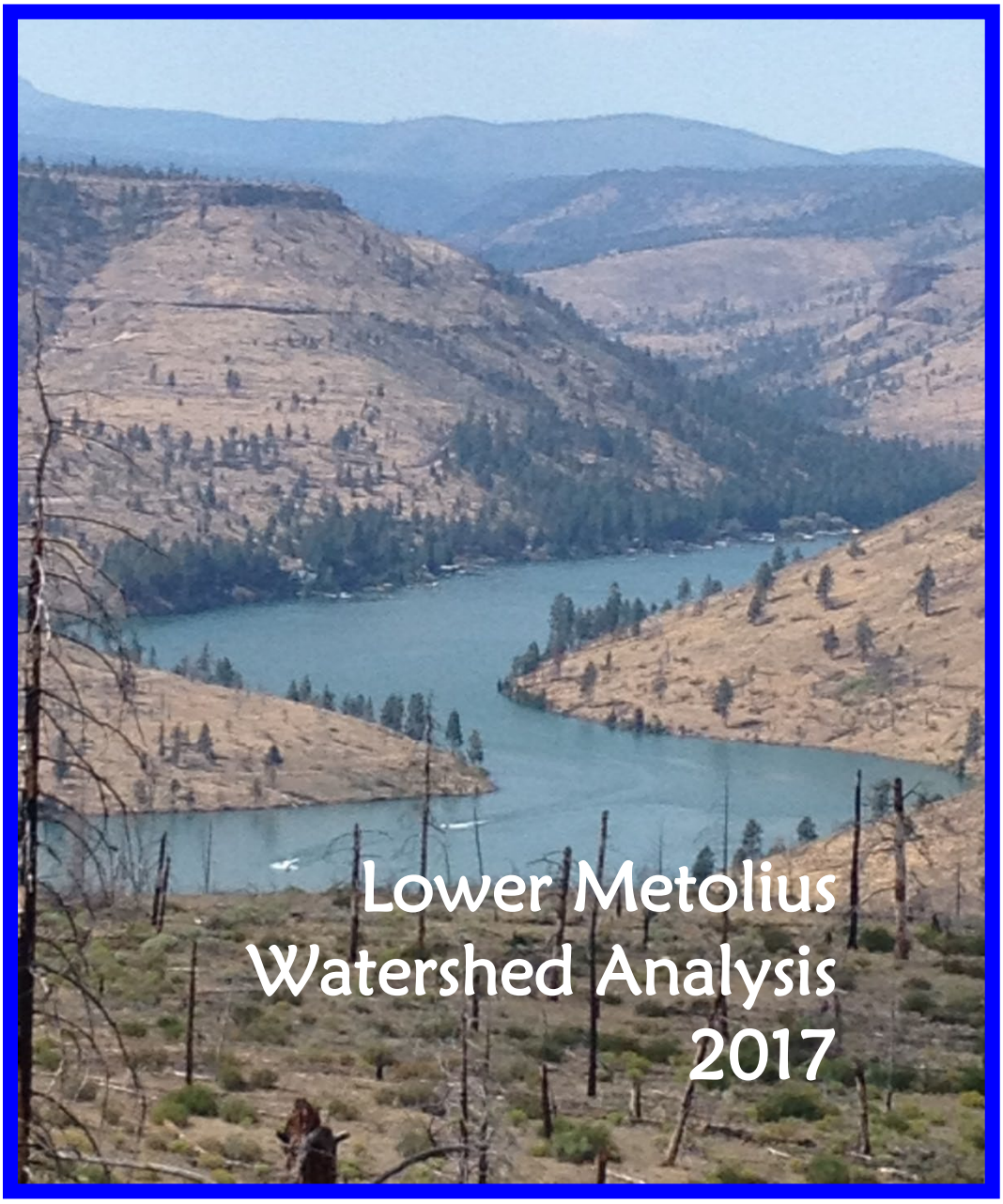

USDA Forest Service
Sisters Ranger District,
Deschutes National Forest, Oregon

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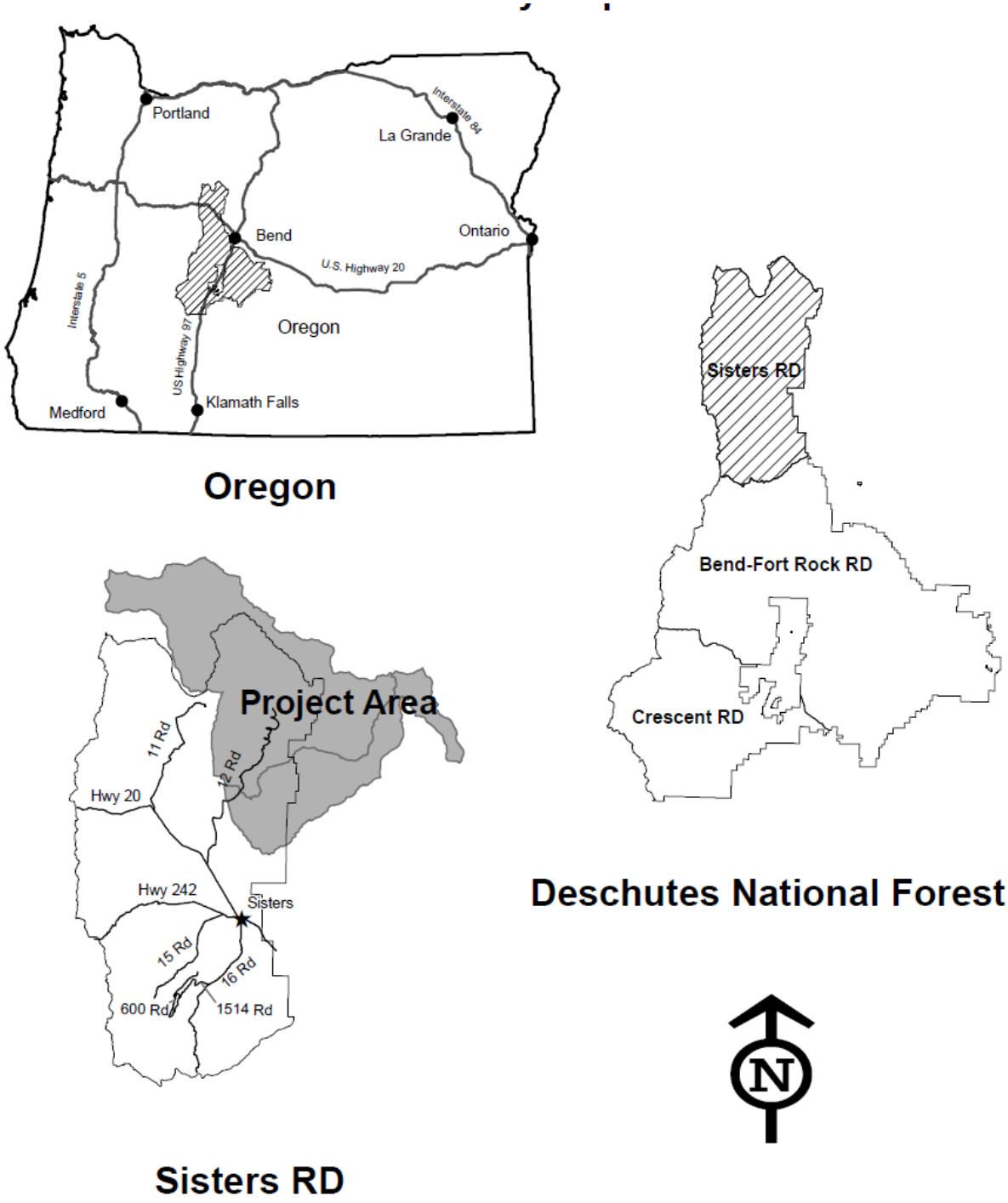


Figure 1- Lower Metolius Watershed Analysis Area Locator Map

Lower Metolius Watershed Analysis 2017

Executive Summary

Purpose and Scope of this Document

Figure 2. Picture of 2003 Eyerly fire

- Initial Watershed Analysis on the Lower Metolius Area, with some overlap from the Metolius Watershed Analysis Update (USFS 2004). Includes some eastside areas such as Potter Canyon watershed that are adjacent.
- Analyzes effects of recent wildfires in the watershed.
- Identifies trends of concern
- Prioritizes areas to guide future management
- Provides recommendations
- Identifies data gaps and monitoring needs
- Provides information for cumulative effects analysis

Major recent events in the Lower Metolius Watershed:

- **Anadromous fish are back.** Steelhead and spring Chinook salmon have been reintroduced to Whychus Creek. The first returning adults were found in 2011 at Pelton Round Butte Dam. The steelhead, chinook and sockeye have also been detected in the Metolius River.
- **Large wildfires have burned into the watershed since 2008 these** include the 2008 Wizard Fire, the 2013 Green Ridge Fire, and the 2014 Bridge 99 Fire.

OVERVIEW

What is Watershed Analysis?

"Watershed Analysis is a systematic procedure to characterize the aquatic, riparian, and terrestrial features within a watershed. Managers use information gathered during watershed analysis to refine riparian reserve boundaries, prescribe land management activities, including watershed restoration, and develop monitoring programs (USFS 1994).

This information helps guide future management and suggests future projects. It serves as a foundation for future project level analysis and decision-making. The analysis helps to ensure that activities are consistent with ecosystem management objectives as described in the *Deschutes National Forest Land and Resource Management Plan* (USFS 1990) as amended by the *Record of Decision for Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl (*USFS 1994). Watershed Analysis process is based on the six step analysis process outlined in the *Federal Guide for Ecosystem Analysis at the Watershed Scale (version 2.2) and associated module* (USFS 1995).

This analysis is not a decision making process. Project level recommendations for federal lands must be

further analyzed according to the National Environmental Policy Act (NEPA) process.

Why Was this Watershed Analysis Update Done?

The Federal Guide for Ecosystem Analysis at the Watershed Scale states: "Federal Agencies will conduct multiple analysis iterations of watersheds as new information becomes available, or as ecological conditions, management needs, or social issues change." The need for an update may be triggered by major disturbance events, or if existing analyses do not adequately support informed decision making for particular projects or issues. As analysis updates are conducted, new information is to be added to existing analyses.

This update serves to support analysis for future management and identifies recommendations for future management activities. This document provides important new information but **does not** update and rewrite all aspects of the Sisters Whychus Watershed Analysis (USFS 1998) or the Whychus Watershed Analysis Update (USFS 2009). Both documents are useful summaries and can be used as references.

How was this Watershed Analysis Update Prepared?

This update is based on an interdisciplinary analysis done by a team of Forest Service specialists between October 2012 and August 2016. This is a dynamic document that may be updated and modified as needed.

Some resource areas have both summaries and full reports. Others have only summaries.

Public Involvement and Scoping

Information for this analysis is derived from the public and comes from several sources including:

- The Deschutes Collaborative Forest Project Meetings and Field Trips
- Information provided by Agency partners
- Green Ridge Landscape Restoration Project Planning and Pre-scoping

Figure 3. Resource Specialists at Prairie Farm Meadow

Lower Metolius Watershed and Potter Canyon

Distingishing Characteristics

Setting

The lower Metolius and Potter Canyon watersheds are located north of Sisters, Oregon and west of Madras, Oregon (Figure 4). They are located on the northernmost end of the Deschutes National Forest with portions occupying the Warm Springs Reservation, Crooked River National Grassland, Ponderosa Land and Cattle LLC as well as Oregon State and other private lands.

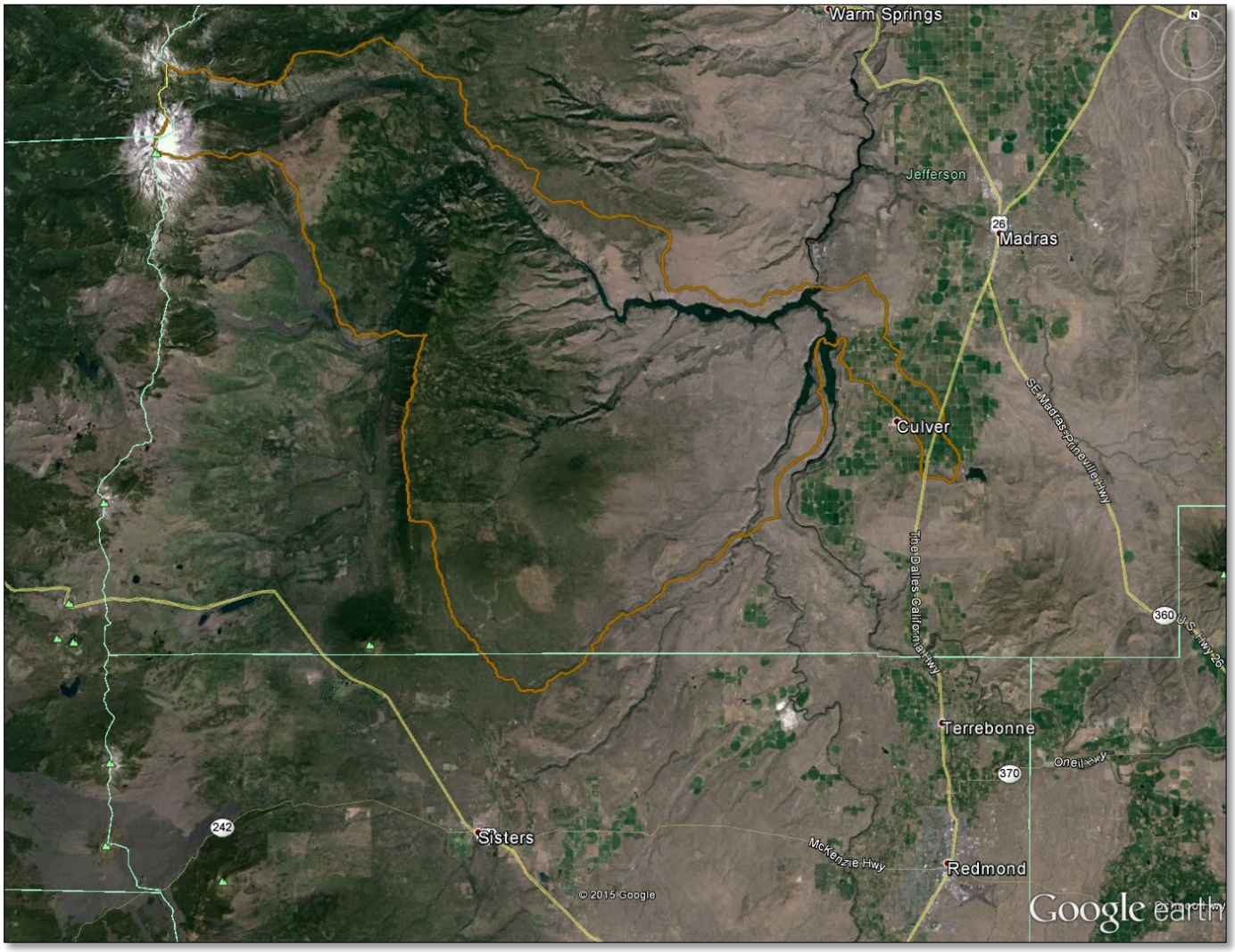


Figure 4. Aerial vicinity map of the Lower Metolius and Potter Canyon watersheds.

Physical

The western portion of the watershed is represented by the peak of Mt. Jefferson with east represented by developed agricultural lands with ground and river sourced irrigation.

Biological

Similar to other eastern trending watersheds arising from the Cascade crest; the Lower Metolius watershed has a drastic precipitation gradient from west to east (Figure 5). In just over 12 west to east air miles, precipitation varies by over 100 inches annually. Though there is a large gradient, at least 80% of the watershed receives between 11”-30” precipitation a year (based on 1981-2010 average; Figure 6).

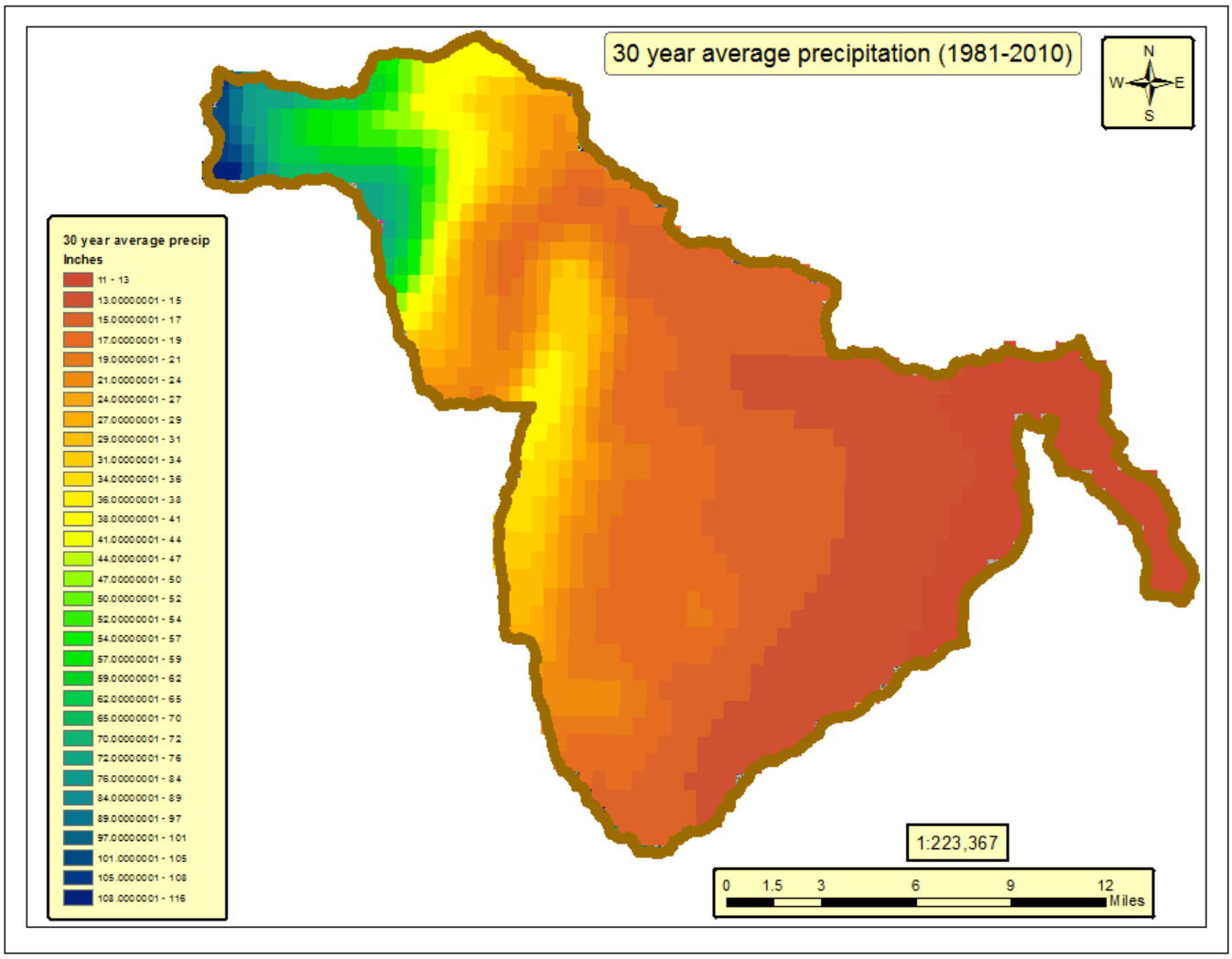


Figure 5. Spatial display of precipitation gradients across the Lower Metolius and Potter Canyon watersheds.*

**Monthly 30-year "normal" dataset covering Oregon, averaged over the climatological period 1981-2010. PRISM Climate Group at Oregon State University

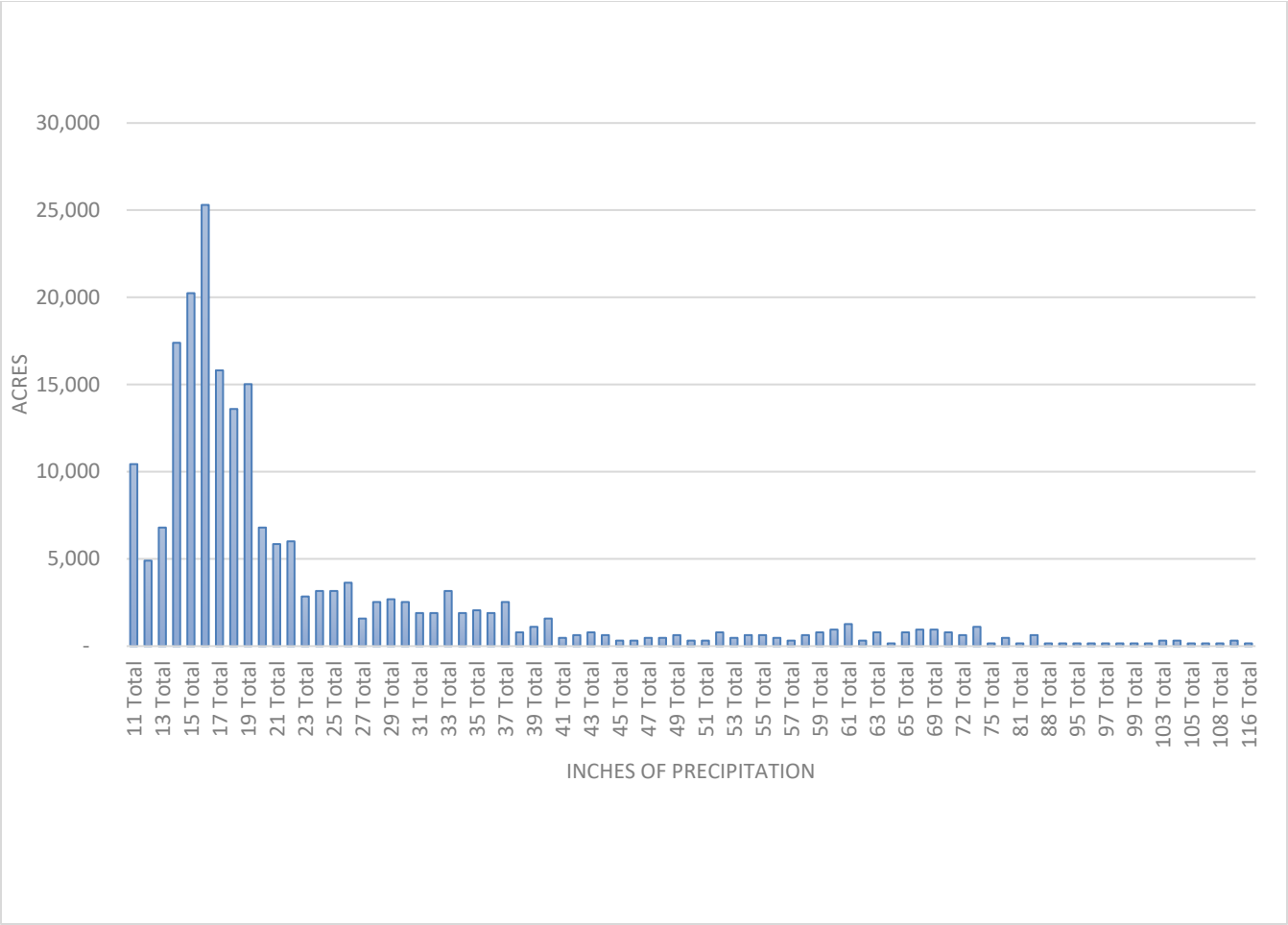


Figure 6. Acres by precipitation (inches) of 30 year precipitation totals (1981-2010) across the Lower Metolius and Potter Canyon Creek watersheds*.
*Monthly 30-year "normal" dataset covering Oregon, averaged over the climatological period 1981-2010. PRISM Climate Group at Oregon State University

Social

The social fabric that makes up the Lower Metolius and Potter Canyon is varied.

Land Allocations

The watershed area totals 204,373 acres, with a mixture of state, federal, tribal, and private ownership (Table 1). The majority of the watershed is in federal ownership, most of which is comprised of Deschutes NF. Both

privately owned land and the Warm Springs Reservation make up most of the remainder of the watershed.

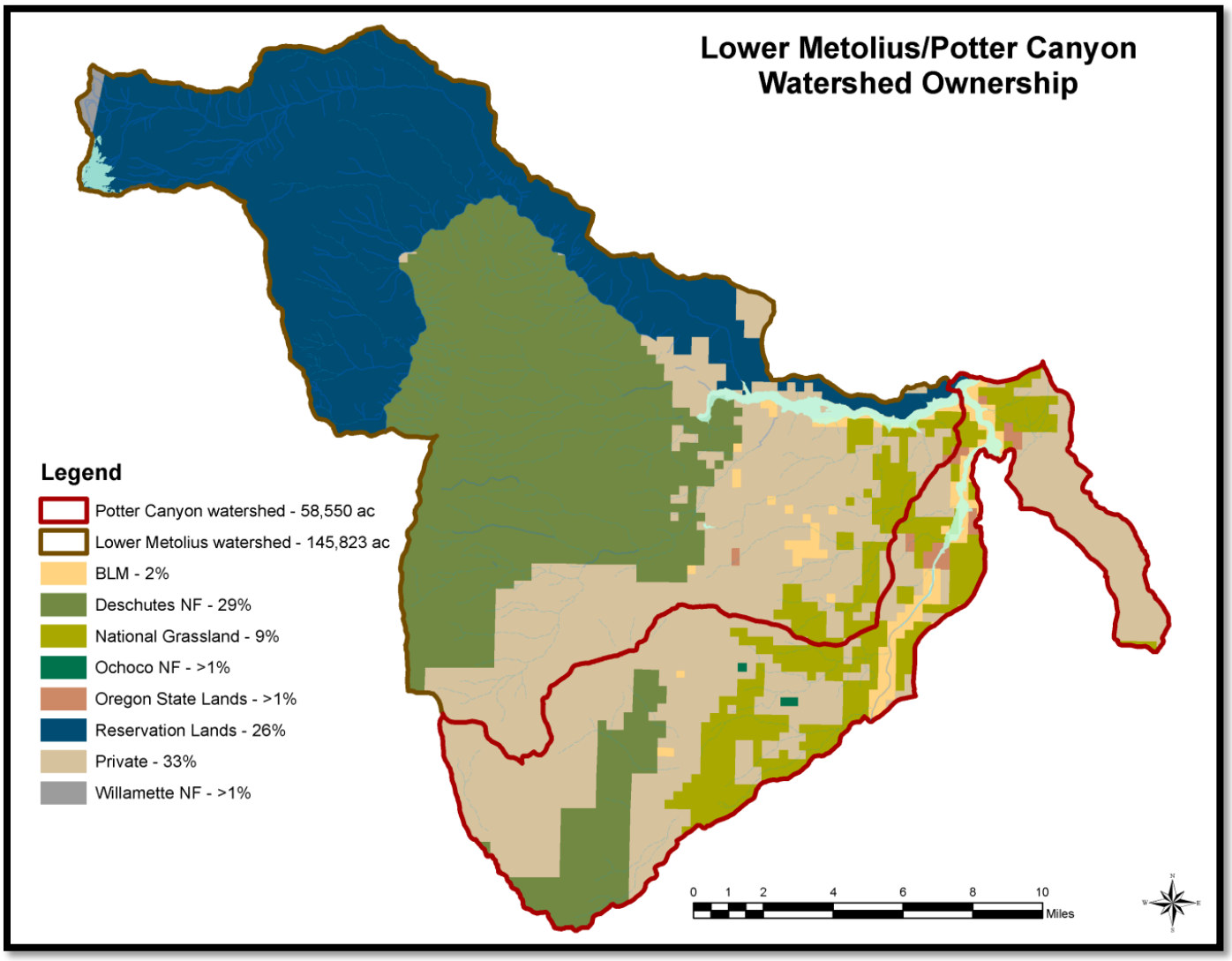


Table 1. Land ownerships within the Lower Metolius and Potter Canyon Watersheds.

Ownership	**Lower Metolius** acres/percentage subwatershed	**Potter Canyon** acres/percentage subwatershed	**Both watersheds** acres/percentage combined watershed
Deschutes NF	50,769 (35%)	7,920 (14%)	58,689 (29%)
Ochoco NF and Crooked River National Grassland	4,957 (3%)	13,108 (22%)	18,065 (9%)
Willamette NF	548 (>1%)	0	548 (>1%)
Confederated Tribes of Warm Springs	54,023 (37%)	75 (>1%)	54,098 (26%)
BLM	1,397 (>1%)	3,292 (6%)	4,689 (2%)
Oregon State	124 (>1%)	875 (>1%)	1,123 (>1%)
Private/Unknown	34,005 (23%)	33,280 (57%)	67,285 (33%)
Total Acres	**145,823**	**58,550**	**204,373**

Table 2. Deschutes National Forest Land and Resource Management Plan (LRMP) within the Lower Metolius and Potter Canyon Watersheds.

Management Area Name	Acres	Proportion
Balancing Rock Special Int Area	43	0.1%
Deer Habitat	19302	23.1%
General Forest	19122	22.8%
Intensive Recreation	371	0.4%
Metolius Heritage	3129	3.7%
Metolius Research Natural Area	23	0.0%
Metolius River - Scenic Segment	2310	2.8%
Metolius Special Int-Black Butte	626	0.7%
Metolius Wildlife/Primitive	12850	15.3%
Old Growth	913	1.1%
Totals	58689	100%

Table 3. Land allocations as described by the Ochoco National Forest and Crooked River National Grassland within the Lower Metolius and Potter Canyon Watersheds.

Deschutes River Scenic Area	57	0.4%
General Forage	3104	19.3%
Lake Billy Chinook View Area	485	3.0%
Metolius Winter Range - Deer	10975	68.1%
Old Growth Juniper	207	1.3%
Research Natural Area	76	0.5%
Whychus Creek Management Area	1212	7.5%
	16116	100%

Table 4. Land Allocations as described by the Northwest Forest Plan for the Lower Metolius and Potter Canyon watersheds

Northwest Forest Plan Allocation	**Lower Metolius** acres/percentage subwatershed	**Potter Canyon** acres/percentage subwatershed	**Both watersheds** acres/percentage combined watershed
Administratively Withdrawn Areas	2783 (6.3%)	0	2783 (6.2%)
Late-successional Reserves	20581 (46.8%)	0	20581 (45.9%)
Matrix	15626 (35.5%)	0	15626 (34.8%)
Other ownership	5000 (11.4%)	867 (100%)	5867 (13.1%)

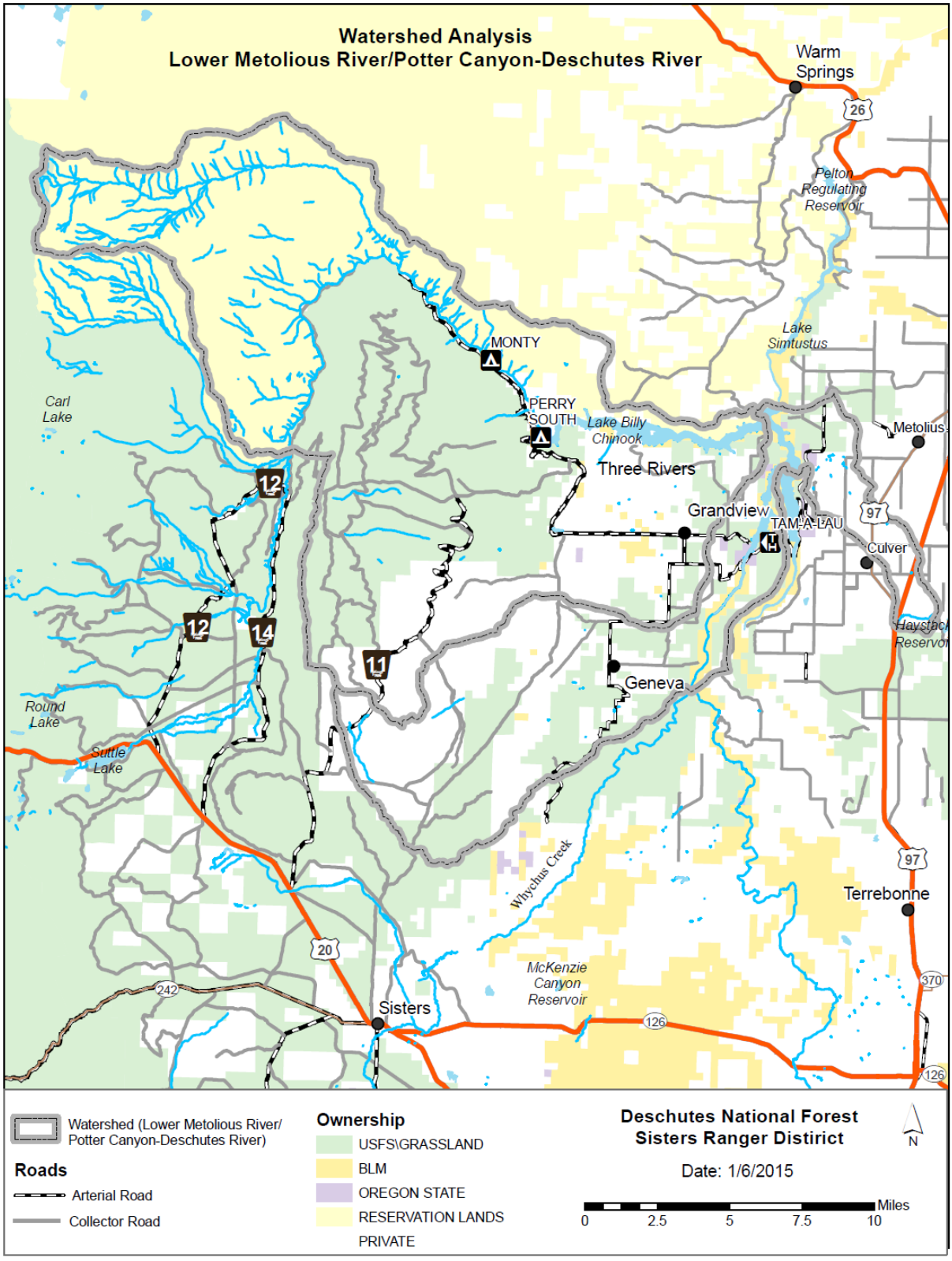


Figure 7. Lower Metolius Watershed Analysis Area

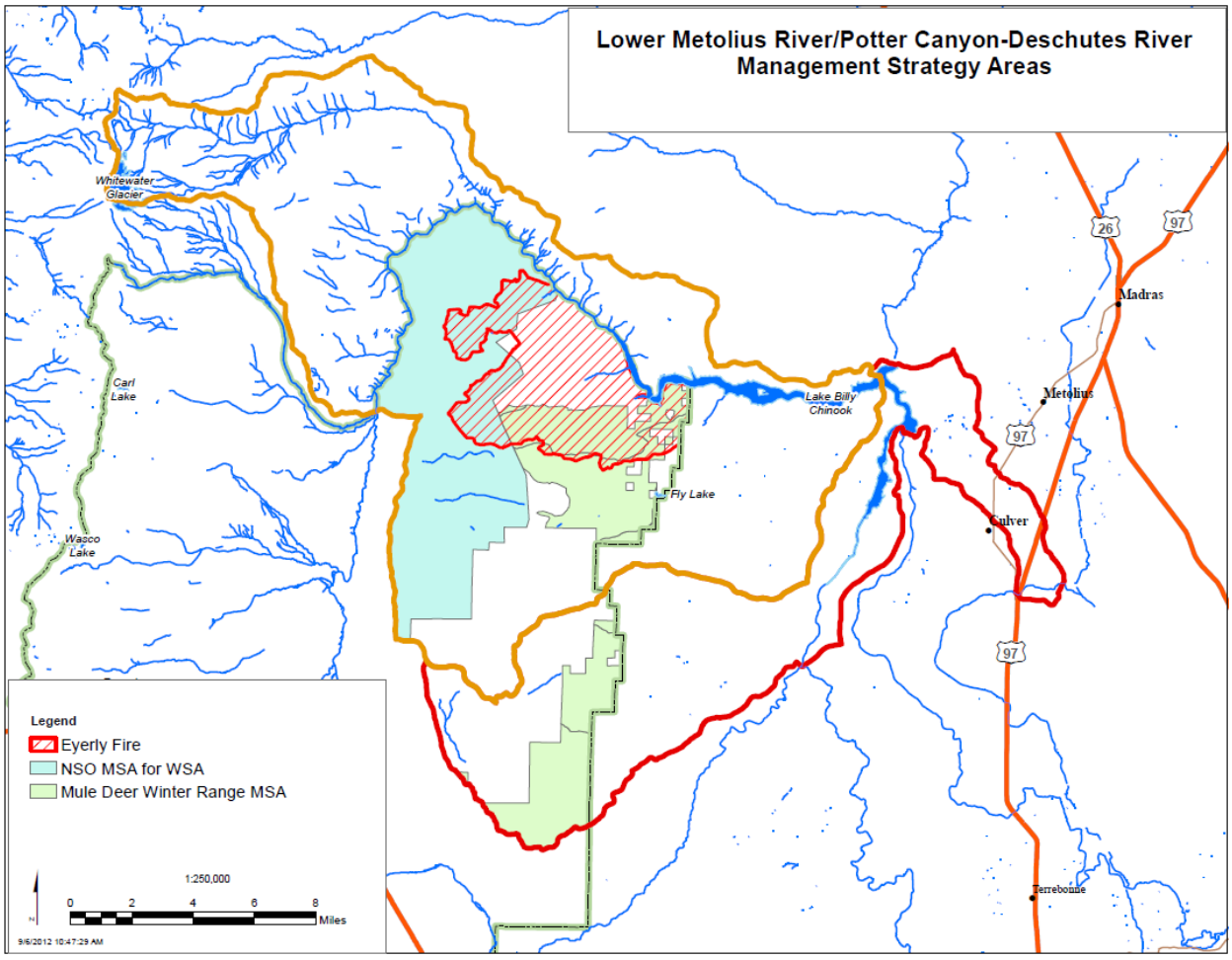
Key Questions- Focus of Analysis

1) How have recent wildfires affected the watershed and it's processes?

2) What other important new information or changes have emerged?

Figure 8. View of Mt Jefferson from the north end of Green Ridge

Lower Metolius Watershed Strategy Areas



Lower Metolius Watershed Analysis- Current Landscape Trends

Red Flag- Urgency for intervention to prevent further deterioration of a resource, endangered or sensitive species or recreation experience.

Yellow Flag- Something must be done soon to prevent a red flag trend developing.

Green Flag- Urgency is not too great or the trend maintains or enhances ecosystem sustainability and should continue.

NA- Not Applicable

TRENDS	1- Northern Spotted Owl -Mixed Conifer Forests	2- Deer Winter Range Forest and Shrub steppe	3- Fire Scars
Increased peak flows	YELLOW	YELLOW	RED
Increased stand densities and fire risk	RED	RED	GREEN
Increased frequency and size of wildfires	RED	YELLOW	GREEN
Increased Fragmentation of habitat	RED	YELLOW	GREEN
Loss of Late Successional habitat, fewer large trees than Historic Range of Variability	RED	YELLOW	RED
Loss of deer winter range and riparian habitats due to flooding from Hydroelectric dam to create Lake Billy Chinook	NA	YELLOW	NA
Aquatic species passage (road crossings)	RED	YELLOW	YELLOW
Increased aquatic invasive species- plants, fish, and snails	YELLOW	YELLOW	RED
Increased terrestrial invasive plant species	YELLOW	RED	YELLOW
Damaging Human Use- ATV's, poaching, illegal firewood cutting, encroachments	YELLOW	RED	YELLOW
Roads affect habitat security	YELLOW	RED	YELLOW
Increasing Urban Interface	YELLOW	RED	NA
Priority for management actions	Highest	High	Moderate
Feasibility of actions	High but habitat recovery requires very long timeframes	Moderate but requires extensive cooperation with other landowners	High

Trend #1- Northern Spotted Owl Focus- Mixed Conifer Forest

Goal-Protect, maintain and restore best areas for Northern Spotted Owl habitat
Rationale/Values at Risk:

- Required by 2013 Recovery Plan-this is a new critical habitat unit and there are regulatory restrictions, East Cascades North CHU 8
- Area has Nesting, Roosting, Foraging Habitat for Northern spotted owl (NRF) and was identified as important for owl connectivity
- Fragmentation from past harvest and wildfire has caused loss of owl habitat
- Protect Late Successional Forest (LSR and other) habitat for other dependent species
- Area has high fire risk, predict that wildfires will continue to occur northward along Green Ridge
- Area has best soils with potential to grow NRF, highest site potential, true mixed conifer
- It is the eastern boundary of Wildland Urban Interface (WUI)
- It contains the headwaters of Fly, Six, Prairie Farm and Street creeks
- It contains the Metolius Wild and Scenic River
- The north portion of the area is proposed as the Metolius Breaks RNA and a potential wilderness

Actions:

- Point protection of spotted owl habitat
- Ground truth Nesting, Roosting, Foraging Habitat for Northern spotted owl (NRF).
- Treat around NRF- no treatment of NRF and within high quality dispersal habitat retained to meet dispersal strategy.
- Grow more NRF, grow/ develop large trees with site specific considerations, especially ponderosa pine and Douglas fir first
- Develop Dispersal Habitat Strategy- stratify stands as “Good”, “Declining” or “Not” Dispersal habitat
- Strategic fuels reduction in inaccessible areas- Metolius breaks, west face of Green Ridge- - small tree thinning by hand, piling where feasible: benches, flat spots, old roads, river corridor to toe of slope
- Develop fuels treatments on both the top of green ridge as well as the western slopes. Prescribed fire should be considered along western slopes even as a stand-alone treatment.
- Use old fire scars to break up fuels continuity- use north/south fuels break from recent fires
- Block up some areas in Eyerly to <u>not do suppression</u>**.**
- Develop a pre-suppression- pre-attack plan with contingency lines, Build a containment box before event happens
- Prioritize road closures near riparian reserves, intermittent streams
- Address encroachments

Trend #2- Deer Winter Range Forests and Shrub steppe

Goal-Manage dry pine forests and shrub lands for reduced fire risk to urban interface and deer winter range

Rationale/Values at Risk:

- These are low productivity forest areas particularly vulnerable to climate change and wildfire
- The most interface with private lands
- Important Deer winter range
- Access issues in Fly creek are hampering weed management
- There are Redband trout streams to protect

Actions

- Stratify according to soil potential
- Manage for deer habitat, hiding cover and forage- small tree thinning, juniper removal
- Reduce road densities
- Reduce fuels in larger blocks, reintroduce fire- (Very carefully- some areas do not grow back)
- Need rotation of shrubs and various age classes
- Reduce weed spread- consider cooperative efforts
- Inventory stream wood on lower river
- Implement user registration as per WSR Plan
- Increase enforcement/education to address ATV misuse, poaching,
- Reactivate collaboratives on habitat restoration (mule deer winter range) and weed control (Cooperative Weed Management Area, Jefferson County Weed Board) , Social issues (Work with private landowners, PGE- more enforcement and self-policing)
- Work with landowners/PGE to resolve access issues passing through Phil Nance, Jeff Morse, Guy Kitchen lands to reach USFS for weed control
- Reduce future urban interface-Acquire private lands or conserve development rights if possible- Ponderosa Land and Cattle, other properties (PGE, Land trusts, Trust for Public Lands)

Trend #3- Fire scars - Eyerly, Bridge 99, and Green Ridge Fires

Goal-Support landscape recovery, strategic fire use and

Rationale/Values at Risk:

- Eyerly is outside HRV with large patches of early seral habitats
- Portions of the Bridge 99 and Green Ridge Fire area may be outside HRV?-
- There has been loss of trees in riparian reserves for shade and long term wood recruitment
- There are expanding populations of invasive plants, especially medusa head
- There are encroachments at Street Creek and on the Lower Metolius/garden encroachment
- There are too many roads
- It contains the Metolius Wild and Scenic River
- The north portion of the area is proposed as the Metolius Breaks RNA and a potential wilderness

Actions

- Use old fire scars to break up Fuels continuity- use North/south fuels break from recent fires
- Block up some areas in Eyerly/Bridge 99, Green Ridge Fire to <u>not do suppression</u>**.**
- **Develop a pre-suppression- pre-attack plan with contingency lines** (ala Wallowa Whitman Look at previous fires, fire lines, ridges that worked)
- Reduce road densities
- Reduce weed spread- consider cooperative efforts
- Address illegal diversions and encroachment
- Replant plantations

Actions specific to the Metolius Breaks- Potential RNA/Wilderness

Goal-Protect Unique Ecological Reference area and Wild Character

Rationale-
The Metolius Breaks (MB) site meets the two criteria established for evaluating areas for Research Natural Area. The criterion of (1) naturalness or conditions which appear to be unmodified by human management or other human activities is met on the steep, forested slopes, and ravines present on the site. The (2) representation criterion is also met by the occurrence of two elements listed in the Oregon Natural Heritage plan (ONHP 2003). Designation of the Metolius Breaks site as an RNA would adequately represent these elements within the Eastern Cascades ecoregion. In addition, presence of fragments of three other elements listed in the Oregon Natural Heritage plan would provide partial representation within the Eastern Cascades ecoregion.

Representation of elements in Metolius Breaks listed as RNA priorities for the East Cascades ecoregion (ONHP 2003).
Elements fully represented at site
EC-25 Dry site Douglas fir with vine maple, Douglas maple and oceanspray
EC-22 Ponderosa pine-white (grand) fir/chinquapin forest, with snowbrush and boxwood if possible

Elements partially represented at site
EC-33 Grand fir/snowberry, with ridgetops containing oceanspray, and other dry shrubs
EC-21 Ponderosa pine-white (grand) fir/snowbrush-greenleaf manzanita forest
EC-14 Ponderosa pine/greenleaf manzanita-bitterbrush forest

Relationship of primary elements to representation in current RNA system.
Dry site Douglas fir with vine maple, Douglas maple and oceanspray No representation in East Cascades ecoregion – low priority
Ponderosa pine-white (grand) fir/chinquapin forest, with snowbrush and boxwood if possible No representation in East Cascades ecoregion – high priority

Actions

- **Weed Control**- Due to the amount of open, rocky exposures at throughout the area, the site is potentially susceptible to establishment of invasive species. Although there are no current records of invasive species within the core of the area, spotted knapweed (*Centaurea maculosa*) occurs sporadically in low amounts along the low elevation access roads.
- **Fire management**- A short- and longer-term issue is how the agency will respond to wildfire in the area, should it occur. One approach that would address unnatural fuel loading that is consistent with RNA direction in the Forest Service Manual, would be to develop a site fire plan that includes fire prescriptions and detailed fire response measures to be taken under a range of conditions. The fire plan would need to demonstrate how future wildfires would burn out of the historic range of natural variability and would

create fire effects that would unacceptably alter conditions with the site. Developing a site fire plan in partnership with the PNW Research Station would provide the ecological context to assess historical range of variability and need, if any, for restoration management activities within the area.

- The Horn IRA, comprised of the Metolius Breaks designated roadless area and the Metolius Wildlife/Primitive area, provides numerous challenges from a fire and fuels stand point. Its unique and rugged nature makes access difficult and suppression efforts hazardous.
- The area is classified primarily as Dry Mixed Conifer ecotype which historically was likely dominated by frequent low severity fire events. Historical records show larger fire events occurring in the area in 1910, 1926, and 1945 (severity of these fires is unknown). However, since 1980 twenty-seven natural starts have been surprised at under 5 acres.
- Many of the dry mixed conifer stands are likely overstocked with shade tolerant species such as White Fir and are prone to high severity fire.
- Understory fuels treatments such as thinning from below coupled with prescribed fire treatments are warranted. Due to location and access issues treatments in this MSA will be logistically challenging.

- **Access Management**- The primary access road at river level leads to the base of the slope which comprises the Metolius Breaks site. The road (Forest Road 64) is gated about two miles east of the RNA and road access poses no significant threat to the area. Similarly, forest roads on Green Ridge pose no significant threats from motorized access due to the steepness of the terrain and the inhospitable nature of the area. However, the property owners in the area have changed and the gate may need to be checked more often.
- **Recreation management**- A seasonal recreation trail parallels the course of the Metolius River adjacent to and outside of the proposed boundary. There is no evidence that recreational hiking poses a threat to the ecological values present within the RNA boundary. The trail was unpassable in 2012 due to blowdown.

Specific Resource Recommendations

Vegetation Management Recommendations

Strategy to Achieve Desired Conditions

- Thin overstocked, closed canopy stands in small and pole size classes where current condition is above the acceptable range.
- Target removal of white fir to reduce the overabundance of late seral stands in the mixed conifer PAGs.
- Thin mixed conifer stands dominated by white fir to allow recruitment of a variety of species to increase insect and disease resilience.
- Remove or mow small trees and/or tall shrubs to allow for introduced fire and increase wildfire resilience.
- Thin in pole and small size class ponderosa pine to allow dominant trees grow into large size trees and create more open canopied stands.
-

Potential Actions to Achieve Desired Conditions

- Vegetation management projects in Green Ridge Landscape Restoration project and Garrison project areas using silvicultural strategies to achieve desired conditions.

Fuels and Fire Management Recommendations

Strategy and Potential Actions to Achieve Desired Conditions
MSA: Northern Spotted Owl and Deer Winter Range

- Achieve a mosaic of landscape-scale treatments managed to reduce fire hazard and threat to facilitate the suppression of human-caused wildfires, protect valuable resources, and allow the re-introduction of fire as a disturbance process. Move acres classified as moderate or high hazard towards low hazard.
- Stands should have a height to live crown that is well above the shrub and seedling components. Shrubs should be maintained at a height and continuity that would reduce the potential for rapid rates of spread and crown fire initiation. Dead and downed materials should not be overly extensive. Large trees that are more resistant to fire-induced mortality should be maintained.
- Encourage the use of prescribed fire to meet resource goals (e.g., timber and forage) and to reduce hazardous fuels. In areas dominated by ponderosa pine and in the WUI, this translates to canopy characteristics and a fuel profile that do not support extreme fire behavior (i.e., crown fire, high resistance to control, high flame lengths) under severe fire conditions.
- Locate and schedule hazard fuel reduction and underburning activities in alignment with wildlife habitat protection and improvement strategies, reducing risk of lost to key ecotypes.
- Restore and maintain old growth characteristics using mechanical fuels treatments and prescribed fire in Ponderosa and Mixed Conifer plant associations. Reduce canopy structure and surface fuel configurations in line with historical range.
- Reduce risk to private lands within and adjacent to USFS boundaries from fires initiating on federal land through strategic placement of treatments and fuel breaks. Determine the

need/feasibility for maintained fuel breaks along Green Ridge and bordering private property inholdings.

- Prevention of human caused wildfire in areas identified as high use and high risk including; major travel ways, firewood cutting areas, and dispersed camping and hunting corridors.
- In the Northern reaches of Green Ridge much of the area is classified as high hazard with steep terrain and stand characteristics that are showing the effects of fire suppression over time. The area is remote and presents numerous challenges in terms of treatment. Consider allowing natural disturbances to influence the character of the landscape and develop fire management plans that provide guidelines for the use of natural fire.
- Identify major travel corridors (scenic, recreation, forest products) and treat appropriately to increase ingress/egress and fire break feasibility in wildfire scenario.

MSA: Eyerly Fire

- Consider allowing natural disturbances to influence the future character of the landscape and develop fire management plans that provide guidelines for the use of natural fire.
- Recent fires and associated fire behavior analysis have shown that much of the Eyerly fire area is prone to lower fire behavior and that allowing fire to plays its natural role in identified areas could be successful under the right conditions.
- Identifying these areas and acceptable conditions while establishing both strategic response plans and associated beneficial pre-treatment is warranted.
- At the same time, identifying and examining areas that could potentially benefit (in coordination with TSI personnel) from planned ignitions (Prescribed Fire) may promote future stand health and resilience.

Potential Metolius Breaks RNA/Horn IRA

- The Horn IRA, comprised of the Metolius Breaks designated roadless area and the Metolius Wildlife/Primitive area, provides numerous challenges from a fire and fuels stand point. Its unique and rugged nature makes access difficult and suppression efforts hazardous.
- The area is classified primarily as Dry Mixed Conifer ecotype which historically was likely dominated by frequent low severity fire events. Historical records show larger fire events occurring in the area in 1910, 1926, and 1945 (severity of these fires is unknown). However, since 1980 twenty-seven natural starts have been suppressed at under 5 acres.
- Many of the dry mixed conifer stands are likely overstocked with shade tolerant species such as White Fir and are prone to high severity fire.
- Understory fuels treatments such as thinning from below coupled with prescribed fire treatments are warranted. Due to location and access issues treatments in this MSA will be logistically challenging.

Other Areas not incorporated into MSAs

The above strategies and recommendations apply to all areas within the watershed analysis area. Strategic planning should be utilized to identify and treat areas for habitat restoration, fire prevention and protection, and suppression success in the event of unplanned ignitions.

Wildlife Recommendations

Strategy and Potential Actions to Achieve Desired Conditions

- Spotted Owl NRF Habitat Within and Outside CHUs
    - Field verify NRF and exclude currently viable NRF habitat from treatment.
    - Develop a thinning and fuels treatment strategy to reduce the risk of stand replacing fire, and loss of NRF habitat.
    - Within areas containing the inherent soil quality and site potential capable of developing NRF habitat;
        1. Where multi-storied stands exist with the overstory containing residual large ponderosa pine, Douglas-fir, incense cedar, western larch, and white fir. Thin stands from below to reduce stress to overstory and removal of ladder fuels, understory treatments should favor ponderosa pine, Douglas-fir, and western larch. NRF habitat develops through fire exclusion, prescribe fire can be used in the initial entry to reduce slash and fire risk, but will be excluded to promote understory development to achieve canopy closure and vertical structure to meet suitable NRF habitat.
        2. In second growth stands, thin stands to promote spatial heterogeneity, while promoting the development of an LOS overstory. Developing ponderosa pine and Douglas-fir large tree structure are the building blocks of NRF habitat.
        3. In homogenous plantation, mosaically thin stands to promote spatial heterogeneity and stocking densities reductions. Treatments will reduce stocking risk of losing plantations in the event of a wildfire, as well expediting the development of overstory stands.
- Spotted Owl Dispersal Habitat Within and Outside CHUs
    - Develop a connectivity strategy to move spotted owls in a north to south continuum through the identified CHU as well as between identified NRF habitats.
    - Within the connectivity strategy, identify stands to be left untreated to facilitate the spotted owl dispersal as well as providing security and predator avoidance.
    - Within the connectivity strategy, identify stands where thinning and prescribed fire could be implemented to promote stand development, reduce wildfire risk, and provide dispersal habitat. Post treatment stand should minimally meet the dispersal objective for MCW, MCD, and PP PAGs. (Note: MCW stands managed to provide future NRF, could potentially fall within the dispersal definitions during the initial stages of management.)
    - Within the Metolius Wildlife Primitive Area, manage fire starts to prevent loss of NRF habitat from stand-replacing wildfire.
- Mule Deer and White-headed Woodpecker

Mule deer winter range and white-headed woodpecker habitat overlap and both are associated with ponderosa pine stands within the watershed. During the Lower Fly Creek Project which also occurs in the watershed, a process was developed to manage habitat conducive to meeting objectives for both species. This process will be utilized to continue to manage habitat for these species, also fulfilling habitat requirement of other ponderosa pine obligates.

1. Due to the low site productivity of the ponderosa pine community, soil typing to determine the inherent soil quality and site potential must be completed.
2. Those areas with high site potential (areas of deeper soil or riparian areas) capable of sustaining higher stocking levels will be identified. Objectives for hiding cover and thermal cover for mule deer as well as nesting and foraging areas for white-headed woodpecker will be attained in these areas. In addition, these sites will also be thinned from below in a mosaic fashion to be managed to develop into contiguous stands of LOS ponderosa pine containing a variety of grass, forbs, and shrubs in the understory. These areas will most likely provide higher levels of large snags for white-headed woodpecker nesting in the long-term.
3. Where the inherent soil quality is low and sites are not capable of growing both fully stocked stands of trees and shrubs, a variety of spatial arrangement of tree and shrub management will occur. Treatments will vary between maintaining openings dominated by shrubs, bunch grasses, and forbs to a mosaic distribution of individual trees between openings.
4. The long-term objective is to maintain these stands with low intensity high frequency prescribed natural fire. Maintaining open grown ponderosa pine stands and recruiting large snags required for white-headed woodpecker nesting habitat. In addition, prescribed fire will create a variety of seral classes of shrubs, providing highly palatable forage for wintering mule deer.

- Peregrine Falcon
    - Habitat for this species is typically associated with rock formation and steep topography, and therefore limits disturbance. Habitat occurs within the Metolius Wildlife Primitive. Manage dispersed recreation use within identified habitat to minimize disturbance.

DESIRED CONDITIONS FOR ONGOING WILDLIFE PROJECTS

- Hawk Watch International Raptor Migration Monitoring Site
    - Stand number 59056 is a 28 acre regeneration harvest unit that was cut under a past timber sale. Due to the lack of overstory, the unit provides a good view of migrating raptors flying south down the face of Green Ridge. To continue to maintain this long-term raptor monitoring site, this stand will be managed in an early seral condition with individual perch trees scattered throughout the unit.
- There are numerous springs and impoundments throughout the analysis area that are important as water sources for wildlife including a large impoundment on Prairie Farm

Creek at the headwater spring. These should be maintained to provide ongoing water sources for a variety of wildlife species.

Fisheries Recommendations

Strategy to Achieve Desired Conditions

- Improve or relocate FS roads near stream channels and decommission and obliterate unneeded roads, to reduce runoff, sediment yield, and stream sedimentation.
- Obliterate roads and benched skid trails near streams that intercept shallow subsurface flow and delivery it rapidly to stream channels.
- Identify stream reaches in need of long-term recruitment of large woody debris, and develop a strategy to increase it.
- Eliminate barriers to fish passage at road crossings.
- Identify and conduct aquatic habitat improvement projects to eliminate barriers to fish movement, improve sediment regime, and improve flow regime and lower water temperatures.
- During reconnaissance for vegetation treatment project, identify areas subject to significant erosion, low soil organic matter, and/or excessive compaction relative to R6 Soil Quality Standards, and take remedial actions.
- Encourage the growth of riparian species and/or large trees in Riparian Reserves and Riparian Habitat Conservation Areas and help protect those corridors from catastrophic wildfire.
- Work with Oregon Department of Fish and Wildlife to monitor impacts of non-native fish on native fish populations. Consider eradication and increased harvest of non-native fish such as brown trout and smallmouth bass.

Potential Actions to Achieve Desired Conditions

- Subsoil suitable areas of soil-compaction after construction of temporary roads or skid trails following harvest to reduce legacy and project-induced compaction to less than 20% of the project areas.
- Monitor stream temperature at the mouth of Street Creek to determine if shade has recovered since the 2003 Eyerly Fire.
- To improve shade, riparian conditions, and future large wood recruitment consider replanting riparian areas in the Eyerly fire area where natural regeneration has been slow.
- Consider decommissioning and/or closing the 12.8 miles of roads shown on Table 5. These roads have the greatest chance to detrimentally affect redband trout and their habitat in the watershed and on USFS lands.
- Investigate roads to decommission/close in the Spring Creek-Lower Metolius and Middle Metolius subwatersheds that may still be impacting water quality, especially if they directly flow into fish bearing sections of Spring and Street Creeks.
- Consider replacing the following culverts in Table 13 to improve fish passage.
- Investigate redband fish populations discovered in Prairie Farm Creek in 2014 and look at fish passage issues at road crossings.

- Monitor off road ATV use near the start of the perennial section of Fly Creek and around other sensitive riparian areas. Work with Ponderosa Land and Cattle to block off ATV access if resource damage increases.
- Thin juniper in the Potter Canyon-Deschutes River watershed to improve surface flow in the intermittent streams and reduce fire risk.
- Thin Riparian Reserves/Riparian Habitat Conservation Areas in subwatersheds with high fuel loads, where thinning can be performed without degrading riparian conditions. Focus treatments on growing large trees and releasing hardwoods.

Table 5. Recommended actions for the road system in the Lower Metolius Watershed.

Road Number	Closure Mileage	Stream Name	Comments	Recommendations
1150-610	0.2	Six Creek	Headwaters of Six Creek, dispersed camping, illegal firewood cutting in RR.	Close, Add drainage where needed and rip first 0.2 mi.
1150-611	0.1	Six Creek	Headwaters of Six Creek, dispersed camping, illegal firewood cutting in RR.	Close, Add drainage where needed and rip first 0.2 mi.
1150-612	0.1	Six Creek	Headwaters of Six Creek, dispersed camping, illegal firewood cutting in RR.	Close, Add drainage where needed and rip first 0.2 mi.
1160-800	0.9	Six Creek	Crosses then Parallels creek in Riparian Reserve for 0.4 mi	Close beyond 845 rd., Add drainage where needed and rip first 0.2 mi. Pull culvert
1100-810	1.8	Six Creek	Parallels creek in Riparian Reserve. Fords creek in fish bearing section, illegal firewood cutting in RR.	Close, Add drainage where needed and rip first 0.2 mi. Reshape channel at crossing.
1100-850	1.7	Six Creek	Parallels creek in Riparian Reserve	Close, Add drainage where needed and rip first 0.4 mi.
1150-Non System	0.7	Prairie Farm Creek	Located in RR of perennial portion of Creek, runoff entering creek from road, illegal firewood cutting in RR. Ties into 1140-880 road.	Close, Add drainage where needed and rip for 0.2 mi on either end.

Road Number	Closure Mileage	Stream Name	Comments	Recommendations
1180-840	0.6	Prairie Farm Creek	Springs create stream that runs down road for several hundred yards. Illegal firewood cutting in RR.	Close, Add drainage where needed and rip first 0.2 mi.
1160-943	0.2	Prairie Farm Creek	Leads down to stream in RR, still need to recon	Close, Add drainage where needed and rip first 0.2 mi.
1160-940	0.4	Prairie Farm Creek	Road runoff and sediments going down road and into stream.	Close, Add drainage where needed and rip first 0.2 mi
1100-945	0.5	Prairie Farm Creek	Parallels creek in Riparian Reserve	Close, Add drainage where needed and rip first 0.2 mi
1100-946	2.8	Prairie Farm Creek	Parallels creek in Riparian Reserve, 2 stream fords, ATV damage, and illegal firewood cutting in RR.	Close, add drainage and rip first 0.2 mi on either end.
1100-600	1.0	Meadow Creek	Intermittent channel runs down road and back into creek, past 400 junction well overgrown, illegal firewood cutting in RR.	Close, Add drainage where needed and rip first 0.2 mi
1150-400	1.4	Meadow Creek	Road erosion gullies in RR	Close, Add drainage where needed and rip first 0.2 mi
1150-440	0.3	Meadow Creek	Crosses intermittent stream	Close, Add drainage where needed and rip first 0.2 mi
1150-442	0.1	Meadow Creek	Crosses intermittent stream	Close, Add drainage where needed and rip first 0.2 mi

Table 6. Culverts on USFS to consider for replacement to improve fish passage in the Lower Metolius

Watershed*.

Road Number	Mile Post	Stream Name	Fish Species	Culvert Database Rating	Comments
6400-600	NA	Spring Creek	Redband Trout	Red	Too narrow, no substrate
6400-600	NA	Spring Creek	Redband Trout	Red	Too narrow, no substrate
6400-600	NA	Unnamed Tributary to Spring Creek	Redband Trout	Red	Too narrow, no substrate, perched

Botany Recommendations

Strategy to Achieve Desired Conditions

Manage rare species to ensure viability

- **Mountain Lady Slipper (CYMO)**
  - Need Management Plan for CYMO, need to identify High priority populations
  - Prioritize Management of invasive species in rare plant habitats
- **Peck's penstemon (PEPE)**
  - Prioritize Management of invasive species in rare plant habitats
  - Re-Assess management needs in edge populations
    - Work cooperatively with CRNG to re-examine PEPE in Trahan(Carcass) & Potter (Geneva) Canyon subwatersheds
- **Invasive Plants**
  - Reduce knapweed populations across land ownerships in Fly Creek
  - Contain infestations of Eurasian millefoil and Ribbongrass
  - Apply Invasive species prevention standards to all projects
  - Treat known occurrences every year

Cultural Plants

- Protect and enhance cultural plant areas

Potential Actions to Achieve Desired Conditions

CYMO

- Identify populations for priority management
- Control weeds on Rd 1190/220

- Control weeds on Rd1193/600
- Map populations southeast of Bean Creek (seen by Dollhausen 2010)

Invasive species-

- Survey the Lower Metolius River, below Candle Creek for invasive ribbongrass, reed canary grass, Yellowflag Iris, false brome and other invasive plants. Develop as a cooperative project with the Confederated Tribes of Warm Springs and PGE.
- Work with County, CRNG to reduce medusahead spread from the east along major roads
- **R**esolve road access issues at Fly Creek to aid in USFS weed control
- Develop a cooperative Weed Management area, Work cooperatively with County, PGE, and landowners for weed control on private lands

Cultural Plants

- Follow Weed EIS Mitigations including notification and posting of spray areas

Heritage Recommendations

Update the Forest Cultural Resource Overview:
An updated Forest Cultural Resource Overview is needed to assist in the management of cultural resources. The understanding of prehistoric land use within the watershed is not well understood. Because of the limited survey and the small number of sites that have received excavation, there are many assumptions about prehistoric land use. An updated Forest Cultural Resource Overview would assist with the development of new research questions and provide an opportunity to test past assumptions about prehistoric land use. Context statements generated as part of the overview would help with the evaluation of cultural resources by reducing the time needed and making the evaluation more consistent. Opportunities to work with local universities and colleges would assist the forest in filling in data gaps pertaining to prehistoric land use within the watershed and partnerships should be sought out. The information acquired could help in the development of interpretive opportunities to tell the history and prehistory of the Lower Metolius basin.

Create an Inventory and Monitoring Program for Sites Within Recreational Use Areas:
Negative impacts from recreation can be mitigated through integration of heritage concerns and needs, identified in the Forest Cultural Resource Overview, into recreation management plans. This will require identification of cultural resources that are being negatively impacted because of recreational activities. For the summer home tracts a condition inventory with pictures will need to be completed and close cooperation with the special use permit administrator will be important. Reconnaissance surveys within the wilderness should be planned to help identify the number and types of sites located within the wilderness. The wilderness contains many high probability areas for heritage resources. Heritage personnel will work more closely with the wilderness recreation personal to help identify and protect heritage resources in the wilderness. Cultural sites that are being negatively impacted by developed and dispersed recreation should be identified and evaluated for NRHP eligibility. Sites found eligible can be prioritized for monitoring, protection or mitigation based on the level of impact.

Continue and Strengthen Partner Groups:
The continued use of partner groups will be invaluable to the success of monitoring and evaluating sites. Through Passport in Time (PIT) projects and working with local volunteers, such as ASCO, sensitive sites can be more frequently monitored. Priority Heritage Assets (PHAs) within the watershed will continue to be identified and evaluated in order to keep all PHAs relevant.

Integrate Heritage into Fire Planning as Early as Possible:
In order to mitigate damage from fire, heritage personnel will work with district fire personnel to identify heritage resources most “at risk” from wild land or human caused fires. The identification of “at risk” resources will help in the development of a fire hazard mitigation plan, which will concentrate efforts on reducing fire hazards in and adjacent to heritage resources. During fires an archaeologist should be consulted on smaller fires as soon as possible but should be part of the READ team on larger fires, such as the Eyerly and B&B to better protect cultural resources from fire suppression activities.

Inventory for Cultural Plants:
An opportunity exists to improve traditional food and forest resources. An inventory of culturally important plants and animals should be included in project surveys. As part of those surveys, areas suitable but lacking culturally important plants should be identified for possible management and reintroduction. This will allow culturally important natural resources to be included into future projects so they can be managed for continued vigor and sustainability. Consultation with the CTWS and other relevant tribes is important in developing these types of projects.

Engineering Recommendations

- Increase the maintenance required for the road system to effectively drain water and reduce the chance of sediment transmission. Find opportunities to apply maintenance to roads through projects, Road Use Permits, and other means.

- Collaborate with other agencies to repair drainage and road facilities that affect the watersheds.

- Work to resolve road access issues in Fly Creek drainage with private landowners to allow easy access to public lands for invasive plant and I and other needed management and monitoring

Recreation/Social Recommendations

Strategy to Achieve Desired Conditions

- Implement uncompleted actions in the Metolius WSR Plan
- Monitor urban interface for trespass and resource damage

Potential Actions to Achieve Desired Conditions

Metolius WSR Plan

- Implement user registration at gates on Rd 64 and 1499. Develop registration forms and collect data.
- Monitor wood related to recreational boat use

Special Uses

- Resolve trespass issues at Cochrans on El Rancho Garden and irrigation

Key Findings- By Resource Area

The following is a summary of resource reports and team synthesis.
For more detail, see the attached Resource Reports.

Climate Change

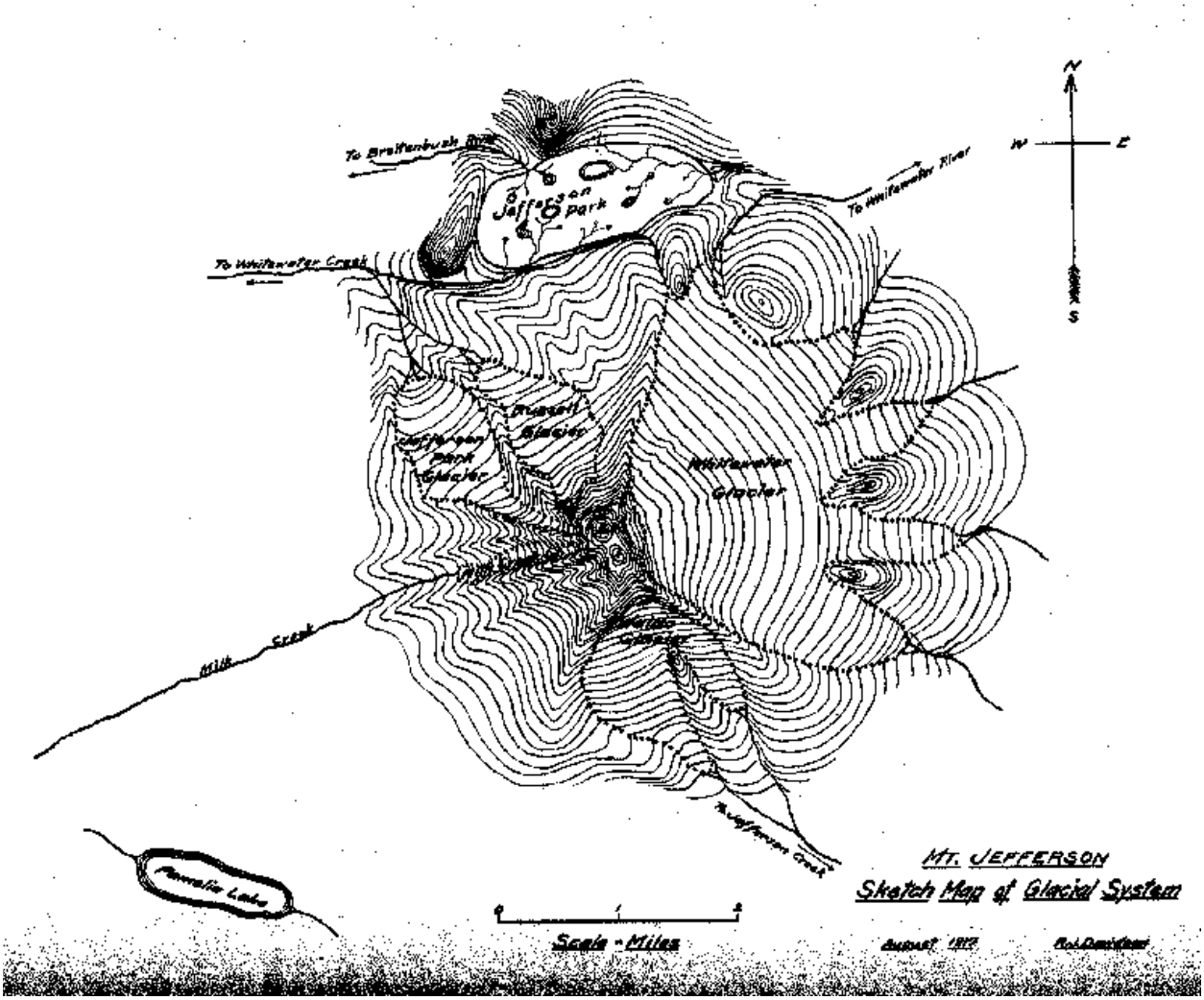


Figure 9. 1917 view of Mt Jefferson glaciers

Mt. Jefferson Glacier Retreat

- In 1917, Hatch noted that Russell and Jefferson Park glaciers had undergone a glacial retreat leaving behind well-defined lateral moraines. He described Whitewater Glacier as approximately five miles wide and one to two miles long splitting into five lobes. However, now Whitewater Glacier is only about three kilometers (1.9 miles) wide and just over one kilometer long. **http://glaciers.research.pdx.edu/glaciers-oregon#Mount_Jefferson**

New assessments and local research on climate change continue to inform us on expected trends.

- **Key expected environmental trends due to climate change are**: (from Vose, et.al 2012):
    - Increased temperatures
    - Longer growing seasons
    - Less snow and
    - More frequent drought
        - These effects are expected to increase plant stress and decrease plant survival in the drier, warmer, and lower elevation portions of species' ranges.
    - Higher atmospheric concentrations of carbon dioxide (CO2), and higher nitrogen (N) deposition are likely and these may lead to changes in ecosystem structure and function.
- **"At Risk" Snow**- Snow found at elevation ranges of 3,500-5,500 feet has been found to be "at risk" because it accumulates at temperatures close to the ice-water phase transition. This means it is at greater risk for climate warming than cold climate snowpack. Under a climate-warming scenario, areas in the Central Oregon Cascades are at risk of converting from a snow-dominated to a rain-dominated winter precipitation regime. Approximately 51% of all at-risk snow in the Pacific Northwest is in the Oregon Cascades, and 21.8% of all snow-covered area in the Oregon Cascades falls into the at-risk snow class (Nolin and Daly 2006).
- **Declining Snowpack** – Long term snowpack records from 1940 to 2010 at Santiam Junction near Sisters show there has been a 0.8 mm yearly reduction of snow accumulation and a 10% per decade decline in the peak amount of snow (Nolin 2013).
- **Snow/Wildfire Interactions**- Wildfire activity is strongly associated with changes in spring snowmelt timing, which in turn is sensitive to changes in temperature. More wildfires occur with early snowmelt and with declining snowpack (Westerling et.al 2006).
    - **Charred forests reduce snow duration because they absorbed more solar energy**. A new study in progress on the Shadow Lake Fire in Sisters found "dirty" snow melts earlier in recently burned forests because of the charred debris and ash on the snow surface which absorbs more heat. Snow melted 23 days earlier in the recently burned forest and was much more open (20% canopy closure versus 52% closure) than the unburned forest. This effect is expected to last for 1-4 years after wildfires. Snow melt may affect post-fire vegetation recovery (Nolin 2013).
- **Altered disturbance regimes**: The most significant short-term effects of climate change on forest ecosystems is expected to be caused by altered disturbance regimes (below trends from Vose, et.al 2012).
    - **Wildfires** – Area burned is expected to double by the mid -21st century.
    - **Insects,** such as such as the current advance of bark beetles in western forests are expected to expand, often affecting more land area per year than wildfire.
    - **Pulses of erosion and flooding** will be caused by higher rain: snow ratios in mountainous regions and more burned area.
    - **Drought-induced tree mortality**.

- **Invasive species** will likely become more widespread, especially in areas of disturbance and in dry forest ecosystems.
  - Plant invasions can be influenced by warmer temperatures, earlier springs and earlier snowmelt, reduced snowpack, changes in fire regimes, elevated N deposition, and elevated CO2 concentrations.
  - Invasive species common to the Sisters Ranger District, such as the Knapweeds (*Centurea* sp.), Canada thistle (*Cirsium arvense*), and cheatgrass (*Bromus tectorum*) show increased productivity in response to elevated CO2 under controlled conditions.

Figure 10. Medusahead in fuel break of Bridge 99 Fire 2014

  - Risk of exotic invasive plants entering forests is likely highest in mountainous ecosystems, where historically cooler temperatures and closed-canopy forests may have limited invasive populations.
  - Wildfire increases the susceptibility of habitats to invasive plants.

- **Spatial Shifts in Forest Types and loss of high elevation meadows**: Higher temperatures and fire frequencies are predicted to lead to significant spatial migration of forest types across the landscape by 2100. Plant communities at the highest and lowest elevations are expected to be particularly affected. Most models predict that species habitat will move upward in elevation and northward in latitude and habitats at lower elevations and lower latitudes will be reduced (Vose, et.al 2012). However, Crimmins, et.al (2011), found climates change has led to significant downhill shifts in optimum elevations for some species, due to extra water availability from increased rain.

  - **A simulation landscape for the Deschutes National Forest (Greaves 2012) over the next 500 years showed:**
    - **Mountain hemlock and high elevation cool, wet conifer forests** are expected to contract.
    - **Lodgepole pine** occupies a unique niche in East Cascades forests, as an early seral dominant following stand-replacing disturbance, and persists in extreme environmental pockets that discourage other species, such as cold –air drainages in flats and hollows. Warming is likely to decrease the prevalence of these cold pockets, leading to more competition with warm-adapted species and potentially a decline of lodgepole pine;
      - Coops and Waring (2011) estimate that lodgepole distribution may decline to 17% of its current range by 2080.
    - **Dry Mixed Conifer and Ponderosa Pine**- Warming led to an upslope shift of warm mixed conifer and ponderosa pine forests.
      - Greaves suggests that although restoration of open, park-like stands of

ponderosa pine and dry conifer may be desirable for safety, recreation, and to control fire behavior, it may prove difficult to maintain such stands in their present locations because warming temperatures will shift the location of suitable environments and potentially replace them with shrublands and juniper.

        - **Grass and shrublands**- In lower elevations, warming and fire contributed to significant expansion of open (<10% tree canopy cover) forest and grass- and shrubland.
    - **Studies near Mt Jefferson on subalpine meadows** found temporal patterns of tree invasion were correlated with climate. Trees occupied 7.75 % of the total meadow landscape in 1950, increased at an average rate of 0.49 % year-1, with 34.71 % occupied in 2008. Tree invasions were found to be correlated with spring temperatures, spring snowfall, maximum annual snowfall, and mean summer temperatures (Zald, et al. 2012)
- **Climate Change Planning on the Deschutes-** The Deschutes and Ochoco National Forest and Crooked River National Grassland are working with other agencies and scientists to proactively address climate change and has begun drafting recommendations for management and monitoring actions (Vora 2012). *Also see Recommendations section of this report.*

Hydrology

Figure 11. Lake Billy Chinook- Lower Metolius

Hydrology- Characterization of the Watershed:

- The Lower Metolius watershed, which is one of the two watersheds in the Lower Metolius Potter Canyon-Deschutes River Watershed Analysis area, was analyzed in the 2004 Metolius Watershed Analysis Update (USDA Forest Service 2004).
- Since the update, subwatershed boundaries have slightly changed (Table 7; Figure 12).

Table 7. Crosswalk between the 2003 subwatershed boundaries and the 2010 subwatershed boundaries.

2003 SWS	2003 Watershed	2003 Acres	2010 SWS	2010 Acres
Upper Fly Creek	Lower Metolius River	16406	Upper Fly Creek	16429
Lower Fly Creek	Lower Metolius River	16227	Lower Fly Creek	16277
Upper Metolius River	Lower Metolius River	31553	Upper Metolius River	31566
Middle Metolius River	Lower Metolius River	21208	Middle Metolius River	21221
Lower Metolius River	Lower Metolius River	24300	Spring Creek – Metolius River	24338
Juniper Creek	Lower Metolius River	15088	Juniper Creek	15099
Whitewater River	Lower Metolius River	20715	Whitewater River	20894
NA	Potter Canyon-Deschutes River	NA	Stevens Canyon	14434
NA	Potter Canyon-Deschutes River	NA	Trahan Canyon	15033
NA	Potter Canyon-Deschutes River	NA	Potter Canyon	10504
NA	Potter Canyon-Deschutes River	NA	Haystack Draw-Deschutes River	18579
Total Acres Analyzed				204374

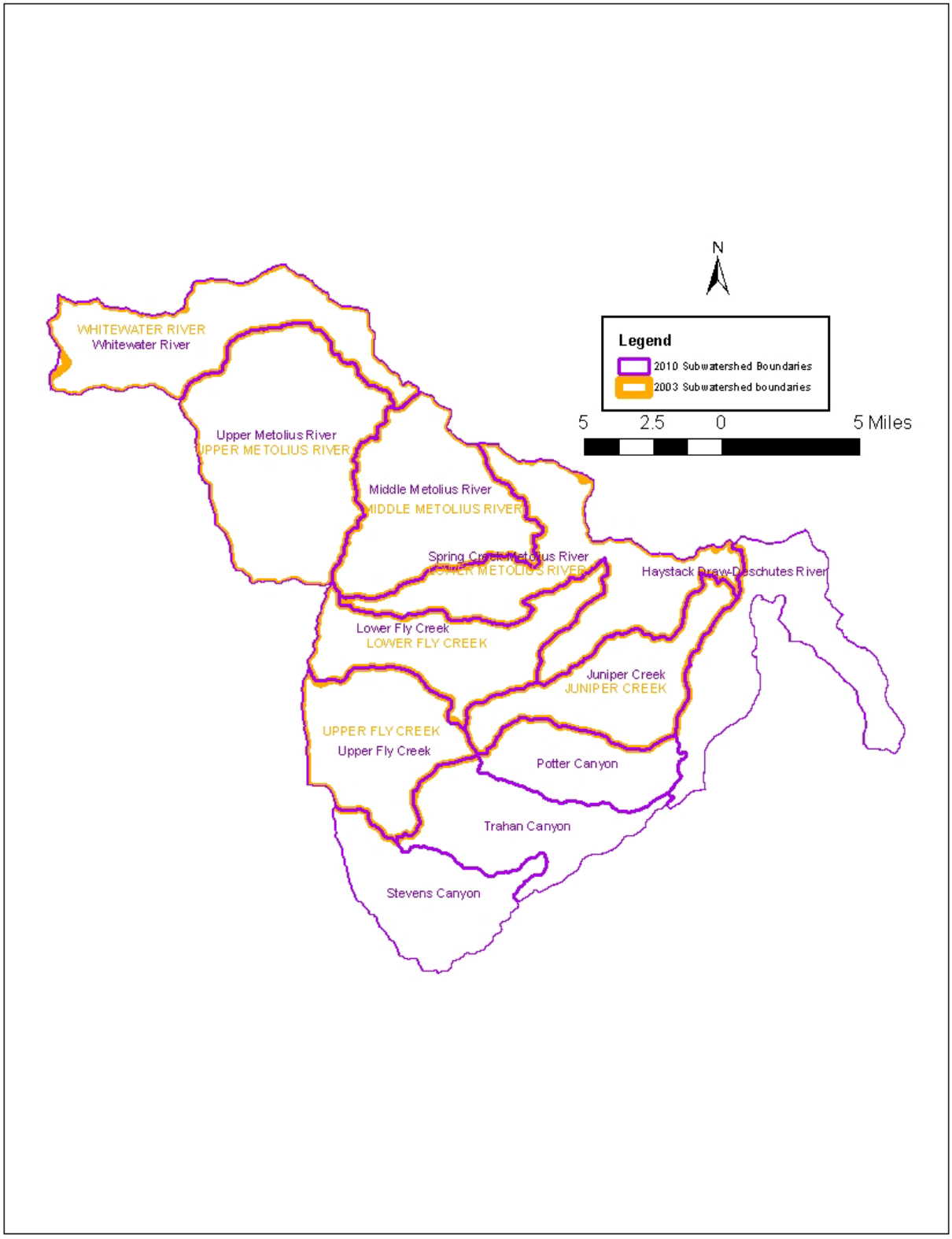


Figure 12. Display of slight area and name changes between the 2003 subwatershed boundaries used in the Metolius Watershed Analysis Update and the subwatershed boundaries used in the Lower Metolius River and Potter Canyon – Deschutes River Watershed Analysis.

- None of the subwatersheds in the analysis area are completely USFS ownership. Primary ownerships include the Deschutes National Forest, Confederated Tribes of the Warm Springs Reservation, Crooked River Grasslands, and private lands (Table 4).
- Lands from the Metolius River to the northwest in Upper Metolius River and Whitewater River subwatersheds and to the northeast in Middle Metolius River and Spring Creek-Metolius River subwatersheds are on the Confederated Tribes of the Warm Springs Reservation.
- There is no comprehensive management plan for the Potter Canyon – Deschutes River watershed. The Bureau of Land Management completed the Upper Deschutes Resource Management Plan in 2005 which covers BLM lands in the Potter Canyon – Deschutes River watershed (USDI Bureau of Land Management 2005).
- Precipitation in the analysis area ranges from approximately 100 inches/yr. at the top of Mt. Jefferson, 35 inches/yr. at the top of Green Ridge to 10 inches a year at Lake Billy Chinook Reservoir, with most of it in the analysis area occurring as rain.
- Elevations in the analysis area range from 2000 ft. to 10,200 ft. at the top of Mt. Jefferson; therefore, approximately 35% of the project area is within the rain-on-snow zone (approx. 3500-5000 ft.) which includes the headwaters of all the streams on the east of Green Ridge in the project area.
- Most of the drainages are intermittent streams with the Metolius River, the Deschutes River, and Lake Billy Chinook Reservoir being the major perennial waterbodies (Table 3).
- Within the analysis area, the following waterbodies are listed on the 2010 Oregon 303(d) list for exceedances above the State standards for water quality (Table 5):
    - Deschutes R –DO and Temperature (salmon/trout rearing and migration 18° C)
    - Lake Billy Chinook Reservoir – pH, Chlorophyll a
    - Metolius R – Temperature (Bull trout spawning – 12° C)
- In 2008 the Summit Springs fire burned 1744 acres in the Stevens Canyon and Trahan subwatersheds but no creeks were burned.
- The 2002 Eyerly fire burned 60% of the Middle Metolius River subwatershed and less than 20% of the Lower Metolius and Lower Fly subwatersheds. Approximately 20% of the Lower Metolius Watershed (10th field) was burned. Ground cover has reestablished in these drainages.
- As a result of the project area being located within two planning jurisdictional areas with different requirements for Key or Priority Watersheds, waterbody buffer widths vary depending on where they are located (Table 2; Figure 2).
    - Approximately half of the Upper Metolius, Middle Metolius, Spring Creek, Lower Fly Creek, and Upper Fly Creek subwatersheds are within the NWFP jurisdiction. The Upper Metolius subwatershed is a Tier 1 Key Watershed under NWFP.
    - The Metolius Watershed Analysis amended the Riparian Reserve widths in the original Metolius Watershed Analysis area which covered the Upper Metolius Watershed and a portion of the Upper and Middle Metolius subwatersheds (both in the Lower Metolius Watershed) (USDA Forest Service 1996). Further analysis shows that site potential tree heights within the Lower Metolius Watershed are 100 ft. and the interim NWFP buffer widths should apply to all subwatersheds

within the NWFP area of the Lower Metolius Watershed (based on productivities established from Simpson 2007) (Table 8).

- The remaining portion of the subwatersheds mentioned above and the other subwatershed in the project area are under the jurisdiction of INFISH. The lower portion of the Spring Creek-Metolius River, most of Juniper Creek and Trahan Canyon, and portions of Potter Canyon, Stevens Canyon, and Haystack Draw – Deschutes River subwatersheds are Priority Watersheds under INFISH direction (Figure 13).

Table 8. Riparian Reserve (RR) and Riparian Habitat Conservation Area (RHCA) widths in the Lower Metolius – Potter Canyon-Deschutes River Project Area.

Category	Stream Class	Description	RR width	RHCA width
			Slope distance (ft.) from edge of the waterbody	Slope distance (ft.) from edge of the waterbody
1	1 & 2	Fish-bearing streams	300	300
2	3	Perennial, non-fish-bearing streams	150	150
3	NA	Lake and natural ponds	300	150
3	NA	Constructed ponds, reservoirs	150	150
3	NA	Wetlands > 1 ac	150	150
3	NA	Wetlands < 1 ac, unstable and potentially unstable areas, springs	100	100 (Priority SWS) 50
4	4	intermittent streams	100	100 (Priority SWS) 50

- A portion of the Middle Metolius subwatershed is within the Inventoried Roadless Area, the Metolius Wild and Scenic River corridor, and the Oregon State Scenic Waterway corridor (USDA Forest Service 1997; Oregon Scenic Waterways Act). A portion of the Haystack Draw – Deschutes River subwatershed is in the Deschutes Wild and Scenic River corridor, Oregon State Scenic Waterway corridor, and the Deschutes Canyon/Steelhead Falls Wilderness Study Area (USDA et al. 1992; Oregon Scenic Waterways Act). Both Wild and Scenic Rivers list hydrology and fisheries as two of their Outstandingly Remarkable Values.

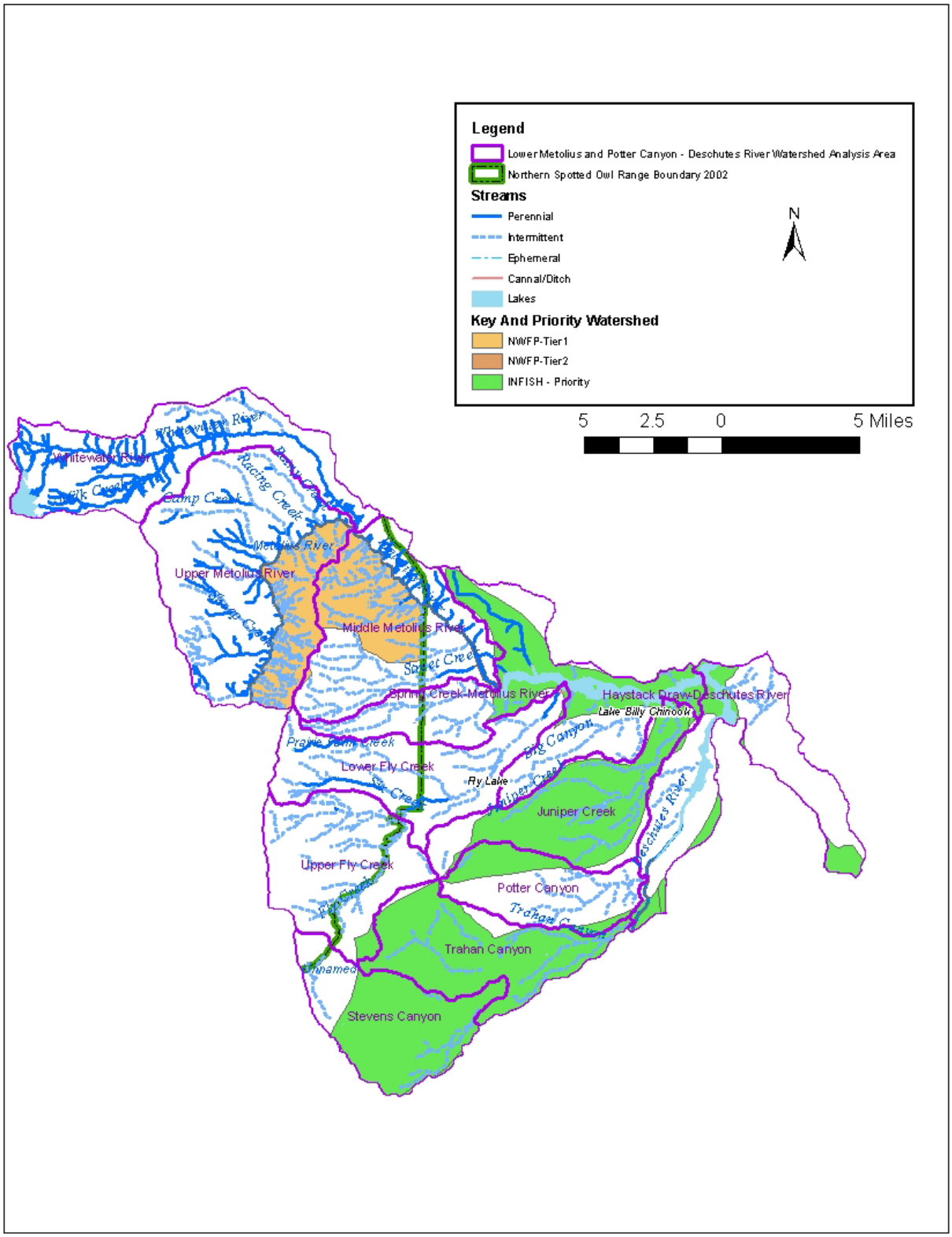


Figure 13. Northwest Forest Plan and INFISH guidance areas within the Lower Metolius River and Potter Canyon – Deschutes River Watershed Analysis Area.

Streamflow

- Although this landscape is very dissected, stream flow is low in these drainages due to low annual precipitation and high infiltration rates. Most of the drainages are intermittent streams with the Metolius River, the Deschutes River, and Lake Billy Chinook Reservoir being the major perennial waterbodies (Table 9). The remaining perennial water is limited to most of the named streams in the Upper Metolius and Whitewater subwatersheds, the lower 1.2 miles of Street Creek, the lower 0.6 miles of Spring Creek, the lower mile of Fly Creek, a short reach in the middle of Fly Creek, a reach of Prairie Farm Creek and Six Creek, and a perennial tributary to the Metolius River.

Table 9. Miles of stream by flow regime in the Lower Metolius and Potter Canyon-Deschutes River Watershed Analysis area.

Subwatersheds	Named streams	Perennial	Intermittent
Upper Fly Creek	Fly Ck. and Meadow Ck	0.2	37.6
Lower Fly Creek	Fly Ck, Prairie Farm Ck, and Six Creek	8.7	33.4
Upper Metolius River	Metolius River, Mariel Ck, Walker Ck, Sheep Ck, Code Ck, Camp Ck, Racing Ck, and Rainy Ck	46.8	77.5
Middle Metolius River	Metolius River, Street Ck, and Bean Ck	20.9	59.3
Spring Creek – Metolius River	Lake Billy Chinook reservoir, Spring Ck, Big Canyon, Box Canyon	6.9	39.0
Juniper Creek	Juniper Creek	0.0	28.0
Whitewater River	Whitewater River, Cache Ck, Lionshead Ck, and Milk Ck	74.1	5.8
Haystack Draw – Deschutes River	Deschutes River	17.7	26.6
Potter Canyon	Potter Canyon	0.1	34.4
Steven Canyon		3.6	10.6
Trahan Canyon	Akawa Gulch	1.6	26.7
Total in Analysis Area		**180.6**	**378.9**

- There are a few water rights in the analysis area:
    - Fly Creek – 3 rights for a total of approximately 2.3 AF
    - Spring Creek – 1 right for 3.3 AF and a USFS right for 0.05 AF; USFS right previously used to gravity feed Perry South Campground.
    - Prairie Farm Creek – a USFS right for 12 AF – storage right for in-channel pond at headwaters or spring of Prairie Farms Ck.
    - Monty Spring – a USFS right for 0.01 AF; previously used for Monty Campground.
    - Juniper Creek – 1 right for 0.6 AF
    - Street Creek spring – There is an illegal spring box adjacent to Street Creek. Oregon Department of Water Resources has shut it down and notified the landowner. He is currently discussing his options with the Forest Service and Water Resources.
- The Metolius River streamflow record shows no trend due to management; however, detecting a trend would be difficult due to the porous geology in the Metolius watersheds.
    - The Metolius River near Grandview gage (#14091500) is located at the end of the free-flowing section of the Metolius River and has 90 years of data.

    - Streamflow in the Metolius River is very stable with mean daily flow ranging from 1337 cfs in October to 1667 cfs in June.
    - Spring peakflow on the Metolius River occurs between May and June with an instantaneous peak flow mean of 2046 cfs.
    - Stormflow, rain-on-snow, or extreme snow-melt peaks on the Metolius River occur mainly between November and February and have a mean of 3051 cfs and range between 1490 and 8430 cfs.
    - The largest peakflow recorded on the Metolius River occurred on February 7, 1996.
- Recent fires in the Upper and Lower Metolius Watersheds increased the risk of higher stormflows in the Upper and Middle Metolius subwatersheds, mostly from rain-on-snow events, especially in Street Creek (USDA Forest Service 2004).
    - Because there is no stream gage in Street Creek it is unclear if peakflows increased since the fire.
    - Peakflows in the Metolius River since the recent fires are mostly associated with rain-on-snow events and are below the average flow for stormflow peaks. The two events over the average for stormflow peakflows are only slightly over the average and still within the range for stormflow peakflows on the Metolius River.
    - Due to the rapid regrowth of vegetation, the erosive effect of increased peakflows appears to be abated.
- Besides the Deschutes River and Lake Billy Chinook Reservoir there are no other perennial waterbodies in the Potter Canyon-Deschutes River watershed.
    - The Watershed Analysis area contains the lower 3 miles of the Wild and Scenic River section of the Deschutes River and the Deschutes Arm (starts right below the Wild and Scenic River section) of Lake Billy Chinook.
    - Streamflow greatly increases in the lower reach of the Wild and Scenic River section due to ground water inputs (Gannett et al. 2001)
    - The Deschutes gage near Culver (#14076500) is located at the end of the free-flowing reach at the end of the Wild and Scenic River section and has 58 years of data.
    - "The uncommonly steady flow of the Deschutes River is due primarily to the poorly integrated surficial drainage system along the eastern flank of the Cascade Range in the southern and western parts of the Deschutes River basin" (O'Conner et al. 2003).
    - Juniper stands in the Potter Canyon – Deschutes River watershed are overstocked and may be reducing the amount of surface flow in the intermittent drainages in this watershed (personal communication, M. McSwain, 2012).
- Both the Metolius River and the Deschutes River receive a substantial amount of its flow from groundwater, resulting in an extremely stable flow regime (Gannett et al. 2001; Gannett et al. 2003).
    - Groundwater discharge from the upper basin provides 80% of the mean annual flow at the mouth of the Deschutes River, much of which discharges from large spring complexes near the confluence of the Deschutes and Crooked Rivers. A substantial amount of the remaining groundwater discharges to tributary streams in and near the margin of the Cascades Range.
    - The general pattern of groundwater flow in the Deschutes Basin is from the Cascade Range toward the confluence of the Deschutes and Crooked Rivers.

- The regional groundwater system involves deep circulation, thick aquifers, and long flow paths resulting in a mean residence time of a 120 years for the springs that discharge at the head of the Metolius River.
- Groundwater wells in the analysis area could affect flows in the Metolius River and Deschutes River.
    - There were no long-term water level declines found from groundwater pumping in the upper Deschutes Basin in the 2001 report; however, the upper Deschutes Basin was and remains one of the fasting growing population centers in the State (Gannett et al. 2001). Development maybe or could in the future affect groundwater levels and associated groundwater discharges to the Deschutes and Metolius Rivers.
    - Analysis of the Oregon Dept. of Water Resources review of Ponderosa Land and Cattle well application G-16674 and Dutch Pacific Water Utility well application G-17008 indicate that the development proposed in these applications could affect the Metolius Springs and ultimately the Deschutes River (Allen 2009). Both these applications were denied.

Riparian Condition and Channel Morphology

- Riparian vegetation is mostly confined to the channel margins of the perennial streams.
    - Approximately, 64% of the RHCA of Street Creek and 93% of the RHCA of Spring Creek were burned by the Eyerly Fire in 2002, with more than half resulting in a stand replacement burn (USDA Forest Service 2004).
    - Ground vegetation monitoring in the Eyerly Fire area shows that only 2 years after the fire, ground cover has increased to 80% (Suna 2004).
    - Riparian vegetation along most of the Metolius River is relatively similar to historic condition, except in developed areas or heavy recreational-use areas (Minear 1999).
- Many RR/RHCAs outside of the high vegetation mortality areas are dense and overstocked, resulting in a fuels concern. Given that most of the drainages are intermittent, RR/RHCAs are mostly comprised of upland vegetation and condition class often resembles that of the adjacent upland.
- Large woody debris in RR/RHCAs is currently sufficient in the Street Creek and Spring Creek drainages within the high vegetation mortality areas (excluding Perry South Campground) but could become deficit in the future while new trees try to get established (see Fisheries Report).
- Due to the incredibly stable streamflow, channel pattern is relatively unchanged in the Metolius River (Minear 1999).

- Although the Metolius River is very stable (i.e. not moving laterally or aggrading or degrading), channel shape and complexity have changed as a result of the reduction of instream large woody debris (LWD).
    - Based on the available data the desired future condition for large woody debris (> 12" dbh, > 35' length) in the Metolius River is between 46 and 155 pieces per mile, which is significantly more than the INFISH minimum recommended value (USDA Forest Service 2007).
    - The 1989 stream survey shows that LWD/mi is slightly less than the desired future condition (See Fisheries Report, Table 4).
    - Pools and vegetated islands are channel features associated with LWD in the Metolius River that are reduced in number from the reduction of LWD.
- 57% of the Potter Canyon – Deschutes River Watershed, 58% of Upper Fly Creek, and 40% of the Spring Creek – Metolius River subwatershed is under private ownership (Table 10). There are numerous residences along the intermittent streams that may be affecting vegetation and channel condition in Riparian Habitat Conservation Areas.

Table 10. Ownership in the Lower Metolius River and Potter Canyon – Deschutes River Watershed Analysis Area.

Subwatershed	USFS Deschutes	USFS Ochoco	USFS Grassland	USFS Willamette	BLM	Oregon State	Confederated Tribes of Warm Springs	Priv Ot
Upper Fly Creek	6,905							9,5
Lower Fly Creek	13,053				135			3,(
Upper Metolius River	7,186						24,329	5
Middle Metolius River	16,066						3,908	1,2
Spring Creek-Metolius River	7,257		1,321		619	12	5,440	9,(
Juniper Creek	302		3,635		642	112		10,
Whitewater River				548			20,347	
Stevens Canyon	5,122	1	467					8,8
Trahan Canyon	2,658		4,358		88			7,9
Potter Canyon	140	122	2,962		139			7,1
Haystack Draw-Deschutes River			5,198		3,065	875	75	9,3
Total	58,689	123	17,942	548	4,689	999	54,098	67,

Water Quality

- Water quality protection is a key interest in the Metolius Watersheds because of its high water quality and Wild and Scenic River status. Additional concern exists as a result of the water quality exceedances in Lake Billy Chinook (LBC) for pH and chlorophyll *a,* both of which are affected by nutrients (ODEQ 2012).
- The Deschutes River, Lake Billy Chinook, and the Metolius River are the only waterbodies in the Watershed Analysis Area listed on the Oregon 2010 303(d) list for water quality exceedances (see Fisheries Report) (Table 11).

Table 11. Waterbodies on the Oregon 2010 303(d) list for water quality exceedances above the State standards.

Waterbody	Pollutant	River Miles	Within analysis area
Deschutes River	Chlorophyll a	168.2 to 189.4	No
	Dissolved Oxygen	116 to 223.3	Yes
	pH	126.4 to 168.2	No
	Sedimentation	168.2 to 222.2	No
	Temperature	110.8 to 223.3	Yes
	Temperature	223.3 to 244.8	No
	Turbidity	168.2 to 222.2	No
Lake Billy Chinook	Chlorophyll a	110.8 to 118.7	Yes
	pH	110.8 to 118.7	Yes
Metolius River	Temperature	8.5 to 39.6	Yes

- The Metolius Wild and Scenic River Plan outlined Limits of Acceptable Change as a method of monitoring water quality conditions and setting standards (USDA Forest Service 1997).
- Water quality in the Deschutes River from Whychus Creek to the Deschutes Arm of Lake Billy Chinook is good due to the high influx of groundwater inputs in lower portion of the Wild and Scenic River reach (personal communication, McSwain, 2012). A Bureau of Land Management Report analyzing the water quality data in the Wild and Scenic River section of the Deschutes should be available in late 2013.
- Bacteria, nitrates and phosphorous have been analyzed in the Upper Metolius Watershed and (USDA Forest Service 2004) and extensive nutrient monitoring was conducted by Portland General Electric (PGE) and the Confederate Tribes of the Warm Springs Reservation (CTWSR) in Lake Billy Chinook for the relicensing of the Pelton Round Butte Dam and is on-going (CTWSR and PGE 2002, Campbell 2012).
    - Metolius Springs are a natural source of phosphorous and nitrogen to the river and levels decrease as the water flows downstream as nutrients are absorbed by algae and bacteria in the river.
    - PH values over the State standard occur in the surface waters of Lake Billy Chinook but there is no measurable increase in pH through the reservoir area and it appears that the reservoir is reducing the pH of the inflow (CTWSR and PGE 2002).
    - The state and tribal nuisance phytoplankton growth standard of 15 ug/L of Chlorophyll *a* is exceeded during the summer within LBC Reservoir. High

summertime concentrations of Chlorophyll *a* are the result of input of nutrients from the tributary rivers and natural processes of seasonal stratification in the reservoirs.

- As part of the Pelton Round Butte Water Quality Maintenance and Monitoring Plan (WQMMP) a Selective Water Withdrawal (SWW) facility was built in 2009 to improve water quality and surface currents for fish passage in LBC reservoir. The 2011 Monitoring Report discusses the results (Campbell 2012).
  - Temperatures through the Project in 2011 were similar to 2010, again reflecting values between historical conditions and the projected temperatures described in the WQMMP.
    - Temperatures in Round Butte forebay were not as cool as Blend 17 had predicted. Deviations from the scheduled surface water/bottom water blend occurred due to intentional adjustments made during summer months to meet NTP.
    - The level of stratification in Round Butte developed at a shallower depth relative to historical conditions, indicating the reservoir has become cooler overall after implementing selective water withdrawal.
    - Both reservoirs were stratified in May and destratified in late October, as evidenced by similar temperatures among depths.
  - Changes resulting from surface withdrawal in dissolved oxygen and pH through the Project were less obvious than those seen in temperatures.
    - Dissolved oxygen levels at the Round Butte Dam tailrace dropped below that of the inflow and lower river sites during late summer and fall months, evidence of oxygen-poor hypolimnetic water in the blend.
    - Lake Billy Chinook showed high levels of oxygen in upper layers during the summer while the hypolimnion was lower in oxygen.
    - Lake Billy Chinook had reportedly higher maximum pH values than the tributaries to Lake Billy Chinook, which is opposite of what was reported in 2002.
  - Total phosphorus in the lower river immediately below the project was similar to values seen in the tributary inflows.
  - In 2011 nitrate nitrogen levels were below detection limits in Lake Billy Chinook.
  - Metolius Arm in Lake Billy Chinook was least productive in terms of chlorophyll *a*. Blue green algae is not monitored in Lake Billy Chinook.
  - *E. coli* bacteria readings evidenced only one reading at the Reregulating Dam tailrace that was relatively high, but still within the state's standard for recreational water for a single sample.

- Water temperature in the Watershed Analysis area is discussed in the Fisheries Report.
- Bank stability in perennial, fish bearing streams on the Deschutes NF is generally good except on Spring Creek in the Perry South Campground and Street Creek (see Fisheries Report). Bank stability along the Metolius River and the Deschutes River is also likely high due to its stable flow regime except at public recreation areas. Bank stability along the intermittent streams in the Potter Canyon – Deschutes River watershed is unknown but likely relatively stable due to its infrequent flow.
- Fine sediment in spawning habitat remains a concern for the Metolius Watersheds (USDA Forest Service 2004).

- Although, fine sediment levels (< 6.4 mm) in Metolius River tributaries upstream of the analysis area are slightly above the U.S. Fish and Wildlife Service (USFWS) recommendation, the Metolius Watersheds support a robust spawning population of both redband trout and bull trout (refer to Fisheries Report).
- Six Creek is the only stream that was sampled in the analysis area that exceeds the USFWS recommendation of less than 20 % fines (<2mm) in bull trout habitat (see Fisheries report).
- Levels of fine sediment in the Metolius watershed streams were found to be similar to that of the chinook salmon and bull trout spawning habitat of the upper Warm Springs River (personal communication, Weldon, M. 2004).
- Sediment yield contributed to LBC reservoir by the Metolius River is remarkable low and appears to be the lowest in the region (O'Conner et al. 2003).
- One year following the 2002 Eyerly Fire, percent fines in spawning gravels in Street Creek increased and streambank stability decreased. These were found to be associated with loss of streambank vegetation and instream and hillslope down wood (Dachtler 2003). However, due to the quick recovery of ground vegetation, including riparian vegetation, and increase in instream wood, hillslope stability has improved in the fire area and the risk of sediment input from hillslopes has decreased.
- Monitoring of hillslope erosion on steep high burn severity slopes in the Eyerly Fire area showed a significant difference in erosion rate between unburned control slopes and high burn severity slopes in the only the first year following the fire. The mean annual erosion rate from the high burn severity slopes in the first year following the fire was less than 0.1 Mg/ha/yr. Low erosion rates in the Eyerly Fire area were mostly attributed a mild winter and spring after the fire and no high-intensity rainstorms the following summer. In addition, erosion rates in the Eyerly Fire area are probably less than other areas in the region due to high infiltration rates that generally exceed average convective storm intensities (McCown and Wasniewski 2005).

- Detrimental soil condition is primarily a concern for hydrology in areas adjacent to waterbodies or hydrologically connected to waterbodies. Detrimental soil condition, a component of which is compaction, in riparian areas can be a result of logging, roads, campsites, or development.
    - Based on sample monitoring, detrimental soil condition on U.S. Forest Service lands in subwatersheds in the Lower Metolius Watershed is below the Deschutes National Forest Plan threshold of 20% (USDA Forest Service 2004; See Soils Report).
    - It appears that the development along the Deschutes River and Arm are high above the river on the bench and not likely to cause water quality effects. There is some residential development in the headwaters of Potter Canyon Creek, a tributary to the Deschutes River, which could deliver sediment to the Deschutes River during flood events.
    - It appears there is substantial residential development along the intermittent streams in the analysis area that feed into the Metolius Arm of Lake Billy Chinook. Although development along these drainages could cause sedimentation, it will likely settle out in the reservoir and not cause significant water quality effects. Likewise, the delta study showed there is not a high influx of fine sediment to the Metolius Arm (O'Conner et al. 2003).

    - There are four developed recreation areas within the analysis area along Lake Billy Chinook that are causing some site-specific riparian damage: The Cove Palisades State Park, Perry South Campground (USFS), Monty Campground (USFS), and Bureau of Land Management Beach (boat-in campsites).
    - The most recent and future foreseeable timber sales in the Watershed Analysis Area were/are the Eyerly Salvage (completed in 2004) and Flymon (ongoing), both of which avoid ground-based treatment in the RR/RHCAs.
- Roads in the analysis area continue to be a source for increasing overland flow (USDA Forest Service 2004) (Table 6). Although open road densities on U.S. Forest Service lands are within the standard for wildlife (see Transportation report), total road densities for all lands within subwatersheds and smaller drainages are high in many areas.
    - Road density in the analysis area is considered high risk in the Upper Fly Creek subwatershed and in the smaller drainages of Spring Creek and Street Creek according to the document, "Determining Risk of Cumulative Watershed Effects Resulting from Multiple Activities" (USDA Forest Service 1993). Given that these subwatersheds are relatively low relief, road densities below 3.1 are considered low risk, between 3.1 and 4.5 are considered moderate risk, and above 4.5 are considered high risk.
    - Roads adjacent to streams, crossing streams, or hydrologically connected to streams via road ditches are the ones that influence streamflow or water quality. Road miles in Riparian Reserves and Riparian Habitat Conservation Areas are high in both Upper Fly Creek and Lower Fly Creek subwatersheds and in the smaller drainages of Street Creek and Spring Creek when compared to the miles of stream in the drainage areas. Stream crossings are high in most subwatersheds in the analysis area.
    - All subwatersheds in the analysis area were rated as functioning at risk in the Watershed Condition Framework (WCF), except Haystack Draw – Deschutes River subwatershed which was rated as having impaired function. Although the WCF rated most of the analysis area as functioning at risk, the rating could be worse because open road densities may be even higher in these systems because many level 1 (closed roads) are still physically open and used by the public.
        - All subwatersheds that intersect the Forest and consist of at least 5% USFS ownership were analyzed during the WCF. The WCF is a National Forest based reconnaissance-level evaluation of watershed condition that describes watershed condition in terms of discrete categories (or classes) that reflect the level of watershed health or integrity (Potyondy and Geier 2010).
        - A component of the classification is the evaluation of the "terrestrial physical" condition and includes evaluation of open road density, road maintenance, proximity to water, and mass wasting potential. Each of these are scored based on if they are functioning properly (good), functioning at risk (fair), or have impaired function (poor) and then averaged to give an overall "roads indicator" value.
    - The Travel Management Rule was implemented in October 2011 and it legally restricts motorized access to designated open roads but no physical road closures or decommissioning occur under this rule; therefore, no physical changes are occurring on the ground and roads that were already closed will remain closed and no new roads will be closed under this decision. Implementation of this rule may allow level

1 (closed roads) to actually function as closed roads and reduce off-road vehicle travel.

- The Eyerly Road Decommissioning Project was implemented in August 2012 and decommissioned approximately 37 miles of road in the Spring Creek – Metolius River, Middle Metolius River, and Lower Fly Creek subwatersheds. The decommissioning reduced the Watershed Risk Rating in the Middle Metolius River subwatershed from Moderate to Low. The numbers in Table 12 reflect these decommissioning.

Table 12. Road density and stream crossings in the Lower Metolius and Potter Canyon – Deschutes River Watershed Analysis area (including known non-system roads).

Subwatershed	Total Road Miles*	Road Density (mi/mi 2)	Watershed Risk Rating	RR/RHCA Roads (mi)	Number of Stream Crossings	WCF Road Indicator
Upper Fly Creek	160.9	6.3	High	13.6	94	Fair
Lower Fly Creek	111.9	4.4	Moderate	13.8	52	Fair
Upper Metolius River	147.7	3.0	Low	17.8	149	Fair
Middle Metolius River	85.2	2.6	Low	8.7	96	Fair
Street Creek**	56.0	4.9	High	6.6	69	NA
Spring Creek-Metolius River	86.2	2.3	Low	7.2	92	Fair
Spring Creek***	49.7	4.7	High	8.4	47	NA
Juniper Creek	55.7	2.4	Low	1.8	39	Fair
Whitewater River	42.6	1.3	Low	0.7	8	NA
Stevens Canyon	94.4	4.2	Moderate	1.9	17	Fair
Trahan Canyon	74.0	3.1	Moderate	2.6	32	Fair
Potter Canyon	43.5	2.6	Low	0.5	51	Fair
Haystack Draw-Deschutes River	81.7	2.8	Low	3.5	42	Poor

* road miles outside of U.S. Forest Service lands are estimated based on best available data.

** smaller drainage area within Middle Metolius subwatershed

*** smaller drainage area within Spring Creek- Metolius River subwatershed

Desired Conditions and Strategies and Actions to Achieve Desired Conditions:

- Refer to Fisheries report.

Fisheries, Aquatics and Riparian Habitat

Management Direction

- The entire project area is covered by the Deschutes Land and Resource Management Plan (USDA 1990).
- The Metolius River, Six Creek a portion of Fly Creek and several intermittent non fish bearing streams are within the Riparian Reserves of the Northwest Forest Plan (NWFP) Area (USDA 1994).
- The NWFP provides standards and guidelines for Key Watersheds and Riparian Reserves (RRs) that prohibit or regulate activities that retard or prevent attainment of the Aquatic Conservation Strategy (ACS) Objectives at the watershed scale (USDA and USDI 1994).
- Within INFISH (USDA 1995) Riparian Habitat Conservation Areas (RHCAs) fish bearing streams include Spring Creek Street Creek, lower Fly Creek and portions of the Metolius River and Deschutes River.
- Whitewater River, Mariel Creek and several intermittent streams are located on the Confederated Tribes of Warm Springs (CTWS) lands (Figure 14).
- Small portions of the analysis area are within an INFISH priority watershed, which includes the perennial section of Spring Creek on the Sisters Ranger District. Other areas are on intermittent drainages that flow into the Middle Deschutes River.
- Fisheries are considered an Outstanding Remarkable Value (ORV) in the Metolius River Wild and Scenic Management Plan.
- The following interim INFISH Riparian Management Objectives (RMOs) in Table 13 apply to streams within the analysis area that are outside of the NWFP area and are on USFS lands.

Table 13.INFISH Riparian Management Objectives for forested stream systems.

Habitat Feature	Interim Objective
Pool Frequency	<10 ft wide =96 pools/mi, 10-20 ft wide = 56 pools/mi, 20-25 ft wide = 47 pools/mi, 25-50 ft wide = 26 pools/mi, 50-75 ft wide = 23 pools/mi, 75-100 ft wide = 18 pools/mi, 100-125 ft wide = 14 pools/mi, 125-150 ft wide = 12 pools/mi, 150->200 ft wide = 9 pools/mi
Water Temperature	No measurable increase in water temp. Max water temp <59°F for adult holding habitat and <48°F within spawning and rearing habitat
Large Woody Debris	>20 pieces/mi; >12" dia by >35' long
Width/Depth Ratio	<10, mean wetted width divided by mean depth

Figure 14. Streams and subwatersheds within the Lower Metolious WA area.

- The northern portion of the Middle Metolius subwatershed is considered a "Tier 1 Key Watershed" under the NWFP. Key watersheds under the NWFP contribute directly to the conservation of at-risk anadromous salmonids, bull trout, and resident fish populations.

Existing Conditions

Fish/Aquatic Populations

- Historically fish passage at Pelton Round Butte Dams was cut off when the dams were built in 1964. The main problem was downstream passage of smolts due to currents in the large reservoir and fish having trouble locating the dam. Fish passage was reestablished by Portland General Electric with the installation of selective water withdraw tower and a fish collection facility in 2009. However, the numbers of smolts passed downstream have not met relicensing goals depending on the year and species. Fish may still be having trouble locating or entering the collection facility. More studies on reservoir currents and fish behavior may be needed followed by modifications to the collection facility in order to meet fish passage goals.
- Middle Columbia bull trout *Salvelinus confluents,* a threatened species and their critical habitat are present in the Metolius River, Deschutes River, Lower Whychus Creek, Whitewater River, LBC and Street Creek. The Metolius River/LBC bull trout population is considered one of the healthiest in the lower forty eight states and has rebounded from depressed population after restrictive angling regulations were implemented. In 1986 only 26 redds were counted and in 2004 a record high of 1,045 redds were counted.
- Experimental populations of Middle Columbia River steelhead *Oncorhynchus mykiss* have been recently reintroduced to Deschutes River and Whychus Creek starting in 2007. Spring chinook *O. tshawytscha* were reintroduced to the Metolius and Whychus Creek starting in 2008. Summaries of adult returns, fry outplants, smolt outplants and smolts passed downstream of Lake Billy Chinook (LBC) to date are located in Tables 14, 15, 16, and 17.
- Sockeye salmon were once native to Suttle Lake located in the Upper Metolius Watershed. However fish passage of kokanee smolts below LBC has been untaken to try and develop a sockeye population in the Metolius River.
- Redband trout *O. mykiss* a USFS Region 6 and State of Oregon sensitive species are present in all perennial fish bearing streams within the project area. On smaller stream such as Prarie farm Creek, Six Creek and Fly Creek the length of of perennial habitat fluctuate seasonally.
- Other native fish species in the project area include mountain whitefish *Prosopium williamsoni*, bridgelip sucker *Catostomus columbianus,* chiselmouth *Acrocheilus alutaceus,* Northern pikeminnow *Ptychocheilus oregonensis*, longnose dace *Rhinichthys cataractae*, speckled dace *Rhinichthys osculus* and sculpin *Cottus sp.* species (Table 18). Although not documented, potential suitable habitat for Region 6 sensitive species a caddisfly *Rhyacophila chandleri* and Indian Ford Juga *Juga hemphilli ssp.* may exist in certain streams and springs within the analysis area.
- Native signal crayfish *Pacifastacus leniusculus* inhabit LBC and are an important forage species for fish in the reservoir. Crayfish are commercially harvested in LBC and account for the largest harvest from a single waterbody in the state (Larson and Olden 2011).

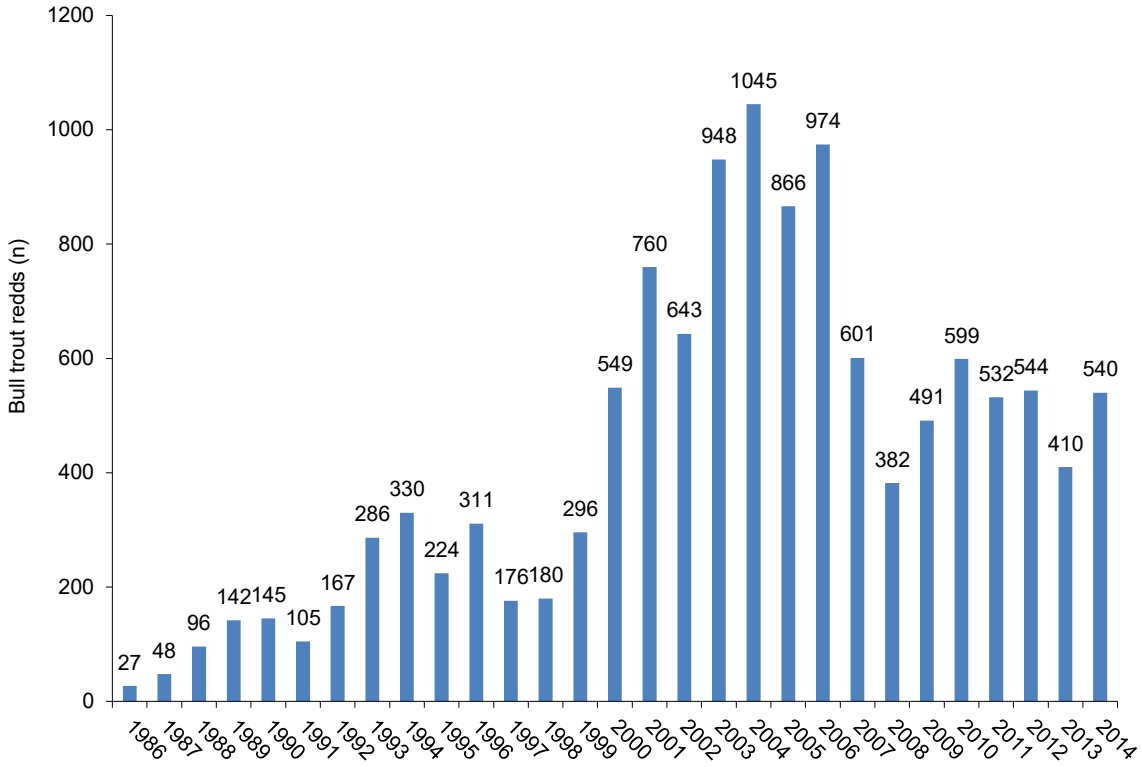


Figure 15. Metolius River and Tributary bull trout redd counts for the last 28 years. Data courtesy of ODFW.

Table 14. Pelton adult collection facility known origin adult returns per run year. Data courtesy of PGE and ODFW.

Chinook	Right Maxillary	Left Maxillary	Total
2011	7	164	171
2012	25	24	49
2013	12	10	22
2014	20	4	24
Sockeye			
2011	19	-	19
2012	86	-	86
2013	25	-	25

2014	20	-	20
Steelhead			
2011-2012	40	21	61
2012-2013	103	29	132
2013-2014	38	12	50

***RM** = Known origin reintroduced upper Deschutes basin fish captured as juveniles at the SWW and released into the lower Deschutes River.

***LM** = Hatchery released test fish captured as juveniles at the SWW and released into the lower Deschutes River.

* 2014 Adult return numbers are through August 31st.

Table 15. Steelhead fry/smolt reintroduction information in the project area. Total fry and smolts released each year are in bold. Data courtesy of PGE and ODFW.

Year	# Steelhead Fry Released	Stream	# Smolts Released
2007	**275,000**	Whychus Creek	0
2008	**291,000**	Whychus Creek	**0**
	91,584	Deschutes River (Mainstem)	0
2009	278,823	Whychus Creek	0
	370,407	Total	**0**
	17,462	Deschutes River (Mainstem)	750
2010	229,797	Whychus Creek	3,600
	247,259	Total	**4,350**
	43,161	Deschutes River (Mainstem)	500
2011	288,768	Whychus Creek	4,871
	331,929	Total	**5,371**
	27,664	Deschutes River (Mainstem)	500
2012	248,131	Whychus Creek	4,871
	275,795	Total	**5,371**
	38,362	Deschutes River (Mainstem)	780
2013	291,921	Whychus Creek	2,209
	330,283	Total	**2,989**
	45,000	Deschutes River (Mainstem)	390
2014	310,900	Whychus Creek	4,498
	355,900	Total	**4,888**

Table 16. Chinook fry/smolt reintroduction information in the project area. Total fry and smolts released each year are in bold. Data courtesy of PGE and ODFW.

Year	# Chinook Fry Released	Stream	# Chinook Smolts Released
	90,000	Metolius River (Mainstem)	
2008	50,000	Lake Creek	
	140,000	**Total**	
	311,733	Metolius River (Mainstem)	
	13,425	Lake Creek	
2009	8,950	Spring Creek	
	11,188	Deschutes River (Mainstem)	
	71,603	Whychus Creek	
	416,899	**Total**	
	200,110	Metolius River (Mainstem)	5,304
	90,178	Lake Creek	
2010	21,706	Spring Creek	
	8,284	Deschutes River (Mainstem)	391
	73,613	Whychus Creek	5,207
	393,891	**Total**	**10,902**
	191,142	Metolius River (Mainstem)	9,106
	80,360	Lake Creek	
2011	14,924	Spring Creek	
	18,368	Deschutes River (Mainstem)	400
	72,898	Whychus Creek	6,504
	377,692	**Total**	**16,010**
	195,210	Metolius River (Mainstem)	5,448
	78,084	Lake Creek	
2012	13,014	Spring Creek	
	11,970	Deschutes River (Mainstem)	450
	53,647	Whychus Creek	6,898
	351,925	**Total**	**12,796**
	246,365	Metolius River (Mainstem)	12,100
	66,690	Lake Creek	
2013	19,325	Spring Creek	
	49,210	Deschutes River (Mainstem)	780
	87,896	Whychus Creek	390
	469,486	**Total**	**13,270**
	167,524	Metolius River (Mainstem)	10,609
2014	44,520	Lake Creek	
	5,964	Spring Creek	
	3,829	Deschutes River (Mainstem)	488
	221,837	**Total**	**11,097**

Table 17. Outmigrant salmon and steelhead smolts passed downstream of Pelton Round Butte Dam

Year	Chinook	Steelhead	Sockeye
2010	43,438	7,612	48,691
2011	60,641	10,452	220,627
2012	24,509	7,806	4,955
2013	20,913	2,705	24,708
2014	18,501	2,110	153,570

Aquatic Habitat

- Perennial streams in the two watersheds are the Metolius River, Deschutes River, Street Creek, Spring Creek, Fly Creek, Six Creek, and Whitewater River. Lake Billy Chinook (LBC) is a large manmade reservoir that all perennial waterbodies drain into.
- Conditions of stream channels on USFS and CTWS lands range from fair to excellent. Stream channels on private land are largely intermittent and their condition is largely unknown.
- The perennial sections of Street Creek and several intermittent steams in the Street and Spring Creek subwatersheds were burned by the Eyerly Fire in 2002. Ground Cover recovered quickly after the fire and more wood has fallen into stream channels since the fire.
- The Green Ridge Fire (2013) and Bridge 99 (2014) fire burned the intermittent portions of the headwaters of Street Creek, Spring Creek, Prairie Farm Creek and Fly Creek.
- The effects of past road building and timber harvest activities are present on the landscape and near streams. The extent of lasting effects from these past activities on stream channels is unknown.
- Lake Billy Chinook is an important rearing and foraging area for bull trout and kokanee. Recent improvements in downstream fish passage and the start of a reintroduction program for steelhead, sockeye salmon and chinook salmon have been the focus of Portland General Electric and the Confederated Tribes of Warm Springs. LBC is used heavily for water recreation which includes boating, camping and fishing.

Invasive Aquatic Species

- Three spine stickleback are non-native and have been documented in lower Street Creek.
- Non-native brown trout *Salmo trutta* and brook trout *S. fontinalis* are present in certain streams and other warm water nonnative species such as brown bullhead, largemeouth bass and small mouth bass utilize LBC.
- Yellow flag iris is present in the LBC and the Metolius River. One piece of Eurasian water milfoil was found in the Metolius Arm near Chinook Island but none has been found since. However it is present in Suttle Lake which flows into the Metolius so infestations in LBC are likely. New Zealand mud snails have been documented around the boat ramp on the Crooked Arm (Lori Campbell, PGE personal communication).

Table 18. Fish species of concern within the Lower Metolius Watershed Analysis area. The symbol (S) notes spawning, the symbol (R) notes rearing, the symbol (M) notes migration, the symbol (E) notes extirpated and the symbol (H) notes there has been no sighting, but suitable habitat exists in a given waterbody. Only rearing (R) is noted if species is documented but life history is unknown.

Fish / Species	Water Body and Location							
	Lower Metolius River	Whitewater River	Lake Billy Chinook	Fly, Prairie Farm and Six Creeks	Street Creek	Spring Creek	Middle Deschutes River Below Whychus Creek	Mariel Creek
Bull Trout	S,R,M	S,R,M	R,M		R		R,M	R
Redband Trout	S,R,M	S,R,M	R,M	S,R,M	S,R,M	S,R,M	S,R,M	R
Chinook Salmon	S,R,M	H	R,M				R,M	
Steelhead	H		R,M	H	H	H	R,M	
Sockeye Salmon	M							
Kokanee Salmon	S,M		R,M			S,M	S,M	
Mountain Whitefish	S,R,M		R,M				R,M	
Bridgelip Sucker			R,M				R,M	
Largescale Sucker			R,M				S,R,M	
Peamouth			R,M				S,R,M	
Northern Pike Minnow			R,M				S,R,M	
Sculpins	S,R,M		R,M				S,R,M	
Longnose Dace	R,M		R,M				R,M	
Hatchery Rainbow Trout								
Brook Trout	R,M							
Brown Trout	R,M		R,M		S, R,M	S,R,M	S,R,M	

Three Spine Stickleback			R,M		R		R,M	
Largemouth Bass			S,R,M					
Smallmouth Bass			S,R,M			R	S,R,M	
Brown Bullhead			R,M				R,M	

Fish and Habitat Surveys

- Data from fish and fish habitat surveys is summarized for streams in the project area.
- Street Creek was surveyed in 1999 (Dachtler) before the Eyerly Fire and for fish, sediment and instream wood following the fire (Dachtler 2003a, b).
- Spring Creek was surveyed for fish and habitat in 2003 (Dachtler 2003c)
- Fly Creek (Dachtler 1998) and Six Creek (Lovtang 1997) were surveyed for fish and fish habitat.
- Off USFS lands, the Deschutes River was surveyed in 1997 and Whitewater River was surveyed in 1998 by ODFW.
- The Lower Metolius River was habitat surveyed in 1989 by USFS and ODFW surveyed it in 2012.
- Redband trout were observed in Prairie Farm Creek by a Resource Advisor on the Bridge 99 Fire in 2014. This is the first documented fish sighting in Prairie Farm Creek.

Pools

- None of the perennial streams within the analysis area meet the INFISH RMO standards for pools/mile (Table 7). The INFISH pool RMO did not take into account stream gradient and many of the streams are over 2% gradient (Table 19). Rosgen (1996) states that pool riffle spacing is inversely proportionate to stream gradient.

Table 19. Average pools/mile, percent pools and stream width for streams in the Lower Metolius Watershed-LBC Watersheds.

STREAM	Pools/mile	Percent Pool	Stream Width ft
Deschutes River (below Whychus Creek)	5	25	64
Fly Creek	56	49	6-10
Metolius River (Lower)	2	6	126
Six Creek	37	39	3
Spring Creek	24	23	8
Street Creek	33	55	3-7
Whitewater River	8	9	22-55

Large Woody Debris

- The lower Metolius River, Whitewater River and Six Creek all met INFISH standards for instream large wood (Table 20).
- Immediately after the Eyerly Fire in 2002 large wood increased in Street Creek to near the INFISH RMO standard but has not been surveyed since then and now likely exceeds it from fire killed trees that continued to fall in.
- The Deschutes River is located in a high desert (non-forested) environment and large wood is not expected to be present in significant amounts.
- Spring Creek is probably deficient in large wood because the perennial section is located all within the Perry South Campground where fallen trees are likely cut up and used as campfire wood.
- It is not clear why Fly Creek is deficient in large wood but past timber harvest and historic wildfires were likely a factor. Also the lower reaches of Fly Creek are in the transition between ponderosa pine and juniper woodland which have fewer large trees. The upper perennial section (reach 4) on Fly Creek is located in a mixed conifer forest type and meets the INFISH standard with 25 pieces of large wood/mile.
- Historically the Metolius River was cleared of wood in the early 1920's to float logs down it and in 1938 a trip to float it from Canyon Creek to Warm Springs required 20 portages (Minear 1999). More recently trees were illegally cut out to provide passage for rafters and kayakers. During the 2012 ODFW habitat survey at least five channel spanning logs that had to be portaged around were noted.

Table 20. Average large wood per mile, small wood per mile densities for streams in the Lower Metolius Watershed-LBC Watersheds.

STREAM	**Average large wood per mile** **<12" x 35'**	**Average small wood per mile** **<6" x 20'**	**Meets INFISH standard** **(<12" x 35')**
Deschutes River (below Whychus Creek)	0	0	No*
Fly Creek	16	17	No**
Metolius River (Lower)	40	13	Yes
Six Creek	33	19	Yes
Spring Creek	0	4	No
Street Creek 1999	16	13	No
Street Creek	19	25	No

2002			
Whitewater River	98	145	Yes

*Non –forested ** Both forested and non-forested

Water Temperature

- The Metolius River is on the 2012 ODEQ 303d list for temperature impairment but it is listed based on data near the headwaters for its entire length. Temperatures become colder downstream from spring inputs and within the analysis area the Metolius River meets the state temperature standard (Table 21).
- The high water temperatures in the Middle Deschutes River are found above the project area and are the result of irrigation withdrawals in Bend which take the majority of the rivers water.
- The Deschutes River is on the 2012 ODEQ 303d list for temperature impairment but it is listed based on data upstream of the project area. Temperatures below Whychus Creek become colder from major spring inputs near Foley Waters and at Alder Springs. Within the analysis area the Deschutes River meets the state temperature standard (Table 9). See hydrology section for more discussion on water temperature.
- Certain streams, although not on the ODEQ 303d list do not meet the state temperature standard and this is likely due to the fact that springs feeding Spring Creek and Street Creek emerge from the ground at higher temperatures than those that feed the Metolius River.
- Six Creek may have elevated water temperatures due to past clear cuts along the stream.
- No streams met the INFISH temperature standard for spawning.

Table 21. ODEQ water temperature standard, highest recorded stream temperature and other pertinent water temperature information.

Stream	ODEQ Temperature Standard °C	On 2012 ODEQ 303d list	Highest Temperature Recorded	Comments
Deschutes River (below Whychus Creek)	18 °C	Yes	17.1 °C	2009 thermograph maximum temperature reading. Continuous data available for 2005, 2006, 2008 and 2009.
Fly Creek	12.8 °C	No	13.9 °C	1998 Stream survey instantaneous reading in perennial stream section.
Metolius River @ Bridge 99	12 °C	Yes	10.6 °C	Sixteen seasons of thermograph data. 7 day average maximum of 10.2 °C in 2002.
Metolius River @ Mouth	12 °C	Yes	12.3 °C	2001 thermograph, 7 day average maximum of 11.7 °C
Six Creek	12.8 °C	No	16.8 °C	2001 thermograph, 7 day average maximum of 16.1 °C
Spring Creek	12.8 °C	No	14.5 °C	2003 stream survey instantaneous reading, temperature at head springs was 13.0 °C
Street Creek	12.8 °C	No	22.3 °C	2004 thermograph, 7 day average maximum of 21.6 °C. Before Eyerly Fire highest temperature was 17.1°C. 1999 stream survey instantaneous reading, temperature at springs was 13.0-15.0 °C
Whitewater River	12 °C	No	11.5 °C	1998 Stream survey instantaneous

				reading

Channel Morphology

- Only Six Creek meets the INFISH width to depth ratio standard (Table 10).
- Stream gradients (% slope) ranged from 0.7 % to 4.9 % within the analysis area.

Table 22. Stream channel morphology for fish bearing streams within the Lower Metolius – LBC Watersheds from fish habitat inventories. The range of values represents the highest and lowest values by geomorphic reach.

STREAM	Wetted Width ft	Bankfull Width ft	Width to Depth Ratio	Entrenchment Ratio	% Slope	Rosgen Stream Type(s)
Deschutes River (below Whychus Creek)	64	68	14	1.1	0.7	F
Fly Creek	6-10	15-25	17-25	1.5-2.4	0.9 - 3.0	B, C
Metolius River (Lower)	126	ND	ND	ND	0.9	B
Six Creek	3	6-11	6-8	1.2-3.0	3.7 - 9.4	A, B
Spring Creek	8	9	16	1.3	1.7	F
Street Creek	3-7	15-19	13-16	1.6-1.7	3.1 - 4.9	B
Whitewater River	22-25	50-58	18 -27	2.5-3.1	2.5 - 3.1	B, C

ND = No Data

Fine Sediment, Substrate and Unstable Banks

- Bank instability was relatively low on all streams except for Spring Creek and Street Creek which both exceeded 10% unstable banks. In Spring Creek this is likely due to the high recreational use associated with Perry South Campground. In Street Creek the cause of the instability is unknown but possible could be the result of increased runoff from past timber harvest activity and fires in the upper watershed along the several miles of intermittent stream channels that enter Street Creek.
- Six Creek was the only stream that exceeded 20 % instream fine sediments <2mm where data was available (Table 23).

Table 23. Percent fine sediments (Fines) <2mm, <5.7mm, D50 substrate size class and percent unstable banks. Data averaged from all pebble counts in each stream

STREAM	% Fines <2 mm	% Fines <5.7 mm	Median Substrate Size Class (D50)	Percent Unstable Banks

Deschutes River (below Whychus Creek)	ND	ND	ND	0.0
Fly Creek	16	20	Fine Gravel	4.7
Metolius River (Lower)	ND	ND	ND	ND
Six Creek	37	41	Very Coarse Gravel	0.0
Spring Creek	11	23	Very Coarse Gravel	14.7
Street Creek (Pre Fire)	17	19	Small Cobble	13.1
Street Creek (Post Fire)	19	25	Small Cobble	ND
Whitewater River	ND	ND	ND	3.6

ND = No Data

Roads and Culverts

- The Metolius Watershed Analysis Update (USDA 2004) analyzed road densities and found only that the Whitewater River Subwatershed and Metolius Face (A portion of Middle Metolius Subwatershed) met the open road density objective of 2.5 mi/sq. mi.
- Approximately 37 miles of roads in the analysis area in the Spring Creek-Metolius and Middle Metolius subwatershed were closed or decommissioned in 2012 as part of the Eyerly Fire Roads Decommissioning Project.
- After the Eyerly Fire a new bridge was installed on the 64 road over Street Creek and an open arch culvert on the 6400-660 road which improved fish passage. Two culverts remain as passage barriers on Spring Creek, and one on a small tributary to Spring Creek in the Perry South Campground.
- With the recent discovery of redband trout in upper Prairie Farm Creek more surveys should be conducted to assess the size and distribution of this population. Fish passage solutions should be assessed at the 1180-800 and 1150 road crossings. The 1180-800 road is a migration barrier.

Desired Conditions

- All Desired Conditions are consistent with the Ecosystem Health and Diversity Vision in the Upper Deschutes Resource Management Plan (USDI Bureau of Land Management 2005), the

Deschutes Land and Resource Management Plan (USDA Forest Service 1990), the Metolius and Deschutes Wild and Scenic Rivers plans (USDA Forest Service 1997; USDA et al. 1992).

- Water quality meets or exceeds State requirements for all onsite and downstream beneficial uses. Adequate summer flow is maintained and/or enhanced in perennial stream sections.
- Road density objectives are less than 3.1 mi/mi^2 for each subwatershed in the analysis area and the WCF rating objectives are "Good". Riparian road miles and stream crossings are reduced as much as possible while still supplying access for management.
- All stream channels and wetlands in the landscape area are in good to excellent condition. Floodplains function during floods, banks are well-vegetated, channels are relatively narrow, pools are deep, undercut banks are frequent and large woody debris is abundant.
- Riparian areas, streams, and special aquatic features support healthy aquatic and riparian ecosystems, protected from the impacts of land use activities, but able to adjust to impacts caused by naturally-occurring disturbance processes such as wildfire, flood, and drought. Spatial and temporal hydrologic and aquatic habitat connectivity for riparian- and aquatic-dependent species within and between watersheds is maintained.
- As in riparian areas, upland soil and plant conditions provide for soil infiltration and permeability rates, soil moisture storage, and the release of water that are appropriate to soil, climate, and landform. Long-term soil productivity is maintained throughout the watershed. Ample organic ground cover is present to ensure nutrient cycling and minimize erosion, and the land base dedicated to growing vegetation is inherently productive, not constrained by detrimental compaction.
- Non-native fish species and aquatic plants and animals are prevented from invading new areas and populations of invasive species are reduced within their current range.

Strategy to Achieve Desired Conditions

- Improve or relocate USFS roads near stream channels and decommission and obliterate unneeded roads, to reduce runoff, sediment yield, and stream sedimentation.
- Obliterate roads and benched skid trails near streams that intercept shallow subsurface flow and delivery it rapidly to stream channels.
- Identify stream reaches in need of long-term recruitment of large woody debris, and develop a strategy to increase it.
- Eliminate barriers to fish passage at road crossings.
- Identify and conduct aquatic habitat improvement projects to eliminate barriers to fish movement, improve sediment regime, and improve flow regime and lower water temperatures.
- During reconnaissance for vegetation treatment project, identify areas subject to significant erosion, low soil organic matter, and/or excessive compaction relative to R6 Soil Quality Standards, and take remedial actions.
- Encourage the growth of riparian species and/or large trees in Riparian Reserves and Riparian Habitat Conservation Areas and help protect those corridors from catastrophic wildfire.
- Work with Oregon Department of Fish and Wildlife to monitor impacts of non-native fish on native fish populations. Consider eradication and increased harvest of non-native fish such as brown trout and smallmouth bass.
- Do not permit instream or streambank activities (such as suction dredging) that do not provide a direct benefit to fish and wildlife.

Potential Actions to Achieve Desired Conditions

- Subsoil suitable areas of soil-compaction after construction of temporary roads or skid trails following harvest to reduce legacy and project-induced compaction to less than 20% of the project areas.
- Monitor stream temperature at the mouth of Street Creek to determine if shade has recovered since the 2003 Eyerly Fire.
- To improve shade, riparian conditions, and future large wood recruitment consider replanting riparian areas in the Eyerly fire area where natural regeneration has been slow.
- Consider decommissioning and/or closing the 12.8 miles of roads shown on Table 24. These roads have the greatest chance to detrimentally affect redband trout and their habitat in the watershed and on USFS lands.
- Investigate roads to decommission/close in the Spring Creek-Lower Metolius and Middle Metolius subwatersheds that may still be impacting water quality, especially if road runoff directly flows into intermittent or fish bearing streams.
- Consider replacing the following culverts in Table 25 to improve fish passage.
- Investigate redband fish populations discovered in Prairie Farm Creek in 2014 and determine fish passage solutions at road crossings.
- Monitor off road ATV use near the start of the perennial section of Fly Creek and around other sensitive riparian areas. Work with Ponderosa Land and Cattle to block off ATV access if resource damage increases.
- Monitor off road ATV use near the Metolius River and around other sensitive riparian areas in the vicinity of the Three Creeks subdivision. Work with Three Creeks subdivision to block off ATV access if resource damage increases. Consider decommissioning more roads on USFS lands in this vicinity that could be causing resource damage.
- Prevent developments/activities that reduce groundwater inputs to the streams in the analysis area.
- Work with the City of Bend to reduce nutrient inputs to the Deschutes River upstream of the analysis area.
- Thin juniper in the Potter Canyon-Deschutes River watershed to improve surface flow in the intermittent streams and reduce fire risk.
- Thin Riparian Reserves/Riparian Habitat Conservation Areas in subwatersheds with high fuel loads, where thinning can be performed without degrading riparian conditions. Focus treatments on growing large trees and releasing hardwoods.

Table 24. Recommended actions for the road system in the Lower Metolius Watershed.

Road Number	Closure Mileage	Stream Name	Comments	Recommendations
1150-610	0.2	Six Creek	Headwaters of Six Creek, dispersed camping, illegal firewood cutting in RR.	Close, Add drainage where needed and rip first 0.2 mi.
1150-611	0.1	Six Creek	Headwaters of Six Creek, dispersed camping, illegal firewood cutting in RR.	Close, Add drainage where needed and rip first 0.2 mi.
1150-612	0.1	Six Creek	Headwaters of Six Creek, dispersed camping, illegal firewood cutting in RR.	Close, Add drainage where needed and rip first 0.2 mi.
1160-800	0.9	Six Creek	Crosses then Parallels creek in Riparian Reserve for 0.4 mi	Close beyond 845 rd, Add drainage where needed and rip first 0.2 mi. Pull culvert
1100-810	1.8	Six Creek	Parallels creek in Riparian Reserve. Fords creek in fish bearing section, illegal firewood cutting in RR.	Close, Add drainage where needed and rip first 0.2 mi. Reshape channel at crossing.
1100-850	1.7	Six Creek	Parallels creek in Riparian Reserve	Close, Add drainage where needed and rip first 0.4 mi.
1150-Non System	0.7	Prairie Farm Creek	Located in RR of perennial portion of Creek, runoff entering creek from road, illegal firewood cutting in RR. Ties into 1140-880 road.	Close, Add drainage where needed and rip for 0.2 mi on either end.
1180-840	0.6	Prairie Farm Creek	Springs create stream that runs down road for several hundred yards. Illegal firewood cutting in RR.	Close, Add drainage where needed and rip first 0.2 mi.
1160-943	0.2	Prairie Farm Creek	Leads down to stream in RR, still need to recon	Close, Add drainage where needed and rip first 0.2 mi.
1160-940	0.4	Prairie Farm Creek	Road runoff and sediments going down road and into stream.	Close, Add drainage where needed and rip first 0.2 mi
1100-945	0.5	Prairie Farm Creek	Parallels creek in Riparian Reserve	Close, Add drainage where needed and rip first 0.2 mi

Road Number	Closure Mileage	Stream Name	Comments	Recommendations
1100-946	2.8	Prairie Farm Creek	Parallels creek in Riparian Reserve, 2 stream fords, ATV damage, and illegal firewood cutting in RR.	Close, add drainage and rip first 0.2 mi on either end.
1100-600	1.0	Meadow Creek	Intermittent channel runs down road and back into creek, past 400 junction well overgrown, illegal firewood cutting in RR.	Close, Add drainage where needed and rip first 0.2 mi
1150-400	1.4	Meadow Creek	Road erosion gullies in RR	Close, Add drainage where needed and rip first 0.2 mi
1150-440	0.3	Meadow Creek	Crosses intermittent stream	Close, Add drainage where needed and rip first 0.2 mi
1150-442	0.1	Meadow Creek	Crosses intermittent stream	Close, Add drainage where needed and rip first 0.2 mi

Table 25. Culverts on USFS to consider for replacement to improve fish passage in the Lower Metolius Watershed*.

Road Number	Mile Post	Stream Name	Fish Species	Culvert Database Rating	Comments
6400-600	NA	Spring Creek	Redband Trout	Red	Too narrow, no substrate
6400-600	NA	Spring Creek	Redband Trout	Red	Too narrow, no substrate
6400-600	NA	Unnamed Tributary to Spring Creek	Redband Trout	Red	Too narrow, no substrate, perched

***** Fish populations and road crossing barriers still need to be assessed on Prairie Farm Creek

Forest Vegetation

Unless noted the focus of vegetation characterization will be contained within the Lower Metolius watershed and within the Deschutes National Forest.

Across both the Lower Metolius and Potter Canyon Watersheds the vegetative conditions are variable in large part to the various biophysical settings that are present. This variability is driven in large part by the rain gradient and growing season that is influenced by topography and elevation in the watersheds. Plant community types range in the western portion of the watershed from alpine and subalpine dominated by hemlock and true fir to shrub steppe and grass community types in the lower elevations to the east. The western portion of the watershed is represented by the peak of Mt. Jefferson with east portion of the watershed represented by developed agricultural lands with ground water and river sourced irrigation.

Introduction

Summary of existing watershed condition

Due to fire exclusion and prior management, the forested parts of the watershed have unusually high stand densities, a dominance of small trees, and a shift in species composition from early seral towards late seral species. These changes have led to a landscape at higher risk of stand replacing fire, disease, and insect infestations. A legacy of past timber management combined with several unusually high severity fires has left the landscape fragmented and further exacerbated the shift in species composition away from historic configurations.

Past Management

Past vegetation management[1] is diverse among the watersheds and within the different forest types in the watershed. Land-use/ land-cover change has occurred in the eastern portion of the watershed consisting of Lake Billy Chinook (from the Metolius River) and agricultural irrigation lands near and in the town of Culver (Figure 16).

[1] Past management here includes- logging, fuels reduction, fire suppression, fire exclusion, grazing and land use/ land cover changes.

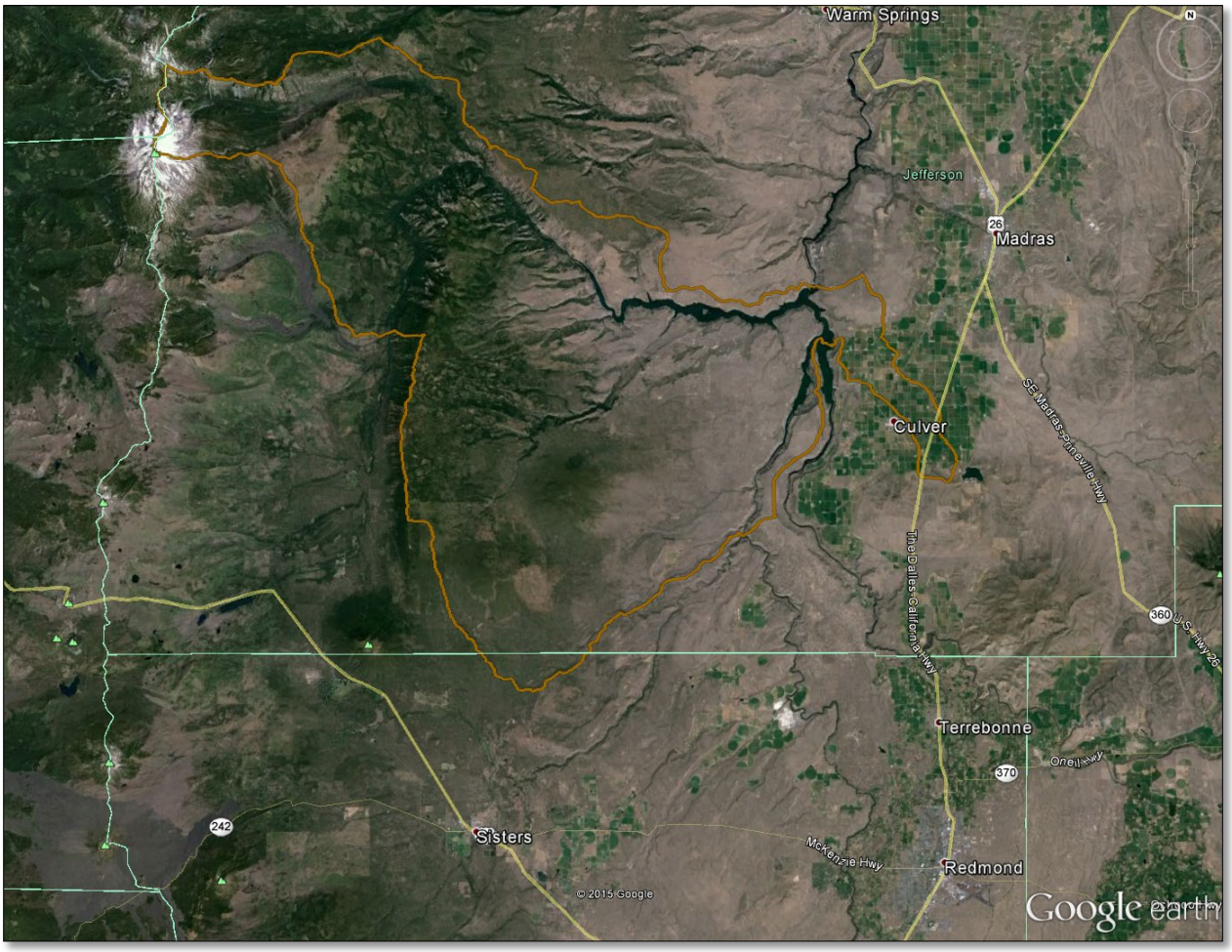


Figure 16. Aerial imagery of the entirety of the watershed. Note diversity in forest cover and land use in the area.

Ownership

The two watershed areas total 204,373 acres, with a mixture of state, federal, tribal, and private ownership. The majority of the watershed is in federal ownership, most of which is comprised of Deschutes NF. Both privately owned land and the Warm Springs Reservation make up most of the remainder of the watershed.

Current Conditions

Forest Type

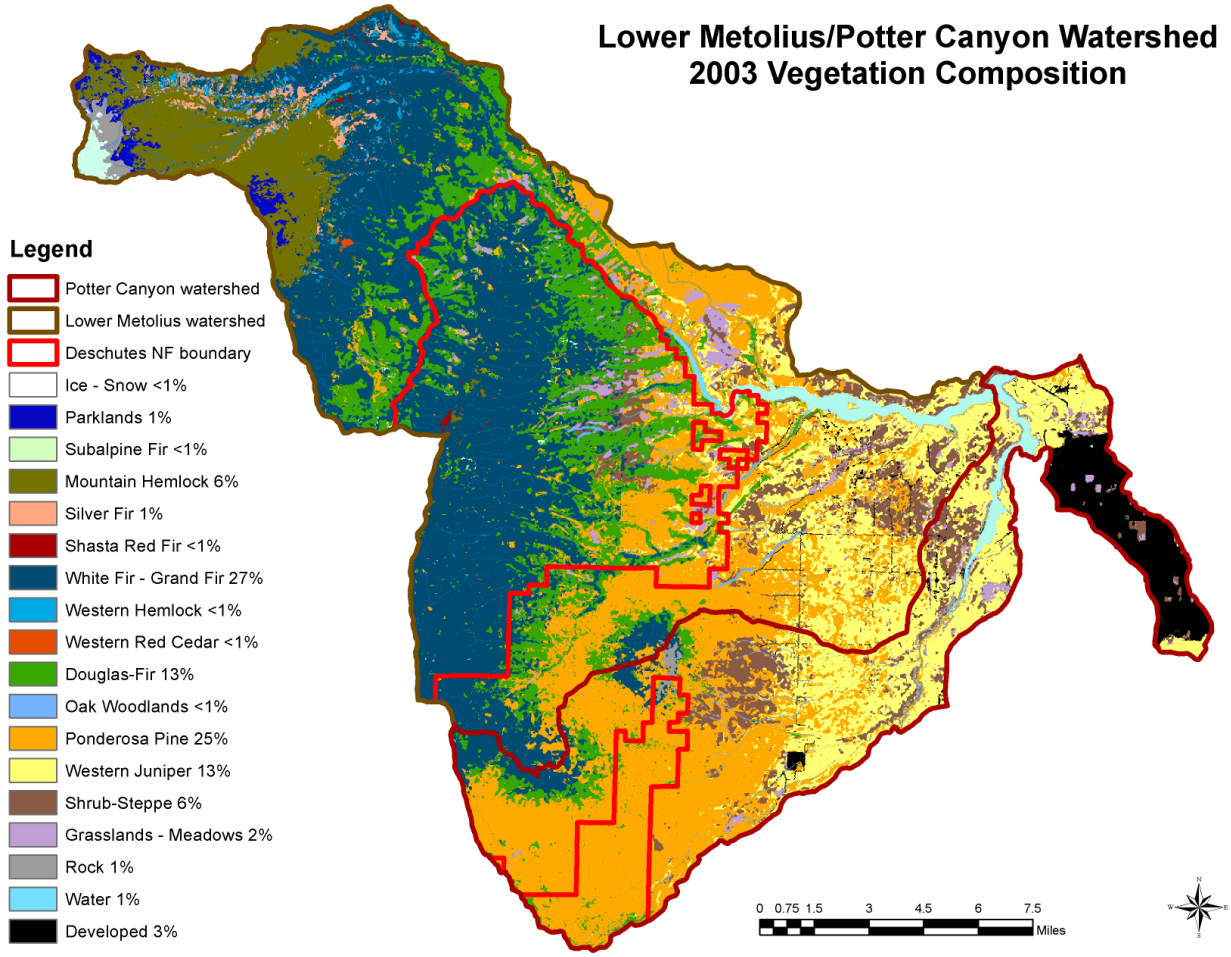
Forest type, which describes dominant tree species (based on basal area) of current vegetation. For conifer and hardwood dominant plots, if the top species accounts for more than 80% of the total conifer or hardwood basal area then only the top species is listed, otherwise the top 2 species are listed (Table 26).

Table 26. Acres and proportions of forest type within both the Lower Metolius and Potter Canyon watersheds

Forest Type	Acres	Proportion of Lower Metolius AND Potter Canyon
Ponderosa pine	66,674	33%
Non-forest/ Fire/ brush/ developed	36,440	18%
Doug-fir	35,079	17%
Western juniper	31,016	15%
Grand and/or white fir	11,995	6%
Remnant- total canopy cover is <10%	9,386	5%
mountain hemlock	3,431	2%
lodgepole	2,772	1%
Incense cedar	1,939	1%
Noble and/or Shasta red fir	1,453	1%
Pacific silver fir	1,399	1%
Oregon white oak	835	0%
western hemlock	566	0%
Subalpine fir	545	0%
Western red cedar/ Doug-fir	497	0%
Engelmann spruce	136	0%
curl-leaf mountain mahogany	58	0%
black cottonwood	52	0%
western white pine	34	0%
Knobcone pine	20	0%
Jeffrey pine	16	0%
giant chinquapin	7	0%
Sugar pine	5	0%
California black oak	2	0%
bitter cherry	1	0%
Pacific madrone	0	0%
Quaking aspen	0	0%
	204,359	100%

Species Composition

Current species composition across the entire watershed is dominated by white fir (27%), followed closely by ponderosa pine (25%). Though the watershed hosts a wide variety of species from alpine trees to high desert shrubs, the majority of vegetation on the Sisters RD is composed of mixed conifers, namely white fir, Douglas-fir, and ponderosa pine. For further analysis, the report will only use vegetation within the Deschutes NF, as complete data is available for this area only.



Plant Community Classification

Potential Natural Community

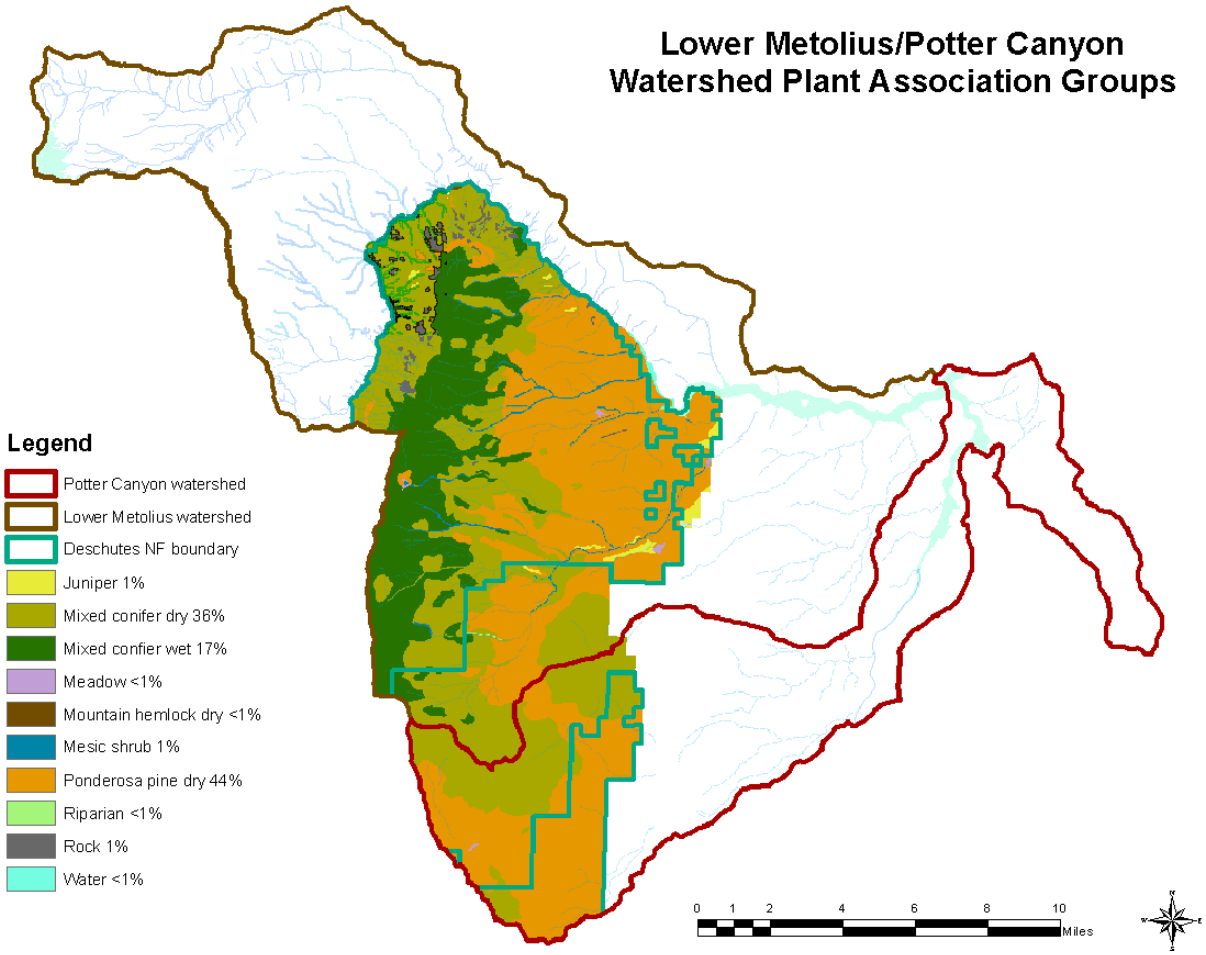
Plant community classification in the Pacific Northwest Region follows guidelines established in FSH 2090.11 (USDA Forest Service 1991). It is founded on the concept of "Potential Natural Communities" (PNC) (Hall et al. 1995, Hall 1998). PNCs are "The biotic community that would be established if all successional sequences of its ecosystem were completed without additional human-caused disturbance under present environmental conditions. Grazing by native fauna, natural disturbances such as drought, floods, wildfire, insects and diseases, are inherent in the development of potential natural communities which may include naturalized non-native species. However, PNC's are described **without** disturbance" (Hall 1998).

In the Pacific Northwest Region, the term used for potential natural communities is "plant associations" (Hall 1998). Plant associations for the Pacific Northwest Region are described without considering disturbance caused by natural elements (as well as human-caused disturbances), including historic fire regimes/ processes (Hall 1998). Consequently, a plant association is composed of species that will be most competitive over time (climax species) and these species will prevent the establishment of less competitive species (seral species) under current climate and site conditions (Hall 1998, Volland 1988,

Simpson 2007). Indicator grasses, forbs, shrubs, trees are used to evaluate the area of the plant associations.

Forest Size/Structural and Seral Stages

A Viable Ecosystems analysis was conducted to determine the size/structure and seral status of the project area. The process used GNN vegetation data on a 30meter pixel and categorized and cross referenced the pixel to a match (nearest neighbor process) from Forest Inventory and Analysis data. Tree information, species dominance and density are evaluated and assigned. The pixels are stratified by plant association group and run through a filter based on species, size and density thresholds. The result is a seral and structural relationship for each pixel. This information was used to inform/ compare the project to the broad-scale HRV watershed condition (USDA 2013).



The forested landscape is influenced by a mosaic of different biotic and abiotic factors. These different environments support different communities of plants. By knowing the plants of a certain site, or a plant association, we can infer much about the site. Plant Association Groups (PAGs) are described by Volland (1985) in the Plant Association of the Central Oregon Pumice Zone guide. While a newer plant association guide is available, this analysis uses the old guide due to the availability of a corresponding

map. Aerial photos from 1991-1993 were used to delineate PAG polygons at a minimum size of 10 acres (any contiguous plant association that was at least 10 acres was delineated as a separate polygon).

Size and Structure

Age

The tree ages among the watersheds indicated the landscapes are dominated by 80-150 year old trees.

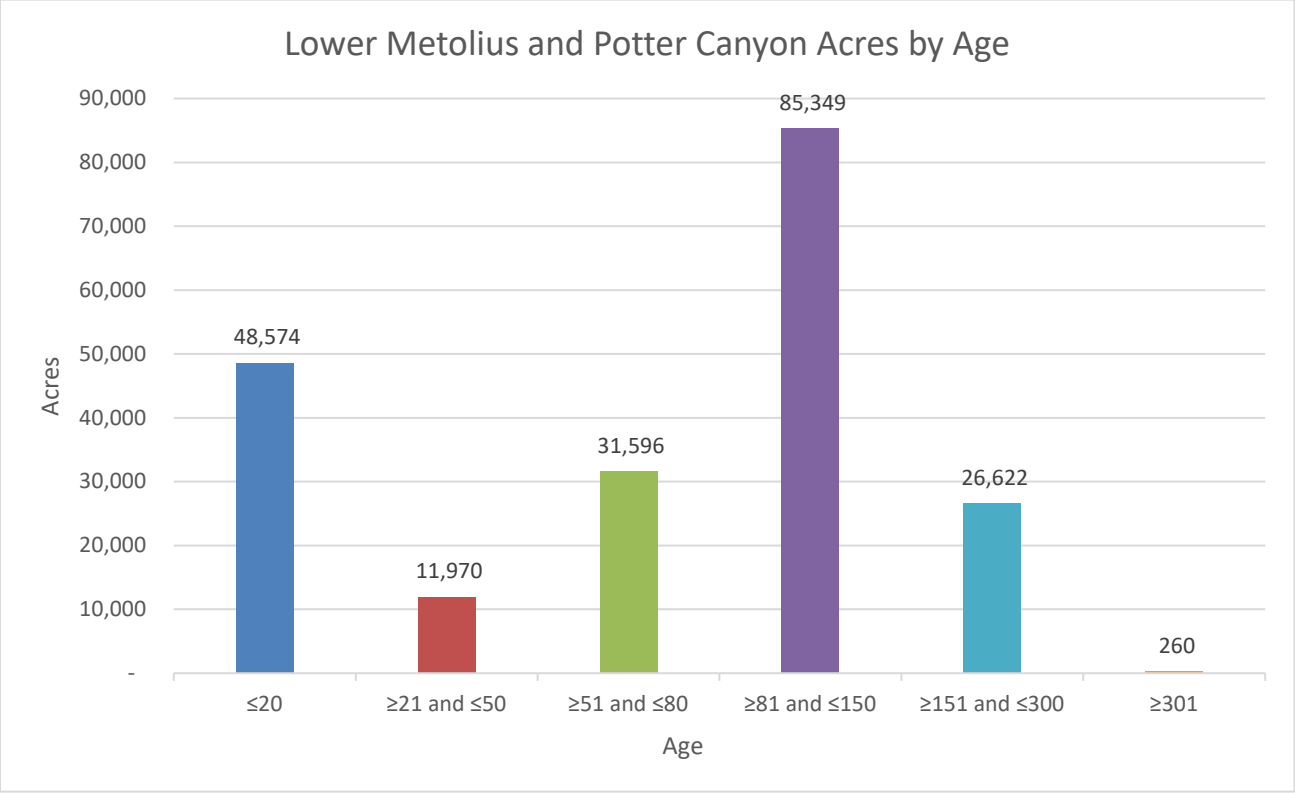


Figure 17. Acres of 6 categories of stand ages among the Lower Metolius and Potter Canyon Watersheds*
*≤20 years is shown artificially inflated due to non-forested areas (agricultural, water, ice/snow, etc.)

Historic Range of Variability (HRV)

Historic Range of Variability (HRV) is a term used to describe the natural fluctuation in pattern of components of ecosystems over time (Stine et al. 2014). HRV serves as a framework of understanding the ecological system in question and serves as a general reference point useful for setting management goals (Landres et al. 1999). The assumption is that past conditions and processes can provide context and information (today) and that these disturbances drove variability in all ecological systems.
In this project, HRV is used as reference framework for historical estimates of forest size-classes (structure) and seral stages, tree species (or lack of) proportion dominance, that may have been present at any given point in the past 100-300 years (Oliver and Larson 1996, O'hara 2001, Franklin et al. 2013). Active forest management described herein includes knowledge-use of historic disturbance processes to evaluate the project area. Vegetation management options are based on current vegetation conditions with the historic landscape patterns in mind. Historic vegetation is defined as what we believe existed prior to the early 1900's. HRV for vegetation was derived from information from the late 1800's, maps

from 1953, current vegetation information, knowledge of successional pathways, and our understanding of past disturbance regimes shaping seral stages and species composition.

Current status of vegetation in relation to the HRV was determined using GNN data to make a seral classification based on size class, density, and canopy closure. The HRV analysis was split by area based on the 3 major PAGs present in the analysis area: dry ponderosa pine, dry mixed conifer, and wet mixed conifer.

Discrepancies from the HRV in dry ponderosa pine PAG:

- Large tree size class is below HRV by 37%
- Early and late seral stages are at the low end of HRV range
- Late seral, open canopied stands (L3b, L4b, L5b) are low in every size class
- Mid and late seral stages have high canopy closure in almost every size class
- Late seral stage stands need to be moved from closed to open canopies
- Most significant variance from the HRV is the lack of late seral, large open canopied stands (L5b) at 46% below the acceptable range

See Figure 18 and table 27.

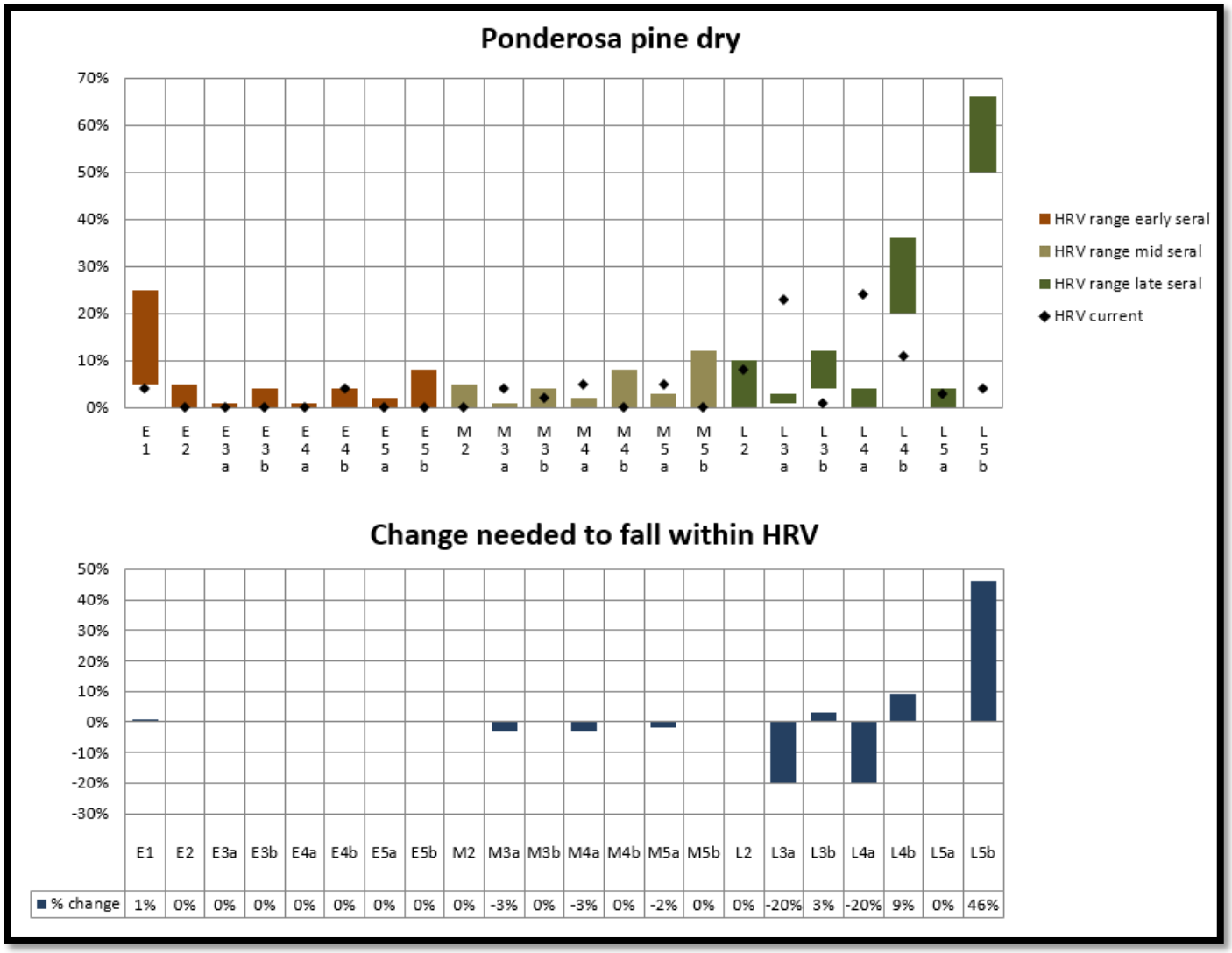


Figure 18. HRV analysis for ponderosa pine PAG

Table 27. HRV analysis (seral and structure) for ponderosa pine PAG.

Ponderosa pine (PP)																									
PAG	Structure	Density	Early Seral					Mid Seral					Late Seral					All Seral Stages				
			Min	Max	Current			Min	Max	Current			Min	Max	Current			Min	Max	Current		
Ponderosa pine (PP)	G/F/S		5%	25%	4%	LOW	-1%				OK	OK				OK	OK	5%	25%	4%	LOW	-1%
	<4.9"		0%	5%	0%	OK	OK	0%	5%	0%	OK	OK	0%	10%	8%	OK	OK	0%	20%	8%	OK	OK
	5 to 9.9	Closed	0%	1%	0%	OK	OK	0%	1%	4%	HIGH	3%	1%	3%	23%	HIGH	20%	5%	25%	30%	HIGH	5%
		Open	0%	4%	0%	OK	OK	0%	4%	2%	OK	OK	4%	12%	1%	LOW	-3%					
	10 to 20.9	Closed	0%	1%	0%	OK	OK	0%	2%	5%	HIGH	3%	0%	4%	24%	HIGH	20%	20%	55%	45%	OK	OK
		Open	0%	4%	4%	OK	OK	0%	8%	0%	OK	OK	20%	36%	11%	LOW	-9%					
	21+	Closed	0%	2%	0%	OK	OK	0%	3%	5%	HIGH	2%	0%	4%	3%	OK	OK	50%	95%	13%	LOW	-37%
		Open	0%	8%	0%	OK	OK	0%	12%	0%	OK	OK	50%	66%	4%	LOW	-46%					
Totals			5%	50%	8%	OK	OK	0%	35%	17%	OK	OK	75%	100%	75%	OK	OK			100%		

Discrepancies from the HRV in dry mixed conifer PAG:

- Pole size class is high and large tree size class is low.
- Mid seral stages average moderately lower than the HRV.
- Late seral stages average higher than the HRV.
- Closed canopy densities are consistently high except in the E5 and M4 categories.
- Open canopy densities are low in the small and large tree size classes for both early and late seral stages (E4b, E5b, M4b, M5b). See Figure 19 and Table 28.

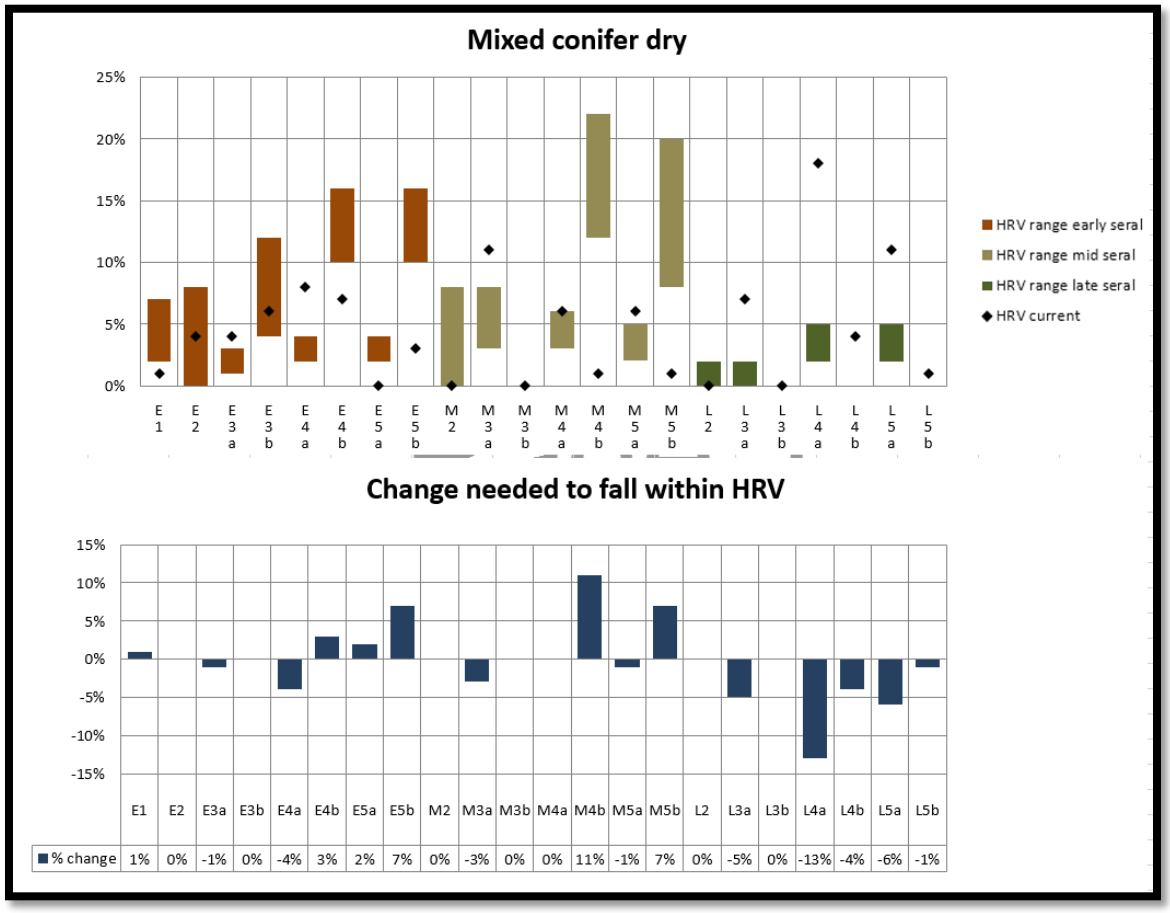


Figure 19. HRV analysis for Mixed Conifer Dry

Table 28. HRV analysis (seral and structure) for Mixed Conifer Dry

Mixed Conifer Dry (MCD)																				
PAG	Structure	Density	Early Seral					Mid Seral					Late Seral					All Seral Stages				
			Min	Max	Current			Min	Max	Current			Min	Max	Current			Min	Max	Current		
Mixed Conifer Dry (MCD)	G/F/S		2%	7%	1%	LOW	-1%				OK	OK				OK	OK	2%	7%	1%	LOW	-1%
	<4.9"		0%	8%	4%	OK	OK	0%	8%	0%	OK	OK	0%	2%	0%	OK	OK	0%	18%	4%	OK	OK
	5 to 9.9	Closed	1%	3%	4%	HIGH	1%	3%	8%	11%	HIGH	3%	0%	2%	7%	HIGH	5%	8%	25%	28%	HIGH	3%
		Open	4%	12%	6%	OK	OK	0%	0%	0%	OK	OK	0%	0%	0%	OK	OK					
	10 to 20.9	Closed	2%	4%	8%	HIGH	4%	3%	6%	6%	OK	OK	2%	5%	18%	HIGH	13%	29%	53%	45%	OK	OK
		Open	10%	16%	7%	LOW	-3%	12%	22%	1%	LOW	-11%	0%	0%	4%	HIGH	4%					
	21+	Closed	2%	4%	0%	LOW	-2%	2%	5%	6%	HIGH	1%	2%	5%	11%	HIGH	6%	24%	50%	22%	LOW	-2%
		Open	10%	16%	3%	LOW	-7%	8%	20%	1%	LOW	-7%	0%	0%	1%	HIGH	1%					
Totals			31%	70%	33%	OK	OK	28%	69%	25%	LOW	-3%	4%	14%	41%	HIGH	27%			100%		

Discrepancies from the HRV in the wet mixed conifer PAG:

- Small tree size class is high and large tree size class is low.
- Early and mid-seral stages within accepted range.
- Late seral stage higher than HRV by 22%.
- Late seral, small open canopy stands (L3B) are much higher than HRV.
- Early seral pole and small size class closed canopy stands higher than HRV

See Figure 20 and Table 29.

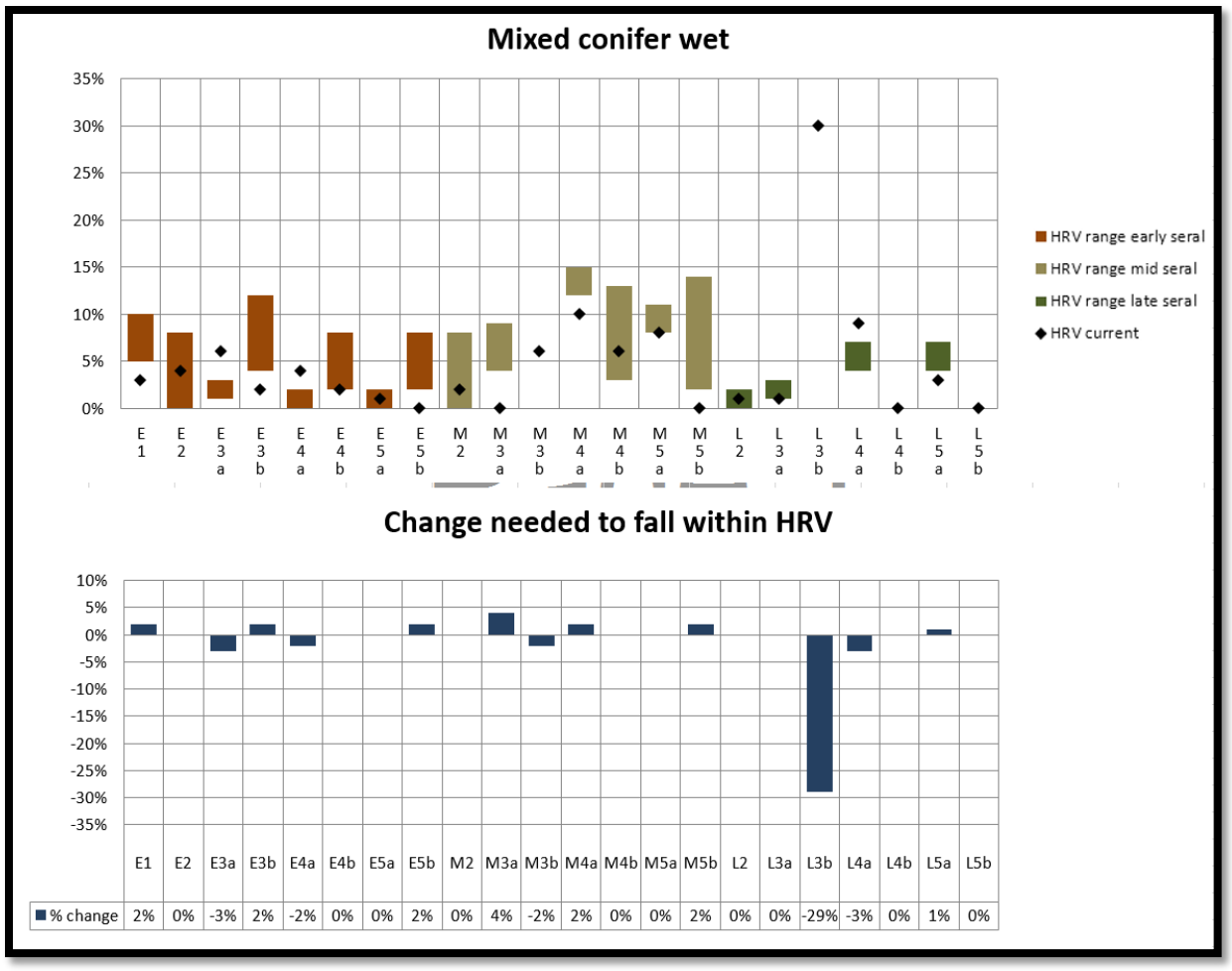


Figure 20. HRV analysis for Mixed Conifer Wet

Table 29. HRV analysis (seral and structure) for Mixed Conifer Wet

Mixed Conifer Wet (MCW)																									
PAG	Structure	Density	Early Seral					Mid Seral					Late Seral					All Seral Stages				
			Min	Max	Current			Min	Max	Current			Min	Max	Current			Min	Max	Current		
Mixed Conifer Wet (MCW)	G/F/S		5%	12%	3%	LOW	-2%				OK	OK				OK	OK	5%	12%	3%	LOW	-2%
	<4.9"		0%	12%	4%	OK	OK	0%	10%	2%	OK	OK	0%	2%	1%	OK	OK	0%	24%	7%	OK	OK
	5 to 9.9	Closed	1%	3%	6%	HIGH	3%	4%	16%	0%	LOW	-4%	1%	4%	1%	OK	OK	11%	40%	46%	HIGH	6%
		Open	4%	12%	2%	LOW	-2%	1%	4%	6%	HIGH	2%	0%	1%	30%	HIGH	29%					
	10 to 20.9	Closed	0%	2%	4%	HIGH	2%	12%	32%	10%	LOW	-2%	4%	6%	9%	HIGH	3%	21%	58%	30%	OK	OK
		Open	2%	8%	2%	OK	OK	3%	8%	6%	OK	OK	0%	2%	0%	OK	OK					
	21+	Closed	0%	1%	1%	OK	OK	8%	16%	8%	OK	OK	4%	6%	3%	LOW	-1%	16%	33%	12%	LOW	-4%
		Open	2%	4%	0%	LOW	-2%	2%	4%	0%	LOW	-2%	0%	2%	0%	OK	OK					
Totals			14%	54%	22%	OK	OK	30%	90%	33%	OK	OK	9%	23%	45%	HIGH	22%			98%		

Desired Conditions

- Forest structure and composition closely resemble pre-settlement conditions and are within the HRV.
- Old growth and NRF (nesting, roosting, foraging) areas have high levels of horizontal and vertical diversity, and have continuity across the landscape.

- Stocking of small and pole sized trees reduced to make stand resilient to fire and insects.
- Disturbance and stand regeneration occur on spatial and temporal scales that maintain ecological integrity and allow desired species to persist.

Strategy to Achieve Desired Conditions

- Thin overstocked, closed canopy stands in small and pole size classes where current condition is above the acceptable range.
- Target removal of white fir to reduce the overabundance of late seral stands in the mixed conifer PAGs.
- Thin mixed conifer stands dominated by white fir to allow recruitment of a variety of species to increase insect and disease resistance/resilience.
- Remove or mow small trees and/or tall shrubs to allow for introduced fire and increase wildfire resilience.
- Thin from below in pole and small size class ponderosa pine to allow dominant trees grow into large size trees and create more open canopied stands.

Potential Actions to Achieve Desired Conditions

- Vegetation management projects in the watersheds that consider active management to move conditions more in-line with desired conditions.

Literature Cited

Hall, Frederick C.; Bryant, Larry; Clausnitzer, Rod; Geier-Hayes, Kathy; Keane, Robert; Kertis, Jane; Shlisky, Ayn; Steele, Robert. 1995. Definitions and codes for seral status and structure of vegetation. Gen.Tech Rep. PNW-GTR-363. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 39 p.

Fire and Fuels

Figure 21. Bear Butte 2 Wildfire 2014

Table 30. Deschutes Land and Resource Management Plan area allocations

Deschutes LRMP	
Forest Management Goal: Provide a fire protection and prescribed burning program which is responsive to land and resource management goals and objectives	
Forest-wide goal: To provide a well-managed fire protection and prescribed fire program that is cost efficient, responsive to land stewardship needs, and resource management goals and objectives	FF-9: Burning plans will be prepared in advance of ignition and approved by the appropriate line officer for each prescribed fire. Prescribed burning will conform to air quality guidelines. Burning plans will define an escaped fire. A fire that escapes will be declared a wildfire and an escaped fire situation analysis [WFDSS] will be prepared. FF-10: Unplanned ignitions may be used as prescribed fires if (1) a prescribed fire plan has been prepared and approved and (2) the fire is burning within prescription. Normally, prescribed burning will be by planned ignition. FF-11: Levels and methods of fuels treatment will be guided by the resource objectives within the management area.
Management Area Goal: General Forest	M8-24: In Ponderosa pine stands (except for reproduction stands) emphasis should be placed on burning out roads and natural barriers rather than constructing new firelines. M8-25: Prescribed fire may be used to protect, maintain, and enhance timber and forage production. The broadest application of prescribed fire will occur in the Ponderosa pine type. Criteria for using fire are as follows: • To reduce risk of conflagration fire • To increase soil productivity by cycling bound nutrients • To prevent encroachment of less desirable, competing tree species • To increase palatability and cover of desirable forage species • To prepare sites for reforestation M8-26: The lowest cost option [for fuel treatment] which meets the silvicultural, soil, water, and fire objectives should be selected. M8-27: Slash will be treated to reduce the chances of fire starts and rates of spread to acceptable levels, but will not be cleared to the point that the forest floor is devoid of all slash and logs. Some slash and larger dead material will be left for ground cover for soil protection, microclimates for establishment of trees, and small mammal habitat. Optimum fuel loadings should be guided by … "Photo Series for Quantifying Forest Residues"… These fuel loadings will be revised when new data, methods, or research indicate that a new profile would improve resource management programs.
Management Area Goal: Intensive Recreation	M11-42: Prescribed fire may be used to reduce hazardous fuel concentrations and to form fuel-breaks adjacent to the high use, high fire occurrence areas such the Lower Metolius, Upper Metolius, Twin Lakes, Pringle Falls, and Deschutes River. Prescribed burning can be done to enhance the recreation experience. Burning will be planned to have the minimum impact on recreation use or appearance of the area. M11-43: Treatment methods that will not be visible over a long period of time should be emphasized. Treatment should occur outside the normal recreation season.

	M11-44: Fuel loadings will normally vary. Areas within sight of campgrounds and other high-use areas should have almost 100 percent cleanup of activity fuels. Maintenance of natural fuels for appearance and leaving activity fuels for firewood is acceptable. Those areas further away from the high-use areas may receive treatment similar to General Forest M11-45 Fuel will be treated quickly and to a level commensurate with the increased risk and protection of recreation values.
Management Area Goal: Special Interest Area	M1-17: Prescribed fire may be used to attain the desired characteristics of the special interest management area and to reduce fuels to their natural conditions. Any burning would be designed to create minimum impacts on the appearance or use of the area for its intended. M1-18: Fuel treatment methods should emphasize maintenance of natural characteristics of the area. Fuel loadings should be low enough to eliminate the possibility of high intensity fires while maintaining the natural characteristics of the area.
Management Area Goal: Metolius Wildlife – Primitive	M20-28: Prescribed burning may be used to improve or maintain wildlife habitat or for other ecological purposes. Burns during the bald eagle nesting season should be restricted to areas at least one quarter mile away from active nests. M20-30: Fuel treatment must be appropriate to the goals and objectives for this management area and must be adequate to meet the fire suppression objective. Fuel reduction will be achieved through intensive utilization of material to the extent possible.
Management Area Goal: Deer Habitat	M7-27: The prescribed use of fire will be necessary to maintain diversity within the plant communities. Burning prescriptions will provide for the reestablishment of bitterbrush within 20 years. Approximately 2-2.5% of this management area could be burned annually. M7-27: In that portion of the management area designated nonsuitable for timber, the preffered method is to lop and scatter. In areas of heavy slash, machine piling and burning may be necessary. Crushing is the least prefered method for treating slash.
Management Area Goal: Metolius Heritage	M19-33: Prescribed fire may be used to reduce hazardous fuel concentrations and to form fuel breaks adjacent to high use, high fire occurrence areas. M19-34: Prescribed burning may be done to enhance stand health and to perpetuate the Ponderosa pine stands for other ecological reasons. Burning will be planned to have the minimum impact on recreation use or appearance of the area. M19-35: Treatment methods that will not be visibleover a long period of time should be emphasized. Treatment should occur outside the normal recreation season.
Management Area Goal: Metolius Special Interest	M23-16: Prescribed fire may be used to attain the desired characteristics of the special interest area and to reduce fuels to their natural conditions. Any burning would be designed to create

	minimum impacts on the appearance or use of the area for its intended purpose. M23-17: Fuels treatment methods should emphasize maintenance of the natural characteristics of the area. Fuel loadings should be low enough to eliminate the possibility of high intensity fires while maintaining the natural characteristics of the area.
Management Area Goal: Metolius Wild and Scenic River	M28-3: Vegetation management activities would be confined to those required to meet health and safety needs and protect resources during catastrophic situations. Vegetation outside the boundary but within the visually seen area should be managed in a manner which retains its visual quality. M28-8: All wildfires will be agressively controlled using low impact methods as much as practible.
Management Area Goal: Old Growth	M15-19: Prescribed fire is not appropriate in lodgepole pine stands. In Ponderosa pine and mixed conifer stands, prescribed fire may be used to achieve desired old growth characteristics. It may also be used there to reduce unacceptable fuel loadings that potentially could result in high intensity wildfire. M15-20: Prescribed fire is the preferred method of fuel treatment. However, if prescribed fire cannot reduce unacceptable fuel loadings, other methods will be considered. M15-21: Natural fuel loading will normally be the standard.
Northwest Forest Plan	
Late Successional Reserve (LSR)	[LSRs], in combination with the other allocations and standards and guidelines, will maintain a functional, interactive, late successional and old-growth forest ecosystem
Administratively Withdrawn	[Administratively Withdrawn Areas] are identified in current forest and district plans or draft plan preferred alternatives and include recreational and visual areas, back country, and other areas not scheduled for timber harvest
Matrix	Most of the timber harvest will occur on matrix lands. Standards and guidelines assure appropriate conservation of ecosystems as well as provide habitat for rare and lesser -known species

Fire and Fuels Management

Existing Land Allocations and Policy relevant to Fire and Fuels Management

General direction for the Forest Service as it relates to Fuels Management is directed by Forest Service Manual (FSM) 5150. FSM 5150 directs Forests to initiate fuels treatments in accordance with local land and resource management plans. On the Deschutes National Forest, the Land and Resource Management Plan (Deschutes LRMP), was completed in 1990. In areas within the range of the Northern Spotted Owl, the Deschutes LRMP was amended with the Final Supplemental Environmental Impact Statement on Management of Habitat for Late-Successional

and Old-Growth Forest Related Species within the Range of the Northern Spotted Owl and its corresponding Record of Decision and Standards and Guidelines (Northwest Forest Plan). Fire and fuels management are directed and/or guided by the goals, objectives, standards, and guidelines in all of these plans. Refer to Table * and the following discussion for an overview of these documents.

National Fire Plan (2000)

The National Fire Plan is a series of documents with an accompanying budget request that guides fire and fuels management as to how best to respond to recent fire events, reduce the impacts of wildland fires on rural communities, and ensure sufficient firefighting resources in the future. The National Fire Plan is also where direction on reducing immediate hazards to the Wildland Urban Interface (WUI) began.

- Hazardous Fuels Reduction- Assign highest priority for fuels reduction to communities at risk, readily accessible municipal watersheds, threatened and endangered species habitat, and other important local features where conditions favor uncharacteristically intense fires
- Restoration- Restore healthy, diverse, and resilient ecological systems to minimize uncharacteristically intense fire on a priority watershed basis. Methods will include removal of excess vegetation and dead fuels through thinning, prescribed fire, and other treatments.

WUI/CWPP

In 2004, the City of Sisters, local fire protection districts, Deschutes and Jefferson Counties, Oregon Department of Forestry, U.S. Forest Service, and the Bureau of Land Management formed a committee to develop a community wildfire protection plan (CWPP) under the direction established by the 2003 Healthy Forest Restoration Act (Project Wildfire 2009). The purpose of the Greater Sisters CWPP is to:

- Protect lives and property from wildland fires;
- Instill a sense of personal responsibility and provide steps for taking preventive actions regarding wildland fire;
- Increase public understanding of living in a fire-adapted ecosystem;
- Increase the community's ability to prepare for, respond to and recover from wildland fires;
- Restore fire-adapted ecosystems; and
- Improve the fire resilience of the landscape while protecting other social, economic and ecological values.

The plan outlines a strategy, identifies priorities for action, and suggests immediate steps that can be taken to protect the communities from wildland fire while simultaneously protecting other important social and ecological values. The plan was revised in May 2006 to include considerations of community growth, seasonal recreation areas, and ingress and egress corridors that were not identified in the initial plan or in the Federal Register (Vol. 66 No 3.) and again in December 2009 to outline updated priorities and action plans for fuels reduction treatments,

structural vulnerabilities, and defensible space in the Greater Sisters Country wildland urban interface (WUI). As a result of these revisions, the committee outlined the following goals:

- Reduce hazardous fuels on public lands;
- Reduce hazardous fuels on private lands (both vacant and occupied);
- Reduce structural vulnerability;
- Increase education and awareness of wildfire threat; and
- Identify, improve and protect critical transportation routes

- All areas where Crown Fire Potential is rated Extreme by the federal agencies within the designated WUI boundary (*with priority given first to the areas within ¼ mile of communities at risk);*
- Within 300 feet of any evacuation route from each Community at Risk;
- For mixed conifer and lodgepole stands which have missed typical fire cycles and still pose threats of potential crown fires to communities, specific fuels treatments shall be accomplished on federal and state lands to reduce and maintain fuel loads to that which can produce flame lengths of less than four feet to provide for effective initial attack and minimize the resistance to control; and
- Although the treatments should focus on areas rated Extreme for Crown Fire Potential, maintenance of previously treated lands is also a top priority where treatment is critical to maintain this status within the CWPP area. Treatment and maintenance of previously treated lands before treatment begins again in other places is an important component of keeping communities safe.

Additionally, the committee determined that the overall WUI boundary would include communities as well as key transportation corridors and seasonal recreation areas with infrastructure.

<u>Protecting People and Natural Resources: A Cohesive Fuels Treatment Strategy (2006)</u>

The mission of the Cohesive Fuels Treatment strategy is to lessen risks from catastrophic wildfires by reducing fuels build-up in federally-managed forests in the most efficient and cost effective manner possible. Four principles guide the strategy, 1) prioritization, 2) coordination, 3) collaboration, and 4) accountability. While all of these principles are important to fuels management, the first principle *Prioritization* provides treatment direction.

- *Prioritization* - The President and the Congress have given clear direction that priority in the fuels treatment program should focus on two key areas. First, priority should be given to the wildland urban interface (WUI) places where people have settled in forests, woodlands, shrublands, and grasslands. Here, people, their structures, and their work face the greatest threats. Second, outside the WUI, priority treatments must concentrate on sites where vegetation is most likely to support catastrophic fires that threaten vital resources or locations of particular value to local communities. In addition, non-WUI treatments must be applied to areas where fuel loads could quickly increase to dangerous levels without active management.

Existing Conditions

The broad plant association groups found in the Lower Metolius Watershed (Table31, Figure22) were developed using the Biophysical settings as established by the Landfire Working group and further refined for the Deschutes National Forest by Upper Deschutes Basin Fire Learning Network (2007).

Table 31. Plant Association Groups within the Lower Metolius Watershed.

Potential Natural Vegetation Groups	Acres	% of Project Area
WHITEBARK PINE/ LODGEPOLE PINE	1,285	1%
MIXED CONIFER WET	25,201	12%
MIXED CONIFER DRY	58,305	29%
PONDEROSA PINE	53,640	26%
JUNIPER WOODLANDS	39,455	19%
MOUNTAIN HEMLOCK DRY	6,894	4%
MEADOW	1502	1%
WATER	3248	2%
MESIC SHRUB	677	0%
XERIC SHRUB	2460	1%
AGRICULTURE	6254	3%
CINDER	6	0%
URBAN/DEVELOPED	270	0%
GLACIER	489	0%
ROCK	4423	2%
TOTAL	**204,105**	100%

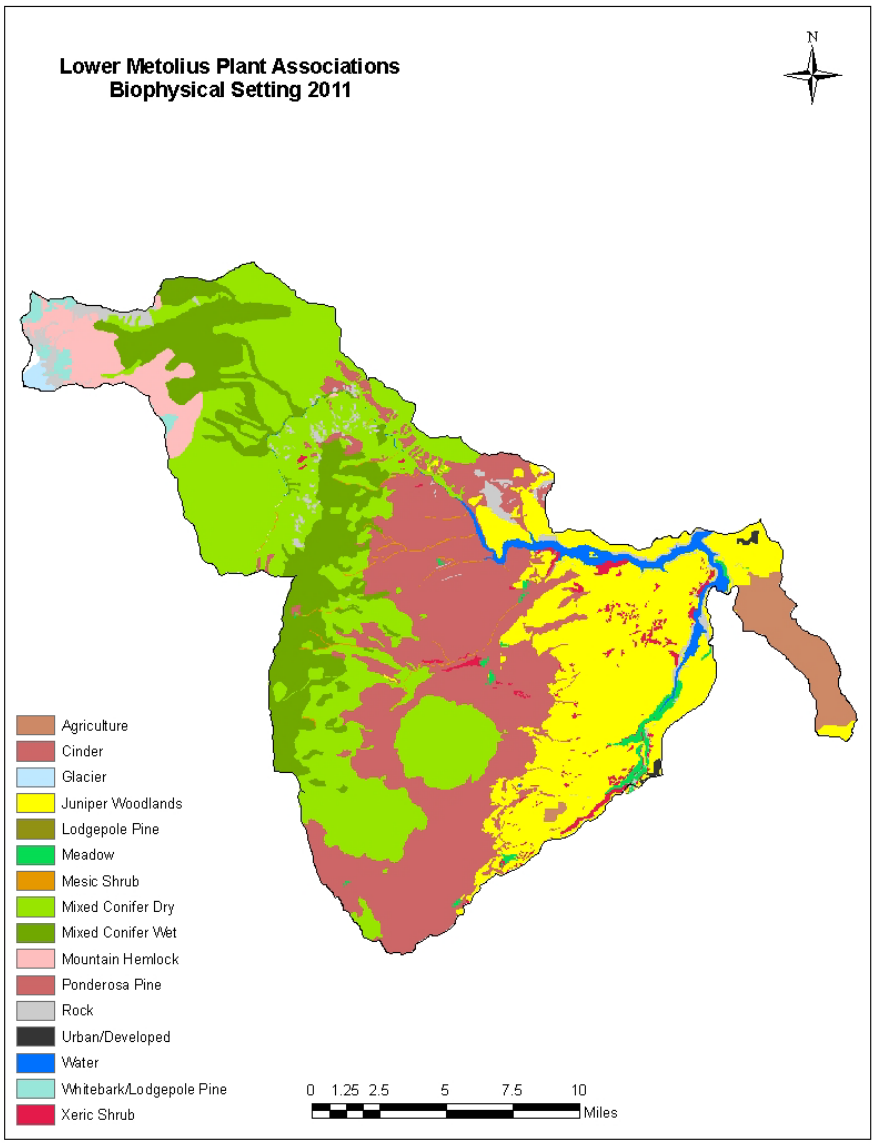


Figure 22. Broad plant groupings across analysis area.

Plant association groups found in the Lower Metolius Watershed area can be further interpreted into historical fire regimes (Table 25, Figure 32). A fire regime is a general classification of the role fire would play across a natural landscape in the absence of modern human mechanical intervention, but including the influence of aboriginal burning. Coarse scale definitions for five natural (historical) fire regimes were developed by Hardy et al. (2001) and Schmidt et al. (2002) and interpreted for fire and fuels management by Hann and Bunnell (2001). These five natural (historical) fire regimes are classified based on average number of years between fires (fire frequency) combined with the severity (amount of mortality) of the fire on the dominant overstory vegetation. Definitions of the five coarse scale categories are as follows:

I. 0-35 years, Low severity

Typical climax plant communities include ponderosa pine, eastside/dry Douglas-fir, pine-oak woodlands, Jeffery pine on serpentine soils, oak

woodlands, and very dry white fir. Large stand-replacing fire can occur under certain weather conditions, but are rare events (i.e., every 200+ years).

II. 0-35 years, Stand-replacing, non-forest
Includes true grasslands (Columbia basin, Palouse, etc.) and savannahs with typical return intervals of less than 10 years; mesic sagebrush communities with typical return intervals of 25-35 years and occasionally up to 50 years, and mountain shrub communities (bitterbrush, snowberry, ninebark, ceanothus, Oregon chaparral, etc.) with typical return intervals of 10-25 years. Fire severity is generally high to moderate. Grasslands and mountain shrub communities are not completely killed, but usually only top-killed and resprout.

III. 35-100+ years, Mixed severity
This regime usually results in heterogeneous landscapes. Large, stand-replacing fires may occur but are usually rare events. Such stand-replacing fires may "reset" large areas (10,000-100,000 acres) but subsequent mixed intensity fires are important for creating the landscape heterogeneity. Within these landscapes a mix of stand ages and size classes are important characteristics; generally the landscape is not dominated by one or two age classes.

IV. 35-100+ years, Stand-replacing
Seral communities that arise from or are maintained by stand-replacement fires, such as lodgepole pine, aspen, western larch, and western white pine, often are important components in this fire regime. Dry sagebrush communities also fall within this fire regime.

V. >200 years, Stand-replacing or any severity
This fire regime occurs at the environmental extremes where natural ignitions are very rare or virtually non-existent or environmental conditions rarely result in large fires. Sites tend to be very cold, very hot, very wet, very dry or some combination of these conditions.

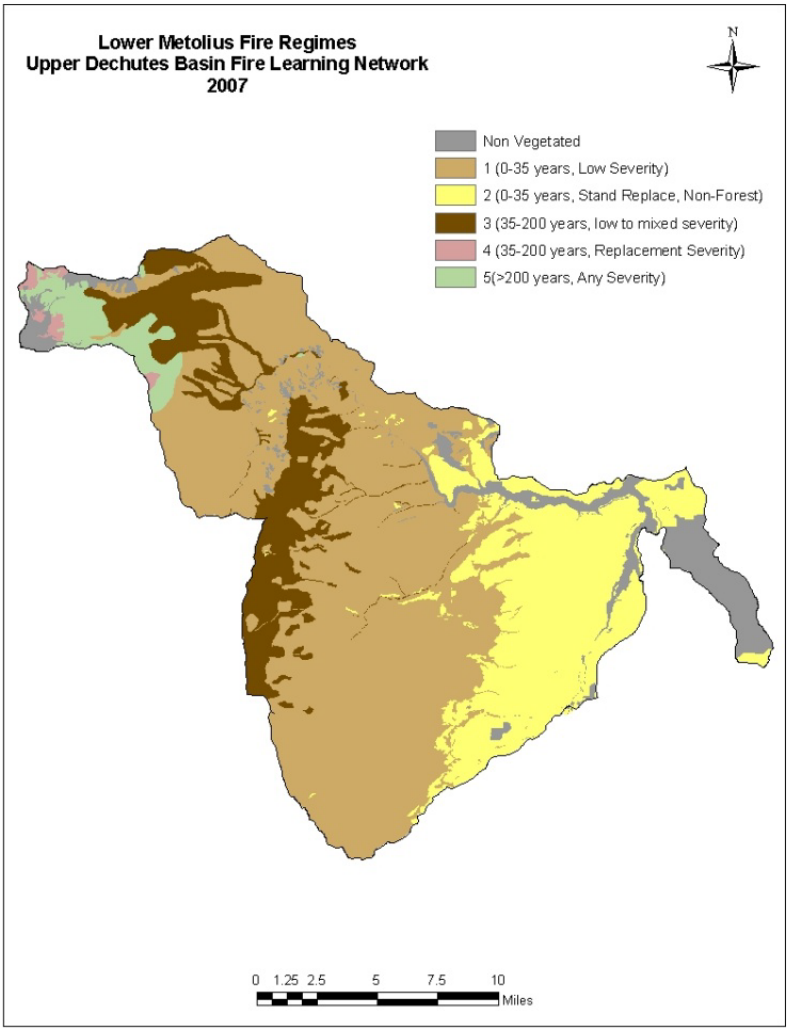


Table 32. Fire regimes within the Lower Metolius area. 14,000 acres of non-burnable (rock, glacial, agriculture, etc.) not classified.

Fire Regime	Acres	% of Project Area
1	111,945	59%
2	43,417	23%
3	25,878	14%
4	1,285	1%
5	6,894	3%

Vegetative conditions in the mountain hemlock plant dominated areas can generally be classified as fire regime V. Less than 5% of the project area falls into this fire regime. The whitebark pine/lodgepole pine dominated areas of the project area are best described by fire regime IV where historically, a 35 - 100 + year fire return interval with high severity could be expected. Approximately 1% of the project area falls within this fire regime. Wet mixed conifer stands can generally be classified into fire regime III where mixed (i.e., low and high) severity fire at a 35 –

100 + year fire return interval was expected under historical conditions, 14% of the analysis area falls into this category. 23%, comprised primarily of the juniper shrublands of the eastern portion of the analysis area, can be classified as fire regime II. The highest percentage, 59%, of the analysis area can be classified into fire regime I, where frequent low severity fire at a 0 – 35 year interval could be expected under historical conditions (Table 32). This 59% is comprised of dominant Ponderosa Pine stands or classified dry Mixed Conifer sites.

Fire has been an important disturbance process for millennia in forested wildlands east of the Cascade crest (Agee, 1993). Unlike today, fires of the past did not occur as isolated events, but rather, they occurred regularly and greatly influenced the development of forest habitats. As evidenced by the mapped fire regimes across the analysis area, historically fires have been a major influence in shaping the ecological components of the landscape. However, in recent times, fire suppression efforts coupled with other anthropogenic influences have reduced the influence of fire across the analysis area. Records archived by the Deschutes National Forest and Oregon Department of Forestry show that within the last 34 and 53 years respectively, 281 lightning fires (an average of 5.3 annually) which burned 100 acres or less each, have been suppressed within the project area. Although it is not possible to determine the number of ignitions suppressed prior to 1979 or 1960 on federal and state protected land respectively, or how much area each one of these ignitions would have burned if they were not suppressed, it is evident that the majority of the analysis area has missed at least one typical fire cycle and is altered from that which would have occurred historically.

Table 33. ODF protected lands 1960-2013 and USFS lands 1979 – 2013, point fire history (natural lightning starts under 100 acres) within the Lower Metolius analysis area. A.5 mile buffer was utilized to capture incidents in close proximity to the Analysis area.

Fire Regime	Number of Ignitions
Fire Regime 1	207
Fire Regime 2	53
Fire Regime 3	16
Fire Regime 4	3
Fire Regime 5	2
Total	**281**

Large fires of record (lightning or undetermined cause) have burned 58,764 acres (31% of burnable acres) of the assessment area since 1910 (Figure 23). Of significance is that 57% (33,353 acres) of the acres consumed has occurred since 2000, or only 13% of the temporal record (see Appendix A). This recent increase of large fire over the past several years is likely the result of a combination (or tipping point if you will) of current vegetation conditions across the landscape increasingly dominated by shrub and overstocked stands of small tree ladder fuels, closed canopies, perhaps the increased fuel loading associated with the spruce budworm outbreak of the 1980s and 1990s, and/or an increasingly warmer and drier climate across the inland Pacific Northwest (McKenzie 2008, Davis et al. 2011). The 2002 Eyerly fire remains a significant example of what many dub as uncharacteristic wildfire, with approximately 76% of the burned area classified as Fire Regime 1 (Ponderosa Pine and Dry Mixed Conifer). Upwards

of 66% of this acreage burned under high or moderate severity killing or stressing most all living overstory. There is little to no evidence that suggests stand replacement events of this size occurred in these plant associations historically (Merschel et al (*in press*), Langille and others (1903), Simon (1991), Agee (1993)). Patches of high severity fire have played an important role in ecological function for centuries, however, findings suggest that even in many of the "mixed conifer sites" within the analysis area frequent low severity fires dominated with only relatively small patches of infrequent high-severity fire (Heyerdahl et al. 2014).

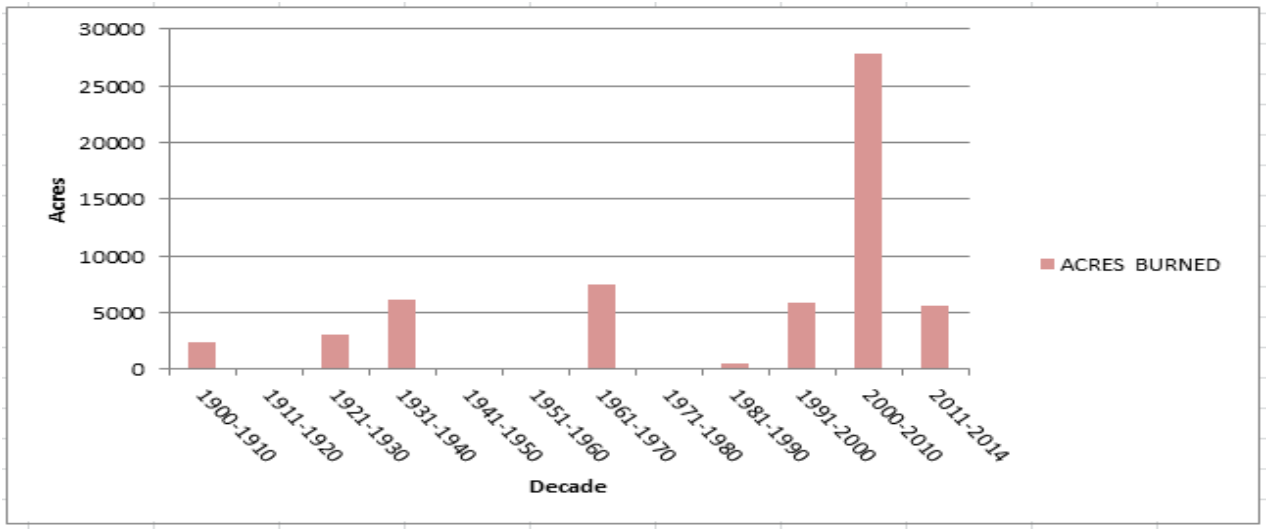


Figure 23. Trends in large fire size (over 100 acres) within the analysis area.

The change in conditions resulting from fire suppression and past management activities are most noticeable in Fire Regime types I and III (with increases in stand density and dominance of shade tolerant species) in the absence of fire. Consequently, increased fire hazard and it's effects on the landscape have become apparent within the last decade and a half. The risk of losing key ecosystem components in these systems is high.

From a fire and fuels standpoint, "fire hazard" provides the best snap shot of the existing condition in terms of effective fire suppression actions under simulated conditions. "Fire Hazard" analysis in turn can assist managers in developing strategic fuels treatments to best limit fires that threaten both public and private property as well as benefit/protect the resource itself. This metric is based on the combination of flame length and crown fire activity (see Appendix B), developed using stand characteristics as well as ground fuels under a specific weather profile of interest. Fires in low hazard areas typically have greater suppression success using hand crews and direct fireline construction. Moderate and high hazard areas typically require heavy equipment such as dozers, and/or aerial methods to effectively suppress a wildfire (NWCG 2006). Moderate and high hazard areas also have an increased likelihood of negative resource and social effects from wildfire such as fire fighter safety, public safety concerns, resource damage, and smoke production (Figure 24). It is important to note that an area identified as low hazard is not less likely to host fire (even larges fires) but rather the associated flame length and crown fire potential is expected to be less.

Table 34. Fire hazard across plant association groups within analysis area under 90th percentile fuel and weather conditions

Plant Association	Fire Hazard					
	Low		Moderate		High	
	Acres	%total	Acres	%total	Acres	%total
Mixed Conifer Dry	36968	64	2174	4	19000	33
Ponderosa Pine	36842	70	11510	22	4172	8
Juniper Woodlands	3028	8	34728	91	574	1
Meadow	195	13	1265	85	22	1
Xeric Shrub	344	14	1994	84	49	2
Mesic Shrub	399	60	36	5	232	35
Mixed Conifer Wet	13211	52	771	3	11192	44
Whitebark/Lodgepole	286	34	102	12	450	54
Lodgepole Dry	2	61		0	2	39
Hemlock	3604	53	556	8	2655	39
Grand Total	**94879**	**51**	**53137**	**28**	**38347**	**21**

While spatially variable, under 90th percentile weather and fuel conditions the model predicts that nearly half of the burnable fuel within the analysis area (Table 34) is in a highly hazardous or moderately hazardous state. Recent fires in the analysis area (the Bridge 99 Complex (2014) and Green Ridge (2013)) have helped validate model outputs. Green Ridge intensity analysis shows 25% of the fire area burning under high-moderate severity during an event where weather parameters were not in the 90th percentile range. Bridge 99 results show close to 50% of the fire area burning in moderate to high severity under conditions more attune to 90th percentile conditions (see 2013 and 2014 BARC products).

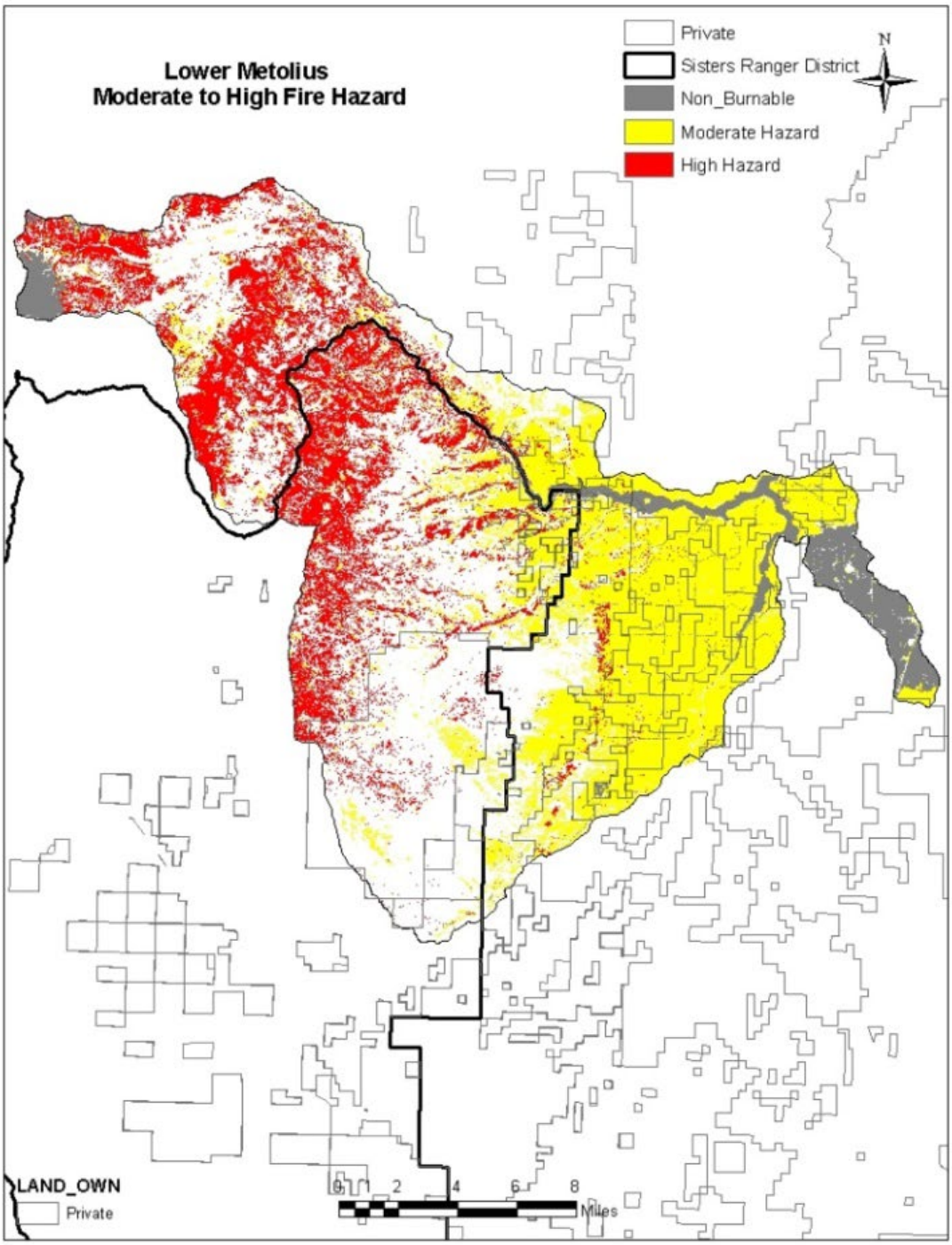


Figure 24. Moderate and High Hazard areas across analysis area

Approximately 84,000 acres within the Lower Metolius Watershed have been classified as Wildland Urban Interface under the Greater Sisters Area and Jefferson County Community Wildfire Protection Plans. Of this area over half of the burnable acres are classified under high or moderate hazard (Table 35).

Table 35. Fire hazard across plant association groups within analysis area under 90th percentile fuel and weather conditions

Fire Hazard	Analysis Area Acres (%)	WUI Acres (%)
Low	94,879 (51)	26,578 (35)
Moderate	53,137 (29)	44,547 (59)
High	38,347 (21)	4,337 (6)

Historical Treatments

Over the last 15 years approximately 11,000 acres (.05%) within the analysis area have received some form of fuels or stand modifying treatment on federal and state lands. These treatments consist of commercial harvest, precommercial thinning, underburning, and pile burning. This measure does not incorporate activities on private lands many of which have ongoing range and forest management activities.

Desired Conditions and Recommendations to Achieve

MSA: Northern Spotted Owl, Deer Winter Range

Achieve a mosaic of landscape-scale treatments managed to reduce fire hazard and threat to facilitate the suppression of human-caused wildfires, protect valuable resources, and allow the re-introduction of fire as a disturbance process. Move acres classified as moderate or high hazard towards low hazard.

Stands should have a height to live crown that is well above the shrub and seedling components. Shrubs should be maintained at a height and continuity that would reduce the potential for rapid rates of spread and crown fire initiation. Dead and downed materials should not be overly extensive. Large trees that are more resistant to fire-induced mortality should be maintained.

Encourage the use of prescribed fire to meet resource goals (e.g., timber and forage) and to reduce hazardous fuels. In areas dominated by ponderosa pine and in the WUI, this translates to canopy characteristics and a fuel profile that do not support extreme fire behavior (i.e., crown fire, high resistance to control, high flame lengths) under severe fire conditions.

Locate and schedule hazard fuel reduction and underburning activities in alignment with wildlife habitat protection and improvement strategies, reducing risk of lost to key ecotypes.

Restore and maintain old growth characteristics using mechanical fuels treatments and prescribed fire in Ponderosa and Mixed Conifer plant associations. Reduce canopy structure and surface fuel configurations in line with historical range.

Reduce risk to private lands within and adjacent to USFS boundaries from fires initiating on federal land through strategic placement of treatments and fuel breaks. Determine the need/feasibility for maintained fuel breaks along Green Ridge and bordering private property inholdings.

Prevention of human caused wildfire in areas identified as high use and high risk including; major travel ways, firewood cutting areas, and dispersed camping and hunting corridors.

In the Northern reaches of Green Ridge much of the area is classified as high hazard with steep terrain and stand characteristics that are showing the effects of fire suppression over time. The

area is remote and presents numerous challenges in terms of treatment. Consider allowing natural disturbances to influence the character of the landscape and develop fire management plans that provide guidelines for the use of natural fire.

Identify major travel corridors (scenic, recreation, forest products) and treat appropriately to increase ingress/egress and fire break feasibility in wildfire scenario.

MSA: Eyerly Fire

Consider allowing natural disturbances to influence the future character of the landscape and develop fire management plans that provide guidelines for the use of natural fire.

Recent fires and associated fire behavior analysis have shown that much of the Eyerly fire area is prone to lower fire behavior and that allowing fire to plays its natural role in identified areas could be successful under the right conditions.

Identifying these areas and acceptable conditions while establishing both strategic response plans and associated beneficial pre-treatment is warranted.

At the same time, identifying and examining areas that could potentially benefit (in coordination with TSI personnel) from planned ignitions (Prescribed Fire) may promote future stand health and resilience.

MSA: Horn IRA

- The Horn IRA, comprised of the Metolius Breaks designated roadless area and the Metolius Wildlife/Primitive area, provides numerous challenges from a fire and fuels stand point. Its unique and rugged nature makes access difficult and suppression efforts hazardous.
- The area is classified primarily as Dry Mixed Conifer ecotype which historically was likely dominated by frequent low severity fire events. Historical records show larger fire events occurring in the area in 1910, 1926, and 1945 (severity of these fires is unknown). However, since 1980 twenty-seven natural starts have been surprised at under 5 acres.
- Many of the dry mixed conifer stands are likely overstocked with shade tolerant species such as White Fir and are prone to high severity fire.
- Understory fuels treatments such as thinning from below coupled with prescribed fire treatments are warranted. Due to location and access issues treatments in this MSA will be logistically challenging.

Other Areas not incorporated into MSAs

The above strategies and recommendations apply to all areas within the watershed analysis area. Strategic planning should be utilized to identify and treat areas for habitat restoration, fire prevention and protection, and suppression success in the event of unplanned ignitions.

Soils
Lower Metolius River / Lake Billy Chinook Watershed Analysis

Geology Overview

- The Lower Metolius River and Lake Billy Chinook watersheds are located between the High Cascade Range and the western flank of the Deschutes Basin in west central Oregon.
- Landforms were formed from volcanic and volcaniclastic rocks ranging in composition from olivine basalt to rhyolite (Hales 1974).
- Green ridge shield volcano is a dominant landform in the watersheds which contributed lava flows, pyroclastic rocks and fluvial sediments eastward in to the Deschutes Basin.
- The oldest lava flows in the area were dated at 9.2 million years and the youngest flows are younger than 10,000 years (Hales 1974).
- Between 4.5 and 2.1 million years ago the western half of the green ridge shield volcano dropped around 800 to 1000 foot along the Metolius fault forming a graben geologic landform in which the Metolius River now flows (Hales 1974).
- Today the eastern flanks of the green ridge shield volcano are largely in tack.

Soils in the Watersheds

- Soils in the watersheds have been mapped by the Natural Resources Conservation Service (NRCS) and have been correlated in a Terrestrial Ecological Unit Inventory (TEUI). The TEUI conforms to the National Soil Survey protocol and thus can be entered into the National Soil Information System (NASIS) and brought into ARC Map through the Soil Data Viewer Extension (Http://soildata viewer.nrcs.usda.gov/) for analysis.

Inherent Soil Properties

- Dominant soils in the watershed have formed in volcanic ash deposits in the western portion of the watersheds and loess (windblown silts and sands) in the eastern portion of the watersheds.
- Three dominant soil Orders are found in area.
    - The Andisols soil order identifies soils formed in volcanic ash deposits which typically range in depth from 40 to greater than 60 inches.
    - The Molisols soil order identifies soils having a thick dark mollic epepedon or surface diagnostic horizon typical of grass land soils. Mollisol soils in these watersheds are typically occurring on shallow soils ranging from 20 to 40 inches in depth.
    - And the Alfisols soil order indicating soils that have weathered clays in lower soil horizons that can influence plant growth by increasing both nutrient storage and soil moisture holding capacity.

Dynamic Soil Conditions

- Timber harvest and wildfires occurring primarily from the 1940's to present account for the majority of the soil disturbances in the watersheds (U.S. Forest Service, 1991).
- Operational efficiency and the effective implementation of logging systems have limited the amounts of detrimental disturbances to the soil resource through the use of designated skid trails and boom-mounted harvest machinery. Silvicultural prescriptions during this period have

included individual tree selection, overstory removal, clearcuting, and more recently thinning from below. These operations have resulted in varying levels of legacy soil disturbances throughout the area (Sisters RD soil monitoring reports).

- Several major wildfires that have occurred within the watersheds have minimally affected the productivity of the soil resource. Although fire behavior in some areas was extreme and tree mortality was classified as stand replacement in many of these areas, the direct effects to the soil resource in terms of altered mineral composition or nutrient volatilization were not observed to be of great extent. Negative changes to the productivity of the soil resource are isolated to areas where stumps or down woody debris were completely combusted and contributed extended durations of elevated temperatures to the soil surface. These areas are not contiguous enough across the landscape to map and area estimated to be less than 4% of the total fire areas (Burned Area Emergency Response Reports 2008 and 2002).
- Debris flows are a naturally occurring mechanism within the watershed. Post-fire risks of debris flows associated with the loss of root strength in areas of stand replacement fire on slopes exceeding 25% are elevated between 3 and 20 years following the fire event. The planting of conifers on these slopes is highly recommended in order to expedite the return of root systems within the soil profile (O'Loughlin, 1982).

Selected Soil Management Interpretations

- Soil erosion hazard (off road off trail)
    - The ratings in this interpretation indicate the hazard of soil loss from off-road and off-trail areas after disturbance activities that expose the soil surface. The ratings are based on slope and soil erosion factor K. The soil loss is caused by sheet or rill erosion in off-road or off-trail areas where 50 to 75 percent of the surface has been exposed by logging, grazing, mining, or other kinds of disturbance.
    - The hazard is described as "slight," "moderate," "severe," or "very severe." A rating of "slight" indicates that erosion is unlikely under ordinary climatic conditions; "moderate" indicates that some erosion is likely and that erosion-control measures may be needed; "severe" indicates that erosion is very likely and that erosion-control measures, including re-vegetation of bare areas, are advised; and "very severe" indicates that significant erosion is expected, loss of soil productivity and off-site damage are likely, and erosion-control measures are costly and generally impractical.

- Fire Damage Susceptibility
    - The susceptibility to fire damage ratings represent the relative risk of creating a water repellant layer, volatilization of essential soil nutrients, destruction of soil biological activity, and vulnerability to water and wind erosion prior to reestablishing adequate watershed cover on the burned site. The ratings are directly related to burn severity (e.g. a low-moderate severity burn will not result in water repellant layer formation).
    - Sandy soils are more susceptible to formation of a water repellant layer. High rock fragment content increases the rate of heat transfer into the soil. Steep slopes increase the vulnerability to water erosion. Susceptibility to formation of hydrophobic or water

repellant layers varies by vegetation type. As an example, pinyon-juniper, Arizona chaparral, and California chaparral vegetation types are more susceptible to hydrophobicity than other shrubland or grassland vegetation types.

Wildlife

Figure 25. Osprey nest on the Lower Metolius

Terrestrial Wildlife

Management Direction

Deschutes Land and Resource Management Plan

Land Allocations and Associated Wildlife Direction

- **MA-7 Deer Habitat - 19,302 acres**

The general themes and objectives are described below in Table 36.

Table 36. General Themes and Objectives

Thermal Cover General Theme and Objectives	Hiding Cover General Theme and Objectives	OHV Seasonal Closure M7-1	Open Road Densities M7-22	Annual Fuels Treatment M7-26
30% of the Winter Range	10% of the Winter Range	December 1 – March 31	1.0-2.5 mile/sq.mile	2.0–2.5 % of MA-7

- **MA-8 General Forest - 19,122 acres**
  M8-15 Minimum standards for wildlife habitat will be the Forest-wide standard and guidelines (S&Gs). Higher levels of wildlife habitat will be pursued as long as they will not conflict with timber management objectives.

- **MA-11 Intensive Recreation - 370 acres**
  M11-29 Emphasize watchable wildlife habitat improvement projects.
  M11-30 If osprey establish nest adjacent to recreation facility, no special precaution is necessary. If a bald eagle establishes a nest site, refer to Forest Plan S&Gs.

- **MA-15 Old Growth - 912 acres**
  M15-9 Snags and live trees needed for future snags will be maintained at a 100% maximum population potential as defined by the Deschutes Wildlife Tree and Log Guide. Down logs will be managed to maximize bio-diversity.

- **MA-19 Metolius Heritage – 3,129 acres**
  M19-18 Emphasize watchable wildlife habitat improvement projects.
  M19-19 Snags and live trees needed for future snags will be maintained at a 100% maximum population potential. Snags determined to be a hazard should be topped or removed. Nest boxes should be placed in campgrounds and other areas of concentrated public use for wildlife observation opportunities.
  M19-20 Roads will be closed that are no longer needed with the objective of 1.5 miles per sq. mile. Road to traditional dispersed sites will remain open.
  M19-21 Portions of this area are within a Key Elk Area. Standard and guidelines WL42-50 will be the priority in this area.

- **M-20 Metolius Wildlife Primitive Area**

Bald Eagle Emphasis Area

M20-11 Protect all nest, roost, and perch trees. Provide alternate nest, roost and perch, trees. These trees should be useable at any point in time and widely distributed throughout the area.

M20-12 Ponderosa pine that exceeds 110 feet in height and 40 inches in diameter provide suitable nesting and perching habitat. Densities should be 1 to 3 trees per acre with large limb structure and flat tops. Sufficient small trees and varying structure are needed to replace these trees in the future.

M20-13 Provide snags at a level of 100% maximum population potential for cavity nesters identified in the Deschutes Wildlife Tree and Log guide. Large snag are desired in this area to provide cavity nester habitat as well as eagle perches.

M20-14 Nest sites will be protected from human disturbance as well as fall and winter roost sites.

M20-15 Disturbing activities are restricted within ¼ mile from January 1 to August 31. If nest is not active the restriction can be waived by May 15.

Other Wildlife Species

M20-16 Portions associated with Key Elk Area refer to S&Gs WL-42-50 for management area.

M20-17 The unmodified character of the Management Area will provide adequate habitat for a wide variety of species.

- **M-23 Metolius Special Interest Black Butte - 626 acres**

  M23-8 Manipulation of Game habitat will be allowed as long as there is no conflict with objectives of the area.

  M23-9 Emphasize watchable wildlife habitat improvement projects

- **M-28 Metolius Wild and Scenic River - 2,309 acres**

  M28-5 Emphasize watchable wildlife habitat improvement projects especially in riparian zones. Retain large snags for wildlife habitat as well as large organic debris for the river. Snags that may be a hazard to the public will receive careful scrutiny and only removed if they pose a hazard.

  M28-6 Habitat improvement project are permitted but should be natural appearing and compatible with other values of the area.

  M28-7 Portion associated with Key Elk Area, refer to S&Gs WL-42-50 for management guidelines for this area.

❖ **Metolius Key Elk Habitat Area - 6,130 Acres**

Table 37 describes KEHA standards and guidelines.

Table 37. KEHA Vegetation and Road Management S&Gs.

Cover Standards and Guidelines in each KEHA	Cover Standard and Guidelines for Black Bark in each KEHA	Open Road Densities in each KEHA
Hiding Cover: Must be present over at least 30% of NF lands in each KEHA and meet one of the following conditions below.	Black Bark: At least 30% of the KEHA will be in clumps that will provide visual screening throughout the area and meet the following conditions below.	Road densities should not exceed 0.5 – 1.5 miles per sq. mi. within each KEHA. Where public use is heavy the low end of the range should be the objective, and for light public use the high end should be the objective.
Six acre or larger Stand Capable of hiding 90% of a standing adult deer at 200 feet.	A minimum of 6 acre in size which has not been thinned or harvested for at least 20 years. Smaller stands may be used if bark beetle epidemic is a concern.	Density will be applied as an average over the KEHA and will be used as a threshold for further evaluation. The procedure described in the Transportation S&Gs will be used implementing this guideline if existing or proposed densities exceed threshold target. Final judgment on open road densities will be based on the further evaluation rather than the density guideline.
Six acres or larger stand with an average height of 10 feet and has not been thinned in 20 years.	Canopy cover at the highest percentage that will maintain healthy stand conditions with a low risk of catastrophic damage due to insects and disease. Minimum canopy cover must be 40% to qualify as thermal cover.	
Residual clumps of 2 acre or larger stands within units with advanced regeneration and at least 12 greater than 7 dbh per acre remaining after harvest. Clumps should be located away from roads.	Minimum stand height of 40 feet	
Thermal Cover: Must be present over at least 20% of KEHA, excluding lakes and black bark pine. Minimum of 10 acre stand with average height of 40 feet. Minimum of 40% canopy cover. Stands may provide	Dispersed throughout the key area.	

both hiding areas and thermal cover.		

Mule Deer Summer Range outside MA-7

The guidelines for hiding cover states, "Hiding area must be present over 30% of National Forest Land in each implementation unit, resulting in 70% of each implementation unit existing as a hiding area or within 600 feet of a hiding area. Black bark stands will not be used to measure conformance". A separate set of guidelines are used to address "Black Bark Pine Management" which are second growth pine stand 60-80 years old. These stands provide very poor quality hiding cover due to the lack of horizontal structure and a single age class of trees. The following Table 38 addresses Standards and Guides outside of Deer Management Area 7 (Mule Deer Summer Range) specific to the management of viable summer range habitat:

Table 38. Summer Range S&Gs.

Hiding Cover: 30% Suitable hiding cover must meet one of the following criteria.	**Open Road Densities**	**Black Bark: 10% of treated stand will be in clumps to provide visual screening throughout and meet the following criteria**
Six acre or larger Stand Capable of hiding 90%of a standing adult deer at 200 feet.	≤ 2.5 miles per square mile	A minimum of ½ acre in size which have not been thinned or harvest for at least 20 years. Small clumps will be suitable in dense stand but larger (4 or 5 acre) clumps may be needed in more open stands.
Six acres or larger stand with an average height of 6 feet and has not been thinned in 15 years		Clumps will be dispersed throughout the unit so that visual screening is provided by the clumps in a combination with topographic features.
Residual clumps of ½ acre or larger stands in units with advanced regeneration and at least 12 greater than 7 dbh per acre remaining after harvest. Clumps should be located away from roads.		

Northwest Forest Plan

Land Allocations and Associated Wildlife Direction

- **Administratively Withdrawn - 2,783 Acres**
  General Objectives
  These areas include recreation and visual areas, back country, and other areas where the management emphasis precludes scheduled timber harvest and which are not included in calculations of allowable sale quantity. These areas are more restrictive than other allocations and provide greater benefits to late-successional and old-growth forest related wildlife species.

- **Late Successional Reserve - 20,580 Acres**

General Objectives
LSRs are to be managed to protect and enhance late-successional and old-growth forests which serve as habitat to those species dependent on those conditions including the Northern spotted owl.

Habitat Improvement
Project designed to improve condition for wildlife or watersheds should be considered if they provide late-successional habitat benefits or if affects to late-successional habitat is negligible. Project required for recovery of T&E species should be considered even if they result in some reduction of habitat quality for other late-successional species.

- **Matrix - 15,626 Acres**

General Objectives
Matrix areas provide the majority of timber harvest and other siliviculture treatment within suitable forest lands. Matrix areas were identified within both forested and non-forested areas.

Habitat Management
Provide specified amount of coarse woody debris in matrix management. Emphasize green tree and snag retention in matrix management. Provide for the retention of old-growth fragments in watersheds where little remains. Management of stands with known spotted owl activity centers will protect 100 acres of owl habitat around all know activity centers. Management of matrix will be designed to reduce risk of natural disturbances to these areas.

Metolius Late Successional Reserve

Management Strategy Area (MSA) G – 3,750 Acres
This MSA includes Camp Sherman and Metolius Meadows. Almost all of the MSA is in the Metolius Wild and Scenic River Corridor. The goals are to manage for late-successional habitat that is primarily fire climax ponderosa pine, develop and maintain large tree habitat adjacent to riparian areas for instream coarse woody debris and reduce the risk of high-intensity forest adjacent to rural and recreational development. The MSA wildlife goals are to maintain snags and coarse woody debris distributed across the MSA focal species (Northern spotted owl, Black-backed woodpecker, White-headed woodpecker, Williamson's sapsucker, Northern goshawk, Bald eagle, Flammulated owl, Cascade frog, Tailed frog, and Oregon spotted frog). The Lower Metolius Watershed Analysis wildlife recommendations are consistent with these wildlife objectives, except that Oregon spotted frogs are not known to occur on the Sisters Ranger District despite repeated surveys.

Management Strategy Area L – 11,700 Acres

This MSA includes the lower Metolius River and the steep slopes of the Horn of the Metolius. It is bordered by the Confederated Tribes of Warms Springs Reservation to the north and the spotted owl range line. These forests are generally healthy with little disturbance. However, there are patches of insect and disease affected areas which are at risk of high-intensity stand-replacement fires. There is concern that the largest snags preferred by eagles and osprey are not being replaced because current stand densities limit the development of large trees near the river. The MSA wildlife objectives include managing for late-successional habitat to provide a mosaic of sustainable fire and climatic climax stands through reduction of stand densities, maintaining habitat for 1 pair of northern spotted owls, maintaining climatic climax stands adjacent to the river and on north slopes, and maintaining snags and coarse woody debris distributed across the MSA focal species (Northern spotted owl, White-headed woodpecker, Black-backed woodpecker, Williamson's sapsucker, Northern goshawk, Bald eagle, Flammulated owl, Cascade frog, Tailed frog, and Oregon spotted frog). The Lower Metolius Watershed Analysis wildlife recommendations are consistent with these wildlife objectives, except that Oregon spotted frogs are not known to occur on the Sisters Ranger District despite repeated surveys.

Other Ownership within the Watershed

- **Crooked River National Grassland - 17,942 Acres**
- **Bureau of Land Management - 4,689 Acres**
- **State of Oregon - 999 Acres**

Common To All: The primary habitat objective for this area is to manage deer habitat within the Metolius Mule Deer Winter Range. Current management of this area has focused on road closures and the removal of encroaching Western juniper. Juniper removal has focused on reducing densities to historic levels, to promote grass, forb, and shrub diversities to enhance mule deer winter and spring habitat. Construction of the Pelton-Round Butte dam in 1964 resulted in the loss of mule deer winter range habitat (juniper and ponderosa pine) through inundation in the Fly Creek drainage and the Upper Metolius Arm of Lake Billy Chinook. As part of the 2005 relicensing of the dam, mitigation funding was received though Portland General Electric to close roads to reduce motorized disturbance and acquire lands to better manage mule deer habitat.

- **Private Lands - 67,284 Acres**
  Private lands occurring within the watershed range from industrial timberland to private residences. The majority of private ownership is also located within the Metolius Mule Deer Winter Range.

Private residences are typically not managed for wildlife habitat although county standards for development typically provide direction to provide wildlife habitat movement through property.

Ponderosa Land and Cattle Timber Land—Lands managed for timber value, habitat management objective unknown for this property.

Portland General Electric—Properties reside in the Metolius Mule Deer Winter Range and management is also focused on mule deer winter and spring habitat.

- **Confederated Tribes of Warm Springs - 54,098 acres**
  Land allocation as well as management direction is unknown for this portion of the watershed.

Existing Condition

Federally Threatened and Endangered and Region 6 Sensitive Wildlife Species

Northern Spotted Owl

Approximately 6,035 acres of mapped nesting, roosting, and foraging (NRF) habitat occur in the Lower Metolius watershed. Approximately 308 of these acres burned in July 2014 during the Bridge 99 fire. The NRF acres in the watershed are now approximately 5,737 acres. The Metolius Basin spotted owl activity center was identified in 2011. Responses were detected during protocol surveys; however, non-nesting was inferred. Roughly one-fifth of the area in the northern part of this activity center is in the Lower Metolius watershed. Approximately 30 acres of a NRF patch in the activity center in the watershed burned during the 2014 Bridge 99 fire and are no longer suitable NRF habitat. A substantial part of the Metolius Basin activity center burned during the Bridge 99 fire outside of the watershed, likely rendering the activity center as non-viable. Prior to the Bridge 99 fire, barred owl responses were detected south of the activity center outside of the Lower Metolius watershed.

Two additional new activity centers were detected in the watershed in 2011 (Six Creek) and 2012 (Meadow Creek). In 2012, nesting was confirmed and two juveniles were observed in the Six Creek activity center. In 2013 and 2014, no spotted owl responses were detected in the Six Creek activity center; however, barred owl responses were detected in each year. A single female responded in the Meadow Creek activity center in 2012 and 2013; non-nesting was inferred for both years. No responses were detected in 2014.

Critical Habitat Units were designated in 2013 by the U.S. Fish and Wildlife Service. Critical Habitat Unit 7 Subunit East Cascades North (ECN 8) occurs in the watershed totaling approximately 23,157 acres. This critical habitat unit was delineated to provide north-south connectivity along Green Ridge, and east to west connectivity along the north slope of Black Butte.

Spotted owl habitat within the Lower Metolius Watershed is some of the most important that occurs on the Sisters Ranger District. Due to large fires associated with the district over the last 10 years, the majority of the remaining higher quality habitat occurs with the Lower Metolius Watershed. There are other areas on the district containing contiguous habitat such as the Whychus Watershed. However, these areas do not contain true mixed conifer stands and therefore lack the Douglas-fir component needed to provide stand conditions favorable for suitable habitat. As a result, Whychus Watershed has historically had fewest numbers of spotted owl detections and territories. The Lower Metolius Watershed contains contiguous stands of true mixed conifer, with Douglas-fir habitat, and therefore provides some of the last remaining higher quality suitable habitat.

White-headed Woodpecker

The White-headed woodpecker uses habitat with large open ponderosa pine, low shrub levels, and large snags. Dixon (1995) found that white-headed woodpecker densities increased with increasing old-growth ponderosa pine trees and showed a positive association with large ponderosa pine. A long-term study on the white-headed woodpecker occurred on the Deschutes and Winema National Forests from 1997-2004 with several Deschutes study sites occurring in the Metolius Basin area. Frenzel (2000) calculated the mean diameter for white-headed woodpecker nest trees to be 26.2"dbh while Dixon (1995) found similar results (mean diameter of 25.6"dbh). Frenzel (2003) found nests at sites with a high density of large diameter trees had a higher survival rate than nests in recently harvested sites. Unharvested sites or sites with greater than 12 trees per acre >21"dbh had a success rate of 63.1% while nests at previously harvested sites or lower densities of large trees had a success rate of 39.8%. Therefore, white-headed woodpeckers were positively associated with higher densities of large trees.
Known observations and nest sites occur in the watershed and areas associated within low elevation ponderosa pine stands. Ongoing treatments are also occurring to enhance habitat for this species within the watershed.

Management Indicator Species

Peregrine Falcon

One peregrine falcon eyre occurs in the watershed. It is the only eyre that exists on the Sisters Ranger District, due to limited cliff habitat. The eyre occurs within the Metolius Wild and Scenic River Boundary as well as the Metolius Wildlife Primitive Area under the Deschutes LRMP. The eyre is within an unfragmented area and therefore disturbance is limited.

Mule Deer and Elk

The following tables summarize the existing conditions for Forest Plan cover and road density standard and guidelines for the Metolius Mule Deer Winter Range MA-7 and Lower Metolius Key Elk Habitat Area associated with the Lower Metolius Watershed.

Metolius Mule Deer Winter Range MA-7 Cover

MA-7 Sub-unit	Total Sub-unit Acres	Acres of Thermal Cover by Sub-unit	% of Sub-unit in Thermal Cover	Acres of Hiding Cover by Sub-unit	% of Sub-unit in Hiding Cover
Metolius	31,416	4,033	13%	7,600	24%

Metolius Winter Range MA-7 Road Densities

MA-7 Winter Range Sub-unit	Total Square Miles	Miles of Open Roads	Open Road Density mi./sq.mi
Metolius	49.15	169.36	2.01

Lower Metolius Key Elk Habitat Area

KEHA Name	KEHA Acres	Open Road Densities mi./sq.mi.	Hiding Cover Acres	% of KEHA in Hiding Cover	Thermal Cover Acres	% KEHA in Thermal Cover
LOWER METOLIUS	6,130	2.65	2,421	39%	3,302	54%

Desired Condition

- Spotted Owl Nesting Roosting and Foraging Habitat Within and Outside CHUs
    - Overstory should consist of multiple layers
    - Dominant and co-dominant trees in the overstory should consist of ponderosa pine and Douglas-fir trees at least 200 years old or greater than 32 inches dbh.
    - Medium to high canopy closures greater than or equal to 60%
    - Relatively heavy canopy habitat with a semi-open understory is essential for effective hunting and movement
    - Adequate quantities of dead and down woody material to provide habitat for prey species such as the Northern flying squirrel, red-backed vole, and bushy-tailed woodrat.
    - Road densities should be limited within core areas.
- Spotted Owl Dispersal Habitat Within and Outside CHUs
    - Dispersal habitat within mixed conifer wet stands could provide the basis for future NRF, as stands are managed to promote the development of large ponderosa pine and/or Douglas-fir to be dominant future overstory trees.
    - Dispersal habitat for mixed conifer wet (MCW) PAG, average stand diameter of 11 inches dbh and 40% canopy cover.
    - Dispersal habitat for mixed conifer dry (MCD) and ponderosa pine (PPD) PAG, average stand diameter of 11 inches dbh and 30% canopy cover.
- White-headed Woodpecker
    - Open stands of late and old structure (LOS) ponderosa pine with individual regenerating pines as well as small aggregate patches of regeneration pines that provide foraging habitat

- Large individual snags >21 inches dbh, occurring at a rate of approximately 4 snags per acres on average.
- Understory would be open and shrub densities would be low with interstitial spaces occupied by bunch grasses and forbs.
- With open LOS pine stand and open understories, rodent habitat would be reduced limiting the risk of nest predation.

- Mule Deer
  - Winter range is managed to meet objective within MA-7 of the Deschutes LRMP
  - Where hiding cover does not meet Forest Plan S&Gs, open road densities should be reduced to limit disturbance.
  - Thermal cover should be managed in areas such as riparian reserves and RHCAs where site productivity is capable of providing habitat in the long-term.
  - Vegetation management and prescribed fire should be used as tools to develop and maintain adequate levels of forage and cover, assisting ODFW in meeting herd management objectives for the Metolius Deer Herd Unit.

- Peregrine Falcon
  - Cliff formations and rock spires in areas of limited disturbance.

Strategy to Achieve Desired Conditions

- Spotted Owl NRF Habitat Within and Outside CHUs
  - Field verify NRF and exclude currently viable NRF habitat from treatment.
  - Develop a thinning and fuels treatment strategy to reduce the risk of stand replacing fire, and loss of NRF habitat.
  - Within areas containing the inherent soil quality and site potential capable of developing NRF habitat;
    4. Where multi-storied stands exist with the overstory containing residual large ponderosa pine, Douglas-fir, incense cedar, western larch, and white fir. Thin stands from below to reduce stress to overstory and removal of ladder fuels, understory treatments should favor ponderosa pine, Douglas-fir, and western larch. NRF habitat develops through fire exclusion, prescribe fire can be used in the initial entry to reduce slash and fire risk, but will be excluded to promote understory development to achieve canopy closure and vertical structure to meet suitable NRF habitat.
    5. In second growth stands, thin stands to promote spatial heterogeneity, while promoting the development of an LOS overstory. Developing ponderosa pine and Douglas-fir large tree structure are the building blocks of NRF habitat.
    6. In homogenous plantation, mosaically thin stands to promote spatial heterogeneity and greatly reduce stocking densities. Treatments will reduce stocking risk of losing plantations in the event of a wildfire, as well expediting the development of overstory stands.
- Spotted Owl Dispersal Habitat Within and Outside CHUs
  - Develop a connectivity strategy to move spotted owls in a north to south continuum through the identified CHU as well as between identified NRF habitat.

- Within the connectivity strategy, identify stands to be left untreated to facilitate the spotted owl dispersal as well as providing security and predator avoidance.
- Within the connectivity strategy, identify stands where thinning and prescribed fire could be implemented to promote stand development, reduce wildfire risk, and provide dispersal habitat. Post treatment stand should minimally meet the dispersal objective for MCW, MCD, and PP PAGs. (Note: MCW stands managed to provide future NRF, could potentially fall within the dispersal definitions during the initial stages of management.)
- Within the Metolius Wildlife Primitive Area, manage fire starts to prevent loss of NRF habitat from stand-replacing wildfire.

- Mule Deer and White-headed Woodpecker

  Mule deer winter range and white-headed woodpecker habitat overlap and both are associated with ponderosa pine stands within the watershed. During the Lower Fly Creek Project which also occurs in the watershed, a process was developed to manage habitat conducive to meeting objectives for both species. This process will be utilized to continue to manage habitat for these species, also fulfilling habitat requirement of other ponderosa pine obligates.

  1. Due to the low site productivity of the ponderosa pine community, soil typing to determine the inherent soil quality and site potential must be completed.
  2. Those areas with high site potential (areas of deeper soil or riparian areas) capable of sustaining higher stocking levels will be identified. Objectives for hiding cover and thermal cover for mule deer as well as nesting and foraging areas for white-headed woodpecker will be attained in these areas. In addition, these sites will also be thinned from below in a mosaic fashion to be managed to develop into contiguous stands of LOS ponderosa pine containing a variety of grass, forbs, and shrubs in the understory. These areas will most likely provide higher levels of large snags for white-headed woodpecker nesting in the long-term.
  3. Where the inherent soil quality is low and sites are not capable of growing both fully stocked stands of trees and shrubs, a variety of spatial arrangement of tree and shrub management will occur. Treatments will vary between maintaining openings dominated by shrubs, bunch grasses, and forbs to a mosaic distribution of individual trees between openings.
  4. The long-term objective is to maintain these stands with low intensity high frequency prescribed natural fire. Maintaining open grown ponderosa pine stands and recruiting large snags required for white-headed woodpecker nesting habitat. In addition, prescribed fire will create a variety of seral classes of shrubs, providing highly palatable forage for wintering mule deer.

- Peregrine Falcon
  - Habitat for this species is typically associated with rock formation and steep topography, and therefore limits disturbance. Habitat occurs within the Metolius Wildlife Primitive. Manage dispersed recreation use within identified habitat to minimize disturbance.

Desired Conditions for Ongoing Wildlife Projects

- Hawk Watch International Raptor Migration Monitoring Site
    - Stand number 59056 is a 28 acre regeneration harvest unit that was cut under a past timber sale. Due to the lack of overstory, the unit provides a good view of migrating raptors flying south down the face of Green Ridge. To continue to maintain this long-term raptor monitoring site, this stand will be managed in an early seral condition with individual perch trees scattered throughout the unit.

Botany

Botany/Ecology

Historic/Desired Condition

- Viable populations of Sensitive and Survey and Manage plant species are maintained
- Invasive species are rapidly treated and contained or controlled. New Infestations are prevented.
- Invasive species management is cooperative.

Existing Condition

Figure 26. The Eyerly Wildfire area ten years after the 2002 wildfire

1) There are large blocks of early seral vegetation and invasive plants from recent wildfires.

Large wildfires such as Eyerly (2002) have created large block of early seral vegetation and accelerated invasive plant spread (Figure 26).

- **Shrub fields**- the Eyerly wildfire area now has extensive shrub fields in some area of red-stem ceanothus and other nitrogen fixing early seral shrubs and forbs (Figures 27 and 28).

A series of Nitrogen Fixing Plants dominate burned areas

Figure 27. North Slope of Rd 1170-600 in 2004, 2 years after the Eyerly Fire- Tailcup Lupine

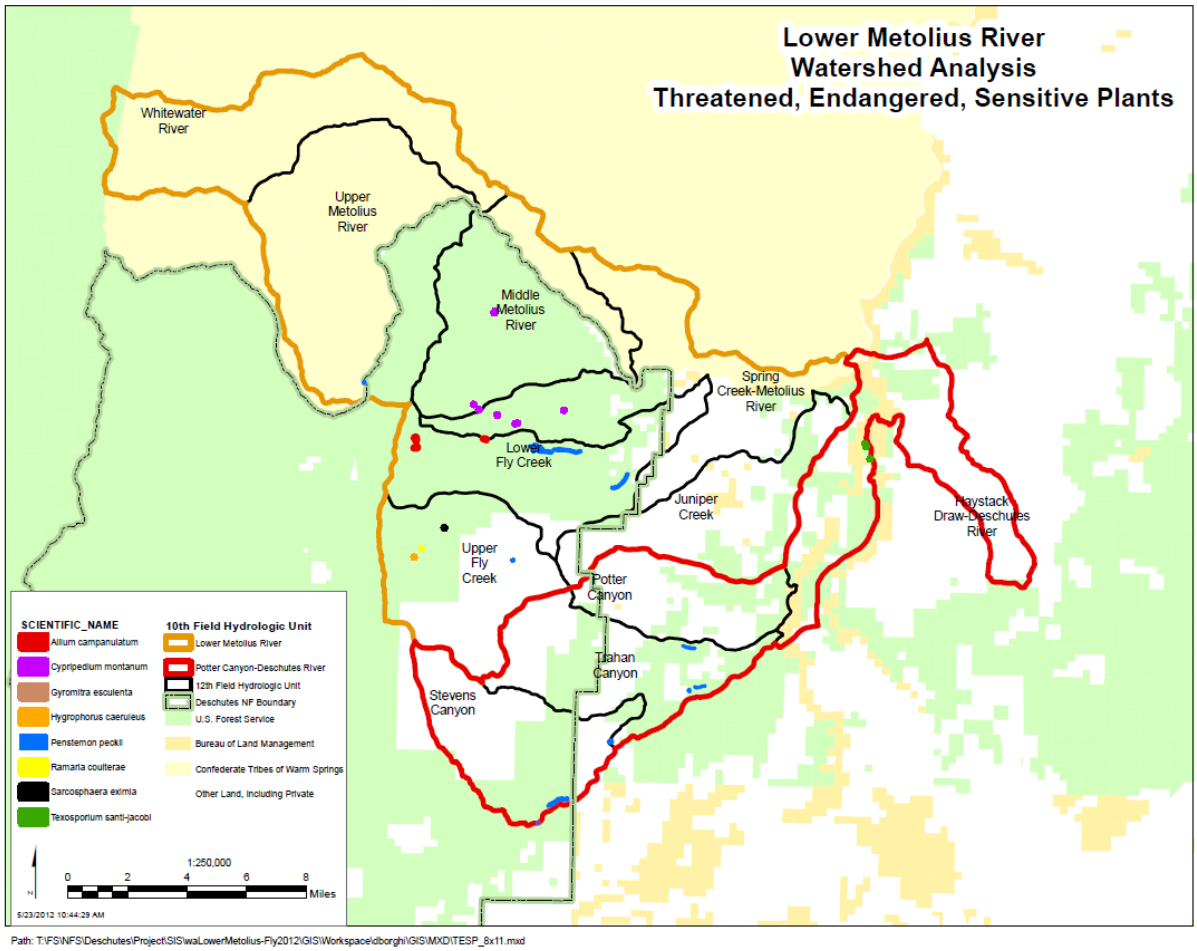
Figure 28. North Slope of Rd 1170-600 in 2014, 12 years after the Eyerly Fire- Red Stem Ceanothus

2) **Post Fire seeding**

- **Eyerly Fire Post-fire Seeding**- 40,000 lbs. of winter wheat and annual rye were seeded in 2002 for erosion control with the expectation they would die out in about 5 years. Some cereal grains are still visible. The seeding did not prevent invasive plant invasion and the District has not seeded since.

3) **Invasive plants**- were aggressively manually treated until herbicides could be used starting in 2013. Some areas have developed access issues after private lands were sold and developed and are no longer treated (Fly Creek drainage).

Sensitive Plants



Peck's penstemon (*Penstemon peckii*), R6 Sensitive

Figure 29. Photo of Peck's penstemon

- 11 populations, 12,000 plants, ~7% of global population
- Eastern most populations, some found to be genetically distinct
- Federal populations managed by Sisters Ranger District and Crooked River National Grassland (CRNG)

Potential Management Conflicts and Recommendations:

1) Fire Suppression

- Consider allowing fires to burn through the Peck's penstemon population area and potential habitats for resource benefit.
- Avoid fire line, safety zones, or equipment in population areas.

2) Timber Harvest and Fire Salvage

- Use low impact equipment or hand thinning when possible.
- Keep equipment on designated skid trails.
- Minimize heavy ground disturbance in population areas (20% of population areas may be impacted in "Managed populations").
- Log over snow or frozen ground in "Protected" populations until studies can be completed which indicate the plant benefits and tolerates ground based equipment over dry ground.
- Do not burn concentrations of slash on top of population.
- Utilize prescribed fire whenever possible for its benefits to the plant.
- Consider thinning and prescribed fire in population areas to increase flowering.
- Make sure equipment is clean (weed free).
- Keep landings out of population concentrations.
- Monitor after operations are complete to aid in early detection of invasive plants.

3) Recreation Management

- Define and confine parking areas and roads in recreation sites with boulders, bollards or other controls to minimize devegetation in habitat areas.
- Close and rehabilitate user created roads in habitat areas.
- Monitor dispersed camping sites in habitat areas and address problem areas as soon as possible.

4) Invasive Plants

- Utilize prevention measures such as requiring clean equipment, using clean material sources, minimizing ground disturbance, and controlling nearby invasive plant populations which could be spread into Peck's penstemon habitat.

- Prioritize control of invasive plant populations within or adjacent to Peck's penstemon habitat.
- Avoid prescribed fire or ground disturbance from other management activities in known invasive plant populations, especially when coincident with Peck's penstemon populations.
- Monitor Peck's penstemon populations more frequently if they occur near activities which may introduce invasive plants, i.e. vegetation management, wildfires, prescribed fires, popular recreation sites, major roadways, or grazing allotments.
- Raise awareness of invasive plant identification and risks with agency personnel and contractors involved in prescribed fire, wildfire suppression, road work, recreation, and vegetation management.

5) Cooperative management

- Work cooperatively with Crooked River National Grassland to reexamine Peck's penstemon in Trahan (Carcass) & Potter (Geneva) Canyon subwatersheds

Woven-spore lichen (Texosporium sancti-jacobi)

- *Caliciaceae* (Pin Lichen Family) R6 Sensitive , 4 populations
- *Soil Crust Lichen* on ground-dead bunchgrass clumps that are impregnated with soil. Also on old, decaying small mammal scat.
    - Threats- Wildfire

Potential Management Conflicts and Recommendations: See Interagency Special Status / Sensitive Species Program (ISSSSP) http://www.fs.fed.us/r6/sfpnw/issssp/

Hygrophorus caeruleus

- R6 Sensitive- 1 population

Potential Management Conflicts and Recommendations: See Interagency Special Status / Sensitive Species Program (ISSSSP) http://www.fs.fed.us/r6/sfpnw/issssp/

Survey and Manage Species

In 1994, the Bureau of Land Management and Forest Service adopted standards and guidelines for the management of habitat for late-successional and old-growth forest-related species within the range of the northern spotted owl, commonly known as the Northwest Forest Plan (USDA Forest Service and USDI Bureau of Land Management 1994). Additional direction was provided in 2001 for management of known sites and conducting surveys for these species (USFS and USDI 2001).

There are 5 categories of Survey and Manage Species with different requirements for inventory and management. These are described below:

Survey and Manage Category:

A-Pre-disturbance surveys and management of all known sites are required

B- Equivalent effort surveys required if old growth habitat disturbed and manage all known sites

C-Pre-disturbance surveys and management of high priority sites are required

D-Pre-disturbance surveys are not required, but required to manage high priority sites

E-Pre-disturbance surveys are not required, but required to manage all known sites

This analysis applies the Survey and Manage species list in the 2001 ROD (USFS and USDI 2001, Table 1-1, Standards and Guidelines, pages 41-51) and thus meets the provisions of the 2001 *Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines.*

Mountain Lady Slipper (*Cypripedium montanum)*

- Category C (Manage High priority sites, conduct Predisturbance surveys and Strategic surveys, 9 populations (7 relocated in 2012), 622 plants.

Figure 30. Mountain Lady Slipper

Management Direction for the Mountain Lady Slipper

http://www.blm.gov/or/plans/surveyandmanage/MR/VascularPlants/section10.htm

Potential Management Conflicts and Recommendations (from Seevers and Lang 1998)

- Maintain or restore habitat conditions in areas with populations of *C. montanum*.
- Maintain canopy closure at 60 percent or greater (USDA and USDI 1994a).
- Maintain down logs, snags, and duff layer within the habitat area for soil moisture and mycorrhizal associates. Provide for future recruitment of coarse woody debris.
- Avoid activities that alter soil, duff, down wood, and the mycorrhizal community in the habitat area.
- Maintain/secure known sites from prescribed burns.
- Manage population sites to include an area large enough to maintain current habitat and associated microclimate, primarily temperature and moisture. The size should be determined by a field visit and should consider factors such as canopy cover, slope, aspect, topographic position, vegetation structure (growth form, stratification, and coverage), and species composition (Chen *et al.* 1995; Harris 1984).
- Given the long life-span of individuals, manage *C. montanum* and associated communities to be responsive to short-term (wildfire, soil disturbance) and long-term (ecological succession) environmental changes and maintain the species evolutionary potential.
- Manage for biological (mycorrhizae and pollinators) and ecological (soil temperature, moisture, and organic matter) requirements at each life stage. Each life stage may require specific mitigation. Ensure that indiscriminate insecticide spraying does not affect the populations of bees or other insects this species depends on for pollination.

Data Gaps and Information needs:

- **Need Management Plan** for ***C. montanum***, need to identify High priority populations
- **Prioritize Management of invasive species** in rare plant habitats. Especially Rd 1190/220.

- **Continue to revisit *C. montanum* sites**. These sites need to be revisited to collect data on populations trends that have occurred since the last visit. Specific information on stand age, fire history, duff layer, coarse woody material, snags, percent canopy, plant association, and abiotic factors should be collected. See Volunteer reports from Kermit Williams/ and Rick Dewey>

- **Inventory reserve areas** (proposed Research Natural Areas, lower Wild and Scenic River). Determine ecological requirements for *C. montanum* seed germination and establishment needs.

- **Determine the role of fire** (wildfire and controlled burns) *C. montanum* habitat needs.

- **Identify pollinators and their habitat requirements** to determine if this is the limiting factor in fruit production.

Survey and Manage Fungi Species

The following survey and manage fungi species are known to occur in the watershed assessment area. Their status and habitat are addressed separately. The discussion of changes to habitat, threats and recommendations is combined. See the **Interagency Special Status / Sensitive Species Program (ISSSSP) webpage at** http://www.fs.fed.us/r6/sfpnw/issssp/planning-tools/#fungi for more information.

What is known about Fungi Habitats -2012 Fall Fungi Surveys (excerpt from Emerson 2012)

Botanists from the Rogue River-Siskiyou NF representing TEAMS Enterprise unit surveyed a total of roughly 1100 acres within the Green Ridge area of the Metolius River watershed during late October to mid-November of 2012.

The 2012 Fall fungi season was one of the worst for fungal fruiting in at least 50 years (pers. com. Clint Emerson and Jim Trappe). Drought conditions persisted throughout the summer and all the way until the first significant rain which occurred around the 20th of October. At that time the rain was immediately followed by a significant cooling trend which resulted in a "snow on dust event". These types of weather conditions have a negative effect on fruiting potential because of impacts to carbon cycling systems. Some research has shown that carbon respiration from mycorrhizal host trees may be a significant trigger for fruiting. When you get cold snowy conditions before any warm high humidity precipitation has occurred (generally in August and September) then it is more likely these host trees will begin the process of shutting down for the winter i.e. going dormant.

Several habitat/ecosystem types were encountered throughout the units that were surveyed. Some habitat's proved to be more prolific for fruiting than others even considering the generally poor nature of the season.

Common trends for Fungi habitats in the Lower Metolius Watershed:

- Survey units with perennial or even intermittent streams and adjacent riparian zones tended to have more established downed woody debris, thicker humus layers and a higher amount of large old trees that provide opportune potential for establishing long term mycorrhizal relationships.
- Survey Units where riparian areas face W, NW, N and NE had the greatest diversity of fruiting. In contrast units that face E, SW, S and SE tend to be dominated by dry open Ponderosa pine/bitterbrush ecosystems that have very little in the way of rotting downed wood or deep humus layers. These areas are comprised of exposed mineral soils that when observed in the field contain very little mycelium.
- Many of the survey units fall somewhere in between these two extremes. For example some units up on top of Green Ridge are flat and at a higher elevation so they display plant assemblages indicative of heavy snow packs. These areas often were found to have various fir species such as noble fir, grand fir and even the occasional western larch. Units fitting into these ecosystems tended to have more fruiting and diversity than the Ponderosa pine/bitterbrush sites but notably less than the riparian units such as the large one along Six Creek.

Known Survey and Manage Fungi
Ramaria aurantiisiccescens

- Category B -Equivalent effort surveys required if old growth habitat disturbed & manage all known sites.
- 2 sites. *Ramaria* sites were near intermittent streams that were mostly dry at the time of the survey.
- Emerson 1230 was about 15 feet from Prairie Farm Creek in old growth mixed conifer forest.
- Emerson 1231 was about 30 feet from Six Creek in old growth mixed conifer forest. The area is very flat and gently rolling and has a tremendous amount of both large and small downed wood, with somewhat deep (4" or deeper) humus and decaying bark and twigs.

Ramaria coulterae

- Category B (Equivalent effort surveys required if old growth habitat disturbed & manage all known sites)
- 1 known site

Clavariadelphus sachalinensis

- Category B (Equivalent effort surveys required if old growth habitat disturbed & manage all known sites
- 3 sites
- Two of the Clavariadelphus sites (Albertson 003 and Dunn 042) were found in the same forest along Six Creek and are very similar in habitat as the ***Ramaria aurantiisiccescens*** site but with a more shallow humus layer and with a greater ponderosa pine component.
- Albertson 001 was found in a unit up closer to the summit of Green Ridge in old growth PSME, CADE, PIPO forest. Definitely a little drier site than the others. Humus layer quite shallow. East to NE facing slope.

Neither ***Clavariadelphus sachalinensis*** or ***Ramaria aurantiisiccescens*** are considered very rare from a regional perspective but are less common in the drier ecosystems of the Deschutes NF.

General Discussion of Changes to Habitat/Threats for Fungi:

The discussion in this section references a treatment effects white paper (Dewey, 2012) as well as two draft treatment effects white papers (Emerson, 2013; Lippert, 2013) that are currently under review.

Two important components of local forest ecosystems, that promote both and abundance and diversity of mycelial networks representing ectomycorrhizal fungi, are live woody plants (shrubs, and especially, trees) and coarse woody debris. The former serve as ectomycorrhizal fungal hosts while providing shade and wind-calming structure that promotes retention of moisture in both the soil and air. Coarse woody debris also promotes local moisture retention while providing habitat/substrate for a subset of local ectomycorrhizal fungi. Thinning, fire (both prescribed and natural), and salvage harvests can all be reasonably expected to reduce that capacity of live woody plants and coarse woody debris to support an

abundance and diversity of ectomycorrhizal fungi. Thinning and fire will reduce the number of ectomycorrhizal fungal hosts available in a local forest ecosystem while concurrently reducing the capacity of live woody plants to moderate local microclimate. Entry of heavy equipment associated with thinning or salvage logging is likely to cause soil compaction which is known to impede the formation of feeder rootlets where mycorrhizae form. Fire will reduce the volume of coarse woody debris and, along with salvage logging, reduce the opportunity for recruitment of coarse woody debris in the future. Additionally, fire, in a direct relationship with intensity, can be lethal to the mycelial networks of a subset of the local ectomycorrhizal fungal species.

Recommendations for Survey and Manage Species related to Vegetation Management including Timber Harvest and Fire Salvage

A potential for management conflict exists when attempting to manage for both early and late seral species on the same acres of land. Managing for more open forest conditions typical to Fire Regimes 1 and 3, or for fire adapted species at a particular locality, may reduce viability and habitat quality for reputedly old-growth dependent species such as the survey and manage bryophytes, lichens or fungi that are occupying habitats within or adjacent to that same locality.

To provide a reasonable assurance of the continued persistence of occupied sites consider incorporation of patch retention areas (USFS and USDI 1994, as described in Standards and Guidelines, C-41) with occupied sites wherever possible (Region 6 ISSSP, Fungi Conservation Planning Tools, Appendix 2)- outlined below.

- Retain patches of green trees and snags generally larger than 2.5 acres.
- Retain at least 15% of the area associated with the cutting unit.
- In general 70% of the are retained should be aggregates of moderate to larger size 0.2-1 hectare or more) with the remainder as dispersed structures (individual trees and smaller clumps)

More specific recommendations can be found at the Interagency Special Status / Sensitive Species Program (ISSSSP) conservation planning tools webpage at
http://www.fs.fed.us/r6/sfpnw/issssp/planning-tools/

Culturally Significant Plants

- Plants important to the Confederated Tribes of Warm Springs are found in the area, especially on scab flats.
    - Tribal concerns include: Invasive species invading gathering areas, herbicide use in gathering areas (request notification and signing), concern about prescribed fire increasing invasive plants or destroying plants in riparian areas where basketry material grows.

Potential Management Conflicts and Recommendations

- Protect and enhance cultural plant areas working in cooperation with The Confederated Tribes of Warm Springs.

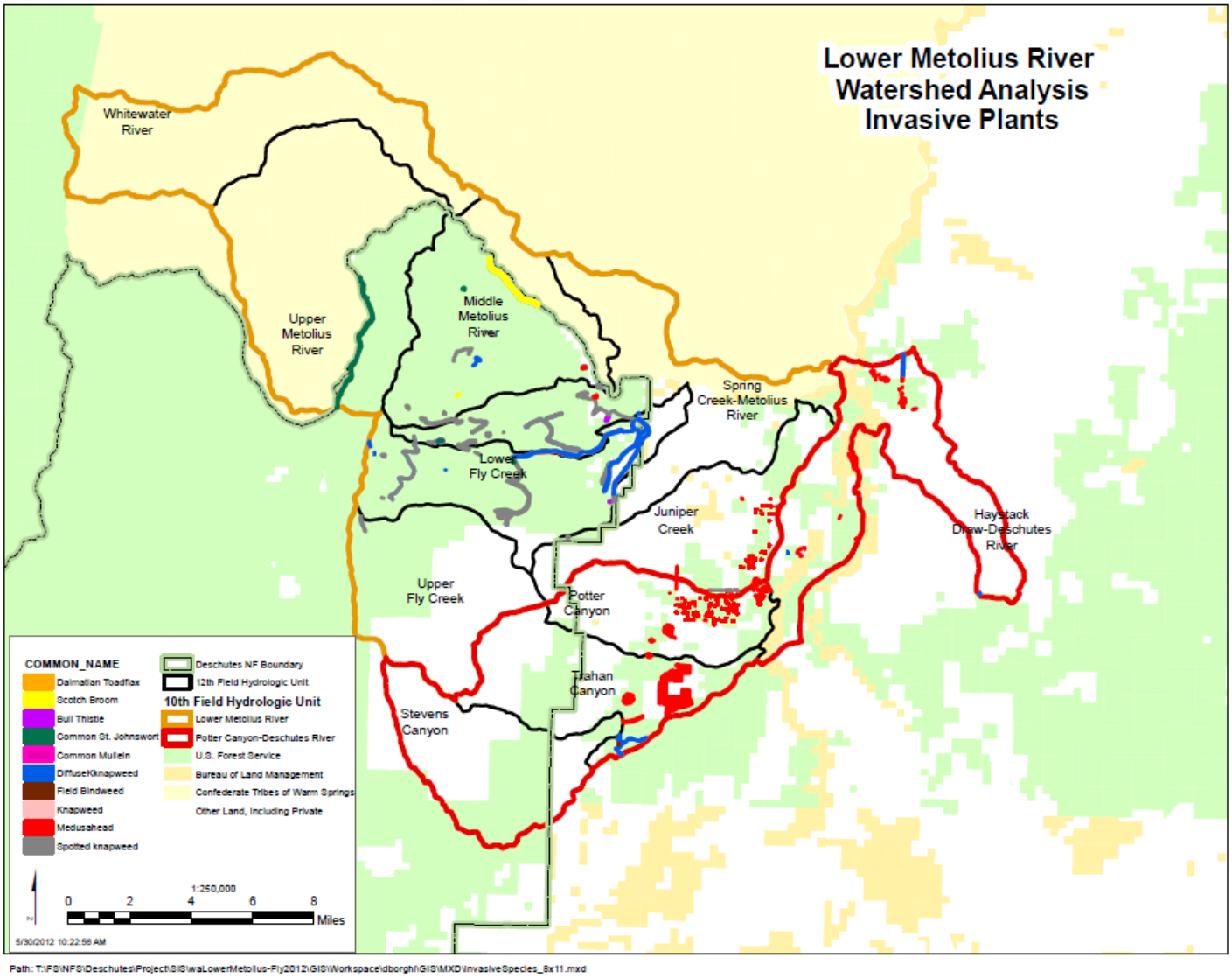


Figure 31. Known invasive plant populations within Lower Metolius River Watershed

Invasive plants

Invasive populations are spreading (Figure 31).

- **More than 2,000 acres of Spotted and Diffuse Knapweed** (mapped populations on Federal lands only- private land populations are not included)
- **Over 1000 acres of Medusahead** (mapped populations on Federal lands only- private land populations are not included)
- **Special Areas of concern are:**

- Public lands along Fly Creek (Knapweeds)
- Private lands on Fly Creek (Knapweeds)
- Private ownerships near Crooked River National Grassland (medusahead)
- Private timberlands (Ponderosa land & Cattle Company) (toadflax and

Potential Management Conflicts and Recommendations

- **Prioritize Management of invasive species in Mountain lady slipper habitats**
  - Control weeds on Rd 1190/220
  - Control weeds on Rd1193/600
- **Fly Creek area (weeds and Pepe)**
  - Resolve road access issues to aid in USFS weed control
  - Consider starting a **Cooperative Weed Management Area**. Potential Partners: Crooked River National Grassland, Portland General Electric, Private Land Owners, Wild Turkey Federation, Confederated Tribes of Warm Springs
  - Map populations southeast of Bean Creek (seen by Dollhausen 2010)
- Reduce knapweed populations across land ownerships in Fly Creek
- Contain infestations of Eurasian millefoil and Ribbongrass
- Apply Invasive species prevention standards to all projects
- Treat known occurrences every year
- **Invasive species- Medusahead**
  - Work with County, CRNG to reduce medusahead spread from the east along major roads
- **Invasive species- Ribbongrass/Eurasian millefoil**
  - Survey the Lower Metolius and Lake Billy Chinook for these species, following the same protocol used for 2014 Upper Metolius surveys by Turnstone Environmental. Contract administered by Cyndy Armour, Ochoco SO 541-416-6662.

- **Cultural Plants**
  - Follow Weed EIS Mitigations including notification and posting of spray areas

Figure 32. Katie Grenier and Joe Bettis from Turnstone examine GPS equipment.

Heritage Resources/Tribal Concerns

Figure 33. Remnant fireplace from El Rancho

Heritage Resources/Tribal Concerns

Summary

The Lower Metolius Watershed encompasses 208,880 acres from Mt Jefferson in the Cascades, down in elevation to the Crooked River National Grasslands in the east. Elevations within the watershed range from 2000 feet in the canyons of the Lake Billy Chinook reservoir to 10,495 feet at the peak of Mt Jefferson. Most of the watershed is between 3000 feet and 5000 feet. Within the watershed, Green Ridge is the oldest geological formation; at 4.5 million years to 2.1 million years., which predates the formation of the Cascades.

Less than half of the Lower Metolius watershed(204,374 acres) has been inventoried for cultural resources. Within the watershed, surveys have been concentrated along Green Ridge and the Lower Metolius River. No surveys have been conducted along the Lower Metolius River at the northern forest boundary and in the southeastern portion of the watershed.

Approximately 286 heritage sites on the Deschutes National Forest and Ochoco NF/Crooked River National Grasslands were found as a part of those surveys. The majority of the sites on the Deschutes NF are prehistoric in nature while historic sites make up more of the assemblage on the Ochoco NF/Crooked River National Grasslands. Many of the prehistoric sites consist of small lithic scatters in drainages or near springs. The historic resources are a mix of early logging resources, homesteads and Forest Service administrative sites. Most of the recorded sites have not been evaluated for their eligibility for nomination to the National Register of Historic Places (NRHP). These unevaluated sites are treated as eligible for listing on the NRHP until a formal evaluation can be made. Management categories also not been determined for any of the cultural resources sites within the Lower Metolius Watershed.

Fire, recreation, logging, looting, and urban interface areas are five activities that have caused the most negative impacts to cultural resources within the watershed. The five activities have the potential to cause future negative impacts and each area will be addressed below, with possible actions that can be taken to remedy future impacts to cultural resources. Additionally areas of concern to the tribes have been presented to the Forest Service, in accordance with the sovereign nation relationship between the tribal governments and the federal government.

Heritage Issues

Fire:

The northern portion of the watershed has experienced hot, stand replacing fires over the last two decades. Stand replacing fires can have a significant impact on heritage resources such as the 2003 B&B fire, which destroyed the remains of the Santiam Wagon Road from loss of vegetation and post fire erosion. Fire suppression efforts have impacted up to 15 recorded sites that are either eligible or unevaluated. Since less than half of the watershed has been inventoried, the damage to cultural resources from fires is probably more significant than is realized.

Recreation:

Dispersed camping along Green Ridge has impacted sites in the past and has the potential to continue to negatively impact cultural resources. The Lower Metolius River receives high visitation in developed campgrounds, permitted recreation residences and private resorts that has had a continued negative effect on cultural resources. The most significant damage can happen with OHV use as riders are often riding in unapproved areas and can access remote areas where resources are generally untouched. This can lead to impacts that can be more significant because the sites are relatively pristine. OHV use also negatively

impacts cultural plants and the collection of plants, as they can spread weeds but also create an environment not suitable for traditional gathering of cultural resources.

Logging:
The watershed has seen extensive logging starting in the late nineteenth century and continuing through the twentieth century. At least four lumber mills were located on Green Ridge to process locally cut timber. Some of the larger cultural sites are associated with the early logging and mills. Railroad logging eventually replaced early forms of logging and the mills moved closer to Sisters, Oregon. While most railroad grade was converted to automobile roads, some of the old grade has not been surveyed and holds the potential for unknown cultural sites associated with logging. While logging in the past has had negative impacts on cultural resources, specifically prehistoric resources, future logging has the potential to mitigate large fire impacts and benefit cultural resources.

Looting:
Looting of cultural sites has become a serious problem for the Central Oregon area. Specifically the Crooked River National Grasslands has seen many of the historic homesteads looted. The remoteness of the northern and eastern portion of the watershed and the checker boarded nature of private and public lands makes monitoring and enforcement difficult. Looting will continue to be a major problem and have the biggest negative impact on cultural resources

Urban Interface:
Along the Lower Metolius River there is a checker board of private and public land from land claims that were established prior to 1884. The private land boundaries are not well marked and private land owners have impacted resources on forest lands that border their property. Some private inholdings are remote and in areas that are visited infrequently, impacts to Forest Service lands can be more severe because of the delayed identification of the impacting activity.

Tribal Resource Issues

The following issues have emerged from Tribal input to project level analysis, cooperative planning efforts between the Forest Service and the Tribes, and discussions with the Culture and Heritage Committee and other tribal members during this watershed analysis.

Restoration of Anadromous Fish to the Deschutes River Basin
The Tribes are interested in restoring steelhead and salmon runs and recognize the Lower Metolius Basin as critical to that objective because it historically provided significant spawning habitat in the middle Deschutes system.

Forest Service Management of Ceded Lands
The Forest Service has a trust responsibility in managing ceded lands. This means that resources valued by the tribes need to be protected and enhanced, especially during management activities. The Tribes closely monitor and comment on Forest Service management.

Sharing information about Cultural Plants
The Tribes rely on the Forest Service to survey, inventory and protect desirable cultural plants. They have asked to be notified when we find potential gathering areas. The Forest Service provides courtesy permits to Tribal Members to help the Forest Service monitor use and protect the gathering rights of enrolled Tribal members.

Project-level plant surveys have identified many species of plants that have cultural significance. Most of these are common species of shrubs, trees, lichens, and forbs that can be found in many places on the Sisters Ranger District. Good stewardship of the forest will enhance these plants. One of the most

important cultural food plants found within the watershed is huckleberries. The exclusion of fire and closing of forest canopies has reduced huckleberry habitat within the wilderness areas and recent large fires have burned too hot for the propagation of huckleberry. As the Forest Service begins to enter burned areas to manage fuels there will be opportunities for habitat restoration. Potential habitat for another important plant, Blue Camas, may have existed in seasonally wet meadows in the Lower Metolius Basin. Camas may have been extirpated through long and intensive grazing. With riparian restoration projects there may be an opportunity to work with the Tribes to reintroduce this important cultural plant. A continued exchange of information can also identify tribally known resources and needed measures to improve or protect those resources from activities that can have a negative impact. This could include OHV use in a resource gathering area or the spread of invasive weeds such as medusa head that can over take an area and replace cultural plants.

Protection of Known and Undiscovered Archeological and Cultural Sites
The Tribes rely on the Forest Service to survey, inventory and protect prehistoric and cultural materials and sites. The Forest Service will continue to work with interested tribes to protect cultural resources on ceded lands within the forest.

Heritage Recommendations

Update the Forest Cultural Resource Overview:

An updated Forest Cultural Resource Overview is needed to assist in the management of cultural resources. The understanding of prehistoric land use within the watershed is not well understood. Because of the limited survey and the small number of sites that have received excavation, there are many assumptions about prehistoric land use. An updated Forest Cultural Resource Overview would assist with the development of new research questions and provide an opportunity to test past assumptions about prehistoric land use. Context statements generated as part of the overview would help with the evaluation of cultural resources by reducing the time needed and making the evaluation more consistent. Opportunities to work with local universities and colleges would assist the forest in filling in data gaps pertaining to prehistoric land use within the watershed and partnerships should be sought out. The information acquired could help in the development of interpretive opportunities to tell the history and prehistory of the Lower Metolius basin.

Create an Inventory and Monitoring Program for Sites Within Recreational Use Areas:

Negative impacts from recreation can be mitigated through integration of heritage concerns and needs, identified in the Forest Cultural Resource Overview, into recreation management plans. This will require identification of cultural resources that are being negatively impacted because of recreational activities. For the summer home tracts a condition inventory with pictures will need to be completed and close cooperation with the special use permit administrator will be important. Reconnaissance surveys within the wilderness should be planned to help identify the number and types of sites located within the wilderness. The wilderness contains many high probability areas for heritage resources. Heritage personnel will work more closely with the wilderness recreation personal to help identify and protect heritage resources in the wilderness. Cultural sites that are being negatively impacted by developed and dispersed recreation should be identified and evaluated for NRHP eligibility. Sites found eligible can be prioritized for monitoring, protection or mitigation based on the level of impact.

Continue and Strengthen Partner Groups:

The continued use of partner groups will be invaluable to the success of monitoring and evaluating sites. Through Passport In Time (PIT) projects and working with local volunteers, such as

ASCO, sensitive sites can be more frequently monitored. Priority Heritage Assets (PHAs) within the watershed will continue to be identified and evaluated in order to keep all PHAs relevant.

Integrate Heritage into Fire Planning as Early as Possible:

In order to mitigate damage from fire, heritage personnel will work with district fire personnel to identify heritage resources most "at risk" from wild land or human caused fires. The identification of "at risk" resources will help in the development of a fire hazard mitigation plan, which will concentrate efforts on reducing fire hazards in and adjacent to heritage resources. During fires an archaeologist should be consulted on smaller fires as soon as possible but should be part of the READ team on larger fires, such as the Eyerly and B&B to better protect cultural resources from fire suppression activities.

Inventory for Cultural Plants:

An opportunity exists to improve traditional food and forest resources. An inventory of culturally important plants and animals should be included in project surveys. As part of those surveys, areas suitable but lacking culturally important plants should be identified for possible management and reintroduction. This will allow culturally important natural resources to be included into future projects so they can be managed for continued vigor and sustainability. Consultation with the CTWS and other relevant tribes is important in developing these types of projects.

Recreation

Figure 34. Perry South Boat launch- Lower Metolius

Identification of Actions Needed to Achieve Desired Conditions

Existing Conditions

- This is the lowest use watershed area on our District- except for the localized use at Lake Billy Chinook at 2 campgrounds (Monty and Perry South) (Figure 34).
- Both Perry South and Monty Campgrounds have been recently upgraded with Pelton/Round Butte Funds
    - Perry South CG- Reconstruction of day use area and Boat Ramp, ADA parking and day use sites, new fisherman access trail, new restrooms, site improvements
    - Monty CG- 30 sites were reduced to 12, new restroom, gated user road to fish screen, added 2 ADA sites.
- The third most popular recreation site is balancing Rocks- a geological interest area. It has also been recently upgraded with an ADA trail and parking area.
- This area is the back door to the District with poaching and ATV issues.

    - There are at least 30 miles of illegally constructed single track motorcycle trails that have been found and GPS'ed. What to do next is unclear but being discussed by Recreation staff and law enforcement.
- Many dispersed campsites are found within the analysis area. Most receive low to moderate use during the spring, summer and fall seasons. The highest use of these sites likely occurs during the fall hunting season.
    - The Eyerly Road Decommissioning Project closed 38 miles of road in the area and limited motorized access to dispersed camping at 7 sites out of 25 in the project area.
- The Forest Service 2005 Travel Management Rule (36 CFR 212.50) mandated that each National Forest and Grassland publish a Motor Vehicle Use Map (MVUM) showing designated roads, trails, and areas open to motor vehicle use. Prior to this rule, National Forest and Grasslands were open to motor vehicle use unless designated closed.
    - The Deschutes National Forest finalized the MVUM rules and maps in the 2011 Travel Management Project Final EIS (USDA FS 2011a). The decision:
        - Limited motor vehicle use to existing designated roads and trail system roads
        - Create new conditions for motor vehicle access off of designated roads for dispersed camping
        - Changed some system roads to highway legal vehicle use only
        - Cross-country travel is no longer allowed except in designated areas.
        - The only motorized vehicle travel allowed off designated open roads or trails or outside of designated areas is to access dispersed camping sites. Motorized access for dispersed camping can occur at three types of sites: designated, defined, or existing.
        - Motorized access for dispersed camping sites is limited to 300 feet from the edge of a road. Motor vehicles at dispersed sites, cannot park closer than 30 feet from a stream, wetland, or water body.
        - The decision makes no changes to developed campgrounds and does not address motorized travel on snowmobiles or snow machines or other permitted activities such as firewood cutting.

Historic/Desired Condition

- The Metolius Wild and Scenic River ORV's are protected and enhanced for present and future generations.

Strategy to Achieve Desired Conditions

- Implement uncompleted actions in the Metolius WSR Plan

Potential Actions to Achieve Desired Conditions

Metolius WSR Plan

- Implement user registration at gates on Rd 64 and 1499.Develop registration forms and collect data.
- Monitor wood related to recreational boat use

Roads- Transportation Analysis

Step 1: Characterization

The general characteristics of roads located in the Sisters Ranger District and Crooked River National Grassland is Maintenance Level 2, native or improved native surfacing, in steep terrain areas. Conditions in this area range from two track Jeep trails to 28 foot wide, two way traffic, paved roads.

Jurisdiction authorities (Figure 35) include:

- Forest Service (including the Crooked River National Grassland)
- Bureau of Land Management
- Jefferson County
- Private entities
- Confederated Tribes of Warm Springs
- State of Oregon

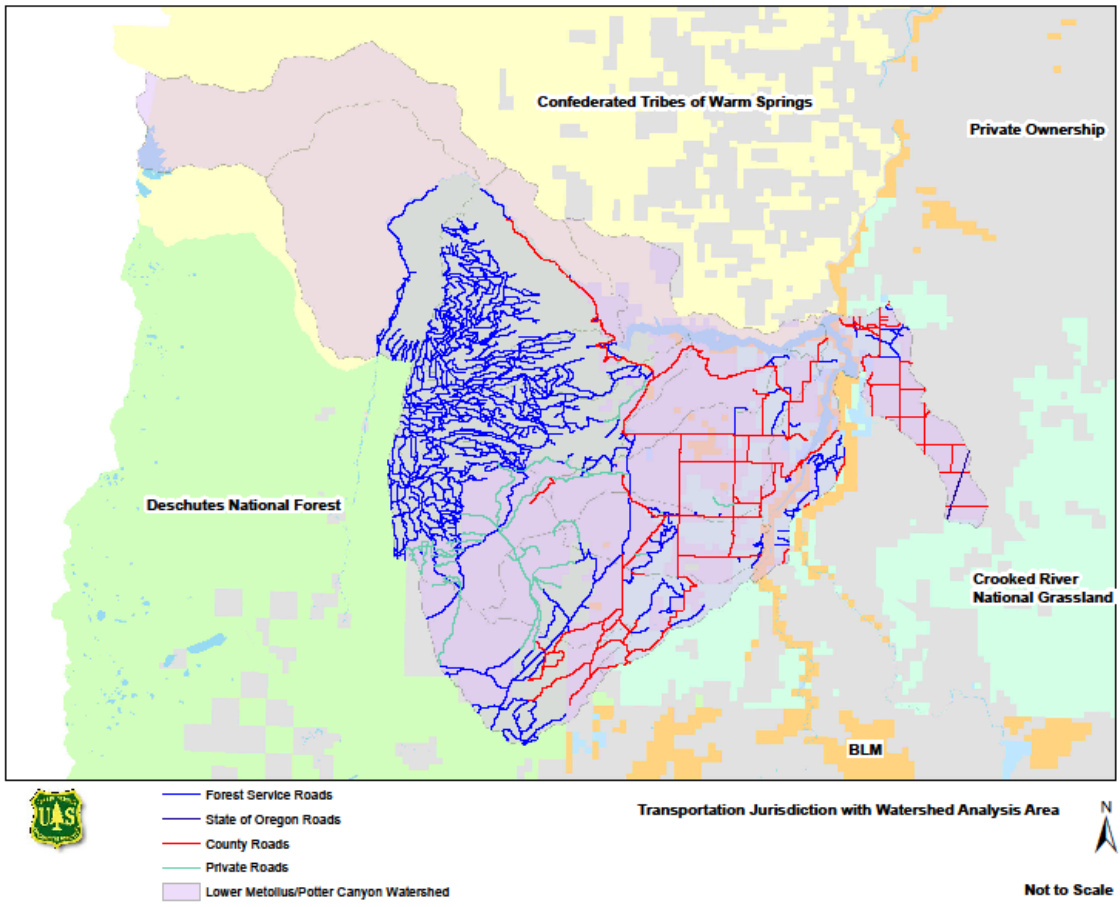


Figure 35. Map of the Analysis Area with Jurisdiction

Step 2: Issues and Key Questions

- How can the Forest Service provide more of a consistent maintenance program to some of the more travel Level 2 roads in the area?
- Can there be a more collaborate effort between public entities on road maintenance issues that included road erosion, culvert failures and human caused resource damage.

Step 3: Current Conditions

There is a wide range of transportation conditions within the Lower Metolius and Potter Canyon Watersheds. Beginning with the northwest section of the watershed where in lies the Warms Springs Reservation. Data is not easily available from the Warms Springs reservation and due to the level of detail required for this analysis. An assumption is made that most of the roads within the watershed are Level 2 type roads with very little or no maintenance

In the areas of the Eyerly Fire which includes the Middle and Lower Metolius sub basins is characterized by an assumed high road density. A majority of the roads are Forest Service with a maintenance level of two, single lane, native or improved native surfacing. Along with lands in the Warms Springs reservation

the terrain is steep with smaller sub basins within each sub basin, providing opportunities to convert overland sheet flow into more concentrated flows. This would have an effect on the roads system by possibly creating drainage paths along unmaintained roads and provide a pathway of concentrated sediment conduits. In the summer of 2012 the final phase of the Eyerly Fire Salvage Area (2002) was complete with the Environmental Assessment of the Eyerly Roads Decommission project. This purpose of this project is to decommission the final 36 miles of roads as recommended in Eyerly Roads Analysis in association with the Eyerly Fire Salvage Area. At the time of this report, the implementation of this project is currently underway. This would decrease the opportunity to transmit overland water flow into concentrated conduit flow and reduce the road densities in the area.

The terrain layout of the Upper and Lower Fly Creek areas have the same characteristics as the previously mentioned areas with more dense vegetation. Forest Roads 11 and 1170 in this area are used more for recreation to and from Monty and Perry South. These roads are partially funding by the Pelton Round Butte Dam relicensing agreement. In 2010, Forest Road 1170 was entirely reconstructed and portions of the road were realigned from the relicensing funding to improve traffic flow and safety. With this construction a number of drainage facilities were installed to reduce the chance of channel flow within the road bed.

The Crooked River National Grassland has a limited amount of federal roads. The Grassland was created during the 1930's as farmers were limited to water available in the area. This would reduce the crop yields that the farmers could produce and eventually would go bankrupt. During this time the Federal Government would purchase parcels of land to assist the farmers and eventually rehabilitate the land back to the native grassland that it once was. During the settlement of the homesteads, public right of ways were established to provide access to the homestead properties. As evidence of today, these public right of ways are still present as county roads and make up a majority of access routes in the Grassland. These roads are mostly would fit the category of "Maintenance Level 2" standards with no maintenance except as provide by local homeowners interspersed among the Grassland properties. Some roads provide major access to the area which are paved, striped and maintained by Jefferson County.

Travel Management

Travel Management began in 2001 and as part of the Code for Federal Regulations (CFR's), CFR36, Part 212 and gave the Forest Service direction on providing a sustainable transportation system to meet the needs for the public and Forest Service administrators. Travel Management is intended to identify opportunities for the forest transportation system to meet current or future management objectives, based on ecological, social, cultural, and economic concerns. The Forest Service Travel Management Rule, promulgated in 2005, contains three Subparts for this direction;

Subpart A – Administration of the Forest Transportation System which includes each forest will complete a minimum roads system analysis to identify unneeded roads. As of the date of this report, this portion of Travel Management is currently being accessed on the Deschutes, Ochoco National Forest, and the Crooked River National Grassland.

Subpart B - Designation of roads, trails, and areas for motor vehicle use. This portion of Travel Management assessment was completed in 2011. This portion make cross country travel across Forest

Service Lands illegal and the Forest Service issue maps of open Forest Service roads which are legal for motorized travel.

Subpart C - Use by over-snow vehicles. This portion of Travel Management has not been addressed.

In August of 2014, the Bridge 99 Fire affected approximately 5,278 acres of forest lands in which 3,765 acres are within the subject watersheds. An indirect effect from the fire is an increase of maintenance on roads that never receive maintenance on a scheduled cycle. At the time of this report, BAER (Burnt Area Emergency Response) funding and rehabilitation of the fire area has not occurred but is scheduled for November of 2014. The BAER activities include stabilizing drainage crossings along Forest Roads 1499, 1490, and other roads. See BAER map for further details.

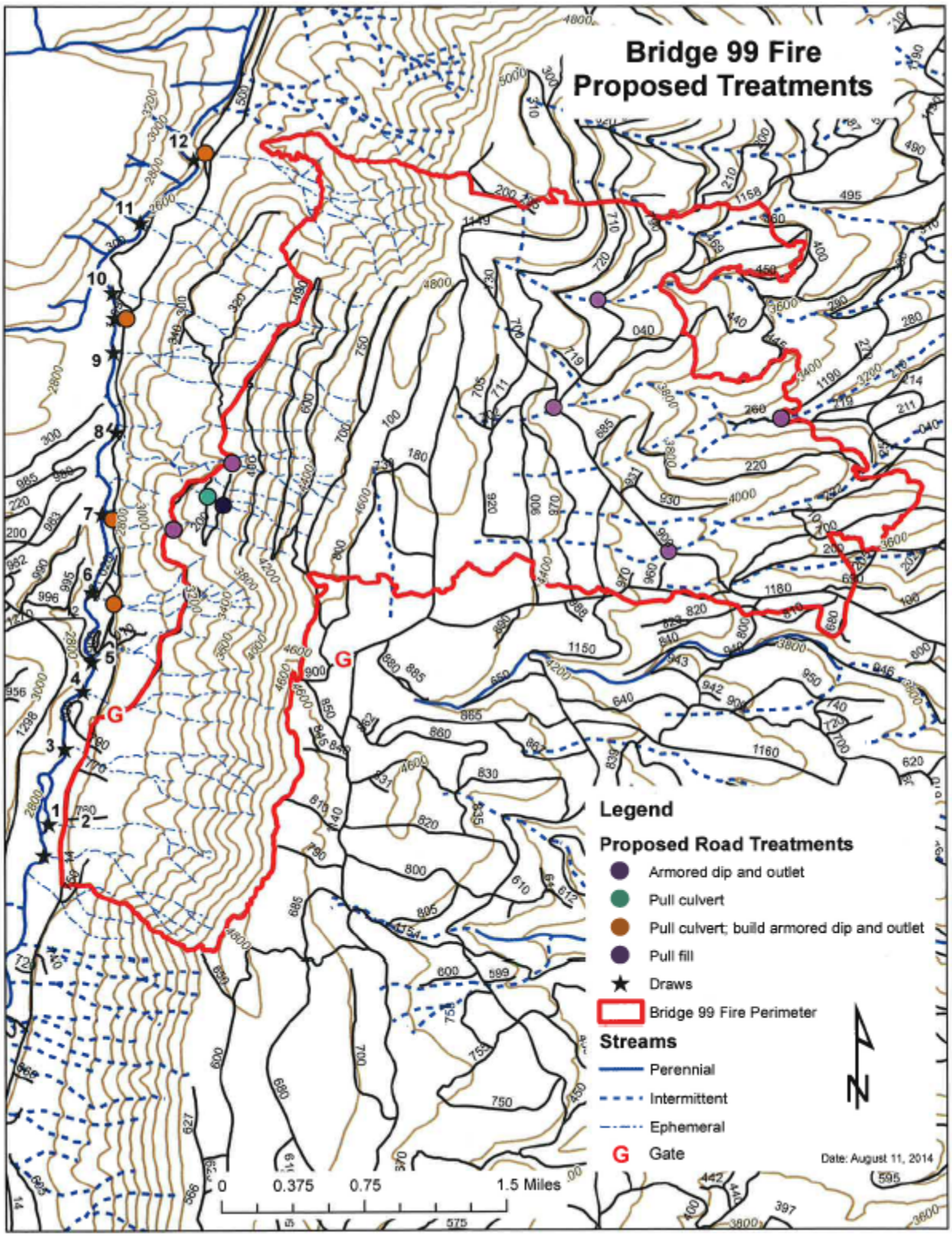


Figure 36. Bridge 99 Fire BAER Map

Lower Metolius Watershed

The transportation system in the Lower Metolius Watershed analysis area consists of about 331.56 known miles of open road (not include roads under the jurisdiction of Confederated Tribes of Warm Springs), as follows (Tables 39, 40 41, and 42):

Forest Service Roads – The analysis area has a total of 251.62 miles of open Forest Service roads including Forest Roads 11, 1170, 1190, 1180, and 1150.

Jefferson County Roads - The analysis area has 47.82 miles of roads under the jurisdiction of Jefferson County. This includes County Road 64 to Monty Campground.

Private Roads – The analysis are contains 32.12 miles of private roads. These roads are under the jurisdiction of individual private property land owners. Maintenance is also under each owner and the extent of the maintenance is not known.

Table 39. All open roads (in miles) within the Lower Metolius Watershed

Lower Metolius Watershed		
Forest Service	Jefferson County	Private
251.62	47.82	32.12

The open road densities for the entire watershed including all lands (private, Tribal, public) with only Open Roads calculates:

Lower Metolius Watershed = 227.84 $mile^2$

All Open Roads = 331.56 miles

Open Road Density = 331.56 miles/227.84 $mile^2$ = 1.45 $miles/mile^2$

Table 40. Forest Service jurisdiction roads (miles) within the Lower Metolius Watershed in the Sisters Ranger District and Crooked National Grassland.

Lower Metolius Watershed			
Maintenance Level 1 (closed)	Maintenance Level 2	Maintenance Level 3	Maintenance Level 4
85.01	218.90	5.28	4.34

The Forest Service open road densities for lands governed by the US Forest Service with only Forest Service Roads calculates:

Lower Metolius Watershed (Sisters Ranger District, Crooked River National Grassland) = 86.90 $mile^2$

Open Forest Service Roads = 228.52 miles

Open Forest Service Road Density = 228.52 miles/86.90 $mile^2$ = 2.62 $miles/mile^2$

The difference in open Forest Service roads between the two analyses represents Forest Service road on non-federal lands with associated easements.

Potter Canyon Watershed

The transportation system in the Potter Canyon Watershed analysis area consists of about 156.45 miles of road, as follows:

Forest Service Roads – The analysis area has a total of 58.60 miles of Open Forest Service roads. A majority of these roads are typically spur roads originating at Jefferson County road intersections.

Jefferson County Roads - The analysis area has 78.01 miles of roads under the jurisdiction of Jefferson County. This includes County Roads 64 and 63. These roads service the residential roads within the area.

Private Roads – The analysis are contains 17.24 miles of private roads. These roads are under the jurisdiction of individual private property land owners. Maintenance is also under each owner and the extent of the maintenance is not known.

State Roads – This consist of 2.6 miles of Highway 97.

Table 41. Open Roads (miles) within the Potter Canyon Watershed

Potter Canyon Watershed			
Forest Service	State	Jefferson County	Private
58.60	2.60	78.01	17.24

The open road densities for the entire watershed including all lands (private, Tribal, public) with only Open Roads calculates:

Potter Canyon Watershed = 91.48 $mile^2$

Open Roads = 156.45 miles

Open Road Density = 156.45 miles/91.48 $mile^2$ = 1.71 $miles/mile^2$

Table 42. Forest Service jurisdiction roads (miles) within the Potter Canyon Watershed in the Sisters Ranger District and Crooked National Grassland.

Potter Canyon Watershed			
Maintenance Level 1 (closed)	Maintenance Level 2	Maintenance Level 3	Maintenance Level 4
7.50	39.14	0.0	0.0

The open road densities for lands governed by the US Forest Service with only Forest Service Roads calculates:

Potter Canyon Watershed (Forest Service Land) = 32.54 $miles^2$

Open Forest Service Roads = 46.64 miles

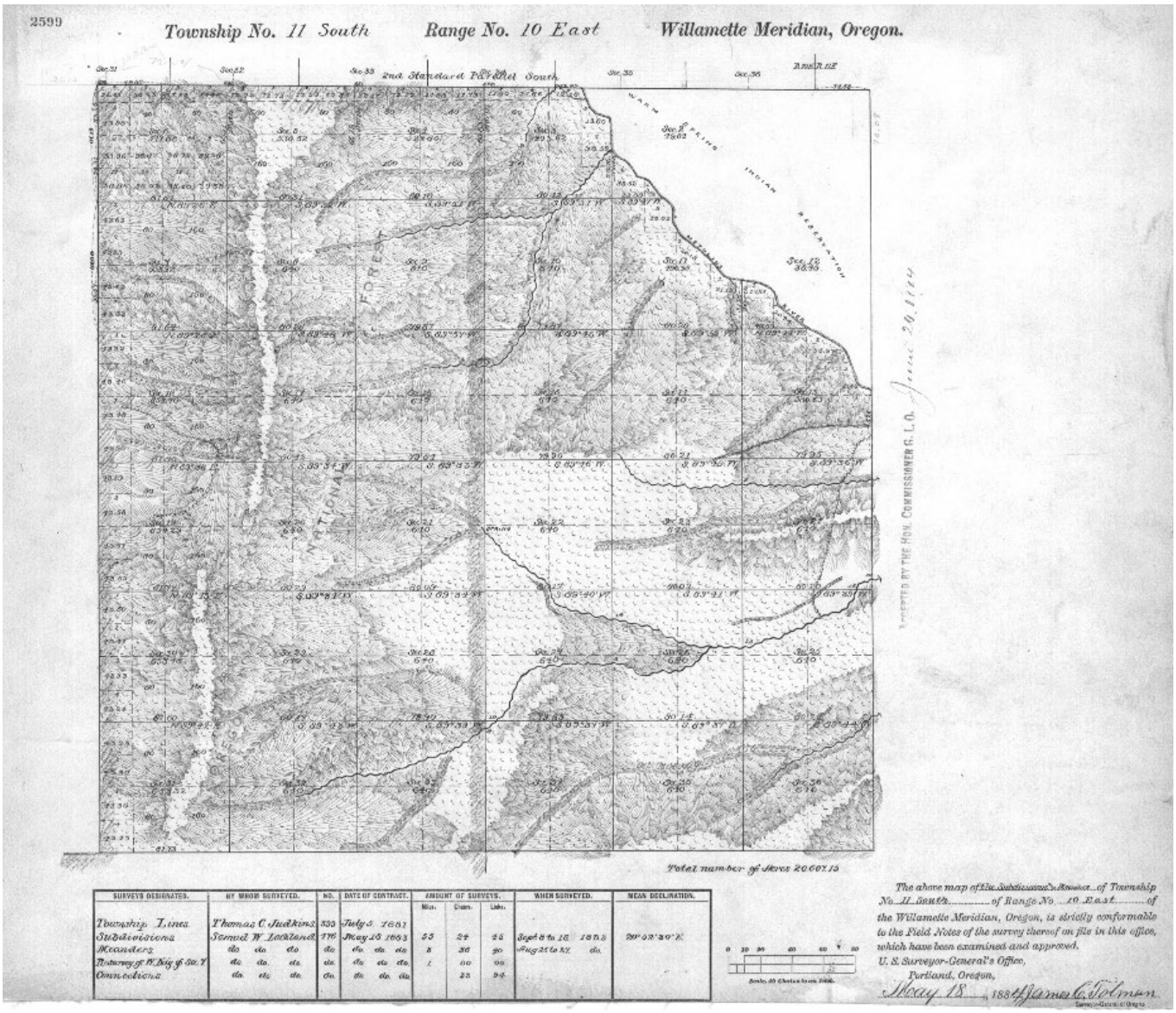
Open Forest Service Road Density = 46.64 miles/32.54 mile^2 = 1.43 miles/mile^2

Step 4: Reference Conditions

After reviewing BLM maps (Figure ##) from the 1880's the increase of road mileage has increased dramatically. Roads on the Sisters Ranger District within the watershed that were in existence since 1881 that are still being utilized today. Roads and trails in the late 19th century were built and constructed to travel from point A to point B. The current road system was constructed to extract the raw timber from the forest and to deliver the product to market.

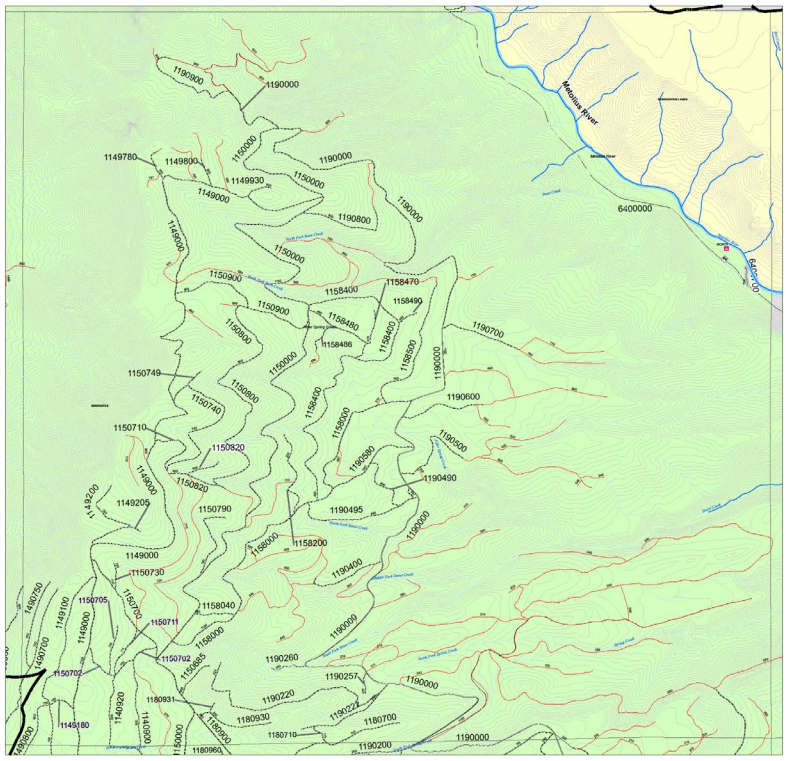
Sections of roads being utilized then and now are sections of Road 12 near the Dahl Ranch, sections of Road near the House on the Metolius, sections of private roads within the Ponderosa Land and Cattle property, and sections of private and County roads around the Fly Creek area.

With modern road building technology, the construction and use of roads within the watershed have enabled the public and administrators of public land to easily and efficiently to gain access and manage the land better than our predecessors but with a price of increasing the chance and introducing more sediment into the drainage basins and the opportunity to distribute evasive weeds in a more efficient manner.



SURVEYS DESIGNATED.	BY WHOM SURVEYED.	NO.	DATE OF CONTRACT.	AMOUNT OF SURVEYS. Miles.	Chains.	Links.	WHEN SURVEYED.	MEAN DECLINATION.
Township Lines	Thomas C. Judkins	535	July 5 1861					
Subdivisions	Samuel W. Lockland	776	May 25 1863	55	24	25	Sept 8 to 12 1868	20° 03' 30" E.
Meanders	do do do		do do do	8	36	90	Aug 21 to 31 do.	
Retracing of E. line of Sec 7	do do do		do do do	1	00	00		
Omn-exterior	do do do		do do do		23	94		

Figure 37. Lower Metolius in T11S, R10E in the 1880's followed by a map of the existing conditions.



Step 5: Synthesis and Interpretation

The purpose of this step is to compare existing and reference conditions and explain the differences, similarities and to identify key management plan objectives for the area.

The existing conditions currently a wide ranging road network. Road conditions range from improved aggregate base roads including Forest Road 1150 and part of Forest Road 1190 which traverses north from the Prairie Farm Area up to Castle Road to very rough, almost Jeep trail conditions such as Forest Road 1149. Maintenance has been rare in the area of the Sisters Ranger District due to the fact it is very remote as compared to other areas in the District with developed recreations sites. Many roads, as stated before have lack sufficient maintenance over the years. The result of this is roads with no distinguish crowns to properly drain water; ditches not being cleaned out, bushes and shrubs are starting to overgrown the road to the point where roads have simply disappeared from the landscape. If roads are not receiving maintenance, the chance of transferring sentiment increases over time.

The reference conditions as dated in the 1880's include very few roads. These roads were established to connect the main Santiam Wagon Road with the Confederated Tribes of Warm Springs. The roads were mainly two track wagon roads which could allow horses and wagons to traverse the terrain to the reservation. There is evidence from old Bureaus of Land Management maps there were two trails traversing in a north south direction to the Warm Springs Reservation. One is located in the Metolius Basin, west of Green Ridge. The other trail is located east of the Fly Creek Canyon area.

The two road networks are very different as to the purpose of their construction. The older road networks were to transport people and possibly goods and services to the Warm Spring Network. There is evidence of western road serving as access to a telephone line up to the reservation.

The newer road network was construction for access to timberlands for the extraction of timber products to markets. Reviewing the maps in regards to the Eyerly area there was no road network in the area as compared to the existing road network as established in the Eyerly area. Within the Lower Metolius Watershed, the Eyerly area has a high road density as compared to 130 years ago.

Key direction from the Deschutes National Forest Land Management plan within the transportation section indicates to adjust the road network to represent road densities to 2.5 miles per square mile, pursuant to guidelines established by wildlife management. Direction from the Management Plan also indicates to provide and safe and efficient road network.

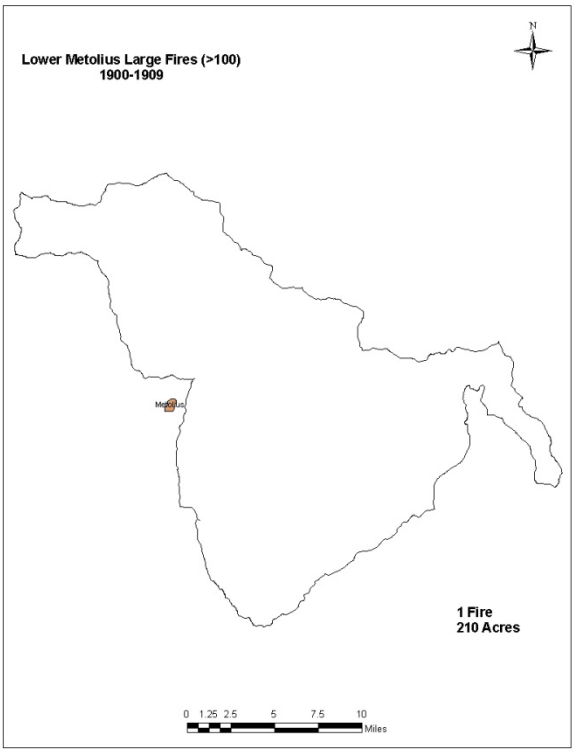
Step 6: Recommendations

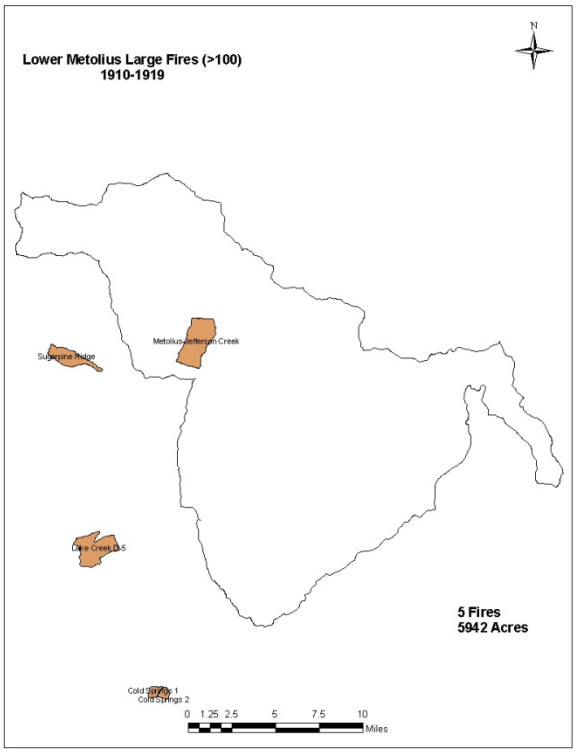
The recommendations and opportunities would be as follows:

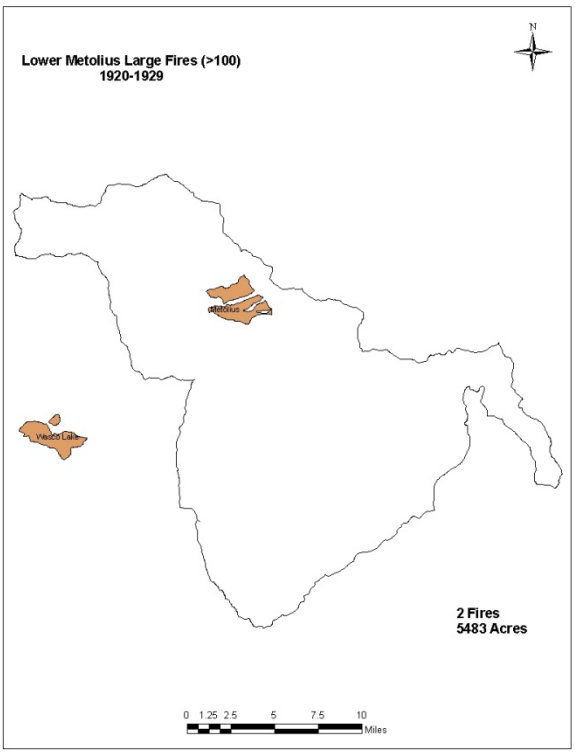
1. Increase the maintenance required for the road system to effectively drain water and reduce the chance of sediment transmission. Find opportunities to apply maintenance to roads through projects, Road Use Permits, and other means.

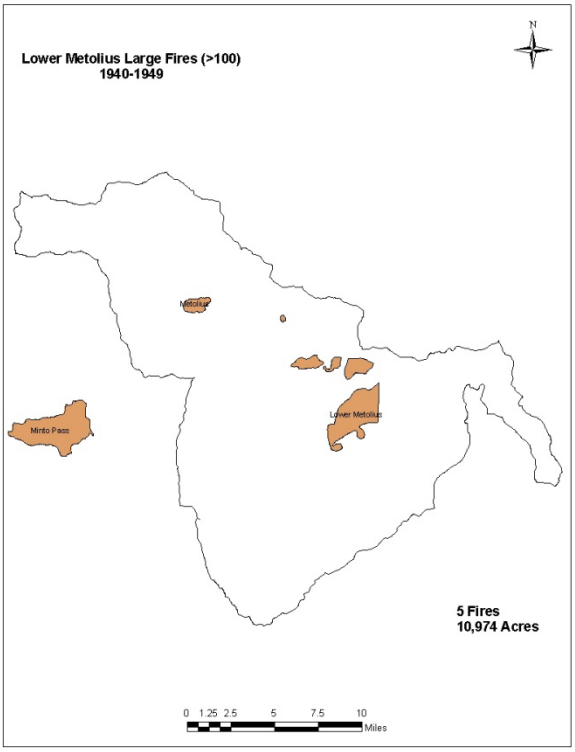
2. Collaborate with other agencies to repair drainage and road facilities that affect the watersheds.

Appendix A. Fires by Decade within or near Analysis Area.

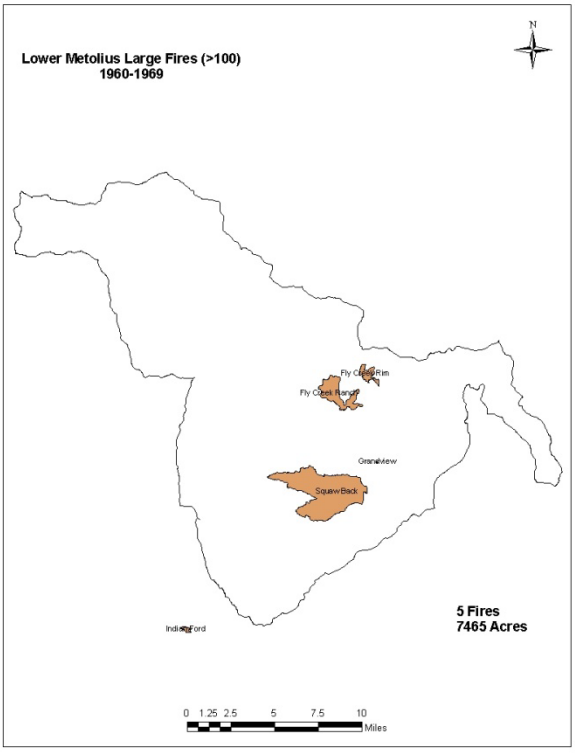






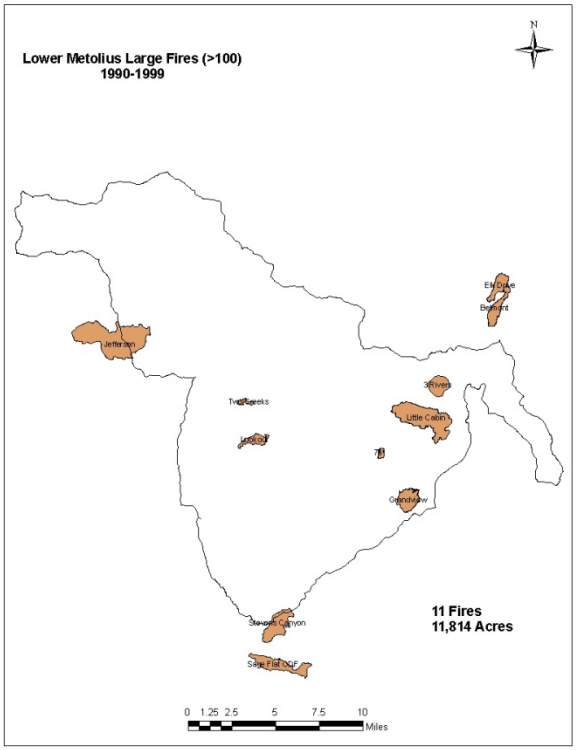

Lower Metolius Large Fires (>100)
1940-1949
N
Metolius
Minto Pass
Lower Metolius
5 Fires
10,974 Acres
0 1.25 2.5 5 7.5 10
Miles

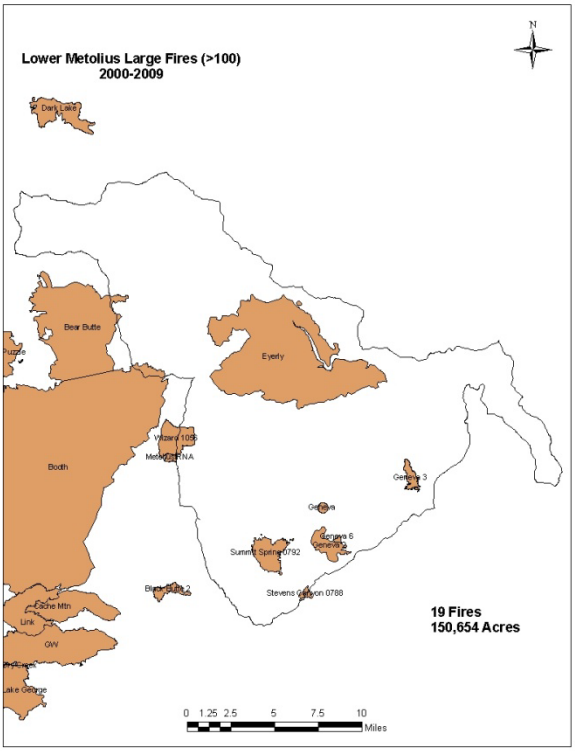

Lower Metolius Large Fires (>100)
1950-1959
N
1 Fire
223 Acres
0 1.25 2.5 5 7.5 10
Miles

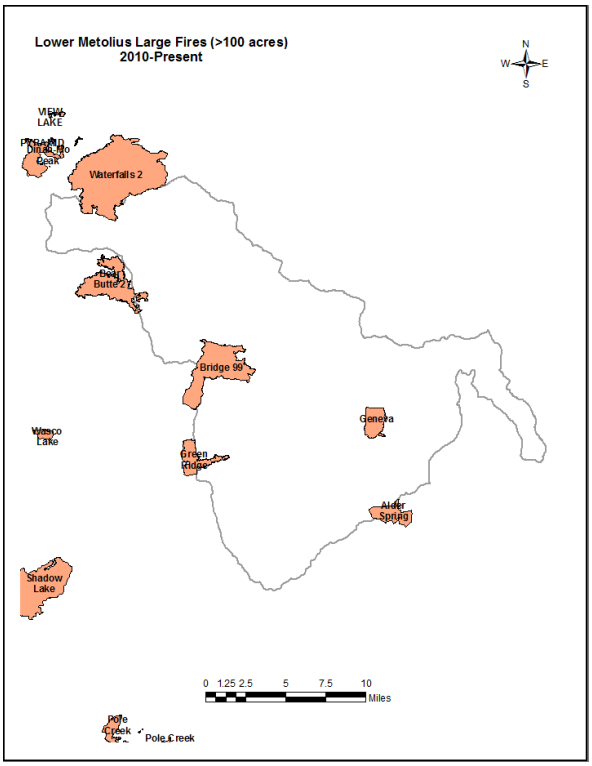

Lower Metolius Large Fires (>100)
1960-1969
N
Fly Creek Rim
Fly Creek Ranger
GrandView
Squaw Back
Indian Ford
5 Fires
7465 Acres
0 1.25 2.5 5 7.5 10
Miles


Lower Metolius Large Fires (>100)
1970-1979
N
No Large Fires
0 1.25 2.5 5 7.5 10
Miles


Lower Metolius Large Fires (>100)
1980-1989
N
Cabot Lake
Fly Creek
Black Butte
5 Fires
5348 Acres
0 1.25 2.5 5 7.5 10
Miles


Lower Metolius Large Fires (>100)
1990-1999
N
Jefferson
Elk Drive
Elephant
Stevens
Little Cabin
Opendraw
Skeleton Canyon
Saw Fish OF
11 Fires
11,814 Acres
0 1.25 2.5 5 7.5 10
Miles


Lower Metolius Large Fires (>100)
2000-2009
N
Bear Butte
Everly
Booth
Cache Mtn
Link
GW
Lake George
Summit Spring 0792
Stevens Canyon 0788
19 Fires
150,654 Acres
0 1.25 2.5 5 7.5 10
Miles


Lower Metolius Large Fires (>100 acres)
2010-Present
N
W
E
S
Waterfalls 2
Bridge 99
Geneva
Green Ridge
Alder Spring
Shadow Lake
0 1.25 2.5 5 7.5 10
Miles
Pole Creek
Pole Creek

Appendix B- Literature Cited

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