



1.2 Middle Fork Willamette Watershed Watershed Mapping Activity

This activity is designed to get students thinking about their sense of place in the watershed. Without looking at a map, it highlights their current knowledge of the watershed's major features, and how they are connected. Students will have an opportunity to reflect on the places they've been and meaningful experiences they've had there.

Time: 30-45 minutes

Materials:

- Sidewalk chalk or
- Yarn/thick string, scissors, and masking tape

The sidewalk chalk is easier to use for this activity, if you have an appropriate outdoor space available. If you need to be inside, students can use the string, taped to the floor, to outline features on the map.

Outcome:

Students gain a greater awareness of their local watershed by working as a team to share knowledge and create a large map.

Drawing the map:

Teacher instruction should be minimal, as this is an exercise in teamwork as well as a pre-assessment of prior knowledge. Ask students to draw a large map of the Middle Fork Willamette Watershed. Let them know that the map needs to be big enough that they can stand in it at various places.

Depending on their background knowledge, you may want to give them some key elements to include in their map. You can choose from the following options, giving them just categories, or specific places to include:

- Cities: Oakridge, Westfir, Dexter, Lowell, Fall Creek, Pleasant Hill, Springfield, Eugene
- L-akes and Reservoirs: Hills Creek, Lookout Point, Dexter, Fall Creek, Timpanogas Lake, Waldo Lake
- Rivers and Creeks: Middle Fork Willamette, North Fork Willamette, Salmon Creek, Salt Creek
- Geographical Features: Diamond Peak, local mountains and buttes, etc.

Middle Fork Watershed Stewards



Exploring the map:

Once the students have drawn their map, ask them to stand in a place where they have had a meaningful experience. Choose a few volunteers to share where they are and what happened there. Next, ask students to stand in a place they would like to visit in the future. Choose a few volunteers to share where they are and why they want to go there.

Have a photographer document the process and the finished product.

Discussion Questions:

- How did the group work together?
- Did you come up with a plan first?
- What roles did people take?
- What was it like for you to draw the map?
- Who jumped right in? Who stood back a bit? Why?

After the activity, or the next time the group is together, look at the provided map of the watershed. Have students reflect on what parts of the map they were able to create accurately, and what parts were new to them.

- Which parts of the watershed were the most familiar to the group?
- What features would they change on their map?
- What features were missing that they would add?

1.2 The Middle Fork Willamette Watershed: There's No Place Like Home

Imagine yourself standing at the summit of snow crested Diamond Peak, looking northwest. Taking in the expansive view is like looking at a map of the Middle Fork Willamette Watershed. You can see the topographic diversity of mountains and valleys, forests, rivers, and lakes, that make up the pristine place that fish, wildlife, plants, and people call home. The snow underfoot, when it melts, will begin its long journey from high elevation springs to mountain streams, surrounded by steep coniferous forest. It will provide habitat for fish, quench the thirst of many mammals, and supply water to plants' roots. As steep mountain valleys converge, their streams come together in a branching pattern that resembles the branches of a tree, and the veins in the human body. Where mountains meet valleys, streams converge into meandering rivers, becoming wider and deeper, providing habitats for different types of plants and animals. All of the water in the streams and creeks drains into the Middle Fork Willamette, bringing all the rich nutrients from the mountains above, down to the fertile Willamette Valley, and eventually meeting up with the Columbia river and flowing into the ocean.

You are privileged to call this abundant landscape home. The watershed provides your community with opportunities to recreate on beautiful mountain trails and clear lakes; opportunities to observe wildlife, hunt, and harvest timber. Ecosystem services keep air pure and water clean. You live in a pristine place that is unique and worthy of protection. When you see a bald eagle flying overhead, a fish swimming in a deep clear pool, or a butterfly sipping nectar from a native wildflower, you are experiencing the results of the healthy habitats of our watershed. You have the opportunity to be a steward to the watershed, to protect native habitats and keep our water clean. The Middle Fork Watershed Stewards program will provide important background knowledge and tools to understand local ecosystems, and protect and enhance them for future generations.

The Middle Fork Willamette Watershed (MFWW) is approximately 865,920 acres, comprised of 95% forest land (72%public, 28% private). Land use in the watershed consists of agriculture, industry, timber production, conservation, public water supply, rural/residential and recreation. The population within the watershed is close to 24,000 and includes the communities of Oakridge, Westfir, Dexter, Lowell, Springfield, Jasper, Pleasant Hill, Lost Creek, Fall Creek and Little Fall Creek.

The Middle Fork Willamette River (MFWR) forms the headwaters of the Willamette River, which has the 13th largest stream flow in the United States, and is one of few rivers that flows south to north. The MFWR has its origins in the volcanic rocks in the west Cascades. Near the creast of the Cascades is Waldo Lake, which has some of the purest water anywhere in the world. Heavy precipitation in the form of rain and snow seep into the Cascades aquifer and deliver high quality water in steady quantities to dozens of stream networks that flow to the MFWR and support multiple beneficial uses such as drinking water and habitat for salmonids and bull trout.

Middle Fork Watershed Stewards

Middle Fork Willamette



The MFWW is a biologically rich watershed that supports healthy populations of aquatic, terrestrial and avian species. Species of concern, such as, bull trout, Oregon chub, spring Chinook, brook lamprey, western pond turtles, northern red-legged frogs, Northern Spotted Owl, bald eagles, and migratory birds utilize the rich habitats and corridors in the watershed. In recognition of the rich habitat and potential for ecological uplift through habitat enhancement, biologists from State, Federal and private organizations have considerable interest and commitment in coordinating restoration efforts with the Middle Fork Willamette Watershed Council and stakeholders in the MFWW. The Oregon Chub has recently been delisted from the Endangered Species Act, partly in thanks to restoration efforts throughout the watershed.

The Middle Fork Willamette Watershed Council

The Middle Fork Willamette Watershed Council (MFWWC) mission is to work together as a community to restore, enhance and sustain the ecological integrity and economic viability of the watershed. The MFWWC is a 501c3 non-profit organization with a volunteer-based partnership of diverse watershed stakeholders that focus on promoting sustainability and making the Middle Fork Willamette Watershed (MFWW) a better place to live, work, and visit; for current and future generations. The MFWW supports a diversity of ecosystems and species: natural assets that define the character of the region, deliver ecosystem services, and provide value as working landscapes and recreational hotspots.

Climate Change and Future Restoration Efforts

Although it is unclear exactly how global climate change will impact the Middle Fork Willamette Watershed, the MFWWC is planning for the future by incorporating strategies that focus on ecological resiliency. Climate models agree that the Pacific Northwest will experience an increase in temperatures, a shift in seasonal patterns of precipitation, and increased frequency and severity of extreme weather events (Battin et al. 2007; Doppelt et al. 2009).

Despite uncertainty in climate change models, projected impacts on salmon habitat and productivity have been negative across-the-board (Battin et al. 2007). Higher water temperatures are projected to seriously impact native aquatic species that are sensitive to high temperature, such as salmonids, trout, and amphibians. (Mantua et al. 2009). Increased temperatures will result in a significantly declining snowpack in the Pacific Northwest (Doppelt et al. 2009), which will produce lower summer and fall flows that will reduce spawning habitat and exacerbate water temperature issues (Battin et al. 2007). Changes in seasonal precipitation patterns will alter the timing and magnitude of peak flows (Doppelt et al. 2009). Native species and populations that are most at risk from climate change are those at high elevations, dependent on old-growth, associated with maritime evergreen communities, are moisture dependent (waterbirds, snails, amphibians, etc.), and species that are already rare or declining (Doppelt et al. 2009). In addition to negative impacts to native species, climate change will also likely find new conditions favorable for non-natives. For instance, increases in water temperature will favor exotic warmwater fish species such as bass, while on land, increased temperatures may benefit insect pests, invasive plants, and diseases. However, some native habitats could benefit from climate change, like the unique Ponderosa pine/white oak community at Jim's Creek, which prefers warmer, drier conditions.

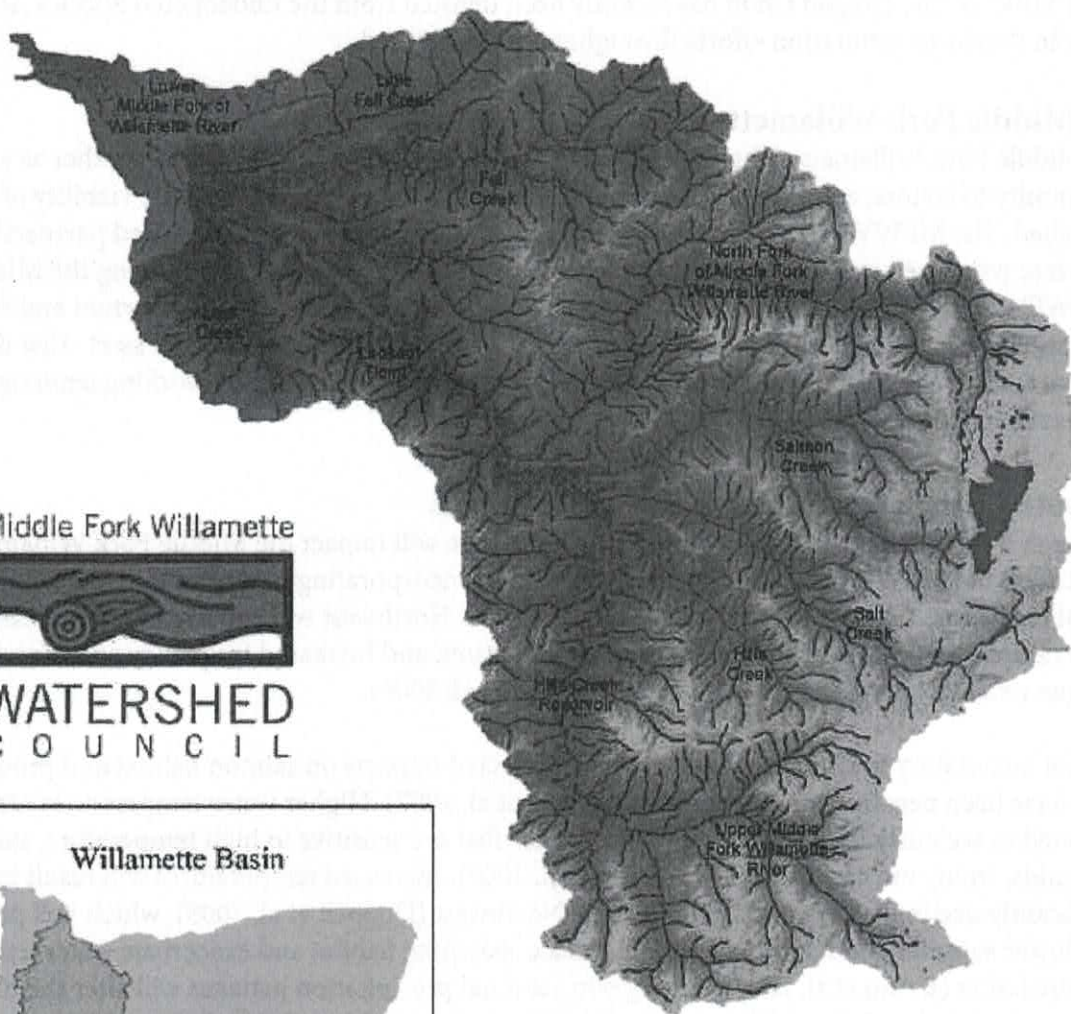
Middle Fork Watershed Stewards

Middle Fork Willamette



WATERSHED
COUNCIL

Middle Fork Willamette Watershed Subbasins (HUC 5)

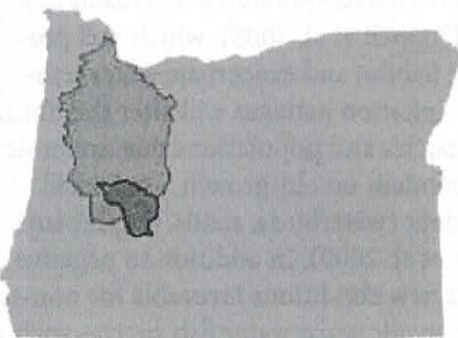


Middle Fork Willamette



WATERSHED
COUNCIL

Willamette Basin



0 5 10 20 Miles

Map created by Middle Fork Willamette Watershed Council
Data Source: USDA NRCS Watershed Boundaries Dataset 1:24k
Map Date: 2012
Projection: Lambert Conformal Conic

Middle Fork Watershed Stewards

Middle Fork Willamette



WATERSHED
COUNCIL

The Subwatersheds of the Middle Fork Willamette Watershed

Subwatersheds exist for each of the major waterways that are a part of the greater watershed. The Middle Fork Willamette Watershed is made up of 11 sixth field (or sub) watersheds as defined by the USGS. The subwatersheds of the Middle Fork Willamette Watershed are Upper Middle Fork, Hills Creek, Hills Creek Reservoir, Salmon Creek, North Fork, Salt Creek, Lookout Point, Fall Creek, Lost creek, Little Fall Creek, and Lower Middle Fork. It can also be helpful to look at the MFWW in terms of Upper, Middle, and Lower Watersheds, since the ecosystems and influences change as the river flows downstream.

The Upper Watershed is comprised of the following subwatersheds:

Upper Middle Fork, Hills Creek, Hills Creek Reservoir, Salmon Creek, North Fork, Salt Creek
Communities: Oakridge, Westfir

The Upper Watershed is also known as the Western Cascade Ecoregion. Steep, often inaccessible wild streams and rivulets follow gravity down from the higher elevations toward the lower valley floors. The headwaters of the Upper Middle Fork Willamette are predominantly spring-fed and often have sections that are subterranean due to highly porous volcanic material at the crest of the Cascades. Warmer headwaters also flow from Timpanogas lake. Hills Creek, Salmon Creek, North Fork Willamette, and Salt Creek, also with headwaters at the crest of the Cascades, all flow into the Middle Fork Willamette in the Upper Watershed, near Oakridge. The upper watershed has many alpine lakes and trails, making it a popular destination for recreation.

Keystone Species: Oregon chub, western pond turtle, lamprey, salmonids, pileated woodpecker, peregrine falcon & bald eagle (foraging), northern spotted owl, Northern red-legged frog, red tree vole, elk, mountain lion, gray wolf

Primary Invasives: Scotch broom, Himalayan blackberries, Japanese knotweed, *Potentilla recta*, rose campion, English Ivy, False Brome

The Middle Watershed is comprised of the following subwatersheds:

Lookout Point and Fall Creek
Communities: Fall Creek

Due to its close proximity to the Eugene-Springfield metro area and the high percentage of federal lands, the Middle Watershed is a destination for recreation. An aerial view shows a patchwork of recent clearcuts, tree plantations, and mature forest, including old growth. The lower part is within the Willamette Valley ecoregion, and contains oak savannas and grasslands. Most of this watershed is within the Western Cascades ecoregion, and is dominated by Douglas-fir/Western hemlock forests. There are areas of ponderosa and sugar pine, a quaking aspen grove, and several upland meadows and outcrops.

Middle Fork Watershed Stewards

Middle Fork Willamette



Keystone Species: Western pond turtles, Oregon chub, Northern spotted owls, Townsend's big-eared bats, and Roosevelt elk, Northern red-legged frog, bald eagle

Primary Invasives: Scotch broom, Himalayan blackberries, Japanese knotweed, Potentilla recta, rose campion, English Ivy, False Brome

The Lower Watershed is comprised of the following subwatersheds:

Lost creek, Little Fall Creek, Lower Middle Fork

Communities: Pleasant Hill, Dexter, Lowell, Jasper, Springfield

The lower watershed falls within the Willamette Valley Ecoregion. It encompasses the area downstream of the Lookout Point Dam. Along the valley floor, roads, communities, infrastructure, and larger order rivers and creeks exist. There are significant urban areas as the Middle Fork Willamette reaches the confluence with the mainstem of the Willamette River. Impacts from the urban areas, agriculture, dams, and high road density are significant, however, water quality remains in relatively good condition.

The Lower Middle Fork Watershed provides important habitat for spring Chinook salmon, rainbow and cutthroat trout, Pacific and brook lamprey, and Oregon chub, in addition to a host of other native species. Bull trout have been extirpated from the lower Middle Fork. There are many non-native fish species present which compete with native species for limited habitat and/or prey upon native fish. Non-native fish species include largemouth and smallmouth bass, panfish such as bluegill and crappie, as well as mosquitofish.

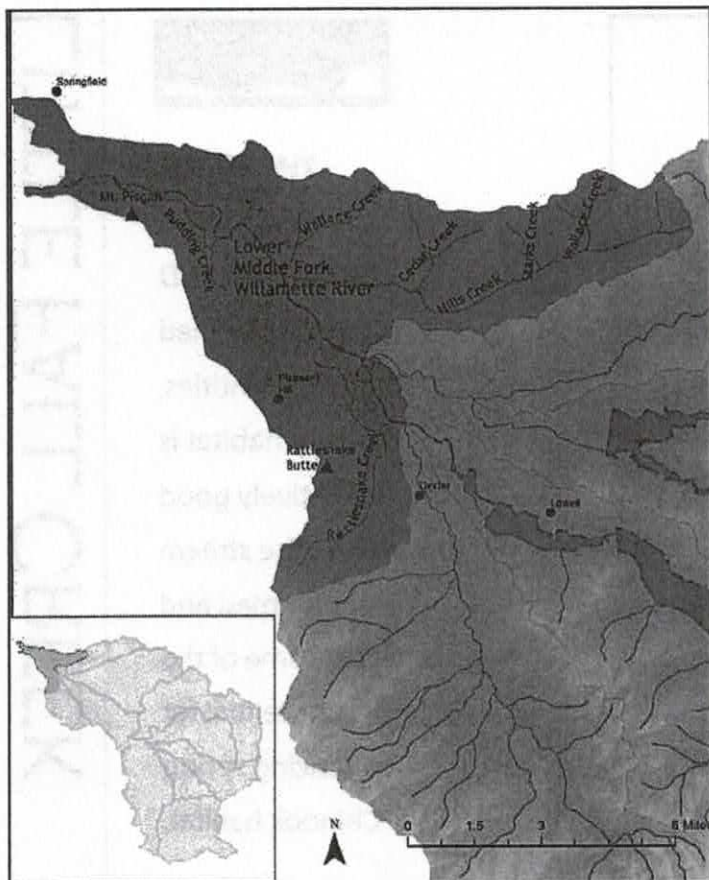
Primary Invasives: Himalayan blackberry, Scotch broom, English ivy, knotweed, false brome, as well as aquatic weeds like Eurasian watermilfoil and yellow flag iris.

1.2 Middle Fork Willamette Watershed

Discussion

1. List 3 new statistics you learned about your local watershed.
2. Use the lists of plants and wildlife species prevalent in the Middle Fork Willamette Watershed to answer:
 - Which plants and wildlife species have you seen?
 - Which ones do you hope to see?
 - Which ones were you surprised to learn live in the MFWW?
3. Which subwatersheds have you visited?
4. Describe one of the places you visited, including details like
 - plants and wildlife present
 - bodies of water
 - observable sign of human impact (dams, stumps, invasive species, litter...)
 - what makes the place special?

LOWER MIDDLE FORK



THE LOWER MIDDLE FORK SUBWATERSHED

includes significant urban areas as it reaches the confluence with the mainstem of the Willamette River. Impacts from the urban areas, agriculture, and high road density are significant, however, water quality remains in relatively good condition.

WATERSHED CHARACTERISTICS

36,000 total acres

Land Ownership

- 13% Bureau of Land Management
- 24% Private industry; 61% Other private land
- 2% State of Oregon
- Includes significant urban areas

Riparian Function

- Lack of seasonal flooding has caused a reduction in complex riparian and floodplain habitat

Large Wood Potential

- Considered insufficient for fish habitat in 46% of total stream miles

Special Habitats

- Significant remnant oak woodlands and prairies

Roads

- High number of roads near streams (riparian zone)

Water Quantity & Quality

- Summer temps sometimes exceed DEQ standards

The Lower Middle Fork subwatershed is transitioning from hardwood to conifer forest due to lack of seasonal flooding resulting from dams.

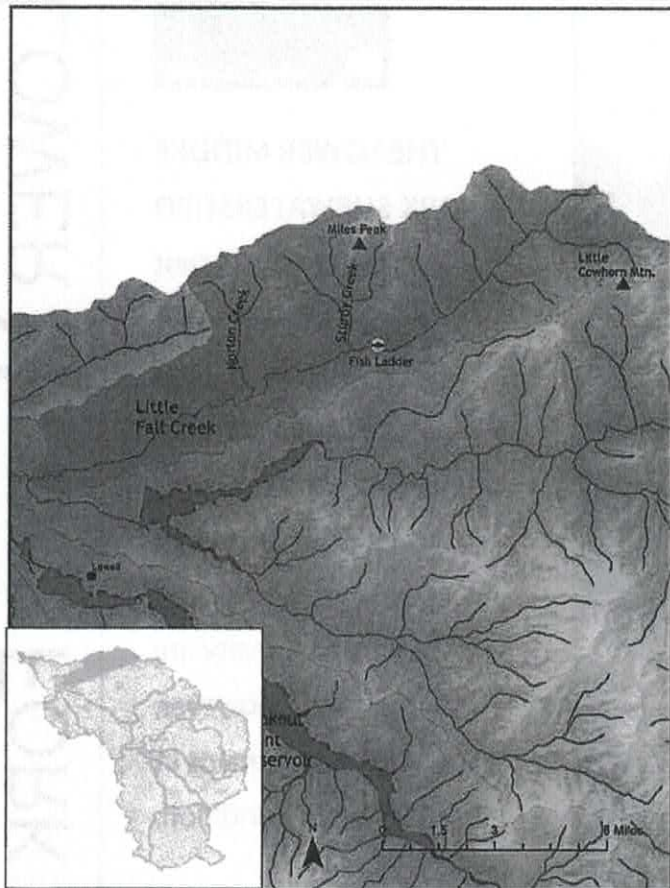
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|---|---|
| 1. Flow regime frequency and duration of natural hydrograph | 6. Hydrological regime - maintenance of natural hydroperiod |
| 2. Quantity of large wood in stream; Pool-to-riffle ratio; Standard deviation of thalweg profile | 7. Wetland native plant community |
| 3. Floodplain inundation frequency / groundwater elevation | 8. Quality and quantity of mosaic patch sizes |
| 4. Riparian corridor continuity and buffer width; Riparian plant community diversity and structural diversity; Invasive species cover | 9. Beaver abundance and distribution |
| 5. Abundance of riparian / floodplain | 10. Native plant community |
| | 11. Frequency of disturbance by fire |
| | 12. Frequency of disturbance by fire, herbivory, windthrow |

PRIORITY INDICATORS

- | | |
|---|---|
| 1. Dam operations; Road in riparian areas route water directly to stream, altering peak discharge | 5. Development in the floodplain and installation of riprap and levees |
| 2. Large wood removed from channel; Reduced riparian vegetation limits recruitment of large wood; Channel straightened, confined, simplified, armored | 6. Hydrology altered to facilitate draining; ditches and tiles |
| 3. Presence of levees and riprap reduces connectivity; Lack of natural floodplain storage due to development and other activities in floodplain | 7. Presence of invasive species |
| 4. Habitat loss; Invasive species; Spread of invasives into riparian area due to disturbance | 8. Loss of critical wetland and prairie habitat due to land use change and hydrological modification |
| | 9. Lack of riparian forest understory |
| | 10. Invasive species cover; Urban development |
| | 11. Fire suppression |
| | 12. Fire suppression; Forest management practices have reduced impacts of disturbance on habitat complexity |

PRIORITY LIMITING FACTORS

SUBWATERSHED ATTRIBUTES 1 River and stream hydrology 2 Channel habitat complexity 3 Floodplain connectivity 4 Riparian vegetation 5 Riparian / floodplain habitat complexity 6 Wetland hydrology 7 Wetland vegetation 8 Wetland habitat complexity 9 Wetland biological composition 10 Grassland, prairie, oak savanna vegetation 11 Grassland, prairie, oak savanna habitat complexity 12 Forest and oak woodland habitat complexity



THE LITTLE FALL CREEK SUBWATERSHED is majority owned by private entities. Riparian habitat is in relatively good condition. The stream is undammed and provides some of the best potential for enhancing spring Chinook habitat.

LITTLE FALL CREEK

WATERSHED CHARACTERISTICS

37,400 total acres

Land Ownership

- 70% private industry
- 17% Forest Service
- 7% BLM and other public lands
- 6% other private land

Stream Conditions

- Loss of complexity resulting from historic splash-damming
- Pools not abundant, but deep
- Low amounts of wood except in upper reaches
- 75% shade cover

Aquatic Species:

- Spring Chinook
- Winter and summer steelhead

Water Quantity & Quality

- Limited data on flows
- Only 1 stream gage, 1936-48

Impacts:

- 838 stream crossings
- Multiple roads along streams
- High sediment potential from roads

1. Water temperature
2. Quantity of large wood in stream; Pool:riffle ratio and thalweg profile
3. Fish communities
4. Floodplain inundation frequency and groundwater elevation
5. Riparian plant community diversity and structural diversity
6. Abundance of habitat features (large wood, snags, side channels, wetlands)

PRIORITY INDICATORS

1. Lack of channel complexity
2. Reduced conifers in riparian corridor result in lack of large wood recruitment to stream; Channel straightened; confined, banks armored
3. Access to off-channel habitat is limited
4. Lack of natural floodplain storage due to development of roads adjacent to stream
5. Reduced structural complexity due to historical splash-damming practices
6. Reduced floodplain forest extent and condition reduces wood available for habitat

PRIORITY LIMITING FACTORS

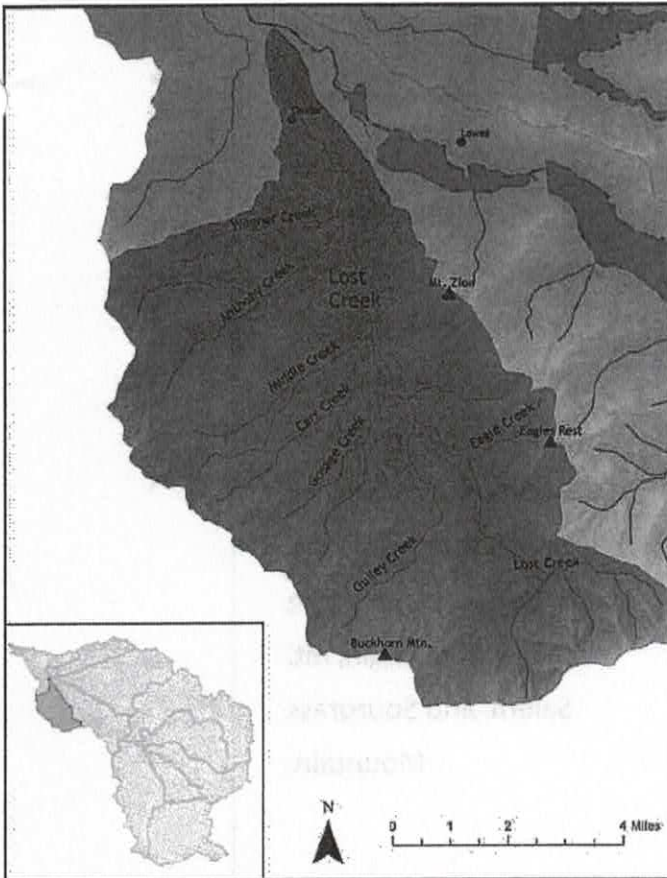
SUBWATERSHED ATTRIBUTES 1 Water Quality 2 Channel habitat complexity 3 Biological Interactions, composition and structure 4 Floodplain connectivity to watercourse 5 Riparian vegetation 6 Riparian/floodplain habitat complexity

LOST CREEK



THE LOST CREEK SUBWATERSHED

includes the town of Dexter. Lost Creek is an undammed tributary to the Middle Fork Willamette and home to spring Chinook salmon and steelhead. High stream temperatures and loss of channel complexity are issues in this subwatershed.



WATERSHED CHARACTERISTICS

34,618 total acres

Land Ownership

- 42% Private timber industry
- 33% Bureau of Land Management
- 25% private residential

Upland Conditions

- Mostly fragmented Douglas fir forest
- Oak woodlands, prairies, and savannas

Riparian Conditions

- Riparian cover generally good in the upper reaches
- Mainstem reaches have lower quality riparian buffers
- Low large wood recruitment in many areas

Aquatic Habitat

- Decline in quantity of deep pools
- Lack of large wood and complex structure

Water Quantity & Quality

- Increased stream temperatures
- Low dissolved oxygen levels in some areas
- Water withdrawals may be impacting aquatic life

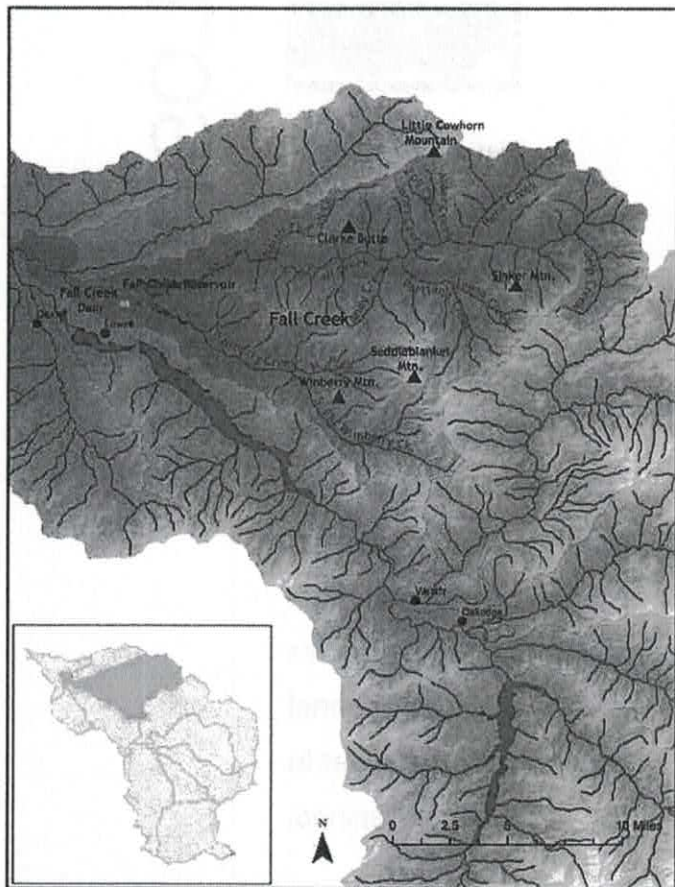
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|---|---|
| 1. Water quantity | 7. Abundance of riparian / floodplain habitat features (large wood, snags, side channels, wetlands) |
| 2. Water temperature | 8. Native plant community |
| 3. Quantity of large wood in stream; Pool-to-riffle ratio; Standard deviation of thalweg profile | 9. Frequency of disturbance by fire and herbivory |
| 4. Fish passage barriers | 10. Forest area with natural hydroperiod and drainage pattern |
| 5. Floodplain inundation frequency / groundwater elevation | 11. Native plant community |
| 6. Riparian corridor continuity and buffer width; Riparian plant community diversity and structural | |

PRIORITY INDICATORS

- | | |
|---|---|
| 1. Water allocations - summer flows too low | 7. Reduced extent of floodplain forests reduces wood available for recruitment, bank stabilization, and shade |
| 2. Lack of shade | 8. Invasive species encroachment; Habitat loss; Altered hydrology |
| 3. Large wood was removed from stream channel; Reduced riparian vegetation limits recruitment of large wood | 9. Fire suppression |
| 4. Inadequate culverts or stream crossings | 10. Forest management practices; Roads |
| 5. Presence of levees or riprap; Development in the floodplain | 11. Logging has altered vegetation structure and composition |
| 6. Habitat loss and land use conversion; Spread of invasives into | |

PRIORITY LIMITING FACTORS

SUBWATERSHED ATTRIBUTES 1 Stream hydrology 2 Water quality 3 Channel habitat complexity 4 Connectivity/fish passage 5 Floodplain connectivity to watercourse 6 Riparian vegetation 7 Riparian/floodplain habitat complexity 8 Grassland, prairie, oak savanna vegetation 9 Grassland, prairie, oak savanna habitat complexity 10 Forest hydrology 11 Forest and oak woodland vegetation



THE FALL CREEK SUBWATERSHED

encompasses Fall Creek Reservoir. Fall Creek is 303(d) listed due to high summer water temperatures. Special habitat such as meadows can be found at Saddle Blanket Mountain, Mt. Salem, and Sourgrass Mountain.

FALL CREEK

WATERSHED CHARACTERISTICS

120,594 total acres

Land Ownership

- 52% Forest Service
- 24% Private Industry
- 15% Army Corps of Engineers & BLM
- 9% Other Private Land

Forest Conditions

- Conifers no longer dominant
- Dominant conifer species: Western Hemlock
- Low winter foraging levels
- Isolation of mature forest blocks

Riparian Conditions

- 21,000 acres riparian reserve

Aquatic Habitat

- Low complexity due to lack of wood
- Loss of connectivity

Water Quantity & Quality

- High summer water temperatures
- 65% reduction in peak flows due to dam

- 1 Quantity of large wood in stream; Pool:riffle ratio; Standard deviation of thalweg profile
- 2 Presence of fish passage barriers
- 3 Riparian plant community diversity and structural diversity

PRIORITY INDICATORS

- 1 Large wood was removed from stream channel; Channel straightened, armored, confined
- 2 Dam restricts upstream and downstream fish migration; Inadequate culverts
- 3 Lack of frequency and abundance of important habitat features (large wood, snags, side channels, wetlands)

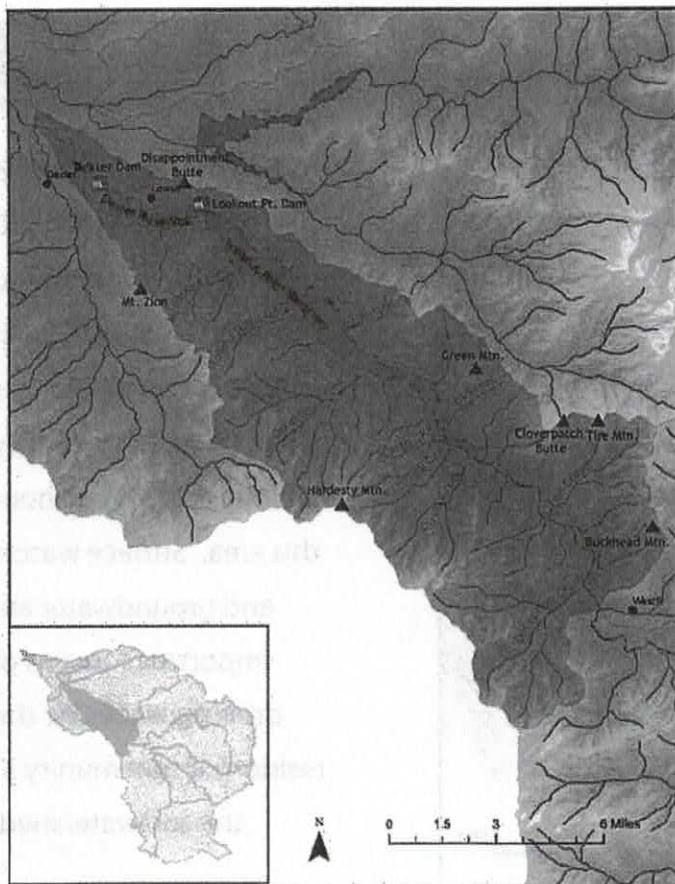
PRIORITY LIMITING FACTORS

SUBWATERSHED ATTRIBUTES 1 Channel habitat complexity 2 Connectivity/Fish passage 3 Riparian Vegetation



THE LOOKOUT POINT SUBWATERSHED

includes the town of Lowell, as well as Dexter and Lookout Point Lakes. Dexter and Lookout Point Dams have a significant impact on fish passage and water quality in this subwatershed. Sedimentation and loss of channel complexity are issues in this subwatershed.



WATERSHED CHARACTERISTICS

49,000 total acres

Land Ownership

- 94% Forest Service
- 4% Corps of Engineers
- 2% Private
- Includes the town of Lowell

Upland Conditions

- Oak woodlands, prairies and savannas
- Mostly western hemlock zone, some dry douglas fir
- Some ponderosa and sugar pine
- Decrease in upland meadows due to lack of fire
- Quaking aspen (rare habitat)

Aquatic Habitat & Riparian Conditions

- Impacted by loss of peak flows (dams)
- Lack of large wood and complex structure
- Loss of channel complexity from multiple causes
- Lack of shade along mainstem

Roads

- 515 stream crossings
- High amount of road sediment
- High amount of streamside roads

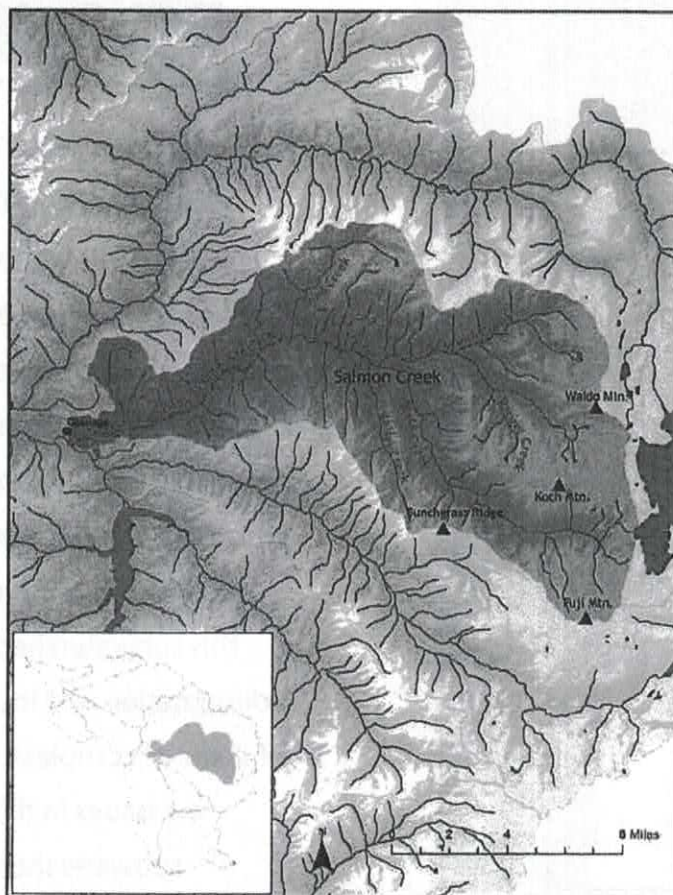
1. Quantity of large wood in stream; Pool:riffle ratio; Thalweg profile
2. Fish passage barriers
3. Fish communities
4. Reduced extent of floodplain forests reduces wood available for recruitment, bank stabilization, and shade

PRIORITY INDICATORS

1. Reduced riparian vegetation limits recruitment of large wood; Channel straightened, confined, simplified, armored banks
2. Dam operations
3. Culverts are barriers to fish passage; Development limits access to off-channel habitat
4. Development in the floodplain and installation of revetments and levees have reduced floodplain connectivity; The frequency of flows is not of sufficient magnitude to create and maintain channel complexity and provide nutrients, organic matter, and sediment inputs from floodplain areas.

PRIORITY LIMITING FACTORS

SUBWATERSHED ATTRIBUTES ■ Channel habitat complexity ■ Connectivity/fish passage ■ Biotic interactions, composition, and structure ■ Riparian/floodplain habitat complexity



SALMON CREEK

THE SALMON CREEK SUBWATERSHED is largely protected (70%) forest land, with significant wilderness areas. Rare, high quality habitats exist throughout this area. Surface waters and groundwater are important sources of drinking water for the residential community in this subwatershed.

WATERSHED CHARACTERISTICS

82,432 total acres

Land Ownership

- 98% Forest Service (13% Wilderness, 31% riparian reserve)
- 2% private

Forest Conditions

- Mostly westside lowlands forest
- 94% conifer forest
- 51% late successional reserve (protected)
- Small areas of special/rare habitat: yellow cedar, whitebark pine and quaking aspen
- Decrease in upland meadows due to lack of fire

Riparian Conditions

- 24,000 acres riparian reserve
- 270 road miles; 12 bridges; 576 culverts

Aquatic Habitat

- General lack of large wood
- Mainstem has no fish barriers

Water Quantity & Quality

- Elevated stream temperatures at Salmon Creek mouth
- Most tributaries have cool temperatures
- Water source for Willamette Fish Hatchery

- 1 Quantity of large wood in stream; Pool:riffle ratio; Standard deviation of thalweg profile
- 2 Fish community

PRIORITY INDICATORS

- 1 Large wood was removed from the channel; Reduced riparian vegetation causes lack of large wood recruitment; Channel straightened, confined, simplified, armored
- 2 Culvert size and placement are barriers to fish passage; Lack of off-channel habitat

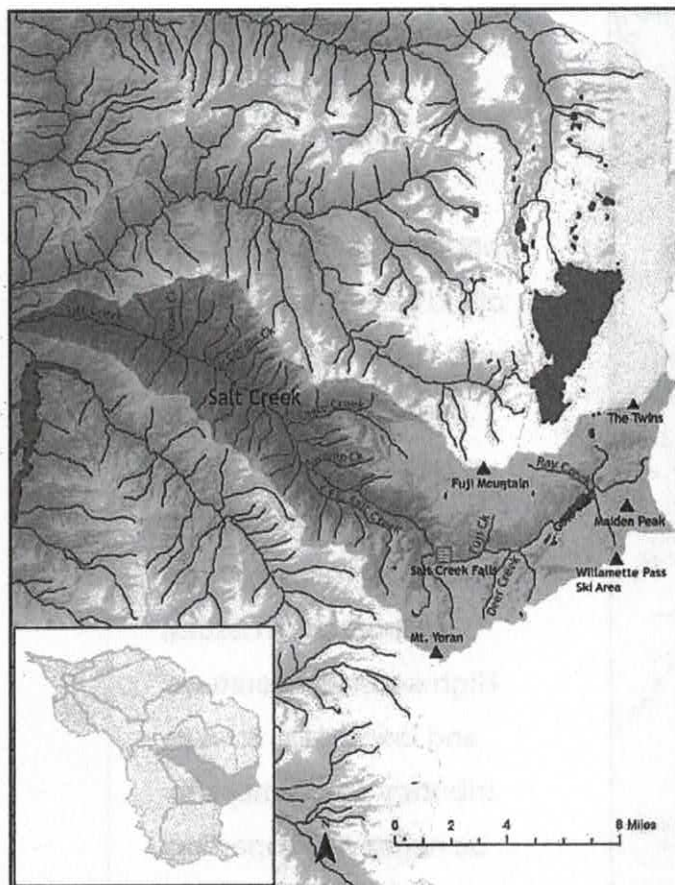
PRIORITY LIMITING FACTORS

SUBWATERSHED ATTRIBUTES 1 Channel habitat complexity 2 Biotic interactions, composition and structure



THE SALT CREEK SUBWATERSHED

is heavily forested, and includes significant high quality habitat for aquatic and terrestrial species. Salt Creek Falls, the 2nd largest waterfall in Oregon, Willamette Pass ski area and Waldo Sno-Park are all located in this subwatershed.



WATERSHED CHARACTERISTICS

71,000 total acres

Land Ownership

- 99.8% Forest Service
- Willamette Pass ski area

Upland Conditions

- 93% forested
- 5% special habitats
- Oak woodlands on south facing slopes
- 7,000 acres late successional reserve
- Significant fire history: 64% burned over 200 years

Riparian Conditions

- 23,000 acres riparian reserve

Aquatic Habitat

- 25 miles of spring Chinook habitat
- Cutthroat and rainbow trout present
- 301 stream miles
- Lack of large wood and complex structure

Water Quantity & Quality

- High summer water temps near mouth

- 1 Quantity of large wood in stream; Pool:riffle ratio; Standard deviation of thalweg profile
- 2 Fish community

PRIORITY INDICATORS

- 1 Large wood was removed from the channel; Reduced riparian vegetation causes lack of large wood recruitment; Channel straightened, confined, simplified, armored
- 2 Culvert size and placement are barriers to fish passage; Lack of off-channel habitat

PRIORITY LIMITING FACTORS

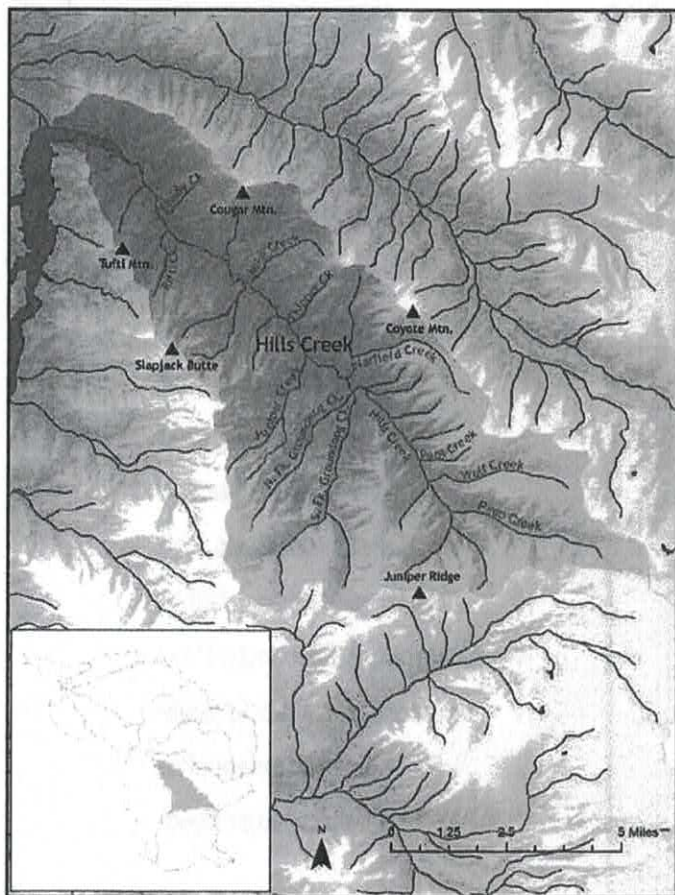
SUBWATERSHED ATTRIBUTES 1 Channel habitat complexity 2 Biotic interactions, composition and structure

HILLS CREEK



THE HILLS CREEK SUBWATERSHED

contains significant stands of old growth and mature forest. However, a relatively high proportion of the subwatershed forests have been harvested or impacted by roads, causing sedimentation issues. High water temperatures and low stream flows in tributary creeks may also be negatively impacting aquatic habitat.



WATERSHED CHARACTERISTICS

38,000 total acres

Land Ownership

- 98% Forest Service
- 2% private

Forest Conditions

- Westside lowlands ecotype
- 26% mature/old growth
- 47% very young/recent clearcuts
- High elevation meadows and outcrops

Riparian Conditions

- 38% mature/old growth

Aquatic Habitat

- Lack of large wood and complex structure
- Historic good spring Chinook habitat

Water Quantity & Quality

- Flows affected by harvest and roads
- 38 year flow record at mouth
- High summer temps at mouth

1. Quantity of large wood in the stream
2. Riparian corridor continuity and buffer width; % cover of invasive species; Riparian plant community diversity and structural diversity
3. Abundance and distribution of beaver and other keystone species
4. Frequency of disturbance by fire and/or herbivory and/or snowpack to maintain condition

PRIORITY INDICATORS

1. Large wood was removed from the channel; Reduced riparian vegetation causes lack of large wood recruitment
2. Habitat loss; Spread of invasive species into the riparian area, degrading native habitat; Grazing of domestic animals reduces native plant cover; Reduced structural complexity due to logging and forest management practices
3. Trend towards mature forests in riparian areas with little understory
4. Fire suppression activities or structural diversity; lack of food resources for beaver

PRIORITY LIMITING FACTORS

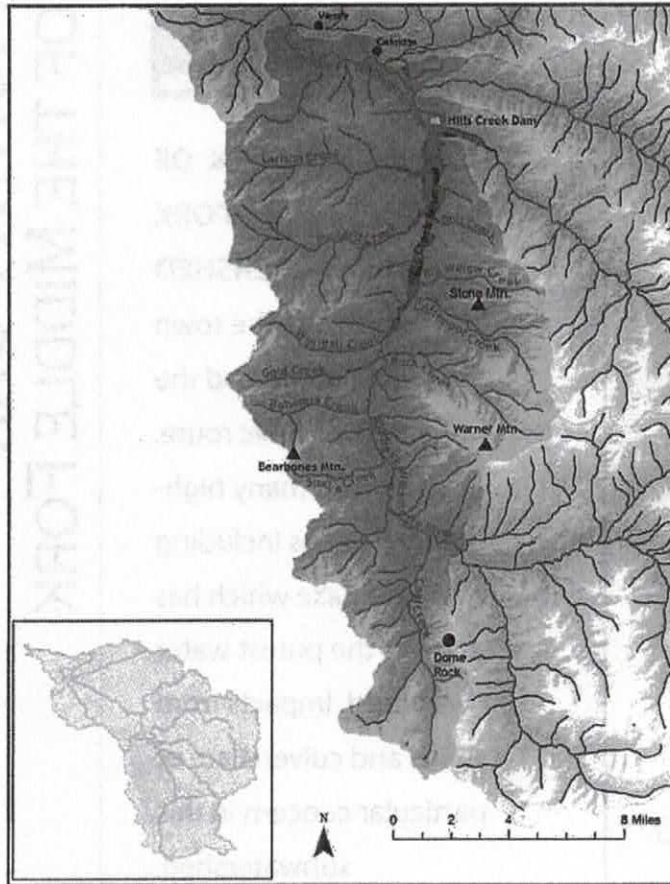
SUBWATERSHED ATTRIBUTES 1 Channel habitat 2 Riparian vegetation 3 Wetland biological interactions, composition, and structure 4 Grassland, prairie, oak savanna habitat complexity

HILLS CREEK RESERVOIR



THE HILLS CREEK RESESERVOIR SUBWATERSHED

has the only successful bull trout reintroduction program in the country. A high number of forest service road closures will occur between 2009-2013. Spring Chinook are known to spawn above the Hills Creek Reservoir. Fire exclusion has contributed to a reduction in abundance and structure of oak forests.



WATERSHED CHARACTERISTICS

Over 100,000 total acres

Land Ownership

- 84% Forest Service
- 15% Private industry
- 1% Hills Creek Reservoir

Forest Conditions

- 51% Late successional reserve
- 2,274 acres closed canopy, mid-development young forest
- 7,648 acres closed canopy late succession
- 1/3 of total montane forests mixed conifer habitat type, unique to watershed
- Loss of meadows due to fire suppression and dam placement
- Mature old-growth ponderosa and sugar pine show stress and increased insect infestation
- Some Oregon white oak

Aquatic Habitat

- Lack of large wood in channels
- Successful Bull trout recovery
- Spring Chinook spawn above reservoir

1. Quantity of large wood in stream; Pool-riffle ratio
2. Riparian plant community diversity and structural diversity
3. Abundance of habitat features (large wood, snags, side channels, wetlands)
4. Native plant community structure, extant; species composition; Frequency of disturbance by fire and/or herbivory, and/or snowpack

PRIORITY INDICATORS

1. Reduced riparian vegetation condition causes lack of large wood recruitment to stream; Channel straightened, confined, banks armored
2. Reduced structural complexity due to historical logging and forest management practices; Spread of invasive species into the riparian, degrading native habitat
3. Development in the floodplain and installation of revetments and levees; Reduced floodplain forest
4. Invasive species encroachment; Encroachment of native trees and shrubs; Fire suppression

PRIORITY LIMITING FACTORS

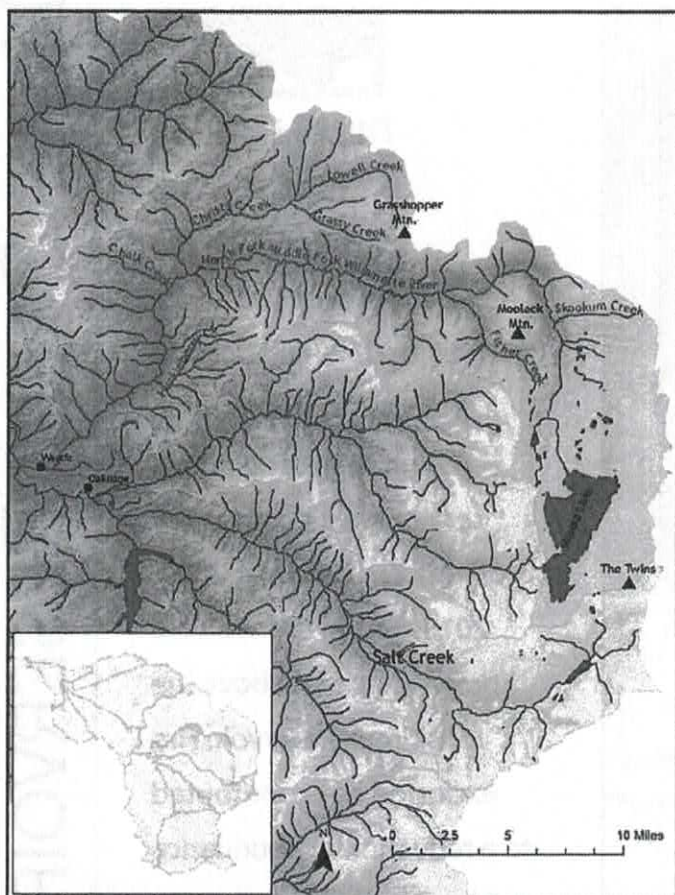
SUBWATERSHED ATTRIBUTES 1 Channel habitat complexity 2 Riparian vegetation 3 Riparian/floodplain habitat complexity 4 Grassland, prairie, oak savanna and alpine meadow habitat complexity

NORTH FORK OF THE MIDDLE FORK



THE NORTH FORK OF
THE MIDDLE FORK
SUBWATERSHED
includes the town
of Westfir, and the
Aufderheide scenic route.

There are many high-
altitude lakes including
Waldo Lake which has
some of the purest water
in the world. Impacts from
roads and culverts are of
particular concern in this
subwatershed.



WATERSHED CHARACTERISTICS

158,000 total acres

Land Ownership

- 94% Forest Service
- 6% Private
- Includes the town of Westfir

Upland Conditions

- 68% mature or old growth
- Multiple meadows decreasing in size due to fire exclusion
- Some white oak in south facing rocky openings

Roads

- 570 mi of road; 15 bridges; 2600 culverts
- Over 800 partially blocked culverts
- Over 400 problem culverts

Aquatic & Riparian Habitat

- Lack of large wood and complex structure
- Chinook salmon reintroduced
- Reduced habitat complexity
- No barriers on mainstream

Water Quantity & Quality

- High water temps; High turbidity; High peak flows
- Waldo Lake among purest water in the world

- 1 Quantity of large wood in stream; Pool:riffle ratio; Standard deviation of thalweg profile
- 2 Fish passage barriers
- 3 Fish communities
- 4 Large mammal use

PRIORITY INDICATORS

- 1 Large wood was removed from the channel; Reduced riparian vegetation causes lack of recruitment of large wood; Channel straightened confined, simplified, armored
- 2 Inadequate culverts or crossings
- 3 Culvert size and placement are barriers to fish passage; Off-channel habitat is limited
- 4 Loss of habitat

PRIORITY LIMITING FACTORS

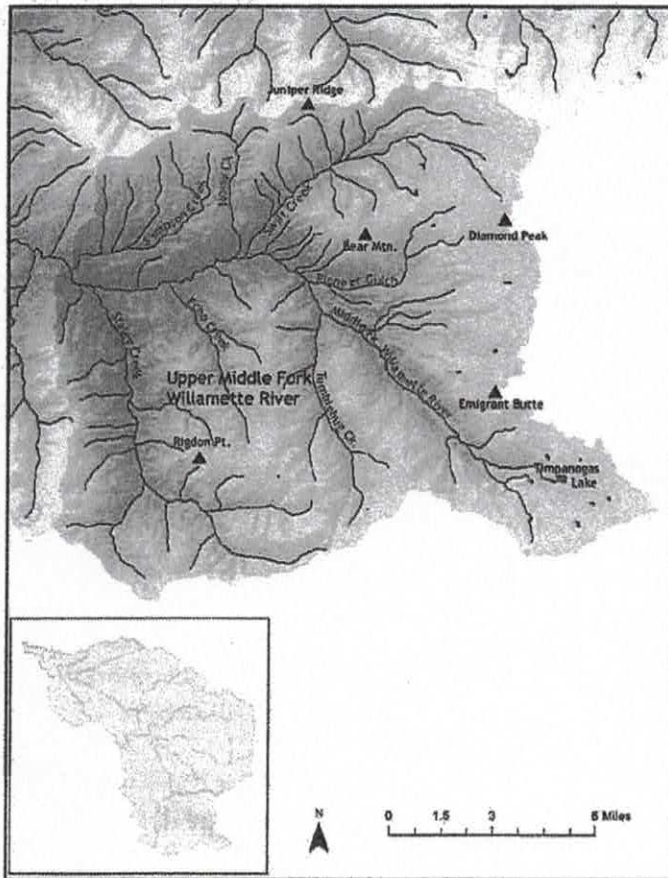
SUBWATERSHED ATTRIBUTES 1 Channel habitat complexity 2 Connectivity 3 Biological interactions, composition, and structure
4 Forests, oak woodlands, coniferous forests: biological interactions, composition and structure

UPPER MIDDLE FORK WILLAMETTE RIVER



THE UPPER MIDDLE FORK WILLAMETTE RIVER SUBWATERSHED

is located at a relatively high elevation. It includes high quality aquatic habitat and several areas of high elevation special habitat. Significant restoration and mitigation work has been occurring in this area. Cold springs offer ideal stream temperatures for bull trout.



WATERSHED CHARACTERISTICS

Over 100,000 total acres

Land Ownership

- 92% Forest Service
- 8% private

Forest Conditions

- High biodiversity
- 94% conifer forest, 49% never harvested
- Small areas of high elevation special habitats: yellow cedar, whitebark pine
- Quaking aspen (rare habitat)
- Ponderosa pine and Oregon white oak

Riparian Conditions

- Large areas of hardwoods
- 672 stream crossings
- Many culverts have been replaced

Aquatic Habitat

- Bull Trout recovery program successful
- Multiple large woody debris projects in recent years
- No barriers on main channel and many tributaries

Water Quantity & Quality

- High due to snowmelt and cold water springs

1. Quantity of large wood per stream segment; Pool:riffle ratio; Thalweg profile
2. Riparian corridor continuity and buffer width; Riparian plant community diversity and structural diversity
3. Frequency of disturbance by fire, herbivory, or snowpack to maintain condition
4. Frequency of disturbance by fire, herbivory, windthrow to maintain forest condition

PRIORITY INDICATORS

1. Large wood was removed from channel; Reduced riparian vegetation causes lack of large wood
2. Habitat loss; Reduced structural complexity due to historical logging practices
3. Fire suppression
4. Fire suppression; Forest management practices have reduced the recruitment of habitat features

PRIORITY LIMITING FACTORS

SUBWATERSHED ATTRIBUTES 1 Channel habitat complexity 2 Riparian vegetation 3 Grassland, prairie, oak savanna habitat complexity
4 Forests, oak woodlands, coniferous forests, aspen forests