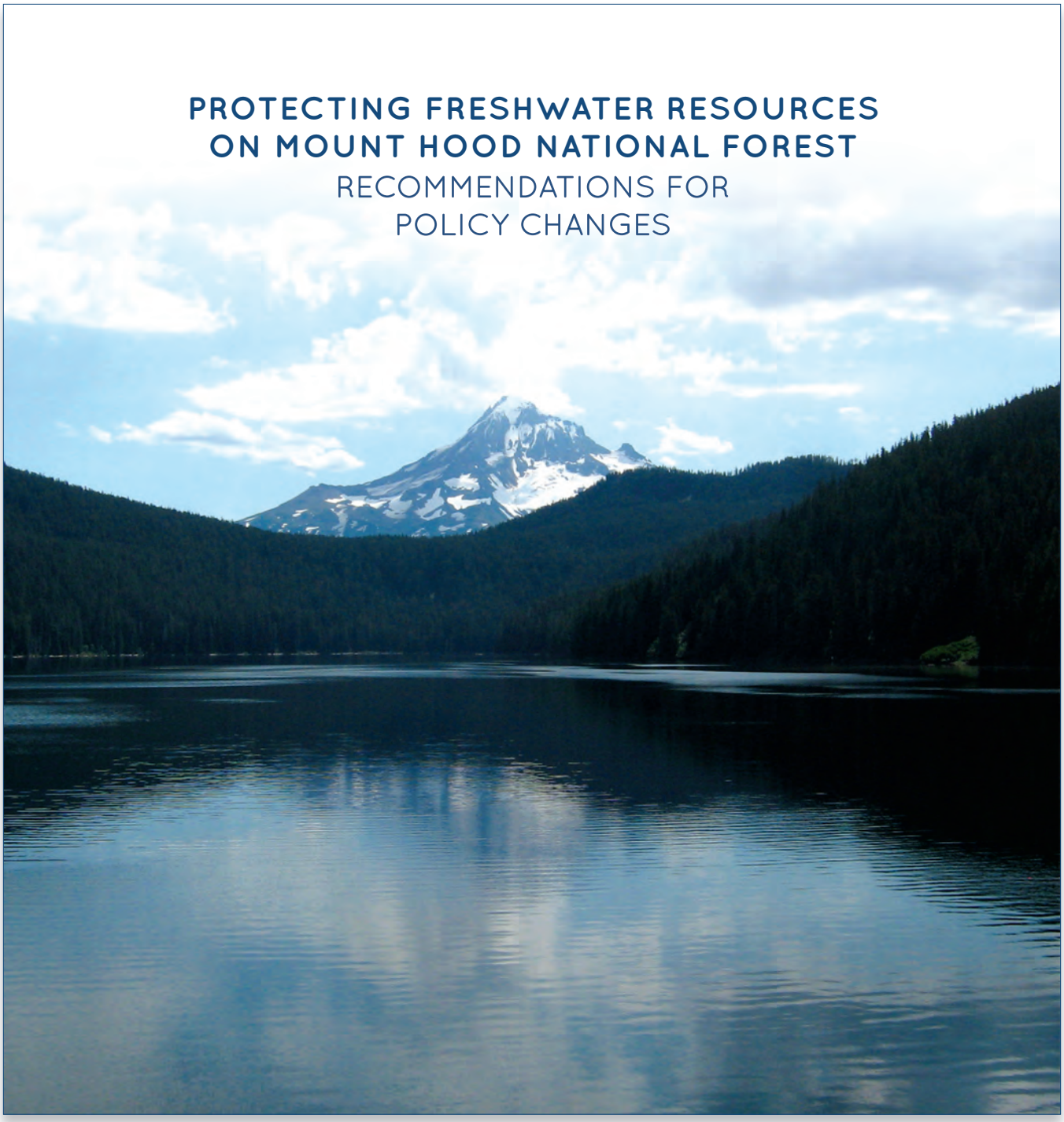
# PROTECTING FRESHWATER RESOURCES ON MOUNT HOOD NATIONAL FOREST

## RECOMMENDATIONS FOR POLICY CHANGES



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# Protecting Freshwater Resources on Mount Hood National Forest

**Pacific Rivers Council**

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Fisherman on the Salmon River

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Defending & Restoring Mt. Hood
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## Executive Summary

The purpose of this white paper is to provide recommendations for the next revision of the Mt. Hood National Forest Land and Resource Management Plan (Forest Plan) to ensure protection and retention of the Forest's water resources, including municipal supplies and riparian and aquatic species habitat. Mt. Hood National Forest (MHNF) has positioned itself ahead of some of its counterpart units in the National Forest System (NFS) by proactively closing and decommissioning roads and developing watershed restoration and prioritization strategies. Forest staff and stakeholders should rightly be pleased with this progress while continuing to follow through on landscape-wide restoration.

This white paper provides recommendations that acknowledge and capitalize on these accomplishments, while encouraging all who work in the Forest and all who depend on water from the Forest to continue to pursue further restoration and protection of this resource. Adopting the protective policies MHNF already implements and building on them in the next revision of the Forest Plan will enable the Forest's legacy of ecologically sound and socially conscious water management to continue for perpetuity.

The recommendations provided in this paper urge the Forest Service to go beyond minimal or merely adequate compliance with statutory mandates and policy directives. Instead, these recommendations offer substantial protection for streams and riparian areas such that natural restoration processes can fully occur. This paper contains sections providing important background information about MHNF, impacts and stressors on the Forest's watersheds, the current management scheme and the scientific rationale for our recommendations. Our recommendations can be summarized by general categorization as indicated on the following page.

## Recommendations for Policy Change

*Key Watersheds*

- Eliminate distinctions between Tier 1 and Tier 2 (fish-bearing and non-fish-bearing) Key Watersheds and manage all according to Tier 1 criteria
- Add the Upper Sandy, Zigzag and East Fork Hood Rivers as Key Watersheds
- Prohibit new road or landing construction of any kind in Key Watersheds
- Develop fine-filter Aquatic Habitat Restoration Strategies for the Clackamas and White River Basins

Riparian Reserves

- Adopt the Aquatic Conservation Strategy objectives of the Northwest Forest Plan as MHNF forest plan standards
- Enforce Northwest Forest Plan standard requiring adjustment or elimination of grazing practices that retard or prevent Aquatic Conservation Strategy objectives
- Establish Riparian Reserve widths of at least two site-potential trees without distinction between fish-bearing and non-fish-bearing streams or permanent and seasonal/intermittent streams
- Exclude timber harvest within the first site-potential tree length
- Restrict timber harvest within the second site-potential tree length unless specific screening criteria and ACS objectives are met
- Restrict mechanical fuel treatments and biomass collection in Riparian Reserves to the wildland-urban interface, with no exception for municipal watersheds
- Exclude livestock from Riparian Reserves
- Restore beavers to the forest and range landscapes

*Prioritization and Management*

- Designate management areas congruous with 6th field sub-watersheds
- Expressly establish a "no degradation" standard for impaired streams

*Road Network Impacts*

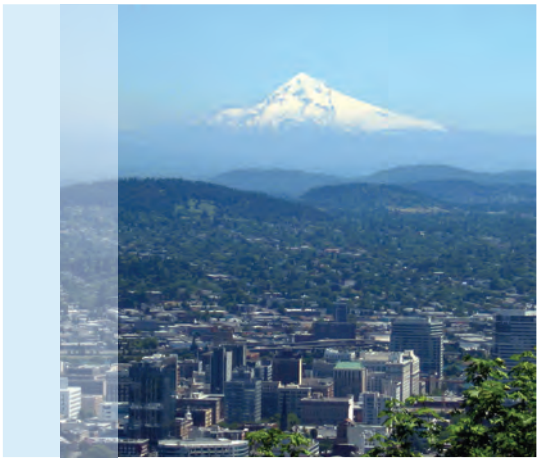
- Extend protections to roadless areas of 1,000 acres or greater
- Assess treatment options for unauthorized and non-system roads and routes
- Establish road density standards at the 6th field sub-watershed scale of no more than 1.5 miles per square mile, then take prompt action to reduce mileage accordingly
- Establish hydrologic connectivity limits between the road network and streams at the 6th field sub-watershed scale of less than 10%
- Prioritize roads in Riparian Reserves for decommissioning or closure

- Prioritize active decommissioning and culvert removal and reassess passively decommissioned road segments to determine if active decommissioning and culvert removal is necessary to eliminate adverse impacts
- Establish aggressive road maintenance, improvement and decommissioning schedules to maximize available funding
- Close roads that cannot be adequately maintained

*Climate Change*

- Establish and protect water quality and quantity as leading use of MHNF
- Expressly recognize that water yield does not justify thinning or other logging
- Establish the Forest's reserved water rights through adjudication

## Part One — Introduction: An Urban Forest



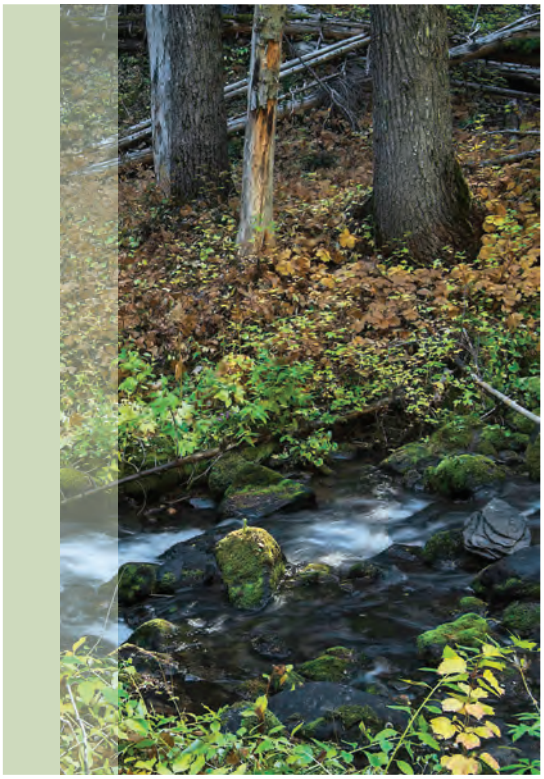
Mt. Hood to the East of Portland

The U.S. Forest Service (USFS) recognizes Mt. Hood National Forest as an "urban national forest" due to its position just east of the two million-plus Portland/Vancouver metropolitan area.[1] Its "urban" status means a great many area citizens regularly visit the Forest in their backyard and care about how it is managed.[2] Many area residents engage with the Forest Service in the agency's stewardship of this special place, more so than on some other Forests.[3] The Forest Service acknowledges that recreation opportunities and water are the Forest's two primary resources.[4]

Mt. Hood National Forest receives four and a half million visitors each year and "[n]inety-eight percent of the Forest is somebody's municipal water supply."[5] The Forest provides a domestic water supply for 1.1 million people[6] as well as an industrial supply for numerous businesses and enterprises. The Forest also provides critical freshwater habitat for a suite of aquatic species, including culturally iconic salmon and steelhead.[7] Although many salmonid runs are protected under the Endangered Species Act[8], all still contribute to local and regional economies through commercial and recreational fishing.[9] Because MHNF already recognizes water and recreation as the primary resources used by its main constituents and because it is governed by a regional forest plan (the Northwest Forest Plan) with strong aquatic conservation requirements, it already aspires to more ecologically sensitive management than many other units of the National Forest System.

For these reasons, water is given significant consideration in management decisions on the Mt. Hood and strides have been taken to restore and improve watershed health as well as reduce and eliminate adverse impacts to streams from human activities on the Forest. Three key accomplishments are noted here. First, the MHNF has made notable progress in decommissioning and/or closing unneeded motorized roads and trails.[10] Second, Aquatic Habitat Restoration Strategies have been prepared for three of the Forest's five major drainage basins: the Hood River[11], the Sandy River[12] and Fifteenmile Creek.[13] These strategic plans have helped the Forest compete well for limited watershed restoration funds through Legacy Roads and Trails and other mechanisms. Third, the MHNF recently adopted an off-highway vehicle plan that greatly restricts the locations in which all-terrain vehicle riders are permitted to operate, to the significant benefit of sensitive stream habitats and quiet recreationists.[14]

Mt. Hood National Forest contains over 5,000 miles of streams[15] within five major drainages: the Clackamas River, Sandy River, Hood River, Fifteenmile Creek and White River.[16] Across the Forest, water quality is generally better at higher elevations and decreases at lower elevations.[17] With a large number of stream miles heavily impacted by past logging, roading practices and other human alterations, much work remains to reestablish fully functioning riparian and aquatic ecosystems across the Forest that will exist in perpetuity, especially as human demands for recreation and water continue to grow along with the surrounding population and the effects of climate change. The Forest Service repeatedly states that national "[p]rogress toward forest health restoration can be expected to proceed very slowly."[18] MHNF might be a few steps ahead of many other units of the NFS and it should continue apace to address restoration priorities, despite an awareness that the full benefits of restoration might not accrue in the near-term. Rather than allow complacency to slow future progress on the Forest, MHNF should firmly cement its status as a model unit in the National Forest System by continuing to demonstrate visionary and ecologically sound management of water resources and watershed health.



Fifteenmile Creek

## 2.1 Aquatic Habitat and Riparian Vegetation

The aquatic organisms native to the Mt. Hood, such as the Pacific Northwest's culturally iconic salmon, require consistent supplies of high quality water: adequate flows of cold, well-oxygenated water that do not have excessive amounts of suspended sediments or other pollutants.[19] Pacific Northwest salmonid populations are mere fractions of historic levels.[20] Remaining runs rely on a severely limited number of high quality streams for spawning and other life cycle stages.[21] A number of watersheds on MHNF now serve as refugia for salmonids due to degradation or loss of access to habitat on many historically used streams (e.g., due to dams and development impacts).[22]

Water quality is closely associated with the intensity of forest management activities and resulting effects on riparian vegetation.[23] Riparian areas (stream-adjacent areas) and their vegetation provide streams with shade, large woody debris, small organic litter, nutrient regulation and sediment control.[24] These are essential functions that reduce the intensity and duration of downstream flood damage, protect water quality, channel form, aquatic habitat conditions and the survival and production of culturally important salmonids and other sensitive aquatic biota.[25] The removal of shade-providing riparian vegetation results in increased water temperatures[26] and sedimentation.[27]

High quality habitat for salmonid species requires large quantities of downed trees[28] which influence formation and location of channels and pools, control sediment transport rates and provide cover and shade.[29] Large wood in streams has been reduced and eliminated by past forest management practices.[30] Large snags and other sources of large woody debris recruitment have also been eliminated from riparian areas by past forest management practices, which routinely clearcut streamside areas and disproportionately harvested the largest trees.[31] Small woody debris derived from riparian areas also plays an important role in forming pools, trapping sediment and generally structuring the biological communities of small streams.[32] Currently, levels of woody debris are below historic averages in most streams across the MHNF.

Beavers historically played a critical role in shaping riparian and aquatic habitat in the lands surrounding Mt. Hood.[33] Beavers create and maintain wetlands, providing valuable complex habitats for salmonids and other wildlife, as well as stream-floodplain interaction and groundwater-recharge.[34] Rather than contribute to snowmelt peakflows, such stored groundwater emerges downstream later in the year as surface baseflow.[35] Beavers use and grow native vegetation, provide flood control and increased cool temperature baseflow, in turn providing excellent salmonid rearing habitat.[36] Beavers still exist in significant numbers on parts of the west side of Mt. Hood National Forest[37] but have been greatly reduced and eliminated from much of their natural range on the east side of the Forest.[38]

## 2.2 Climate and Hydrogeography of Mt. Hood National Forest

Mt. Hood National Forest is often described as encompassing two very different climate zones—the wetter west side and the dryer east side.[39] The Cascade Range, whose spine runs in a general north-south line through the Forest, blocks clouds rolling in from the Pacific Ocean, causing them to release their moisture as precipitation and dissipate on the west side, leaving the east side more arid.[40] Although this characterization is easy to grasp and not without merit, a more nuanced description notes the subtle transitions of the Forest's average temperatures, precipitation patterns and predominant vegetation communities as elevation rises moving east toward the crest of the Cascades then generally back to lower elevations and dryer conditions on MHNF's far eastern reaches.[41]

Subalpine Krummholz

For example, MHNF recognizes certain representative vegetation zones, particularly on the west-side, such as Western Hemlock, Pacific Silver Fir, Mountain Hemlock and Alpine/Subalpine.[42] The Western Hemlock Zone is characterized by a relatively warm and moist climate at lower elevations.[43] The Pacific Silver Fir Zone is characterized by slightly higher elevations than the Western Hemlock Zone, cooler temperatures, the potential for summer frost and winter rain-on-snow events, but persistent winter snowpack.[44] The Mountain Hemlock Zone is generally even higher in elevation than the Pacific Silver Fir Zone, with harsher conditions, prevalent snowpack, regular frost during the growing season and smaller, slower-growing trees in a more fragile ecosystem.[45] Finally, the Alpine/Subalpine Zone begins near treeline, with no continuous forest canopy cover but instead sparse clumps of trees mixed with shrubs, small plants and bare rock.[46]

MHNF recognizes three distinct east-side climate zones: Crest, Transition and Eastside.[47] The Crest Zone, at the highest elevations on the east side, has similar forest conditions as those on the west side of the spine of the Cascades, with cold, moist winters with consistent snowpack and warm, dry summers.[48] The Transition Zone of the east side begins at lower elevations than the Crest Zone and, as its name implies, contains a mix of forest conditions representative of both the Crest Zone and the lowest elevation Eastside Zone.[49] The Transition Zone has cool, moist winters with inconsistent snowpack.[50] The Eastside Zone is characterized by cool, semi-dry winters with snowpack that often does not persist and hot, dry summers.[51] Ponderosa pine is a dominant tree species.[52]

Perhaps the most precipitation in Mt. Hood National Forest falls in the Bull Run Watershed Management Unit, making its historic selection as Portland's water supply back in the late 1800s particularly wise.[53] Although the headwaters of The Dalles' municipal watershed, Mill Creek, on the east side of the Forest, does not receive nearly as much rain as the Bull Run (up to 50 inches annually compared to 170 inches annually)[54], it still receives many inches more precipitation than The Dalles itself (less than 15 inches annually)[55] and serves a drastically smaller community (roughly 12,000 users as opposed to nearly 900,000).[56]

### *Sandy River Drainage*

The Sandy River proper begins not from the Sandy Glacier, but instead from the Reid Glacier on the west face of Mt. Hood in the congressionally designated Mt. Hood Wilderness.[57] The mountain's Sandy Glacier, meanwhile, feeds the Muddy Fork of the Sandy, which joins the main stem along with the Clear Fork before the Sandy proper leaves the MHNF boundary.[58] Ridges near Lolo Pass separate the Upper Sandy River Watershed from the Bull Run and West Fork Hood River watersheds.[59] Congress has designated nearly 25 miles of the Sandy as Wild and Scenic.[60] Alder Creek, a back-up

water supply for the City of Sandy, begins on a northwest corner of Mt. Hood National Forest near McIntyre Ridge and joins the Sandy River near the community of Alder Creek along U.S. Highway 26.[61] Gordon Creek, a water supply for the small community of Corbett, begins on the far northwest side of MHNF near the Columbia River Gorge National Scenic Area, flows through Bureau of Land Management (BLM) and private lands and then enters the Sandy River before it reaches the outskirts of the Portland metropolitan area.[62]

Sandy River near the Pacific Trail crossing

Other major tributaries of the Sandy begin on Mt. Hood, as well.[63] The Zigzag River flows down from the Zigzag Glacier on the southwest side of the mountain in the Mt. Hood Wilderness, joined by Still Creek before emptying into the Sandy.[64] Congress designated the 4.3 miles of the Zigzag within the Mt. Hood Wilderness as Wild and Scenic in 2009.[65] Still Creek begins as meltwater from the Palmer Snowfield above Timberline Lodge on the south face of Mt. Hood.[66] The Zigzag River is also fed by Lady and Camp Creeks on either side of U.S. Highway 26 before joining the Sandy River just outside the MHNF boundary in the community of Zigzag.[67]

The Salmon River also begins near Timberline Lodge, just to the east of Still Creek's beginnings on Mt. Hood.[68] The Salmon River and its East and West Forks head south from the mountain before joining and curving west, gaining volume from many tributary creeks, as well as the South Fork of the Salmon, flowing through the Salmon-Huckleberry Wilderness.[69] The Salmon joins the Sandy River near the community of Brightwood along U.S. Highway 26 outside the MHNF boundary.[70] Congress designated the entire Salmon River as Wild and Scenic in 1988.[71]

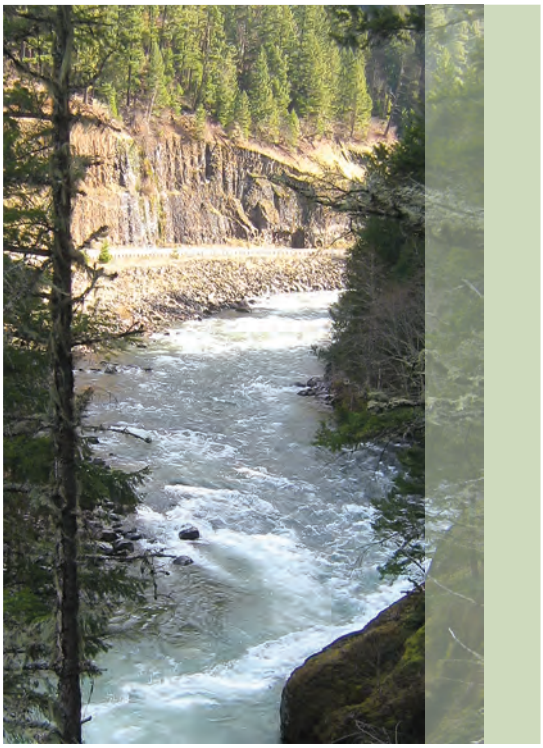
The Bull Run River's origins lie on the west side of Lolo Pass.[72] The Bull Run is unique among the Sandy River's major tributaries in that none of its waters flow down from Mt. Hood itself, but instead from a bowl of sorts created by ridges to the north, west and south, keeping its waters free of glacial sediment.[73] The Bull Run is fed by streams flowing down from the bowl's ridges, including Blazed Alder and Falls Creeks and the Bull Run's North and South Forks.[74] The Little Sandy River begins within the MHNF and joins the Bull Run after it exits the Forest's boundaries.[75] Shortly thereafter, the Bull Run flows into the Sandy River not far north of the City of Sandy.[76]

### *Clackamas River Drainage*

The Clackamas River is an 82-mile tributary of the Willamette River that supplies drinking water to 300,000 people.[77] The Clackamas River drains an area of 940 square miles, a significant portion of which is land within the Mt. Hood National Forest.[78] Congress designated 47 miles of the Clackamas as Wild and Scenic in 1988.[79] The Clackamas River proper begins from Big Spring and headwater streams in the Olallie Lakes Scenic Area of MHNF, as well as streams flowing down the slopes of Olallie Butte on the Warm Springs Indian Reservation, just east of the MHNF boundary.[80] The Clackamas winds its way downstream in a northwest direction, fed by a large number of significant tributaries of its own, including the Collawash River, the Oak Grove Fork, the Roaring River, Fish Creek and Eagle Creek.[81]

The North and South Forks of the Clackamas River also flow from MHNF land into the main stem.[82] Congress designated a 4-mile stretch of the South Fork as Wild and Scenic in 2009.[83] Memaloose Creek provides the South Fork with a significant amount of water before it meets the main stem just within the MHNF boundary.[84] The North Fork collects water from a handful of creeks before joining the Clackamas main stem on a section of BLM land adjacent to MHNF.[85] Clear Creek begins on the checkerboard of MHNF and BLM lands on the far west side of the Forest before joining the Clackamas in the community of Carver downstream from Estacada.[86]

Eagle Creek begins in the Salmon-Huckleberry Wilderness on the south side of Wildcat Mountain.[87] Eagle Creek's South Fork also begins within the MHNF boundary, but not in the Wilderness.[88] Some of Eagle Creek's tributaries, including its North Fork, begin outside the MHNF boundary or on adjacent BLM land, or only ephemerally flow down from the edges of MHNF.[89] Eagle Creek joins the Clackamas River a few miles north of the City of Estacada.[90] Congress designated the 8.3-mile stretch of Eagle Creek from its headwaters to the MHNF boundary as Wild and Scenic in 2009.[91]



Clackamas River Drainage

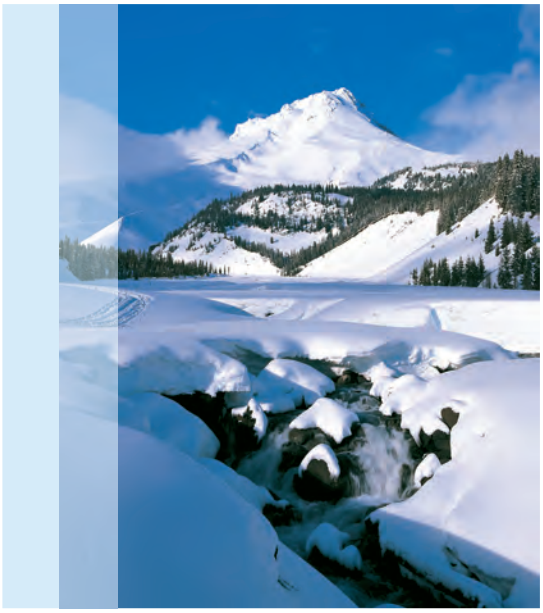
The Roaring River begins near Signal Buttes, kept separate from the Salmon River watershed by features such as Hambone Butte and Sheepshead Rock.[92] Fed by Cougar, Splintercat and Plaza Creeks, as well as the South Fork of the Roaring River, Congress designated the 13.7-mile entire stretch as Wild and Scenic in 1988.[93] In 2009, Congress designated the 4.6-mile South Fork of the Roaring River as Wild and Scenic, as well as designated the surrounding 36,768 acres as the Roaring River Wilderness.[94]

The Oak Grove Fork heads downstream in a westerly direction, originating on the Warm Springs Indian Reservation before it flows through the artificially enlarged Timothy Lake.[95] The Roaring River flows generally west through its newly designated namesake Wilderness, gaining volume from its own South Fork before joining the Clackamas River main stem just before Fish Creek joins the Clackamas as well.[96] Fish Creek flows north along the west side of Fish Creek Divide, gaining water from many smaller tributaries along its way, including Wash Creek.[97] Congress designated the entire 13.5 miles of Fish Creek as Wild and Scenic in 2009.[98]

The Collawash River generally flows north from the MHNF's southern border with Willamette National Forest toward the Clackamas main stem, fed in large part by its own Hot Springs Fork (which in turn is fed by Nohorn, Hugh and Pansy Creeks, among others).[99] The Collawash River is widely regarded as one of the least geologically stable watersheds on the MHNF due to high earthflow movement and associated landslide risk.[100] Congress designated nearly 18 miles of the Collawash as Wild and Scenic in 2009.[101]

### *White River Drainage*

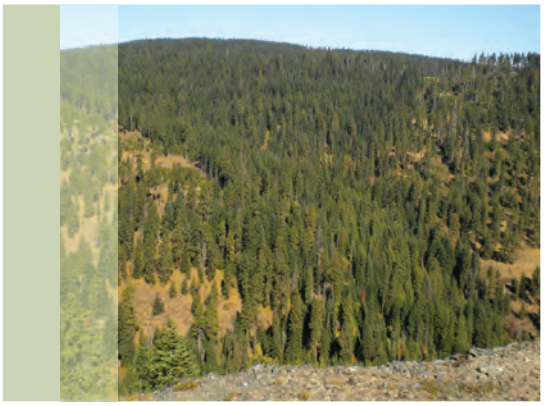
The White River flows southeast down from the White River Glacier on Mt. Hood, then curves to the east and northeast before joining the Deschutes River 22 miles or so outside the boundary of Mt. Hood National Forest.[102] During peakflows the White River carries a significant amount of glacial sediment.[103] Several streams, like Iron, Barlow, Bonney and Boulder Creeks, feed the upper White River.[104]



White River Canyon

Rock and Threemile Creeks join the White River further downstream, flowing in an easterly direction.[105] Badger and Tygh Creeks emerge from the Badger Creek Wilderness and join the White River near Tygh Valley.[106] Congress designated USFS and BLM lands adjacent to the White River as the Lower White River Wilderness in 2009.[107] Congress designated the entire White River as Wild and Scenic in 1988.[108]

The White River sub-basin epitomizes the three climate zones of the eastern half of Mt. Hood National Forest: the Crest Zone, the Transition Zone and the Eastside Zone.[109] The Crest Zone occurs at higher elevations along the Cascade Range's spine, characterized by cold, moist winters with consistent snowpack and warm dry summers.[110] Forest conditions in the Crest Zone are very similar to those west of the Cascades' spine.[111] The Transition Zone occurs at lower elevations and generally further east than the Crest Zone, characterized by cool, moist winters with inconsistent snowpack and a mix of forest conditions that include both Crest Eastside Zone traits.[112] The Eastside Zone, as implied by its name, occurs in the far eastern reaches of the White River sub-basin, characterized by cool, semi-dry winters where snowpack often does not last all winter and hot, dry summers.[113]



The Dalles Watershed

### *Fifteenmile Creek Drainage*

Mill Creek serves as The Dalles' municipal water supply.[114] Flowing parallel to the Fifteenmile Creek drainage but never joining it, Mill Creek heads northeast from its beginnings at 4,913 feet of elevation on the Mill Creek Buttes.[115] Mill Creek flows into the Columbia River in The Dalles.[116] To Mill Creek's west, the East Fork of the Hood River flows north, fed in part by Dog River.[117] The City of The Dalles diverts water from Dog River via an aqueduct to the South Fork of Mill Creek to augment its municipal water supply.[118] The South Fork of Mill Creek receives Crow Creek within the municipal watershed and MHNF boundary and a dam creates the Crow Creek Reservoir at the confluence.[119] The North Fork of Mill Creek also originates within MHNF, but joins the South Fork outside both the Forest and the Municipal Watershed boundaries.[120]

The "Miles" Creeks Watershed includes a number of streams that run nearly parallel to Fifteenmile Creek, including Fivemile and Eightmile Creeks.[121] Five- and Eightmile Creeks finally join Fifteenmile Creek just before it empties into the Columbia River east of The Dalles.[122] Ramsey Creek flows into Fifteenmile Creek before Fifteenmile reaches Dufur.[123] Fifteenmile Creek begins on the slopes of Lookout Mountain near Senecal Spring in the Badger Creek Wilderness.[124] In 2009, Congress designated an 11-mile stretch of Fifteenmile Creek from its headwaters as a Wild and Scenic River.[125]

Confluence of the Middle and East Forks of the Hood River

### *Hood River Drainage*

The Hood River drainage consists of three main forks and countless tributaries eventually merging into the main stem Hood River outside the MHNF boundary before emptying into Columbia in the City of Hood River.[126] The West Fork of the Hood River begins as glacial runoff and snowmelt on Mt. Hood's northwest slopes, fed by McGee and Ladd Creeks, which originate directly from the Glisan and Ladd Glaciers, respectively.[127] Stump Creek, flowing down from Barrett Spur, further feeds the West Fork, as does the Lake Branch the emerges from Lost Lake just to the north of the ridge separating the Bull Run Watershed from the Hood River drainage and Columbia River Gorge streams.[128]

The Middle Fork of the Hood River also begins on the slopes of Mt. Hood, emanating from Barrett Spur and the Coe and Eliot Glaciers on the mountain's north face in the Mt. Hood Wilderness.[129] The Clear, Coe and Eliot Branches merge to form the Middle Fork, which joins the East Fork of the Hood River upstream of the West Fork's confluence with the main stem.[130] Congress designated 3.7 miles of the Middle Fork as Wild and Scenic in 2009.[131]

The East Fork of the Hood River emerges from the southeast face of Mt. Hood near the Mt. Hood Meadows ski area.[132] The East Fork is further fed by streams flowing from the southeast and east slopes of Mt. Hood, with Cold Spring, Polallie, Tilly Jane and Evans Creeks entering the East Fork from the west.[133] The East Fork is also fed by streams on the west side of the Badger Creek Wilderness, Mill Creek Buttes and Surveyors Ridge (which separate Mill and the Miles Creeks and White River tributaries).[134] Congress designated 13.5 miles of the East Fork as Wild and Scenic in 2009.[135]

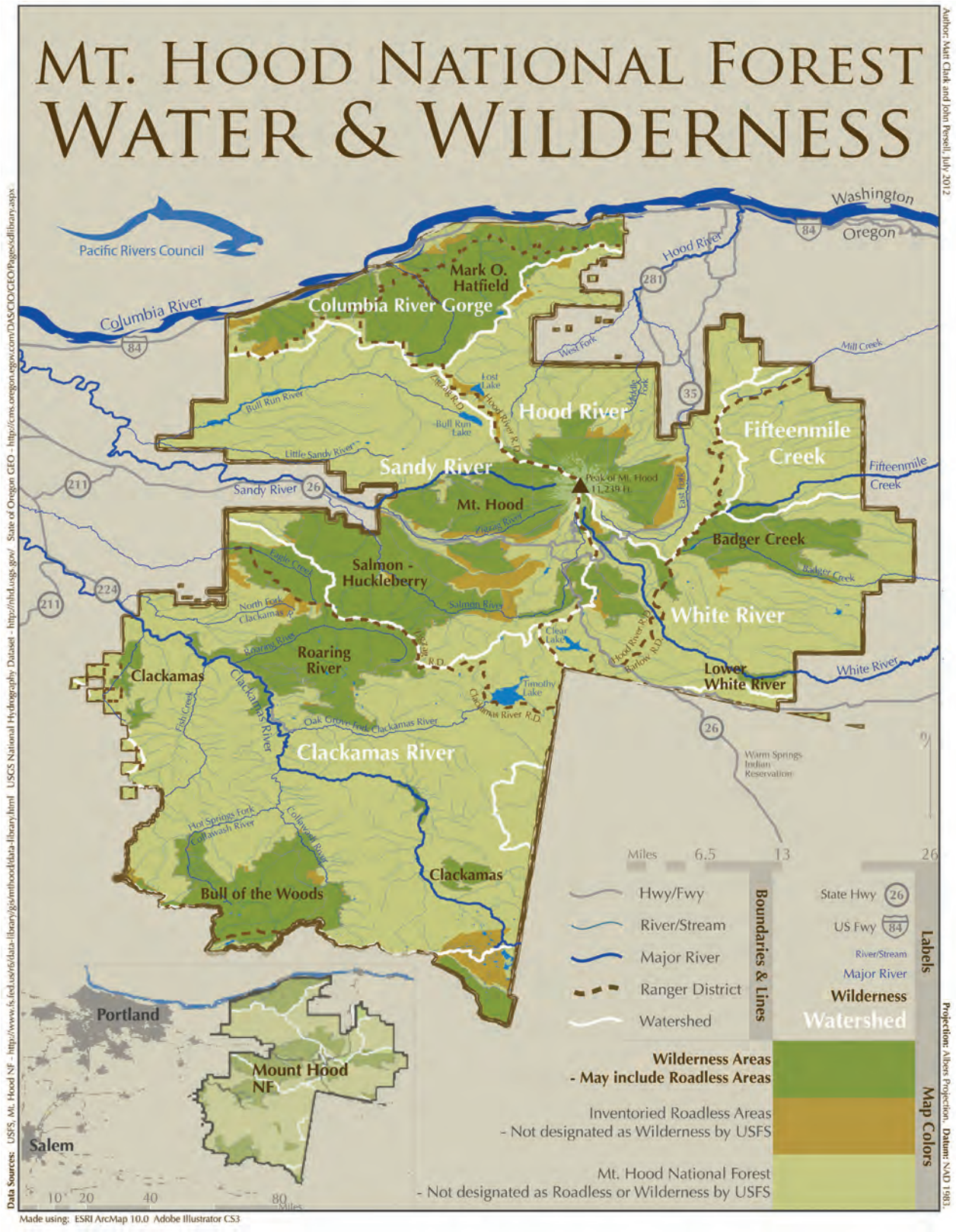
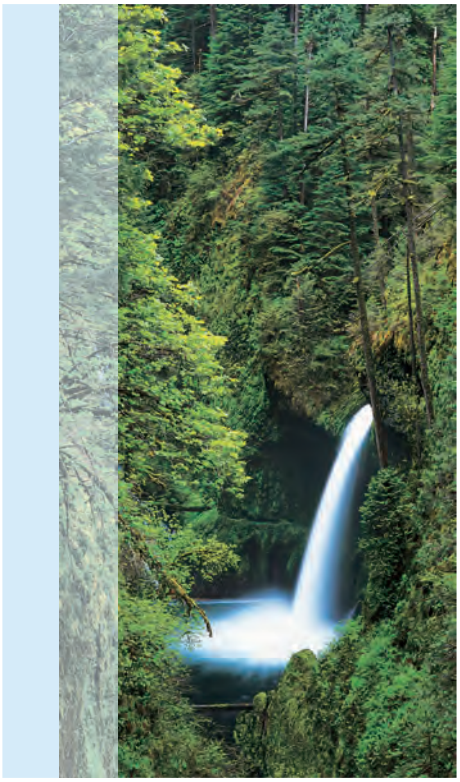



Figure 1. Mt. Hood National Forest Water and Wildness Map | Author *Matt Clark*



Metlako Falls along Eagle Creek

### *Columbia River Gorge*

Numerous streams flow down from the ridge that separates the Bull Run River's drainage from direct flow into the Columbia River.[136] Many of these streams flow directly from MHNF lands and/or pass through the Columbia River Gorge National Scenic Area, which the U.S. Forest Service manages.[137] One of the longest of these streams is Eagle Creek, not to be confused with the Clackamas River tributary of the same name.[138] Eagle Creek begins near the edge of the Mark O. Hatfield Wilderness and generally flows north-to-northwest down to the Columbia.[139] Two other significant streams also flow through this Wilderness, Tanner Creek to Eagle Creek's west and Herman Creek to Eagle Creek's east.[140]

Moffett Creek begins in the Bull Run Watershed Management Unit (but not in the Bull Run drainage) just to the southwest of the Mark O. Hatfield Wilderness.[141] Lindsey and Warren Creeks also begin on the Mark O. Hatfield Wilderness's eastern side.[142] A major characteristic of these streams, due to their location along the Columbia River Gorge with its sharp descents, is an incredibly high concentration of waterfalls, many of which prevent anadromous fish passage.[143] Congress expanded the Mark O. Hatfield Wilderness in 2009 to include much of the Oregon side of the Columbia River Gorge National Scenic Area, including the headwaters of many of the streams that create its iconic waterfalls: Multnomah, Oneonta and Horsetail.[144]

## Part Three — Watershed Stressors and Uses

### 3.1 Timber Harvest Impacts

Clearcut logging, commercial and non-commercial thinning, mechanical fuels treatments and biomass collection involve similar suites of activities, i.e., vegetation removal and forest floor disturbance, soil compaction and road use. Such activities can contribute to water quality degradation by increasing the volume and rapidity of surface runoff, erosion and sediment delivery to streams,

Meditation Point on Timothy Lake

reducing habitat value and increasing mortality of salmonids and other species.[145] They can also increase water temperature by eliminating shade provided by vegetation and increasing sun exposure.[146] Removal of vegetation and forest floor cover also eliminates sources of down wood and woody debris, necessary habitat features for most aquatic species that rely on shaded, cold water and complex habitat with pools of various depths.[147] Logging and similar activities involve the use of and often new construction of roads, even "temporary" roads, which further contributes to high erosion rates into streams.[148]

#### *Riparian Thinning*

Many riparian timber stands in the MHNF provide habitat and connectivity corridors for bird, mammal, amphibian and fish species.[149] Riparian forests influence water quality by providing necessary habitat components to streams, such as small and large woody debris through self-thinning processes and shade to keep the microclimates of pools and streams at appropriately cool temperatures for dependent species and downstream users.[150] In addition, the duff (needle mulch, leaves and other ground cover), coarse woody debris and vegetation on the floor of functioning riparian forests naturally filter and absorb precipitation runoff before it enters streams.[151] Most large woody debris (LWD) reaches streams from the directly adjacent riparian area, usually within one site-potential tree height's distance from channels.[152] However, up to 30% of LWD derives from sources beyond one site-potential tree, including trees that roll downslope, those delivered by mass failures and those toppled by secondary impact from upslope trees.[153]

Timber sale projects have been proposed and authorized by MHNF within Riparian Reserves and near headwater streams under the presumption that thinning in these areas (i.e. reducing the density of trees) will increase forest diversity or stand complexity and hasten growth of some trees, ultimately leading to greater recruitment of LWD to adjacent streams and acquisition of desired vegetation characteristics.[154] However, this premise is unlikely to be true in many cases and even when some larger trees might result, this does not occur without several decades of depleted recruitment of vital natural woody debris.[155] Further, many smaller streams do not require larger trees for woody debris delivery, but rather need smaller woody debris to restore natural pool habitat complexity.[156] Forest self-thinning processes, which deliver woody debris to streams, are not

allowed to occur at the same rate over the same time span when mechanical thinning intervenes.[157] Mechanical thinning may be unnecessary in riparian forests given the high diversity and frequency of natural stand disturbance processes that operate there, including floods, landslides, fluvial erosion, windthrow, fire, herbivory and disease.[158] As is often pointed out, riparian forests are naturally dynamic ecosystems, not static.[159] This dynamism, along with diversity of species and good growing conditions, often leads to complex, robust riparian forests without active human management.[160]

Research-derived evidence clearly shows many adverse effects are likely to occur through thinning in Riparian Reserves, including persistent soil disturbance, erosion and increased sediment delivery, reduction of near and medium-term recruitment of woody debris to streams, temperature increases due to removal of canopy, shade trees and increased sedimentation, impacts from roads created and/or used to access Riparian Reserves[161], pathogen dispersal and depletion of green tree diversity.[162] In addition, in some circumstances, the effects of fire within a Riparian Reserve can be intensified following thinning activities.[163] In contrast, evidence for net ecological benefits resulting from riparian thinning is sparse and speculative.[164]

Eastside vegetation treatment

### *Mechanical Fuel Treatments*

Mechanical fuel treatments are at times proposed by MHNF, or on occasion, requested by water managers, to reduce the hazards of high-severity fire and associated impacts to streams, species, municipal water supplies and timber resources.[165] The fire regime on the west side of MHNF is generally one of high severity but low frequency.[166] The stands in this part of the Forest have likely not had their natural fire regimes altered, in contrast with the east side.[167] Weather primarily controls fire behavior and frequency in this fire regime.[168]

The east side of MHNF generally has a mixed severity fire regime. It is not always clear that fire behavior is operating outside the historic patterns for these fire regimes, or that the regimes have been majorly altered.[169] Weather and fuel conditions both control fire behavior in this regime, but extreme weather and climate can override fuel conditions.[170]

Unlike the Portland Water Bureau's management of the Bull Run Watershed on the west side of the Forest, the City of The Dalles advocates for a great deal of active management of its namesake Watershed to lessen potential impacts to its water supply from wildfire.[171] Scientific reviews have urged caution in undertaking such treatment projects, as the likelihood of a treated area actually being visited by a wildfire within the time period in which the treatment might be effective is very low.[172] Further, the actual effectiveness of such treatments can easily be outweighed by the ecological costs to watersheds from increased sediment delivery, runoff, erosion and temperature that often accompany associated vegetation removal and forest floor disturbance, soil compaction and road building and transportation.[173] In addition, fire impacts are typically transient and convey aquatic benefits such as down wood.

Given the slim likelihood of fire visiting any treated area within the period of a treatment's effectiveness, fuel treatments generally would need to be repeated on approximately a 20-year cycle indefinitely to actually align with the location of a wildfire in the future.[174] Although fire can produce relatively temporary adverse effects on streams, fuel treatments do not serve primary restoration measures identified by scientists as necessary to improve water quality, channel form and aquatic habitats.[175] Fuel treatments do not address road impacts and actually exacerbate

them by requiring continued or expanded use of roads in treated areas.[176] Fuel treatments do not address other common stressors to watersheds, such as grazing impacts and water withdrawals.[177] Fuel treatments do not generally help reestablish habitat and population connectivity and may hinder it in many cases.[178]

While wildfires can have significant impacts on streams[179], the actual likelihood of a wildfire occurring in a given place and the duration of any resulting adverse impacts should be fully considered and disclosed to stakeholders and the general public, as well as compared and contrasted with the ecological and fiscal costs and benefits of mechanical treatments.

### *Biomass Collection*

Biomass collection, i.e., gathering logs and branches through mechanical and other means, has begun to be implemented on the Mt. Hood National Forest, often in connection with fuel treatments.[180] In these operations, leftover tree components not sold as commercial logs or other products are collected, turned into wood chips and sold and combusted for electricity generation purposes.[181] Some concern exists that biomass collection might be implemented on the MHNF not merely in conjunction with fuel reduction but for the primary purpose of revenue generation. Whether associated with fuel reduction and other thinning operations or done as a primary goal, biomass collection produces a similar suite of impacts as other forms of timber harvest—road use, construction, reconstruction and maintenance and soil disturbance, erosion and sediment delivery to streams. Overall, the ecological costs of biomass collection likely exceed its benefits.[182] Research also shows large-scale biomass energy production is not greenhouse gas neutral, but ultimately reduces carbon storage and increases emissions.[183] While biomass may seem a logical use of tree parts otherwise burned on location or left behind following logging operations and a means by which to reduce use of fossil fuels for energy, the net social and ecological benefits should be weighed carefully against the net social and ecological costs.

Sediment delivery from culvert near No Whisky Creek

## 3.2 Road Network Impacts

Road networks, including landings, have multiple adverse impacts on watershed functions and their aquatic and terrestrial habitats and biota.[184] Road construction and use greatly compact soils.[185] Roads are the leading cause of water quality impairment on forestlands nationwide and present one of the major sources of increased sediment delivery.[186] Roads directly affect natural sediment and hydrologic regimes by altering streamflow, sediment loading, sediment transport and deposition, channel morphology, channel stability, substrate composition, stream temperatures, water quality and riparian conditions within a watershed.[187] Roads damage watershed integrity by intercepting rainfall, concentrating flow and diverting water from natural flowpaths.[188] Runoff converted to surface flows in roadside ditches warms water rapidly prior to entering streams.[189] Elevated summer stream temperatures negatively affect salmonids and amphibians.[190]

Surface erosion, road-related landslides and stream channel diversion over roadways can deliver large amounts of sediment into streams.[191] Roads-produced fine sediments reduce pool volumes, increase channel widths and exacerbate seasonal temperature extremes.[192] Pools provide multiple habitat functions and are an essential habitat for native salmonids at a variety of lifestages; loss of pool volume and quality thus negatively affects native salmonids.[193] Especially following storms,

sediment delivery from roads can be catastrophic and reduce survival rates of eggs and juvenile fish, reduce food availability for aquatic species and reduce aquatic habitat generally.[194]

Further, road stream crossings are a common migration barrier for fish[195] and increasing numbers of culverts correlate with decreased fish densities.[196] Riparian vegetation removal and reduction in riparian canopy cover associated with roads can elevate stream temperatures beyond the range for rearing, increase susceptibility of fishes to disease, reduce metabolic efficiency, shift species assemblages and inhibit upstream migrations.[197]

Watershed Analyses prepared by MHNF following adoption of the Northwest Forest Plan echo these findings:

*Fish Creek Watershed*[198]

- Roads create disturbances on the landscape that are not replicated by natural factors
- Roads cause steep slopes to be less stable
- Roads contribute sediment to stream systems from road surfaces and cutslope surfaces
- Roads interrupt the surface and subsurface flow of water to stream channels, affecting baseflow and peakflow characteristics
- Impacts to water quality occur when roads deliver sediment directly to stream systems at road crossings through runoff generated in road ditch lines delivered directly to stream systems
- Roads located in close proximity to streams can deliver sediment to stream channels from culvert outflow
- Timber harvest and road construction have increased rates of mass wasting
- Rates of landslide originating from harvested areas and road locations are approximately three times natural levels
- In managed terrain, debris slides were roughly twice as common as debris flows, while debris flows were more than three times as common as debris slides in unmanaged terrain

*Eagle Creek Watershed*[199]

- Roads deliver chronic levels of sediment to streams over long periods of time from unvegetated cutslopes and running surfaces
- Impacts to water quality occur where road crossings directly deliver sediment to stream systems through runoff accumulated in road ditch lines
- Roads located in close proximity to streams can deliver sediment via overland flow to stream channels from culvert outflow
- Historically, sediment delivery was more episodic than continual, with high levels of delivery occurring during periods when there had been recent large-scale fires and/or floods
- Causal agents for natural sediment delivery were rain-on-snow events, floods and landslides

Decommissioned road in the Clackamas River Ranger District

*Collawash River Watershed*[200]

- The dominant processes contributing to sediment production from roads are cut bank- and fill slope-related erosion and erosion related to concentrated flows
- Upland forest sites that were not a source of sediment in the past are now sites of chronic production
- Pathways for sediment transport have been enlarged by road drainage systems

In 2000, the U.S. Forest Service promulgated the "Roads Rule" for the National Forest System, requiring the identification of a minimum road system for each NFS unit.[201] MHNF issued its Roads Analysis in 2003, which acknowledged its previous 1999 Access and Travel Management Plan showed 49% of classified roads are already closed or could be closed or decommissioned.[202] In 2005, the agency promulgated the Travel Management Rule, requiring each unit of the National Forest System (or districts within units) to devise travel management plans to restrict cross-country travel of motorized vehicles.[203] Over-snow travel management plans must also be adopted eventually.[204] Mt. Hood National Forest recently published its Motor Vehicle Use Map (MVUM) as the culmination of the first stage of Travel Management Rule compliance, closing certain roads to motorized use and keeping others open and restricting cross-country motorized travel.[205] MHNF also recently adopted its Off-Highway Vehicle (OHV) Plan, limiting the locations in which OHV users can lawfully ride such vehicles on the Forest.[206]

As noted, the Roads Rule and Travel Management Rule contain provisions requiring analysis and determination of road impacts and minimization of those impacts.[207] In 2008, Congress appropriated funds to begin tackling road impacts across the National Forest System as part of the Legacy Roads and Trails Remediation Initiative.[208] Region 6 of the U.S. Forest Service, or the Pacific Northwest Region, received a large portion of these appropriated funds, as it had already made significant progress in determining road segments' impacts and future necessity and also

had extensive road networks leftover from previous decades when timber harvest was at a much higher rate.[209] With the listing of several Pacific Northwest salmonid species under the Endangered Species Act and the recognition that sediment delivery from roads to streams impeded recovery of those species, road decommissioning began in earnest on the Mt. Hood National Forest and other units in the Pacific Northwest Region.[210]

Across the MHNF, the open road mileage has decreased from around 4,000 miles to approximately 3,400 miles following implementation of two of six increments of road decommissioning planned for the Forest.[211] Of the remaining 3,400 miles of open roads, 62% have been reviewed and analyzed for future use or closure under the National Environmental Policy Act (NEPA).[212] 746 miles are planned for long-term closures, a reduction of over one-fifth of the open system road network.[213] In the spring of 2012, MHNF announced planning work on Increment 4 of the series of road decommissioning environmental assessments had stalled due to lack of funding.[214] The fate of Increments 4, 5 and 6 of the planned series remains uncertain.

Closed and non-system roads continue to have impacts, particularly if not hydrologically disconnected from streams. On the Mt. Hood and in other units of the National Forest System, roads no longer in use by the Forest Service are often removed from the open road network database, even if future use is anticipated, providing a false impression of the actual number of miles of road that exist on the landscape.[215] In addition, some user-created or long-abandoned routes might not be in the agency's database of roads. This ghost road network continues to impact watersheds even when particular road segments are not actively used, especially if they have not been storm-proofed to hydrologically disconnect them from stream channels.

Road density is often used to quantify the impact of roads on a given area.[216] Multiple studies have demonstrated that there is no "safe" level of road density.[217] "Negative impacts begin to accrue and be expressed with incursion of the very first road segment" in an area.[218] Low road densities (<0.1 mile of road per square mile) are generally associated with low degradation of watersheds, while areas with >0.7 mile of road per square mile are generally associated with high degradation.[219] Portions of MHNF have road densities approaching five miles per square mile.[220] Calculations of road density based only on open and/or system roads underestimate actual road density and attendant impacts. While road density is not the only relevant metric to assess human impacts on watersheds, aquatic habitats and species, it is a reliable, easily measureable and highly predictive indicator of watershed impairment.[221]

### 3.3 Grazing Impacts

Grazing occurs on approximately 15% of the total acreage of Mt. Hood National Forest, or 159,877.[222] At the time MHNF adopted its Forest Plan in 1990, the Forest Service listed nine grazing allotments on the Forest,[223] but identified only six on the map included in the Plan.[224] The six grazing allotments identified on the Plan's map continue to be managed by the Forest Service today, but one, the Clackamas Lake Allotment, in the Clackamas River and Zigzag Ranger Districts, has been vacant since 1995.[225] Of the five active grazing allotments, the Wapinitia Allotment lies in both the Zigzag and Hood River Ranger Districts, the White River Allotment lies in both the Hood River and Barlow Ranger Districts, the Badger and Grasshopper Allotments lie in the Barlow Ranger District and the Long Prairie Allotment lies in the Hood River Ranger District.[226]

Grazing has numerous negative impacts on watersheds, riparian areas, water quality and aquatic systems and management approaches can exacerbate such impacts based on the intensity, timing and location of authorized grazing.[227] Grazing leads to vegetation depletion, commonly concentrated and most intense in riparian areas, resulting in bank damage, elevated sedimentation, reduced stream shading, increased water temperature and reduced habitat complexity and quality.[228] Grazing, especially when it occurs in wet conditions, compacts soils, reducing their ability to store water.[229]

Several streams flowing through grazing allotments have been listed as impaired under the Clean Water Act, as they are not meeting state water quality standards for sedimentation and temperature.[230]


Cut bank in the Long Prairie Allotment

Watershed Analyses prepared following adoption of the Northwest Forest Plan revealed uncontrolled riparian livestock grazing in the Salmon River, Oak Grove Fork, Miles Creeks and White River Watersheds.[231] The extended vacancy of the Clackamas Lake Allotment has likely allowed significant recovery of the riparian areas from grazing impacts in the Oak Grove Fork Watershed. Recommendations in Watershed Analyses for the Salmon River and Miles Creeks Watersheds to prevent erosion from grazing included installation of grazing enclosures in riparian areas, exclusion of livestock from sensitive riparian areas and use of water gaps and/or out-of-channel water developments for livestock.[232] The White River Watershed Analysis recommended the development of a monitoring program to specifically assess physical damage to Riparian Reserves caused by cattle, as well as exclusion of grazing around young cottonwood and aspen seedlings and sprouts.[233]

### 3.4 Fire Impacts

Natural fire regimes vary across Mount Hood National Forest based on inter-related factors including precipitation patterns, vegetation types and elevation. Generally, the east side of the Forest is drier and more prone to fires than the wetter west side, with the highest ridges and peaks of the Cascade Range forming an imperfect and permeable dividing line between the two generalized climate types. The west side of MHNF primarily lies within a natural fire regime with relatively infrequent, high-severity fires.[234] The east side, meanwhile, primarily lies within a more mixed severity and frequency fire regime.[235]


Fire near Tilly Jane

In general, fire poses less of a threat to watershed processes and functions than other more commonly occurring stressors, including roads and grazing.[236] Fire does not typically target riparian areas along streams.[237] Riparian area topography, microclimate, fuel moisture and, at times, forest type mean they burn less frequently and at lower severities than areas further from the edges of streams.[238] The potential adverse effects of a high severity fire on a watershed include soil erosion and topsoil loss.[239] However, fire's "effects on runoff and soil hydrology are transient, seldom lasting more than three years."[240] Fire, in contrast to roads and grazing, actually provides both terrestrial and aquatic benefits, such as snags and large woody debris.[241]

### 3.5 Recreation Impacts

The Forest receives four and a half million visits each year, usually for recreational purposes.[242] Many of these visits occur at the historic Timberline Lodge.[243] Essentially all of these visitors arrive in passenger vehicles, using various levels of Forest system and non-system roads to reach their destinations on the MHNF. Four and a half million annual visitors translates to a significant percentage of the road network's use (including closed roads that still exist on the landscape), adding to sediment delivery into streams and erosion issues that accompany road existence, maintenance and use. Lawful and unlawful off-highway vehicle use can adversely impact streams through compaction of soils, erosion and sediment delivery.[244] Recreation and campsites near riparian areas are especially susceptible to alterations in natural vegetation and bank stability.[245]

Off-road vehicle use of skid trails near La Dee Flat

But recreation by Forest-users can impact riparian and aquatic areas in a number of ways aside from vehicle use and camping. Many forms of recreation on the Forest focus on water, including boating, personal watercraft, canoeing, kayaking and rafting, as well as crossing streams while hiking or wading, swimming, soaking in hot springs and fishing.[246] Such forms of recreation bring humans in direct contact with Forest water sources. Use of motorboats can deliver oil and gasoline into water bodies, as can passenger vehicles and off-road vehicles when used in relative proximity to streams and areas of runoff delivery.[247] As noted, a very high percentage of MHNF provides drinking water.[248] While dilution of chemicals and pollutants across a watershed may occur such that they pose little threat downstream, discharges can rise to a level at which point municipal treatment costs increase.

Concerns about human waste from dispersed camping entering streams were identified in some MHNF Watershed Analyses.[249] Some parts of the Forest, such as the Bull Run Watershed Management Unit and The Dalles Watershed, are restricted from general visits by the public to protect the quality of the municipal supplies.[250] Some concern also exists regarding the nearly one million pounds of salt operators of Timberline Lodge apply to the Palmer Snowfield during summer months to create appropriate recreational and educational skiing and snowboarding conditions.[251] Such a large amount of salt is likely to unnaturally raise chloride levels in streams originating from the Palmer's snowmelt, particularly the Salmon River and one of its tributaries, Still Creek. According to a 2004 study by the U.S. Geological Survey, chloride levels in the Salmon River are well above what can be accounted for by precipitation[252], but below EPA limits.[253] According to Robert Jackson, an ecology professor at Duke university, "[c]hloride concentrations take decades to build up."[254]

Diversion of the Oak Grove Fork near Lake Harriet

### 3.6 Hydroelectricity

Hydroelectricity generation through the impoundment of streams, i.e., "dams," is a relatively common use of water resources on Mt. Hood National Forest.[255] Many of the major drainage basins encompassing and surrounding the Forest have impoundments and diversions both within and outside the Forest boundary operated by entities such as Portland General Electric, PacifiCorp, the Eugene Water and Electric Board.[256]

Some well-known features on the Forest, including Timothy Lake and Lake Harriet, along the Oak Grove Fork of the Clackamas River, are the result of impoundments for hydroelectric purposes.[257] The Oak Grove Fork's volume is significantly withdrawn at Lake Harriet and channeled via a pipeline to a Portland General Electric power station.[258] Relatively new certifications from the Federal Energy Regulatory Commission and the Oregon Department of Environmental Quality obtained by PGE requires the company to leave at least 270 cubic feet per second in the Oak Grove Fork's natural channel for aquatic species habitat, an increase from previous hydroelectric license requirements.[259]

Some hydroelectric projects on streams originating from Mt. Hood National Forest have been decommissioned, including the Little Sandy Dam on the Little Sandy River and the Marmot Dam on the Sandy River[260] and the White River Falls Dam on the White River.[261]

Hydroelectric projects and associated impoundments and diversions significantly alter flow regimes of streams, resulting in changes to hydrologic, riparian and aquatic conditions for many species' habitats.[262] Dams and similar barriers can block migration of fish species, change the depth of historic spawning areas, alter water temperatures and result in changed predation patterns and food availability.[263] Fish passage facilities associated with dams and impoundments tend to vary in design criteria, usage and effectiveness for fish survival.[264]

### 3.7 Municipal Water Use

The Forest Service as a whole acknowledges that "[p]roviding cold, clear waters of high quality" for both "aquatic organisms and human use is probably the proper focus for managing water on the National Forest System," recognizing that clean water benefits both humans and other species. [265] MHNF recognizes that a very high percentage of the Forest provides drinking water to someone.[266] Many surrounding communities rely on streams and springs emerging from Mt. Hood National Forest for municipal water supplies, including the following[267]:

| Stream | Managing Entity and/or Served Municipalities |
|---|---|
| Bull Run River | *Portland Water Bureau (Cities of Portland, Gresham, Tigard, etc.)* |
| Alder Creek | *City of Sandy (alternate source)* |
| Gordon Creek | *City of Corbett* |
| Henry Creek | *Rhododendron Summer Homes* |
| Clackamas River | *Clackamas River Water (parts of Milwaukie, Sunnyside, and Clackamas), North Clackamas County Water Commission, and South Fork Water Board; Sunrise Water Authority (communities of Happy Valley and Damascus and some unincorporated areas in Clackamas County), Oak Lodge Water District, Cities of Estacada, Lake Oswego, Oregon City, West Linn, Gladstone, Forest Service Timber Lake Job Corps Center* |
| Dog River, Mill Creek | *City of The Dalles* |
| Fifteenmile Creek | *City of Dufur* |
| Springs near Lost Lake | *City of Hood River* |
| Weygandt Canyon | *Crystal Springs Water District (Cities of Parkdale, Odell, and unincorporated Upper Hood River Valley)* |

MHNF has an agreement with the Portland Water Bureau regarding the Bull Run Watershed Management Unit[268] setting forth a management plan in compliance with Bull Run-specific congressional legislation.[269] A memorandum of understanding between The Dalles and MHNF also exists for Mill Creek, The Dalles' municipal watershed, dating back to 1972, providing that water quality is the primary resource for which it is managed.[270] A similar 1912 agreement for the watershed between the City of The Dalles and the Secretary of Agriculture preceded the current memorandum of understanding.[271] For both the Bull Run and Mill Creek watersheds, public access is greatly restricted to prevent tampering with or contamination of the respective municipal water sources.[272]

The management schemes laid out in applicable legislation and agreements for the Bull Run and Mill Creek lie in stark contrast. Whereas timber harvest activities of nearly all types are now strictly prohibited in the Bull Run by federal legislation[273], The Dalles Municipal Watershed agreement advocates for active fuels treatments (i.e., logging) to prevent or lessen the severity of wildfire threats to its water supply.[274] Mill Creek and the Bull Run River lie on opposite sides of the Forest and encompass different precipitation zones and fire regimes.[275] Still, the contrast in management is notable: in the Bull Run Watershed active vegetation management is essentially prohibited to prevent sediment delivery, but in Mill Creek active vegetation management is promoted to do the same.

Past fires caused a cessation of service to The Dalles water users for periods of time due to resulting sediment delivery.[276] A major 1996 rain-on-snow event following previous extensive timber harvest

in the Bull Run Watershed similarly inundated the Portland Water Bureau's system with muddy water, prompting the Bureau to switch to its alternate groundwater source for a period and leading to further congressional restrictions of management activities within the Watershed.[277]

Federal legislation prohibits timber harvest in the Bull Run Watershed Management Unit except to enhance water quantity or water quality.[278] Both the City of Portland and the Forest Service "agree

Bull Run Reservoir 1

that a vigorous fire protection and suppression program is required" for the Bull Run.[279] The Bull Run Management Agreement provides that the Forest Service "will retain primary responsibility for a comprehensive fire protection program" for the Unit.[280]

Other municipalities relying on water originating from the MHNF often have withdrawal points outside the national forest boundary, but nonetheless engage with the Forest Service through the Clackamas River Water Providers, Clackamas River Basin Council, Clackamas Stewardship Partners and other such entities that provide comments, suggestions and feedback on MHNF management of their water sources.

### 3.8 Non-municipal and Non-hydroelectric Water Rights

The Oregon Water Resources Department (OWRD) administers the State's water rights scheme.[281] Along with private domestic users, irrigators and industrial users, government entities, including the Forest Service, have secured rights to water originating from the MHNF.[282] Portions of the MHNF have had all water rights adjudicated, mainly on the east side (Hood River, Fifteenmile Creek and White River Basins), while others on the west side of MHNF, including the Sandy River and Clackamas River Basins, have not.[283] Adjudication in the context of water rights refers to the legal process by which

rights that arose before the 1909 adoption of Oregon's water code are quantified and documented in a court.[284] As climate and precipitation patterns change in the future, water rights holders may place greater demand on MHNF-originating streams, seeking to appropriate the full amount to which they are entitled.

Washout of Lolo Pass Road by the Sandy River after rain and snow event, January 2011

### 3.9 Macro-effects of Climate Change and Population Growth

Many simulation models suggest precipitation and temperature patterns will change in the Pacific Northwest in coming decades. The region could become drier if total precipitation decreases, but remain relatively wet compared to other parts of the country. The timing and type of precipitation is also likely to change, leading to more rainfall instead of snowfall and more rain-on-snow events and snowmelt could occur at earlier times and in higher volumes over shorter periods of time if average temperatures and sun exposure increase, altering peak and low-flow patterns for streams.[285]

Climate change is predicted to result in more flood events and fires across the Pacific Northwest.[286] Flood events could lead to greater egg mortality for native fish species.[287] Increased stream temperatures could prove lethal to salmon and trout.[288] Reduced summer flows due to earlier spring melting could force native fish species into fewer channels and less diverse habitats due to decreased usable habitat overall.[289] Increased stream temperatures could favor other species adapted to warmer water, leading to increased competition and predation on native salmonids.[290] Studies show a diversity of habitat conditions across the Forest will be needed for salmonid population stability in the face of these anticipated climate change effects.[291] The higher-elevation, relatively well-connected habitats on the MHNF will become even more important to maintain to support salmonid survival and recovery in the face of climate change and temperature increases.[292]

At the same time that climate change may alter ecosystems through precipitation and temperature changes, the region's relatively wet climate with established and protected supplies of water could bring an influx of "climate refugees" from already arid parts of the country that scientists expect to become even drier, such as the Southwest. Due to the Portland metropolitan area's proximity to MHNF and relatively safe water supply from the Bull Run River, the Cities of Portland, Gresham, Tigard and Beaverton can be expected to place further demands on the Portland Water Bureau as their populations grow. Similarly, Clackamas River Water Providers will likely see significant population growth in municipalities drawing water from that basin, raising long-term concerns about water storage and quality and implications for non-municipal users and species that also rely on the Clackamas River.

# Part Four — Legal and Policy Mandates and Current Management Direction

## 4.1 National Forest Management Act

The National Forest Management Act (NFMA) of 1976 amended the Forest, Rangeland and Renewable Resources Act.[293] NFMA affirmed mandates from the 1897 Organic Administrative Act and the 1960 Multiple-Use and Sustained Yield Act (MUSYA) that the Forest Service must manage units of the National Forest System for water, wildlife and recreation, as well as timber.[294]

### *Forest Plans and NFMA Regulations*

NFMA requires the Forest Service to devise and periodically revise land and resource management plans (forest plans) for each unit of the National Forest System.[295] NFMA requires the Forest Service to provide habitat for diverse plant and animal communities.[296] The Forest Service promulgated regulations to implement NFMA several times over the past 30 years.[297] The 1982 regulations stood in place until 2000, when new regulations were adopted.[298] The Forest Service adopted new regulations in 2005 and 2008 as well, but both sets were struck down as unlawful by a federal court in California.[299] The 2000 regulations were reinstated while the current administration finalized new implementing regulations.[300] The Forest Service just published final new regulations on April 9, 2012.[301]

Most forest plans currently in place, including Mt. Hood National Forest's, were devised under the 1982 regulations. The 1982 regulations required the Forest Service to maintain the viability of native and desired non-native plant and vertebrate species.[302] The Forest Service generally asserts it has jurisdiction over habitat, but not the species themselves, which are managed by state agencies.[303]

### *2012 NFMA Regulations*

All plan revisions initiated after May 9, 2012, must conform to the requirements of the 2012 planning regulations (rule).[304] The 2012 rule establishes that its purpose is to "guide the collaborative and science-based development, amendment and revision of land management plans that promote the ecological integrity of national forests . . . so that they are ecologically sustainable and contribute to social and economic sustainability."[305] Further, plans revised under the 2012 rule will guide management of national forests so they "consist of ecosystems and watersheds with ecological integrity and diverse plant and animal communities; and have the capacity to provide people and communities with ecosystem services and multiple uses that provide a range of social, economic and ecological benefits for the present and into the future."[306] The 2012 rule specifies that such "benefits include clean air and water; habitat for fish, wildlife and plant communities; and opportunities for recreational, spiritual, educational and cultural benefits."[307]

The 2012 rule requires the Forest Service to "use the best available scientific information to inform the planning process" laid out in the rule's provisions.[308] The Forest Service must "[i]dentify what information was determined to be the best available scientific information, explain the basis for that determination and explain how the information was applied to the issues considered."[309]

Section 219.8 of the 2012 rule requires that "plan[s] must provide for social, economic and ecological sustainability within Forest Service authority and consistent with the inherent capability of the plan area" by including standards and guidelines and other components "to maintain or restore the ecological integrity of terrestrial and aquatic ecosystems and watersheds in the plan area," including "structure, function, composition and connectivity."[310] The 2012 rule recognizes and directs the Forest Service to take into account[311]:

(i) Interdependence of terrestrial and aquatic ecosystems in the plan area.

(ii) Contributions of the plan area to ecological conditions within the broader landscape influenced by the plan area.

(iii) Conditions in the broader landscape that may influence sustainability of resources and ecosystems within the plan area.

(iv) System drivers, including dominant ecological processes, disturbance regimes and stressors, such as natural succession, wildland fire, invasive species and climate change; and the ability of terrestrial and aquatic ecosystems on the plan area to adapt to change.

(v) Wildland fire and opportunities to restore fire adapted ecosystems.

(vi) Opportunities for landscape scale restoration.

The 2012 rule also requires plans to include protections "to maintain or restore"[312]:

(i) Air quality.

(ii) Soils and soil productivity, including guidance to reduce soil erosion and sedimentation.

(iii) Water quality.

(iv) Water resources in the plan area, including lakes, streams and wetlands; ground water; public water supplies; sole source aquifers; source water protection areas; and other sources of drinking water (including guidance to prevent or mitigate detrimental changes in quantity, quality and availability).

Further, the 2012 rule requires plans "to maintain or restores the ecological integrity of riparian areas in the plan area," including "structure, function, composition and connectivity, taking into account"[313]:

- water temperature and chemical composition;
- blockages (uncharacteristic and characteristic) of water courses;
- deposits of sediment;
- aquatic and terrestrial habitats;
- ecological connectivity;
- restoration needs; and
- floodplain values and risk of flood loss.

The 2012 rule defines "riparian areas" as "[t]hree-dimensional ecotones of interaction that include terrestrial and aquatic ecosystems that extend down into the groundwater, up above the canopy, outward across the floodplain, up the near-slopes that drain to the water, laterally into the terrestrial ecosystem and along the water course at variable widths."[314]

Plans revised under the 2012 rule "must establish width(s) for riparian management zones around all lakes, perennial and intermittent streams and open water wetlands . . . giving special attention to land and vegetation for approximately 100 feet from the edges of all perennial streams and lakes."[315] These widths "may vary based on ecological or geomorphic factors or type of water body," but "will apply unless replaced by a site-specific delineation of the riparian area."[316] A "riparian management zone" is defined in the 2012 rule as "[p]ortions of a watershed where riparian-dependent

resources receive primary emphasis and for which plans include plan components to maintain or restore riparian functions and ecological functions."[317]

Under the 2012 rule, plans "must ensure that no management practices causing detrimental changes in water temperature or chemical composition, blockages of water courses, or deposits of sediment that seriously and adversely affect water conditions or fish habitat shall be permitted within the riparian management zones or the site-specific delineated riparian areas."[318] The 2012 rule requires the Forest Service to "establish requirements for national best management practices for water quality," and plans revised under the 2012 rule "must ensure implementation of these practices."[319]

Instead of requiring the Forest Service to maintain the viability of all native and desired non-native species, as the 1982 regulations required, the 2012 rule requires the agency to "maintain a viable population of species of conservation concern within the plan area" by "provid[ing] the ecological conditions necessary" for those species' viability.[320] The 2012 rule defines a "species of conservation concern" as "a species, other than federally recognized threatened, endangered, proposed, or candidate species, that is known to occur in the plan area and for which the regional forester has determined that the best available scientific information indicates substantial concern about the species' capability to persist over the long-term in the plan area."[321] The 2012 rule requires the Forest Service to "provide the ecological conditions necessary to: contribute to the recovery of federally listed threatened and endangered species," including Chinook and coho salmon and steelhead trout and "conserve proposed and candidate species."[322] To maintain the viability of species of conservation concern, contribute to the recovery of listed species and conserve proposed and candidate species, the Forest Service must "maintain or restore the ecological integrity of terrestrial and aquatic ecosystems and watersheds in the plan area," including "structure, function, composition and connectivity."[323] Plans must "maintain or restore the diversity of ecosystems and habitat types throughout the plan area."[324] This further includes "[k]ey characteristics associated with terrestrial and aquatic ecosystem types" and "[r]are aquatic and terrestrial plant and animal communities."

Because the Forest Service has a multiple-use mandate from the Organic Administrative Act, MUSYA and NFMA, the 2012 rule directs the Forest Service to ensure plans "provide for ecosystem services and multiple uses, including outdoor recreation, range, timber, watershed, wildlife and fish."[325]

To accomplish this, plans must use "integrated resource management," considering"[326]

> *Aesthetic values, air quality, cultural and heritage resources, ecosystem services, fish and wildlife species, forage, geologic features, grazing and rangelands, habitat and habitat connectivity, recreation settings and opportunities, riparian areas, scenery, soil, surface and subsurface water quality, timber, trails, vegetation, viewsheds, wilderness, and other relevant resources and uses.*

"Integrated resource management" must also consider "[a]ppropriate placement and sustainable management of infrastructure, such as recreational facilities and transportation and utility corridors."[327] In addition, the Forest Service must consider "[h]abitat conditions… for wildlife, fish and plants commonly enjoyed and used by the public,"[328] "[r]easonably foreseeable risks to ecological, social and economic sustainability,"[329] "dominant ecological processes, disturbance regimes and stressors,"[330] "[p]ublic water supplies and associated water quality,"[331] and provide for "[s]ustainable recreation."[332] Plans revised under the 2012 rule must protect designated wilderness and recommended wilderness[333] as well as designated wild and scenic rivers and eligible rivers.[334]

### 4.2 Endangered Species Act

The Endangered Species Act of 1973 set forth a statutory scheme charging the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) with protection of species listed pursuant to Section 4 of the Act as "endangered" or "threatened."[335] USFWS has jurisdiction over terrestrial and non-anadromous aquatic species (fish species that do not spend part of their lives in the sea), while NMFS has jurisdiction over marine species and anadromous fish species (those that do spend part of their lives in the sea). Section 9 of the ESA prohibits the "take" of any species listed as "endangered" by any person or entity.[336] By regulation, implementing agencies prohibit the "take" of most species listed as "threatened" as well.[337] "Take" is defined as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct."[338]

Spawning salmon

Several fish species on the Mt. Hood National Forest have been listed as threatened under the ESA: coho salmon[339], spring Chinook salmon[340] and winter steelhead.[341] The Forest Service must refrain from any actions that jeopardize their survival or recovery.[342] USFWS and the Oregon Department of Fish and Wildlife (ODFW) also recently reintroduced the endangered bull trout to the Clackamas River in Mount Hood National Forest under Section 10(j) of the ESA.[343] Section 10(j) allows for reintroductions of listed species as "experimental" and "non-essential," such that many of the ESA's provisions do not apply to the reintroduced population.[344]

Section 7 of the ESA requires the Forest Service to consult with either USFWS or NMFS before undertaking any action that might jeopardize the survival or recovery of a listed species.[345] Such consultation can be either informal or formal. Informal consultation occurs when the Forest Service proposes actions that it believes are not likely to adversely affect listed species.[346] The Forest Service must receive a concurrence letter confirming that USFWS or NMFS agrees the proposed actions will not adversely affect listed species.[347] Formal consultation occurs when proposed actions are likely to adversely affect listed species, typically as determined by an action agency through a biological assessment shared with either USFWS or NMFS, depending on the species.[348] If the consulted agency determines through a biological opinion (BiOp) the action will in fact jeopardize the survival or recovery of a listed species, the Forest Service must alter its proposal so as to avoid such jeopardy.[349] If the consulted agency determines the action will not jeopardize the survival or recovery of a listed species, the Forest Service may proceed with the action.[350]

In recent years, MHNF has attempted to structure its projects to avoid the need for formal consultation. To do this, the Forest Service attempts to ensure any proposed actions are not likely to adversely affect listed species, including coho, Chinook and steelhead.[351] NMFS has generally concurred with the Forest Service and provided programmatic design criteria to avoid the likelihood of adverse effects.[352] For example, the Jazz Thin Preliminary Assessment from the Clackamas River Ranger District lists the following design criteria drawn from a NMFS letter of concurrence[353]:

- Retain all legacy trees within Riparian Reserves (snags and live trees left from previous harvest that are typically larger than the remaining trees in the stand)
- Hazard trees cut for safety in Riparian Reserves must be left on site
- Gaps and felling in Riparian Reserves must be less than one acre in size

- Gaps must be more than one site-potential tree length away from listed fish habitat streams
- Within 1,000 feet of a listed fish's habitat, leave a no-cut buffer of 100 feet along perennial streams and 50 feet along intermittent streams
- Between 1,000 feet and one mile of a listed fish's habitat, leave a no-cut buffer of 50 feet along both perennial and intermittent streams
- Beyond one mile of a listed fish's habitat, leave a no-cut buffer of 50 feet along perennial streams and 30 feet along intermittent streams
- 50% canopy closure must be retained in Riparian Reserves
- No road construction allowed within 500 feet of listed fish habitat streams
- No road reconstruction allowed within 200 feet of listed fish habitat streams
- No road construction allowed within 200 feet of other streams

These design criteria, while offering some protections for cold, clean water, fail to fully prevent impacts in order to maximize recovery potential for listed species.

### 4.3 Clean Water Act

Congress enacted the Clean Water Act (CWA) in 1972 with the goal of ending all pollution of waters of the United States by 1985.[354] Section 301 generally prohibits the discharge of pollutants into streams and other water bodies except in compliance with other sections of the CWA.[355] Section 402 of the CWA aims to control pollution to navigable waters and their tributaries by requiring point source polluters to obtain permits specifying effluent limits.[356] Permits are obtained through National Pollutant Discharge Elimination System.[357] Section 502 defines point sources as "discernible, confined, discrete conveyances" including ditches and channels.[358] Pollutants under the CWA include rock, sand and heat, as well as toxic compounds and heavy metals.[359] Under the recent Ninth Circuit decision NEDC v. Brown, actively-used logging roads and associated ditches that channel pollutants into streams are considered point sources.[360]

Section 302 of the CWA requires states to devise water quality standards that if met would fully protect beneficial uses.[361] If a state finds that water quality standards for a particular water body are not being met, total maximum daily loads (TMDLs) of pollutants must be devised for that water body.[362] ODEQ has identified several streams originating from Mt. Hood National Forest that are not meeting state water quality standards, discussed below.[363] Many of these streams flow through areas impacted by livestock grazing as well as other management uses.

The following streams were recently listed as impaired for sedimentation by ODEQ[364]:

*Fivemile Creek*
*Eightmile Creek*
*Ramsey Creek*
*Gate Creek*

ODEQ also listed the following streams as impaired by temperature[365]:

*White River*
*Threemile Creek*
*Wapinitia Creek*

Other MHNF-originating streams for which TMDLs for temperature have been approved include[366]:

Nohorn Creek

Eightmile Creek
Fivemile Creek
Fifteenmile Creek
Mill Creek
North Fork Mill Creek
South Fork Mill Creek
Ramsey Creek
Mosier Creek
West Fork Mosier Creek
Rock Creek
Threemile Creek
Collawash River
Eagle Creek
North Fork Eagle Creek
Fish Creek
Nohorn Creek

No sedimentation TMDLs for streams that flow through or originate on Mt. Hood National Forest have yet been approved.[367]

### 4.4 Wild and Scenic Rivers Act

In 1968, Congress enacted the Wild and Scenic Rivers Act to preserve "in free-flowing condition" rivers of the United States that "possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values."[368] Further, in the Act, Congress declared it national policy to protect such rivers' "immediate environments... for the benefit and enjoyment of present and future generations."[369] Congress recognized that the national policy of the time encouraging dam construction needed to be balanced with preservation of free-flowing river stretches "to protect the water quality of such rivers and to fulfill other vital national conservation purposes."[370]

Collawash River

Congress described an eligible river area as "a free-flowing stream and the related adjacent land area that possesses one or more" specified outstandingly remarkable values.[371] Congress classified eligible rivers as "wild, scenic, or recreational."[372] The Forest Service must consider potential additions to the National Wild and Scenic River System during the forest planning process.[373] Congress amended the Wild and Scenic Rivers Act to make clear the U.S. Forest Service "may utilize the general statutory authorities relating to the national forests in such manner . . . appropriate[] to carry out the purposes of" the Act.[374] The Forest Service must "take such actions respecting management policies, regulations, contracts, [and] plans... as may be necessary to protect [designated] rivers in accordance with the purposes of" the Act.[375] Congress emphasized that the Forest Service must give "[p]articular attention . . . to scheduled timber harvesting, road construction and similar activities which might be contrary to the purposes" of the Wild and Scenic Rivers Act.[376]

In 1988, Congress added many more Oregon rivers to the system, including large segments of the Sandy, Salmon, Clackamas, Roaring and White Rivers within Mt. Hood National Forest.[377] In the 1990 Mt. Hood National Forest Land and Resource Management Plan, the Forest Service recognized the eligibility of the North, South and Oak Grove Forks of the Clackamas River, Eagle Creek (Clackamas

County), Fish Creek, the South Fork of the Roaring River, the Collawash River and the North Fork of the Breitenbush River, the Zigzag River and the Middle Fork of the Hood River for addition to the National Wild and Scenic Rivers System and incorporated Forest-wide Standards and Guidelines regarding the eligible rivers.[378]

In 2009, Congress further expanded the system to include portions or all of the following Clackamas River tributaries that flow through Mt. Hood National Forest: the South Fork of the Clackamas River, Eagle Creek, the South Fork of the Roaring River, the Collawash River and Fish Creek.[379] Congress also added parts of the Zigzag River, the East and Middle Forks of the Hood River and Fifteenmile Creek to the national wild and scenic rivers system.[380]

### 4.5 1990 Land and Resource Management Plan

MHNF adopted a land and resource management plan (Plan) in 1990.[381] The Plan aims to create sustainable parameters for natural resource production in the Forest, while establishing standards and guidelines to protect its biological diversity and terrestrial and aquatic habitats.[382] The 1990 Plan recognizes water as one of MHNF's most valuable resources.[383] The Plan attempts to mitigate risks to the Forest's streams from active timber harvest and management by designating Special Emphasis Watersheds, Key Site Riparian Areas and General Riparian Areas.[384] Such designations do not expressly prohibit timber harvest in these areas, but subordinate timber to the needs of riparian-dependent organisms.[385] The 1990 Plan further delineates management prescription areas for non-riparian purposes, including those with timber and recreation emphases.[386]

#### *Forest-Wide Water, Riparian and Fisheries Standards and Guidelines*

The 1990 Plan requires the Forest Service to use best management practices (BMPs) on the Forest so water quality complies with state requirements established pursuant to the Clean Water Act.[387] Foreshadowing the 2012 rule, the 1990 Plan specifically prohibits "[m]anagement practices causing detrimental changes in water temperature or chemical composition, blockages of water courses, or deposits of sediment."[388] The 1990 plan allows up to "35 percent of an area available for vegetative manipulation" to be "in a hydrologically disturbed condition at any one time."[389]

The 1990 Plan also prioritizes watershed improvement projects in areas "with a high potential for recovery" that "increase channel stability, improve effective stream shading, reduce sedimentation and stabilize areas of severe soil erosion and/or mass movement."[390] The 1990 Plan requires the MHNF to cooperate with the state on all water rights adjudications affecting lands within the Forest.[391] The Plan directs the Forest to assert claims for in-stream water flows under federal or state laws when necessary.[392] Further, the 1990 Plan requires the Forest Service to prevent pesticides, fertilizers and road surface treatments from entering water.[393]

In riparian areas, the 1990 plan aims to limit the amount of exposed, compacted, puddle, or displaced soils and requires that 95 percent of ground cover in riparian project areas be maintained.[394] According to the 1990 Plan, management activities near water or wetlands "should" not accelerate sediment delivery, but are not expressly prohibited.[395]

The 1990 Plan distinguishes streams into classes and sets forth different management requirements based on those classes and whether streams are fish-bearing.[396] The stream classes used in the 1990 Plan are as follows[397]:

> Class I – Perennial or intermittent streams that: provide a source of water for domestic use; are used by large numbers of fish for spawning, rearing or migration; and/or are major tributaries of other Class I streams.

Class II – Perennial or intermittent streams that: are used by moderate though significant numbers of fish for spawning, rearing or migration; and/or may be tributaries to Class I streams or other Class II streams.

Class III – All other perennial streams not meeting higher class criteria.

Class IV – All other intermittent streams not meeting higher class criteria.

Wahtum Lake

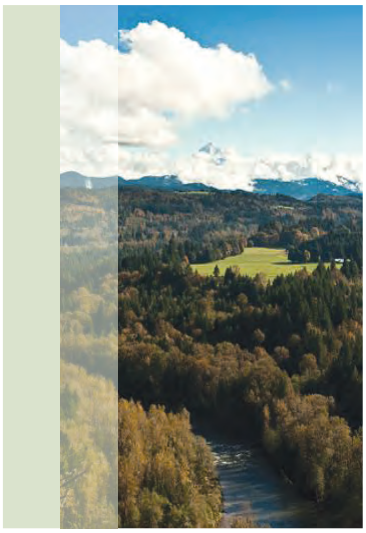
In Class I, Class II and fish-bearing Class III streams, the Plan requires the Forest Service to maintain, increase, or enhance existing aquatic habitat complexity and natural pool habitat levels.[398] The Plan requires the maintenance of 90 percent of large woody debris in these same streams.[399] The Plan defines eastside LWD as at least 35 feet in length and at least 12 inches in diameter.[400] For the westside, LWD is defined as at least 50 feet in length and at least 24 inches in diameter.[401] 20% of eastside LWD should be 20 inches in diameter or greater and 20% of westside LWD should be 36 inches in diameter or greater.[402] The Plan also places limits on spawning habitat sediment levels, requirements for streambank and shoreline stability maintenance and protections for special aquatic habitat features.[403]

In riparian areas along streams, the 1990 Plan aims to maintain 95 percent ground cover in project areas and 80 percent of forested riparian areas must be maintained as or restored to old growth or mature forest.[404] 90 percent of LWD pieces per acre "should" be maintained.[405] The 1990 Plan caps summer water temperatures caused by management activities at 58 degrees and limits increases to two degrees Fahrenheit.[406] If, however, natural maximum stream temperatures exceed 58 degrees, no increases due to management are permitted.[407]

The 1990 Plan aims to increase stream shading when state water quality standards are exceeded and when temperature increases reduce water-related values.[408] The Plan aims to keep cumulative turbidity increases from management activities below 10 percent.[409] Under the 1990 Plan, fish

passage "should" be maintained or improved and barriers "should" be identified or corrected.[410] However, new road construction must maintain or enhance fish passage.[411]

For non-fish-bearing Class III streams, the 1990 Plan establishes a minimum LWD piece length of "two bankfull widths," but otherwise keeps the requirements similar to those for Class I, Class II and fish-bearing Class III streams.[412] However, percentage requirements for non-fish-bearing Class III streams are based on "subdrainages" as opposed to each stream.[413] 90 percent of ground cover must be maintained in these Class III streams and similar stream shade increases are encouraged as for Class I, Class II and fish-bearing Class III streams.[414] The Plan requires sediment loading be minimized and stream channel conditions be maintained for non-fish-bearing Class III streams to meet state turbidity standards.[415] Non-fish-bearing Class III streams are managed the same as Class I, Class II and fish-bearing Class III streams with regards to vegetation and sediment.[416]



Sandy River below Mt. Hood

Finally, for Class IV streams, the 1990 Plan aims to minimize management activities that compact, puddle, erode, furrow, or otherwise disturb ground along such streams, avoid deteriorating channel and bank stability beyond existing conditions and encourages restoration to natural conditions.[417] The Plan encourages the maintenance of "noncommercial" trees along these streams.[418] Also, 100 percent of LWD "should" be maintained in Class IV streams.[419]

The 1990 Plan requires MHNF to maintain fish habitat capability "at existing levels or greater."[420] Habitat for threatened and endangered species must be protected "and/or" improved under the 1990 Plan.[421] At the time of the 1990 Plan, a number of now-protected species had not yet been listed, including steelhead, spring Chinook and coho salmon.[422]

### *Wild, Scenic and Recreational Rivers*

Within Wild, Scenic and Recreational River corridors, the 1990 Plan requires management activities to "protect and/or enhance the identified outstandingly remarkable values" for which the segments were designated by Congress, as well as the "[r]iver characteristics necessary to support the existing classification" of those segments.[423]

Recreation, timber and road restrictions for Wild, Scenic and Recreational River corridors are based on their classifications as such.[424] Recreation improvements must minimize site degradation in wild segments, but provide "comfort and convenience" in recreational segments, with "a minimum of convenience" provided in scenic segments.[425] The 1990 Plan prohibits new recreation sites in wild segments.[426]

In wild river segments, timber harvest and salvage are prohibited except for limited insect, fire and safety exception; within scenic and recreational river segments, regulated timber harvest should occur so long as "recreation opportunity spectrum" classes and "visual quality objectives" are met.[427] Within scenic and recreational segments, timber salvage "for protection of the Forest, Forest visitors or river-related resource values" is permitted.[428]

New roads are prohibited in wild river corridors and existing roads are allowed to be "phased out and rehabilitated."[429] The 1990 Plan discourages new roads in scenic segments and expressly allows new roads in recreational segments.[430]

Recreational and commercial livestock are allowed in all segment corridors, "provided river banks and riparian vegetation are protected from adverse impacts."[431]

### *Special Emphasis Watersheds*

The 1990 Plan establishes 78,600 acres of Special Emphasis Watersheds[432] with "unusually high combinations of riparian resource values and high sensitivity due to generally demanding site conditions and where the goal is to maintain or improve habitat conditions for the sustained, long-term production of fisheries and high quality water."[433]

In "Special Emphasis Watersheds," the 1990 Plan sets "thresholds of concern" for watershed impact percentages from management activities[434]:

| Special Emphasis Watershed | Threshold of Concern |
|---|---|
| Alder Creek (City of Sandy Watershed) | 25% |
| Blister Creek | 18% |
| Clear Branch Hood River | 18% |
| Upper Collawash River | 18% |
| Upper Dog River (City of The Dalles Watershed) | 25% |
| Eagle Creek | 25% |
| South Fork Eagle Creek | 25% |
| Eightmile Creek | 25% |
| Fifteenmile Creek (City of Dufur Watershed) | 25% |
| Fish Creek | 18% |
| Fivemile Creek | 25% |
| Gordon Creek (City or Corbett Watershed) | 18% |
| Hot Springs Fork Tributaries (Collawash River) | 25% |
| Lake Branch Hood River | 18% |
| Mill Creek (City of The Dalles Watershed) | 25% |
| Pansy Creek | 18% |
| Ramsey Creek | 25% |
| Still Creek | 25% |

These percentages encompass non-Forest Service lands in the respective watersheds, as well.[435] The 1990 Plan prohibits development of recreation sites and trails in The Dalles Watershed, but allows them elsewhere so long as watershed values are protected.[436] Such developments should avoid "special aquatic and terrestrial habitats."[437] Existing sites inconsistent with riparian or watershed values should be modified.[438] Fisheries habitat improvement projects are permitted.[439]

Existing commercial livestock use may occur, but mitigation measures should prevent degradation of watershed values.[440] Regulated timber harvest "should occur" in Special Emphasis Watersheds, so long as "thresholds of concern" are not exceeded.[441] Timber salvage may occur.[442] Roads "consistent with protection of watershed values, specifically thresholds of concern," are permitted and must be designed to provide fish passage and minimize or eliminate sediment delivery to water bodies.[443]

### *Key Site Riparian Areas*

The 1990 Plan places 16,000 acres of the MHNF in Key Site Riparian Areas.[444] The Plan defines these areas as "[l]arge riparian areas exhibiting high habitat diversity and outstanding capabilities for producing high quality water, excellent fish spawning and rearing habitat, high quality waterfowl breeding, nesting and resting habitat, wildlife cover and diverse plant communities."[445]

Within these Key Site Riparian Areas, the 1990 Plan limits new and expanded recreation in designated Key Site Riparian Areas on the MHNF and requires modification or removal of recreation facilities or trails that are inconsistent with the protection of riparian values.[446] The 1990 Plan

permits recreational and commercial livestock within Key Site Riparian Areas, but encourages fencing to protect riparian values.[447] Timber harvest and salvage is prohibited in Key Site Riparian Areas except to "maintain or enhance riparian resource values."[448] Prescribed fire to maintain open meadows is encouraged.[449] New road construction in Key Site Riparian Areas "should not occur," and existing local roads must "be considered for closure and obliteration."[450] Sediment discharges from roads should be minimized or eliminated.[451]

### *General Riparian Areas*

The 1990 Plan designates approximately 106,100 acres of the MHNF as General Riparian Areas.[452] Within General Riparian Areas, the 1990 Plan allows new and expanded recreation facilities and trails, but they "should be located to protect riparian values."[453] "[S]pecial aquatic and terrestrial habitats" are to be avoided.[454] Existing recreation facilities should be modified or removed where not consistent with riparian values.[455] Sites with damage to riparian resources should be promptly restored.[456]

Recreational and commercial livestock are allowed in General Riparian Areas, but commercial livestock should not be concentrated in them.[457] "Livestock access may be precluded" in riparian areas with degraded streambanks and soil compaction.[458]

Within most General Riparian Areas, "[r]egulated timber harvest should occur," according to the 1990 Plan.[459] Timber salvage can occur.[460] Landing and skids trails are not to be located in stream channels in these areas.[461] Roads are not expressly prohibited in General Riparian Areas, but "should not occur."[462] Roads causing impacts to riparian values should be "mitigated or relocated."[463] Unneeded and abandoned roads "should be rehabilitated."[464]

## 4.6 Northwest Forest Plan

In 1994, the Forest Service and the Bureau of Land Management adopted the Northwest Forest Plan, which amended all land and resource management plans within the range of the northern spotted owl, including MHNF's Plan.[465] The Northwest Forest Plan incorporates recommendations by a presidentially-commissioned expert science panel, the Forest Ecosystem Management Assessment Team (FEMAT), including a comprehensive Aquatic Conservation Strategy (ACS) to provide protection and restoration to aquatic and riparian areas and their dependent species.[466]

In reviewing the ACS for compliance with the National Forest Management Act and National Environmental Policy Act, Judge Dwyer of the federal court for the Western District of Washington found that "[t]he effectiveness of the ACS is still subject to debate among scientists," and that "[i]f the plan as implemented is to remain lawful the monitoring, watershed analysis and mitigating steps called for by the [Northwest Forest Plan Record of Decision] will have to be faithfully carried out and adjustments made as necessary."[467]

The ACS includes four main components[468]:

1) Designation of Key Watersheds
2) Designation of Riparian Reserves
3) Watershed Analyses for Key Watersheds and those encompassing roadless areas
4) Watershed restoration

Following its adoption, all management activities on MHNF must comply with the Northwest Forest Plan and its ACS, but those provisions of the 1990 Plan not in conflict with the Northwest Forest Plan and ACS remain in effect.[469]

White River Canyon and distant Mt. Jefferson

### *Key Watersheds*

Under the ACS, designated Key Watersheds are divided into two categories: Tier 1 for those streams that directly support anadromous salmonids, bull trout and other resident fish species and Tier 2 from those that do not support such species but remain important sources of high quality water.[470] For Mt. Hood National Forest, FEMAT identified the following Key Watersheds[471]:

| Watershed | Tier |
|---|---|
| Fifteenmile Creek/Ramsey Creek | 1 |
| West Fork Hood River | 1 |
| Mill Creek/Fivemile Creek/Eightmile Creek | 1 |
| Clackamas River Corridor (Big Cliff to Headwaters) | 1 |
| Collawash River | 1 |
| Fish Creek | 1 |
| Oak Grove Fork Corridor | 1 |
| Roaring River | 1 |
| Eagle Creek | 1 |
| Salmon River | 1 |
| Bull Run River | 2 |
| White River | 2 |

The inclusion of only the "corridors" of the Oak Grove Fork and the upper Clackamas River limit the restoration impact of those particular designations. Notably absent from the list of Key Watersheds on the MHNF is the Upper Sandy River, although at the time of FEMAT's designations it was not free flowing due to the Marmot Dam, removed in 2007.[472] Also absent are the important Zigzag River and East Fork of the Hood River. Since their designation, the Forest Service has determined that "[m]ore

than 70% of key watersheds improved" in quality "compared with <50% of non-key watersheds."[473] Even incremental improvements landscape-wide could have significant effect in long-term restoration, making the omission of streams that seem to meet the criteria used by FEMAT concerning. FEMAT recommended road reductions in Key Watershed[474], but outside inventoried roadless areas, only a "no net gain of road mileage" became part of NWFP management direction.[475]

Key Watersheds were meant to serve as coarse-filter priority restoration areas and refugia for aquatic species.[476] Based on our review of MHNF aquatic restoration plans and projects, Key Watersheds have generally been appropriately prioritized for restoration. While some Key Watersheds like Fish Creek[477] have had their road densities greatly reduced through decommissioning, others still have relatively high road densities.[478]

### *Riparian Reserves and Watershed Analyses*

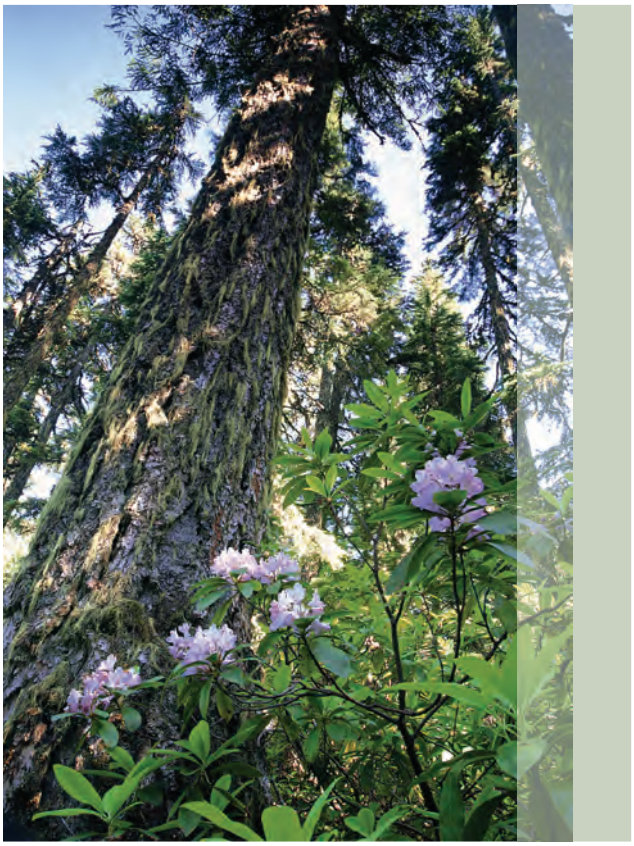
In Riparian Reserves, the Northwest Forest Plan allows timber harvest when necessary for restorative purposes "to control stocking, reestablish and manage stands and acquire desired vegetation characteristics needed to attain Aquatic Conservation Strategy objectives."[479] The Aquatic Conservation Strategy Objectives (ACSOs) devised by FEMAT are as follows[480]:

1) Maintain and restore the distribution, diversity and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species populations and communities are uniquely adapted.
2) Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian-dependent species.
3) Maintain and restore the physical integrity of the aquatic system, including shorelines, banks and bottom configurations.
4) Maintain and restore water quality necessary to support healthy riparian, aquatic and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical and chemical integrity of the system and benefits survival, growth, reproduction and migration of individuals composing aquatic and riparian communities.
5) Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate and character of sediment input, storage and transport.
6) Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic and wetland habitats and to retain patterns of sediment, nutrient and wood routing. The timing, magnitude, duration and spatial distribution of peak, high and low flows must be protected.
7) Maintain and restore the timing, variability and duration of floodplain inundation and water table elevation in meadows and wetlands.
8) Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion and channel migration and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability.

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

The ACSOs recognize the essential components of properly functioning aquatic and riparian ecosystems.[481] However, as objectives, they do not establish clear mandates for management decisions nor provide easily quantifiable metrics to determine whether an action actually maintains or restores the components identified. Thus, timber harvest activities continue in Riparian Reserves on the MHNF despite controversy over the efficacy of thinning to meet certain ACSOs without hindering restoration progress toward others.

The NWFP established minimum Riparian Reserve widths in which timber harvest activities are restricted consistent with the above ACSOs based on the type of water body or channel.[482] For fish-bearing streams and lakes and natural ponds, a Riparian Reserve must at least extend outward from the stream "to a distance equal to the height of two site-potential trees, or 300 feet slope distance ...whichever is greatest."[483] For permanently flowing non-fish-bearing streams, constructed ponds and reservoirs and wetlands greater than one acre, Riparian Reserves must at least extend outward from the stream "to a distance equal to the height of one site-potential tree, or 150 feet slope distance ...whichever is greatest."[484] Finally, for seasonally flowing or intermittent streams, wetlands less than one acre and unstable and potentially unstable areas, Riparian Reserves must at least extend "to a distance equal to the height of one site potential tree, or 100 feet slope distance, whichever is greatest."[485]



Old growth Douglas fir

Some Watershed Analyses conducted for Key Watersheds and those within roadless areas on the MHNF have led to more extensive Riparian Reserve widths than the minimums required by the NWFP. For example, the Watershed Analysis for the Salmon River Watershed recommended different Riparian Reserve widths depending on what "zone" the Reserve occurred within: western hemlock, Pacific silver fir, or mountain hemlock.[486] However, distinctions between permanent and intermittent streams and fish-bearing and non-fish-bearing streams have generally been carried forward in most MHNF Watershed Analyses.[487]

As an example of Riparian Reserve widths in the MHNF following adoption of the Northwest Forest Plan, the Forest Service uses the following widths in the Salmon River Watershed on the basis of its Watershed Analysis. The MHNF uses a Douglas fir measured at 210 feet as a site-potential tree for the western hemlock zone.[488] Two such site-potential trees thus establish a Riparian Reserve width of 420 on each side of a fish-bearing stream in that zone (840 feet total), more protective than the minimum 300 feet required by the NWFP.[489] A Douglas fir measured at 170 feet is used to establish a 340-foot buffer on each side of fish-bearing streams in the Pacific silver fir zone (680 feet total) of the Salmon River Watershed.[490] Finally, in the Salmon River Watershed, MHNF uses the minimum default 300-foot width on either side of fish-bearing streams in the mountain hemlock zone of Riparian Reserves (600 feet total).[491]

MHNF established the same Riparian Reserve widths in the Salmon River Watershed for lakes and natural ponds and widths half as wide for non-fish-bearing permanent streams and wetlands.[492] For seasonally flowing or intermittent streams and unstable and potentially unstable areas, MHNF used the single site-potential tree widths required for non-fish-bearing permanent streams and wetlands, except in the mountain hemlock zone of the Salmon River Watershed, in which only 100 feet were protected on each side.[493] Aside from at times modifying Riparian Reserves widths upward from the NWFP's minimum requirements, Watershed Analyses also provided MHNF with data compilations to use for watershed restoration prioritization purposes.[494]

### 4.7 2008 Region 6 Guidance: The Aquatic and Riparian Conservation Strategy (ARCS)

In 2008, Region 6 developed an Aquatic and Riparian Conservation Strategy (ARCS) "to provide a Regional framework to use in revising Forest plans in the Pacific Northwest Region."[495] The ARCS consists of five elements: riparian management areas, key watersheds, watershed analysis, watershed restoration and monitoring.[496] Clearly, the ARCS contains many of the same concepts set forth by FEMAT in the ACS of the Northwest Forest Plan. The ARCS says "[k]ey watersheds should be the highest priority for active aquatic and riparian restoration."[497] However, the ARCS retains the "no net increase" in road mileage in Key Watersheds, rather than expressly prohibit new road construction.[498]

Riparian management areas (RMAs) function as the equivalent of the Northwest Forest Plan's Riparian Reserves. Unfortunately, the 2008 ARCS continues FEMAT's requirement of larger riparian management areas for fish-bearing and permanently flowing streams, as opposed to non-fish-bearing and seasonally flowing or intermittent streams.[499] Further, the ARCS only requires 600-foot total minimum buffers on fish-bearing streams unless the 100-year floodplain is greater.[500] In light of MHNF's Riparian Reserve widths up to 840 feet total in the Salmon River Watershed, MHNF currently manages its riparian areas in a more protective manner than prescribed by Region 6 for future Forest plan revisions.

The ARCS finds "[l]imited short term or site-scale effects from activities in RMAs may be acceptable when they support, or do not diminish, long-term benefits to aquatic and riparian resources."[501] The ARCS does not provide specific direction on the assessment necessary to determine whether a given activity will "support, or [] not diminish, long-term benefits." The ARCS provides this direction in the form of a guideline, from which USFS could deviate, as opposed to a standard.

The ARCS continues the Northwest Forest Plan's general strategy for timber harvest and thinning in riparian management areas with a guideline specifying it should occur "only as necessary to maintain, restore or enhance conditions that are needed to support aquatic and riparian dependent resources."[502] However, the ARCS provides no further guidance as to how to ensure thinning actions do in fact maintain, restore, or enhance conditions with an overall beneficial result, considering associated road use, potential delays in large woody debris recruitment and other ecological concerns.

The ARCS also allows "new landings, designated skid trails, staging [and] decking" in RMAs when there are "no alternatives."[503] The ARCS contains a guideline directing Forests to "generally avoid new road construction in RMAs except where necessary for stream crossings."[504] No such guideline exists in the ARCS for road reconstruction, except to avoid wetlands and unstable areas during both new road construction and road reconstruction unless "avoidance is not practical."[505] The definition of "guideline" used by USFS indicates deviation from a guideline is acceptable if the reason for the deviation is documented.[506] Standards, meanwhile, must be met absent an amendment of the underlying forest plan.[507] More positively, the ARCS contains a guideline to "[g]enerally minimize hydrologic connectivity and delivery from roads" both "inside and outside of RMAs."[508] Again, however, the ARCS sets this forth in a guideline, not a standard.

Badger Creek

The ARCS sets for a number of guidelines related to grazing management in RMAs that still allow for questionable levels of impacts to streams: 20% streambank alteration, residual stubble heights down to 4-6 inches and 40% utilization of woody and herbaceous vegetation "[w]ithin green-line vegetation area adjacent to all watercourses."[509] Even more surprising, the ARCS sets forth mere guidelines recommending that "[l]ivestock trailing, bedding, loading and other handling activities should be avoided in RMAs," and most concerning of all, the ARCS says USFS should "[g]enerally avoid trampling of Federally listed threatened or endangered fish redds by livestock."[510]

The ARCS, while recognizing the importance of riparian areas and headwater streams for listed fish species and high quality water, fails to preemptively prevent known adverse effects by primarily using guidelines instead of standards and by failing to expressly restrict or exclude certain impacts from RMAs.

The Ninth Circuit has held that every site-specific project must be supported by a determination of consistency with each Aquatic Conservation Strategy Objective under the Northwest Forest Plan.[511] Under the ARCS, however, "desired conditions" are to be applied at the "landscape or watershed level, not at a particular site."[512] The ARCS, according to Region 6, "is designed to contribute to the sustainability of aquatic and riparian ecosystems and species."[513] This is notably different than the ACS' aim to "maintain and restore" these ecosystems.[514]

The ARCS purports to be "a refinement of earlier strategies," including the Northwest Forest Plan's Aquatic Conservation Strategy, but it actually decreases protections provided by the ACS, despite legal precedent that the ACS serves as the bare minimum, or floor, for aquatic and riparian resource management in the Northwest Forest Plan area.[515] It therefore remains to be determined whether forest plan revisions that rely on the ARCS rather than incorporating the ACS will be found lawful.

# Part Five — Forest-Level Assessments of Watershed Conditions and Restoration Priorities

## 5.1 2005 Region 6 Aquatic Restoration Strategy

Mt. Hood north of stands in the Oak Grove Fork watershed

In 2005, Region 6 of the Forest Service set forth an Aquatic Restoration Strategy structured around three indicators: aquatic resource condition, basin sensitivity and management intensity.[516] The prioritization process used by Region 6 in this Strategy gave the least amount of weight to management intensity (i.e., road density and associated activities), slightly greater weight to basin sensitivity and the most weight to aquatic resource conditions.[517] The respective weights may derive from the Strategy's stated philosophy that "[m]aintenance of healthy habitat is the foundation for effective restoration,"[518] leading to greater weight placed on current habitat conditions as opposed to potential for further harm. The Strategy's stated philosophy further supports a "[s]trategic focus of activities on priority areas (areas where basic integrity and processes are still adequately functioning but 'at risk')."[519]

Ultimately, the Region 6 team determined the Lower Columbia Basin to be a high priority for restoration.[520] According to the division of basins used by Region 6 at the time, the Sandy River Watershed, which originates in the MHNF, is part of the Lower Columbia Basin.[521] The other basins relevant to MHNF, the Willamette (Clackamas River)), Deschutes (White River) and Middle Columbia Basins (Hood River, Fifteenmile Creek), were considered moderate priorities for restoration in 2005.[522]

## 5.2 Aquatic Habitat Restoration Strategies

Aquatic Habitat Restoration Strategies have been developed for three of MHNF's five major drainages. MHNF published the Hood River Basin Aquatic Habitat Restoration Strategy in 2006.[523] Oregon Trout (now the Freshwater Trust) published the Sandy River Basin Aquatic Habitat Restoration Strategy in 2007.[524] In 2010, MHNF published the Fifteenmile Creek Basin Aquatic Habitat Restoration Strategy.[525] Strategies of this type have not been developed yet for the Clackamas River Basin or the White River Basin.

The three Strategies currently developed encompass not only MHNF-managed lands, but downstream, non-MHNF lands in the respective basins as well. The Forest Service engaged certain stakeholders in the basins to assess restoration priorities and actions. Concerns addressed by the Strategies include fish habitat, fish passage, streamflow, roads and riparian conditions.[526] Management actions relevant to MHNF include pursuing pre-commercial and commercial riparian thinning for conifer release[527] and large woody debris recruitment[528] as well as large woody debris placement in some locations.[529] The Strategies also continue to note the need for further road decommissioning and storm-proofing on the MHNF within the basins.[530]

The Strategies reflect more fine-filtered management than has thus resulted from Key Watershed designations by FEMAT and subsequent Watershed Analyses. The engagement of interested stakeholders that use the basins' land and water beyond the Forest boundary provides greater likelihood of funding sources outside the Forest Service budget to implement prioritized restoration pursuant

to these Strategies. However, the Strategies do not explicitly acknowledge in all instances the scientific support or lack thereof for some of the proposed restoration techniques and with the exception of the Sandy River Basin Strategy, did not include local and regional non-governmental conservation groups, possibly limiting the credibility of such Strategies with some members of the public.

Moreover, it is questionable whether lasting, ecosystem-level restoration benefits can accrue to fish and wildlife species without strategic mustering of effort at a spatial scale approaching or exceeding the Key Watershed. "Fine filter" priorities commonly overlook and are neutralized by larger-scale threats, including roads, logging and grazing.[531]

### 5.3 2011 Watershed Condition Framework

Road-stream connectivity near Skunk Creek

Just recently, the Washington Office of the Forest Service issued a Watershed Condition Framework Implementation Guide, revising previous assessment models and altering the weights given to various indicators.[532] A Technical Guide provided to National Forest System units indicated the "watershed classification approach was specifically designed as a rapid, coarse filter, office assessment process to be completed by a Forest interdisciplinary (ID) team over a two week time period using professional judgment and relying on existing information, maps and GIS layers."[533] The goal of the Watershed Condition Framework is to again prioritize watersheds for restoration.[534] The Washington Office has identified five characteristics of properly functioning watersheds[535]:

1) High biotic integrity—habitats supporting plant and animal communities that reflect natural processes.
2) Resilience and rapid recovery from natural and human disturbances.
3) High degree of connectivity along the stream, across the floodplain and valley bottom and between surface and substrate flows.
4) Important ecosystem services—high quality water, stream and aquifer recharge, riparian community maintenance and climate variability and change moderation.
5) Long-term soil productivity maintenance.

Current direction from the Forest Service's Washington Office categorizes three classes of watershed conditions[536]:

| | |
|---|---|
| Class 1 | *healthy* |
| Class 2 | *relatively healthy, but may require restoration work* |
| Class 3 | *impaired, degraded, or damaged* |

The Washington Office of the Forest Service now directs Regional Offices to use a twelve-indicator model to determine watershed condition for restoration prioritization purposes, with certain groups of indicators given specific weights[537]:

*Aquatic Physical (Weight = 30%)*

- Water quality (listed under Clean Water Act 303[d])
- Water quantity (flow characteristics)
- Aquatic habitat (fragmentation, large woody debris, channel shape and function)

*Aquatic Biological (Weight = 30%)*

- Aquatic biota (lifeform presence, native species, exotic and/or invasive species)
- Riparian/wetland vegetation (condition)

*Terrestrial Physical (Weight = 30%)*

- Roads and trails (open road density, maintenance, proximity to water, mass wasting)
- Soils (productivity, erosion, contamination)

*Terrestrial Biological (Weight = 10%)*

- Fire regime or wildfire (fire condition class or wildfire effects)
- Forest cover (loss of cover)
- Rangeland vegetation (condition)
- Terrestrial invasive species (extent and rate of spread)
- Forest health (insects and disease; ozone)

The division of weight among the various indicators appears somewhat arbitrary, as some watersheds may have more stressors related to "Aquatic Physical" factors, while others may warrant more attention to "Terrestrial Physical" concerns. Overall, the indicators place emphasis on aquatic factors most heavily (60%). The Regional Office identified no Class 3 watersheds on the Mt. Hood National Forest, but the agency categorized twenty watersheds as Class 2 (relatively healthy, but may require restoration work).[538]

Notably included were all reaches of the Bull Run River, now one of the most heavily protected watersheds on the Forest.[539] Other watersheds that feed municipal supplies were also found to require restoration work, including Gordon Creek and portions of the Clackamas River and Fifteenmile Creek.[540]

Notably absent from the Class 3 list were the 6th Field hydrologic units associated with the Collawash River, arguably one of the Forest's most degraded and at-risk streams due to heavy forest management in the past and history of roads and timber harvest on highly volatile earthflow-prone geology. Its lack of recognition by Region 6 and implied "health" causes questions about the application of the twelve indicators to watersheds Forest-wide. The Forest Service's Watershed Condition and Prioritization Interactive Map indicates that the East Fork Collawash River, Happy Creek, Upper Hot Springs Fork and Nohorn Creek 6th Field hydrologic units all received "poor" ratings for aquatic habitat condition.[541] Farm Creek, Nohorn Creek and Lower Hot Springs Fork 6th

Field hydrologic units within the Collawash watershed received "poor" ratings for road and trail condition.[542] Yet because other indicators were rated "good" or "fair," the Watershed Condition Map gives the impression the Collawash might not be a target for needed aquatic habitat restoration and road remediation.[543]

A key question for MHNF to answer moving forward is how it intends to reconcile the various directives and watershed restoration prioritization schemes set forth by the Washington and Regional Offices in the last several years and how those directives and schemes relate to work already underway or accomplished on the Forest and future management measures that protect and restore aquatic systems.

# Part Six — Management Recommendations for Protecting Freshwater Resources on MHNF

## 6.1. Strengthen FEMAT recommendations and ACS components as Forest Plan standards

### *a. Strengthen Key Watershed protections*

Region 6's ARCS requires Forests to continue following the Key Watershed paradigm.[544] Given their significance to overall health of the Sandy River Basin, the addition of the Upper Sandy and Zigzag Rivers would strengthen the network of refugia across the MHNF. This is consistent with Region 6's ARCS direction that Forests should continue following the Key Watersheds paradigm.[545]

Within Key Watersheds, the distinction between Tier 1 and Tier 2 designations should be eliminated and all Key Watersheds should be managed the same as Tier 1 Key Watersheds have been under the Northwest Forest Plan. Distinctions between fish-bearing and non-fish-bearing streams make little sense for overall watershed restoration, especially when such a significant emphasis is placed on protection of water for downstream municipal use. Cold, clean waters benefit not only fish and other aquatic species but also the human communities that rely on water supplies that require minimal treatment.

FEMAT's recommendation that no new road construction of any kind occur in Key Watersheds should be embedded in the Forest Plan, going beyond the ACS' "no net gain of road mileage" standard and also prohibiting landing construction. Moreover, Key Watersheds with total road density higher than 1.5 miles per square mile should be required to reduce density to below that threshold by way of hydrologically effective road decommissioning.

The Forest Plan should explicitly require further development of fine-filter restoration strategies to produce measureable progress in returning Key Watersheds to proper functioning across the landscape. The three Aquatic Habitat Restoration Strategies provide starting points for the development of similar Strategies for the Clackamas and White River Basins and further refinement of restoration techniques and prioritization should continue based on best available science. Fine filter priorities may be justified, but not at the expense of meeting longer-term, larger-scale assurances of high-quality habitat in Key Watersheds.

### *b. Adopt the Aquatic Conservation Strategy Objectives as standards in the Forest Plan*

The ACSOs recognize the critical components of properly functioning riparian and aquatic ecosystems. Current active vegetation management in Riparian Reserves continually raises concerns that the treatments proposed and implemented do not, on balance, promote all ACSOs. The longer-term benefits for one component are not easily weighed against adverse effects to another component. The relative values of the components and functions in a given stream cannot easily be quantified in metrics that allow simple calculation of net ecological benefits and costs. Despite these difficulties, adopting the ACSOs as standards and requiring a clear showing of compliance, considering short and long-term effects for all component factors, will better promote the goal of the ACSOs to restore ecosystem processes in riparian and aquatic habitat.

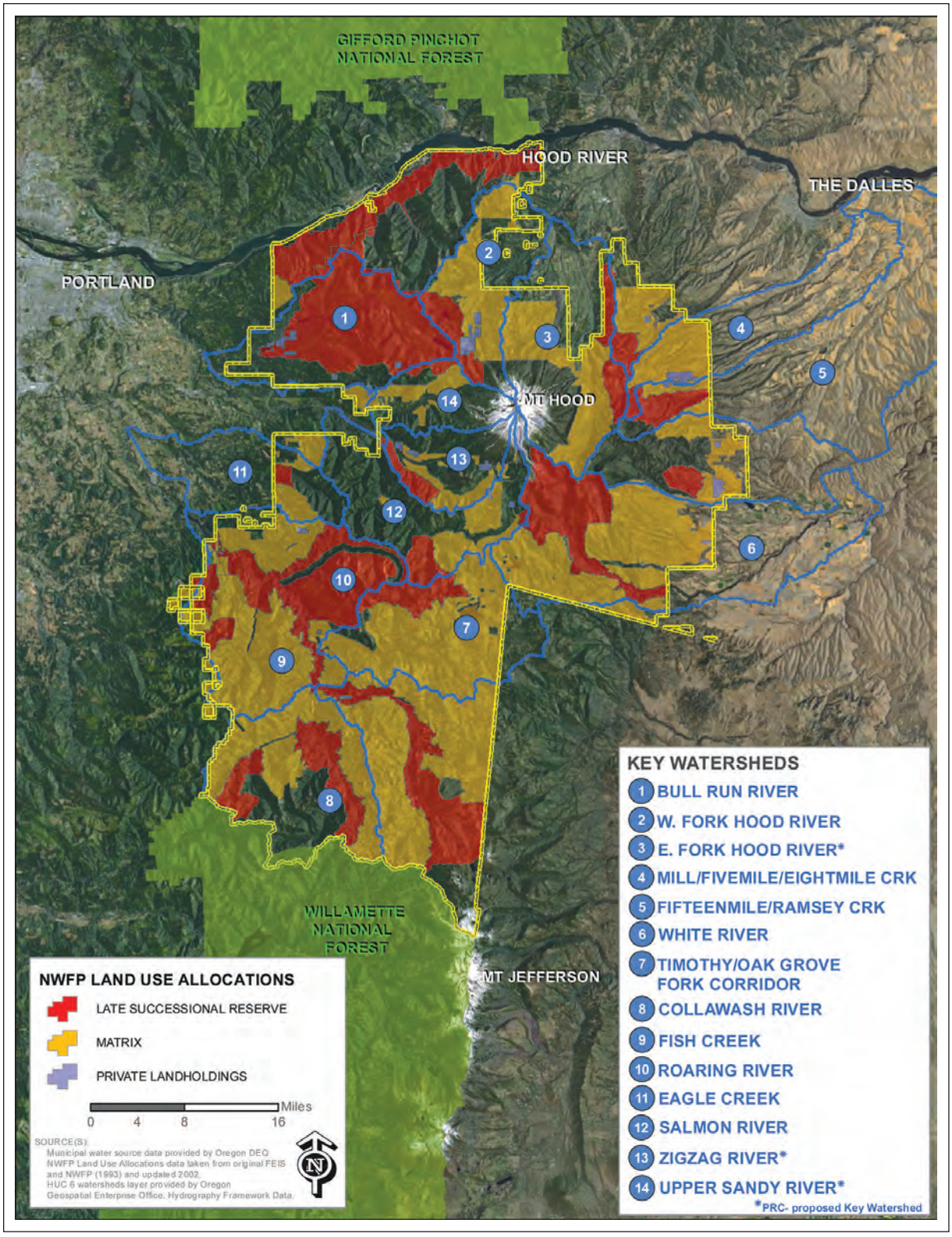



Figure 2. Map of key watersheds | Author *Thatch Moyle*

***c. Adopt Riparian Reserve widths of at least two site-potential trees without distinction between fish-bearing and non-fish-bearing streams or permanent or seasonal/ intermittent streams***

The 2008 ARCS directs Forests to continue the Riparian Reserve concept under the heading of "riparian management areas."[546] Protection of at least a two site-potential tree height buffer around all streams, regardless of fish presence or seasonality, will best promote dynamic and continuous delivery of woody debris, provision of appropriate shade and sediment and erosion control to provide the cold, clear waters with adequate pool habitat complexity. Both fish-bearing and non-fish-bearing streams provide water flowing to municipal supplies downstream and non-fish-bearing streams typically flow into fish-bearing streams, carrying woody debris past geological hurdles fish might not be able to overcome on upstream journeys. A significant percentage of large woody debris in streams derives from sources beyond one site-potential tree height, hence the importance of a two-tree distance buffer.[547]

The same functional widths of protected riparian area should also apply to ephemeral headwater streams. FEMAT and a plenitude of scientific studies recognize the significant importance headwater streams play in watershed health, as they comprise the bulk of a stream network.[548] Headwater streams are sometimes seasonal, beginning on higher slopes and flowing most often during wet periods or during snowmelt.

In some instances, buffers wider than two site-potential tree heights on either side of a water body might be necessary when the top of an inner gorge of a stream or its floodplain's outer edges or riparian vegetation extend beyond the distance of two site-potential trees. MHNF should re-examine current Riparian Reserve buffers to ensure there is indeed adequate protection of riparian vegetation and critical riparian habitat components within previously designated widths. At a minimum, riparian buffers should extend to the outer edge of the channel migration zone of a stream, the outer margin of floodplain-fringing wetlands, springs and shallow alluvial aquifers and encompass unstable or potentially unstable slopes contiguous with any of the above or the stream channel itself.

(i) Exclude timber harvest and road construction and reconstruction within the first site-potential tree length

(ii) Restrict timber harvest within the second site-potential tree length, allowing thinning only after applying the following screening criteria:

- field inventory and analysis of forest and aquatic conditions justify a site-specific objective and treatment;
- canopy reduction will not cause warming of streams or wetlands;
- all larger woody material is retained on site;
- treatment can be accomplished from existing roads;
- cumulative riparian area impacted by silvicultural treatment, yarding, and transportation does not exceed 5% over a ten-year period in any 6th field Hydrologic Unit Code sub-watershed; and
- firm agency commitment exists to monitor and report silvicultural and environmental outcomes.

Downwood near the Clackamas River

The District Court for the Western District of Washington found that "any more logging than the [Northwest Forest] plan contemplates will probably violate the laws," referring to the National Forest Management Act and National Environmental Policy Act.[549] Further, the court found that "[w]hether the plan and its implementation will remain legal will depend on future events conditions."[550] Coupling these statements with the court's determination that the ACS' lawfulness hinged on faithful adherence to the Northwest Forest Plan's monitoring, watershed analysis and mitigation components, the Forest Service should reasonably assume that future revisions to the Mt. Hood National Forest Plan and on-the-ground implementation of projects must be at least as protective as envisioned by the Northwest Forest Plan and its ACS to pass ecological and legal muster. As such, while the above recommendations include specific language and concepts from the Northwest Forest Plan, different language might be adopted by MHNF to implement these recommendations so long as on-the-ground protection of water and aquatic habitat resources results in the same or greater degree of protection contemplated by FEMAT and the courts.

### 6.2. Further strengthen protections and restoration for riparian areas and headwater streams

***a. Restrict mechanical fuel treatments and biomass collection in riparian areas and along headwater streams to locations in the wildland-urban interface[551] with no exception for municipal watersheds***

Because the benefits of mechanical fuel treatments so rarely outweigh the ecological and fiscal costs of such treatments, these management techniques should be restricted on both the west and east sides of Mt. Hood National Forest. Studies have shown that for fire regimes similar to those on the west side of MHNF (high severity, low frequency), mechanical fuel treatments are not likely to aid in restoring a natural fire regime.[552] Further, there is significant uncertainty regarding mechanical fuel treatments in mixed severity fire regimes, such as those found on the east side of MHNF. It is not always clear that fire behavior is operating outside historic patterns or that the regimes have been significantly altered.[553]

Because mechanical fuel treatments so rarely will target the actual location of a future wildfire in an effective timeframe, reliance on such treatments as preventative and protective measures is misplaced. Instead, prioritize use of prescribed fire to help restore natural fire regime characteristics whenever possible. Also, refrain from suppressing wildland fires that restore characteristics of the natural fire regime and do not threaten human health or safety. A clear showing that threats of increased sediment delivery to streams supplying municipal water outweigh the long-term benefits of restored natural fire regime and other rejuvenating results of fire should accompany all decisions to suppress wildland fire for that justification alone.

Pond in recently burned section of the Bull of the Woods Wilderness

***b. Exclude livestock from Riparian Reserves and headwater streams areas through retirement of vacant/inactive allotments, off-stream watering sites and/or wildlife-friendly fencing***

Grazing and habitat restoration are not compatible. Adverse grazing impacts are most intense in riparian areas, including soil compaction, erosion and bank instability. The Record of Decision for the Northwest Forest Plan required adjustment of grazing practices to eliminate impacts that retard or prevent ACSOs and if adjustment is not effective, grazing should be eliminated in Riparian Reserves.[554] To proactively implement this, grazing should not be allowed within Riparian Reserves, including headwater streams. Fencing can keep cattle out of riparian areas, but an examination of the fiscal costs of such exclosures may result in elimination or adjustments of allotment boundaries to prevent further riparian degradation.

***c. Restore beavers to the forest and range landscapes***

Because beavers create high-quality salmonid habitat and help moderate streamflow, MHNF should partner with ODFW and other entities to restore beavers in appropriate locations where they existed prior to Euro-American settlement of the region.

**6.3. Prioritize and manage based on entire stream lengths and sub-watersheds**

***a. Eliminate current management prescriptions areas to manage instead based on 6th-field sub-watershed restoration needs***

Management prescription areas were created by the 1990 Plan focused on resource emphasis concerns, i.e., timber harvest, recreation, or riparian area. Following the decline in demand for timber products and heightened focus on watershed restoration, a management scheme for MHNF using a watershed-by-watershed approach better places priority on landscape-wide restoration needs when considering management actions.

### *b. Expressly establish a MHNF "no degradation" standard for impaired streams*

Pursuant to the Clean Water Act, the Oregon Department of Environmental Quality (ODEQ) has identified several MHNF-originating streams as having impaired water quality due to elevated temperature and sedimentation and has devised Total Maximum Daily Loads for certain streams as well. As noted above, forest management practices can elevate both of these conditions. Particularly for impaired streams with TMDLs, MHNF should contribute no pollutants through its management of the watersheds in question. To ensure this, clear assessments of likely contributions of sediment, removal of shade vegetation and depletion of LWD sources must be undertaken before authorizing management actions that otherwise would result in downstream temperature increases or elevated sediment loads.

Even if the impaired portions of these streams lie outside the Forest boundaries, MHNF should not undertake activities that would add or contribute any pollutants for which the streams have been identified, because upstream management activities in implicated watersheds affect downstream water quality.

MHNF should actively restore riparian vegetation to return stream temperatures to natural, cool states and avoid further riparian vegetation removal for streams listed for temperature. MHNF should work with volunteers and watershed councils to address such restoration needs. MHNF should strive not to merely comply with state water quality standards, but rather should fall well below those standards' limits so as to maximize downstream recovery.

Salt application on Mt. Hood's Palmer Snowfield

### *c. Restrict recreation impacts on headwater stream areas*

Impacts to headwater streams affect downstream watershed health.[555] These impacts arise not solely from timber harvest activities and road-building, but also recreation.[556] A key headwater stream on the MHNF currently facing on-going and imminent threats is Still Creek, a target for fine-filter aquatic habitat restoration activities by the Sandy River Basin Working Group.[557] Yet Still Creek is subject to ongoing deposits of salt to maintain the Palmer Snowfield at Timberline Ski Area[558] as well as under analysis for a "Mountain Bike Trails and Skills Park."[559] Given the recognized importance of headwater streams to overall watershed health and the prioritization of Still Creek for restoration, the long-term impacts of continued dumping of salt and potential sediment delivery through the construction and use of steep-slope mountain bike skills trails should be thoroughly assessed and restricted if analysis shows habitat restoration will be impeded otherwise.

## 6.4. Remediate road network impacts to watersheds

### *a. Extend protections to roadless areas of 1,000 contiguous acres or greater*

Because road-associated sedimentation, erosion and mass wasting problems are so pervasive, areas without roads have increased value for habitat and provision of cool, clear water. Currently, MHNF operates under the Roadless Area Conservation Rule, which prohibits road construction, reconstruction and maintenance in inventoried roadless areas 5,000 acres or larger.[560] This road-building moratorium should be embedded into the Forest Plan to further protect such areas. Roadless areas greater than 1,000 acres have been identified across

MHNF[561] and should receive the same protections embedded into the Forest Plan to maximize the amount of landscape not contributing sedimentation to watersheds.

***b. Use available and gather needed information to assess aquatic risks and treatment options for all roads existing on the landscape that are not yet documented or ground-confirmed as hydrologically stabilized (including unauthorized routes and those not included as system roads)***

Illegal off-road vehicle trail near Rimrock Creek

Expressly recognizing unauthorized and/or non-system roads that exist on the landscape will better enable MHNF to assess ongoing impacts to watersheds. Development of a Minimum Road System pursuant to the Roads Rule will aid in this effort, but MHNF must acknowledge and address continuing impacts from roads that were never part of its Forest Service Infrastructure Database or have been removed due to road "closures" despite still physically existing, in whole or in part. User-created roads should be given particular attention for treatment options and barrier placement to prevent further use.

***c. Establish road density standards at the 6th field sub-watershed scale Forest-wide, with a density of less than 1.5 miles per square mile as an initial target and reduce road mileage to 51% of the network as recognized in the 1999 Access and Travel Management Plan and 2003 Roads Analysis over the life (10-15 years) of the next MHNF revised plan***

MHNF has made progress in downsizing its road network since the adoption of the Northwest Forest Plan and implementation of its Road Decommissioning Increment process. Combined with a complete moratorium on road construction in Key Watersheds, roadless areas over 1,000 acres and designated wilderness, an established road density standard of less than 1.5 miles per square mile, measured at the 6th field sub-watershed scale, will continue the progress already underway and capitalize on current momentum.

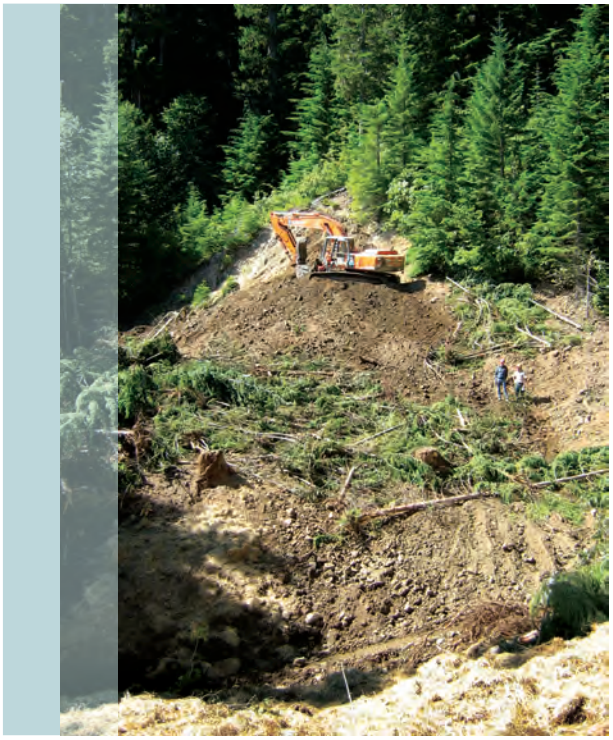
Road density is a reliable, easily measureable and highly predictive indicator of watershed impairment. The Watershed Condition Framework released by the Washington Office in May of 2011 considered "open road density" an indicator of watershed condition.[562] Setting road density standards and using road density as a monitored metric of watershed condition at appropriate scales is an effective tool. In cases where road density is already low, a density standard will be effective in keeping that density low and further reducing it. MHNF should adopt road density standards at the 6th-field watershed scale and use road density as a factor in prioritizing road decommissioning decisions. MHNF should prioritize areas with low-to-moderately-low levels of road mileage for further reductions in order to attain the most economically efficient and ecologically effective results.[563] However, areas with severely high road density levels must also see road mileage decreases to reduce watershed impacts.

While no "safe" level of road density exists, road density targets below two miles per square mile will produce drastically less sediment delivery to streams, as well as benefit wildlife. The 2005 Aquatic Restoration Strategy from Region 6 considered road densities above 2.0 miles per square mile to be an indicator for watershed restoration prioritization. Because this fails to acknowledge that adverse impacts accrue above 0.1 mile per square mile, MHNF should aim to reduce road densities Forest-wide below this point.

***d. Establish hydrologic connectivity limits for the road network at the 6th-field sub-watershed scale Forest-wide, with an initial target of less than 10% connectivity to streams***

Hydrologically disconnecting road segments from streams significantly reduces the impact of roads that will remain on the landscape. Identifying priority roads for such hydrologic disconnection and actively addressing and eliminating the points of connectivity will mitigate some of the on-going delivery of sediment from the road network.

***e. Actively decommission roads previously decommissioned through passive means where passive measures do not eliminate adverse impacts***



Road decommissioning and stream channel restoration in progress in the Clackamas Ranger District

Because road decommissioning has already begun in earnest across the Forest, MHNF should reassess roads previously "decommissioned" through passive methods, i.e., simple placement of barriers and natural re-growth of vegetation, or merely abandoned, to ascertain whether adverse impacts (runoff, sediment delivery, unlawful use) have been effectively curbed. If they have not, MHNF should consider them for further active decommissioning, using the same prioritization criteria as non-decommissioned roads.

***f. Prioritize active decommissioning***

MHNF generally categorizes active road decommissioning into eight methods, including decompaction techniques, stabilization, drainage improvements, culvert and bridge removals and full re-contouring (obliteration) of roadbeds. Certainly, some less-intense methods might effectively mitigate the adverse impacts posed by a certain road segment, making more-intense decommissioning of limited long-term value. However, MHNF should adopt a clear prioritization process to ensure decommissioning adequately resolves watershed impact concerns and fish passage barriers and storm-proofs roads to ensure hydrologic disconnection in the future during major weather events. Both the short and long-term restoration value (and fiscal and ecological costs) of obliteration of roadbeds with high levels of environmental risk or damage should be considered before opting for less costly methods. Perceived future need for road segments for timber harvest or continued use by stakeholders such as hunters must be appropriately balanced against watershed restoration goals to determine whether a potential future use warrants continued adverse impacts from road segments in the meantime.

Decoupling road decommissioning work from forest thinning will produce more noticeable results in terms of watershed restoration, as forest thinning (i.e., logging) involves a suite of activities that exacerbate road impacts to streams, including road reconstruction, maintenance, vegetation removal and forest floor disturbance. Rather than condition road decommissioning on first accomplishing management activities that further degrade watersheds, MHNF should subordinate timber harvest to the most pressing watershed restoration need identified by FEMAT: roads and associated runoff and sediment delivery.

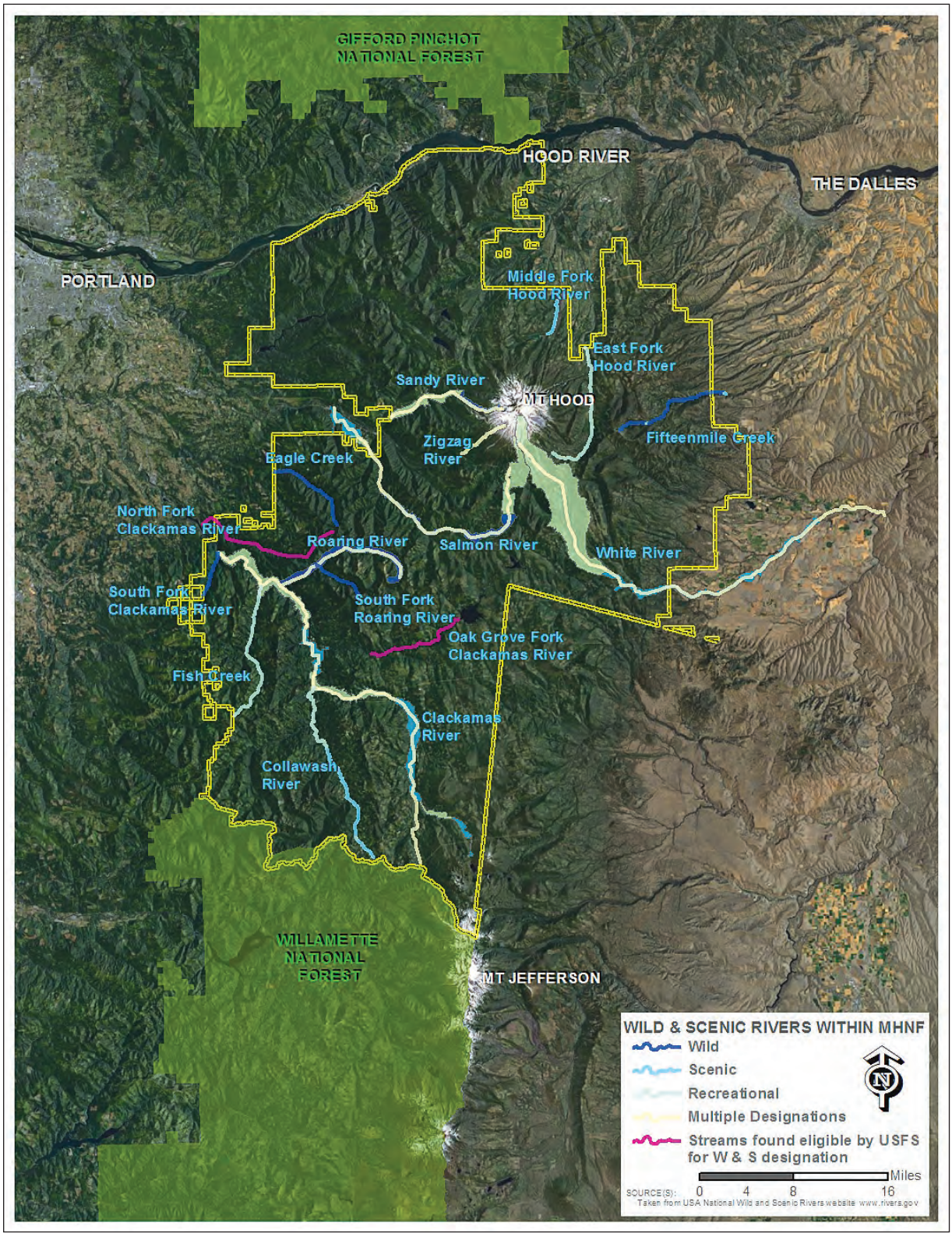



Figure 3. Map of wild and scenic rivers within Mt. Hood National Forest | Author *Thatch Moyle*

***g. Set aggressive road maintenance, improvement and decommissioning schedules to maximize available funding***

By preparing for road decommissioning in advance by conducting National Environmental Policy Act (NEPA) documentation, MHNF has capitalized on recent Congressional Legacy Roads appropriations. MHNF should continue to maximize available future funding by having NEPA-ready decommissioning projects ready to go should federal funding or other sources present themselves in the future. Although agency budgets and appropriations continue to be tightened throughout the federal government, positioning itself ahead of other units of the National Forest System will allow MHNF to move quickly when opportunities do appear to proceed with further road decommissioning and storm-proofing work.

## 6.5. Manage Wild, Scenic and Recreational River corridors to maximize stream protection and recovery

***a. Prohibit new road construction or recreation sites in all designated river segment corridors***

A minimum road system analysis is already underway on the MHNF and must be completed by 2015.[564] This process will likely indicate that the road network along designated road segments already amply provides necessary access to all designated river segments, whether classified as wild, scenic, or recreational and further road or recreation site construction is not necessary to meet demands. Prohibiting future road construction in these corridors is consistent with existing and proposed Key Watershed designations and the outstandingly remarkable values for which Congress designated the streams.

***b. Maintain the eligibility of stream segments previously found eligible***

The 1990 Plan found the North Fork of the Clackamas River and a 10-mile segment of the Oak Grove Fork of the Clackamas River eligible for designation under scenic or recreational classifications. The MHNF should maintain these streams' eligibility by refraining from management activities that degrade the outstandingly remarkable values previously recognized. This is consistent with the Oak Grove Fork's Key Watershed designation and this paper's recommendations for roadless area protections, such as those found at the headwaters of the North Fork of the Clackamas River.

## 6.6. Anticipate climate change and population growth by establishing water as the primary Forest resource

***a. Establish and protect water quality and quantity as the leading use of the Forest***

Water quality and quantity should be established as the leading use of MHNF in the Forest Plan, with other multiple uses subordinate. Such a commitment both complements and allows for other multiple uses of the Forest, including recreation, fish and wildlife habitat, municipal water supplies and healthy forest conditions. The Forest Service recognizes that management activities that result in less clean water increase costs to municipal water suppliers and ratepayers through higher treatment needs before domestic use.[565] An increased population surrounding the MHNF and inevitable increased demand for water supplies will mean higher potential treatment costs and rates. MHNF should expressly recognize its role in planning for this expected increase in demand and its duty to provide clean water that places as little economic burden on municipal water suppliers and ratepayers as possible.


Portland Water Bureau's Forest to Faucet tour bus on a visit to the Bull Run Watershed

To ensure clean and sufficient water supplies in perpetuity, MHNF should continue to emphasize and implement watershed restoration that addresses root causes, such as road network impacts. MHNF should further allow natural processes to restore aquatic habitat features that produce cool, clear waters and restrict activities that degrade water quality, even if such activities individually only produce minimal impacts.

***b. Expressly recognize that water yield does not justify Forest thinning or other logging***

Thinning for the purpose of increasing annual water yield cannot be justified based on scientific literature. The Forest Service as a whole already recognizes this[566], but an explicit recognition by MHNF in the Forest Plan will avoid repeated consideration of thinning proposals for this purpose in the future.

***c. Establish the Forest's reserved water rights***

As noted, some basins overlaying MHNF have already had water rights adjudicated, including the Hood River, Fifteenmile Creek and White River Basins. MHNF should explore ways to further establish its reserved water rights for forest management purposes for the Sandy and Clackamas River Basins. Clarifying the quantity to which the Forest is entitled through adjudication will better allow the Forest to protect Forest resources and enable MHNF to assist in water supply discussions in the future.

## Part Seven — Conclusion

Mt. Hood beyond Portland at sunrise

Mt. Hood National Forest's 1990 plan is long overdue to be revised under NFMA.[567] Although national and regional Forest Service direction and funding play a heavy role in the Forest's ability to move forward with necessary plan revision, there are steps that can be taken now to lay the groundwork for adoption of a solid, protective and effective revised plan. Further, many aspects of this groundwork can be implemented now through on-the-ground, site-specific projects, easing the transition between the 1990 and Northwest Forest Plans and the Mt. Hood National Forest's future revised plan.

The recommendations contained in this paper aim to help the Forest better protect its most valuable resource—water. By better protecting its water now, the Forest will prepare itself to withstand the challenges of a growing Portland-area population and the inevitable shifts in precipitation and stream flow patterns that will accompany climate change. The Forest will also establish itself as a proactive partner to the National Marine Fisheries and U.S. Fish and Wildlife Services in the recovery of listed coho and Chinook salmon, steelhead and bull trout.

These recommendations better ensure full hydrologic and riparian functioning and natural restoration than the 1990 Plan by limiting disturbance areas and expanding and extending protections to all types of streams. These recommendations strengthen and go beyond the Aquatic Conservation Strategy of the Northwest Forest Plan by establishing the ACSOs as standards with which all activities within Riparian Reserves must comply, excluding timber harvest and road construction and reconstruction within a site-potential tree length buffer along all streams, providing explicit criteria to screen proposed riparian thinning projects in the second site-potential tree length in Riparian Reserves and expressly prohibiting any new roads or road reconstruction in Key Watersheds.

The recommendations in this paper address chronic sediment delivery from the still-oversized road network on Mt. Hood National Forest by urging swift reductions in road density, hydrologic disconnection of the road network from streams, prioritization of active decommissioning of unneeded roads with high aquatic risks, hydrologic stabilization of all roads that exist on the landscape and firm restrictions on any extension of the road network in critical areas.

These recommendations are consistent with and stronger than the framework set forth by the Region 6 ARCS, because they expand minimum buffers in Riparian Reserves and by establishing firm exclusions and restrictions of activities within Riparian Reserves unless ACSOs and screening criteria are clearly met at the site-specific level. Rather than decreasing protections under the ACS as the ARCS does, these recommendations strengthen protections for cold, clean water by limiting activities near streams that could alter stream temperature, sediment delivery and woody debris recruitment.

The recommendations in this paper are also consistent with the minimum protections and considerations for aquatic and riparian resources set forth by the 2012 NFMA planning rule. These recommendations promote the ecological integrity of the Forest and the goal of ecological sustainability. The recommendations take into account landscape-scale functions

and processes and allow for natural restoration and necessary active restoration of water and related resources. The recommendations will allow the Forest Service to provide the ecological conditions necessary to contribute to the recovery of coho, Chinook and steelhead, as well as bull trout. The recommendations recognize the importance of the Forest's ecosystem services, including drinking water supplies.

Mt. Hood National Forest has made significant progress in addressing issues related to its water resources since the adoption of the Northwest Forest Plan. As the Forest moves closer toward revision of its management plan, it is critical that it continues to maximize opportunities to maintain its momentum in addressing its road network and implementing the best available science to ensure it is in fact maintaining and restoring the critical components of aquatic and riparian ecosystems. Taking a proactive, protective approach to managing its water resources will best ensure the Forest's ability to provide cold, clean water in perpetuity for humans and aquatic organisms.

## Notes

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