar, unpleasant or in jeopardy.

If these become Special Places under the Forest Plan, they would have a higher VQO in the Foreground (to be determined in a management "plan" for the special place.(See LMP under Special Places). Barlow does not have an official Special Place list. In general, the VQO's for these vistas seem too low for the values they represent. Partial Retention, FG and MOD MG/BG would be supported by the Forest Plan and the current condition of plant associations. It would help if harvest units in the Middlegrounds blended with the landscape, which they often do not. Project possibilities for Restoration exist at these locations.

PART III: ROS CLASSES

Recreational Opportunity Spectrum classes represent management goals for the type of experience a Forest Visitor will be able to enjoy in particular landscapes or land allocations. The Forest Plan assigned ROS classes to each land allocation. The land allocations within Mile Creeks Watershed are:

Mostly B2 & B6 = ROADED NATURAL

With Small areas of A12 & A9 = ROADED NATURAL
A8 = ROADED NATURAL (Because within B6)

For spiritual and other non-activity oriented experiences, the ROS classes of roaded natural, semi-primitive non-motorized and semi-primitive motorized would seem most appropriate. Most rare everywhere is the semi-primitive non-motorized experience. This type of experience allows a person to get away from people and automobiles to get in touch with the natural world. The Fifteenmile drainage best offers this rare type of experience in the Mile Creeks Watershed. However, the ROS class for this area is Roaded Natural.

PART IV: OTHER SPECIAL PLACES

This classification applies to Prehistoric and Historic Cultural Resource Sites and sites other than vistas mapped for PULSE.

Prehistoric uses of the Mile Creeks Watershed were probably more subsistence oriented than experiential. Near the Columbia and Deschutes Rivers, long-term village sites were present. These sites were fairly large and indicate summer use by large groups of people. Activities were most often related to salmon harvest. Village sites for winter use by smaller groups of people were often located about a mile from the large rivers and were primarily found in sheltered areas near the Mile Creeks. The upland (Forest Service) area of Mile Creeks was primarily used for hunting and gathering activity. Seasonal changes at different elevations brought about the growth of various plants with cultural significance (i.e., plants used for food, medicine, clothing, shelter, tools, and containers). Depending upon the individual plants, spring or fall were the primary gathering times. Short-term seasonal camps were associated with the hunting and gathering activity, and resources saught included game meat, pelts, and fish, and plants such as berries, wild celery, camas, wild onion, nuts and acorns, mushrooms, willow, and cedar.

Cultural resource sites found on National Forest land reflect the hunting and gathering use and include several small lithic scatters, a number of isolated projectile points, and many peeled cedar trees. Although experiential use may have occurred, the natural setting was most likely not affected by this use, and there are no known prehistoric experiential sites in the Mile Creeks area of the Forest.

Oral history and other evidence indicates that prehistoric human-caused fires were frequent and deliberate. These fires were most often associated with gathering sites. Old records indicate that the Forest Service discouraged the Native Americans from starting these fires.

PULSE included three Huckleberry collection sites in the Watershed, but site visits and interviews with Sarah Crump and Scott Stemke suggest that this activity usually occured at higher elevations such as the Camp Windy area. No repressed huckleberry plants were found at the sites visited in the Mile Creeks area.

It is important to note that although Native American use and dependance upon the plant and animal resources available in the Mile Creeks area has changed through contact with European Americans, the area is probably still in use today by Native Americans. Although there is little documentation, hunting and gathering may still occur on a small level. Also, a couple modern-day experiential use sites of an intrusive nature (non-local tribes) have been noted in the Forest. (No trace is left at the majority of experiential use sites of Native American tribes who inhabited the Mile Creeks area prior to the establishment of the Warm Springs Reservation.) It is also important to note that experiential sites are of a personal nature, and it is often the wish of the individual involved that the purpose and location of such sites not be made public.

Historically, the area was also more workhorse than experiential. In 1845 the Barlow Road provided access to the area for European Americans. Although the road was at first used for emigration, some people did settle, and by the late 1800s the Mile Creeks area was fairly well populated. Although not as populated as the lower elevation of the Mile Creeks area, many people did live and work in the area now owned by the Forest Service.

Several mills with associated wood-cutting sites for lumber production were located in the drainages. For example, the old Dufur Mill along Eightmile Creek may have been in use as early as 1906, and the Westfall Mill on Fivemile Creek was in use in the 1920s. Lookout towers and tree platforms such as those at Fivemile Butte and Perry Point were used for fire detection and were located on most of the high areas. The current lookout at Fivemile Butte was built in 1957, but old towers and tree platforms were in use in the 1930s and earlier. Also, telephone lines were strung through the Forest in association with the fire lookouts. To aid in irrigation, ditches were dug to divert water from the creeks. Township and range maps from the 1880s show old roads and homestead and cabin sites. In addition, sheep camps, small trash scatters with cans and bottles, and wagon remains sites also indicate historic use in the area.

Although early historic use was primarily oriented toward work-related activities necessary for life, as towns were settled and some commodities became more easily available, some of these work-related activities probably changed in nature to more recreational type pursuits. These activites may have included fishing, hunting, horseback riding, hiking, and camping--all of which are recreational uses of the Forest today.

Cultural resource inventory of the Mile Creeks area is limited, so there is potential for location of additional prehistoric and historic sites of various types as further inventory is completed.

See map included with hard copy for generl location of some of the prehistoric and historic sites.

PART V: CONCLUSIONS

The major broadbrushed conclusions I can draw from the information collected for this report are:

GENERAL EFFECTS ON EXPERIENTIAL VALUES OF CURRENT DIRECTION
Depending on how specific aspects of the President's Forest Plan and the Forest Plan are interpreted, some variation of the effects below could occur.

1) Most of the current vistas in the Watershed will gradually disappear unless certain ones are managed as vistas because only 2 of those evaluated are permanent vistas (not dependent on managed openings).

2) Current geometrically shaped visible clearcuts will gradually soften over the years but stands of trees will still appear blocky. Clearcuts with poor regeneration may persist on the landscape.

3) Riparian related values will be both more numerous and less accessible.

4) The FR 44 viewshed will move more slowly to DFC's than surrounding landscapes.

5) There will be more areas where the ROS of semi-primitive motorized or nonmotorized will be possible.

6) Hunting and gathering (which is also very experiential in many cases) may diminish for those species requiring disturbance factors.

7) Underburning to maintain ecosystem health may create atmospheric haze which will affect scenery.

AREAS OF CONFLICT

** Meeting Retention, Foreground in areas which are far out of the range of natural conditions.

** Short term scenic goals versus long term scenic goals.

** Vistas in Mile Creeks rely mostly rely on unnatural openings in areas where road closures appear to be popular.

** VQO's of vistas in Mile Creeks is not compatible with their value.

** We have too much Roaded Natural ROS in the area. Need more variation of experiences.

** Current experiential use by American Indians cannot be protected while protecting the privacy of those places.

** The social need for access and the need for road closures.

AREAS OF COMPATIBILTY:

** The unmet social demand for firewood and post and pole material is compatible with the need to move some plant association types closer to the range of natural conditions and remove some of the risk for major crown fires in areas where underburns occurred naturally.

** The social need for berries and mushrooms and other species needing more open stands with restoring fire climax landscapes.

** The unmet social demand for semi-primitive non-motorized ROS class is compatible with implementing the PFP's standards and guidelines.

** The social need for high quality scenic and relatively small scale recreation facilities is compatible with DFC's in the LMP and PFP.

OPPORTUNITIES

** To combine eco-tourism with study and treatment of stands along 1720

** Restoration of Fivemile Lookout: Facilities and Veg. Management

** Restoration of Scenic Viewsheds in Mile Creeks Watershed

** To combine special products needs with scenic and experiential needs in a single project.

[illegible]

GIS Map Listing

Note:

The next few pages are a list of maps that were generated for the Mile Creeks Watershed Analysis. There will be a description of each map accompaning this list when the hardcopy of the maps are handed over to the basin, in the coming weeks. The list here is provided for information only.

irectory :D4:MOSS_USER:MILES

?OVERLAY.CLI	TXT	28-Jun-94	13:42:50	1010	----
BALDWIN	UDF	14-Jul-94	16:14:22	1536	----
BALDWIN.40	UDF	14-Jul-94	16:06:34	30976	----
BAR.STANDS	UDF	4-Apr-94	12:53:24	3859968	----
BARLINK	UDF	28-Feb-94	20:28:24	1483008	----
CHU.402	UDF	13-Jul-94	14:36:26	238336	----
CHULSR.40	UDF	13-Jul-94	15:29:26	218112	----
COMMUNITIES	UDF	26-Jun-94	9:22:20	146944	----
CON.TEXT	UDF	15-Jul-94	14:23:20	3584	----
CONNECT.TEXT	UDF	15-Jul-94	13:47:28	9472	----
CTSOIL.HI.B2	UDF	14-Jul-94	9:12:22	6656	----
CTSOIL.HI200	UDF	7-Jul-94	11:54:08	73216	----
CTSOIL.HIGH2	UDF	8-Jul-94	12:14:08	33280	----
CTSOIL.LO200	UDF	7-Jul-94	12:17:16	142080	----
CTSOIL.LOW	UDF	7-Jul-94	10:53:52	57856	----
CTSOIL.ME200	UDF	7-Jul-94	12:04:00	223744	----
CTSOIL.MED	UDF	7-Jul-94	10:43:00	97024	----
CTSOIL.NAT200H	UDF	7-Jul-94	12:26:12	4608	----
CTSOIL.NAT200L	UDF	7-Jul-94	12:50:38	26880	----
CTSOIL.NAT200M	UDF	7-Jul-94	12:40:18	16384	----
CTSOIL.NATH2	UDF	7-Jul-94	15:32:06	6912	----
CTSOIL.NATL	UDF	7-Jul-94	15:57:38	73472	----
CTSOIL.NATM	UDF	7-Jul-94	15:41:44	43776	----
CTSOIL.PRD200H	UDF	7-Jul-94	13:17:42	14080	----
CTSOIL.PRD200L	UDF	7-Jul-94	13:57:50	75776	----
CTSOIL.PRD200M	UDF	7-Jul-94	13:37:30	66048	----
CTSOIL.PRDH	UDF	7-Jul-94	14:09:16	59392	----
CTSOIL.PRDL	UDF	7-Jul-94	14:53:02	294912	----
CTSOIL.PRDM	UDF	7-Jul-94	14:25:24	203264	----
CTSTREAMS.300	UDF	14-Jul-94	11:21:54	14592	----
DESCRIBE.DT	UDF	16-Jun-94	11:59:12	1280	----
DESCRIBE.FA	UDF	18-Jul-94	16:43:54	493056	----
DITCH.BAR2	UDF	28-Jun-94	9:19:16	208128	----
E.40M	UDF	20-Jun-94	15:03:30	784384	----
E.40R	UDF	20-Jun-94	14:08:26	238080	----
EFORTY	UDF	13-Dec-91	12:26:32	2395136	----
FISHBOX	UDF	11-Sep-94	13:33:20	1280	----
FISHES	LCC	11-Sep-94	13:17:10	140544	----
FISHES.TXT	UDF	11-Sep-94	13:44:26	2560	----
HAR.TXT	UDF	12-Sep-94	13:02:34	2304	----
HAR91BAR	UDF	10-Jan-92	9:14:12	39680	----
HAR92BAR	UDF	14-Dec-92	7:15:08	36352	----
HAR93BAR	UDF	14-Nov-93	13:47:02	87296	----
HARBUFF	UDF	1-Sep-94	10:06:24	1280	----
HARBUFF.TXT	UDF	1-Sep-94	10:21:14	1280	----
HARVEST.TXT	UDF	1-Sep-94	13:58:52	1792	----
HARVSS	LCC	9-Sep-94	14:29:56	640768	----
HARVSS.TXT	UDF	9-Sep-94	16:04:00	2048	----
HORMAINT.SQL	TXT	20-Jul-94	15:36:30	1585	----
IMPORT	UDF	15-Jun-94	11:09:02	432	----
INTERPRO	UDF	14-Sep-94	13:41:18	9022	----
LARCH.CR	UDF	21-Jul-94	9:38:20	2816	----
LINE.PRINTER	TXT	13-Sep-94	11:27:26	699	----
LSR.40	UDF	13-Jul-94	15:21:26	248064	----
LWD_HARVEST	LCC	6-Jul-94	7:37:12	243200	----
M.3SUBS	TXT	1-Jul-94	12:18:56	440420	----
M.LWD_HARV	TXT	6-Jul-94	7:41:46	879364	----
M.MILE.CONN	TXT	15-Jul-94	16:25:48	918258	----
M.MILE.SP	TXT	28-Jun-94	16:01:20	157327	----

M.MILES.BUFF	TXT	20-Jun-94	13:17:20	787713	----
M.MILES.CROSS	TXT	7-Jun-94	14:54:08	176710	----
M.MILES.CTSOIL2	TXT	8-Jul-94	12:29:44	739212	----
M.MILES.CUTT	TXT	16-Jun-94	16:05:16	154724	----

M.MILES.HARVEST	TXT	20-Jun-94	17:02:54	962484	----
M.MILES.LSR	TXT	21-Jun-94	15:14:56	12288	----
M.MILES.PP	TXT	21-Jun-94	15:17:56	206575	----
M.MILES.PV	TXT	23-Jun-94	15:14:28	707098	----
M.MILES.RDS.NAT	TXT	7-Jun-94	13:29:40	343515	----
M.MILES.SLOPE	TXT	24-Jun-94	13:43:42	1534999	----
M.MILES.SR2	TXT	11-Jul-94	13:48:06	62152	----
M.MILES.ST200	TXT	7-Jun-94	11:20:02	716251	----
M.MILES200H	TXT	7-Jul-94	17:16:44	31717	----
M.MILES200L	TXT	7-Jul-94	17:58:52	47957	----
M.MILES200M2	TXT	7-Jul-94	17:54:12	36428	----
M.MILES200VL	TXT	7-Jul-94	18:09:52	125712	----
M.MILESFAP	TXT	22-Jun-94	11:14:42	352908	----
M.PLANDS.VG	TXT	11-Jul-94	14:46:42	140950	----
M.RDSAC	UDF	19-Jul-94	10:52:56	57856	----
M.RDSAG	UDF	19-Jul-94	11:21:26	124416	----
M.RDSIM	UDF	19-Jul-94	11:29:14	6656	----
M.RDSNA	UDF	19-Jul-94	11:43:32	58880	----
M.RDSST	UDF	19-Jul-94	11:56:16	25088	----
M.RRCC1	TXT	26-Jun-94	8:43:06	565563	----
M.STRMDW	TXT	21-Jun-94	10:48:02	1867	----
M.STRMWF	TXT	21-Jun-94	10:45:34	132044	----
M.WAT	TXT	9-Aug-94	13:51:42	334745	----
M1.LARCH	UDF	21-Jul-94	9:31:00	23808	----
M1.SUB	UDF	20-Jul-94	16:45:20	89088	----
M2.LARCH	UDF	21-Jul-94	9:33:04	4352	----
M2.SUB	UDF	20-Jul-94	17:08:00	122368	----
M3.LARCH	UDF	21-Jul-94	9:34:34	8192	----
M3.SUB	UDF	20-Jul-94	17:20:12	62464	----
M5.SUB	UDF	20-Jul-94	17:27:32	26112	----
MAP.LIS	TXT	26-May-94	11:02:56	9	----
MAPFILE	TXT	1-Jun-94	18:09:24	181	----
MAPS.BATCH.CLI	LNK	:D5:GIS:MAPS:MAPS.BATCH.CLI			----
MAPS.CLI	LNK	:D5:GIS:MAPS:MAPS.CLI			----
MCHULSR	UDF	13-Jul-94	11:25:04	12800	----
MERGE.BATCH	TXT	19-May-94	12:44:50	27	----
MERGE.BATCH.OUT	TXT	19-May-94	12:52:58	686	----
MILE.FB	UDF	19-Jul-94	11:32:28	8960	----
MILE.KSR	UDF	14-Jul-94	16:24:36	44544	----
MILE.LA.B	UDF	14-Jul-94	17:55:08	2560	----
MILE.M1	UDF	20-Jul-94	17:42:16	75520	----
MILE.REFOR	UDF	7-Sep-94	15:49:08	226560	----
MILE.SPR	UDF	14-Jul-94	13:24:58	7680	----
MILE.SPR6	UDF	14-Jul-94	17:46:12	15616	----
MILE.SUB3	UDF	15-Jun-94	14:52:58	22784	----
MILE300.N	UDF	14-Jul-94	8:08:06	102144	----
MILEFB.RDSCUT	UDF	19-Jul-94	18:06:46	334080	----
MILES.BOX	UDF	24-Jun-94	13:10:06	4608	----
MILES.CON.RAIN	UDF	6-May-94	10:59:04	8704	----
MILES.CONTOUR	UDF	6-Apr-94	13:08:12	156416	----
MILES.CROSS	UDF	3-Jun-94	9:11:16	116224	----
MILES.DATA.OO	UDF	22-Mar-94	11:21:22	124672	----
MILES.DATA.SP	UDF	18-Mar-94	11:14:42	2560	----
MILES.DATA.SP2	UDF	18-Mar-94	11:16:22	1280	----
MILES.DATA.WE	UDF	18-Mar-94	10:47:18	348672	----
MILES.FAP	UDF	22-Jun-94	7:38:58	32000	----
MILES.HARE	UDF	16-Jun-94	15:58:00	417024	----
MILES.LSR	UDF	16-Jun-94	11:24:28	34048	----
MILES.NAT.DAT	UDF	7-Jun-94	16:57:48	100608	----
MILES.PPT	UDF	29-Aug-94	12:24:12	37120	----
MILES.PRQUADS	UDF	11-Jul-94	14:35:30	11264	----
MILES.ROADS	UDF	18-May-94	16:58:46	480000	----

MILES.SEC.RDS	UDF	6-Apr-94	15:22:22	106496	----
MILES.SLOPE2	UDF	24-Jun-94	11:49:42	672768	----
MILES.SLTEXT	UDF	24-Jun-94	13:33:10	2304	----
MILES.SOILS	UDF	5-Apr-94	15:38:24	190208	----

MILES.STAND	UDF	5-Apr-94	7:42:20	1387776	----
MILES.STREAMS3	LCC	1-Jun-94	11:04:52	534784	----
MILES.VG	UDF	19-May-94	17:26:00	976640	----
MILES.WILD	UDF	13-Jul-94	14:15:40	2560	----
MILES1	UDF	10-May-94	10:06:36	11520	----
MILES100	UDF	13-Jun-94	10:12:54	172288	----
MILES125	UDF	15-Jul-94	12:17:34	271616	----
MILES150	UDF	13-Jun-94	12:36:00	39424	----
MILES150.N	UDF	15-Jul-94	8:07:36	21504	----
MILES2	UDF	20-May-94	10:01:14	11520	----
MILES200	UDF	14-Jun-94	11:19:54	256512	----
MILES300	UDF	13-Jun-94	9:55:48	77568	----
MILES39	UDF	1-Jul-94	12:18:48	766208	----
MILES39B	UDF	1-Jul-94	14:51:22	2304	----
MILESCHU	UDF	13-Jul-94	11:13:44	5120	----
MILESHAR100	UDF	21-Jun-94	14:30:32	128512	----
MILESHAR150	UDF	21-Jun-94	17:11:20	33024	----
MILESHAR300	UDF	22-Jun-94	9:47:56	102400	----
MILESLSR.DATA	UDF	13-Jul-94	11:10:30	33536	----
MILESMRM	UDF	5-Jul-94	12:50:18	12032	----
MILESMRW	UDF	5-Jul-94	12:40:12	6144	----
MILESOILRESIL	UDF	2-Jun-94	10:40:50	185344	----
MILESPPT	TXT	29-Aug-94	13:01:38	73064	----
MILESROS	UDF	16-May-94	13:23:26	20736	----
MILESUB.TXT	UDF	12-Sep-94	17:13:52	2560	----
MILES_OR.LINES	UDF	14-Jul-94	14:52:42	4352	----
MILES_PST701.OR	LCC	18-Jul-94	10:43:16	378624	----
MOSS.BATCH.CLI	LNK	:D5:GIS:MOSS:MOSS.BATCH.CLI			----
MOSS.CLI	LNK	:D5:GIS:MOSS:MOSS.CLI			----
MROADS.SUB	UDF	6-Jul-94	16:16:00	598272	----
MSALL	UDF	5-Nov-90	6:04:50	356352	----
NATIVE	UDF	7-Jun-94	13:55:48	291840	----
ONCL.TXT	UNX	16-Jun-94	9:28:16	290	----
ONCL2.TXT	UNX	16-Jun-94	9:28:42	1297	----
ONMY1.TXT	UNX	16-Jun-94	9:26:38	3560	----
ONMY2.TXT	UNX	16-Jun-94	9:27:10	10476	----
ONMY3.TXT	UNX	16-Jun-94	9:27:42	2985	----
ORDER.TEST2	UDF	10-Aug-94	10:03:06	2304	----
ORDER.TEXT	UDF	10-Aug-94	9:40:54	7680	----
ORDER1	UDF	9-Aug-94	16:30:22	197120	----
ORDER2	UDF	9-Aug-94	16:34:56	98816	----
ORDER3	UDF	9-Aug-94	16:35:42	58368	----
ORDER4	UDF	9-Aug-94	16:36:18	25856	----
PLABAR	UDF	26-Mar-90	10:14:26	119040	----
POLYGON.DT	UDF	3-Feb-94	10:47:38	9216	----
PRDEAST	UDF	4-May-94	11:39:52	4925440	----
PRIVATE.LA	UDF	10-Jan-91	10:31:10	31744	----
PROMPT	TXT	31-Mar-94	16:13:58	16	----
PROV.BOX	UDF	8-Sep-94	16:17:48	2048	----
PROV.TXT	UDF	8-Sep-94	16:32:20	2304	----
PSBAR	UDF	6-Feb-91	15:58:20	182784	----
PSPBAR	UDF	20-Feb-90	11:01:58	39680	----
PVTCT	UDF	1-Jul-94	10:52:32	1536	----
R.L1T	UDF	29-Jun-94	14:55:50	1024	----
R.L2AT	UDF	29-Jun-94	15:25:26	1024	----
R.L3T	UDF	29-Jun-94	15:19:14	1024	----
R.L4T	UDF	29-Jun-94	15:28:42	1024	----
R3.LINE	UDF	29-Jun-94	14:47:14	3840	----
R6MAP.CLI	LNK	:D5:GIS:R6MAP:R6MAP.CLI			----
RAIN.TEXT	UDF	6-May-94	11:59:34	2560	----
RDSAC.SUB	UDF	19-Jul-94	9:00:08	61696	----
RDSAG.SUB	UDF	19-Jul-94	9:53:30	139776	----

RDSIM.SUB	UDF	19-Jul-94	10:03:18	16896	----
RDSNA.SUB	UDF	19-Jul-94	10:27:50	59136	----
RDSST.SUB	UDF	19-Jul-94	10:33:40	27648	----
REFOR.LA	UDF	26-Sep-90	9:10:20	891392	----

REFORCC	UDF	8-Sep-94	10:23:50	2048	----
REFORCC.TXT	UDF	8-Sep-94	10:31:12	1280	----
RESIL.TXT	UDF	1-Sep-94	13:21:04	1536	----
RIP.3	UDF	18-Jul-94	16:22:54	21760	----
RIP.4	UDF	18-Jul-94	16:31:48	239104	----
RIP.40	UDF	18-Jul-94	16:56:20	472576	----
RIP.402	UDF	18-Jul-94	17:11:46	11776	----
RIPARIAN.R	UDF	18-Jul-94	13:08:26	424960	----
RR.TXT	UDF	10-Sep-94	7:29:36	2048	----
RRCC1	UDF	26-Jun-94	8:33:24	244992	----
RRCCHARV	UDF	24-Jun-94	10:02:02	244992	----
RRHARVLS70	LCC	9-Sep-94	14:33:44	324096	----
RSURF.DMP	UDF	11-Jul-94	14:16:50	280265	----
SERAL	UDF	8-Jul-94	7:09:10	1024	----
SERAL1	UDF	27-Jun-94	12:00:56	373760	----
SERALBOX	UDF	9-Sep-94	15:43:38	3584	----
SESSION.DT	UDF	3-Feb-94	10:48:18	512	----
SLOPE_RR	UDF	29-Jun-94	8:16:48	1675264	----
SOIL.EROS	UDF	20-May-94	11:21:30	7168	----
SOIL.TXT2	UDF	1-Sep-94	13:17:28	1536	----
SOILS.HIGH	UDF	20-May-94	11:15:48	40704	----
SOILS.LOW	UDF	20-May-94	11:14:34	72960	----
SOILS.MED	UDF	20-May-94	11:12:20	89600	----
SOILSED.TXT	UDF	7-Jul-94	11:13:10	1792	----
SR16	UDF	11-Feb-94	10:16:22	368640	----
SR17	UDF	10-Feb-94	20:55:24	321536	----
SR24	UDF	11-Feb-94	10:18:04	417792	----
SR25	UDF	14-Feb-94	13:44:20	288256	----
STRATA	LCC	8-Sep-94	11:22:26	932864	----
STRATA.BOX	UDF	8-Sep-94	13:13:26	4352	----
STRATA.TXT	UDF	14-Sep-94	11:10:06	3840	----
STREAM.TXT	UDF	21-Jul-94	11:55:24	5632	----
SURF.SQL	TXT	19-May-94	15:43:12	1383	----
TEMPKEYS	UDF	18-Jul-94	16:31:28	18	----
TMSDIS.SQL	TXT	19-May-94	10:20:36	394	----
TSI.LA	UDF	20-Jun-90	9:09:28	252672	----
WASCO	LCC	1-Jul-94	10:41:38	1567744	----
WILD	UDF	23-Aug-90	14:56:50	61440	----
WILD.40	UDF	13-Jul-94	14:43:30	59648	----
WINTER.TEXT	UDF	7-Sep-94	12:07:00	1792	----
WONG3	TXT	14-Sep-94	13:41:32	14336	----
WRANGE	UDF	16-Dec-92	13:53:36	6912	----